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20th century 'invisible' heritage: qualities and values in the real estate market.

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Turin, April 30th, 2021

Summary

New requirements due to global socio-economic and environmental changes are affecting cities and driving their transformations. Assessment of the "value" of built heritage is a complex trans-disciplinary issue, that both public administrations and real estate developers need to carefully consider for any intervention. This research places a particular focus on 20th century buildings, inspired by recent literature and changes in the Italian heritage protection regulations.

This work aims to study the residential heritage of the second half of the 20th century and its real estate market and to understand if, how and in what measure the building qualities that characterize this residential heritage are recognized and monetized by buyers. Considering that the real estate market is the expression of behaviours and preferences of the demand, this market is constituted by individuals who choose how to spend within their budgetary constraints, according to models of a social and cultural nature.

The city of Turin was chosen as study area: residential buildings were investigated which were built in the second half of the 20th century, characterized by high architectural and building quality or by widely recognized authorship, whose value is not adequately recognized currently. These qualities are synthetized by two indicators: "RecQ" represents quality which is recognised by entities for the protection of cultural heritage and by experts, while "ObeQ" represents quality observed by this researcher based on a number of specific criteria. Geo-statistical models were applied to study the influence of these building quality indicators on listing prices and to understand which features are mostly appreciated by possible buyers. Spatial Autoregressive models (SAR) and Geographical Weighted Regressions (GWR) were performed on point data, in order to manage spatial dependence and to identify the variables that significantly influence the process of the formation of housing prices.

The results of the analysis highlighted that the housing quality indicators (RecQ and ObeQ) are generally not yet recognised by the real estate market and these variables do not have a significant influence on housing prices. Nevertheless, the local regression (GWR) outputs highlight that in some areas of the city, the quality features prevail on other building features for price determination: in particular, the building category (i.e., economic, medium, classy, etc.) and the Energy Performance Certificate (EPC) labels are commonly monetized by the real estate market.

A further analysis was performed using a second regression model, with buyers' favourite real estate ads (Leads) as the dependent variable; this detected which building features influence the preferences of the demand and the possible buyers. Using the Leads frequency as dependent variable and some buildings and locational features as explanatory variables, only a few characteristics resulted as decisive for the buyers' choice: the price, the number of rooms, the highest level of EPC and some specific locations.

The results of this study confirm the need and urgency to intervene in the recognition and safeguarding of contemporary residential heritage. They can constitute a real support for both public and private bodies to identify which "invisible" quality building features of the housing stock built from 1950 to 2000 are immediately exploitable for the enhancement of the stock. The spatial distribution of the predicted price suggests new possibilities for the sub-segmentation the real estate market and new opportunities to render it more dynamic. In fact, currently, the quality of these residential buildings is not recognized enough by buyers or reflected in market prices; high quality buildings therefore risk being underestimated and offered on the market with a low price comparable with low quality ones. The recognition of building quality offers a real opportunity for urban redevelopment. Educating the market on the value of this heritage would allow the creation of an urban landscape capable of increasing knowledge and understanding of this heritage and triggering regeneration processes and public policies to enhance the awareness of this heritage. Greater awareness of the architectonic and building quality of the residential heritage of the second half of the 20th century could then lead to more respectful retrofit interventions and a modern protection policy to guarantee preventive maintenance of this heritage and to increase its value.

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- The "MuseoTorino API" service allows all users, public and private bodies or organizations, to use the data on the website according to the open IODL 2.0 license, in compliance with the laws in force, offering various possibilities for data recovery: the content of a single card, the list of cards belonging to a specific theme, the search by period or by keyword (https://www.museotorino.it/). MuseoTorino releases its data in Open Data mode.

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Riassunto della Tesi (italiano)

Introduzione e contesto di ricerca

Il progetto di ricerca qui presentato affronta il ruolo che l'estimo e la microeconomia possono avere nell'analizzare in che misura e con quali modalità gli individui percepiscano la qualità architettonica delle architetture contemporanee e la monetizzino attraverso il mercato immobiliare.

La ricerca effettuata si focalizza sullo studio e sull'analisi del mercato immobiliare in relazione al prezzo marginale del patrimonio residenziale realizzato nella seconda metà del 1900 (1950-1999), assumendo la città di Torino come area di studio. In particolare, le analisi si sono focalizzate sugli edifici che si distinguono per la qualità architettonica e costruttiva, con l'obiettivo di individuare il valore economico del patrimonio residenziale realizzato nella seconda metà del ventesimo secolo. Isolare il prezzo marginale della qualità costruttiva e architettonica, permette di poter riconoscere i modelli culturali che all'epoca dello sviluppo delle città, determinato dall'industrializzazione, erano alla base del mercato immobiliare.

Infine, uno dei temi affrontati dalla ricerca è il fatto che sul mercato viene offerta solo una bassa percentuale di case costruite tra gli anni '50 e '90, riconoscibili per la loro qualità architettonica. Ciò si riflette da un lato sul funzionamento di questo particolare segmento del mercato immobiliare, dall'altro ha complicato l'analisi della ricerca, rendendola più complessa e rendendo meno immediati i risultati dei modelli.

Tuttavia, mentre cittadini e turisti paiono riconoscere il valore del patrimonio antico o quello delle architetture contemporanee degli ultimi decenni, realizzate dagli architetti noti a livello internazionale, le architetture realizzate tra il '50 e '90 sembrano essere meno riconosciute per i valori che possiedono anche se largamente avallati dalla storiografia.

La ricerca ha dovuto affrontare preliminarmente il nodo di come definire e misurare la qualità architettonica e di come distinguerla dalle altre qualità costruttive degli edifici residenziali. L'aspetto più delicato della ricerca è stato quello di individuare e misurare la qualità architettonica, non solo degli edifici di autore - pubblicati su riviste e monografie e presenti nelle più complete banche dati online - ma anche degli edifici di cui non si conoscevano i progettisti e la storia. Gli edifici di qualità architettonica, non presenti nelle pubblicazioni e nelle banche dati consultate sono stati individuati attraverso il rilievo visivo.

In seguito, si è fatto ricorso ai modelli edonici, correntemente utilizzati nel *mass appraisal*, che permettono di scomporre i prezzi totali nelle loro diverse componenti, rappresentate dai prezzi marginali delle caratteristiche estrinseche (tra cui quelle posizionali) ed intrinseche considerate dai modelli. I modelli edonici sono stati applicati finora per riconoscere l'influenza prodotta dalle qualità storico-architettoniche del patrimonio d'epoca sulla formazione del prezzo di mercato, ma non ancora sulle qualità del patrimonio contemporaneo, come quello analizzato nel presente lavoro di ricerca.

Infine, uno dei nodi affrontati dalla ricerca è costituito dal fatto che le abitazioni della seconda metà del XX secolo offerte sul mercato, riconoscibili per l'alta qualità architettonica, risultano una percentuale minima rispetto al totale delle abitazioni scambiate. Questo fatto si riflette, da una parte, sul funzionamento di questo particolare segmento del mercato immobiliare e, dall'altra, sulle analisi, rendendole più complesse e rendendo meno immediati i risultati dei modelli.

I risultati ottenuti dalla ricerca, come si vedrà in seguito, sono utili per ridefinire segmenti e sub-segmenti del mercato immobiliare oggi dati per scontati, proprio nel rapporto tra micro e macroaree e/o tra aree centrali e periferiche.

Rispetto ai risultati ottenuti in ricerche precedenti (Curto, 1988), il sistema di valori degli anni '60 e '70 del XX secolo, rispecchiava direttamente la distribuzione del reddito e la divisione sociale dello spazio e che era basato su un modello sociale e culturale incentrato sulla preferenza di una abitazione "nuova piuttosto che bella", si presenta oggi fortemente modificato. Infatti, a partire dal modello, valido ancora oggi, che si è evoluto negli ultimi due decenni del XX secolo la "casa d'epoca" è la tipologia di residenziale a cui viene attribuito maggior valore, con la rivalutazione delle aree centrali e storiche della Città, riflesso da parte del mercato nel riconoscimento del valore della qualità storico-architettonica dei beni. Negli ultimi anni, tuttavia, anche a seguito della crisi economica mondiale e delle sue conseguenze sul mercato immobiliare, anche questo paradigma sta cambiando, con la sempre maggiore attenzione volta alle questioni energetiche. La domanda sempre più consapevole e coinvolta nella lotta ai problemi ambientali infatti riconosce maggior valore alle case energeticamente sostenibili che sono, per la maggior parte, costruite negli ultimi dieci anni.

In seguito alla crisi intervenuta nel mercato immobiliare (in Italia a partire circa dal 2008), e dalle sue conseguenze questo modello è andato progressivamente trasformandosi. Infatti, a causa del persistere della crisi dell'economia reale e dei cambiamenti intervenuti nel tessuto sociale, a livello demografico e nella distribuzione del reddito, in particolare con la

polarizzazione tra le fasce sociali estreme, forti e vulnerabili, (Barreca, Curto and Rolando, 2017a) e all'interno del settore edile (Barreca, Curto and Rolando, 2018), si è progressivamente modificato il sistema dei valori di mercato e di conseguenza le gerarchie territoriali e sociali preesistenti. Le attuali gerarchie spaziali urbane vedono aree di vulnerabilità sociale sempre più estese e connotate da un'elevata fragilità abitativa associata a fenomeni di degrado edilizio e territoriale e, d'altra parte aree sempre più circoscritte e concentrate nel centro storico con i prezzi più elevati la presenza principale degli strati sociali più forti per reddito, posizione sociale e livello culturale. Queste ultime aree, connotate da *vibrancy* urbana, la cui definizione è oggetto di numerose recenti pubblicazioni (Yue *et al.*, 2017; Wu *et al.*, 2018; Malizia and Motoyama, 2019), colgono il modificarsi dei modelli culturali inerenti l'abitare degli strati più agiati, che sembrano apprezzare sempre più la presenza di servizi di vicinato, la concentrazione di esercizi commerciali e spazi dedicati all'offerta culturale. Queste qualità urbane (estrinseche) sono monetizzate sia dal mercato immobiliare delle abitazioni "usate", sia dal mercato delle nuove costruzioni (Barreca, Curto and Rolando, 2020b, 2020a).

In continuità con queste precedenti ricerche, il presente lavoro intende analizzare le preferenze dei consumatori, intese come espressione del mercato, inerenti alla scelta di unità abitative in edifici con qualità architettoniche e costruttive diverse. Pertanto, considera e confronta due qualità: le qualità architettonica e costruttiva, riconosciute o osservate.

La qualità architettonica è intesa come un valore inglobato nella costruzione nel momento della sua progettazione/edificazione spesso data dalla qualità della progettazione e delle soluzioni tecnologiche e formali innovative date dall'autore. Tale qualità è attribuita a residenze, per la maggior parte, ma non ancora completamente, già studiate e pubblicate in riviste e monografie di settore. La qualità architettonica e costruttiva osservata, invece, è intesa come una qualità potenziale, riconoscibile solo da esperti del settore, ma non ancora pubblicata e difficilmente distinguibile dalle altre qualità dell'edificato della seconda metà del '900.

I risultati di questa ricerca, come ulteriormente approfonditi, possono essere utili per ridefinire segmenti e sub-segmenti del mercato immobiliare oggi dati per scontati, proprio nel rapporto tra micro e macroaree e/o tra aree centrali e periferiche.

Obiettivo della ricerca

A partire dalle premesse sopracitate e concentrandosi nelle analisi del mercato immobiliare del contesto urbano - comparto residenziale, pare necessario individuare nuovi paradigmi e nuovi strumenti operativi al fine di orientare le politiche e gli investimenti per la

valorizzazione del patrimonio del Novecento e anche al fine di salvaguardare l'abitabilità delle città, gestire la decrescita necessaria e assicurare la salvaguardia dei siti del patrimonio. Il presente lavoro intende tracciare una possibile via nell'acquisizione dell'approccio metodologico per capire se la qualità edilizia possa essere uno dei fattori cardine della *vibrancy* o della vulnerabilità urbane e per favorire lo sviluppo e la diffusione di conoscenza inerente al patrimonio immobiliare della seconda metà del XX secolo.

Se si considera il mercato immobiliare come l'espressione di comportamenti e delle preferenze, si può definire la domanda come costituita da individui che si esprimono a partire dai loro vincoli di bilancio e secondo modelli di natura sociale e culturale. Inoltre, assumendo che la domanda basa le proprie scelte tra beni alternativi, secondo campi ordinatori delle preferenze e le relative utilità marginali, la presente ricerca intende capire se, come e in che misura le qualità che caratterizzano il patrimonio residenziale realizzato nel corso della seconda metà del XX secolo siano riconosciute e monetizzate dai potenziali acquirenti.

Di conseguenza, i principali interrogativi posti alla base del presente lavoro di ricerca sono stati:

- È possibile isolare, attraverso i modelli edonici, la qualità architettonica da altre qualità e caratteristiche fisiche costruttive e posizionali? Quali sono le qualità oggi monetizzate dal mercato? Come e in che misura sono variate rispetto al passato? Come sono variati i prezzi relativi delle qualità fisiche rispetto alla posizione (*location*)? In che misura? Da quali strati sociali sono valorizzate queste qualità, nei diversi cicli economici?
- È possibile dedurre dai modelli edonici in che misura le diverse qualità, intrinseche e posizionali, sono monetizzate dal mercato e, quindi, risalire alle preferenze dei consumatori e ai modelli culturali che determinano i valori di mercato?
- Come stanno cambiando le preferenze della domanda e con quali prospettive future, anche in relazione ai processi di innovazione che investono l'edilizia e l'economia reale?
- È possibile prevederne l'evoluzione, considerando il cambiamento epocale in corso, determinato dai processi di innovazione tecnologica e dai simultanei cambiamenti demografici, sociali e culturali?

Senza pretendere di rispondere a tutti i quesiti posti, la ricerca intende rilevare i cambiamenti strutturali in corso nel mercato immobiliare e mettere in evidenza i riflessi che questi possono avere nell'indirizzare gli studi sociali e di economia urbana.

L'approccio metodologico utilizzato nella presente ricerca si articola quindi su tre grandi temi principali (*pillars*):

- l'analisi del mercato immobiliare e della domanda;
- l'analisi del patrimonio residenziale della seconda metà del '900 e l'individuazione delle sue caratteristiche di qualità;
- le ripercussioni che il riconoscimento e la monetizzazione delle caratteristiche di qualità potrebbero avere sulle politiche e sull'economia urbana.

Questi temi vengono specificati in breve di seguito:

Analisi del mercato immobiliare

La grande trasformazione prodotta dall'industrializzazione nell'economia e nella società può dirsi conclusa, con profondi segni lasciati sulla morfologia delle città e le stratificazioni edilizie e sociali. La globalizzazione dell'economia e i processi di innovazione tecnologica stanno producendo trasformazioni strutturali sul sistema economico e sociale che si riflettono sui paradigmi che per molti decenni sono stati alla base dello sviluppo delle città. I cambiamenti profondi riconducibili alla scala del sovra-sistema stanno portando a modifiche altrettanto profonde nell'edilizia e nel mercato immobiliare italiano, a partire dalla definizione di nuove gerarchie di valori.

Il mercato immobiliare in Italia è oggi caratterizzato da una fase di decrescita iniziata nel 2006: le conseguenze prodotte dal contrarsi dell'occupazione e dalla mutata distribuzione del reddito sono percepibili nelle città attraverso l'abbandono delle aree residenziali e commerciali e, nelle aree interne, attraverso lo spopolamento dei borghi e l'espansione delle aree boschive (SIU, 2021).

La popolazione urbana sta diminuendo dal 2015 e nel 2019 per la prima volta negli ultimi 90 anni si è determinata una fase di declino demografico (ISTAT, Bilancio demografico nazionale, 2019). Inoltre, la popolazione presenta una generale diminuzione del tasso di fertilità, alti livelli di disoccupazione giovanile, un continuo flusso di migrazioni ambientali e politiche in entrata e un aumento dell'emigrazione giovanile altamente specializzata.

In questa situazione, l'approccio al settore del mercato immobiliare deve essere ripensato, anche in relazione alla riforma dei Piani regolatori: data l'assenza di aumenti teorici di abitanti, il consumo di suolo deve fermarsi, impedendo l'uso di terreni inedificati ed invece ripensando al patrimonio pubblico sottoutilizzato o al patrimonio residenziale vuoto e inutilizzato, e prevedendo una gestione dell'inevitabile surplus di servizi urbani che si creerà nelle città.

Al fine di salvaguardare l'abitabilità delle città, gestire la decrescita necessaria e assicurare la salvaguardia dei siti del patrimonio, sarà necessario individuare i nuovi paradigmi alla base delle politiche e nuovi strumenti operativi.

La Teoria dei Cicli Spaziali (TSC) ha definito fasi sequenziali di sviluppo urbano, definendo intervalli di tempo caratterizzati da condizioni economiche, demografiche, sociali o istituzionali omogenee, che permettono una generale valutazione della storia recente delle città europee contemporanee (Van Den Berg et al., 1981; Barkley et al., 1982). L'approccio TSC, attraverso metodi geografici, econometrici e misti, ha identificato quattro cicli principali: urbanizzazione, sub-urbanizzazione, dis-urbanizzazione e re-urbanizzazione, che sono legati ai movimenti della popolazione e delle attività economiche nei centri urbani e sub-urbani.

I quattro cicli individuati consentono di analizzare e interpretare le stratificazioni edilizie e urbanistiche, e possono aiutare a comprenderne meglio la complessità e chiarire il ruolo dei fattori socioeconomici nel plasmare l'adattamento al cambiamento (Zambon and Salvati, 2019).

I mercati immobiliari locali hanno un rapporto di mutua correlazione con i cicli urbani: da un lato, essi sono influenzati da forze socioeconomiche e culturali specifiche del luogo, correlate ai cicli del sovra-sistema economico nazionale e internazionale; d'altro canto, le dinamiche del mercato immobiliare, determinate dal sovra-sistema non solo economico ma anche finanziario, influenzano le attività economiche e la morfologia urbana (Delladetsima, 2006; Edelstein and Tsang, 2007; Salvati, 2016). Ondate sequenziali di espansione economica e stasi agiscono anche sulle tendenze sociodemografiche, sui cicli edilizi, sulle politiche abitative deboli e sui regimi di welfare orientati alla famiglia (Morelli, Rontos and Salvati, 2014).

L'attuale fase rientra in un ciclo di de-urbanizzazione delle medio-piccole città e agglomerazione della popolazione in pochi grandi centri (metropoli) situati in diverse aree del mondo, che presentano caratteristiche comuni: facili collegamenti internazionali (connessioni), normativa fiscale semplificata (agevolazioni) e presenza di agglomerati di sedi di multinazionali e uffici (hub). Questo processo porta ad una polarizzazione tra aree forti e aree deboli, con la conseguente formazione di sotto-mercati con densità e valori molto elevati, che creano un certo raggio di "*spill-over*" nello stesso territorio e nei territori vicini, ed aree di mercato con valori bassi e addirittura inferiori alla media.

In questi tipi di centri, i valori per metro quadrato non consentono la presenza di quella *mixité sociale* tipica delle città, ma creano una sempre maggiore settorializzazione e

confermano la struttura gerarchica delle zone della città con i noti fenomeni di *gentrification,* che determinano processi di valorizzazione e devalorizzazione di parti diverse di città.

Il patrimonio edilizio del XX secolo

Negli ultimi 40 anni, l'interesse per la salvaguardia e la conservazione del patrimonio del XX secolo è aumentato, con un'accresciuta produzione scientifica di convegni e pubblicazioni. Tuttavia, la conservazione degli edifici del XX secolo pone continue nuove sfide ai responsabili della loro gestione e ai professionisti della conservazione. La mancanza di riconoscimento (con l'eccezione delle icone), l'assenza di quadri di ricerca completi per l'analisi del patrimonio della seconda metà del XX secolo (1950-1999) e l'insufficienza di adeguate strategie di protezione e politiche di riuso, hanno portato all'abbandono e persino alla perdita di molti elementi di questo patrimonio in tutto il mondo.

Due casi emblematici per la città di Torino sono il Palazzo a Vela (Palavela) e il Palazzo del Lavoro. Il Palavela, progettato e costruito negli anni 1959 - 1961 dall'architetto Annibale Rigotti (1870-1968) e dal figlio ing. Giorgio Rigotti (1905-2000) con gli ingegneri Franco Levi (1914-2009) e Nicolas Esquillan (1902-1989), che studiano una struttura autoportante a doppia soletta nervata in cemento armato precompresso, composta da una cupola su tre punti di appoggio, eseguita dall'impresa Gastone Guerrini. Privo di vincolo di tutela, è stato totalmente snaturato dall'intervento di rifunzionalizzazione del 2003 su progetto di dell'arch. Gae Aulenti e dell'ing. Aurelio De Bernardi che realizzano un nuovo corpo indipendente dalla volta, adibito a palazzetto dell'hockey per le Olimpiadi invernali di Torino 2006 capace di 8.000 posti a sedere. Le vetrate che ne definivano l'eterea geometria sono state demolite e il nuovo volume, rosso, ne altera la geometria minimalista di calcestruzzo armato, privando la copertura a vela della sua funzione. Il luogo è però adesso utilizzato e frequentato dai cittadini ed è sede di eventi sportivi.

Il Palazzo del Lavoro (1960-61), progettato e realizzato da Pierluigi and Antonio Nervi, e Gino Covre per le strutture metalliche, è totalmente abbandonato da anni; ha subito un grave incendio il 20 agosto 2015, ma ancora oggi le vetrate sono rotte, le strutture sono danneggiate e non viene svolta la minima manutenzione ordinaria neanche sulle aree esterne. In caso di eventi cittadini nazionali e internazionali, poiché si trova ad uno dei principali ingessi alla città, è stato semplicemente coperto da striscioni pubblicitari per nasconderne il degrado. Ma mentre gli esperti e gli architetti ne conoscono l'essenza e ne hanno studiato la storia nella letteratura, i cittadini non ne capiscono il valore e lo vedono solo per lo stato di rudere in cui verte.

Figure 0.1: (a) Annibale e Giorgio Rigotti, Palazzo a Vela, via Ventimiglia 145, Torino, 1961. A sinistra Cartolina datata 1961, a destra foto del 2018. (b) Pierluigi e Antonio Nervi, Palazzo del Lavoro, via Ventimiglia, 211, Torino, 1961. A sinistra foto del 1965, destra foto del 2018 (Fonti e crediti: (a) Sinistra: AtlasFor, (a)Destra: foto propria, (b) Sinistra: Il giornale dell'architettura "Cronistoria di una vita grama: il Palazzo del Lavoro dal 1961 a oggi", 20 settembre 2015, (b) Destra: ZaziRound)

Anche dall'analisi della recente letteratura, si ritiene che il patrimonio del XX secolo sia minacciato, nonostante la sempre maggiore presenza e formazione di organi e strutture consolidate per il riconoscimento e la protezione dei luoghi del patrimonio contemporaneo (Burke, 2007).

La tutela del patrimonio del XX secolo comporta inoltre un'ulteriore problematica relativa principalmente al patrimonio costruito, ossia le pratiche operative relative agli interventi di conservazione. Negli ultimi 20 anni molto è successo in termini di identificazione, protezione e conservazione del patrimonio del XX secolo: i dibattiti a livello internazionale hanno a loro volta promosso risposte locali e viceversa. La conservazione del patrimonio è infatti generalmente guidata a livello nazionale e locale e fornisce risposte molto specifiche che, almeno nel caso italiano, spesso anticipano anche le questioni internazionali. Lo scambio e la "fertilizzazione" incrociata di idee e pratiche a livello internazionale ha permesso la nascita e lo sviluppo di organi di controllo e di ricerca nazionali e internazionali, come: MiBACT, DOCOMOMO, ICOMOS e UNESCO. Il Consiglio d'Europa è stato attivamente impegnato

nell'identificazione e nella cura del patrimonio del XX secolo dalla fine degli anni '80, così come le principali Agenzie e Organizzazioni a Tutela del Patrimonio in Europa (Del Monaco in (Canella and Mellano, 2019)).

L'eredità della storia e della teoria architettonica del XX secolo è ricca e diversificata; senza dubbio è però l'evoluzione del Modernismo che ha innescato i cambiamenti del paesaggio costruito più significativi nel corso degli ultimi 100 anni. Il Modernismo è stato concepito con l'obiettivo di esprimere le opportunità e l'ottimismo della nuova era, iniziata dopo la Seconda Guerra Mondiale. In Italia ha favorito, anche se con qualche ritardo rispetto al resto d'Europa, una rottura con la tradizione e con le forme classiche del regime, lo sviluppo di nuovi materiali e tecnologie più adatti ai nuovi stili di vita e di un nuovo linguaggio (Zevi, 1989). Una nuova comprensione delle qualità spaziali, utilizzando nuove tecnologie e applicando innovazioni strutturali, come la prefabbricazione, sono stati elementi utilizzati come possibile infrastruttura di una nuova società, con l'obiettivo di risolvere problemi di igiene, comfort e standard di vita (Zevi, 2000). L'architettura era considerata un potente strumento di riforma sociale (ICOMOS, 2005). Nel periodo successivo alla Seconda Guerra Mondiale, architetti, ingegneri e imprese di costruzione hanno utilizzato in modo esuberante i nuovi materiali, tra cui il calcestruzzo armato, senza tuttavia avere i mezzi per comprenderli pienamente in termini di prestazioni a medio e lungo termine e causando così i fenomeni di degrado che si vedono oggi.

L'approccio errato del passato, dovuto a una mancanza di conoscenza, secondo cui i materiali moderni richiedono poca manutenzione, combinato al problema dei costi di gestione elevati, in seguito all'aumento del costo del petrolio del 1975, ha prodotto il sottoutilizzo o l'abbandono dei beni e il loro degrado fisico e funzionale, evidenziando guasti precoci, dettagli inefficienti e prestazioni energetiche scadenti. L'evoluzione dei servizi per l'edilizia è avvenuta più rapidamente nel Novecento che in qualsiasi altro secolo, ma la crisi energetica tra la metà e la fine degli anni '70 ha avuto un effetto importante sulle modalità di manutenzione degli edifici e le esigenze di riscaldamento e raffreddamento attivo di molti edifici di inizio e metà secolo sono oggi insostenibili.

Molti edifici del XX secolo non hanno resistito bene alla prova del tempo e la loro incapacità di invecchiare "con grazia" ha messo in dubbio i principi fondamentali della conservazione, come il "minimo intervento" e la "reversibilità", e ha comportato il rischio di danni ingenti o di perdite permanenti.

Un ulteriore aspetto di difficoltà nel riuso adattivo dell'architettura contemporanea è l'adattabilità dei grandi contenitori a nuovi usi, sia per le risapute difficoltà relative a interventi

di rifunzionalizzazione e ristrutturazione con adeguamento sismico ed energetico, sia anche per gli elevati costi da sostenere e l'elevata rischiosità degli interventi.

Tra le varie tematiche relative alla tutela va considerato anche il principio secondo cui alcuni edifici dell'epoca moderna sono stati costruiti appositamente per avere una vita breve e che invece sono rimasto in uso, con tutti i limiti, fino ad oggi. Senza una generalizzazione eccessiva, l'idea di architettura "usa e getta" potrebbe aver guadagnato legittimità nella seconda metà del XX secolo, dove le strutture leggere e smontabili hanno iniziato a svolgere un ruolo più importante nella realizzazione di edifici sia pubblici sia privati. Tuttavia, questo è un campo di ricerca del restauro dell'architettura moderna e contemporanea in continua evoluzione, molto trattato anche nella disciplina della scienza e tecnologia dei materiali, che pone sfide e questioni ricorrenti nel restauro degli edifici del Novecento:

- Come conservare edifici progettati intenzionalmente per brevi periodi di vita?
- Come conciliare le scarse prestazioni tecniche di alcuni materiali e sistemi e la loro conservazione?
- Come adattare edifici moderni, funzionalmente obsoleti, ai requisiti d'uso e ai criteri di prestazione contemporanei, senza snaturarli?
- Come valutare la redditività economica della rifunzionalizzazione, anche in relazione ai risparmi energetici che ne conseguono?
- Come conciliare gli interventi di restauro e conservazione con quelli di adeguamento energetico e miglioramento delle prestazioni ambientali?

Riguardo agli ultimi punti, la sostenibilità (economica e ambientale) sta diventando l'obiettivo principale di tutte le politiche di sviluppo: gli audit energetici degli edifici iniziano a essere utilizzati sempre più per valutare interventi di adeguamento energetico integrativi o sostitutivi rispetto al solo adeguamento delle strutture esistenti. Tuttavia, mentre gli audit energetici spesso confermano il valore ambientale della conservazione degli edifici più tradizionali, ciò non accade per gli edifici progettati dalla metà del secolo in poi, che, concepiti e costruiti in un'epoca in cui le risorse energetiche ed economiche sembravano inesauribili, sono ad oggi altamente energivori.

Come in Europa, gli edifici italiani del Novecento manifestano la necessità di un primo intervento di manutenzione generale (di livello medio) dopo circa 25-30 anni dalla costruzione, ossia entro circa la metà del tempo di edifici costruiti più tradizionalmente (Thorne, 1997). Se si presuppone poi che potrebbero essere necessari interventi di manutenzione straordinaria entro

i 50-60 anni dalla costruzione, anziché nei 100-120 anni comunemente documentati per il patrimonio edilizio più tradizionale(Thorne, 1997; Fregonara, Moretti and Naretto, 2018) questo significa che ad oggi tutti gli edifici costruiti tra 1950 e 1970 potrebbero richiedere tali interventi.

In Italia, in base al quadro normativo di tutela aggiornato nel 2017[1], gli edifici residenziali privati di età inferiore ai 70 anni non sono soggetti alle disposizioni di tutela "automatiche" e, quindi, non sono assoggettati a verifica "automatica" di interesse culturale. Infatti, la definizione del concetto di patrimonio culturale ha sottolineato che "[…] per gli oggetti immobili appartenenti a qualsiasi proprietario privato, siano essi opera di un autore vivente o la cui esecuzione risale a meno di 70 anni, nonché se siano opera di un autore vivente o la cui esecuzione risale a meno di 50 anni fa, non sono soggetti a disposizioni di tutela e, pertanto, non possono essere oggetto di dichiarazione di interesse culturale […]" (Legge 4 agosto 2017, n. 124). Essere sprovvisti del "provvedimento di tutela" implica che solo se c'è una chiara richiesta da parte della Regione o di qualche ente territoriale, eventualmente, alcuni di questi edifici potrebbero essere segnalati e posti sotto tutela.

Anche se il patrimonio contemporaneo italiano, inteso anche come patrimonio post-moderno e riferibile al Movimento Moderno, è quasi interamente studiato e classificato, è ancora poco presente nelle banche dati ufficiali on line di settore. In particolare, le residenze (sia condomini sia ville) sono ancora maggiormente assenti, pur costituendo la gran parte del patrimonio costruito delle città e una parte importante dello sviluppo architettonico del '900 (Urban, 2017). L'architettura residenziale, forse perché di uso comune, è meno studiata, ma presenta peculiarità e valori che dovrebbero essere evidenziati e resi di dominio pubblico. Se da un lato, infatti, i grandi edifici industriali, commerciali e dei servizi, definiscono la morfologia delle città post-industriali, dall'altro gli edifici residenziali ne definiscono il paesaggio.

Nel settore residenziale, le architetture d'autore, ossia progettate da architetti di spicco influenzati dal Movimento Moderno, sono state realizzate sia per il settore pubblico (interi quartieri con case a prezzi accessibili principalmente per i lavoratori immigrati), sia per le classi medie e alte (nuova borghesia). Il fenomeno dell'introduzione delle città di una nuova tipologia abitativa, il condominio, ha interessato tutta l'Europa e ha definito la forma della città contemporanea (Urban, 2018). Nei paesaggi urbani, condomini e ville realizzati con un alto

[1] Legge 4 agosto 2017, n. 124, Legge annuale per il mercato e la concorrenza. (17G00140) GU n.189 del 14-8-2017)

livello di qualità architettonica e costruttiva sono però mescolati ad architetture prive di qualità, costruite spesso "in economia" e in tempi rapidi (Dümcke and Gnedovsky, 2013; Sowińska-Świerkosz, 2017). A prescindere dalla tipologia, la distinzione tra edifici di qualità architettonica e costruttiva è poco comune sia da parte della domanda (dei cittadini), sia da parte degli operatori del mercato immobiliare e anche il mercato immobiliare in sé difficilmente riconosce ne monetizza il valore aggiunto, facendo prevalere l'influenza di altre caratteristiche intrinseche ed estrinseche, nonché della *location* degli immobili nel meccanismo di formazione dei prezzi.

Nella presente ricerca, gli "edifici residenziali del XX secolo" sono identificati come edifici di derivazione modernista in cui è chiara l'influenza del Movimento Moderno Internazionale in termini di scopo, tipologie, tecnologie e funzioni (Cunningham, 2013); in alcuni casi la categoria ricomprende architetture contemporanee del dopoguerra e del secondo novecento. Il termine "patrimonio residenziale invisibile" identifica quella parte degli edifici residenziali della seconda metà del XX secolo, che non sono definibili come "icone" nel panorama della storia dell'architettura, il cui valore non è facilmente riconoscibile se non dagli esperti del settore e non vengono monetizzati nel mercato immobiliare.

Ripercussioni sulle politiche e sull'economia urbana

Il riconoscimento del patrimonio edilizio anche residenziale e contemporaneo come parte integrante del patrimonio storico da tutelare della città potrebbe contribuire, in varia misura alla trasformazione dell'economia urbana.

Nel campo del marketing territoriale (city-branding), per esempio, potrebbe portare alla definizione di un'unica immagine urbana, riconoscibile all'esterno e utilizzabile per possibili campagne di promozione e per l'attivazione di nuove strategie di sviluppo (Berg, 2017). Riconoscere il valore intrinseco di questo tipo di architettura, quindi, non solo è utile per le possibili strategie di trasformazione e riqualificazione urbana, ma potrebbe innescare nuove modalità di conoscenza, diversi modelli e connessioni utili per la ri-definizione dei valori immobiliari (Coulson and Leichenko, 2001; Franco and Macdonald, 2018). Letteratura recente ha anche dimostrato che il riconoscimento del valore storico e architettonico del patrimonio contemporaneo può aiutare a ridefinire il valore delle aree in cui si trova, anche dal punto di vista dei valori immobiliari (Tengberg *et al.*, 2012).

L'UNESCO ha dichiarato, nella definizione degli Heritage Urban Landscape (HUL), che è fondamentale integrare i valori del patrimonio urbano e il loro possibile stato di vulnerabilità

in un quadro più ampio di sviluppo, capace di fornire indicazioni su aree di maggiore "sensibilità" del patrimonio che richiedono da parte del Comune e dei costruttori una particolare attenzione alla pianificazione, progettazione e realizzazione di progetti di sviluppo (Bandarin and van Oers, 2012; Albert, Bernecker and Rudolf, 2013).

Attualmente, la richiesta di una maggiore attenzione al patrimonio moderno e contemporaneo può essere anche sottolineata dalla pubblicazione di guide "non ufficiali" e divulgative dedicate a tour tra queste architetture, l'aggiornamento di piattaforme web che gestiscono dati generati dagli utenti e la progettazione di itinerari dedicati integrati all'interno dei maggiori siti di tour operator europei (Minucciani, 2000) .

Interventi su questo tipo di patrimonio hanno quindi molteplici impatti sia per gli enti pubblici sia per i privati: permettono di completare il quadro di conoscenze del patrimonio costruito, culturale e umano delle città (Ost, 2012; Tengberg et al., 2012), permettono di seguire il crescente interesse e la nuova segmentazione della domanda di abitazioni e dell'industria turistica; permettono, tramite la divulgazione, di aumentare la consapevolezza degli acquirenti e dei cittadini; promuovere politiche di equità fiscale di moderare le disuguaglianze degli affitti; contribuire, con nuovi dati e informazioni, alla riforma dei Piani Strategici Urbani.

Letteratura di riferimento: lo stato dell'arte

Dopo aver stabilito alcuni obiettivi teorici e operativi della ricerca, il lavoro di ricerca è proseguito con la revisione della letteratura. L'analisi della letteratura e lo stato dell'arte della ricerca definiscono il quadro concettuale e relativo alla presente Tesi e comprendono pubblicazioni sui seguenti temi:

- teorie del mercato immobiliare e della sua componente geografica;
- definizione di autorialità, qualità architettonica e costruttiva degli edifici residenziali del XX secolo;
- metodi di catalogazione e archiviazione dell'architettura della seconda metà del XX secolo;
- approcci estimativi di *mass appraisal*;
- definizione di indicatori di qualità;
- la gestione della conoscenza, la costruzione di banche dati geografiche e la gestione dei dati;
- principi di statistica spaziale per il mercato immobiliare;

- teorie e applicazione dei modelli Multiple Regression Analysis (MRA) per il mercato immobiliare; teorie e modelli delle analisi di statistica spaziale e regressioni spaziali globali (Spatial Lag SLM e Spatial Error SEM)
- Geographical Weighted Regression (GWR).

Come parte integrante della ricerca, è stata condotta una revisione critica della letteratura pertinente. I risultati della revisione della letteratura sono stati usati per la costruzione e l'affinamento del *geodatabase* del patrimonio residenziale del XX secolo (XXQDB), per definire l'approccio metodologico da utilizzare e per l'interpretazione dei risultati. La ricognizione dei portali online che forniscono dati open secondo la Direttiva Europea Inspire[2] conferma che, anche se molti dati relativi alle architetture del XX secolo sono già presenti in diverse banche dati nazionali e regionali e anche se, grazie all'avvio del progetto nazionale del MiBACT "Censimento nazionale delle architetture italiane del secondo Novecento"[3], si stanno portando avanti, su tutto il territorio nazionale, campagne di rilievo, documentazione fotografica e catalogazione del patrimonio, definendone le caratteristiche qualitative.

Si possono ricontrare alcune mancanze nelle ricerche ed in particolare:

- mancanza nelle banche dati esistenti di un chiaro legame tra architettura residenziale di qualità, riconosciuta come patrimonio culturale, e mercato immobiliare;
- mancanza di analisi del patrimonio residenziale del Novecento che metta in relazione qualità architettonica e la sua *location*;
- mancanza di analisi statistiche spaziali sull'influenza delle caratteristiche architettoniche e fisiche sul processo di formazione dei prezzi nel mercato immobiliare;
- mancanza di analisi spaziali e statistiche in grado di distinguere la qualità architettonica e le caratteristiche fisiche degli edifici dalle loro caratteristiche di localizzazione.

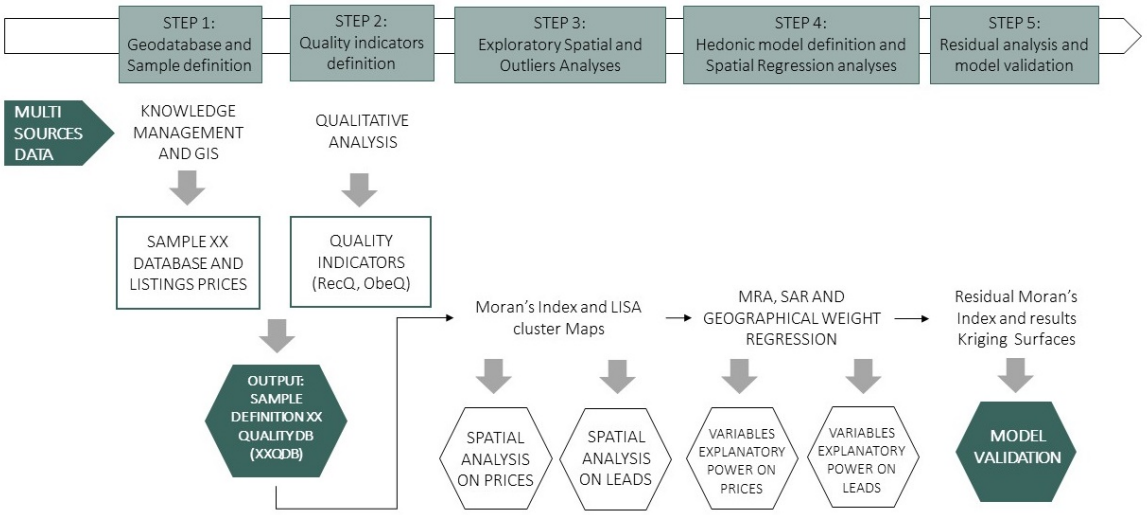
A partire da queste mancanze nella letteratura si è potuto affinare l'indirizzo di ricerca e contribuire criticamente all'avanzamento della ricerca in alcuni di questi punti. Successivamente è stato definito il work-flow e la metodologia scientifica di ricerca.

[2] Direttiva 2007/2/CE del Parlamento europeo e del Consiglio, del 14 marzo 2007, che istituisce un'Infrastruttura per l'informazione territoriale nella Comunità europea (Inspire).
https://eur-lex.europa.eu/legal-content/IT/ALL/?uri=celex%3A32007L0002

[3] Censimento nazionale delle architetture italiane del secondo Novecento. http://architetturecontemporanee.beniculturali.it/architetture/

Metodologia di ricerca

L'approccio metodologico sviluppato include sia analisi qualitative sia quantitative dell'architettura contemporanea, in relazione al mercato immobiliare. La metodologia si compone di 5 fasi successive, ciascuna delle quali si sviluppa a partire dai risultati della fase precedente.



Workflow of the Methodological approach (Source: Author's processing)

Il primo passo della ricerca è stato la definizione della qualità architettonica ed edilizia (riconosciuta ed osservata) e la conseguente formazione del campione di dati alla base delle analisi, relativi sia alle architetture residenziali di qualità sia alle unità residenziali offerte sul mercato nel 2019 a Torino, entrambe datate tra il 1950 e il 2000. La struttura concettuale del campione implica la definizione di variabili tramite l'uso di join spaziali, query di attributi e query spaziali per l'unione e l'armonizzazione di dati provenienti da fonti diverse. La costruzione del campione è partita dalla ricerca dei dati già pubblicati, sia in risorse online sia in articoli e monografie. A seguito di questa prima ricerca, è stato necessario integrare il campione tramite il rilievo visivo delle architetture. Lo scopo principale per questa prima ricognizione è stato il raggiungimento di un numero statisticamente significativo di dati per poter procedere con le analisi successive. Si è ottenuta così una prima classificazione del patrimonio residenziale urbano della seconda metà del XX secolo, con qualità architettoniche o costruttive.

Il campione iniziale, relativo alle residenze della seconda metà del XX secolo di qualità, è stato successivamente integrato con una banca dati di offerte immobiliari rilevate sul mercato immobiliare nel 2019[4]. La banca dati così composta comprende sia variabili descrittive intrinseche delle caratteristiche delle unità immobiliari, sia caratteristiche intrinseche dell'edificio nel suo complesso (prezzo di offerta, metri quadri, numero di stanze, presenza di ascensore, ecc.) e, per gli edifici di qualità, caratteristiche relative anche al riconoscimento delle loro qualità sia architettonica sia edilizia (autore, età, segnalazione di interesse culturale, vincolo di soprintendenza, presenza in pubblicazioni).

Il campione di dati così composto è stato quindi osservato e descritto tramite l'uso di classici indicatori statistici centrali e di dispersione e affinato tramite l'analisi degli *outliers*.

In seguito, sono stati utilizzati metodi e modelli di statistica spaziale con lo scopo di stimare i valori delle architetture classificate nel campione di dati e di capire quali caratteristiche avessero una influenza significativa sulla formazione dei prezzi, in particolare:

- Exploratory Spatial Data Analysis (ESDA)[5], per analizzare la presenza di autocorrelazione spaziale dei dati preliminari e per verificare la correlazione tra i dati;
- Modelli di regressione edonica (Ordinary Least Squares – OLS)[6] e analisi dei residui;
- Modelli di regressioni spaziali globali (Spatial Lag and Spatial Error Models – SLM and SEM)[7];
- Regressione Geografica Ponderata (Geographical Weighted Regression - GWR)[8], per comprendere il contributo della caratteristica fisica alla formazione del prezzo e per inferire il valore di tutte le unità residenziali classificate nel campione;
- Kriging Prediction Surface Map[9], per ottenere l'interpolazione dei coefficienti marginali di ogni variabile esplicativa stimati (previsti) su tutto il territorio cittadino.

[4] Dati Immobiliare.it
[5] Cfr. Capitolo 3.2.2
[6] Cfr. Capitolo 3.2.1
[7] Cfr. Capitolo 3.2.2
[8] Cfr. Capitolo 3.2.3
[9] Cfr. Capitolo 3.2.4

Per procedere con l'applicazione di un modello edonico e con la conseguente applicazione della GWR, sono state prodotti una serie di test preliminari per l'analisi della componente spaziale del campione spaziale di dati.

Un modello di regressione ponderata geografica (Geographically Weighted Regression - GWR) ha portato alla stima inferenziale di tutti gli edifici di qualità architettonica analizzati, classificando le caratteristiche più o meno monetizzate nel mercato immobiliare. Infine, per analizzare la bontà e l'efficacia del modello, sono stati analizzati i residui attraverso test per la correlazione e clustering spaziali.

Area di Studio e Campione dei Dati

Il mercato immobiliare del patrimonio abitativo esistente analizzato come area di studio è quello della Città di Torino. A Torino, sebbene il numero delle transazioni sia aumentato, i prezzi di quotazione del patrimonio immobiliare esistente sono diminuiti in modo significativo e costante dal 2011 al 2018 (-25%), mentre sono aumentati i tempi di contrattazione. Anche il mercato immobiliare del nuovo patrimonio abitativo ha subito un consistente calo dei prezzi dal 2011 al 2018 (-14%), ma soprattutto un calo del numero totale di cantieri (-30%) e una significativa crescita del numero di unità abitative invendute (OMI, Agenzie delle Entrate, Rapporto Immobiliare 2019).

Attualmente, a Torino la crisi ciclica del mercato immobiliare sembra essere diventata strutturale: la città sta attraversando una fase di dis-urbanizzazione caratterizzata da una serie di fattori economici, sociali e demografici che stanno determinando radicali trasformazioni urbane, sia nella zona centrale e nelle aree storiche della città, sia in quelle periferiche. La trasformazione delle gerarchie urbane sta modificando anche i sotto-mercati immobiliari (in termini di dinamismo e andamento dei prezzi) e i loro confini territoriali. La grande influenza della variabile di localizzazione (*location*), nel processo di determinazione del prezzo delle abitazioni e nell'influenzare i comportamenti di acquirenti e venditori, è ampiamente riconosciuta.

Il paradigma di localizzazione si sta evolvendo, assumendo parametri differenti, e le preferenze degli acquirenti relative alle caratteristiche di localizzazione e di vicinato stanno cambiando. Emblematico a tal proposito il caso del versante collinare della Città di Torino, che è considerata una delle zone più prestigiose della città, con prezzi immobiliari alti, alte dotazioni e qualità ambientali, ma sprovvista di servizi pubblici e privati, che vede l'andamento nelle compravendite e nei cantieri in continua diminuzione.

Il patrimonio residenziale contemporaneo di alta qualità architettonica e costruttiva all'interno del mercato immobiliare di Torino è del tutto indistinguibile rispetto alle altre architetture ed è spesso sottovalutato nel processo di determinazione dei prezzi di offerta. Gli esempi presenti nel paesaggio urbano non hanno caratteristiche e forme eclatanti, che li distinguono per forma e tipologia dal patrimonio di tipo "standard", ma elementi di qualità architettonici e costruttivi in facciata, nell'uso sapiente dei materiali, nell'uso originale dei vuoti e dei pieni, nell'uso di geometrie compositive di facciata ecc. D'altra parte, la preparazione degli agenti immobiliari e degli acquirenti sulla qualità architettonica degli edifici contemporanei è troppo spesso molto bassa; questo implica la pubblicazione di annunci immobiliari con una classificazione di edifici d'Autore come "media" o "bassa", senza ulteriori specifiche e il prezzo di offerta di conseguenza calcolato solo sulle caratteristiche standard e in base alla posizione. Dal lato della domanda, ciò implica non essere abituati a vedere negli annunci di mercato caratteristiche qualificanti, che distinguono edifici di pregio da quelli appartenenti allo standard medio della seconda metà del XX secolo, e attribuire la "signorilità" di un edificio ai servizi presenti come la presenza di custode, la presenza di doppi ascensori, lo stato di conservazione elevato.

Infine, da parte degli autori e delle imprese di costruzioni, c'è l'abitudine di non vedere pubblicamente riconosciuta "la paternità" delle proprie opere, soprattutto in ambito residenziale, perché valutate come architettura di secondaria importanza rispetto ad altre opere come scuole e uffici che, se di successo, sono più facilmente attribuiti.

Il campione di dati degli edifici segnalati di interesse culturale del XX secolo a Torino è composto da 1104 dati, di cui il campione relativo al residenziale è pari a 868 dati, di cui, a sua volta il campione di dati limitato alla seconda metà del XX secolo è pari a 562 dati ed è nominato QDB. In parallelo l'universo dei dati delle offerte immobiliari (dati Immobiliare.it) presenti sul mercato nel 2019, per il comparto residenziale è pari a 10716 unità, di cui 6.441 in edifici costruiti nella seconda metà del XX secolo. Questo campione, unito al precedente e sottoposto alle puliture necessarie per l'applicazione dei modelli (7545 dati), si è poi ridotto a 3705 dati ed è nominato XXQDB, composto da 3259 dati di offerte immobiliari presenti sul mercato nel 2019 (XXQDBS), di cui 116 relative ad edifici di qualità e 446 dati relativi ad unità immobiliari in edifici di qualità architettonica e costruttiva non presenti sul mercato nel 2019, il cui prezzo quindi, per le analisi svolte, è stato stimato.

Risultati e conclusioni

Il primo risultato ottenuto dal lavoro di ricerca è stato il nuovo geodatabase XXQDB composto dalle architetture residenziali di qualità della seconda metà del XX secolo collegate alle unità residenziali, costruite nello stesso periodo e offerte sul mercato immobiliare della città nel 2019.

Il secondo risultato è stato poi lo studio e la definizione di due indicatori di qualità architettonica e costruttiva, sia riconosciuta (RecQ) tramite vincoli, dichiarazioni di interesse culturale, pubblicazioni sia solamente osservata (ObeQ) tramite rilievo diretto, sulla base caratteristiche fisiche rilevanti e comuni al patrimonio di quell'epoca.

Infine, il risultato principale è stato ottenuto tramite l'applicazione di metodi di econometria e geostatistica. In particolare, i modelli edonici (MRA e SEM) e la Geographical Weighted Regression (GWR) sono stati applicati per analizzare l'influenza di diverse caratteristiche intrinseche delle unità abitative e degli edifici residenziali sulla formazione dei prezzi di offerta. I risultati delle analisi confermano che per entrambi i campioni di dati analizzati (3259 dati e 3705 dati), le componenti relative alla qualità architettonica e costruttiva degli edifici residenziali della seconda metà del Novecento non hanno un coefficiente marginale significativo e pertanto non influenzano il processo di formazione dei prezzi.

Tuttavia, bisogna fare alcune osservazioni inerenti ai due modelli applicati. I modelli di regressione, definiti modelli "globali" (MRA e SEM), presuppongono che l'influenza delle caratteristiche sui prezzi, anche quelle spaziali, siano costanti nello spazio, questo è stato smentito dalla letteratura e la componente geografica viene perciò gestita a sua volta tramite i modelli spaziali locali (GWR), invece, la componente spaziale e tutte le caratteristiche vengono stimate osservazione per osservazione, garantendo quindi la variabilità dell'influenza delle caratteristiche nelle varie aree della città.

I risultati del modello OLS, quindi, non annoverano la qualità tra le caratteristiche influenti quali invece sono la categoria dell'edificio, la presenza dell'ascensore, il numero di stanze abitabili, lo stato di conservazione, la presenza del terrazzo e la classe di performance energetica APE con coefficienti marginali di segno diverso.

Il modello GWR invece è in grado di valutare l'influenza della componente qualitativa in ogni punto del campione e, in questo caso, sia la qualità riconosciuta sia la qualità osservata influiscono sui prezzi in determinate aree urbane, mentre in altre seguono l'andamento dei risultati del modello globale e non sono significative. La capacità della GWR di stimare e

inferire il valore delle unità prive di prezzo è inoltre un'altra potenzialità del modello che viene sottolineata dall'interpolazione dei valori "*predicted*" tramite l'equazione di Kriging.

L'elemento più interessante è che il sistema di valori dell'epoca di costruzione delle residenze analizzate è profondamente modificato proprio dal punto di vista spaziale. Si riscontra quindi che zone tradizionalmente forti come la Crocetta e la Collina torinese hanno subito un processo di svalutazione a favore delle zone centrali. Questo cambiamento nel sistema di valori è il risultato sia di fattori demografici sia dell'emergere di nuovi modelli culturali che interessano anche gli strati più giovani che possono accedere al patrimonio immobiliare.

1. Introduction

1.1. Research context and research questions

The research project here presented addresses the role that estimation and microeconomics can play in analysing to what extent and in which ways individuals perceive the architectural quality of contemporary architecture and monetize it through the real estate market; this, makes it possible to grasp the system of values that has characterized the evolution of societies over time. This research focused on the study and analysis of the real estate market, to identify the economic value of residential stock built in the second half of the 1900s (1950-1999). In particular, the analyses focused on housing that stands out for its architectural and building quality: materials used and level of technology and workmanship.

Residential buildings in Europe in the 1950s and 1970s are characterized by poor construction quality, often impersonal, conditioned by the economy and consequent income distribution, although this varies from country to country. Focusing on the residential heritage, the research attempts to verify whether and how the architectures built between the 50s and 90s - when the Modern Movement and its subsequent evolutions were internationally affirmed - are perceived by the current society. In fact, citizens and tourists generally recognize the value of both ancient heritage and of contemporary architecture of recent decades, but the great architectures produced by the Modern Movement seem not to be recognized for the value they have, despite the fact that this value is well evidenced by the historiography.

First of all, it was necessary to deal with the crux of how to define and measure architectural quality and how to distinguish it from other qualities, including construction quality. The most challenging aspect of the research was to identify and measure the architectural quality, not only for famous buildings - published in magazines and monographs

- but also for buildings whose designers are unknown. These buildings, not recognized in published works or already included in heritage lists, were identified through visual surveys.

Hedonic models have been widely applied to recognize the influence produced by the historical-architectural qualities of historical built heritage, but until now they have rarely been applied to contemporary built heritage. Hedonic models were used in this study to obtain a breakdown of total prices into different components, represented as marginal prices of the locations and intrinsic characteristics considered by the models.

Lastly, one of the issues addressed by the research is the fact that only a low percentage of houses built between 50s and 90s, recognizable by their architectural quality, are offered on the market. This reflects on the one hand, on the functioning of this particular segment of the real estate market and on the other hand it complicated the research analysis, making it more complex and making the results of the models less immediate.

The results of this research can contribute to redefining segments and sub-segments of the real estate market taken for granted today, precisely in the relationship between micro and macro areas and/or between central and peripheral areas.

Previous research on Turin has shown that the system of values in real estate of the second half of the 20th century (Curto, 1988) no longer exists today. At the time, the system reflected the distribution of income and the social division of space and it was based on a social and cultural model which expressed the preference 'better new rather than beautiful'. A different model evolved in the last two decades of the 1900s, with the revaluation of the period house and the recovery of the central areas of the cities, together with the appreciation by the market of the historical-architectural quality of assets.

Since 2006, following the crisis that has occurred in the real estate market, this model has progressively transformed, due to the persistence of the crisis in the real economy and the social changes in terms of demographic level and distribution of income, that resulted in the extreme polarization between, strong and vulnerable social groups (Barreca, Curto and Rolando, 2017b) and within the construction sector (Barreca, Curto and Rolando, 2018). These changes have gradually but radically modified the system of market values and consequently the pre-existing territorial and social hierarchies: on one hand, increasingly extensive areas of social vulnerability were produced, characterized by high housing fragility and building and territorial degradation phenomena; on the other hand, the areas with the highest prices and the strongest social strata in terms of income and social and cultural position increasingly limited and concentrated in the so-called historic centre. These areas, characterized by an urban vibrancy,

whose definition is studied in several recent papers (Yue *et al.*, 2017; Wu *et al.*, 2018; Malizia and Motoyama, 2019), have incorporated the changing cultural models inherent in the higher society lifestyle, which seem to increasingly appreciate the presence of neighbourhood services and the concentration of shops and spaces dedicated to the cultural offer. These qualities are monetized both by the real estate market for "used" existing houses and by the market for new constructions (Barreca, Curto and Rolando, 2020b, 2020a).

In continuity with previous studies, the present work aims to analyse consumer preferences inherent in the choice of housing units located in buildings with different architectural and construction qualities. Therefore, it considers and compares two principal areas of quality: the architectural and constructive aspects, recognized or observed. Recognised architectural quality is intended as a value embedded into the construction at the time of its design/construction, often given by the quality of the design and the innovative technological and formal solutions given by the architect. Recognised architectural quality is often internationally attributed to architectures with known authorship. This quality is attributed to residences, for the most part already studied and published in magazines, monographs and databases of the sector.

Observed architectural and building quality, on the other hand, is intended as a potential quality, normally recognizable only by experts in the sector, but not yet published and difficult to distinguish from the other qualities of the buildings of the second half of the 20th century. The results of this research, as further detailed, may be useful to redefine segments and sub-segments of the real estate market taken for granted today, precisely in the relationship between micro and macro-areas and/or between central and peripheral areas.

1.2. Research aim

Assuming the aforementioned premises and concentrating on the analysis of the real estate market of the residential sector in the urban context, it emerges that new paradigms and new operational tools are required in order to guide the policies and investments for the redevelopment of the twentieth century heritage and to safeguard the habitability of cities, manage degrowth and ensure the protection of heritage sites. This research aims at: i) constituting a first step in the establishment of a methodological approach to understand whether building quality is a key factor in urban vibrancy and ii) favouring the development and dissemination of knowledge concerning 50s to 90s heritage.

Considering the real estate market as the expression of individual behaviours and preferences, the research intends to understand whether, how and in what measures the qualities that characterize the residential heritage built during the 20th century are recognized and monetized by buyers who base their choices among alternative goods according to the ordering fields of preferences and the relative marginal utilities.

Therefore, the main questions at the basis of this research work are:

- Is it possible by using hedonic models to isolate, architectural quality from other constructive and locational qualities and characteristics? Which qualities are monetized by the market today? How and to what extent have they changed from the past? How have the relative prices of physical qualities varied with respect to location? To what extent? By which social strata are these qualities valued, in different economic cycles?
- Is it possible to deduce from the hedonic models to what extent the different qualities, intrinsic and locational, are monetized by the market and, therefore, to trace the preferences of consumers and the cultural models that determine market values?
- How are consumers' preferences changing and with what future prospects, also in relation to the innovation processes that affect construction and the real economy?
- Considering the epochal change in progress, is it possible to predict an evolution, determined by the processes of technological innovation and by simultaneous demographic, social and cultural changes?

Without claiming to answer all the questions posed, this research intends to detect the structural changes underway in the real estate market and to highlight the repercussions that these may have in guiding social and urban economics studies.

The three pillars of the research are therefore through:

- analysis of the real estate market and its demand;
- analysis of the residential assets of the second half of the 20th century and the identification of its quality characteristics;
- the repercussions on policies and urban economy that the recognition and monetization of the quality characteristics could have.

The three pillars are briefly detailed in the following paragraphs.

Real Estate Market Analysis

The globalization of the economy and the processes of technological innovation are producing structural transformations of the economic and social system that are reflected in the paradigms that for many decades have been the basis of the development of cities. The profound remarkable changes in Italy at the scale of the macroeconomic system are bringing equally profound transformations in the construction and real estate market, starting from the hierarchy of values.

Today it can be said to be over the great transformation produced by industrialization in the economy and society, that profoundly changed the morphology of cities, buildings and social stratifications.

The real estate market in Italy has been characterized by a phase of continuous decline since 2006: the contraction of employment rate and the changed distribution of income are perceptible in the cities through the abandonment of residential and commercial areas, while, in the inner territories, they are causing the progressive forest growth and the depopulation of villages (SIU, 2021).

The population has been decreasing since 2015 and in 2019, for the first time in the last 90 years, there was a phase of demographic decline (ISTAT, 2019). Moreover, the Italian context presents an aging population, a decline in the fertility rate, continuous inbound migratory flows that are not adequately managed and an increase in youth emigration.

In this situation, the approach to the real estate market needs to be rethought, also in relation with the reform of several Regulatory City Plans: given the stop to the population increase (also theoretical), land consumption must cease, the use of free land must be totally substituted by the re-use of the abandoned building stock and the empty and underused residential stock. In addition, the consequent problem of the surplus of services in urban areas shall be considered. It will be necessary to identify the new paradigms underlying the policies and new operational tools to safeguard the habitability of cities, manage the necessary degrowth and safeguard heritage sites.

A general evaluation of the recent history of European contemporary cities (Van Den Berg et al., 1981; Barkley et al., 1982) was introduced by the Theory of Space Cycles (TSC). TSC defined sequential phases of urban development, through the identification of time intervals connoted by homogeneous economic, demographic, social or institutional conditions. In particular, four main cycles have been identified, using geographic, econometric and mixed

methods: urbanization, sub-urbanization, dis-urbanization and re-urbanization, that are linked to the movements of the population and economic activities in urban and sub-urban centres.

The four identified cycles allow the analysis and interpretation of the building and urban planning stratifications determined and can help to better understand their complexity and clarify the role of socio-economic factors in shaping adaptation to change (Zambon and Salvati, 2019).

Local real estate markets have a mutual correlation with the four cycles above-mentioned: on one side, they are influenced by specific socio-economic and cultural processes, linked to the cycles of the national and international economic macrosystem; on the other hand, the dynamics of the real estate market influence urban cycles, as well as economic activities and morphology (Delladetsima, 2006; Edelstein and Tsang, 2007; Salvati, 2016). Sequential waves of economic expansion and stasis also act on socio-demographic trends, on building cycles, on weak housing policies and family-oriented welfare regimes (Morelli, Rontos and Salvati, 2014).

Recent years belong to a phase of de-urbanization of medium-small cities, with the agglomeration of the population in few large centres (metropolis) located in different areas of the world. Metropolis share common characteristics: easy international connections (connections), simplified tax legislation (concessions) and the presence of agglomerations of multinational headquarters and offices (hubs). This process leads to a polarization between strong and weak urban areas, with the consequent formation of sub-markets with very high density and values and sub-markets with a low-density and property values below the mean, which create a certain range of "spill-over", positive or negative, in the neighbouring territories.

In these big cities, the higher values per square meter hinder the presence of the typical social *mixité* and create an ever greater sectorization of the geographical areas of the city. This confirms the hierarchical structure of the city areas based on the well-known phenomena of *gentrification*, which determine processes of enhancement and devaluation of different parts of the city often regardless the different social strata of inhabitants.

The 20th century building heritage.

In the last 40 years, all around the world, the interest in the safeguarding and conservation of 20th century heritage has increased, with the relative increase in the scientific production of conferences and publications. However, the conservation of 20th century buildings poses continues new challenges to those responsible for their management and to the conservation professionals. The lack of recognition (except for masterpieces), the absence of complete

research frameworks and the insufficiency of adequate protection strategies and policies of reuse, have led to the abandonment and even the loss of many elements of this heritage around the world.

Recent literature confirms that the heritage of the twentieth century is threatened (Figure 1.1), despite the increasing presence and formation of entities and structures rightly consolidated for the recognition and protection of places of contemporary heritage (Guillet, 2007; Martins *et al.*, 2018).

Figure 1.1: Examples of winner of the "Keep it modern" award. (a) Louis Kahn, view of Salk Institute for Biological Studies, 1965. La Jolla, California, USA, 3 July 2019, Photo credits: Codera23 under CC-BY SA 4.0. (b) Lina Bo Bardi, São Paulo Museum of Art view from NW /SO Av. Paulista (MASP), 1968, São Paulo, Brazil, 3rd Janauary 2015. Photo credits: Wilfredor under CC0)

The protection of the built heritage of the twentieth century also presents a further problem: the operational practices relating to conservation interventions. Much has happened over the past 20 years in terms of identifying, protecting and conserving 20th century heritage: international debates have in turn promoted local responses; in fact, heritage conservation is generally guided on a national and local level and provides very specific answers which, at least in the Italian case, often anticipate international issues as well. The exchange and "cross - fertilization" of ideas and practices at an international level allowed the birth and development of national and international control and research bodies, such as: MiBACT, Docomomo, ICOMOS and UNESCO.

The European Council has been actively engaged in identifying and caring for 20th century heritage since the late 1980s, as have the leading Heritage Protection Agencies and Organizations in Europe (Del Monaco in Canella and Mellano, 2019).

The legacy of 20th century history and architectural theory is rich and diverse; undoubtedly, however, it is the evolution of Modernism that has triggered the most significant

changes in the built landscape over the last 100 years. Modernism was conceived with the aim of expressing the opportunities and optimism of the new era, which began after the World War II.

In the post - World War II period, architects, engineers and construction companies exuberantly used new materials, including reinforced concrete, without however having the means to fully understand them in terms of medium and long-term performance and thus causing phenomena of degradation that are today visible. The wrong approach of the past, due to a lack of knowledge, that modern materials require little maintenance, combined with the problem of high operating costs, has resulted in the assets under-utilization or abandonment and their physical and functional degradation highlighting early failures, inefficient details and poor energy performance. The evolution of building services occurred more rapidly in the twentieth century than in any other century, but the energy crisis between the mid-to-late 1970s had a big effect on how buildings are maintained and sparked the search for technological alternatives capable of improving the heating and cooling systems of the time which to date have proved unsustainable.

Therefore, several twentieth-century buildings have not well withstood the test of time and their inability to age "gracefully" has questioned the fundamental principles of conservation, such as "minimal intervention" and "reversibility" and has led some places at risk of extensive damage or permanent loss. A further aspect of difficulty in the adaptive reuse of contemporary architecture is the adaptability of large containers to new uses, due to the difficulties related to re-functionalization and consequent restructuring interventions with seismic and energy adaptation, but also for the costs to be incurred and the risks always high to manage.

Among the various issues relating to protection, the principle of a building specifically built to have a short life, and which has remained in use, with all limits, to this day, must also be considered. Without excessive generalization, the idea of "throwaway" architecture may have gained legitimacy in the second half of the 20th century, where lightweight, demountable structures began to play a more important role in the construction of both public and private buildings. However, this is an ever-evolving field of research in the restoration of contemporary architecture, also much treated in the discipline of science and technology of materials and poses: it presents challenges and issues that can be easily extended to the restoration of all the twentieth-century buildings:

- How to preserve buildings intentionally designed for short periods of life?

- How to reconcile the poor technical performance of some materials and systems and their conservation?
- How to adapt modern buildings, functionally obsolete, to contemporary use requirements and performance criteria, without distorting them?
- How to assess the economic profitability of the repair, also in relation to the resulting energy savings?
- How to reconcile restoration and conservation interventions with those of energy adaptation and improvement of environmental performance?

Regarding the last points (economic and environmental), sustainability is becoming the main objective of all development policies and energy audits of buildings are starting to be used more and more to evaluate supplementary or replacement energy interventions, with respect to the only adaptation of existing structures. However, while energy audits often confirm the environmental value of conserving more traditional buildings, this usually do not happen for buildings designed from the mid-century onwards, which, conceived and built in an era when energy and economic resources seemed inexhaustible, are now highly energy-intensive.

In Italy, albeit with some delay compared to the rest of Europe, it has favoured a break with tradition and with the classic forms of the regime, the development of new materials and technologies more suited to new lifestyles and a new language (Zevi, 1989). A new understanding of spatial qualities, using new technologies and applying structural innovations, such as prefabrication, were elements used as if they could provide the infrastructure of a new society, with the aim of solving problems of hygiene, comfort and standard of living (Zevi, 2000). Architecture was considered a powerful tool for social reform (Brooks, 2002).

As in Europe, also Italian buildings of the twentieth century seem to require a first general maintenance intervention (of medium level) only after about 25-30 years from the construction, which means within about half the time of buildings more traditionally built. In addition, extraordinary maintenance interventions may be required within 50-60 years from the construction, rather than in the 100-120 years commonly documented for the more traditional building heritage (Stratton 1997; Fregonara, Moretti, Naretto, 2018). Therefore, nowadays, virtually all the buildings built between 1950s and 1990s could require such massive interventions.

In Italy, from the point of view of the regulatory framework of protection, private residential buildings under the age of 70 are not subject to the "automatic" protection provisions and, therefore, are not subject to "automatic" verification of cultural interest. The definition of

the concept of cultural heritage underlined that "[...] for immovable objects belonging to any private owner, whether they are the work of a living author or whose execution dates back to less than 70 years, as well as whether they are the work of a living author or whose execution dates back to less than 50 years ago, are not subject to protection provisions and, therefore, cannot be the subject of a declaration of cultural interest […] "(Law 4 August 2017, n. 124). Not having the "protection measure" implies that only if there is a clear request from the Region or some local authority, possibly, some of these buildings could be reported and placed under protection.

Two emblematic cases for the city of Turin are the 'Palazzo a vela' and the 'Palazzo del Lavoro' (Figure 1.2). The 'Palazzo a vela' building, with no protection alley, was totally distorted by the refurbishment to transform it into a hockey arena for the 2006 Turin Winter Olympics. The huge windows that defined its ethereal geometry were demolished and the new red volume alters the minimalist geometry of reinforced concrete, depriving the sail roof of its function. However, the site is now being maintained and is used by the citizens.

Two emblematic examples for the city of Turin are the 'Palazzo a Vela (Palavela)' and the 'Palazzo del Lavoro'. The Palavela was designed and built in the years 1959 - 1961 by the architect Annibale Rigotti (1870-1968) and his son Eng. Giorgio Rigotti (1905-2000) with the engineers Franco Levi (1914-2009) and Nicolas Esquillan (1902-1989), who studied a self-supporting structure with a double ribbed slab in prestressed concrete, composed of a dome on three support points and was built by the Gastone Guerrini company. With no protection constraint, it was totally transformed by the re-functionalization intervention in 2003 on a project by the architect Gae Aulenti and Eng. Aurelio De Bernardi, who created a new building, independent from the vault, used as a hockey arena for the 2006 Turin Winter Olympics Games, capable of 8,000 seating. The windows that defined the building ethereal geometry have been demolished and the new volume, red, alters the minimalist geometry of reinforced concrete, depriving the sail roof of its function. The site, however, is now used, enjoyed by citizens and is the house of international sports events.

The 'Palazzo del Lavoro' (1960-61), designed and built by Pierluigi and Antonio Nervi, and Gino Covre for the metal structures, has been totally abandoned for years; it suffered a severe fire on August 20th, 2015, but still today the windows have been broken, the structures are damaged, and no routine maintenance is carried out even on the external areas. In the case of city and international events, since it is located at one of the main entrances to the city, it has simply been covered by advertising banners to hide its deterioration. But while experts and

architects know its essence and have studied its history in literature, citizens do not understand its value and see it only for the state of ruin in which it relates.

Figure 1.2: a) Palazzo a Vela, via Ventimiglia 145, Torino, Left: postcard dated 1961, Right: photo of 2018 (b) Palazzo del Lavoro, via Ventimiglia, 211, Torino. Left in 1965, Right in 2018 (Sources: (a) Left: Photo credits AtlasFor, Right: Author's Photo, (b) Left: Il giornale dell'architettura "Cronistoria di una vita grama: il Palazzo del Lavoro dal 1961 a oggi", 20 settembre 2015, Right: Photo Credits ZaziRound)

Even if the contemporary Italian heritage, understood as post-modern heritage and referable to the Modern Movement, is almost entirely studied and classified, it is still not very present in the official online databases on urban heritage. In particular, the residential buildings (both condominiums and villas) are even more absent, even though they constitute most of the built heritage of cities and an important part of the architectural development of the 1900s (Urban, 2018). Within the large set of buildings of the twentieth century, residential architecture, perhaps because of common use, is less studied, but has peculiarities and values that should be more emphasized and disseminated. While, on the one hand, large industrial, commercial and service buildings define the morphology of post-industrial cities, on the other, residential buildings define their urban landscape. In the housing sector, the architectures, designed by leading architects influenced by the Modern Movement, were built from 60s to 80s

both for the public sector (entire neighbourhoods with affordable houses mainly for immigrant workers) and for the middle and middle-high classes (new bourgeoisie). The phenomenon of cities introducing a new type of housing, the condominium, has affected all of Europe and has defined the shape of the contemporary city (Urban, 2018). In urban landscapes, condominiums and villas built with a high level of architectural and construction quality are however mixed with architecture lacking in quality, often built "economically" and quickly (Dümcke and Gnedovsky, 2013; Sowińska-Świerkosz, 2017). The distinction between the two types of architecture is not very common both on the part of the demand (of citizens) and on the part of real estate market operators. Also, the real estate market itself hardly recognizes and monetizes the added value of architectural and construction quality, making prevail in the price formation mechanism the influence of other intrinsic and extrinsic characteristics, as well as the properties location.

Figure 1.3. Examples of Italian residential buildings of the late 1900s. (a)Vittoriano Viganò, Villa La Scala, San Felice del Benaco, Brescia, Italy, 1958, Photo credits: LombardiaBeniCulturali. (b) Venturino Ventura, residential building in via Salaria, Rome, Italy,1968. (Photo credits: Artribune - Elena Mattia)

In this research, "residential buildings of the second half of 20th century" are intended as the modernist ones, for which the influence of the "International Modern Movement" is evident in terms of purpose, typologies, technologies and functions for the design of buildings (Cunningham, 2013), but also the contemporary post-war and late twentieth century architecture.

The term "invisible residential heritage" refers to that part of the residential buildings of the second half of the twentieth century, which cannot be defined "masterpieces" in the panorama of the history of architecture, whose value is not easily recognizable, if not by experts, and their added value is not already monetized in the real estate market.

Consequences on policies and urban economy

The possible positive impacts of the re-valuation of the modern and contemporary heritage, also residential, are numerous and well documented by a broader literature and several best practices developed on housing all over the world.

In the field of city branding, the recognition of the residential and contemporary building heritage as an integral part of the city historical heritage to be protected, , contributes to the definition of a single urban image, recognizable from the outside and usable for possible promotion campaigns and for the activation of new development strategies (Berg, 2017).

From a real estate perspective the recognizing the value of this type of architecture as one of the intrinsic feature of building, therefore, is not only useful for possible strategies of urban transformation and redevelopment, but could trigger new ways of knowing, different models and connections useful for the re-definition of real estate values (Coulson and Leichenko, 2001; Franco and Macdonald, 2018). Moreover, recent literature has also shown that recognizing the historical and architectural value of contemporary heritage as extrinsic feature can help redefining the value of the whole sub-area in which it is located, including the related real estate sub-market values (Tengberg et al., 2012).

UNESCO has declared, in the definition of Heritage Urban Landscapes (HUL), that it is essential to integrate the values of the urban heritage and their possible state of vulnerability in a broader development framework, capable of providing indications on areas of greater "sensitivity" of heritage, that need an increased attention from the Municipality and the builders to the planning, design and implementation of development projects (Bandarin and van Oers, 2012; Albert, Bernecker and Rudolf, 2013).

The Getty Foundation with the project "Keep it Modern" has carried on several conservation and redevelopment projects on residential buildings with important recognised authorship. Some examples of intervention that have also trigger the development of different guide and best-practices are reported in Figure 1.5.

Figure 1.4. (a) Charles and Roy Eames, Eames House, 1949, Los Angeles California (Photo credits: Mattiasb, 6 March 2005, under CCBY 1.0) (b) Le Corbusier, Immueble Molitor, 1934, Paris, France (Photo credits: Sailko, 20 Jauary 2009, under CCBY 2.5)

Currently, the demand for greater attention to modern and contemporary heritage is also underlined by the publication of "unofficial" and informative guides dedicated to tours among these architectures, the updating of web platforms that manage data generated by users and the design of dedicated itineraries integrated within the major European tour operator sites (Minucciani, 2000) [11].

Interventions on this type of heritage therefore have multiple outlets for both public and private entities, making it possible to:

- contribute, with new data and information, to the reform of the Urban Strategic Plans.
- complete the framework of knowledge of the built, natural, cultural and human heritage of cities (Ost, 2012; Tengberg et al., 2012);
- meet the growing interest and the new segmentation of the demand for housing and the tourism industry;
- permit to increase the awareness of buyers and citizens, through opportune dissemination;
- promote fiscal equity policies to moderate rent inequalities;

1.3. Literature review

The literature review and the state of the art of research, further discussed in Chapter 2, define the conceptual framework and include publications on the following topics:

- theories of the real estate market and its geographic components;
- definition of *authorship* and of the *architectural and building quality* of 20th century residential buildings;
- methods of cataloguing and archiving architecture of the second half of the 20th century;
- methodological approaches to mass appraisal;
- quality indicators definition;
- knowledge management, construction of geographic databases and data management;
- principles of geostatistics for the real estate market analysis;
- theories and application of Multiple Regression Analysis (MRA – OLS) models for the real estate market;
- Geographical Weighted Regression (GWR).

In addition, the survey of the web portals[10] providing open data according to the European Inspire Directive, confirms that surveying campaigns, photographic documentation and cataloguing of the heritage are being carried out, defining its qualitative characteristics. Other data relating to 20th century architectures are available in various national and regional databases, in particular for Italy after the launched in 2000 of the national projects of the MiBACT – Italian Ministry for Cultural Heritage, focused on a "National census of Italian architectures of the second half of the twentieth century".

Furthermore, some shortcomings are emerged from the process of literature review:

- lack in existing databases of a clear link between quality residential architecture, recognized as a cultural heritage, and the real estate market;
- lack of analysis of the residential heritage of the 20th century that relates architectural quality and its location;
- lack of spatial statistical analysis on the influence of architectural and physical characteristics on the price formation process in the real estate market;

[10] See e.g https://www.museotorino.it/

- lack of spatial and statistical analyses, for distinguishing the architectural quality and physical characteristics of buildings from their locational characteristics.

Starting from these shortcomings, it was possible to refine the research direction and critically contribute to the advancement of research in some of these points. Results of the literature review were used also for the construction and refinement of the geodatabase of the residential heritage of the 20th century, and to define the workflow and the scientific research methodology.

1.4. Research methodological approach

The methodological approach developed and implemented in this work includes both qualitative and quantitative analysis of contemporary architecture, in relation to the real estate market. The methodology consists of 5 consequent phases, each of which develops from the results of the previous one (Figure 1.5).

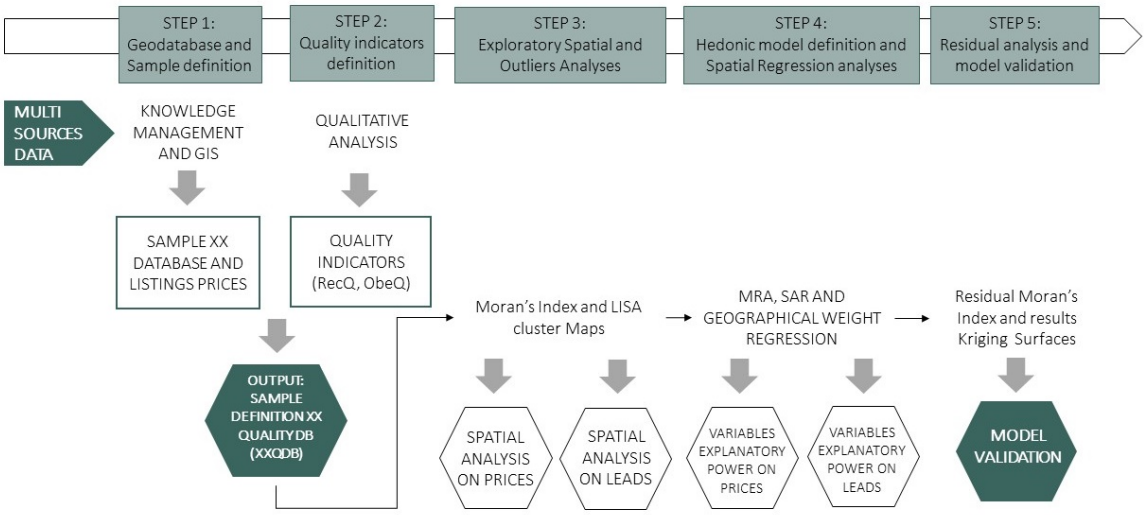


Figure 1.5. Workflow of the methodological approach (Source: Author processing)

STEP 1: Geodatabase and sample definition: the first step of the research was the definition of the objective of the research and the problem question. This drives the choice of the rules for the data sampling and the definition of the dataset which underpin the statistical analyses. The conceptual structure of the sample involves the definition of variables, the use of spatial joins, attribute queries and spatial queries for the union and harmonization of data from different sources. The construction of the sample started from the data already published, both

in online resources and in articles and monographs. Then, the sample was integrated through the visual survey of the architectures of outstanding value. The main purpose for this first survey was to reach a statistically significant amount of data in order to proceed with subsequent analyses. In this way, an initial classification of the urban residential heritage with architectural or built qualities was obtained.

The collected data sample was integrated with a database of real estate listings, detected on the real estate market in 2019. The database thus composed includes intrinsic descriptive variables of the characteristics of the real estate units, intrinsic characteristics of the building (listing price, square meters, number of rooms, presence of lift, etc.)

STEP 2: Quality indicators definition: some features related to both architectural and built qualities (authorship, age, notification of interest, bonds by the Superintendence of Cultural assets, presence in publications, etc.) were detected and evaluated to form the two main indicators of quality used in this research: RecQ and ObeQ.

STEP 3: Exploratory spatial and Outliers analysis: the sample of data thus composed was observed and described through the use of classical central and statistical dispersion indicators and refined through the analysis of the outliers.

STEP 4: Hedonic model definition and Spatial regression analysis: spatial statistics methods and models were applied for estimating the values of the classified architectures in the data sample and understanding which characteristics have a significant influence on price formation. To this aim the following tools were employed:

- Exploratory Spatial Data Analysis (ESDA): Morans'Index and Anselin's LISA cluster analysis to analyse the presence of spatial autocorrelation of preliminary data and to verify the correlation among the data;
- Hedonic regression models and residual analysis;
- Geographic Weighted Regression (GWR), to understand the contribution of the physical characteristic to the price formation and to infer the value of all the residential units classified in the sample;
- Kernel interpolation, to obtain the interpolation of the estimated (expected) values throughout the city.

To proceed with the application of a hedonic model and the consequent application of the GWR, a series of preliminary tests were produced for the analysis of the spatial component of the spatial data sample. Then, GWR led to the inferential estimation of the buildings of

architectural quality analysed, classifying the characteristics more or less monetized in the real estate market.

STEP 5: Residual analysis and model validation: regressions results residuals were analysed through tests for correlation and spatial clustering, in order to analyse the goodness and effectiveness of the model.

1.5. Study area and data sampling

The study area analysed is the real estate market of the existing housing stock of the city of Turin in Italy.

In Turin, although the number of transactions has increased, from 2011 to 2018 the listing prices of existing real estate assets have significantly and steadily decreased (-25%), with longer negotiation times. In the same period of time the real estate market of the new housing stock also suffered a significant drop in prices (-14%), a drop in the total number of construction sites (-30%) and a significant increase in the number of unsold housing units.

Currently, in Turin the cyclical crisis of the real estate market seems to have become structural: the city is going through a phase of dis-urbanization characterized by a series of economic, social and demographic factors that are determining radical urban transformations, both in the central historical areas of the city and in the peripheral ones. The transformation of urban hierarchies is also modifying the real estate sub-markets both in terms of dynamism and price trends and in their territorial boundaries.

The great influence of the location variable, in the process of determining the price of houses and in influencing the behaviour of buyers and sellers, is widely recognized, nevertheless, the location paradigm is evolving, taking on different parameters, and buyers' preferences regarding location and neighbourhood characteristics are changing. Emblematic in this regard is the case of the hill-side area of the City of Turin: despite the absence of public and private services, it is considered one of the most prestigious areas of the city, with high real estate prices, high endowments and environmental qualities, but in last years the trend in housing sales is decreasing and construction sites are mostly located in other areas of the city.

The contemporary residential heritage of high architectural and building quality in the Turin real estate market is completely indistinguishable from other architectures and is often underestimated in the process of determining prices. On the one hand, the examples present in the urban landscape generally do not have striking characteristics and shapes, which distinguish them in shape and typology from the "standard" type of heritage, but indeed owe appreciable

elements of architectural and construction quality on the facades, in the use of materials, in the original use of voids and solids, in the use of compositional facade geometries etc. On the other hand, the preparation of real estate agents and buyers on the architectural quality of contemporary buildings is low; this implies the publication of real estate advertisements with a classification of buildings standing out for its architectural quality in a building category "medium" or "low", without further specifications, and the related listing price consequently calculated just on standard characteristics and based on the location. On the demand side, this implies that the buyers are not used to see qualifying characteristics in the market announcements, which distinguish prestigious buildings from those belonging to the average standard of the second half of the 20th century; the "refinement" of a building is only attributed to services as the presence of a caretaker, the presence of double lifts, the high state of conservation.

Finally, architectural and construction companies rarely have the habit to see publicly acknowledged the "authorship" of their works, especially for residential houses; indeed, the latter are valued as architecture of secondary importance compared to other works such as big buildings (schools, theatres, conference hall, etc.), if successful, are more easily attributed.

The initial data sample related to buildings of cultural interest and/or of high building and architectural quality built during the whole 20th century in Turin is made up of 1,104 data, of which the sample relating to residential is equal to 868 data, of which, in turn, the data sample limited to the second half of the 20th century is equal to 562 data (named QDB). In parallel, the universe of data related to real estate listings (Immobiliare.it data) on the market in 2019, for the residential sector is equal to 10,716 units, of which 6,441 in buildings built in the second half of the twentieth century. This sample, combined with the previous one and subjected to the cleaning processes necessary for the application of the models (7,545 data), was then reduced to 3,705 data and named XXQDB. The final XXQDB is composed of 3,259 data of real estate listings in the market in 2019 (XXQDBS), of which 116 relating to quality buildings and 446 data relating to real estate units in buildings of architectural and construction quality not on the market in 2019, the price of which, therefore, for the analyses carried out, was estimated.

1.6. Structure of the thesis

The thesis proceeds as follows: Section 2 introduces the background of the analysis; Section 3 presents the case of modern heritage of Turin and the cross-referencing of existing databases; Section 4 is related to the implementation of the Turin Contemporary Residential

Buildings database and the first spatial statistical analyses; Section 5 discusses the results. The final section presents conclusions. In the Appendixes are reported the whole results tables and maps.

2. Background and theoretical framework

In this chapter, the up-to-date and foundational references of a critical analysis of the literature carried out on the three pillars at the basis of this research work are presented.

These will be summarized, namely:

- the right to the protection of the residential heritage of the 20th century (2.1), with the related enhancement projects and programs in progress at national and international levels (2.1.1- 2.1.4);
- the topic of energy upgrading of the existing heritage, and how these interventions may not be a threat of transformation but an opportunity for enhancement (2.2);
- the main analysis models of the real estate market (2.3) and spatial statistics analyses implemented through a GIS project (2.4).

2.1. Vulnerability of 20th century heritage and the "right to protection" in Europe

The time between a building creation and its protection and conservation has never been as complicated as it is for the heritage of the 20th century: one of the main difficulties in recognizing its value is its proximity to us in time. However, in the recent years a different notion of heritage and how we assess its significance is affirming.

Despite some early efforts to protect and preserve the most iconic places of the Modern era, until the 1990s the conservation of contemporary heritage was not recognized as a distinct area of practice thanks to an intense activity carried out by growing groups of practitioners with the aim to address conservation of the 20th century heritage. By the beginning of the 21st century, a number of governmental and non-governmental organisations were focused on this work and with local, national and international organisations (such as DOCOMOMO International and ICOMOS) were created to save and conserve modern heritage. The large number of such groups demonstrate an interest in identifying the recent past as important and brings together sectors of the architectural and conservation community.

However, buildings from the more recent past constitute a very small percentage of the statutorily protected ones in most European countries; only in very recent times, proactive national programmes of identification and protection have been initiated. In some European countries, this is yet to occur. The absence of a wider public recognition makes it difficult to convince people of the value of tangible evidence of the recent past; experiences from other European countries showed that publicity and education programs are necessary to attain the

required level of public support. 20th century heritage is likely to remain at risk without such support (Macdonald and Ostergren, 2013; Lardinois, 2017).

As international statutory, listing programs for 20th century places are still in the formative stages, while buildings from the more recent past tend to be reactively and punctually protected. Given the technical problems that have been identified with conserving some 20th-century buildings and the importance of carrying out adequate repairs to retain their architectural value, also in the case of energy efficiency interventions, it is important to act quickly to prevent these places from becoming at risk (ICOMOS, 2005).

The role of national and international architectural organizations - such as the International Union of Architects (UIA) - that are acting in the selection of 20th century buildings for registers, is crucial to determine the value, and therefore, the future of a building. Usually, in case the architectural significance is recognized, the building is selected for protection and can successfully perform its intended function or successfully accommodated a change of use. The original fabric is largely conserved, and this constitutes a large part for the significance of the building.

In absence of recognition, there is no conservation action, and without conservation action, what determines the building significance cannot be protected. In addition to a general lack of recognition for 20th century buildings, in practical terms there is also a lack of experience in both identifying the issues and finding appropriate practical solutions[11]. There are repair techniques that have been developed to accommodate conservation aims, but this is still a critical issue for the unrecognised heritage: despite literature studies, there are scarce examples in terms of knowledge, skills, and funding to operatively cope with restoration and functional recovery of Modern heritage buildings.

For buildings of the second half of the 20th century, practical and technical issues should be addressed in parallel with the identification and protection stages: the solutions to the technical challenges should be identified at the time of listing, to actively involve private owners and to identify new adaptable and convertible uses. Organizations like Docomomo International[12] have been actively engaged in trying to find practical solutions to some of the issues of the buildings recognition and listing.

Despite the described practical problems associated with buildings from the more recent past, the fact that the design and construction processes for mid-century modern buildings are

[11] This is changing in Italy since 2019, see chapter 2.1.2.
[12] See Par. 2.1.3.1

still in living memory, offers the potential to understand them in a way that has not been possible before. The architects may still be able to explain the *raison d'être* of their buildings, the construction process, why certain materials and methods were selected, the maintenance expectations and so on.

On the other hand, Macdonald (1996), reported that: "even when the original designer is available for guidance, the best adaptation may be derived from the original design rather than from its author"; this because the creators tends naturally to take an evolutionary approach towards his work and, even if the original author is involved in the conservation project, if the new proposal reflect a later design *motif* of the author it may did not marry well with the original design. Anyhow, the potential of this kind of knowledge exchange should be maximized; statutory heritage bodies have been requesting that the original architect could be consulted or involved in major conservation works.

2.1.1. The residential heritage of the 20th century in European and Italian post-industrial cities

Assuming the premises presented above, focusing on residential assets as a sub-sample of the whole built heritage of the 20th century, means to face some additional issues related to their conservation and their identification.

To define a work framework, some literature on the principal housing typologies arose in Europe and in Italy in the second half of the 20th century is analysed below. On this matter on an European level, Urban (2017) carried out a huge work of comparison, evaluating and analysing the residential neighbourhood in five European cities: Berlin, Copenhagen, Glasgow, Rotterdam and Vienna built since 1970. The "new" tenements design that he analysed does not present a homogenous stylistic current, but it consists of a multi-faced response to cultural specificities and local traditions. He found that the new tenements design is in clear opposition with post-war modernism, and stands as a counterproposal to tower blocks, functionally separated neighbourhoods and car-oriented cities. Urban define three principal "new" types of housing assets:

- The "new" tenements – particularly larger developments on post-industrial sites or new suburbs – were built combining an array of different designers and types (typically, they combined different six-to-eight-storey multi-family buildings). Contrasting with what Urban define "monotonous" and "illegible" estates of the 1960s", the block pattern was

rediscovered as a guiding principle and serial repetition was avoided. Buildings were mostly erected along the streets, both on the block perimeter.

- The 'urban villa' promoted for example by the "west Berlin international building exhibit" as an elegant combination of urbanity and privacy, are usually a four-to-six-storey blocks of flats on a quadrangular plan, built with small setback from the street and recognizable shape.
- The "townhouse", a two-to-four-storey single family building with a separate entrance to the street, is a denser, more urban version of the English terraced house and it has usually no garden.

The typological distinction between townhouse and tenement is further complicated by the fact that many buildings have a mixed typology, particularly in Berlin.

Figure 2.1. In the picture are reported some examples cited by Urban (2018). (a) Example of new tenement in Hermann Czech - Apartment building, Petrusgasse, Vienna, Austria, 1989, (Photo credits: Google street view), (b) Example of urban villa by Hans Hollein, Berlin (Photo credits: Hudson, 2019) (c) Example of townhouse, the Friedrichswerder Town Houses, Berlin (Photo credits: Urban, 2018)

Some of these building typologies born also in Italy in those years. The Italian housing stock of the second half of the 20th century also see the raising of the "new tenement" as the

principal form of the new lifestyle. In Italy it can be divided into two main groups: public housing in working-class residential districts and houses belonging to the middle class.

The Italian "Fanfani" Law of 1949 - Legge 28 febbraio 1949, n. 43 Provvedimenti per incrementare l'occupazione operaia, agevolando la costruzione di case per lavoratori. (GU Serie Generale n.54 del 07-03-1949) decreed the start of an exorbitant number of construction sites for the whole national territory; practically, all the architects of that period dealt with the issue of public housing. At the conclusion of the INA-CASA plan, after 14 years of activity, more than 355,000 houses were built with more than 20,000 construction sites. Many architectural typologies were adopted, but the most famous unitary design districts were made up of enormous, multi-storey buildings containing hundreds of apartments; they were usually located in peripheral areas and had no neighbourhood services. This lack of urban services in many cases determined the complete failure of that type of architecture over time and the lack of easy infrastructure connections determine the complete isolation of these parts of the city (Rossi, 1982).

On the other hand, as in Europe, the residential construction for the new "middle class" was composed by five-to-seven-storey buildings, with facades containing elements of asymmetry and non-repetitiveness, condominium gardens and housing services such as concierge, underground garages, large reception halls, various types of internal heating and cooling. The type of "urban villa" was also spreading in Italy, both in areas of unitary design with a condominium park, and with the design of individual villas, however very close to the main connections with the city centre.

Starting from this framework, one problem of protecting this heritage is related to the lack of public protection, so that adjustments both for living comfort and for ordinary maintenance risk to alter it (Prudon, 2017). The advantage for residential buildings is that changes in intended use are very rare, therefore additions or inconsistent changes are often limited.

Another problem, typical of Italy, it due to the property, usually shared by several private owners; when no constraints and safeguards are present, the choices concerning ordinary and extraordinary maintenance are left to the responsibility of administrators and condominium, even if under the control of the Municipality technical offices. This means that unfortunately the most discriminating variable for building adaptation works is the price of the interventions, and the least expensive alternative is rarely compatible with the conservation of the value and quality of the building.

This obviously does not apply to all buildings: some of them, inhabited by groups of people with high incomes, thanks to the greater availability of money undergo more frequent routine maintenance works, and this allows them to be "maintained" as much as possible as they were in origin.

Nowadays, programs aimed at surveying and protecting the heritage of the 1900s, included the residential one, are spreading; their main characteristics are summarized in the following Paragraphs.

2.1.2. MiBACT-DGAAP and the project "National Census of late 20th century architecture"

The DGAAP - Directorate General for Contemporary Art and Architecture and Urban Suburbs, is the office of the MiBACT - Italian Ministry for Cultural heritage dedicated to contemporaneity, whose main task consists in the promotion and dissemination of contemporary art and architecture. Recently, DGAAP was charged with the "mission" of initiating redevelopment processes in urban suburbs.

The definition of programs and intervention strategies on contemporary architecture and on urban peripheries requires new methods, new criteria, new approaches to the problem, starting from the indispensable identification of the "excellent" architecture within the enormous recent building production, often totally lacking in quality. The promotion of training in the field of knowledge and protection of contemporary architecture is also aimed at evaluating and issuing declarations of 'Important artistic nature', in compliance with the Law 633/1941 or as provided for in art 11, paragraph 1, lett. e, of Legislative Decree 42/2004 and subsequent amendments.

The "National Census of late 20th century architecture" is a mapping of contemporary architecture that was created to promote its knowledge and enhancement. It allows to identify the architectures of interest throughout the national territory through an interactive web platform. The project, launched in 2000, is constantly updated.

Based on a unified methodology and on homogeneous and unitary selection criteria, applied in the different national areas, the project includes an articulated and coordinated set of activities that can be summarized in three phases:

- Selection of buildings and urban areas of significant historical and artistic interest;
- filing;

- promotion, dissemination and exploitation of results.

The methodology up to now developed and used for all the territorial surveys of the Census is based on a series of quality criteria capable of selecting, in a coherent and homogeneous way on the national territory, all the contemporary architectures of historical and artistic interest.

The criteria were identified through discussion and in-depth analysis together with the universities entrusted with the research; in fact, while for an ancient monument the historicization allows an easier recognition of the features of historical-artistic interest within well-defined critical categories, on the contrary contemporary architecture lacks an already consolidated historiography. The identification of objective criteria, shared as much as possible, was needed, aiming to guide the judgment of value and certify the recognition of interest in certain works.

The defined National Census criteria are partly quantitative (for example, number of bibliographic recurrences) and partly critical (capacity for technological innovation, renewal of typological schemes, solution of technical or social problems, etc.). In particular, the bibliographic checks take into account the "critical fortune" of an architectural work, the citations in specific publications and of recognized national and international value, while the historical-critical criteria consider elements linked to historical and architectural events, to the evolution of the cultural and disciplinary debate, the significant role played by the work in the context, the notoriety and relevance of its author. Seven selection criteria have been identified for each search referring to the single area:

1. The work is published in at least two of the systematic studies or repertories that dealt with architecture in the Region of reference, or in Italy.
2. The work is published in one of the studies defined in criterion (1) and in an internationally important Italian or foreign magazine.
3. The work is published in at least two Italian or foreign magazines of international importance.
4. The work has an original significant role in the regional panorama in relation to developments in both the debate and the international research.
5. The building has a significant role in the typological evolution, with progressive or experimental constructive interpretations.
6. The building was designed by a prominent figure in the panorama of regional, national or international architecture.

7. The building stands out for its particular qualitative value within the urban context in which it is built.

The architectural works, therefore, are selected on the basis of the presence of at least one of the above-described criteria and become part of a list that arises from an effort to understand the general framework of the regional architectural culture; this determines a complex and, in some ways, still confused scenario, full of items, of personalities, of well-known episodes and of others almost unpublished or completely unknown.

The results of the Census are collected on a platform, opened in 2019, publicly accessible, that reports very complete information about the surveyed building (Figure 2.2).

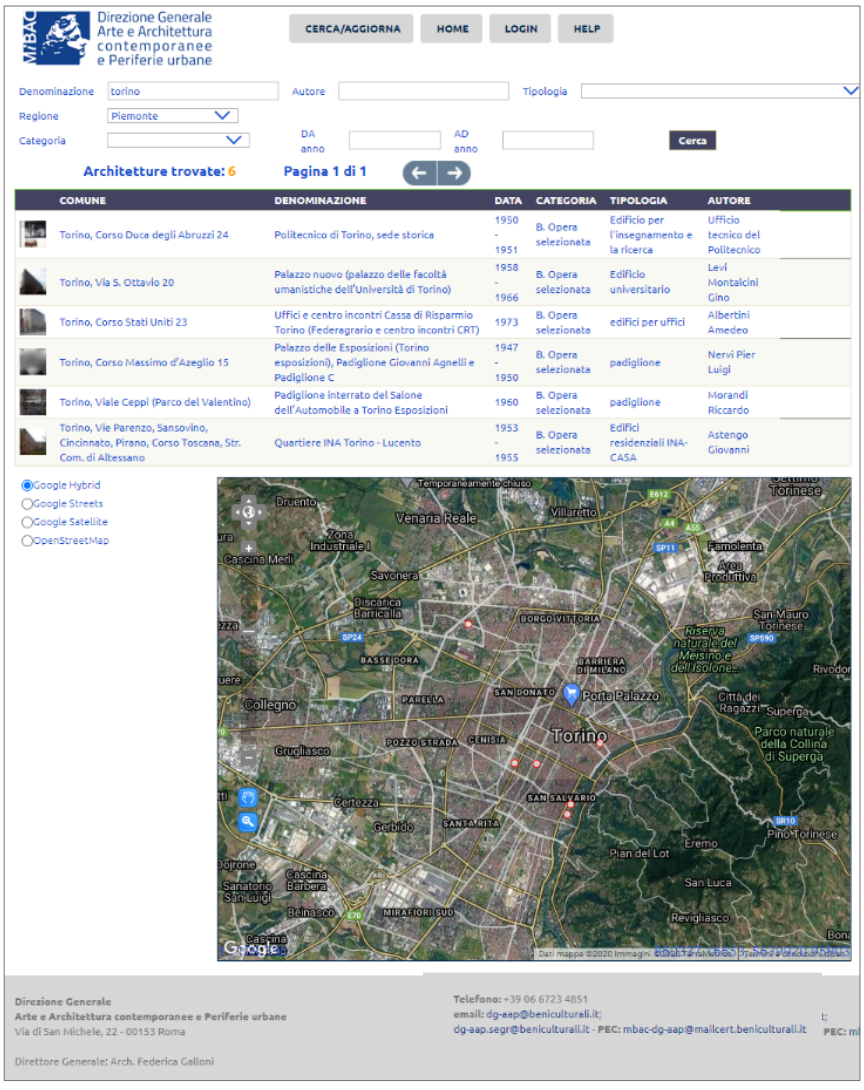


Figure 2.2: MiBACT "Architetture del secondo 900" project. (Source: Web Site http://architetturecontemporanee.beniculturali.it/architetture/index.php. Accessed on 30 October 2020)

2.1.2.1. The concept of Architectural and building Quality.

Architectural quality and building quality have a big impact on the design and implementation of a project, on the neighbourhood quality assurance and on the raising of the overall quality standards in society.

Architectural and building quality can initially be seen in relation to urban design, quality is a challenging topic, and many classical authors wrote about it during the urban development of the 1960s and 1970s.

Kevin Lynch and Lloyd Rodwin (Lynch and Rodwin, 1958) for example, correlate the architectural form to the built urban environment and warns that cities are too often considered simply as collections of separate smaller environments, such as the layers considered in traditional design: shopping malls, neighbourhoods, traffic net, children's playgrounds, etc. Lynch and Rodwin declare that the transformation in the definition of the quality of an urban form is not enough to consider in the sum of its parts, even if individually beautiful and valuable. Indeed, author affirms that each physical whole is influenced not only by the quality of its parts, but also by their total organization and arrangement. Therefore, the authors built an analytical model and suggest six criteria for shape analysis, for evaluate the interrelation between them, and for identifying the qualities of the form meaningful at the metropolitan scale: element types, quantity, density, grain, focal organization and spatial distribution generalized,

Appleyard and Lintell (Appleyard and Lintell, 1972) to determine how traffic conditions affected the livability and quality of the road environment, conducted interviews and observations on three similar San Francisco streets with different traffic levels . All aspects of perceived livability - absence of noise, stress and pollution; levels of social interaction, territorial extension and environmental awareness; and safety were inversely correlated with traffic intensity. The results of the thirty-six interviews conducted show that the maintenance of a quality environment has been "paid for" by the inhabitants themselves through higher rents. However, the authors note that the erosion of environmental quality is a subtle and slow phenomenon, with a period of ten years or more, during which tenants hardly realize it quickly, continuing to live in the same environments even if quality levels decrease. The authors identified five factors for the analysis of environmental quality in relation to traffic: danger of traffic, stress, noise and pollution, social interaction, privacy and domestic territory and environmental awareness.

Bacon (Bacon, 1963), without directly claiming urban quality, defines the architectural image for urban planning within his diagram of the seven essential steps for the "comprehensive planning process". With the aim of describing the nature of simultaneous movement systems, to indicate their relationship with natural phenomena, and then to show how they can be operational in the growth of the form of the city, he identifies some essential elements necessary for the urban project. He indicates how the essential elements to consider in order to get the "Comprehensive Urban Plan": the functional plan, the area plan, the project plan, the architectural image, the money entity, the capital program. As for the architectural image, he defines it as the simulation of the final image of the urban project that allows possible users to imagine the environment and how it could be to move in it, this would allow, according to his experience in Philadelphia, to have already in the project phase a strong understanding and social acceptance of the ideas of the plan and popular support for the implementation of the project.

More specifically, architectural quality is one of the parameters that often fall into consideration for the award of architectural or urban planning projects and goes far beyond the production of a precise and error-free work. Urban and architectural quality is linked to the urban context in which it is located and is to be considered as a positive increase in the environment.

Qualities intended as new forms, types and contents constantly appear in architectural design, but quality concept is dynamic and complex and can assume new meaning in time and in different places. Architects and academics tried in years to give a definition and understanding quality in architecture: "Architectural quality has always been about making a surprise. It means a new combination of traditional materials put together in a way, which gives a feeling of satisfaction to the one who is experiencing that space. It is dealing with interpretation of factors that might not have been known before" (Rönn, 2011).

As far as it concerns legislation, some national policy programmes developed in Europe during the 1990s explicitly refer to quality: Netherlands (1991), Norway (1992) and Denmark (1994), promoted an aesthetic oriented concept to develop quality in architecture and urban design.

In February 2008, the European Parliament approved a resolution on the follow-up of the Territorial Agenda and the Leipzig Charter of Sustainable European Cities, which calls on Member States to favour the growth of a culture of a high quality built environment "giving particular attention to the quality of the public space, notably in terms of architectural design

quality, as a means of improving the well-being of European Union citizens" (Europe Parliament resolution, 2008).

The European Council Resolution of 12 February 2001 (2001/C 73/04) establishes that "architectural quality is a constituent part of both the rural and urban environment" (Council Resolution, 2001); key extracts of the Council Resolution on Architectural Quality are reported below:

> *"[…] Architecture is a fundamental feature of the history, culture and fabric of life of each of our countries; it represents an essential means of artistic expression in the daily life of citizens and that it constitutes the heritage of tomorrow;*
>
> *architectural quality is a constituent part of both the rural and urban environment; the cultural dimension and the quality of the physical treatment of space should be taken into account in Community regional and cohesion policies;*
>
> [The European Council] *expresses its attachment to:*
>
> - *the common characteristics shared by European towns and cities, such as the importance of historical continuity, the quality of public areas, the social mix and richness of urban diversity;*
> - *the fact that good quality architecture, by improving the living context and the relationship between citizens, and their environment, whether rural or urban, can contribute effectively towards social cohesion and job creation, the promotion of cultural tourism and regional economic development.*
>
> [The European Council] *hereby encourages the Member States to:*
>
> - *intensify their efforts to improve the knowledge and promotion of architectural and urban design, and to make contracting authorities and the general public more aware of and better trained in appreciation of architectural, urban and landscape culture;*
> - *take into account the specific nature of architectural service in the decisions and measures which require it;*
> - *promote architectural quality by means of exemplary public building policies;*
> - *foster the exchange of information and experience in the field of architecture.*
> - *calls on the Commission to ensure that architectural quality and the specific nature of architectural service are taken into consideration in all its policies, measures and programmes; […]"*

In 2018, the European Ministers of Culture, along with other institutions and NGOs, denounced in the Davos Declaration "a trend towards a loss of quality in […] the built environment […] all over Europe", characterized by "the trivialization of construction, the lack of design values, […] the growth of faceless urban sprawl and irresponsible land use, the

deterioration of historic fabric, and the loss of regional traditions and identities" (Davos Declaration, 2018). A high-quality built environment could give a "crucial contribution […] to achieving a sustainable society, characterized by a high quality of life, cultural diversity, individual and collective well-being, social justice and cohesion, and economic efficiency" (Davos Declaration, 2018).

In November 2018, the European Council created under the Work Plan for Culture 2019-2022 an expert group on "High-quality Architecture and Built Environment for Everyone" (EU Council, 2018). Experts designated by EU Member States were asked to exchange on best practices with respect to "multi-disciplinary and participatory governance models contributing to social inclusion and sustainable development of neighbourhoods", particularly focusing on "architecture as a discipline that encompasses the right balance between cultural, social, economic, environmental and technical aspects for the common good" (EU Council, 2018).

The constitution of the "High-quality Architecture and Built Environment for Everyone" expert group represents a huge step forward for the whole architectural profession in Europe, the group is nowadays (2020) working to define topics for its work (Architect's council of Europe, 2019).

As far as it concerns Italian legislative approach, the Italian Council of Ministers approved a Law on Architectural Quality in 2017 (D.L. n. 2867, 2017, "Legge quadro sulla qualità architettonica"), that is still under analysis at the Seventh Standing Committee (Public education, cultural heritage) of the Senate. The text of the law refers to Article 9 of the Italian Constitution "The Republic promotes the development of culture and scientific and technical research. It protects the landscape and the historical and artistic heritage of the Nation"; the concept of quality of architectural design and construction attains to urban planning: "a quality recognized as a matter of public interest - because it is capable of contributing to the preservation of the landscape and to the improvement of the living conditions of citizens - and defined as the result of a coherent project development that incorporates the functional, social and formal requirements based on the realization of the work, ensuring its harmonious insertion into the surrounding environment" (D.L. n. 2867, 2017, "Legge quadro sulla qualità architettonica").

This Italian Legge-Quadro establishes instruments for the promotion of architecture quality (such as competitions, prizes to young professionals), and for the protection of the architectural works of the second half of the 20th century; in order to promote the knowledge and enhancement of architectural, urban planning and landscape culture.

In the meantime, several certification methodologies across Europe have been developed to testify and measure the quality of buildings (Gann, Salter and Whyte, 2003). These certifications are suitable for newly constructed building, applicable in different areas and at different stages of the building process, but few are also adaptable to the existing building stock. Some examples are reported in Acampa et al.(Acampa, 2019):

- Housing Quality Indicator (HQI): developed by the English Government (Homes and Communities Agency) (DTLR, 2000), it measures quality based on the requirements of the buildings and the context in which they are placed;
- Building Quality Evaluation (BQE): developed by CIRI (Centro Interdipartimentale per la Ricerca Industriale) Building and Construction, which is part of the network of research and innovation facilities in the Emilia-Romagna region, is focused on the enhancement and management of assets.

While there is a broad consensus on the fact that "high-quality" built environments have positive impacts on people's everyday lives, the characteristics of a high-quality architecture need a deeper discussion and specification. International architects, academics and experts from local public authorities, national governments and the EU institutions should cooperate in order to homogenously define the concept of quality architecture and discuss existing tools, policies and good practices that enable to ensure that high-quality architecture is actually achieved in the built environment.

2.1.3. Docomomo, ICOMOS and the Getty Conservation Institute's (GCI)

In the last decades, the architectural heritage of the Modern Movement, despite being a unique and significant legacy of the spirit of the Machine Age, appeared more at risk than during any other period. At the end of the 1980s, many contemporary masterpieces had already been demolished or had changed beyond recognition; their cultural heritage was often not recognized, therefore the loss of the original function or the deterioration of their technological innovations were frequently used as valid reasons to completely alter them.

Several organizations at international level were built and developed for the study and preservation of contemporary and modern architectural quality; this paragraph briefly present the work some of the most famous ones (Docomomo, ICOMOS and Getty Institute).

2.1.3.1. Docomomo International

Docomomo International is a non-profit organization dedicated to the documentation and conservation of buildings, sites and neighbourhoods of the Modern Movement, established in 1988 by Hubert-Jan Henket, architect and professor, and Wessel de Jonge, architect and research fellow, at the School of Architecture of the Technical University in Eindhoven (Netherlands). Docomomo main goals are brought together in the Eindhoven-Seoul Statement (Endoven-Seul, 2014), and are reported below:

- Bring the significance of the architecture of the Modern Movement to the attention of the public, the authorities, the professionals and the educational community;
- Identify and promote the surveying of the works of the Modern Movement;
- Promote the conservation and (re)use of buildings and sites of the Modern Movement;
- Oppose destruction and disfigurement of significant works;
- Foster and disseminate the development of appropriate techniques and methods of conservation and adaptive (re)use;
- Attract funding for documentation conservation and (re)use;
- Explore and develop new ideas for the future of a sustainable built environment based on the past experiences of the Modern Movement.

About the theme of Authorship, the organization supported research for the attribution and the verification of authorship in several cases all over the world[13] However, Docomomo considers that "sole authorship is more an exception than a rule in architecture, the involvement of a variable number of partners, collaborators, specialists and even clients –not only in the design but also in the decisions around how a project is to be developed and implemented– attests to the inadequacy of narratives extolling a grand master builder's single authorship. Most of the short number of highly reputed names accorded authority in the discipline are always backed by other participants who have not been sufficiently acknowledged and who are even more difficult to identify in today's environment, due to the constantly rising number of team members" (DOCOMOMO, 2017).

The life of the built heritage is always subject to change; political and social circumstances other than those prevailing at the start of the project, the mere passing of time in

[13] An emblematic example was such of Casa Dagorret (Chile), initially residential and later transformed into a professional institute, that during a restoration and reuse intervention was attributed to Kulczewski.

buildings that last many generations, or even inevitable changes in ownership can result in the development of new projects in addition to the original architecture and the appearance of new overlapping paternities.

Starting a research of authorship on an architecture implies building a story that discerns the variability of the states of a building and its ownership conditions, starting from the first author and his team, and can constitute an operational framework for authorship accreditation otherwise lost.

As will be seen in the Paragraph 3.1.2 the search of authorship of an architecture is one of the criteria that can be used to define its architectonical quality and to define the related social, historical and temporal framework in which it was firstly designed.

2.1.3.2. ICOMOS

For nearly 40 years, ICOMOS members and committees have been concerned about the protection, conservation, management and presentation of the more recent forms of cultural heritage that bear witness to intellectual, social, technological or artistic evolution.

In 1999, in Mexico, the General Assembly received a number of resolutions relating to the preservation of modern heritage, namely in Eastern Europe and Israel. In the "Heritage at Risk 2000 Report", many national reports mentioned concern over the fate of various heritage types associated with 19th and 20th century, such as residential or urban architecture, industrial complexes, landscape creations or new building types such as stadiums, airports, waterworks or large city parks.

ICOMOS has been cooperating closely with UNESCO World Heritage Centre to organize a series of scientific meetings during 2001 and 2002 to promote the nomination of 20th century properties for the World Heritage List. In addition, ICOMOS co-operates and maintains links with other organizations in the field, such as TICCIH (industrial heritage) with whom signed a cooperation agreement, and Docomomo (Modern Movement heritage). In July 2001, ICOMOS also took part in the founding meeting for the Modern Asian Architecture Network (MAAN), in Macao.

To help define a consistent ICOMOS action on the more recent heritage (that created over the last 100-150 years), proposals for an international action plan and a scientific and co-operative programme were adopted by the Advisory and Executive Committees at the ICOMOS meeting in Dubrovnik in October 2001.

ICOMOS recognizes that the issue of 20th century heritage and its precursors cannot be reduced to the appreciation of few great monuments of Modern Architecture: that is why the Montreal Action Plan was developed around the following elements:

- Understand the full diversity of 20th century heritage and of the issues related to its recognition and conservation. To that effect, ICOMOS, with the support of US/ICOMOS, promoted a survey of illustrative cases, through all its National and International Committees. The survey was presented in April 2002 and published later as a Scientific Journal. Its result is helping ICOMOS identifying the needs for new international committees or further partnerships with other organizations.
- Put a special emphasis on 20th century heritage in the 2002 edition of the Heritage@Risk Report and invite other partner organizations TICCIH and Docomomo to contribute substantially to its content.
- Fully co-operate with UNESCO and other partners to develop workshops and meetings on that theme.

The Heritage@Risk program was endorsed by ICOMOS members at the General Assembly in Mexico in 1999. The aim of these reports is to identify threatened heritage places, monuments and sites, present typical case studies and trends, and share suggestions for solving individual or global threats to our cultural heritage. Each year an invitation is made to all ICOMOS National Committees, International Scientific Committees and ICOMOS' world-wide professional network, to provide short reports outlining risks in their country or area of expertise including case studies (ICOMOS, 1999).

2.1.3.3. Getty Conservation Institute's (GCI)

The Getty Conservation Institute's (GCI)[14] works internationally since 1985 to advance conservation practice in the visual arts—broadly interpreted to include objects, collections, architecture, and sites. The GCI is a private, non-profit institution that contribute to the conservation community through scientific research, education and training, field projects, and the dissemination of information. The GCI creates and delivers knowledge that contributes to the conservation of the world's cultural heritage. The GCI developed also the "Contemporary Architecture in the Historic Environment" (CAHE) project which addressing one of the critical issues in heritage conservation - the management of change - by exploring the role of

[14] See https://www.getty.edu/conservation/our_projects/field_projects/cahe/.

contemporary architecture in historic environments and developing methodologies and criteria for designing new buildings that are respectful of their historic contexts, assessing their impacts. Above all a useful publication studied for this research work was the open publication of Lardinois et al. (Lardinois, 2017) that collect a critical international bibliography on the relation between contemporary construction and existing urban environment.

2.2. The energy issue: threat or opportunity?

The second pillar at the basis of this research work is related to the increasing importance that the topic of energy and environmental sustainability is globally gaining. In particular, for buildings and the real estate market, this translates into the reduction of the consumption of non-renewable energy and of the emission of CO2 into the atmosphere (Green New Deal, 2020).

The existing residential building stock is wide, heterogeneous and composed of a great number of buildings with poor energy characteristics; however, for the residential heritage of the 20th century, the requirement of the first extraordinary maintenance or energy efficiency interventions could represent an opportunity for the enhancement.

Given how much environmental issues have gained precedence in almost all fields of the economy, including the real estate market, the compromises between conservation practices and energy adaptation interventions are currently an important object of reflection. In detail, in the framework of conservation, restoration, refurbishment and retrofit actions, the debate among scientists, administrators and skilled people is still open: in Italy, where the energy retrofit actions are often focused on modern buildings, generally built after the Second World War, many aspects still need to be considered and solved.

At the European level, in the construction field, the objectives of environmental, energy and economic sustainability are implemented and mainly regulated in approaches for the planning and design of interventions, as well as in the definition of standards for measuring the energy performance of buildings (Fregonara, 2017; Fregonara *et al.*, 2017; Fregonara, Rolando and Semeraro, 2017; Marmolejo-Duarte and Bravi, 2017; Marmolejo-Duarte, Chen and Bravi, 2020). The current regulatory framework at European scale about energy and environmental policies for the construction sector is reported below (Relevant regulations):

- European Directive 2002/91/EC, which introduces the Energy Performance Certificate (EPC), aimed at measuring the energy performance of buildings;

- European Directive 2010/31 / EU, which makes the Energy Performance Certificate mandatory for all buildings in the European Union and introduces (art. 9) the concept of "nearly Zero-Energy Buildings" (nZEB) as a future minimum requirement that public buildings will have to reach from 2019 onwards, and all the new buildings from 2021 onwards;
- Directive (EU) 2018/844 of the European Parliament and of the Council of 30 May 2018, which amends Directive 2010/31 / EU on the energy performance of buildings and Directive 2012/27 / EU.
- EPBD Recast II of the European Parliament and of the Council of 30 May 2018, amending Directive 2010/31 / EU on the energy performance of buildings and Directive 2012/27 / EU on energy efficiency, requires existing buildings to be redeveloped by 2050. By that date, in fact (see article 2bis), the European building stock must be de-carbonised and energy efficient (reaching the nZEB level). To ensure that this important result is achieved, Member States must indicate redevelopment strategies for their real estate portfolio, including measurable progress indicators in order to verify the trend in 2030 and 2040.

By 2050, all buildings will have to demonstrate very high energy performance and their low, or almost no energy demand, must come from renewable sources. Furthermore, the path towards the construction of nearly zero energy buildings will trigger a profound transformation of the construction market sector and will require a great use of high efficiency technology.

The EPBD directives require EU members to develop national definitions and design national plans for the construction of nearly zero-energy buildings, which will reflect specific national and regional conditions.

The Directive suggests, as a measure to achieve targeted and cost-effective renovations, the introduction of an optional "Building Renovation Passport" system: this should work as a personalized document for each building, detailing how and when is necessary to carry out a deep redevelopment in stages or transform an existing building into a nZEB, thanks to partial interventions spread over a period of 15-20 years.

In Italy, the energy directives have been mainly implemented in the following standards:

- Directive 2012/27 / EU was implemented through the Legislative Decree 4 July 2014, n. 102, which came into force with the provision of 19/07/2014;

- D.P.R. 2 April 2009, n. 59, Regulation implementing article 4, paragraph 1, letters a) and b), of the legislative decree of 19 August 2005, n. 192, concerning the implementation of Directive 2002/91 / EC on energy performance in buildings;
- Ministerial Decree June 26, 2009 of the Ministry of Economic Development, National guidelines for the Energy certification of buildings;
- Legislative Decree n. 28 of 03/03/2011 - in which the obligation to insert the Certification of the real estate unit in the deeds for the transfer of ownership is issued starting from 01/01/2012;
- Law 3 August 2013, n. 90: Conversion, with modifications, of the decree-law 4 June 2013, n. 63. The law introduced a new methodology for calculating the energy performance of buildings, adopted at national level (transforms 192 of 2005).
- 11 June 2020, the legislative decree 10 June 2020 no. 48 which implements Directive (EU) 2018/844 (EPBD III), which amends Directive 2010/31 / EU on energy performance in buildings and Directive 2012/27 / EU on energy efficiency.

National policies such as tax exemption tools for the interventions and deduction of expenses were implemented to encourage the application of these laws:

- Decree-Law no. 83 of 22 June 2012, which modified Dpr no. 917/1986, introduced tax deductions for the energy redevelopment of existing buildings. They have been extended several times and, most recently, until 31 December 2020 by the 2020 Budget Law.
- Decree-Law 19 May 2020, no. 34 Urgent measures in the field of health, support for work and the economy, as well as social policies related to the epidemiological emergency from COVID-19. (20G00052) (GU Generale n.128 of 19-05-2020 - Ordinary Suppl. 21) notes: The measure came into force: 19/05/2020. Decree-Law converted with amendments by Law 17 July 2020, n. 77 (in SO n. 25, relating to the Official Gazette 07/18/2020, n. 180), that introduce the so called "Super EcoBonus 110%";

The nZEB requirement can be achieved by a historic building that is properly recognized by citizens and critics as it is widely approved. But what if the value of the building is not recognized and still "invisible"?

The energy retrofit, for various reasons, offers owners the possibility of carrying out interventions that improve and reduce management costs, due to energy consumption, and at

the same time improve the appearance and living comfort. Furthermore, to the extent that retrofit events involve envelopes, they can improve the architectural quality of anonymous buildings in urban suburbs, which are often characterized by marginal market segments in terms of market prices and dynamism of trade. In these markets, the costs related to retrofit interventions most often fail to translate into an increase in market prices (marginal prices) corresponding to the costs themselves (marginal costs).

In this respect, the "Super Ecobonus 110%" can play an important role in redeveloping the contemporary heritage in the most vulnerable areas from an economic and social point of view, as the public bears a significant part of the cost of energy efficiency interventions, carried out by private individuals at a very low cost, if not zero. In general, retrofit interventions greatly improve their construction quality of the contemporary heritage, which is very fragile from an energy point of view. This may not necessarily be transferred to a contextual improvement of architectural quality. Indeed, in the case of the contemporary heritage of architectural quality, which is often not under protection, it may happen that the attempts of retrofit can compromise the original architectural values. On the contrary, in favour of energy saving, design and formal aspects have often been renounced, transforming the buildings with external coats and new windows that have distorted their identity. The Superintendence is now sensitive to this issue, but the solutions proposed still often present a gap between the theory of restoration "what should be done" and the actual technologies available. For this reason, no nZEB requirement will be never totally applied to an historical building correctly recognised by citizens and critics.

But what happens if the value of the building it is not recognised and yet "invisible"?

In the end, energy efficiency interventions on one hand constitute the best opportunity for owners to obtain an improvement in the living quality of their homes and condominiums and to reduce consumption and therefore operating costs, but on the other hand, they can threaten the historical identity of buildings, especially of contemporary buildings.

However, given the serious crisis in the construction sector in Italy, the introduction of tax exemption measures can only be seen in a positive way, as fundamental tool for activating new regeneration processes.

2.3. Real estate market models and trends in 2019: European context and Italy

The third *pillar* at the base of this study is the real estate market, that cannot be ignored if we consider the advantages of individuals in redeveloping assets, which depend on the market's ability to recognize the energy component as a real quality. In the following paragraphs

a photograph, updated to 2019[15], of the European markets and their relationship with the Italian one will be presented. In addition, some basic principles for price formation and the definition of market segments will be presented.

The development of the housing market is determined by many closely related economic, legal, financial, institutional and political factors (Cellmer, Cichulska and Bełej, 2020). They can be quantified primarily in international terms, where macroeconomic factors such as GDP (Gross Domestic Product), inflation, rates of return, availability of mortgage and the cost of money loans play a major role (Hott and Monnin, 2008; Gasparėnienė, Remeikienė and Skuka, 2016). Then, several factors can affect demand throughout the country, generally regardless of local variations.

Housing prices rose in 15 out of the 16 selected countries from 2015 to 2019. The only exception was Italy, where dwelling prices have been constantly dropping since the beginning of the financial crisis; Italy remains the only country having a Hosing Price Index lower than 100 (Figure 2.3).

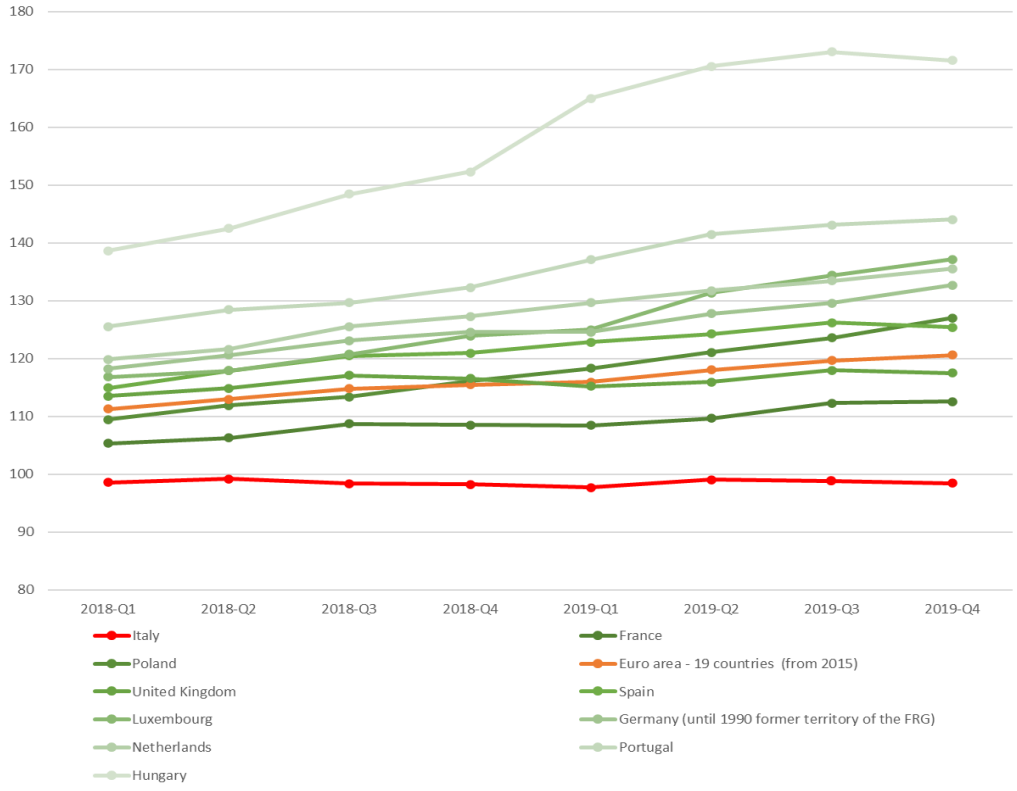


Figure 2.3: House price index (2015 = 100) - quarterly data [PRC_HPI_Q] of European Housing Markets - 8th edition, July 2019. (Author processing of Eurostat data extracted on 29/11/2020 21:14:44 from [ESTAT] Last update 07/10/2020 11:00).

[15] The global health crisis of 2020, due to the COVID-19 epidemic, constitutes a huge exception for the performance of all sectors of the economy, which is already for sale and which will also have gigantic and unpredictable repercussions on the real estate market. That is why the research did not include 2020, even if it will be for sure analysed in the future.

On national scales, it is necessary to consider various causes and administrative political, legal and economic mechanisms, such as the housing policy of government authorities, the existing system of loans and the possibilities of obtaining them, the inflation rate, income and its distribution, etc., and lastly, the conditions of the operation of entities on the supply side, such as developers.

The diversity of prices and activity of the housing market on a regional scale results primarily from the diversity of socio-economic factors and social processes. Special attention has been paid in many papers to demographic factors, which include age, gender, marital status and which also affect the housing needs (Anas and Eum, 1984; DeSilva and Elmelech, 2012; Lee, 2014).

The level of housing market development reflects the economic condition of households, which depends primarily on the employment rate, the average income level of the population and, even more so, the distribution of income itself, on which the solvency bands of potential demand depend. Housing demand is also largely influenced not only by income but also by household wealth, e.g., by savings and in addition to disposable income (Gallin, 2006; Essafi and Simon, 2017). A significant share of housing expenditure in the budgets of households results in a close correlation between the growth of income in a given area and the growth of housing prices (Jud, G.D.;Winkler, D.T. , 2002). At the same time, the results of empirical studies presented by Gallin (Gallin, 2006) indicate that due to the low income flexibility of the housing market, this relationship may be debatable in many cases.

Focusing on Italy, the Average Transaction Price of a New Dwelling (EUR/sqm) and annual change in 2019 is reported in Figure 2.4. Among the biggest cities in Italy, Turin shows the lower values.

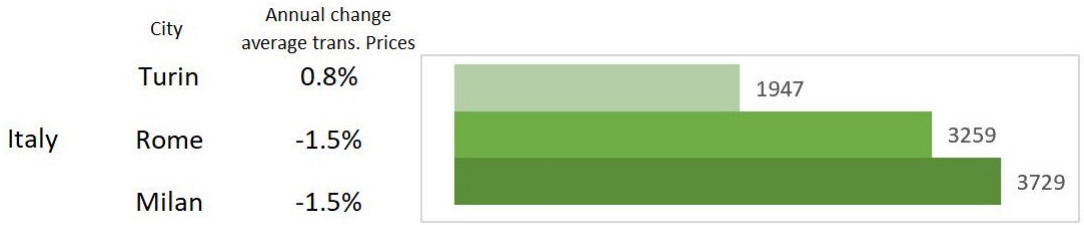


Figure 2.4. Average Transaction Price of a new dwelling (EUR/sqm) in 2019 and % Annual change Average transaction price (Source: Author processing on data of the 9th report of housing price. Deloitte national offices)

During 2019, the real estate sector in Italy remained essentially stable with an increase in demand, in line with the increase in residential construction activity. Towards the end of 2019,

the market outlook pre COVID-19 pandemic crisis ranged from general stability to a possible improvement in the sector. In terms of the number of transactions in residential real estate market, in 2018 580,000 transactions are reported, with an increase of around 10% compared to 2017; this data remained stable in 2019.

In 2019, Italian GDP registered a growth of 0.3% in relation to 2018 and, with respect to government debt, in 2019 the Government deficit narrowed to 1.6% of GDP from 2.2% of GDP in 2018.

In 2019, the residential household consumption expenditure grew by around 0.5% and, thanks to the stabilization of unemployment and an increase in wages in the country, the purchasing power of households was supported. In turn, the unemployment rate slightly decreased from 10.5% in 2018 to 9.8% in 2019.

The population income is closely linked to the labour market; hence employment opportunities represent an important potential, which results in an increase in local housing prices. Similarly, an increase in the percentage of the unemployed population in the area is expected to result in a decrease in housing prices. De Bruyne and van Hove 2013) emphasize the importance of the employment structure: i.e., if in a Municipal territory, agriculture has a high importance, prices are expected to be lower, with fewer job opportunities available.

Moreover, economic factors, such as the population income and the labour market, also depend by the condition of the local economy. Indicators arising directly from the housing market, concerning the balance or imbalance between supply and demand, are important. De Bruyne and van Hove, (2013) propose to take into account the number of apartments sold in relation to the available housing stock, as well as the number of newly designed residential buildings (both private and constructed by developers).

Among the factors affecting the housing prices of flats, those related to the environment quality and pollution are important. Ridker and Henning, (1967), Kim *et al.*, (2018) and Saphores *et al*., (2003) pointed out that low air quality causes the considerable housing prices decrease. On the other hand, the availability of green areas can have a positive impact on the prices.

In general, demographic, economic and environmental factors have the greatest impact on prices and market activity. Lin *et al.*, (2014), used twenty local indicators, including the population age, percentage of marriages, education, unemployment, safety, air quality, etc., among which the household income, the rent/income ratio, the percentage of the elderly in

population, and rent-income ratio produce different effects on housing prices in different urban areas.

The regional diversity and the socio-economic and environmental specificities, as well as the different intensity and directions of social processes, resulted in different levels of housing demand in different parts of the country. Thus, it can be observed that the development of the housing market varies considerably in time and space. The spatial and temporal dynamics concern different levels of the spatial hierarchy, with economic and demographic processes relating to housing changes at these hierarchical levels in different ways (Huang, Wu and Barry, 2010; Purhadi and Yasin, 2012). For example, Rencher and Schaalje, (2007) claim that the prices at the national level are affected to the greatest extent by mortgage interest rates, while at the regional level by population migration, employment rate and household income.

The above-mentioned groups of factors (demographic, socio-economic and environmental) can be quantified in regional and local terms, depending on the spatial resolution of statistical data: De Bruyne and van Hove, (2013) identified local factors such as differences in income levels, demographic effects, government policies and quality of life. They also point out that the relative location of individual areas is very important for the development of the housing market. In particular, housing prices are influenced by the distance and time required to access to the economic centres, which offer employment and extensive networks of services (Brunsdon, Fotheringham and Charlton, 1998). Furthermore, investments in the transport network, including roads, motorways and public transport systems, affecting travel time and distance, form the basis for the decision-making process of individuals and households, which choose the location of their future home.

The Italian situation, which as we have seen is distinguished from the European one by the weakness of the real estate market, is presented in the following paragraph. An attempt was made to use the most up-to-date data possible to establish an up-to-date framework.

2.3.1. Real estate market historical transformations in Italy

Italy (with about 77% of households owning homes) ranks at the top of the ranking of nations with the highest rate of small owners compared to the national population (Ernst & Young Global Limited report and Eurostat data 2019). During the years, demographic dynamics had a determining role in the real estate market trends, so that the Italian real estate market was progressively influenced by the following phenomena:

- reduction of the number of households that include at least two components;
- increase of the single-component families;
- increase of the average age;
- reduction of the birth rate;

Since 1985, the Italian real estate market underwent five different production cycles (EY Report, 2020), connoted by similar or at least homogeneous characteristics, shown in the following Figure 2.5.

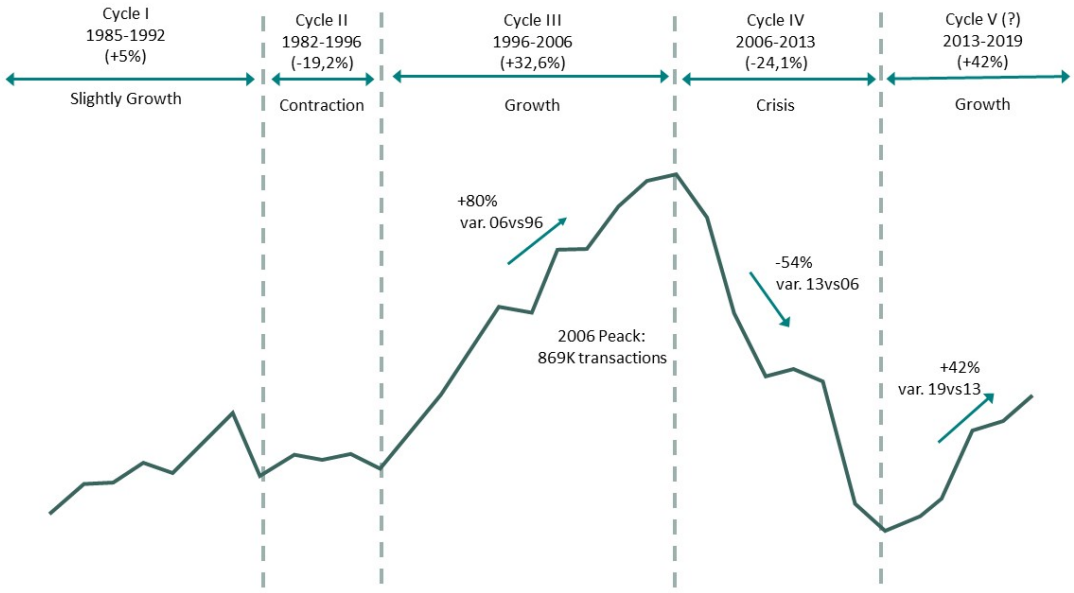


Figure 2.5: Historical number of residential transactions (1985-2019). (Source: Author processing on EY report 2020 data)

Real prices show a rising curve until 1992, while from 1993 they begin to decline until 1998, when they amounted to a national mean of 1,588 euros per square meter, compared to 2,149 euros per square meter in 1992. House sales begin to increase after a few years of stability, first modestly between '96 and '99, then increasingly in the new millennium. The drop in prices that occurred in 2008 was mainly caused by the collapse of the US real estate market and by the bankruptcy of the saving banks, which destroyed the European markets. In this critical juncture, the Italian real estate market almost overcame the levels of the previous period of decrease (1982-1996).

Real average prices in Italy are still declining, but at a clearly slower speed. In 2019, the annual change in nominal mean prices was 0.6 per cent less with respect to 2018, 1.2 less than

in 2000 in real terms. In 2019, however, a slight recovery was estimated (between 0.3 and 0.8 per cent compared to 2018).

Since 1990, the two largest Italian metropolises, capital of politics (Rome) and financial capital (Milan), have recorded a price trend that is clearly above the Italian average. In fact, the phase of price contraction in these cities came to a halt in 2015. In 2017, nominal mean prices increased by 48.4 per cent in Rome since 1993 and by 43.5 per cent in Milan city- centre, while the Italian mean was 37 per cent higher since 1993. The trend curves of Rome and Milan follow the national one, but about ten points apart on average. Also, with regard to real prices, the two cities show a better trend than the other Italian district capitals. However, even if Milan city-centre shows an increase of nine percent compared to 25 years ago, its semi-centre, as well as the Roman one, underwent a drop in real mean prices of respectively eight and eleven percent.

As regards the trend of sales, the most important flow of transactions of the century precisely began together with the rise of prices in 2000, and continued for seven years, reaching 900 thousand sales in 2003, until the economic-financial crisis progressed in 2010. In these eight years the dynamism of the market has been around thirty percentage points, marking the highest values so far recorded in Italy.

In 1993, the volume of transactions recorded was 502 thousand sales, 11 percent less than the 560 thousand expected for 2017.

The first years of the new millennium show a promise: high and stable international growth led by emerging economies and at the same time low inflation, development of finance in conditions of abundant liquidity, with low interest rates; a large and growing availability of credit and, consequently, a reduction in the cost of mortgages. The real estate market rapidly climbed to the top, with real prices rising. The number of real estate agents grew significantly, increasing by 127.3 percent between 1993 and 2017.

The downturn began with the subprime mortgage crisis in the United States and resulted in a general collapse of European markets. In this scenario, unemployment increased, causing a decline in incomes and the freeze of investments, which generated the recession in the housing market. This financial upheaval had more severe consequences in Italy, while Europe and United States have been able to overcome it more quickly.

In 2013, the lowest value in terms of sales since 1993 was recorded: they were just 410 thousand. Prices continue to decline even today, but at a decidedly slowed speed. Only in very recent times, a restart of the market can be noticed, given that prices have recently stopped their descent and sales have started to increase again.

A new cycle and a new phase of expansion is upon us, even if lighter than the previous ones. A more decisive increase was seen in 2016 and 2017. The increase in real house prices is linked to demographic pressures and urbanization phenomena that have occurred in limited areas and subject to increasingly stringent constraints.

The spread of houses in peripheral areas, less valuable and farther from the centres and the resources there available, raised the demand (and therefore the value) of pre-existing properties built in the central areas, leading to significant capital gains. This increases generated problems of inequality, making increasingly difficult to acquire a house for those who do not have one, as young people. However, the high diffusion of home ownership in Italy reduces the risks of unsustainability of social tensions evoked by the growth in the relationship between wealth and income. In a country where home ownership is so widespread, the increase in the price of housing tends to have the effect of levelling out income inequalities.

The housing problem of those who do not own a house and aspire to buy one, today affects less than twenty percent of the population, of which above all young people aged between 20 and 34. Indeed millennials represent the 16.4 percent of Italian citizens, the lowest percentage among the countries of the European Union.

The current national population photograph shows an aging country. Italy has been one of the nations with the highest rate of property owners since the seventies of the last century. The myth of the brick is hard to be forgotten and many families are willing to draw on their savings in order to allow their children to buy a house: an undisputed security. Being able to buy a house is the dream of all young people, even if it is currently not very feasible.

2.3.1.1. Price formation mechanism and segmentation of the real estate market

An aside is necessary to better understand how property prices, within the general framework presented above, are formed. The real estate market is segmented into sub-markets that behave in different ways at the local level compared to the global level.

Prices are divided first of all into offer prices and purchase and sale prices; the difference between the two for 2019 in Italy was -13.5%, but this depends on latent and stochastic variables that fall within the negotiation phases between supply and demand (Rapporto Immobiliare 2019, OMI, Agenzia delle Entrate).

Therefore, the listing prices represent, in addition to the hypothetical market price of the asset, the will of the owner and the real estate agent, who increase or decrease the price in the pre-negotiation phases. The listings prices in Italy are currently held by the most important real

estate web-portals (e.g., immobiliare.it, real.it, casa.it, etc.) while selling prices are not public. A state body of the Agenzia delle Entrate, the Real Estate Market Observatory (OMI) also provides official data[16] for estimations and evaluations and presents every quarter an update of the property prices calculated in a mixed way.

The lack of transparency of the real estate market impedes an analysis of the real trading price of the asset on the market, however the literature confirms that the study of offer prices can actually work as a *proxy* for analysing the real estate market (Curto, Fregonara and Semeraro, 2012).

The property value of an asset is formed by the main characteristics reported in Figure 2.6. The intrinsic variables that represent the construction characteristics of the housing units and buildings include the variables of architectural and building quality, while the extrinsic variables describe the characteristics of the micro-surrounding of the building and the environmental and social variables.

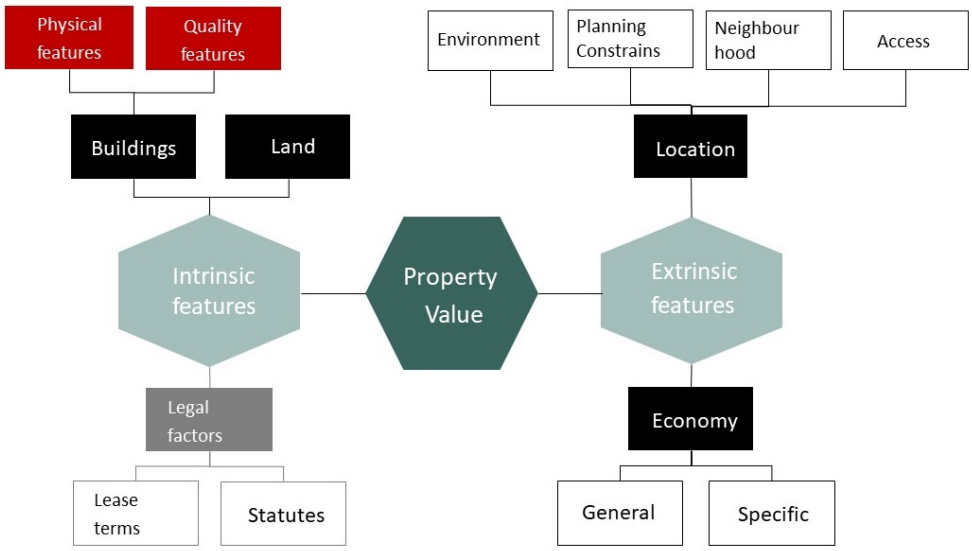


Figure 2.6: Intrinsic and extrinsic features of the Property value formation process. (Source: Author processing)

Understanding the price formation mechanism of the market is an extremely debated topic in the literature, and even if some assumptions are now globally recognized, the complexity of the market and its stochastic nature always require new analyses. These analyses also have

[16] Open access data at municipal level on the web platform https://wwwt.agenziaentrate.gov.it/servizi/Consultazione/ricerca.htm

different impacts on the urban economy and tax inequality in the residential sector, so a focus is presented in the next paragraph (Curto, Fregonara and Semeraro, 2017).

2.4. Geographical information science and Spatial econometric

At the basis of the research work there is the science of spatial information and the discipline of econometrics. The following paragraphs will therefore present the basic principles of the formation of geographical systems and the definition of spatial information, the state of the art of the models for the treatment of the space component, and the application of these models to the real estate market.

First of all, it is useful to underline that data, included spatial data, must be transformed into information to be useful. When data are organized, presented, analysed, interpreted and considered useful for the decision problem, they become information. Accordingly, geographical information can be defined as geo-referenced data that has been processed into a form that is significant to the recipient and is of perceived value in the decision-making process. The process of converting data to information adds extra values to the original data (Cassettari, 2012).

To collect, organize and analyse data, the definition of an Information System can be defined as "an integrated set of components for collecting, storing, and processing data and for providing information, knowledge, and digital products" (Britannica Encyclopedia). Each system consists of an interdependent group of components, such that each component can be identified, analysed and, if necessary, independently designed from the others.

According to literature, Information System can be defined "as a set of interrelated components that collect, process, store and distribute information to support decision-making and control in an organization. In addition to support decision-making, coordination and control, information systems may also help managers and workers analyses problems, visualize subjects, and create new products" (Maguire, 1991).

2.4.1. Geographical Information Systems base principles

There have been a number of attempts to define Geographical Information Systems (GIS) (Goodchild and Haining, 2003). On a careful analysis, most of GIS definition focused on two aspects of the system: the technology and/or the problem solving. GIS are truly interdisciplinary and multidisciplinary as highlighted from Burrough, who define a GIS as a "powerful set of

tools for collecting, storing, retrieving at will, transforming and displaying spatial data from the real world for a particular set of purposes" (Burrough, 1986).

First, GIS can be considered as a special-purpose digital database in which common spatial coordinate system is the primary mean for storing and accessing data and information. These systems have the ability to perform numerous tasks utilizing both the spatial and the attribute data stored within them. These functions distinguish GIS from others Management Information System (MIS)[17] and the geographical data represent phenomena in terms of position, attributes and spatial interrelation with each other.

GIS tries to interpret the real world through an adaptive data collection and with the developing of a group of tools and procedures for a correct data collection management. The conceptual model can be distinguished in three connected parts:

- Data storage and management.
- Data manipulation and analysis.
- Visualization, results representation and interpretation.

To take advantage of the possibilities that a computerized spatial modeling tool may provide, it is essential to understand how the data models used to represent geographical phenomena are coded. In fact, the data need to be organized to allow efficient accessing, retrieval and manipulation; systems for organizing data in the computer range, from simple lists of indexed files to highly structured databases based on hierarchical, network, relational, and object-oriented schema. These structures determine how the data are organized into data records and so control the way they are held in the computer. The various combinations impose some limitations on the data representation and handling, which affect the analysis and modeling of the information.

According to the quantitative geography, there is a phenomena conceptualization and process that govern dynamics of the systems. In particular, changes, adjustments and balanced situations are specified through a global link where territorial articulation become increasing important (Brunsdon, Fotheringham and Charlton, 1998; Bertuglia, Bianchi and Mela, 2012).

Such analysis approach, in relation of territorial systems, is accompanied moreover to the knowledge that exists a difference between the described world (our world representations) and the real or perceived world object of the analysis and this could cause errors and uncertainty. Therefore, the most important aspect to emphasize in a GIS project concerns the explicit

[17] See also 3.1 Information Systems and knowledge Management paragraph.

awareness that territorial phenomena complexity cannot be faced privileging a unique approach and point of view. Various ways of investigation are necessary and must opportunely be held in consideration and put in relation (Yandell and Anselin, 1990; Casetti, 1997; Davidson *et al.*, 2006).

2.4.2. Modeling location and the management of the geographical components

The importance of the spatial aspects of the real estate market is unquestioned. Thanks to the widespread recognition by both theorists and practitioners of the complexity of location and spatial interaction and the resulting geographically segmented nature of real estate markets, the explicit "spatial" treatment of these markets, in empirical real estate research, is today well developed.

The inherent spatial immobility of land and properties means that location can be either absolutely or relatively considered. Absolute spatial location requires a single distance measurement, such as distance from the city centre or distance from seashore, while relatively spatial location requires multiple measurement in different defined neighbourhood. The nineteenth-century economist Alfred Marshall coned the terms site and situation to describe geographic location and its importance to real estate (Thrall, 2002).

Significant differences in value can occur over short distances and evaluators generally agree that location is the most important factor affecting value. This has been reiterated on many occasions: Porter concluded that "of dominant importance in understanding the demand for any property is its location in a regional as well as a local sense" (Porter, 2000). As previously written, Tobler's First Law of Geography holds that "everything is related to everything else, but near things are more related than distant things" (Tobler, 2004).

Nevertheless, modeling location, for the general purpose of property appraisal, has proved to be difficult. The wide range of spatially defined attributes that may or may not affect perceptions of value at given points in time, are notoriously difficult to standardize (Can, 1990a; Miller, 2004). It is common knowledge that appraisers infer a substantial amount of information about property from its location, which in turn is based in local knowledge and experience.

The problem that any evaluator is facing now is related to the abundance of data: all the potential value influences shall be effectively incorporate into the evaluation process. Furthermore, the evaluator must rationalize the relativity between the various "negative" and "positive" value impacts, before arriving at the final picture. Indeed, understanding "why" a particular position exerts a particular influence on property values is very different from

attempting a measurement of that location factor (Figueroa, 1999). Literature also confirmed that in the real world "fuzzy zones" of spatial trends occur as opposed to distinct areas of homogeneous property subset (Can, 1990b; Dubin, 1992). As highlighted by Thrall (2002): "the city is an aggregate of sub-markets[18]. Each submarket is affected by the whole city; each sub-market affects, and in turn is affected by, other nearby sub-markets. In other words, sub-markets are independent with one another and each is independent with the whole. The geographic boundaries of the sub-market are defined with an objective of minimizing the variation of the descriptive characteristics and phenomena that characterize the sub-market" (Thrall, 2002).

Academic research has explored a number of techniques and ways to approach the question, showing how it is successfully possible to define location into valuation practice[19]

Scientific Geography series (Thrall, 1998) sought to bridge the gap between spatial geography, economic disciplines and property appraisal process.

Hedonic models of house prices are a mainstay of empirical research in real estate analysis; in the hedonic housing price model, three types of characteristics are specified: accessibility, neighbourhood characteristics and structural characteristics. Among these characteristics, the first two are strongly related to the location. This has given rise to a new reclassification of said characteristics, distinguishing between location and structural features.

Spatial effects, though typically ignored, are relevant for two aspects: on one hand, neighbourhood characteristics that cannot be captured in the explanatory manner, cause spatial autocorrelation in the error term of the hedonic regression (Dubin, 1992); alternatively, transactions occurring near each other may exhibit a proximity effect, which could be incorporated as a spatial Lag in the model (Can and Megbolugbe, 1997). In both cases, the application of spatial econometric estimation methods and specification tests of spatial

18 A considerable literature exists on the identification of residential sub-markets in which local factors play a dominant role. Sub-markets are essentially subset of large markets and whilst their existence is a priori accepted; there is, however, less consensus on considering that the submarkets should be defined in spatial terms or according to property characteristics or based on the actual house price (Adair, 1999)

19 One of the most common approach adopted for examining the effect of locational accessibility on house prices considers a distance variable from the central business district (CBD). Mono-centric models of residential location assume a single employment node which is located at the centre of the city (CBD). If all households have at least one employed member, transportation is not free, and spatial equilibrium exists, then these models show that housing price will decrease with the distance from the CDB. Distance from the CDB functions as a measure of employment accessibility. However, cities rarely have a simple mono-centric structure as written by Dubin and Sung (1987). This implicitly assumes that locational distribution is mono-centric, but clearly, a multiple nuclei/multi-centric model incorporating a concentric pattern is much more appropriate, given the existence of urban sub-centres. Muth (1969), in his estimation of housing price gradient for Chicago, attempted to control for factors that might affect the price gradient (such as proximity to public transportation and shopping centres) with dummy variables. He admitted that his "proximity" variable are crude measures and none are significant at the 5 per cent level, but it is significant only at 20 per cent level (Math's research is quoted in Dublin and Sung, 1987).

dependence is needed, and it requires close interaction with the spatial management functions of GIS.

There have been two important obstacles to such spatial management, one methodological and the other operational. From a methodological perspective, a proper space management requires the recognition of the importance of the two-dimensional nature of spatial interaction (or spatial autocorrelation) and its implications for statistical analysis. In other words, the prevalence of spatial dependence in the cross-sectional data used in real estate analysis requires the application of appropriate techniques of spatial statistics and spatial econometrics. It has been amply demonstrated that ignoring the specular nature of spatial data in econometric analyses may lead to biased or inefficient estimates and misleading inference (Anselin, 1988; Anselin and Griffith, 1988).

More recently, an appreciation of spatial econometric approaches has started to appear in the public policy literature as well. From an operational perspective, the initial lack of dissemination of the methods of Spatial Econometrics and Spatial Statistics to the practice of empirical Real Estate (and other policies) research has often been attributed to a dearth of software tools (Haining, Wise and Ma, 1998). Although this may have been an important factor in the 1980s, it is clearly no longer the case. Then, assuming that each location is influenced by other locations, econometric analysis must be concerned not only with the possibility of errors due to the problem of time autocorrelation but shall also examine the problems of spatial correlation.

In the past, Wyatt, (1997) agreed that location influences on property value are of the utmost significance, but within the valuation process they remained largely implicit. The deductive ability and intuitive capacity of a skilled evaluator has largely accounted for this factor. Wyatt therefore considered the potential of several computer-based techniques, which could undertake evaluations. He explored the use of Expert Systems, Neural Networks (as did in Italy, (Del Giudice, 1996) and Multiple Regression Analysis (MRA) (Curto, 1990, 1993; Simonotti, 1994; Morano, 2002), but found each lacking in some important aspect. However, Multiple Regression Analyses is still the most utilized technique to explain and predict property prices (Morano, 2002; Simonotti, 2002; Curto, Fregonara and Semeraro, 2015).

In a MRA model one of the biggest problems was to incorporate location by analysing small homogeneous areas within which it was assumed that residential properties were considered to share similar location attributes (neighbourhood), and the definition of the correct sample size. Finally, it is possible to conclude that the MRA technique is suspect because of

the presence of multicollinearity and the spatial autocorrelation that could occur in geographical analysis (Anselin and Griffith, 1988; Wyatt, 1997).

2.4.2.1. Lattice data and sub-markets

Focusing on data types and geographical representation of the reality and the real estate market, it is important to clarify the concept of sub-segmentation and sub-markets. From 2000 it is generally accepted that, from a mass appraisal perspective, the design of a predictive model requires the sub-division of a significant geographical area into realistic sub-markets or neighbourhoods (Mccluskey *et al.*, 2000). In Italy, the national government included this indication in the Law 138/98[20] and the related "Regolamento del Ministero delle Finanze", that provided the methodology to divide the Italian national territory in sub-markets. The subdivision was locally conducted by different bodies, and in Turin the formation of the Microzone[21];was developed by a project between Politecnico di Torino and the Municipality of Turin, named "Real Estate Market Observatory of the city of Turin (TREMO)" in 2000 (Curto, 1990; Curto, 1994; Curto, 1999, Curto *et al*., 2008,). In 2018 the National Observatory of the Real Estate market (OMI)[22] changed some of the original boundaries of the "Microzone" and currently the "OMI Zones" are now in use.

Sub-markets can be defined in several different ways by employing the principle of stratification: a process of creating several homogeneous segments from a larger heterogeneous database. In a spatial context, it is possible to create localized areas (clusters) formed through the aggregation of area units, such as postal zones, enumeration districts or ward boundaries. However, the use of political, administrative or other fixed non-property-based location areas can create problems related to boundary positioning.

Alternatively, a sub-market or neighbourhood can be created on the basis of environmental or locational characteristics.

Neighbourhood quality is a very complex variable to be observed and assessed, although a qualitative assessment may be made on a variety of perceived quality indicators, ranging from site sizes and housing quality to infrastructure and environmental conditions, to social structure

[20] Decreto del Presidente della Repubblica 23 marzo 1998, n. 138. Regolamento recante norme per la revisione generale delle zone censuarie, delle tariffe d'estimo delle unità immobiliari urbane e dei relativi criteri nonché delle commissioni censuarie in esecuzione dell'articolo 3, commi 154 e 155, della legge 23 dicembre 1996, n. 662. (GU Serie Generale n.108 del 12-05-1998) Entrata in vigore il 27/5/1998.
[21] The Microzone of the city of Turin were initially defined by the Real Estate Observatory of the City of Turin in a collaboration between the Municipality of Turin and the Politecnico di Torino, these boundaries were in use from 2000 to 2018.
[22] In 2018 OMI changed some boundaries on Microzone, now called "OMI Zone".

and employment levels. There is no consensus in the literature regarding which variable is deemed as the most appropriate to measure neighbourhood quality, but it is an ever-evolving research field (Figure 2.5).

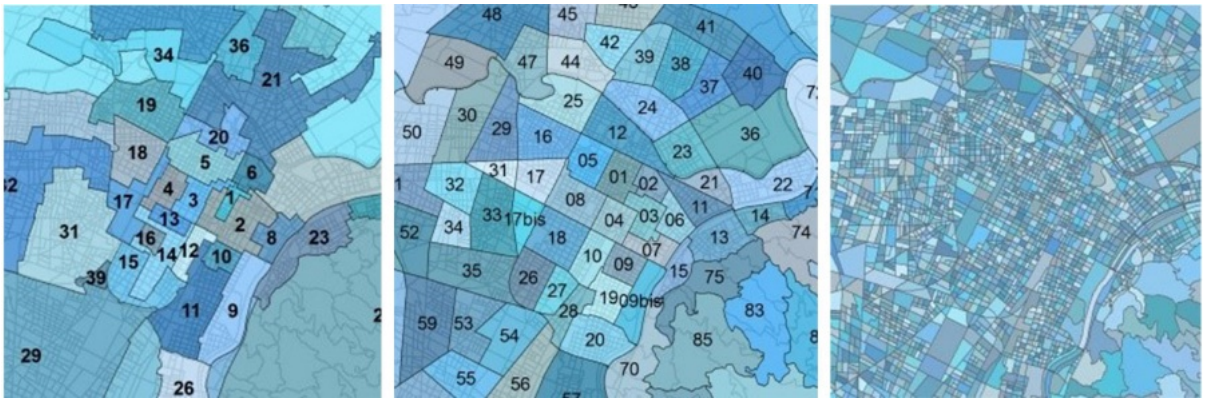


Figure 2.7: Example of different spatial segmentation on the same territory. (Source Author processing).

From a mass appraisal modeling perspective, due to the large number of point-data to be processed, it is essential that a large geographical area is divided into sub-markets or neighbourhoods to enable the model to reflect the influence of location by using lattice data. However, global estimates of value relationships can produce misleading interpretations of local value relationships, shown through Simpson paradox (Agresti, 2006). Simpson paradox refers to the reversal of results when groups of data are analysed separately or combined (Figure 2.8).

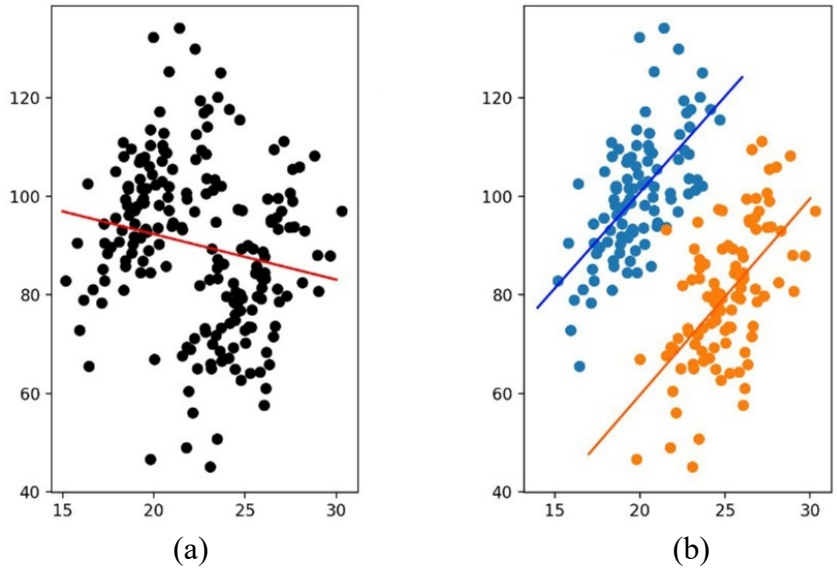


Figure 2.8: Simpson Paradox scheme with simulated data (Source: Author processing)

In the examples presented, scatterplots are showing the relationship between the price of a house and the population density of the area in which the house is located. In Figure 2.8a, data from more locations are aggregated and the relationship shown by the linear regression line is negative, which suggests that house prices diminish with the increasing of the population density.

In Figure 2.6b, the data are separately analysed for 2 locations and in both locations the relationship between house price and population density is now positive. For both individual locations there is a positive relationship between house prices and density. So, the Simpson paradox highlights the dangers of analysing aggregate data sets, whilst it is normally demonstrated in spatial data sets where the aggregation is over spatial subgroups locations.

Classical statistical assumption (for procedures such as regression and significance testing) requires data independence from each other. If some data grossly violate this assumption, which happens frequently in time-series data, the conclusions drawn from the data analysis will probably be incorrect. Therefore, Zone delineation has a significant impact on model results: the concept of Modifiable Areal Units Problem (MAUP) is described in detail by Fotheringham and Wong (1991). Two main effects are related to the definition of zones:

- the aggregation of smaller units into larger ones significantly changes the results. Polygons, typically used to define the zones, are area regions in which the process is assumed to be homogeneous. The aggregation of polygons, however, increases the variance of the measurements. The within-zone mean does not change, but the increase in variance causes problems in the models.
- the definition of the boundaries (edge effect) can cause problems. The spatial tolerance of the boundary is not constant, and the boundaries are often arbitrarily drawn with respect to the process in question. This discretization of a continuous process, however, is often necessary to make the data fit into a classification scheme or within the constrain of an analysis.

MAUP interests any continuous process that is represented discretely or by data aggregation/reconfiguration and demonstrates the problems of altering the scale of data to fit the needs of analysis.

The various contributors in the housing market literature of the past decades considered the housing market to be set of distinctive but interrelated submarkets (Tu, Sun and Yu, 2007). The marginal prices of the distinctive components in the hedonic price function across the sub-markets are significantly different. Sub-markets are technically clusters of related attributes,

which are apparently distinct from other clusters. The definition of a housing sub-market offered by Goodman and Thibodeau (1998) is distinct but related to the other definitions. They defined a housing sub-market as "geographic areas where (1) the price of housing (per unit of service) is constant and (2) individual housing characteristics are available for purchase" (Goodman and Thibodeau, 1998, 2003). This definition implies that within the submarket, the benefits derived from each housing service provided by the different housing attributes (structural, physical, neighbourhood and location) are substantially the same, but distinct between the submarkets.

Inoue et al. (2018) pointed out that a property market is geographically segmented so that the attributes marginal price of the property is different for each submarket. The identification of the right segmentation is necessary for an accurate property pricing. Thus, the importance of property market segmentation in price modeling, using lattice data, cannot be overemphasized (Keskin and Watkins, 2017).

The incorporation of market segmentation into pricing non-spatial models can help to avoid aggregation bias, which could occur due to the integration of homogeneously distinct submarkets into an entire "forced" market. This can lead to inaccurate parameter estimates and poor model fit. Segmenting the housing market therefore leads to better accuracy of the property price structure. Such market characterization reveals the structure of the urban housing market, captures price trends in different locations, and substantially improves property price prediction, thereby making the prediction more reliable and accurate (Goodman and Thibodeau, 2003; Pryce, 2013; Gabrielli, Giuffrida and Trovato, 2017).

2.4.2.2. Point of Interest and Big Data

In recent years, thanks to the increase of the availability of open data on the web, also thanks to supranational agreements such as the International Open Data Charter (2015) point data, rather than lattice data, are increasingly commonly used in various research fields through web-crawling on open access platforms.

Many types of point data are called Point-of-Interest (POIs), of which there is not an official definition yet, but the most commonly used is: "a specific physical location which someone may find interesting". Heritage buildings, real estate ads, urban amenities, restaurants and retail stores are all examples of Points-of-Interest. Many companies that sell or provide open POIs databases or POIs data API's call their products 'Places Data APIs'.

Recent explorations of POIs data on open access platforms have provided new opportunities to address these data issues. Particular urban amenities and services in terms of POIs can be extracted and categorized, as POIs represent the smallest spatial resolution of the built environment of urban landscapes. Many scholars have employed POIs to evaluate city's growth potential (Zhang and Pfoser, 2019), as well as to analyse land use and classification strategies (Jiang *et al.*, 2015) and the real estate market (Hu *et al.*, 2019; Kang *et al.*, 2020) and (Xiao *et al.*, 2017; Hu *et al.*, 2019; Kang *et al.*, 2020). There is a huge need to utilize POIs for housing price studies, as the pace at which some new communities are born (e.g., in China) and the sheer number of geospatial variables generated in that processes cannot be efficiently captured in a traditional manner.

Existing classical models such as the *hedonic pricing model* proposed by Rosen (Rosen, 1974) typically take into account only *structural attributes* and *locational amenities*, which may not fully describe other aspects affecting the appreciation rate of housing price . Structural (intrinsic) attributes contain the material assets of the property, including the size of the house, the year of construction, the number of the bedrooms and bathrooms, etc., which can describe the internal characteristics of the houses (Can, 1990b). Location amenities (extrinsic) refer to geographical-related variables, such as distance from nearest facilities, which can reflect the intangible environment nearby (Chin and Chau, 2003). The POIs data can assess the second type of data, and by means of geographical hedonic models it is possible to analyse them even if they belong to very different sources and data structure.

However, the "house price appreciation rate" and the social aspects and demand choices could be analysed in more depth in the future. In fact the "appreciation" of a home is affected by other variables such as the physical appearance of the house, surrounding physical and social environment and dynamic patterns of human mobility (Du *et al.*, 2018). For example, homes located in districts and areas with a beautiful visual aesthetic environment, where residents' well-being can be benefited, might have higher appreciation rate, homes with refined decoration may be attributed higher values, and more attractive neighbourhood could have higher selling prices. However, these key factors were overlooked by most of the previous studies, due to the lack of quantitative measurements in conventional data collection methods, (Kang *et al.*, 2020).

The emergence of big data, high-performance computing, and advanced machine learning methods provide unprecedented opportunities to model those intangible and latent features of houses, which can improve the estimation of house price appreciation rates. On the one hand, in contrast to previous studies which used official statistical data and manual surveys in

exploration of house price appreciation rates (Crone and Voith, 1992; Archer, Gatzlaff and Ling, 1996; Quercia *et al.*, 2000; Andrew and Meen, 2003), larger volumes and varieties of geo-referenced data are actively and passively produced by users, bring more comprehensive insights into the representation of socio-economic environments in the era of Volunteered Geographic Information (VGI) (Goodchild, 2007) and big geo-data (Gao *et al.*, 2017). For instance, photographs of houses that reflect indoor and outdoor scenarios of the properties, taken by the house owners and seller agents, are uploaded to online websites, which enable people to understand the scenery of houses and Street View images can describe the relationships between urban physical attributes and socio-economic environments (Gebru *et al.*, 2017; Wen, Jin and Zhang, 2017; Liu *et al.*, 2019). In addition, tracking individuals' trajectories to infer people's activities and movements is made possible by means of popular built-in GPS devices (e.g., mobile phones and vehicles). These dynamic observations of human movements may be taken as a supplement to the locational amenities that characterize only the static geospatial aspects of houses. Intuitively, houses located in the areas with high accessibility to other places and greater attractiveness to others, may have higher price appreciation rate due to travel convenience. A better understanding of the relationship between all these dimensions and house price appreciation rates can provide more comprehensive and valuable information for policy making to improve the overall quality of neighbourhoods and stimulate social and economic balances between urban areas(Kang *et al.*, 2020).

2.4.2.3. Policy implications

Open access to information on the prices and values of properties is one of the underlying conditions for ensuring the transparency of the property market. The critical role of monitoring real estate markets and making market information available to the public is emphasized by the relationship between local decisions concerning space and national and even global economic consequences.

The access to spatial information on prices and values constitutes a tool to control the risk of investing in real estate, especially in a dynamic economic situation. Real estate information provided in the form of maps can be particularly useful for public administrations, but also real estate appraisal agencies, mortgage lenders and planning organizations.

Real estate, as well as their prices, are linked by topological relations, which allow relating information on the price of real estate to geographical space and its visualization in the form of a map with the use of GIS tools. Price and value maps are most often discussed in the

context of mass valuation of real estate for tax purposes. While the development of maps for tax purposes requires the application of rules strictly defined by law, investment or generally utilitarian purposes open the possibility of applying open rules based on substantive analysis of local real estate markets. The basis for the development of such maps is usually detailed market analyses prepared for areas of single cities.

2.4.3. Spatial econometric for the Real Estate Market

The state of the art in spatial analysis of the real estate markets highlights the relevance of a spatial data analytic perspective on the operational setting in which this can be implemented. Given the importance of location in real estate, the variables used in empirical studies overwhelmingly tend to be spatial or geo-referenced. Such data do not often satisfy the requirements of independence and homogeneity required in classical statistics. Despite widespread recognition by both theorists and analysts of the complex roles of location and spatial interaction and the resulting geographically segmented nature of real estate markets, an explicit spatial treatment of these markets in real estate research is however more considered.

Traditionally, although the literature on this topic is quite dated, the spatial distribution has not been considered in regional or local economic analysis or it has been considered as a stochastic part. Economic variables have been studied more in time than in space, perhaps due to the greater complexity of the study of space and the lack of specific computer software. Today the obstacles are partially overcome with the publication of more rigorous and homogeneous studies, increasingly based on the development of geostatistics.

From a methodological point of view, a proper treatment of space needs the recognition of the importance of the two-dimensional nature of spatial interaction (Cliff and Ord, 1981) and its implications for statistical analysis. In other words, the application of appropriate techniques of Spatial Statistics and Spatial Econometrics in real estate analyses requires the acknowledgement of the spatial association between value at different locations (spatial dependency) and the systematic variation of phenomena by location (spatial heterogeneity or non-stationary) (LeSage and Pace, 2009).

Can and Dubin (Can, 1990b; Dubin, 1992, 1998) considered the application of hedonic modeling to house prices and concluded providing worthwhile means of exploring price determinants and movements. The analyses of house values using hedonic modeling makes it possible to estimate the marginal monetary contribution of property attributes and neighbourhood externalities (Rosen, 1974).

On the other hand, from an operational perspective, the growth of GIS enabled a much more realistic and detailed representation of features of the urban economic geography, relevant for the analysis of real estate markets and spatial information system tools. Several research and studies had been carried out on Geographical information Management Systems design.

In the mainstream research on cartographic visualization of prices and values, hedonic models are used considering selected characteristics of real estate as price determinants. It is then assumed that real estate is a heterogeneous good, the price of which is decomposed into a set of utility features constituting the explained variables. One of the essential elements of market analysis is the identification of the impact of location factors that constitute the essence of cartographic reflection of value.

In the real estate market, proximate properties tend to be developed at the same time and the similar quality of the buildings may be a natural consequence of this. Secondly, residents in the same neighbourhood may follow similar commuting patterns (Costello *et al.*, 2011), suggesting similar accessibility conditions. Thirdly, property values in the same neighbourhood capitalize on shared location amenities (Basu and Thibodeau, 1998; Ismail, 2006).

Considerations on location in the context of defining the determinants of apartment prices are presented, among others, by Kiel and Zabel (Kiel and Zabel, 2008), indicating at the same time relatively simple methods of econometric modeling as a primary tool for identifying location factors.

The use of GIS tools and geostatistical methods to model surfaces showing the value of real estate seem particularly interesting, because they allow the assessment of auxiliary variables spatially co-dependent on property values, including structural and residential housing characteristics. On the contrary, Hedonic models are influenced by limited data due to high monetary and time data collection costs, geostatistical models, explicit modeling of spatial autocorrelational effects, as well as spatially extensive patterns, which are compelling reasons to develop an alternative.

Bourassa et al. (2004) and Tsutsumi et al. (2006) advocate for the combined use of hedonic models and geostatistical methods (Bourassa *et al.*, 2004). Geostatistical methods can be treated as a natural complement to traditional statistical analysis, considering the spatial distribution of the analysed phenomenon. These methods are much less commonly used in the real estate market than other statistical methods. A specific obstacle to their use may be the need to meet fundamental assumptions concerning the size of the data set and, above all, the location.

The spatial structure of location features may also be included in the Geographically Weighted Regression (GWR) model[23] Due to price volatility over time, Fotheringham et al. (2011) postulate the use of GWR not only for spatial analyses but also for spatial and temporal analyses. These analyses allow us to present not only the current spatial distribution of prices and values, but also local trends and short-term forecasts spatial autocorrelation. A crucial issue in the definition of spatial autocorrelation is the notion of "location similarity", or the determination of those locations called "neighbours", for which the values of the random variable are correlated.

In the context of this research work, spatial autocorrelation refers to a situation where the ordinary Least Squares (OLS) residuals exhibit a regular pattern over space. Assuming the importance of market segmentation for property price prediction, and the spatial autocorrelation of data, the estimation of hedonic regression models has grown substantially over recent years, developing ultimately into spatial regression models. In the very extensive list of spatial estimation techniques, Anselin Local Indicators and Spatial Regression have established themselves as widely used methods with lattice data (Anselin, 1994, 2019). In the explanation of real estate prices across space, the integration of new approaches for modeling spatial heterogeneity is fundamental.

A wide range of literature confirms the idea that territorial segmentation in sub-markets represents the different sets of local features such as green areas, public schools, public spaces, social centres or police departments. The nearer a house is located to positive attributes, the higher the benefits for this household should be; otherwise, the nearer a house is located to negative attributes, the higher the vulnerability should be. The spatial structuring of environmental variables and community processes is a source of spatial autocorrelation in data.

Econometric modeling of real estate prices using socioeconomic and environmental factors has a relatively long tradition and has been often described in the literature. An extensive review of statistical models describing the relationships between house prices and factors influencing them both at the national, regional and local level is presented by Gaspareniene et al. (2014), who mentions both advantages and disadvantages of the models as well as their structural elements. It should be noted, however, that usually the models developed so far do not consider spatial relationships, either as a geographical reference of the variables adopted or as a structural model. Spatial effects taken into account in price and market activity models,

[23] See paragraph 3.2.3

especially in regional terms, may concern both spatial autocorrelation and spatial heterogeneity. Spatial autocorrelation is included in Spatial Autoregressive models (SAR) as well as spatial panel models (Holly, Pesaran and Yamagata, 2010; Lee and Yu, 2010; Otto and Schmid, 2018), while spatial heterogeneity can be presented with geographically weighted regression models.

The occurrence of spatial autocorrelation may also form the basis for the application of the Eigenvector Spatial Filtering (ESF) approach, which is a certain alternative to SAR models. In its basic format, the Eigenvector Spatial Filtering method is an approach that captures spatial dependence applying map pattern variables obtained from spatial connectivity information using the Moran coefficient (Griffith, 2009). Spatial filtering addresses spatial autocorrelation from a quasi-semi-parametric point of view. Apart from the observed covariates, also known as the systematic component, spatial filtering techniques generate synthetic explanatory variables representing the dataset spatial structure. More flexibility is added to the model by bringing these synthetic variables into the systematic part of a model. This approach produces unbiased parameter estimates, reduces spatial misspecification error, increases model fit, increases the normality of model residuals and can increase the homoscedasticity of model residuals spatial dependence and spatial spill-over effect (Thayn and Simanis, 2013).

Although ESF approach seems to be more advantageous than GWR modeling, the interpretation of the GWR model is certainly more intuitive and, most of all, it allows the evaluators to determine whether the analysed dependencies are local or global. Griffith, (2008) also stated that there is an indirect relationship between GWR and spatial filtering via interaction terms: GWR can be seen as a special case of indirect spatial filtering. In other words, spatial filtering should be able to address apparent heterogeneity in behaviours by interacting Eigenvectors (synthetic variables) and systematic covariates.

Geographically Weighted Regression (GWR) is widely used in the real estate market primarily in local-scale research. Spatial-temporal GWR models play an increasingly important role in the study of spatial diversity determinants of the real estate market, which assumes not only a spatial heterogeneity but also a temporal one (Huang, Wu and Barry, 2010). Basic GWR models assume that the influence of explanatory variables may differ at each point of the analysed space. It has been shown earlier that some of the variables may be global and some may be local. This assumption was the basis for creating Mixed Geographically Weighted Regression (MGWR) models. These models are used increasingly often for both local and regional research and seems to solve some problem addressed to the classical GWR (Wu *et al.*, 2016).

The relevance of spatial econometrics, spatial statistics and GIS for empirical analysis of real estate markets is illustrated in the following Chapter. Particular attention is paid to the linkages between the spatial data analytic functions and the GIS analysis functions. In particular in the methods section will be presented: Hedonic models, MRS techniques, Global Spatial Regression models, Geographically Weighted Regression and Kernel density.

3. Materials and methods

The methodological approach adopted for the present research work is composed of five steps that employ different well known methods of econometrics and spatial statistics (Figure 3.1).

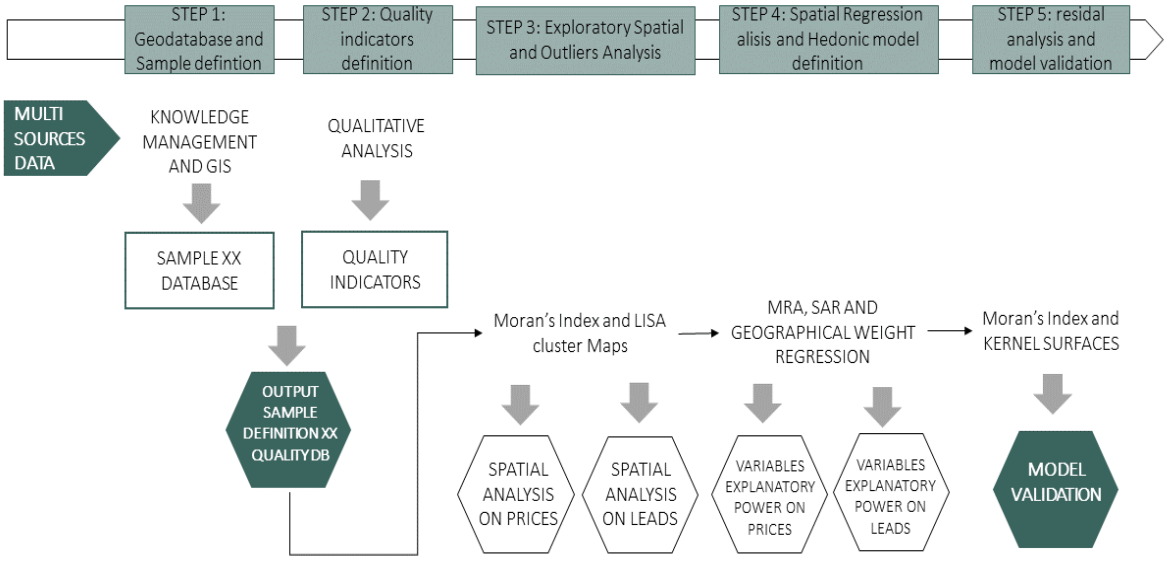


Figure 3.1: Methodological procedure (Source: Author processing)

The process started from the multi-source sample scaffolding definition (Step 1) and the data sampling that produce the final database and samples. The second step (Step 2) implied a more qualitatively research and aims at defining architectural and building quality indicators, based on literature and attribute available. Subsequently, the primary descriptive statistics and the analysis of outliers and error were carried out on the defined sample; this first explorative spatial analyses provided a first information on how the sample was distributed and even clustered in the space (Step 3). Finally, starting from a Multiple Regression Analysis (MRA) (in particular, an Ordinary Least Squared (OLS) model) and on the basis of the results of different statistical tests, the final regression model was designed, therefore in the fourth step (Step 4) were reached the first results. The validation and verification of the procedure and the model were processed in the fifth step (Step 5) by means of residual and error analyses and the Kernel Surface Interpolation technique to predict surface values.

3.1. Information Systems and Knowledge Management for a Spatial Analysis Approach

As previously mentioned, GIS can be divided into three principal aspects: reality observation, technological tool and user knowledge. These tree aspects are presented in the following process scheme in Figure 3.2:

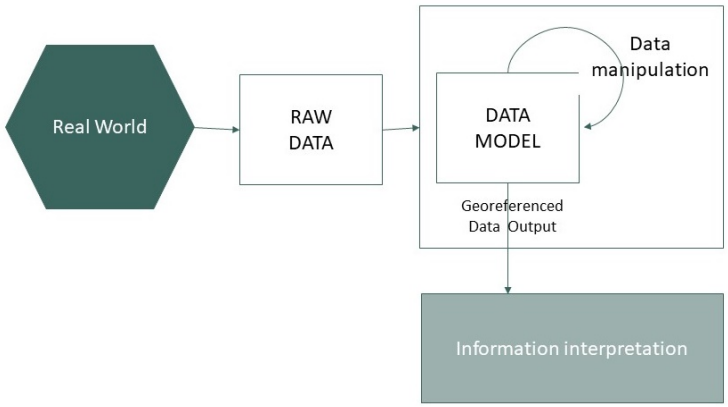


Figure 3.2: Geographical information system analysis process. (Source: Author processing from Martin (1995)).

From the real world input specific raw data were collected for the purpose of the research, then the data processing and manipulation were carried out to transform all the attributes and levels into a homogenous language, and finally, after the statistical analyses, they were transformed into information. The results must always be interpreted on the basis of parallel statistical tests and on the basis of the researcher's experience.

Information is the main output of a GIS. Not considering the mathematical definition, the information concept is not definable in a single way, but it can be declined along a continuum that goes more from the simple fact to an elaborated form that includes a general definition. Therefore, according to this second point, "information can be considered as the product of a creative manipulation, finalized to help to catch up new levels of understanding" (Janelle, Hodge and National Center for Geographic Information & Analysis (U.S.), 2000).

The conception of a GIS includes the information around which the decision-making process develops. The process of transforming raw data into knowledge is part of a brad discipline, Knowledge Management (KM), which has developed in recent years: methodologies and systems have been developed to manage multi-sources data from different points of view. Some of the KM approaches used for this research are presented in the following paragraph.

3.1.1. Knowledge management and multi-sources databases integration

Borrowing some principles of the wider approach of Knowledge Management (KM), it is possible to explain the process that led to the formation of the "20th-century database" and the datasets used for the subsequent phases of analysis.

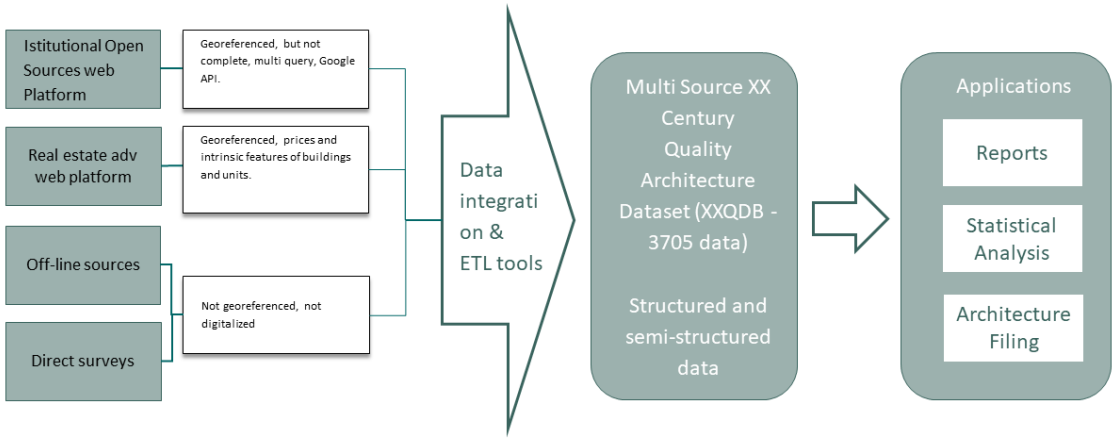


Figure 3.3. Sampling process and multi-source database integration (Source: Author's elaboration)

In the literature, a KM is defined as "the tools, techniques, and processes to collect, retain, analyse, organize, improve, and share understanding about data and information", and to use that understanding towards meaningful action (Wang et al., 2001).

The Knowledge Management approach is particularly crucial for converting raw data into useful information and applicable knowledge in spatial and real estate market analyses (Alavi and Leidner, 2001). Since big data and geographical open data emerged after from the great diffusion of Web 2.0, also brought about by the development of geospatial technologies, the search for new integrated analysis methodologies and techniques has been at the centre of the researchers' attention.

The knowledge-based perspective first emerged in the strategic management literature (Cole 1998; Spender 1996a, 1996b; Nonaka and Takeuchi 1995).

The issue of defining knowledge by distinguishing among knowledge, information, and data is mainly addressed by authors in IT literature (Fahey and Prusak, 1998). A common view is that data are raw numbers and facts, information is processed data, and knowledge is authenticated information (Dreske 1981; Machlup 1983; Vance 1997). Advanced information technologies (e.g., the Internet, intranets, extra-nets, browsers, data warehouses, data mining techniques, and software agents) can be used to systematize, improve, and accelerate large-scale intra- and inter-company knowledge management (Alavi and Leidner, 2001).

Among various definition of knowledge in this research work, it was assumed the definition of Carlsson et al. (1996) who see knowledge as a capacity with the potential to influence future action and Watson (1999) who suggests that knowledge is not so much a capacity for a specific action, but the ability to use information; learning and experience result in an ability to interpret information and to ascertain what information is necessary in decision making.

As presented in (Barreca *et al*, IFKAD conference proceedings, 2020) some KM functions can be integrated with GIS. GIS integrates common database operations such as queries and statistical analyses with geographical analyses and geographical representation of data and analysis results.

GIS in a KM perspective allows to handle all the knowledge information from various sources, both digitized and analogue with different structures and normalization of data and information. Subsequently phases of the GIS design in a KM perspective is presented in Figure 3.4.

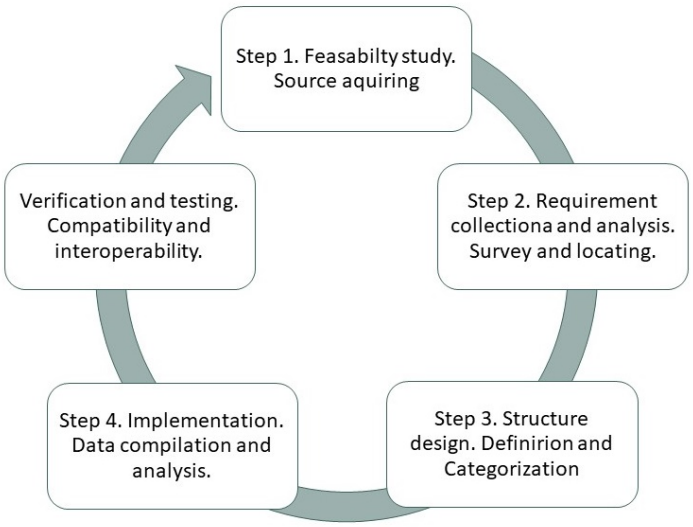


Figure 3.4: GIS formation process for the implementation of the KM (Source: Author processing from Barreca et al., 2020).

The initial identification of knowledge represents a crucial operation to guarantee a correct initial setting of the GIS design, to preliminary evaluate its feasibility and to analyse the main related requirements. The Feasibility study (Step1) is the study of the available open data related to the case study and its (source acquiring) in order to evaluate the feasibility of the development of a new geodatabase. Numerous existing data sources were consulted in this first preliminary step, such as the Geoportal of the city of Turin, the Geoportal of the Piedmont Region, the Real Estate Market Observatory of the Agenzia delle Entrate (OMI), the web-portal

of Immobilaire.it and the Italian National Institute of Statistics (ISTAT)[24]. Moreover, other more specific data sources were consulted, such as Sigec Web and MuseoTorino[25].

Each of these sources give data with different specific requirements to be considered for the creation of the conceptual modeling of the GIS (Step 2). Once the knowledge database is preliminary identified and analysed, in the Step 3 the missing data are identified the new data structure is transformed to be integrated and finally multi-source data were acquired.

Subsequently, Step 4 is voted to verify new data queries and congruence both by attributes and by geographical information.

In the subsequent step, after the system implementation, it is possible to proceed with its verification and testing of the integration of the whole GIS with different software and tools, and eventually change some part of the original structure (Step 5).

3.1.2. Second half 20th Century Architectural quality indicator

As previously mentioned in Paragraph 2.3.1.1., the buildings characteristics classically analysed in a regression model for the explanation of the price formation process are numerous; they are usually divided into the two macro-categories of extrinsic and intrinsic building features.

In order to transform architectural and building qualities into variables that can be analysed through a regression model and spatial statistics, it was therefore necessary to identify the related attributes and subsequently group them into indicators.

To identify the characteristics of the residential heritage capable of defining its architectural and building quality, related literature was first analysed, even if these characteristics are useful for the interpretation of the urban phenomena, the historical reconstruction and the identification of the architectural languages (Magnaghi and Tosoni, 1996) and are not directly adaptable to a quantitative analysis relating to the real estate market.

The following Table 3.1 reports the criteria for quality established by MiBACT project "National census of quality architecture of the second half of the twentieth century[26], also reported in paragraph 2.1.2:

[24] See Chapter 4
[25] See Chapter 4
[26] The archive cards already published for Piedmont can be entirely consulted on the website http://www.architetturecontemporanee.beniculturali.it/architetture/index.php, except for the city of Turin that is not part of the project yet. 250 assets are nowadays identified, but the open database is being constantly implemented and updated (November 2020, Consultation).

Table 3.1: Criteria used for the census of quality architecture of the second half of the 20th century (Author processing on Directorate General for Contemporary Art and Architecture and Urban Peripheries. See http://www.architetturecontemporanee.beniculturali.it/architetture/index.php. Web-site visited on November 2020)

Criteria	*Levels*
Publication in at least two of the systematic studies or repertories that dealt with architecture in the Region or in Italy;	Yes / No
Publication in one of the studies of criterion 1 and in a journal of Italian or foreign international importance;	Yes / No
Publication in at least two Italian or foreign magazines;	Yes / No
Originally significant role in the regional landscape in relation to developments both in the debate and international research;	Yes / No
Significant role in typological evolution with building progressive or experimental interpretations;	Yes / No
Designed by a prominent figure in the panorama of regional, national or international architecture;	Yes / No
Work of qualitative value within the urban and / or environmental context in which it is built;	Yes / No

The heritage assets previously identified by a search carried out in 1999 in the public archives and in the private designers' archives (project promoted by National Association of Contemporary Architecture Archive project – AAA Italia[27] and then MiBACT, were subsequently filed for the regional project "*Architecture of quality from 1945 to today*", launched in 2001 by MiBACT.[28] Metadata and attributes used to filed the heritage assets are shown in Table 3.2.

Table 3.2: Metadata of the catalogue cards (Author processing on data of the General Directorate of Contemporary Art and Architecture and Urban Suburbs. http://www.architetturecontemporanee.beniculturali.it/architetture/index.php, November 2020)

Name Attribute	*Levels*	*Example*
Asset name	Title of the asset	Casa Gilli
Location	General geographical reference (Region, City, District)	Ivrea, Montenavale
Building typology	Building typology	Villas and single-family houses
Design	Time period of the asset design	1955 - 0
Construction	Time period of the asset construction	1955 - 1956
Category:	Filing category classification	B. Selected artefact
Authors	Name, Surname and eventually Society or Firm affiliation	Emilio Aventino Tarpino, UCCD (Ufficio Consulenza Case Dipendenti Olivetti)
Client/Customer	Name, Surname	Mario Gilli

[27] AAA association networked the most advanced and prestigious archival institutions dedicated to architecture, engineering and design and promoted a series of census, research, training and dissemination initiatives. See http://www.aaa-italia.org. MiBACT published the archive portal on: http://www.architetti.san.beniculturali.it/web/architetti/home.
[28] See http://www.architetturecontemporanee.beniculturali.it/architetture/index.php

Name Attribute	*Levels*	*Example*
Property type	Property type: public or private	Private property
Original use:	Intended use at the time of design	single-family house
Current use	Intended use at the time of the survey	single-family house
Description	Description of the original work and subsequent modifications, up to the date of detection. Each card has an author and a date.	Original asset « […] The foundations will be isolated plinths for the spine pillars […] » «Casa Gilli: 1955; address: Montenavale, via Montenavale, n. 13/A; designer: Emilio Aventino Tarpino / UCCD; n. 208 / tavola G / R0152506». (Patrizia Bonifazio, Enrico Giacopelli, Il paesaggio futuro. Letture e norme per il patrimonio dell'architettura moderna a Ivrea, Allemandi, Torino, 2007, p. 123) Consistency of the asset in 2019 / Current status The work maintains its original intended use as a single-family residence. It has a good state of preservation, […] Casa Gilli is included in the buffer zone of the "Ivrea, industrial city of the twentieth century" included in the UNESCO World Heritage List in 2018. (http://whc.unesco.org/en/list/1538). (Filing by Stefania Dassi MiBACT SR-PIE con Bianca Guiso, DAD - Politecnico di Torino)
Picture/Photo	Photographic survey	Professional photographs
Map location	Address and coordinates	Asset localization on Google Map module
Analysis of the building construction elements		
Structure	Brief description of the structures and materials used	"Foundations with isolated plinths, concrete spine pillars. Continuous masonry in cement concrete with annular pilasters. "
Structure Conservation Status	Definition of the state of conservation of the structures (levels: Excellent / Good / ... / Bad)	Good
Façade material	Brief description of the materials used in the facade	"Exterior plasters in lime mortar and cement. Masons of the semi-basal floor externally in hand guard bricks […] Parapets of the windows in solid brick masonry".
Façade material Conservation Status	Definition of the state of conservation of the structures (levels: Excellent / Good / ... / Bad)	Good
Roof	Brief description of the shape and materials of roof.	"Roof covering in corrugated fiber cement sheets […] Downspouts in sheet metal".
Roofing conservation status	Definition of the state of conservation of the structures (levels: Excellent / Good / ... / Bad)	Good
Joinery	Brief description of the geometric characteristics and materials of the windows.	"Fir and poplar windows. External windows of the mezzanine floor in larch […]. Interior windows with melded glass windows, exterior windows of semi-transparent glass. "
Joinery status	Definition of the state of conservation of the structures (levels: Excellent / Good / ... / Bad)	Good
Heritage protection law	Presence of heritage protection law constrains (levels=Yes/no)	No
Protection measures	References to any protective measures present	-
Protection measure date	Affixation date of the protection measure	-

Name Attribute	*Levels*	*Example*
Regulatory reference	Regulatory reference of the present protection measure	-
Land Registry detail (Foglio)	Land registry details	-
Land Registry detail (Particella)	Land registry details	-
Bibliography Reference (Author, year, Title, Publisher, Place; pages)		Patrizia Bonifazio, Enrico Giacopelli, 2007, Il paesaggio futuro. Letture e norme per il patrimonio dell'architettura moderna a Ivrea, Allemandi, Torino, pp. 64, 123
Archival sources (references, document title, archive name)		Casa Gilli Mario di Ivrea, fascicolo 66, cartella 0, 1955-1971, Associazione Archivio Storico Olivetti.
Attachments		Photos files

The structure of the filing proposed by MiBACT census was recovered and simplified in this research to build the sample of data related to the residential heritage of the second half of the 20th century. To assess the influence of a variable linked to the construction quality of residential buildings on prices, it was necessary to build new (qualitative) indicators starting from the available variables; two indicators have been defined (see Table 3.3):

- the Recognized Quality (RecQ) indicator, referred to the architectures that have already been documented and published in official documents, or institutional sites or architectural guides and magazines, and whose value and authors are known and knowable by all.
- the Observed Quality (ObeQ) indicator. Given the small number of identifiable assets for RecQ, a second indicator was necessary. It is based on the visual survey of buildings of architectural and construction quality; in a future research development, these elements will certainly be verified through archival research.

Following the main purpose of this research work (the analysis of the construction and architectural quality in the real estate market), the historical research was delegated to future possible collaborations and insights.

Table 3.3: Definition of the Recognised Quality (RecQ) and Observed Quality (ObeQ) indicators (Source: Author processing)

Indicator	*Components*	*Description*	*Levels/Contents*
RecQ Recognised Architectural and Building Quality	Author	Name, surname year of life and death of the architect or group of architects.	Name Surname (year of birth-year of death)
	Construction firm	Name of the company that carried out the work (in many cases the designer was internal to the construction company)	Company Name (period of activity)
	Description	If there is a description of the property in trade magazines, catalogues or publications.	Bibliographic reference of the publication

Indicator	*Components*	*Description*	*Levels/Contents*
	Protection measure	If there is a protective measure and any references.	References to any protective measures present
ObeQ Observed Architectural and Building Quality	Facade elements	All the elements that characterize the facade of the building must be included.	Stringcourse cornices, Cornices around the openings, type and shape of windows, type and shape of the parapets and of cornices and terraces, vertical elements such as columns, pillars or pilasters, other.
	Fine materials / material processing	All materials or mixes of materials that make the workmanship valuable and distinctive are to be included.	Type and arrangement of exposed bricks, type and laying of stone and imitation stone, workmanship and material of ashlar and imitation ashlar, workmanship of reinforced or unfinished concrete, other.
	Geometry / shape of the building	All the geometries that define the shape of the building and that connote the quality of the design and construction are to be included.	Alignment of the building to the street level, orientation within the lot, presence and type of projecting or set back volumes on the façade, asymmetrical scanning of solids and voids, ground floor with pilotis, ground floor below street level, shape and type roofing, other.

The result of this classification, however limited and expeditious, has led to already obtaining satisfactory results, but it could be implemented and integrated with further insights and studies.

The indicators described, being part of the broader group of constructive characteristics of the buildings, were then analysed using classical and geospatial statistical procedures which are presented in the next paragraph.

3.2. Spatial statistics analyses for the Real Estate Market

The growth in the GIS technology offered a much more realistic and detailed measurement and representation of the features of the urban economic geography, relevant to the analysis of real estate markets. Not only GIS allows the collection and integration of very large databases for use in the real estate market analysis, but it also extends the frontiers of the types of analytical studies that can be carried out in a realistic setting (for example the assessment of residential quality in Can 1992 and the study of underserved mortgage markets (Can and Megbolugbe, 1997). The current state of the art permits the application of sophisticated spatial statistical techniques in conjunction with an operational GIS environment that is generated to support policy as well as business decision making, as illustrated in the studies of (Can and Megbolugbe, 1997; Anselin, 1998).

In Figure 3.5 is shown an overlook on statistical and regression analyses that will be presented in subsequent paragraph.

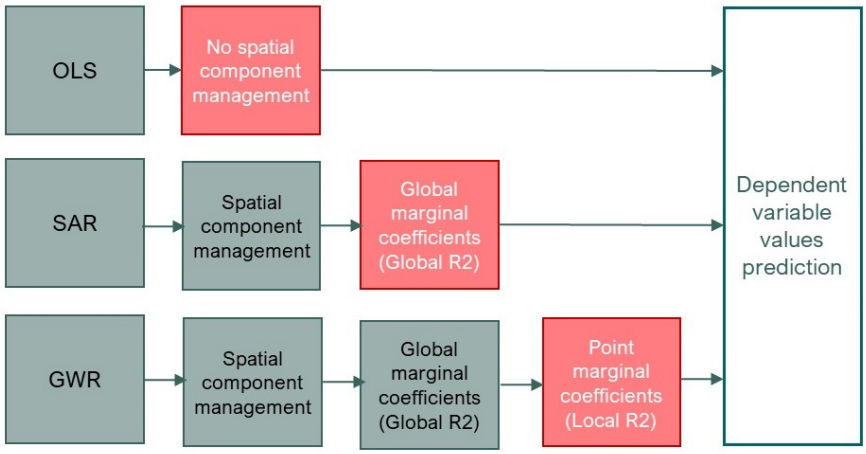


Figure 3.5. Regressions model scheme (Source: author's elaboration)

3.2.1. Ordinary Least Square Regression

Assuming that real estate is a heterogeneous good, its price is decomposed into a set of utility features constituting the explained variables. Prices and values of real estate depend on many exogenous and endogenous elements, which should be taken into account in the market analysis, with a particular emphasis on detailed location. Hedonic Models and Spatial Regression Models can isolate the impact of each element and the location factors.

Formally, if a standard Ordinary Least Squares (OLS) model has the following form (1), we can define the error term ε in two different way for each spatial regression model.

$$y = \beta_0 + X_i\beta_i + \varepsilon \quad (1)$$

where y stands for the dependent variable, X_i, with i = 1, …, k is the independent variable, β_0 is the constant to be estimated and β_i with i=1, …, m represents the hedonic weights assigned to each variable (i.e., the contribution given by each single characteristic level to the price value) and ε represents the error term. The OLS model could be represented as in Figure 3.6.

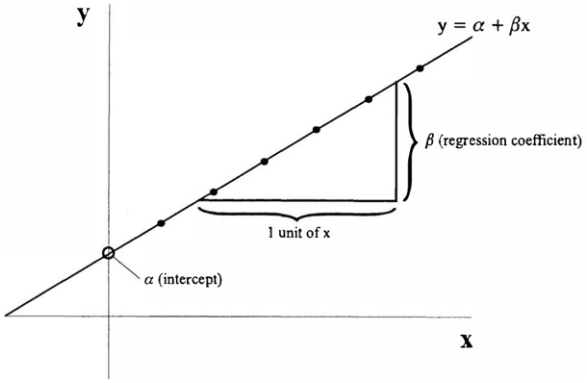


Figure 3.6. Graphic representation of Ordinary Least square method. (Source: Hutcheson, 1999)

3.2.2. Spatial Autoregressive models (SAR)

Since spatial data are not generally independent, statistical inference in OLS regression models applied to spatial data is suspect; consequently, several attempts have been made to provide a regression framework in which spatial dependency is duly considered.

These approaches may be generally described as Spatial Autoregressive models (SAR). Spatial models are divided into global and local models. The global ones, including SAR, can recognize the local nature of spatial data, for instance by relaxing the assumption that the error terms of each observation are independent but calculating a (global) marginal coefficient of each explanatory variable homogenous for all the observation in the space.

If each observation is associated with a location in space, it is assumed that the error terms of the observations in close spatial proximity are correlated. Spatial correlation can be represented by the Moran's Index as in Figure 3.7.

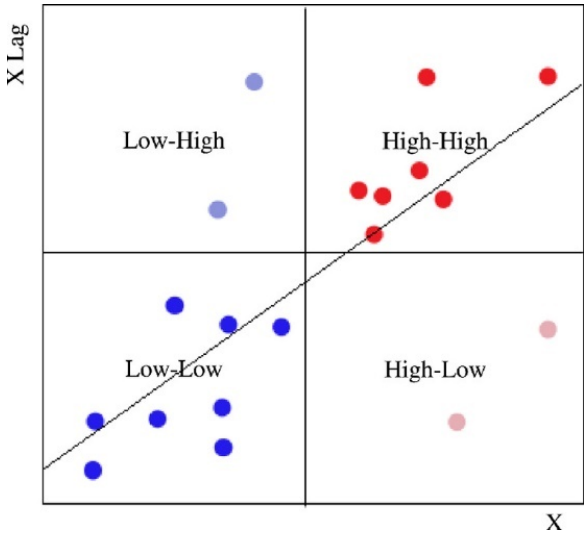


Figure 3.7. Moran's Index scatterplot to assess spatial dependence both between values and regression residuals (Source: Manesh et al. 2020)

Two models from the SAR group were considered in the present research work: Spatial Errom Model (SEM) and Spatial Lag Model (SLM).

The Spatial Error Model (SEM) can be specified as follows (2):

$$y_i = X_i\beta + \lambda w_i \varepsilon_i + u_i \quad (2)$$

where u_i is the random error (independent identically distributed - i.i.d.), and the spatially structured error is composed by the added spatial error coefficient, λ, and the original ε error

term weighted by a weight matrix w_i (W). If there is no spatial correlation between errors, then $\lambda = 0$. If $\lambda \neq 0$, OLS is unbiased and consistent, but the standard errors will be wrong and the β will be inefficient.

The vector of error terms λ is assumed to have a multivariate Gaussian distribution, with a zero mean and a variance-covariance matrix having nonzero terms away from the principal diagonal. This implies that although any given λ will have a zero-centred marginal distribution, its conditional distribution will depend on the values of the error term in the surrounding observations. For example, given an error term at one point, another nearby observation is also expected to have an equally positive error term. That is, its conditional distribution would be centred on some positive quality rather than zero.

Otherwise, the second general spatial regression model that it is tested in this work is the Spatial Lag Model (SLM), that can be specified as in (3):

$$y_i = X_i\beta + \rho w_i y_i + u_i \quad (3)$$

where $X_i$is a matrix of observations on the explanatory variables, ρ is the spatial coefficient and $w_i y_i$is the spatially lagged dependent variable for weights matrix w_i (W). If there is no spatial dependence, and y does not depend on neighbouring y values, then $\rho = 0$. ρ reflects the spatial dependence inherent in the sample data, by measuring the mean influence on observations from their neighbouring observations. If ρ is significant, then OLS is both biased and inconsistent in this case.

3.2.3. Local spatial regression: The Geographically Weighted Regression

Geographically Weighted Regression (GWR) is one of several spatial regression techniques used in geography and many other disciplines. The principal difference from the global spatial models presented above is that GWR evaluates a local model of the variable or process you are trying to understand or predict by fitting a regression equation to every feature in the dataset.

Mc Millen (1996) introduced a form of spatial non-parametric locally Linear Weighted Regression (LWR) which Brundson, Fotheringham and Charlton (Brunsdon, Fotheringham and Charlton, 1996) term Geographically Weighted Regression (GWR).

The GWR approach imply a subsequently methodological steps that drive to the representation of results as shown in figure 3.4.

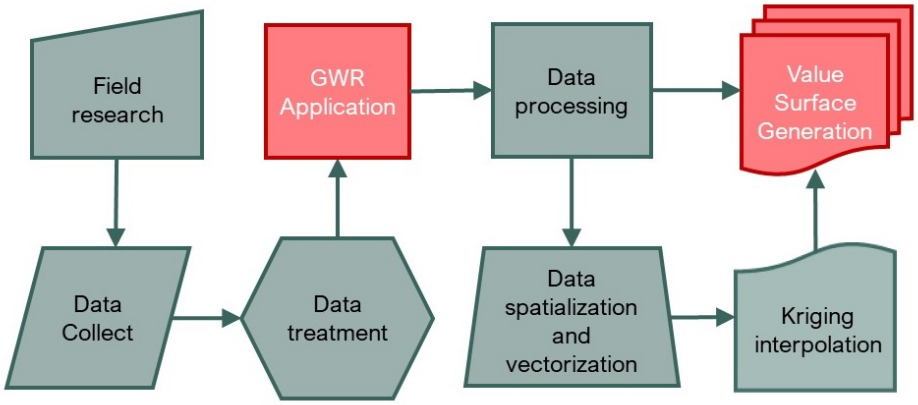


Figure 3.8. GWR data processing (Source: Author's processing on (Flávio, Fontoura Júnior and Uberti, 2020)*)*

This approach for modeling spatial dependence differs from the ""classical" regression model where the relationship and the regression parameter are assumed to be "full map" statistics. GWR constructs separate equations and position-based estimates for each characteristic of the dataset by incorporating the dependent and explanatory variables of the characteristic falling within the neighbourhood of each target feature. The shape and extent of each neighbourhood analysed is based on the neighbourhood type and Neighbourhood Selection Method (NSM) parameters. GWR is suitable to datasets with several hundred single point features (POIs), while it is not an appropriate method for small datasets. In many situations this is not necessary the case, as mapping the residuals (the difference between the observed and predicted data) may reveal. Many different solutions have been proposed for dealing with spatial variation in the relationship. GWR provides an easily grasped means of modeling such relationship (Curto *et al.*, 2009; Massimo *et al.*, 2018).

The assumption in the OLS model (1) is that the values β_0 and β_i are constant across the study area. This means that is there is any geographic variation in the relationship then it must be confined in the error term. Supposing we had some location in the study area, perhaps one of the data points, where (u, v) are the coordinates of its position. It is possibile to rewrite the model thus (4):

$$y \quad (u, v) = \beta_0(u, v) + X_i\beta_i(u, v) + \varepsilon \quad (u, v) \tag{4}$$

This can be fitted by least squares to give an estimate of the parameters at the location (u, v) and a predicted value. This is achieved though the implementation of the geographical weighting scheme. So generally, a basic form of GWR can be expressed as (5):

$$y_i = \beta_{i0} + \sum_{K=1}^{m} \beta_{ik} x_{ik} + \varepsilon_i, \quad (5)$$

Where y_i and x_{ik} (k = *1, ..., m*) are the observations of dependent variable and independent variable, respectively, at location i , β_{ik} (k = *1, ..., m*) is the set of regression parameters estimates at location i ; and ε_i is the random error term.

A standard calibration model is calibrated by a e weight least squares approach at each regression point, of which the matrix expression is:

$$\widehat{\beta_i} = (X^T W_i X)^{-1} X^T W_i y, \quad (6)$$

Where X is the matrix of the independent variables with m+1 column and a column of 1 is for the intercept (if there is one); y is the vector of the dependent variable and W_i s a diagonal matrix denoting the geographical weighting for each observation data (sub)set at regression location i. Notably, W_i is calculated with a distance decay kernel function, which is non-increasing, real and bounded from 0 to 1 (Cho et. al.2010). There are many kernel functions to choose from, the one used in this thesis is the Gaussian kernel function, which can be expressed as (7):

$$\text{Gaussian: } w_{ij} = exp\left[-\frac{1}{2}\left(\frac{d_{ij}}{b}\right)^2\right] \quad (7)$$

Where w_{ij} is the weight attributed to observation *j;* d_{ij} is the distance between observation *j* and regression point *i*, and *b* is the bandwidth, a key parameter for controlling the extent of distance decay. The bandwidth can be either a fixed distance (i.e., a fixed distance bandwidth) or a fixed number of nearest neighbours (i.e., an adaptive distance bandwidth). It can be optimally found by minimizing the CV score or the Akaike Information Criterion (AIC) (Cleveland, 1979).

AIC approaches are preferred as they account for model parsimony, which is a trade-off between accuracy and complexity of the prediction. In particular, in this study a corrected version of the AIC (AICc) is used (Hurvich and Tsai, 1991) , whose calculation is:

$$AIC_c = 2n\, ln(\hat{\sigma}) + n \ln(2n) + n\left\{\frac{n + tr(S)}{n - 2 - tr(S)}\right\} \quad (8)$$

The weighting scheme is organized in such a way that closer data is given more weight in the model than more distant data. Weights are determined using a kernel model, which is a distance decay function that determines how quickly weights decrease as distances increase. This allows to make a separate estimate of the parameters at each data point. The resulting parameter estimates can then be mapped. Graphically the GWR estimation process can be represented as in Figure 3.9.

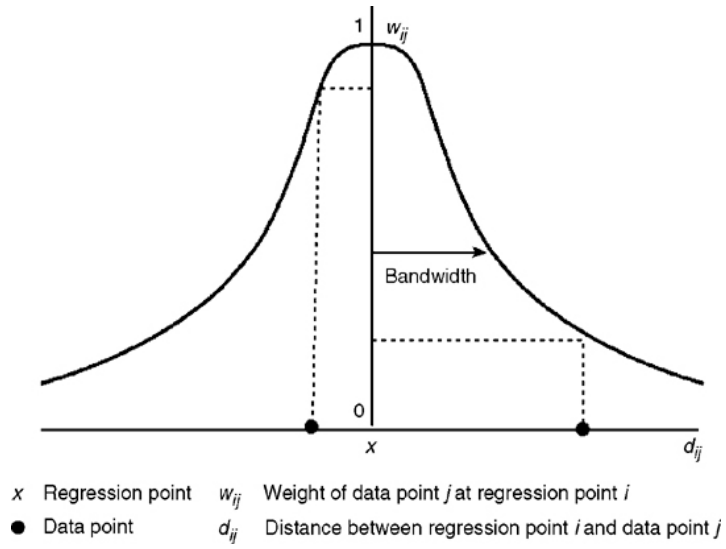


Figure 3.9. GWR graphical scheme (Source: Fotheringham, 2009)

There is currently no consensus on how to evaluate confidence in coefficients from a GWR model. Although t-tests have been used to base the inference on the estimated value of coefficients being significantly different from zero, the validity of this approach is still an active research area. One approach to informally evaluate coefficients is to divide the coefficient by the standard error provided for each feature, in order to scale the size of the estimate with the associated standard error and visualize those results, looking for clusters of high standard errors related to their coefficients.

GWR, when applied to sampled data, can be also used to predict/estimate absent data. The GWR model can define a feature class containing all the explanatory variables even for locations where the dependent variable is unknown. The model calibrates the regression equation using known dependent variable values from the input feature classes, then creates a new output feature class with dependent variable estimates (Brunsdon, Fotheringham and Charlton, 1996, 2002).

3.2.4. Kriging geospatial prediction

The results of the spatial analysis of market processes, which may have a certain intensity in space, are crucial information to understand the conditions of local real estate markets. They can be represented in a cartographic form presenting, among other things, market activity expressed as a number of transactions.

Kriging is part of a family of interpolation methods consisting of geostatistical methods based on statistical models that include autocorrelation, that is, the statistical relationships between measured points. For this reason, Kriging not only has the ability to produce a prediction surface, but also provides some measure of the certainty or accuracy of the predictions. Kriging assumes that the distance or direction between the sample points reflects a spatial correlation that can be used to explain variations in the surface.

Kriging uses a mathematical function for a specified number of points, or all points within a specified radius, to determine the output value for each location. Kriging is most appropriate when you know there is a spatially correlated distance or directional bias in the data.

Kriging weighs the surrounding measured values to derive a prediction for an unmeasured location. The general formula for both interpolators is formed as a weighted sum of the data:

$$\hat{Z}(s_0) = \sum_{i=1}^{N} \lambda_i Z(s_i) \tag{9}$$

Where $Z(s_i)$ is the measured value at the i location, λ_i is an unknown weight for the measured value at the i location, s_0 is the prediction location and N is the number of measured values.

However, with the Kriging method, the weight λ_i is based not only on the distance between the measured points and the prediction location but also on the overall spatial arrangement of the measured points. Thus, in ordinary kriging, the weight λ_i depends on a fitted model to the measured points, the distance to the prediction location, and the spatial relationships among the measured values around the prediction location (correlation). By means of GIS tools the Kriging results may be used to create maps of prediction surface and map of accuracy of the predictions(Burrough, 1986; Oliver and Webster, 1990).

Called Z(x) the locally estimation of the n_s sampled data points. The covariance of matrix of Z(x) is given by Eqn. (10).

$$Cov\left[Z(x^i), Z(x^j)\right] = \sigma^2 R\left[R(x^i, x^j)\right] \quad (10)$$

Where R is the correlation matrix, and $R(x^i, x^j)$ is the correlation function between any two of the n_s sampled data points x^i and x^j. R is a (n_s x n_s) symmetric matrix with ones along the diagonal. The correlation function $R(x^i, x^j)$ is specified by the user. In this work, a Gaussian correlation function was employed, of the form:

$$R\left(x^i, x^j\right) = exp\left[-\sum_{k=1}^{n_{dv}} \theta_k \left|x_k^i - x_k^j\right|^2\right] \quad (11)$$

where n_{dv} is the number of design variables, θ_k are the unknown correlation parameters used to fit the model, and the x_k^i and x_k^i are the k^{th} components of sample points x^i and x^j. In some cases using a single correlation parameter gives sufficiently good results (Simpson *et al.*, 2001).

4. The 20th century residential building stock in Turin: Data and sampling

The city of Turin is assumed as study area for this work, Turin is the capital of the Piedmont region, in the north-west of Italy: being the first capital of Italy, it is an important historical city, with many buildings dating back before 1918; the urban morphology maintains a clear track of the historical development and transformations. In 2020, Turin extension is equal to 130,01 km²; the city has 867.620,00 inhabitants (data update 30-6-2020) and a density of 6. 673,49 ab./km².

Turin belongs to the circuits of UNESCO sites: "Savoy Residences" (1997), "Ivrea Industrial City of the 20th Century" (2018), "Sacro Monte di Belmonte" (2003), "Palafitte del Lago di Viverone" (2011) The city was also nominated among the UNESCO Creative Cities as Creative City for Design (2014) and has a protected naturalistic area, the "Biosphere Reserve: MAB Collina Po" (2016).

Thanks to its important industrial past, especially linked to automotive industry, Turin owes various and prestigious buildings, built during the second half of the 20th century, attributable to architects influenced from the Modern Movement and subsequent architectural currents. Turin represents a remarkable case study for both the availability of open data and the real estate market situation that, being in stagnation / decline, needs new strategies and changes of vision in order to restart.

The following paragraphs will present some preliminary analyses conducted on the city of Turin in order to better understand the structure of the real estate market, its trend over time and the relation with the different waves of population, and the peculiar characteristics of the residential heritage of the second half of the 20th century, following the process chart shown in Figure 4.1.

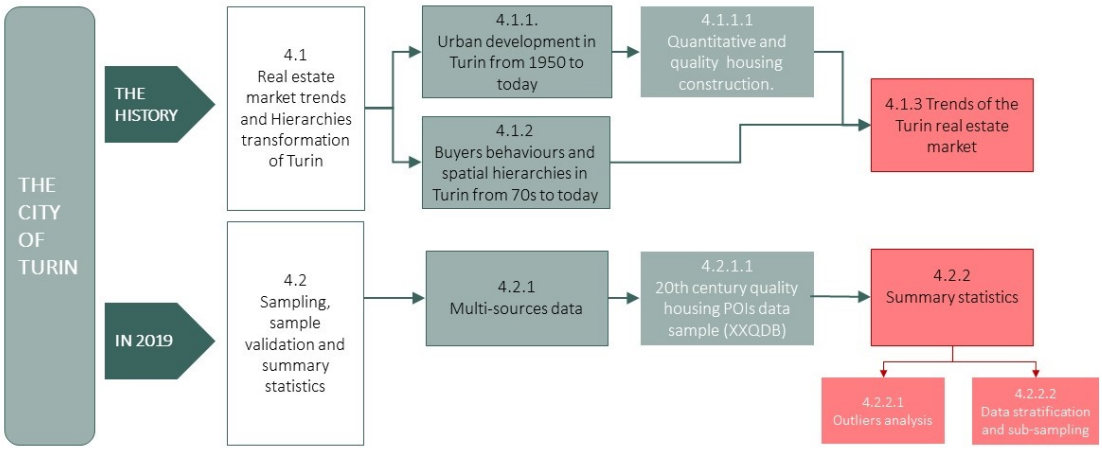
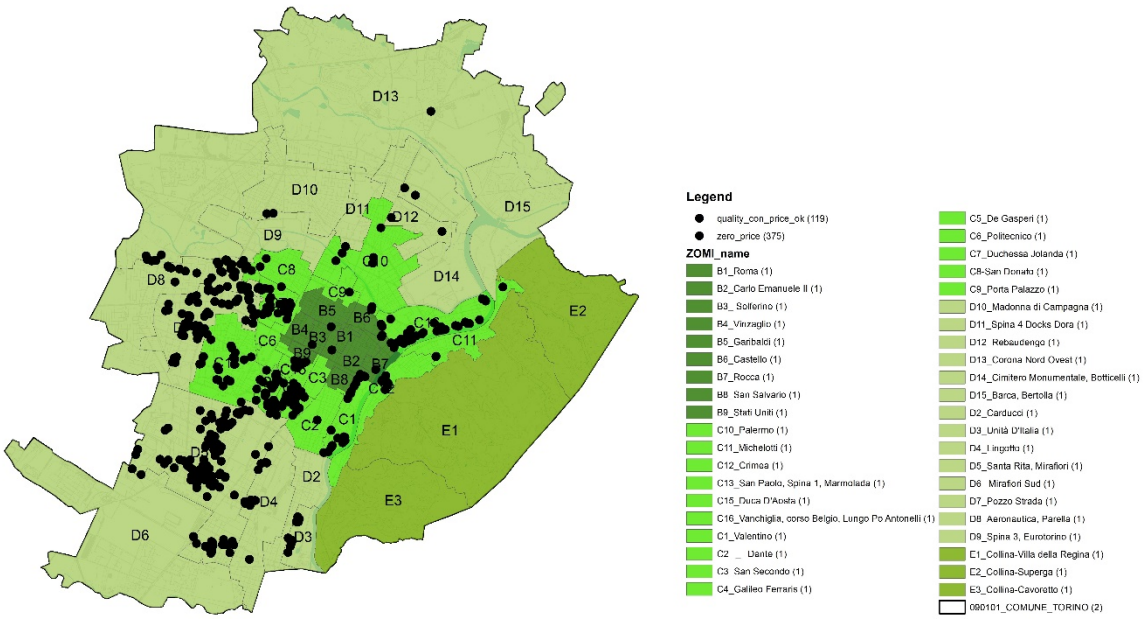


Figure 4.1. Chapter 4 Analysis methodological approach chart to present the Turin real estate market and the Data sample (Source: Author's elaboration).

4.1. Real estate market trends and hierarchies transformation of Turin

In the map of Figure 4.2 the XXQDB[29] is represented overlapped on OMI Zones[30] that divide the city territory in homogeneous areas and independent sub-markets of the real estate market.



[29] See Chapter 4.2 for data sampling

[30] See Chapter 2.4.2.1

Figure 4.2: Turin map with the 41 OMI Zones. (Source: Author processing)

4.1.1. Urban development in Turin from 1950 to today

Turin real estate market underwent numerous transformations over the decades; some relevant milestones that profoundly modified the asset of the city are reported below:

- 1861 - 1865: from the national Italian foundation (1861) to the year of the transfer of the capital of Italy to Florence, and the foundation of the first industries (1865);
- 1898 – 1918: "electric revolution" and birth of a solid automotive industry, in which FIAT began to predominate;
- 1918 - 1945: Turin between the two World Wars;
- 1945 - 1960: the hegemony of FIAT was consolidated, the population doubled, Turin assumed a metropolitan dimension and the municipal boundaries became more fleeting;
- 1961: events for the centenary of the Italian foundation "Italy '61", which attracted funding and big interventions of the major exponents of the Modern Movement;
- 1973 – 1980: oil market crisis, primary economic sector crisis during the 70s in coincidence with the "technological revolution". Advent of robotic and automated processes in production and subsequent closure of many industrial departments;
- 1995: adoption of the General Regulatory Urban Plan;
- 2006: Winter Olympics Games.

As most of the Italian big cities, in Turin the numbers of citizens and the city itself radically changed between, before and after World War II: Figure 4.3 shows four principal time periods.

1) From 1861, Turin constantly grew, knowing a light stop only during the first and second Word War;
2) Thanks to the success of large and small production companies (e.g., FIAT) in the early post-War period, a wave of worker immigration between 1946 and 1971 changed the connotation of the city, with a high demand for low-cost housing.
3) The 70s marked the start of decrease. The first automated systems were introduced between 1977 and 1978 in Mirafiori, Rivalta and Cassino FIAT plants and the use of flexible automation robots was experimented, with measures destined to have decisive repercussions in few years. The fall in employment of the large industry was accompanied

by the fall of the entire industrial sector. Between 1971 and 1996, the number of workers employed in manufacturing activities in Turin province decreased, in absolute number, from 476,300 to 281,400, with a fall of over 40 percent; on the other hand, building and construction workers increased from 33,500 to 50,000, while the service sector jumped from 218,000 to 310,000.

4) From 2001, twenty years of stasis began.

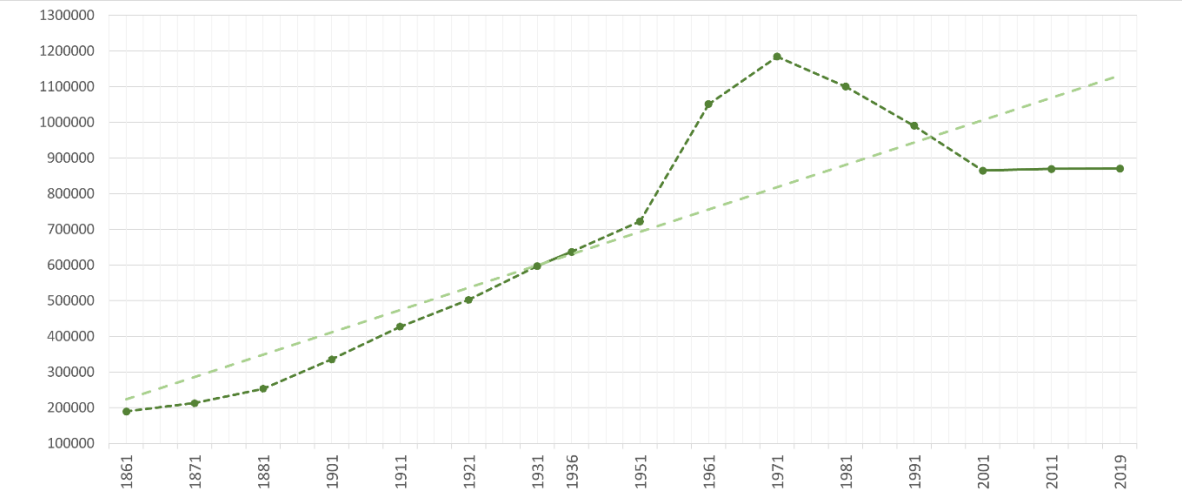


Figure 4.3: Citizens number trend from 1861 to 2019. (Source: Author processing on Census Data ISTAT)

The phenomena of quantitative construction characterize the development of Turin as occurs in many other Italian and European cities. On the one hand, in Turin, important low-cost building districts are built on the outskirts of the city, consisting of simple modules and simple systems that are easy to replicate and using low-quality materials. On the other hand, there is access to ownership by social strata, including workers and the middle and emerging classes, who are located in the more prestigious areas adjacent to the centre, or in the new neighbourhoods, characterized by a high level of building and social homogeneity at the same time.

4.1.1.1. Quantitative and quality housing construction.

The building development of the second half of 20th century represents, on the territorial and building level, the distribution of income determined by the development of the industrial city. This is not only perceptible in the neighbourhoods where the presence of workers is prevalent, such as Falchera, Valette and Mirafiori, but also in the peripheral and semi-central areas, where the middle social strata and those linked to free professions are concentrated

almost the same subjects are called to design units high quality housing for the emerging middle and upper classes (Curto, 1988). The social and economic structure of the population is well represented by the neighbourhoods that developed between 1950 and 1961, Pozzo Strada, Mirafiori, in the neighbourhoods of Santa Rita, San Paolo and Madonna di Campagna-Borgo Vittoria (Figure 4.3).These districts were located nearby the most important industrial complexes, and were connoted by extensive flat land parcels not yet built (Castronovo, Gabetti and Isola, 1995). In that period, the new middle class was starting to occupy the historical centre of the city, activating reconstruction and refurbishment processes, and to occupy some parts of the new expansion of the city, closer to the city-centre than the workers' blocks, but in newly planned areas).

This phase of urban development is well documented by Morbelli and Falco (Morbelli and Falco, 1976), who mapped the development of the building sector in Turin from 1961 to 1975.

In the map of Figure 4.4 residential buildings are different coloured according to their period of construction. Construction periods are divided in the classes: before 1946, 1947-1951, 1952-1956, 1957-1961, 1962-1966, 1967-1971, 1972-1974. 1974 is also year of the cartographic base. Symbols are referred only to the plan part of the city, while the hill side is excluded from this analysis. In the map are also reported principal production and services buildings.

Even if this map is partial (both from a temporal and a spatial point of view) it constitutes a very important base of study for years, and one of the first example of "manually edited" historical choropleth map for the city of Turin.

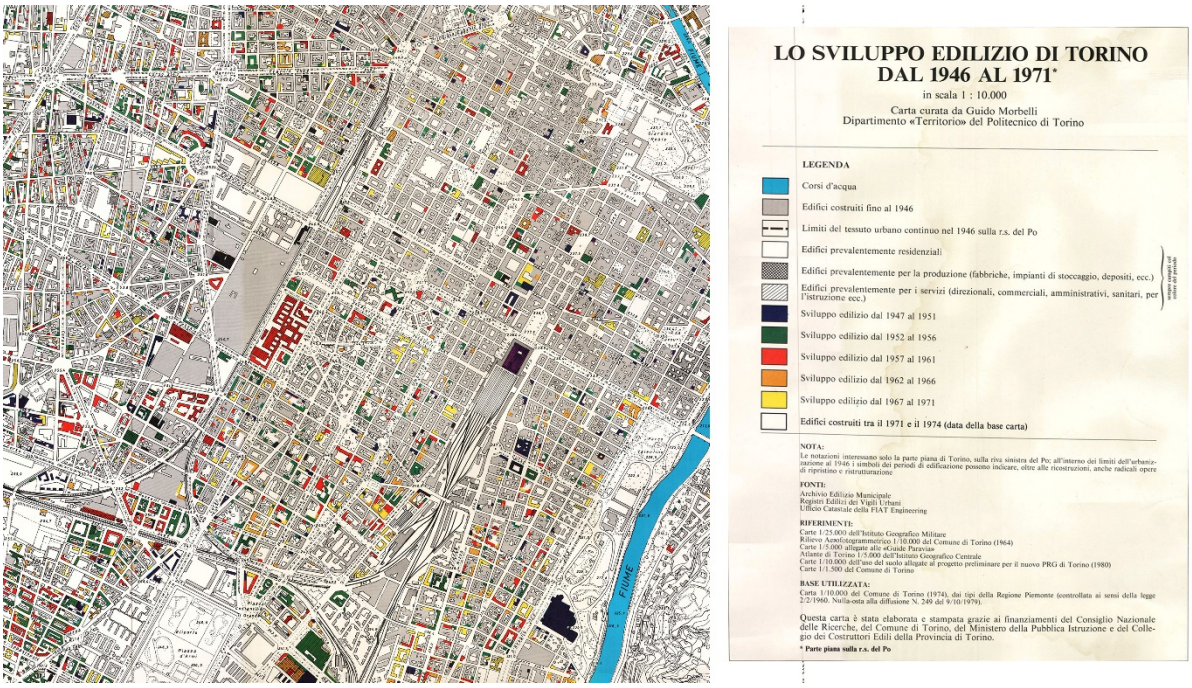


Figure 4.4: Extract of the Map "Lo sviluppo Edilizio di Torino dal 1946 al 1971", Guido Morbelli (Source: Lo sviluppo Edilizio di Torino dal 1946 al 1971, Guido Morbelli, a cura di, Dipartimento Territorio del Politecnico di Torino. Carta elaborata e stampata grazie al Consiglio Nazionale delle Ricerche, Ministero Pubblica Istruzione e del Collegio Costruttori Edili della Provincia di Torino, Scala 1:10000).

From the 1960s, some texts concerning the history of the residential architecture in Turin appeared, together with the analyses of the activity of some architects and companies that were important players in the city market in expansion. For example, attention was paid to professionals such as G. Becker, G. Casalegno, G. Raineri, F. Dolza, S. Jaretti and E. Luzi and on companies such as that of the Rosso brothers or the Manolino family (see Table 4.1).

The intent was not only to study their specific works and lines of research, but also to reconstruct a more complete and richer image of the professional context of the time, through the study of a professionalism, less investigated by historiography, but that for the quality and quantity of interventions was fundamental for the construction of the city (Carapellucci, 2019).

Table 4.1: Principal monographs of the architects active in Turin between 1946 and 1990.

Year of publication	Reference	Summary
1973	L. G. Marini, Gualtiero Casalegno architetto, Ed. EDA e SERCA, Torino, 1973	Casalegno's works, more or less known, in the field of residential, school and industrial construction. Sort of catalog, preceded by the preface by GL Marini in which architect Casalegno is presented as a professional with thirty years of experience, particularly careful towards reality and research in the field of residential construction.
1982	A. Magnaghi, M. Monge, L. Re, Guida all'architettura moderna di Torino,	This publication can be considered a turning point, because the authors' attention was focused on the relationship between architecture and the construction of the city. It is a sort of census of Turin professionalism.

	Designers Riuniti, Torino, 1982	
1989	Regis, D, Gino. Becker Architetto, Architettura e cultura a Torino negli anni 50. Gatto Editore, Torino.	The figure of the arch. Becker was presented through his most significant works, integrated in an analysis of the cultural, philosophical and architectural context of the 50s and 70s. D. Regis investigates the figures of some "technical-intellectuals" such as Mollino, Montalcini, Passanti, Romano and Raineri, until then "censored by the masters of modern international architectural culture". Their design thinking and build quality are considered worthy of attention as much as the best known authors.
1993	D. Bagliani, Domenico Morelli ingegnere architetto, Ordine degli Arch. della Provincia di To., Torino, 1993	Collection of essays that presents the reflections that emerged during a conference held by Morelli in 1990 and one of his exhibitions in 1991. The figure of the Morelli is presented through the points of view of numerous authors whose essays are gathered in four topics. For example, R. Gabetti and C. Olmo help to trace the Turin cultural and architectural context in which the architect carried out his activity, S. Hutter and G. Morbelli describe Morelli professional figure through their personal point of view as collaborators, E. Levi Montalcini and E. Garda deal with the theme of his theoretical and compositional research and finally L. Barello and PM Sudano describe his main works.
1995	V. Castronovo, R. Gabetti, A. Isola, L'Impresa Rosso. Note sul settore edilizio a Torino negli ultimi cinquant'anni, Pluriverso, Torino, 1995	Rosso company was active since 1946 in the construction and real estate sector. The volume contains contributions by V. Castronovo, R. Gabetti and A. Isola, and other authors. Also in this case, the description of the history of the company and the buildings built is preceded by an "introductory" part. A reconstruction of the industrial and urban evolution of Turin from the Second World War II to the 1990s is presented, as well as a picture of construction entrepreneurship and its evolution.
1997	L. Barello, A. Luzi, Le case Manolino, il Tipografo, Asti, 1997	History of the Manolino Company, its achievements and the collaboration with the architects S. Jaretti and E. Luzi. Before the presentation of the buildings, contributions by L. Barello, R. Gabetti, E. Luzi and G. Manolino present the protagonists of the story and reconstruct their history through their different points of view.
2001	C. Bordogna Neirotti, Carlo Alberto Bordogna 65 anni di architettura, Allemandi, Torino, 2001	Resume of the architect's sixty-five years of professional activity. A. De Magistris and P. M. Sudano present the figure of Bordogna, reconstructing the historical and professional context of Turin within which he trained and practiced the profession.
2002	L. Gibello, P. M. Sudano, Francesco Dolza: l'architetto e l'impresa, Celid, Torino, 2002	Architect Dolza is presented here in his dual role of professional and entrepreneur, as heir to a family of builders whose company was active from 1946 to 2002. His professional activity is framed within the architectural historiography and "of the common feeling of an era" by placing him alongside Gabetti and Isola, Mollino and Raineri.

4.1.2. Buyers behaviours and spatial hierarchies in Turin from 70s to today

Turin presents the social articulation of industrial cities characterized not only by the presence of the working class but also by the middle classes (such as employees, traders, teachers, professionals, etc.) which grow to respond to the needs of services determined by the urbanization of the population which is used in industry (Caramellino, De Pieri and Renzoni, 2015). In the case of Turin, the location of Fiat in Mirafiori has determined the development of the district (Mirafiori), with the presence not only of the working classes employed in that industry. In Santa Rita, San Paolo and Pozzo Strada there are the highest concentrations of the

intermediate classes. In Madonna di Campagna-Borgo Vittoria there are predominantly workers. On the extension of the great historical courses (Corso Massimo d'Azeglio, Corso Re Umberto, Corso Galileo Ferraris, Matteotti, etc.) and in the hills, simplifying, the strongest social and economic strata prevail. In particular, the Crocetta was considered the district of the city particularly representative of the social status of the consolidated or newly formed Turin bourgeoisie (R. Curto) (Figure 4.6).

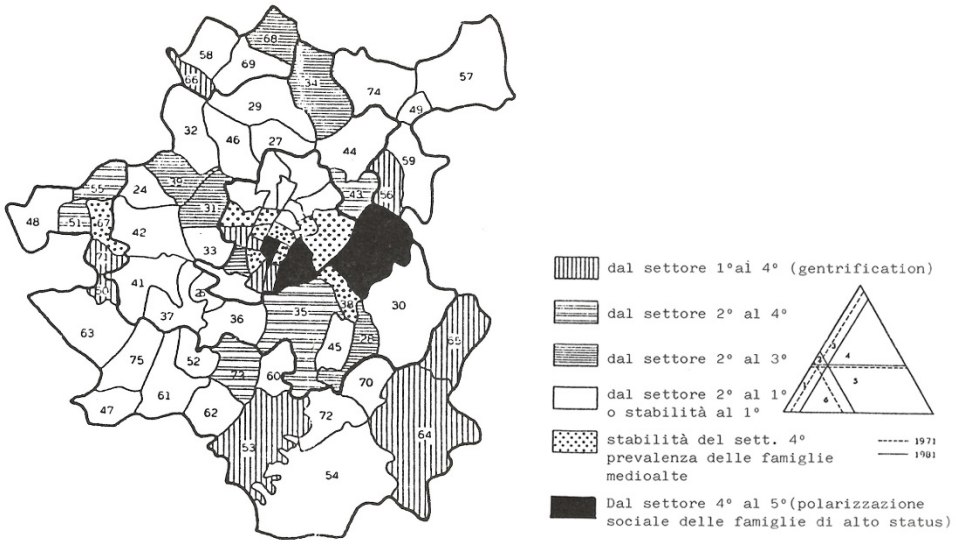
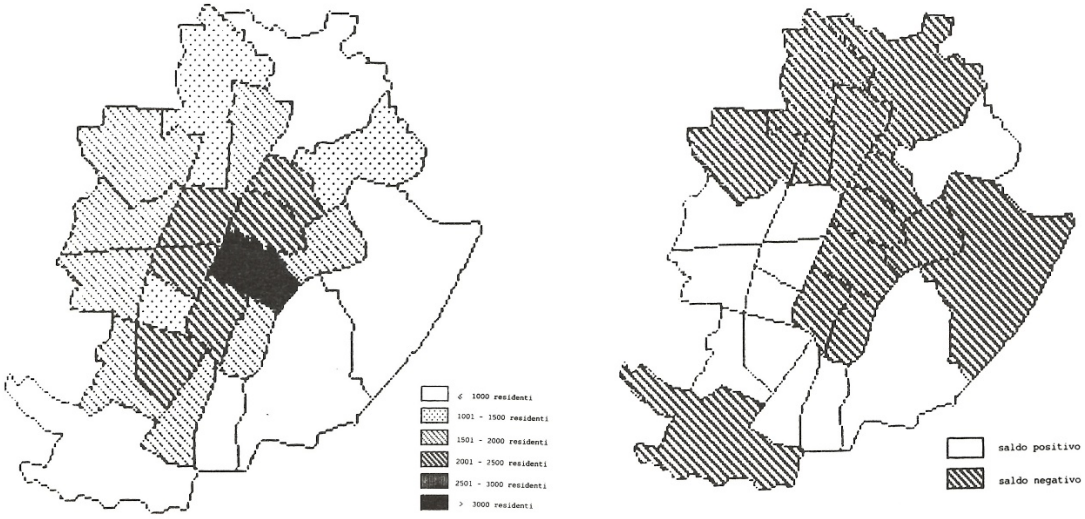


Figure 4.5: evolution of the social structure of the metropolitan area of Turin 1971-1981, (Source maps in Curto, R.A (a cura di), 1988, La casa scambiata, Stige editore, Torino).

In the second half of the 1900s, the central areas of the city, characterized today by the highest prices, were abandoned by the middle and medium-high classes who moved to the areas of new expansion following the affirmation of "better a new housing than a beautiful one".

After the economic crisis and the real estate market triggered in 1975 by the increase in the price of oil, in a progressive way and starting from the 1980s, the central areas will became attractive and the existing relationship in terms of real estate values between peripheral areas and central, in favour of the latter, grew thanks also to the prevalence of the model of the period house, whose historical and architectural characteristics were appreciated (Curto, 1988; Curto, 1992) (Figure 4.6). This social division of the space of the Turin area, which is still partially visible, is fundamental to understand the relationship between the real estate market and the development of cities, considering contemporary companies (Veblen, 2017). During the quantitative growth, the builders have intercepted all the brackets of demand solvency by creating buildings that present constructive and typological characteristics at the time perfectly

represented by the cadastral categories that have a full correspondence with social classes. Building policies based on encouraging home ownership, thanks to the low cost of money, have therefore also made the workers strata of the population solvent (Curto, 1988).



(a) (b)

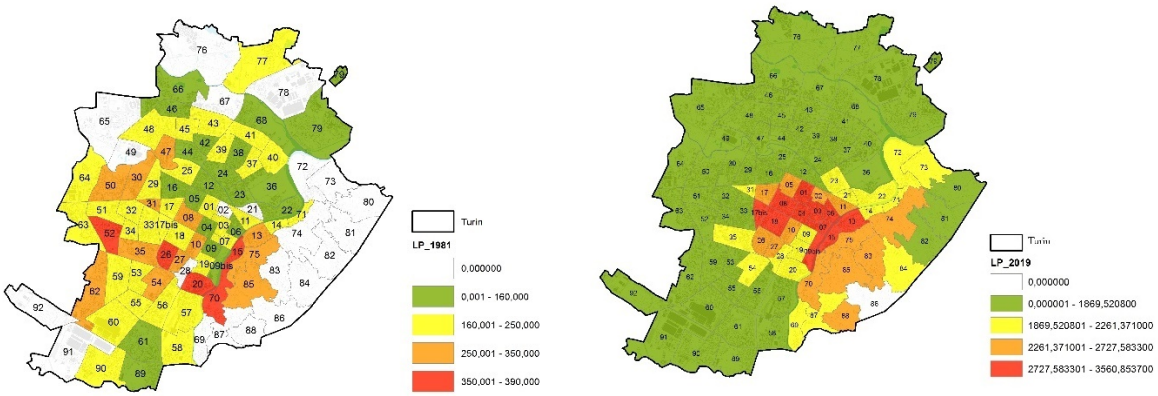
Figure 4.6: (a) Turin neighbourhoods according to the number of residents who left the neighbourhood and related to internal movements in 1984, (b) neighbourhoods according to the migration balance relating to internal movements of 1984 (Source: Curto, R.A (a cura di), 1988, La casa scambiata, Stige editore, Torino).

4.1.3. Trend of the Turin Real Estate Market

The trend of Turin real estate market is linked with that of the population. Generally, it tends to grow, but has shown by Figure 4.7, in 1965 and 1975 it underwent two important negative peaks. The second was due to the world oil crisis which damaged all the industries at the time, but in particular construction sector. The oil crisis results in a serious economic crisis, that has as a consequence the development of inflation and in turn the increase in the cost of money, which causes the contraction of the demand for housing on the real estate market due to the increase in interest rates (that exceed even 20%).

Figure 4.7: Unitary mean prices in the city of Turin from 1951 to 1999. (Source: Author processing of data from Curto, 1988 and Immobiliare.it data)

Some choropleth maps have been elaborated to spatially analyse the changes in the distribution of the real estate market in 1981 (on data from Curto, 1988) and in 2019 (on data from Immobiliare.it), with mean market prices for each Statistical Zone (SZ) [31](Figure 4.8).



(a) (b)

Figure 4.8: Choropleth map of listing prices (Euro/ m²) and concentration of buildings at the time. Map a) 1981 -Real estate listing prices (Source: Author processing on data from Curto,1988) b) 2019 - Real estate listing prices (Source: Author processing)

Comparison of the mean price distributions in 1981 and 2019 show that in 1981 prices were less clustered across the various Statistical Zones; some of the zones with the highest

[31] The 94 Statistical Zones of Turin are administrative census boundaries used at national level to sub-segment urban areas. For the city of Turin see http://www.comune.torino.it/statistica/osservatorio/annuario/2016/index.htm

values (> 380,00 Euro/m^2 – original value was in Italian Lire), today have low prices compared to the city listings mean (2.211,00 Euro/m^2). According to Figure 4.8, Map b), in 2019 three main clustered areas can be identified: 1) the historic centre of the city and the hill, with the highest real estate values (> 3.300,00 Euro/m^2); 2) the south and south-west areas of the city, with medium prices; 3) the northern area of the city with the lowest prices (< 1.500,00 Euro/m^2).

Figure 4.9 below reports the trend of the NTN[32] that permits to evaluate the dynamism of the Turin real estate market. The number of normalized transactions follows the price trend; the graph shows how the periods of crisis have negatively influenced the real estate market, causing not only a decrease in the average market price, but also influencing the number of transactions and therefore liquidity.

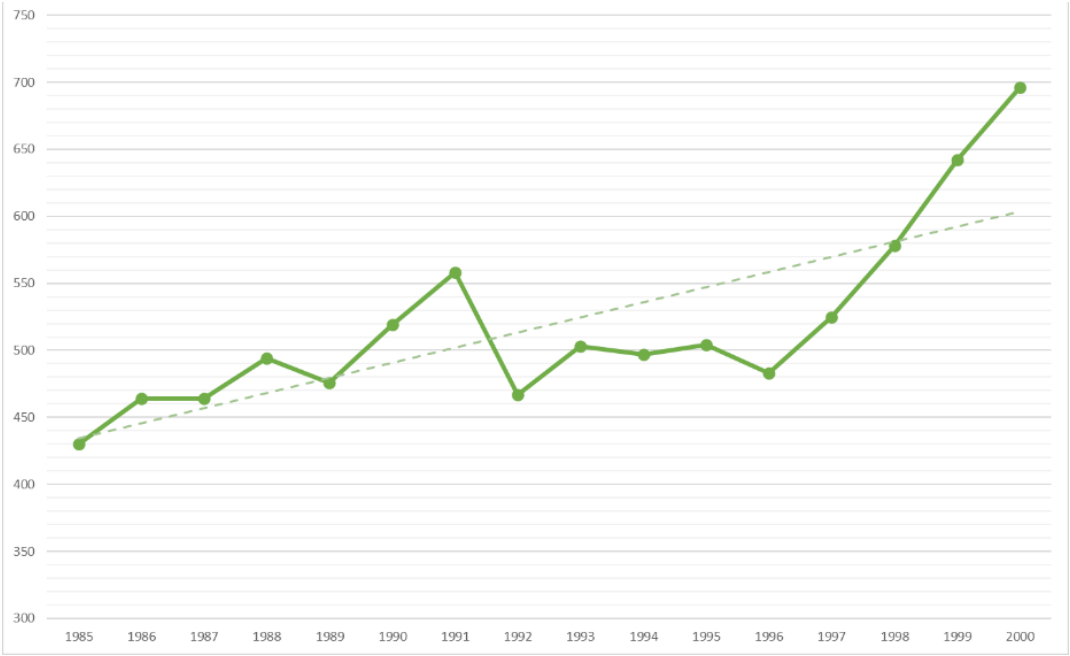


Figure 4.9: Trend of NTNs from 1985 to 2000. (Source: Author processing on OMI-Agenzia delle Entrate data)

4.2. Sampling, sample validation and summary statistics

To analyse how and to what extent the architectural and construction characteristics of the building heritage of the second half of the 20th century are monetized by the real estate

[32] Normalized Transactions Number (NTN) is a market dynamics indicator; represents the number of transactions, normalized with respect to the share of property bought and sold, which took place in a given period of time; it is a data extracted from the Data Bank of the Real Estate Advertising and it periodically published by the Italian Agenzia delle Entrate and Nomisma.

market, a POIs data sample, to be managed in a geospatial database, was built. In the following sections, the database will be called XXQDB for brevity (as detailed in Paragraph 4.2.2).

The POIs data constituting the sample were mainly collected from the on-line open sources, and open-access database. The survey of the major existing open-access databases and of the cartography and historical monographs guided the construction of the spatial elaborations presented in the next Paragraphs.

4.2.1. Multi-sources data

The new database XXQDB, built on the basis of the knowledge management organizational process, included data from the following on-line open websites:

- Vincoli in Rete (http://vincoliinrete.beniculturali.it/);
- Web GIS of the City of Turin (http://geoportale.comune.torino.it/);
- Docomomo Italia (https://www.docomomoitalia.it/);
- MuseoTorino (http://www.museotorino.it/).
- Immobiliare.it (http://www.immobiliare.it)[33]
- Architetture Rivelate (AR OAT – https://www.oato.it/iniziative/premio-architetture-rivelate/)

User-generated databases were also considered, such as:

- Mimoa.eu (MIMOA - https://www.mimoa.eu/);
- Architectour.net (ARCHT – https://www.architectour.net/).

Visual direct survey:

- Direct survey collecting data for each building in relation to the information reported in Chapter 3.1.2

Vincoli in Rete (VIR): includes data on the presence on the national databases of buildings under Environmental, Historical or Cultural protection, with different level of restrictions for the intervention.

[33] Immobiliare.it is the principal real estate portal in Italy. It was launched in 2007 with the aim of offering the best platform for publishing and searching for real estate ads.

Geoportale of the City of Turin (GEOCT): the basic numerical cartography provides morphological and geometric information, also in relation to the main uses of the buildings in the city and the historical periodization of the buildings.

Docomomo Italia (DocomomoIT) and MuseoTorino (MT): provide practically complete information on the architecture of the city, already published in monographs and articles. The data is mostly referred on non-residential mainstream architectures or residential building stock, mostly built before 1945. Data are Open and can be downloaded and processed by means of Google Maps API (application programming interface). Immobiliare.it - database of 2019[34]: provides data related to the individual housing units and buildings and, above all, the market listing prices. The Street View application (on http://maps.google.com) was used to conduct virtual inspections of buildings and supply the relevant data on height, typology, category and, most importantly, construction and architectural quality.

The lack of interoperability between regulatory sources, partially already solved through the VIR platform, favours the fragmentation of information and often facilitates losses of data. Geographical information has now been added or used in almost all the mentioned databases, thus facilitating the interoperability and management of information from different sources.

Despite the rich collected patrimony of data and information, the data on second post-war residential period resulted scarce and fragmented; therefore, the research was conducted by authors' names, and especially by construction companies' names, analysing monographs.

Therefore, very complete information is present in the literature but is not yet put into a spatial network, allowing to analyse the interaction between the architectures built in time and space and the evolution of the real estate market considered from the point of view of behaviour and social structure of the population The impossibility to consult in a totally transparent way the information related to the architectures listed for their cultural value, even as far as it concerns MT platform (Figure 4.10), makes it still difficult to establish links with other sources of information, like e.g. the web-sites for tourism, the statistical information of the censuses (ISTAT), the several digital technical maps of the city (GEOCT) and last from information on the real estate market. As we will see, the fact that residential buildings of architectural quality are not surveyed as they should have a negative impact on market analyses as the number of data relating to assets that can be appreciated in terms of architectural quality is lower than

[34] The database was provided and can be used in this thesis work thanks to an agreement framework stipulated between the Politecnico di Torino and the company Immobiliare.it.

reality. This means that the number of data relating to the quality architectures that are sold is too small to be able to estimate with a high degree of reliability the marginal coefficients of architectural quality, which is particularly complex to classify, if one disregards the authorship. The classification and dissemination of data also inherent to this heritage, therefore, becomes central to the analysis of how architectural quality is appreciated by the market at the moment of knowledge.

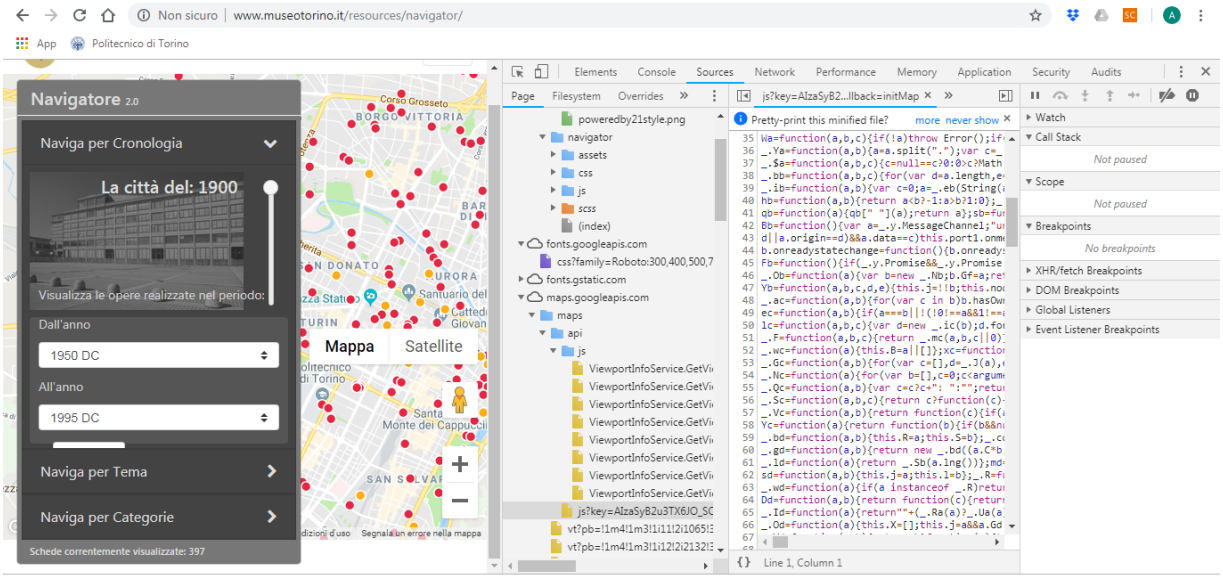


Figure 4.10: Example of export and processing of MuseoTorino (MT) data using the Google API tool. (Source http://www.museotorino.it)

To identify the extent to which architectural quality is appreciated by buyers, the analyst must possess the necessary tools to correctly recognize the characteristics of assets of the second half of the 20th century from an architectural point of view, to classify them and to measure how these are filtered and monetized by the market, also in relation to different economic and social contexts and/or their changing.

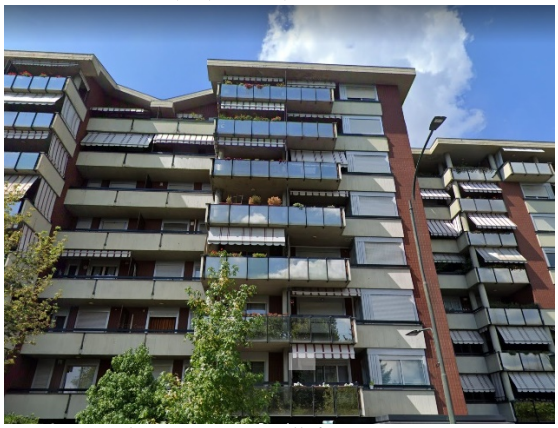
This research has therefore had to compensate for the fact that:

1. the contemporary residential heritage of architectural interest has not yet been systematically surveyed and therefore has not even been digitized;
2. The databases on real estate sales do not report any information on the architectural quality of the goods offered on the market, a sign that the architectural quality is not yet recognized as it should by most buyers.

To rise up for this last lack, a direct visual survey was conducted. The visual survey is used, as the first step, by those who need to identify deserving buildings by affixing the relative

constraints. Of course, after first generic cataloguing with visual analysis, it will be necessary to identify and analyse in-depth all published and archival sources, in order to refine the classification of the work.

The following figure (Figure 4.11) shows, for illustrative purposes, a list of photographic images both of architectures whose architectural quality is evident and recognized (on the right column) and of architectures whose high construction quality is recognizable but not associated with an equally high architectural quality, which should be safeguarded; these architectures are not present, for the research conducted so far, in the publications (on the left column).

Observed Architectonical Quality (ObeQ)	*Recognised Architectonical Quality (RecQ)*
 Corso Re Umberto, 26, Centro, Turin	 Casa dell'Obelisco, via Bicocca 1, Crimea, Torino
 Via Ventimiglia, 174, Nizza Millefonti, Turin	 Via G. B. Tiepolo, 1, Dante, Torino


Via Lamarmora, 75, Crocetta, Torino


Torre Mirafiori, C.so Unione Sovietica, 409, Mirafiori, Torino


Via Fattori, 12, Torino (Viberti Block), Pozzo Strada, Torino


Torri Pitagora, Corso Siracusa, 174, Mirafiori, Torino


Via Lamarmora,74, Crocetta, Torino


Corso Galileo Ferraris, 2, Centro, Torino


Corso Eunaudi, 9; Crocetta, Torino


Palazzina_Ajmone-Marsan, Corso R. Montevecchio, 35, Crocetta, Turin

Figure 4.11:. Examples of residential architectures of: (column on the left) observed architectural quality; (column on the right) recognised architectural quality. (Source: Author photographs, 2019-2020)

4.2.1.1. 20th century quality housing POIs data sample (XXQDB)

The datasets for this study included both housing POIs and heritage POIs (3705 data), which only matched in a few cases (116 observations). First, the property POI data were gathered from Immobiliare.it, the primary Italian portal of real estate advertisement. The housing heritage POI data were gathered using a POI extractor developed based on the Google Map JavaScript application programming interface (API) principally from the portal Museo Torino. Other observations were manually added and georeferenced by building addresses. The distribution of the property POIs included a total amount of 10,716 housing ads for the year 2019 of which 6,441 in buildings built in the second half of the twentieth century. While the 20th century housing heritage POIs include a total amount of 868 observations of high quality residential architecture built during the 20th century, of which 562 data (QDB sample) were built in the second half of the 20th century. Due to the specific objective of this research the complete database was sub-segmented both by construction period and by building typology and spatially joined as explained in the following paragraphs.

Finally, property and heritage characteristics were further classified into structural, locational, and environmental variables to explore their impact on housing prices. (da Exploring Determinants of Housing Prices in Beijing: An Enhanced Hedonic Regression with Open Access POI Data)

The complete database called "20th century housing database" (XXQDB) is composed of 3705 records whose attributes, belong to different sources. The collection, homogenization and joining of the main variables identified in the various databases (see previous Paragraph 4.21) followed the sequential steps shown in (Figure 4.12).

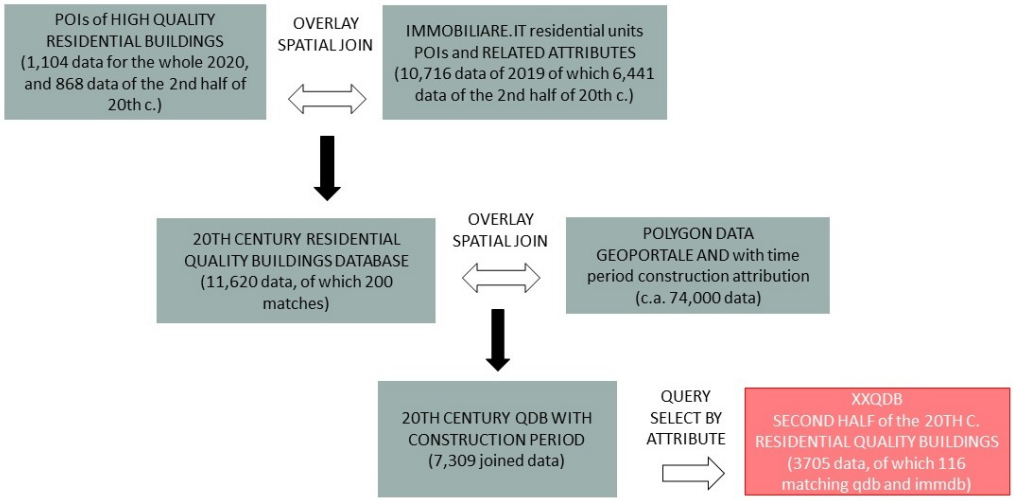


Figure 4.12. Phases for the construction of XXQDB database (Source: Author processing)

The link between the attributes was established through two well-known procedures: 1) a non-spatial procedure, based on the query between attributes performed through Access software, using a common field of two databases; 2) a spatial procedure, applied thanks to ArcGIS software Overlay tools, and in particular using the spatial join. The spatial join connects database and geo-referenced data as shown in Figure 4.13, especially for records that have no variables in common, but that share the position. This procedure implies a margin of error, due both to the different geographical reference systems of the various elements and to errors in the attribution of the coordinates.

The overlay (Spatial join) tool allows to spatially join vectorial points, polygons or lines belonging to different shapes, also combining their attributes. It is possible to select the type of join as shown in Figure 4.13, the type chosen for the present analyses is "intersect" with a radius of 10 m to ensure a correspondence of almost 95% of the data.

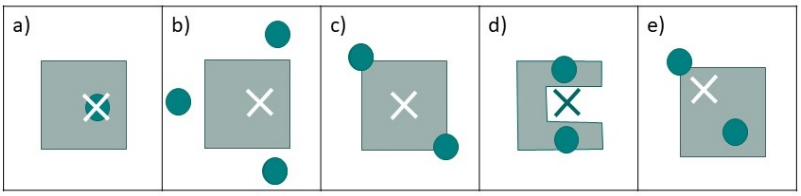


Figure 4.13: Overlay - Spatial Join match option. a) have their centre in, b) within a distance, c) boundary touches, d) contains, e) intersect (Source: Author processing on ArcGIS tools manual)

The union of data informative contents, often not in contrast, took place keeping the record with attributes as complete as possible. In case of lack of congruence, the data was promptly verified or

deleted. Table 4.2 reports the variables collected from the various sources and clarifies the progressive process of harmonization and merging that conducted to the final XXQDB variables (last column).

Table 4.2: Attributes joining and linking: multi source database (Source: Author processing)

TURIN GEOPORTAL	*MT API*	*SIGEC-WEB*	*IMMOBILIARE.IT*	*XXQDB*
			Idad	Idad
Fid	Id	Code		XXID
Name		Name		Name
Title	Title			Title
Subtype	Building Type	Building Type		Building Type
		Locality	Locality	Locality
	Address	Address	Address	Address
		Region	Region	Region
		Province	Province	Province
		City	City	City
			Postcode	Postcode
	Latitude		Latitude	Latitude
	Longitude		Longitude	Longitude
	Latitude, Longitude			Latitude, Longitude
	Year of Construction			Year of Construction
	Year of First Transformation			Year of First Transformation
	Year of Second Transformation			Year of Second Transformation
Time Construction Period (10 Years)	Construction Time Period			Construction Time Period
	Authors' Name			Authors' Name
	Building Company Name			Building Company Name
	Protection	Protection		Protection
	Cultural/Historical Interest			Cultural/Historical Interest
	Publication			Publication
		Competent Body		Competent Body
		Filing Body		Filing Body
	Number of Buildings of The Same Complex			Number of Buildings of The Same Complex
	Building Category		Building Category	Building Category
	Other Databases ref.	Other Databases		Other Databases ref.
		Catalogue Code		Catalogue Code
		Sigec Keycode		Sigec Keycode
		Id Listed Heritage		Id Listed Heritage
		Id Risk Cartography		Id Risk Cartography
Id				Id
Census Code				Census Code
Gross Area				Gross Area
Typology				Typology
Use	Use			Use
Completion Level				Completion Level
Listed Heritage	Listed Heritage			Listed Heritage
	Description			Description
			Elevator	Elevator
			Building floors	Building floors
			Allocation Floor	Allocation Floor
			Floor Area	Floor Area
			Price	Price
			Price/mq (LP)	Price/mq (LP)

TURIN GEOPORTAL MT API	*SIGEC-WEB*	*IMMOBILIARE.IT*	*XXQDB*
		Rooms	Rooms
		Bathrooms	Bathrooms
		Car Box	Car Box
		Parking space	Parking Space
		Kitchen Type	Kitchen Type
		Level of maintenance	Level of maintenance
		Terrace	Terrace
		Balcony	Balcony
		Furnished	Furnished
		Garden	Garden
		Garden Type	Garden Type
		Air Conditioning	Air Conditioning
		Heating Type	Heating Type
		EPC Labels	EPC Labels
		Renewable Energy	Renewable Energy
		Winter Energy	Winter Energy
		Summer Energy	Summer Energy
		Free Unit	Free Unit
		Visits	Visits
		Leads - Favorites	Leads - Favorites
		Entity	Entity
		Area	Area
		Spine	Spine
		OMI Zone Name	OMI Zone Name
		OMI Zone Id	OMI Zone Id
RecQ	RecQ		RecQ
Façade Elements	Façade Elements	Façade Elements	Façade Elements
Façade Materials	Façade Materials	Façade Materials	Façade Materials
Geometry	Geometry	Geometry	Geometry
			ObeQ

The total linked database XXQDB was made up of 10,654 data; a filter was applied to select only the data related to the present research. The following data were excluded:

- records related to non-residential buildings;
- records related to constructions belonging to the first half of the 20th century and after 2000;
- records related to buildings block,
- records related to buildings with no indication of time construction period;
- records related to data without correctly geo-referenced coordinates;
- records related to data without indication of the building category;
- units with private garden.

After this cleaning sample procedure, the sample of data referred to the residential buildings of the second half of the 20th century resulted 8,885 of which 466 records related to quality buildings were no priced.

Finally, a further cleaning procedure must be applied because regression models and in particular GWR models work well only if all record of the sample data has entirely attributes filled in. The Final XXQDB is formed by 3705 data, of which 156 quality buildings matched with ads and 446 quality buildings are no priced. In the subsequent analyses both the whole XXQDB (3705 data) and its totally priced sub-sample XXQDBS (3259 data) were used in the elaborations.

The XXQDB sample is spatially distributed as reported in Figure 4.14; this choropleth map represents the late 20th century housing buildings (1946-1999) distribution, overlapped on the total building stock of the 20th century in Turin.

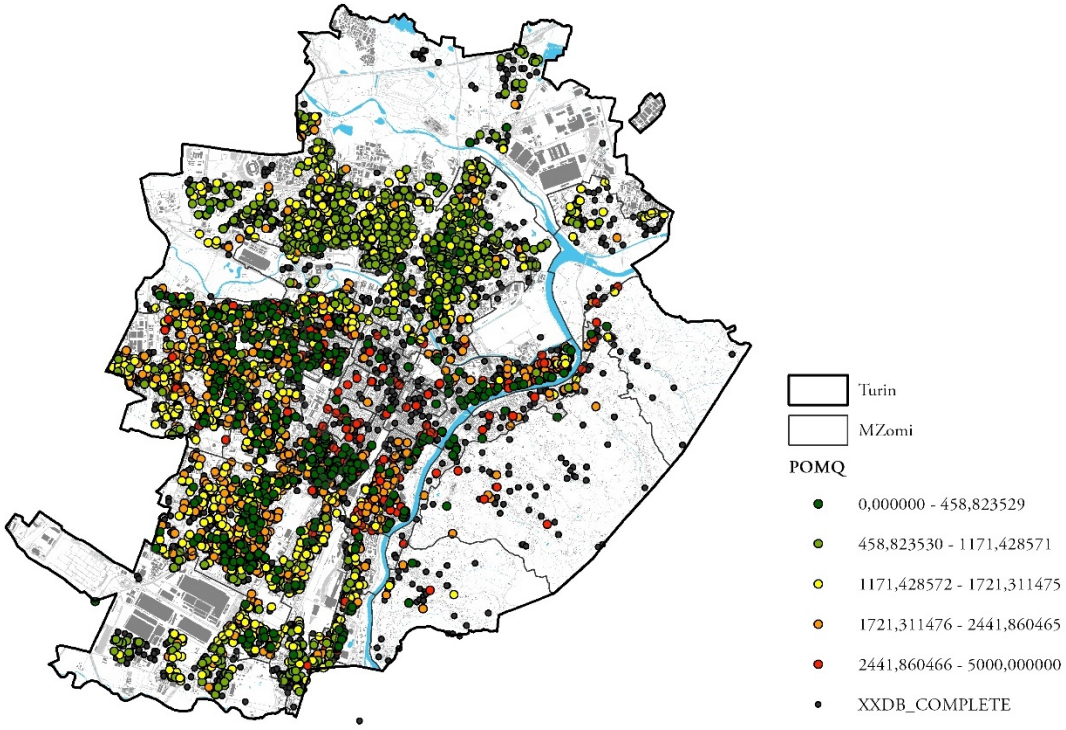


Figure 4.14: Choropleth map of the whole XXQDB whole 20th century housing stock in Turin. (Source: Author processing)

Figure 4.14 leads to observe that the 20th century residential buildings do not follow a clustered distribution and, starting from the city centre, are located along main roadway axes. The first historical axes of development are directed from the city-centre to the South (along via Nizza and corso Unione Sovietica), westward along corso Francia, northward along corso Giulio Cesare and eastward around corso Giovanni Lanza.

Clearly, the most historic part of the city, the city centre, shows a lower presence of post-war buildings, also due to the lack of free areas. The buildings built in the central areas have

almost always been built by reconstructing buildings destroyed by bombing. The historic centre, however, hosts the best known contemporary architecture, as well as the most representative ancient buildings.

4.2.2. Summary statistics

Frome the whole data sample descripted above were extracted two subsets to apply the regression models. Therefore, analyses were carried on a whole data-sample (3705 data) and its sub-set (2359 data).

The first one is composed by 3259 data with listing prices (LP), of which 116 are referred to quality buildings. It was necessary to delete all observations that did not have complete compiled attributes. This is a fundamental requirement for the functioning of the predictive capacity of the GWR regression models, so that the first sample was reduced from 8875 data of the whole data sample of listings of the year 2019 to 3259 data. By joining the Immobiliare.it data sample with the Quality building data sample only 116 data matches. Those are the only observation with both description of quality features and a listing price.

The second data sample was composed by the 3259 data above mentioned with the addition of 446 quality buildings with all the attributed described but without a listing price for the 2019. This sample is composed by 3705 data of which 562 data are referred to quality buildings. In the following paragraphs it will be explained how the zero prices of this second sample will be statistically estimated in order to carry on the spatial regression analyses.

In the following Table 4.3 some descriptive statistics of the 3259 data sample were presented. From the 22 variables of the data sample only 12 were selected to carry on the analyses and 7 were finally used in the regression models. Statistics report the dependent variables (Listing prices, Leads and related variables) and the 12 candidate explanatory variables (building and unit features) among which the indicators of recognised and observed Quality (RecQ and ObeQ).

Table 4.3: Descriptive statistics on 3705 data XXQDB (Source: Author processing)

		Data type	Freq. (no zero)	Min	Media	Max	Dev.st
Dependent variables							
TLP	Total Listing Price	Euro	3259.000	0.000	121636.975	1190000.000	116999.093
GS	Gross surface	Mq	3705.000	28.000	89.604	800.000	41.946
LP	Unitary Listing Price	Euro/mq	3259.000	0.000	1328.927	5000.000	757.480
LogLP	Log listing price (estimates)	Log e	3705.000	5.298	7.276	8.517	0.405
Visits	Number of visits of an ADS	Numeric	3259.000	0.000	2026.866	32751.000	2900.019
Leads	Number of Preference of an ADS	Numeric	3259.000	0.000	2.921	84.000	5.311
Independent variables							
Building features:							
BLDTYP	Building Type (Levels: 2 = condominium, 1 = other)	dummy	3705.000	1.000	0.259	2.000	1.042
BLDCAT	Building category (Levels: 0 = NA, 1 = tenement or Economic, 2 = Medium, 3 = Noble, 4 = Prestigious)	dummy	3705.000	1.000	2.273	4.000	0.646
CNSTM	Construction time period (Levels: 0 = NA, 1 = 1946 -1960, 2 = 1961 - 1970, 3 = 1971 – 1980; 4=1981-1990; 5=1991-2000)	dummy	3705.000	1.000	2.050	5.000	0.977
CBX	Car Box (Levels: 0 = no; 1 = yes)	dummy	445.000	0.000	0.060	1.000	0.238
LFT	Lift (Levels, 0=no; 1=yes)	dummy	6249.000	0.000	0.763	1.000	0.425
Housing unit features:							
NRM	Number of rooms	numeric	3705.000	1.000	3.170	8.000	1.096
NBT	Number of bathrooms	numeric	3705.000	1.000	1.271	4.000	0.483
ALL	Allocation Level (Levels: 0 = NA, 1 = lower, 2 = intermediate, 3 = higher)	dummy	3705.000	1.000	2.607	15.000	2.252
MTL	Maintenance Level (Levels: 0 = NA; 1 = to renovate; 2 = good; 3 = renovated)	dummy	3705.000	1.000	2.329	3.000	0.674
LTR	Large Terrace (Levels: 0 = no; 1 = yes)	dummy	3705.000	0.000	0.104	1.000	0.306
ARC	Air-conditioning system (Levels, 0=no; 1=yes)	dummy	3705.000	0.000	0.175	1.000	0.380
EPC	EPC label group (Levels: 0=NA, 1=E, F, G, 2 = C and D, 3= A - A4 and B)	dummy	3705.000	0.000	1.130	3.000	0.621
Quality features:							
RecQ	(Levels: 0 = no; 1 = yes)	dummy	107.000	0.000	0.029	1.000	0.167
ObeQ	(Levels: 0 = no; 1 = yes)	dummy	455.000	0.000	0.123	1.000	0.328

4.2.2.1. Outliers analysis

In order to verify the distribution of the data, an outliers analysis was carried out on the basis of some key variables. The analysis is twofold: firstly, the curve of the distribution of data is useful to verify if the data are symmetrical, how tightly they are grouped and if and how the data is skewed. In parallel, the boxplot, as a standardized way of displaying the distribution of

data based on a summary statistic ("minimum", first quartile (Q1), median, third quartile (Q3), and "maximum"), can show outliers and their values.

In Figure 4.15 the outliers box-plot and normal distribution of the principal candidate as dependent variables are presented.

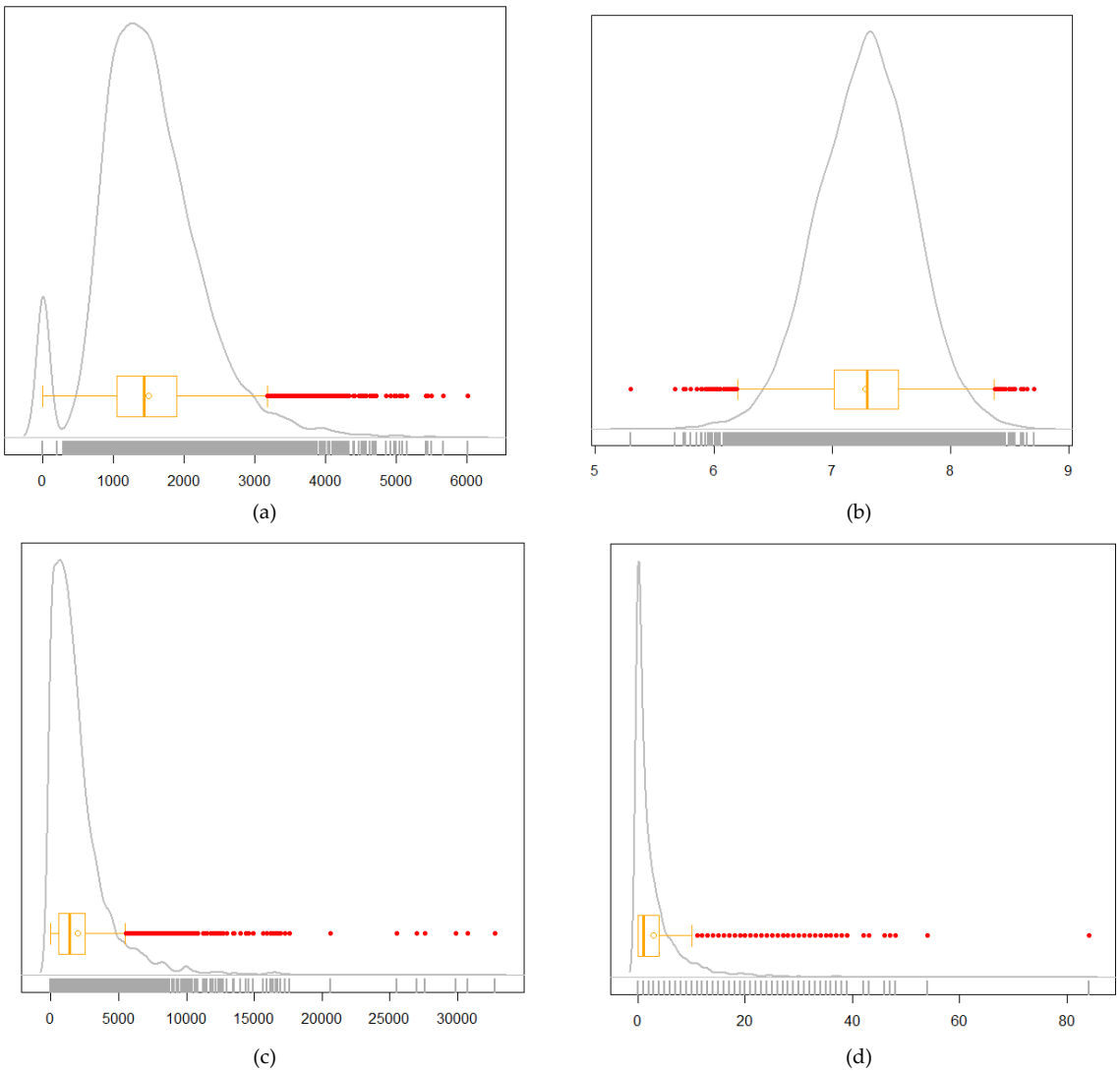


Figure 4.15: Boxplot of variables: (a) LP, (b) Log LP, (c) Visits, (d) Leads. (Source: Author processing)

The extreme outliers were verified and eventually deleted from the sample to reduce the variability in the data which prevents a clear reading of the analysed phenomenon. The distribution of LP (a) is a very irregular double hump curve, due to the presence in the sample of 446 priceless data. If we use the logarithm of the listing prices (b), a distribution "comparable" to normal distributions emerges, albeit slightly positively skewed. For the dependent variables analysed in the Chapter 5.5, visits (c) and leads (d) it is evident that the

distribution it is totally positive skewed. For the analyses also in this case extreme data will be cancelled.

4.2.2.2. Data stratification and sub-sampling

The XXQDB sample includes data about the architectures built in Turin from the 1950 to the end of the 20th century.

In order to preliminarily analyse the data, the sample consisting of 20th century buildings was classified according to the age of construction, authorship and/or level of protection and, finally, in relation to the prices of the real estate market.

The complete sample, including all the data of the 20th century quality buildings surveyed, was broken down into two sub-samples, of which only the second will be used for the analyses conducted on the real estate market of residential buildings.

1. The first complete sample obtained consists of 1104 data (QDB). This includes both the non-residential buildings and the villas and public residential buildings of the IACP built throughout the 20th century in Turin, not considered in the market analyses.
2. The second sub-sample (QDBS), which will later be combined with the data of the real estate listings, is instead made up of the data used for the subsequent analyses, it is constituted by the patrimony of residential buildings, mainly condominiums, built only in the second half of the twentieth century (1946 - 1999) and consists of 573 data.

The segmentation presented in Table 4.4 is suitable both to define the homogeneous areas of the urban territory and to take into account the construction factors (age, type, floor numbers) that can allow the identification of possible subsegments.

Table 4.4: Frequencies of principal variables in the QDB and its sub-sample QDBS (Source: Author processing)

Variable	*Description*	*Frequency (1900-1999) QDB*	*Frequency (1946-1999) QDBS*
	Cultural Interest		
DCI	Declared of cultural interest	3%	1%
UNCV	Unverified cultural interest*	26%	18%
WCI	With an indication of interest*	52%	60%
NCV	With no cultural value declared	19%	21%
	Principal use		
RES	Residential buildings**	39%	100%
NRES	Nonresidential buildings**	11%	0%
	Building typologies		
HOU	Houses/Villas	2%	2%
LBU	Little Building (Single-double family b.)	1%	1%

Variable	*Description*		*Frequency (1900-1999) QDB*	*Frequency (1946-1999) QDBS*
BUI	Medium-large (Condominium)	Building	94%	99%
TOW	Tower		1%	1%
BLK	Housing block		5%	0%

* From MT open access API, based on a classification presented in "Beni culturali ambientali nel Comune di Torino"
** From other sources, publication and direct observation

Regarding the protection classification, the connection of the XXQDB database with the VIR one demonstrated that only a little part of the buildings matched. The residential heritage in the VIR database is 39% of the total 1112 data about built heritage. This heritage is partly "Declared of cultural interest" (3%) and partly listed as owing an "Unverified cultural interest" (36%). Moreover, only a minimum part of these data is referred to 20th century post World War II period (29%).

This confirms once again the scarce attention paid by specialists to private residential buildings built in the second half of the 20th century, apart from the architecture created by critically recognized architects of the Modern Movement. The attention of the specialists stopped at the residential buildings built in the years between the two wars and then jump to the most contemporary architectures.

The attention on late 20th century buildings is focused only on the economic and social housing districts built starting from the years of reconstruction and concentrated in particular on large containers (stations, industrial buildings, exhibition buildings, large public buildings, etc.), which have thus entered fully into architectural historiography.

Table 4.5. Sample stratification by construction period. Summary statistics on prices. (Source: Author processing)

Var1	*Freq.*	*Min*	*Mean*	*Max*	*DevSt*	*Median*
1946-1960	2491	0	1393.739	6006	738.5032	1271
1961-1970	2806	0	1437.004	4714	689.3407	1410.5
1971-1980	1292	0	1492.98	4923	686.348	1501.5
1981-1990	322	0	1578.429	3444	726.1474	1593
1991-2000	163	0	1675.387	3590	870.2058	1816

The prevalence of the recent over the modern also emerges from the system of real estate values which, according to the sample analysed, are directly proportional to the age of the building. The trends relating to older buildings, preceding the Second World War, would certainly be different where the relationship would become inverse.

5. Results: the hedonic price of quality in second half of 20th century housing market

The first result obtained from the research work was the new XXQDB geodatabase (as presented in Chapter 4) composed of the quality residential architectures of the second half of the 20th century connected to the residential units, built in the same period and offered on the real estate market of the city in 2019 (STEP 1 of the methodological process 'chart reported in Figure 5.1).

The second result was then the study and definition of two indicators of architectural and construction quality, both recognized (RecQ) through constraints, declarations of cultural interest, publications and only observed (ObeQ) through direct survey, on the basis of relevant physical characteristics and common to the heritage of that era, as presented in Chapter 3.1.2. (STEP 2 of the methodological process' chart reported in Figure 5.1)

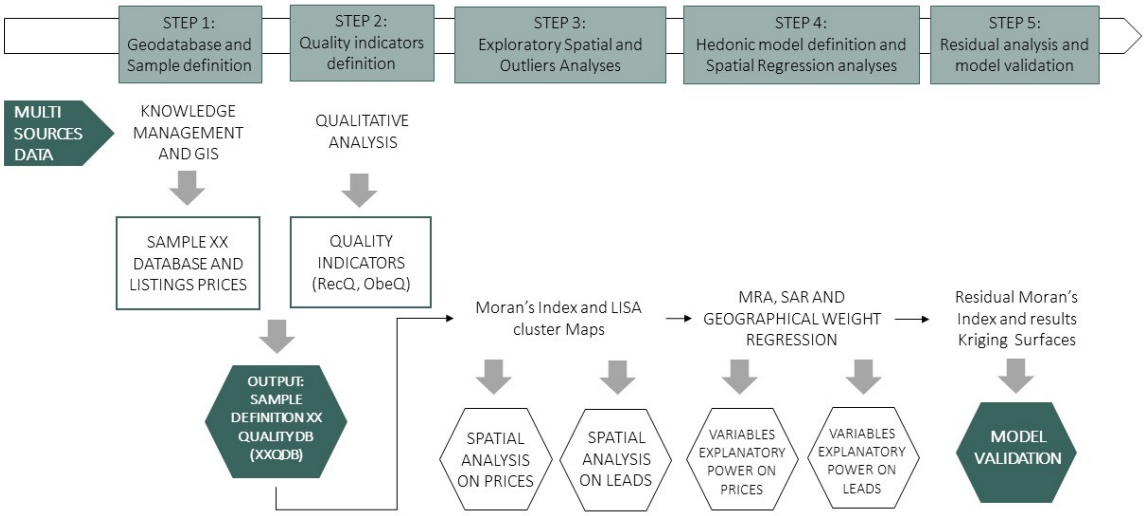


Figure 5.1. Methodological approach chart that guides also the results presentation.

Finally, the main result is presented in this chapter through the application of econometrics and geostatistics methods.

Following the methodological approach steps presented in Chapter 3, the explanatory and regression analyses and related results are here presented. The employed data are part of the data sample presented in Chapter 4; they were selected using a POIs data sample in order to avoid "a priori" segmentations in sub-markets, that can cause documented problems due to boundaries division in the study area. However, OMI Zones will be reported on some maps to allow more easy readability of the different zones of the city.

The MRA, Spatial Error and GWR model applications were conducted on the basis of the scheme shown in Figure 5.2.

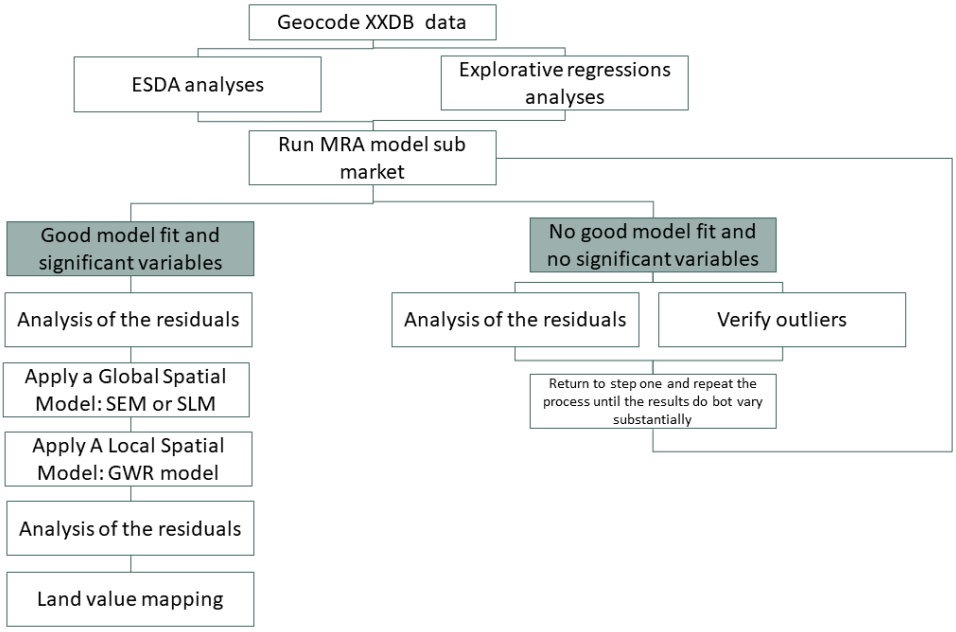


Figure 5.2. Methodology for the application of MRA analysis. (Source: Author's processing)

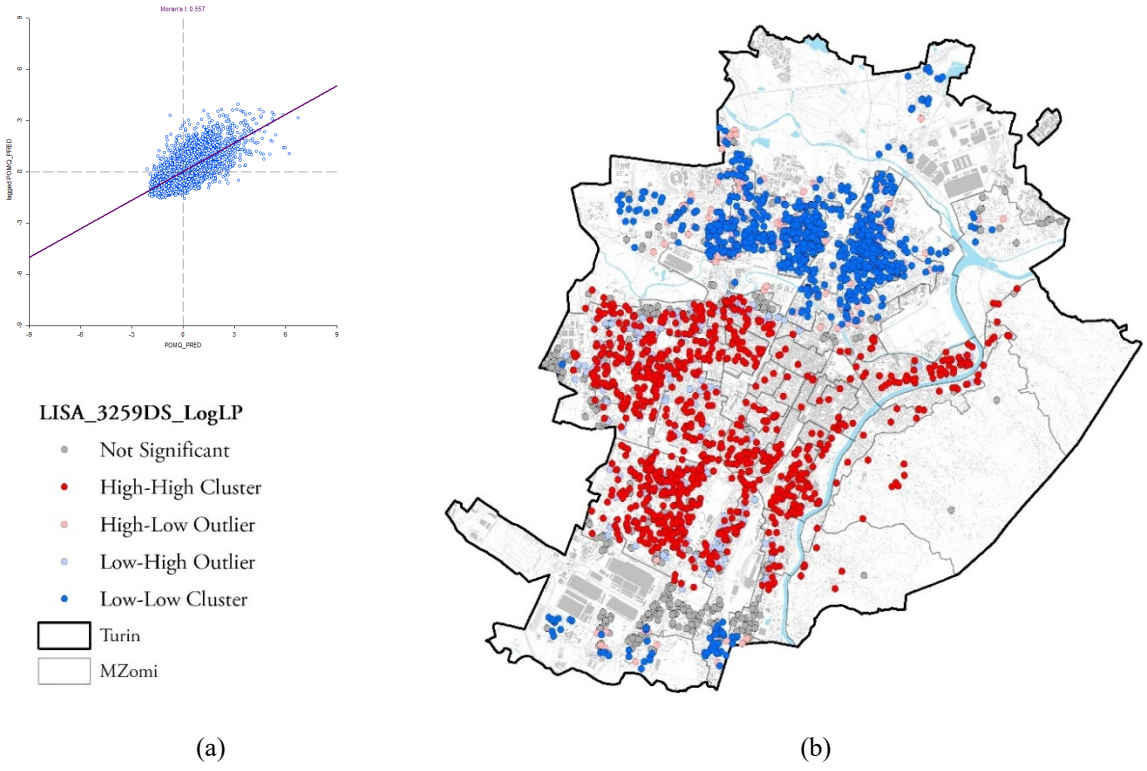
The XXQDB database was then used for the first phase of Explorative regression and the spatial analyses to produce opportune sub-samples and final (more explicative) regression models. Firstly, on the basis of the Moran Index, the presence of spatial autocorrelation above the dependent variables was investigated. Subsequently, MRA was applied to get the best-suited model by means of Stepwise selection and by verifying Multicollinearity/Homoscedasticity tests. When the presence of spatial dependence in residuals was detected, two global spatial regression models (Spatial Lag and Spatial Error)[35] were performed, to manage the influence of the spatial component at a global level. Finally, the chosen model was analysed through a local spatial regression, the Geographical Weighted Regression[36], whose results were then interpolated and predicted by means of a Kriging prediction value surface model[37].

[35] See Chapter 3.2.4
[36] See Chapter 3.2.3
[37] See Chapter 3.2.4

5.1. Exploratory Spatial Data Analysis (ESDA) and Exploratory Regressions

The STEP 3 of the methodological process 'chart (Figure 5.1) is presented in this chapter. The Pearson and Spearman correlation tests were performed to verify the absence of correlation between variables: the results of the Pearson correlation test, showed in Appendix B, confirmed the absence of linear correlation between independent variables.

The calculation of the Moran Index highlighted the presence of spatial autocorrelation in Listing prices (LP) values (Moran's I= 0.557); the Moran Index scatterplot, reported in Figure 5.2a, shows the positive autocorrelation. Furthermore, the Cluster and Outliers Analysis (Anselin Local Morans'I - LISA statistics) identified high-high and low-low clustering of LP values (II and IV quadrants), as represented in the map of Figure 5.2b.



(a) (b)

Figure 5.3. (a) LP Moran Index Scatterplot, (b) Cluster and Outliers Analysis (Anselin Local Morans'I) LP map. (Source: Author processing on XXQDB sample).

The results of LISA statistics (Figure 5.2 b) on listing prices suggested striking geographic clustering of LP in three urban areas: two clusters, located in the northern and southern zones of Turin, showed positive autocorrelation of lower values; the third cluster, that was mostly condensed around the central areas of the city, presented positive autocorrelation of higher values.

The Exploratory Regressions permitted to identify, among the initial 12 exploratory variables, the 7 variables able to better explain the LP variation in a regression model. The more effective model, which avoided variables with co-variation and minimized multicollinearity, is synthetically reported in Table 5.1 and the whole exploratory regression report in Appendix D.

Table 5.1. The chosen 7 out of 12 candidate variables Summary: Highest Adjusted R-Squared Results

Model	*AdjR2*	*AICc*	*JB*	*K(BP)*	*VIF*	*SA*
BLDCAT *** + LFT*** + NRM*** + MTL*** + LTR*** + EPC*** + MZOMI***	0,54	896,09	0,00	0,00	1,26	0,00
BLDCAT*** + LFT*** + NRM***-CBX*** + MTL*** + EPC*** + MZOMI***	0,54	909,66	0,00	0,00	1,24	0,00
BLDCAT***+LFT***+NRM***+NBT***+MTL***+EPC***+MZOMI***	0,54	912,25	0,00	0,00	1,86	0,00

Models were applied on two data samples having the same variables, but different amounts of observations. The XXQDB sample was composed by 3705 formed by listings of 2019 with the addition of 446 data related to units belonging to architectonical quality buildings data that in 2019 were not on the market. The second data sample (XXQDBS) was a sub-set of the XXQDB, and it is composed only by buildings offered on the market in 2019 (3259 data). Both databases were filtered as previously presented in Chapter 4 and SETEP 4 and STEP 5 of the methodological process recalled in Figure 5.1 were applied on both sub-samples, results are shown in the subsequent paragraph.

5.2. Multiple Regression Analysis (MRA), Spatial Error Model (SEM) and Geographically Weighted Regression (GWR) applied on the XXQDBS sample.

The regression model outlined in the methodology section[38] was applied to assess the influence of the quality indicators RecQ and ObeQ, and of the physical features of buildings and units on the LP formation process (Logarithm of LP). Findings of the first model suggested that Quality indicators have a small significant influence in determining listing prices (RecQ = 0,210 and ObeQ=0.225); the introduction of the location variable OMI MZ mean price, entails a further loss of significance of the quality indicators, mainly because location extrinsic variables have a higher explanatory power that the intrinsic physical ones (Table 5.1). OMI MZ is the expression of the "quality" of the location: it can assume 4 different levels and was calculated on the XXQDBS sample of listing prices of 2019 (3259 data – 116 quality buildings).

[38] See paragraph 3.2.1

In Turin, the highest prices correspond to the historical, classy and prestigious neighborhoods, inhabited by the wealthier citizens, and adequately supplied with public spaces and services. At the same time, lowest prices correspond to the more vulnerable neighborhoods of the city, both regarding the social conditions and the quality and availability of public spaces and services. The results highlight a phenomenon of dichotomy present in the City of Turin between rich social strata of the population, that are concentrated in the prestigious areas of the city, and the weaker social strata, which are present in the most degraded areas in terms of construction and more lacking in terms of urban services.

Table 5.2 OLS model to assess the influence of the features of buildings and units on the dependent variable LP. (Source: Author processing on XXQDBS sample).

Housing Listing Prices per Square Meter (LOGLP)											
Dependent variab	***LogLP***										
Model:	***Ordinary Least Squares (OLS)***										
Variables	*Coefficient*	*StdError*	*t-Statistic*	*Probability*	*VIF*	*Variable*	*Coefficient*	*StdError*	*t-Statistic*	*Probability*	*VIF*
Intercept	6.87622	0.02459	279.67381	0.000000*	--------	Intercept	6.451992	0.023467	274.937909	0,000000*	--------
BLDCAT 1	-0.11112	0.01910	-5.81767	0.000000*	1.07671	BLDCAT 1	-0.074876	0.015993	-4.681677	0,000004*	1.080667
BLDCAT 3	0.19358	0.01447	13.37722	0.000000*	1.20211	BLDCAT 3	0.13394	0.0122	10.978761	0,000000*	1.222962
LFT	0.19780	0.01398	14.15375	0.000000*	1.10201	LFT	0.153683	0.01174	13.09025	0,000000*	1.113225
NRM	0.06435	0.00570	11.28861	0.000000*	1.11724	NRM	0.0487	0.004783	10.181602	0,000000*	1.125844
MNTLV 1	-0.07063	0.01797	-3.92990	0.000096*	1.10761	MNTLV 1	-0.104466	0.015049	-6.941531	0,000000*	1.111615
MNTLV 3	0.14670	0.01313	11.17210	0.000000*	1.20539	MNTLV 3	0.139816	0.010977	12.737622	0,000000*	1.205727
LTR	0.07047	0.01877	3.75416	0.000189*	1.07482	LTR	0.086669	0.015695	5.522063	0,000000*	1.075637
EPC 1	-0.11409	0.01408	-8.10081	0.000000*	1.14976	EPC 1	-0.086851	0.011794	-7.364125	0,000000*	1.154153
EPC 3	0.14236	0.04360	3.26483	0.001123*	1.07480	EPC 3	0.158402	0.036447	4.346052	0,000018*	1.074949
RecQ	0.20995	0.06543	3.20871	0.001362*	1.01043	RecQ	0.015807	0.054935	0.287732	0.773578	1.019509
ObeQ	0.22458	0.03597	6.24389	0.000000*	1.03595	ObeQ	0.031164	0.030504	1.021654	0.30701	1.066538
						Mzomi	0.35951	0.009602	37.439623	0,000000*	1.132909
Number of observations	3259.00000		Jarque-Bera Statistic	234.66127		Number of observations	3259.00000		Jarque-Bera Statistic	532.34226	
Log likelihood			Breush-Pagan test			Log likelihood			Breush-Pagan test		
R square	**0.34467**		Likelihood ratio test			**R square**	**0.54231**		Likelihood ratio test		
Adj R square	**0.34245**		Akaike's Information Criterion (AICc)	2048.01688		**Adj R square**	**0.54062**		Akaike's Information Criterion (AICc)	880.20159	

As shown in Table 5.2, the tests executed on the goodness of the models (Log Likelihood, Breush-Pagan Likelihood Ratio AIC) returned significant and positive outcomes. The explanatory variables with the highest marginal coefficient resulted the indicators of quality, that mainly correspond to the prestigious building category, (RecQ = 0.209 and ObeQ = 0.224) and the "classy" building category (BCAT 3=0.19). When the location variable was added, it absorbed the main part of the above-mentioned explanatory power (RMEDFAS= 0.359) and building quality indicators lost their significance.

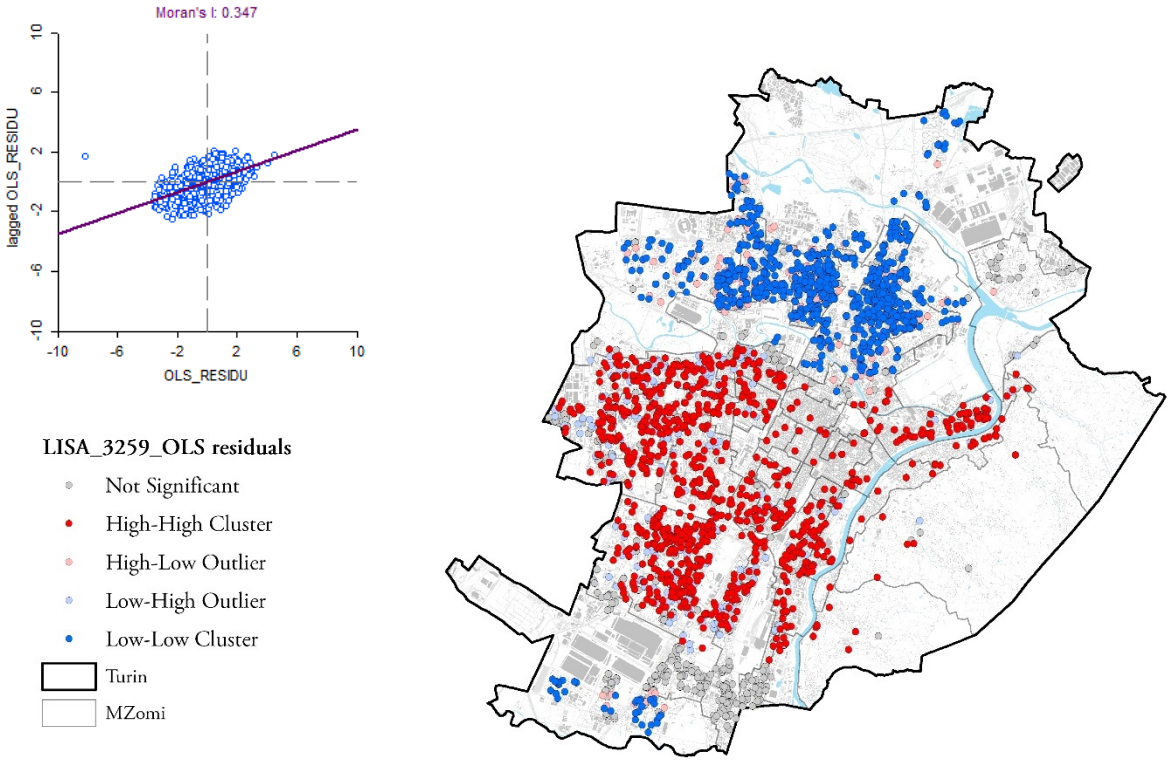
In fact, the most valuable areas are characterized by a building fabric of high architectural/building quality, which is in turn associated with the greater endowment of urban services, squares and gardens. In other words, the building fabric still constitutes a component of the quality of the location. However, these considerations apply beyond the robustness of the

models. Indeed, they are confirmed by the fact that the tests on the OLS model reveal the presence of spatial dependence between variables as a result of the fact that the OLS model is distorted. The tested spatial model were the SEM and the LAG as shown in Table 5.3.

Table 5.3. Diagnostics for spatial dependence

DIAGNOSTICS FOR SPATIAL DEPENDENCE FOR WEIGHT MATRIX: XXQDBS_3259 (row-standardized weights)			
TEST	MI/DF	VALUE	PROB
Moran I (error)	0.3283	34.332	0
Lagrange Multiplier (lag)	1	1365.014	0
Robust LM (lag)	1	244.7814	0
Lagrange Multiplier (error)	1	1164.212	0
Robust LM (error)	1	43.9789	0
Lagrange Multiplier (SARMA)	2	1408.993	0

The diagnostics for spatial dependence (Table 5.3), in fact, revealed the presence of spatial autocorrelation of the residuals (Moran I = 0.3283) and all the tests for the Lagrange Multiplier (both simple and robust) were significant. After testing both the Spatial Lag (SLM) and the Spatial Error model (SEM), the second was found more suitable for the current research. In Figure 5.3 are reported the Moran's Index scatterplot and the related LISA cluster map on OLS residuals.



(a) (b)

Figure 5.4. Residuals Spatial Autocorrelation (Source: Author processing on XXQDBS sample).

Comparing the performances of the spatial Lag regression (SLM) and the spatial Error (SEM) one, for the latter, the AIC values resulted lower and the Log likelihood higher than for the OLS and SLM models. Similarly, for SEM the Akaike info criterion and Schwarz criterion are sensibly lower than for the OLS model. The Breusch-Pagan test on the spatial effects, calculated for testing the homoscedasticity hypothesis, showed the null hypothesis was confirmed. The results of the SEM model are shown in Table 5.4.

Table 5.4. Spatial Error Model. (Source. Author processing)

Dependent variable:	***Housing Listing Prices per Square Meter (LOGLP)***			
Model:	***Spatial Error Regression Model (SEM)***			
Variables	Coefficient	StdError	t-Statistic	Probability
Constant	6.51932	0.02636	247.34200	0.00000
BLTCAT 1	-0.03513	0.01427	-2.46110	0.01385
BLDCAT 3	0.09986	0.01099	9.08666	0.00000
LFT	0.14764	0.01097	13.45720	0.00000
NRM	0.04374	0.00436	10.03670	0.00000
MNTLV 1	-0.11565	0.01314	-8.79787	0.00000
MNTLV 3	0.13081	0.00960	13.63110	0.00000
LTR	0.08539	0.01380	6.18944	0.00000
EPC 1	-0.07854	0.01034	-7.59574	0.00000
EPC 3	0.11337	0.03405	3.32987	0.00087
RecQ	0.03443	0.05247	0.65616	0.51172
ObeQ	0.01756	0.02738	0.64122	0.52138
MZomi	0.32731	0.01344	24.36080	0.00000
Lambda	0.43865	0.02425	18.09040	0.00000
Number of observations	3259		Jarque-Bera Statistic:	-
R square	0.64199		AIC:	130.49600
Adj R square	-			
TEST		DF	VALUE	PROB
Breusch-Pagan test		12	193.82060	0
Likelihood Ratio Test		1	747.57660	0

As evidenced by Table 5.4, SEM model can explain 64% of the price variation (R^2 = 0.642). In particular, the two "locational" variables represent, in addition to being the most significant, the highest marginal coefficients: the mean OMI MZ price seen above and the Lambda coefficient of the Error model. The presence of the lift (LFT = 0.148), the maintenance

level of the housing unit (MTL3 = 0.131) and the group of EPC labels (EPC 3 = 0.113) are also significant and have a positive influence on prices. The observed and recognized architectural quality variables are not significant and consequently would not be monetized by the real estate market. Other intrinsic characteristics are significant with minimal marginal prices.

The R-square, equal to 0.642, must be considered taking into account the fact that the dependent variable is made up of the listing prices and not the transaction prices that are determined in the market. The same model based on data consisting of selling prices, that are the result of the competitive mechanism, could pursue a definitely better R-square. In this case, R-square is adversely affected by the lack of transparency in the real estate market, which, moreover, also acts in amplifying the weight of the stochastic components, which in the case of real estate markets are already relevant in themselves.

Beyond the goodness of the model, the results of the OLS regression model still seem to highlight how the "buyers" appreciate the energy quality of the buildings but instead do not perceive the architectural quality of the buildings of the second half of the 20th century.

Table 5.5. GWR model to assess the influence of quality and other features of buildings and units on the LP dependent variable (Source Author processing)

Dependent variable:	***Housing Listing Prices per Square Meter (LOGLP)***	
Model:	***Geographically Weighted Regression (GWR)***	
Variables	Coefficient	Definition
Bandwidth	0.01497	
ResidualSquares	172.39421	
EffectiveNumber	165.69216	
Sigma	0.23607	
AICc	-82.99369	
R2	0.68163	
R2Adjusted	0.66468	
Dependent Field	0	LOGLP
Explanatory Field	1	BLDCAT
Explanatory Field	2	LFT
Explanatory Field	3	NRM
Explanatory Field	4	MTL
Explanatory Field	5	LTR
Explanatory Field	6	EPC
Explanatory Field	7	QLT

Despite the results of previous global models, in which quality is "overshadowed" by localization, a local model has been applied to analyse if, where and how this variable affects

price formation. The basic hypothesis is that its influence varies on a spatial level and therefore it does not act uniformly in the city of Turin.

In fact, architectural quality is expected to act on the market value of assets in prized areas of the city where LP- Listing prices are highest.

Starting from these assumptions, the GWR local regression model was applied with the aim of trying to improve both the explanatory capacity of the model - also in relation to the architectural quality - and the predictive capacity of the goods whose price was not known. GWR R squared is slightly higher to the R squared of the global spatial regression (SEM R2 = 0.642; GWR AdjR2=0.665) and the Aic value is clearly lower (SEM AIC= 130.496; GWR AIC= -82.994) as a result, the explanatory and predictive capacity of the model is evident.

Complete results by point are reported in Appendix D and Appendix E, while follows some maps and graphs to explain main results. The observed and corresponding predicted values resulted from the GWR model are shown in Figure 5.4.

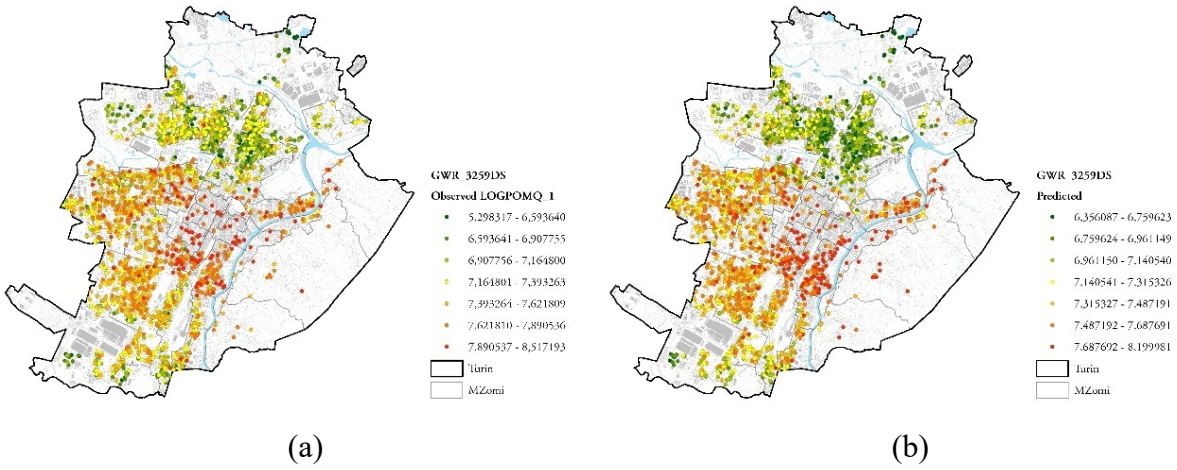


Figure 5.5. GWR model results. Observed values (a) and Predicted values (b) presented in 7 classes Natural Jenked classified. (Source: Author processing)

The observed and corresponding predicted values presented similar pattern and slightly different values, but a models comparison on the goodness of the models will be presented in the following Paragraph 5.4.

Figure 5.6 presents the different performance (Local R squared) of the GWR model across Turin city.

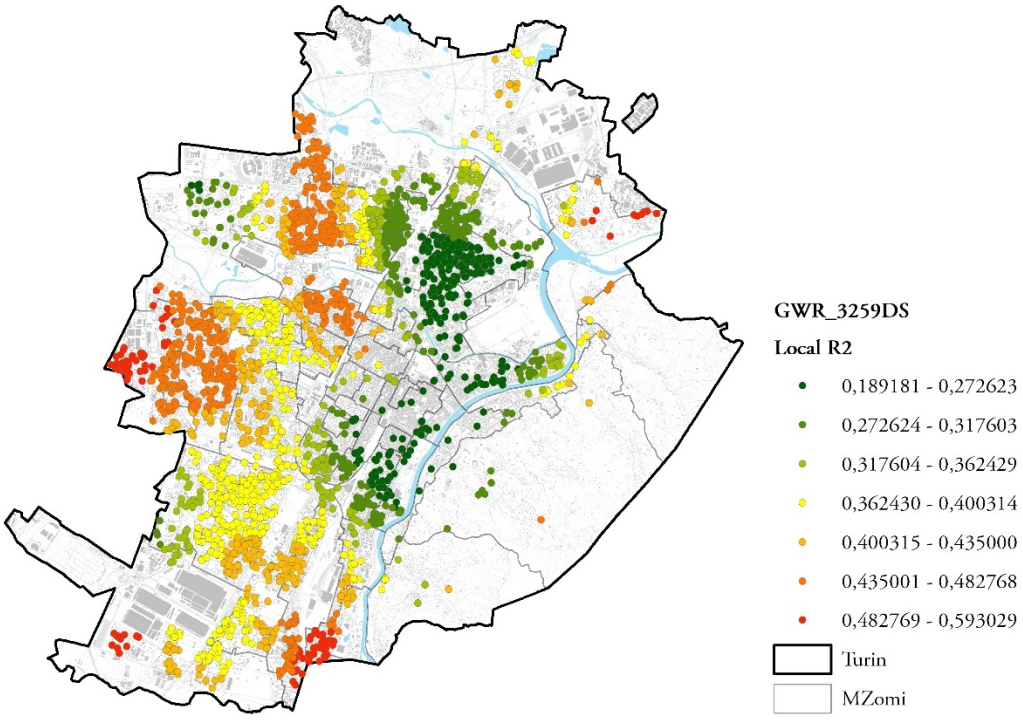


Figure 5.6. GWR Local R2. (Source: Author processing)

The different distribution of Local R Squared (Local R2) can be explained by several reasons. The city centre is characterized, on the one hand, by having the highest market values and, on the other, for being equipped with important urban services, for high historical, architectural and construction quality of the fabric associated with a good level of conservation and the presence of listed historic buildings, due to the highest concentration of urban services and social strata with the highest cultural skills and financial resources. Individual property assets may benefit from externalities that are an important component of their value, amplified by interplay between individual qualities.

Regression models have the limit of not measuring the effect of the interaction of variables on real estate values, unlike the analysis of variance, which has not a predictive ability.

In the west, however, where there is the presence of high quality buildings mainly from a constructive rather than an architectural point of view, the values are aligned with the mean value inherent in the entire city, even if in this part of the city the market has changed in recent years and values are increasing.

In the northern area, there are no buildings recognizable for high architectural and building quality; some social housing or economic social housing districts are under protection, but they do not belong to the XXQDBS sample of data here analysed.

Finally, the map in Figure 5.7 shows the pattern of the values relating to the residuals of the GWR, calculated for each point of the XXQDBS sample.

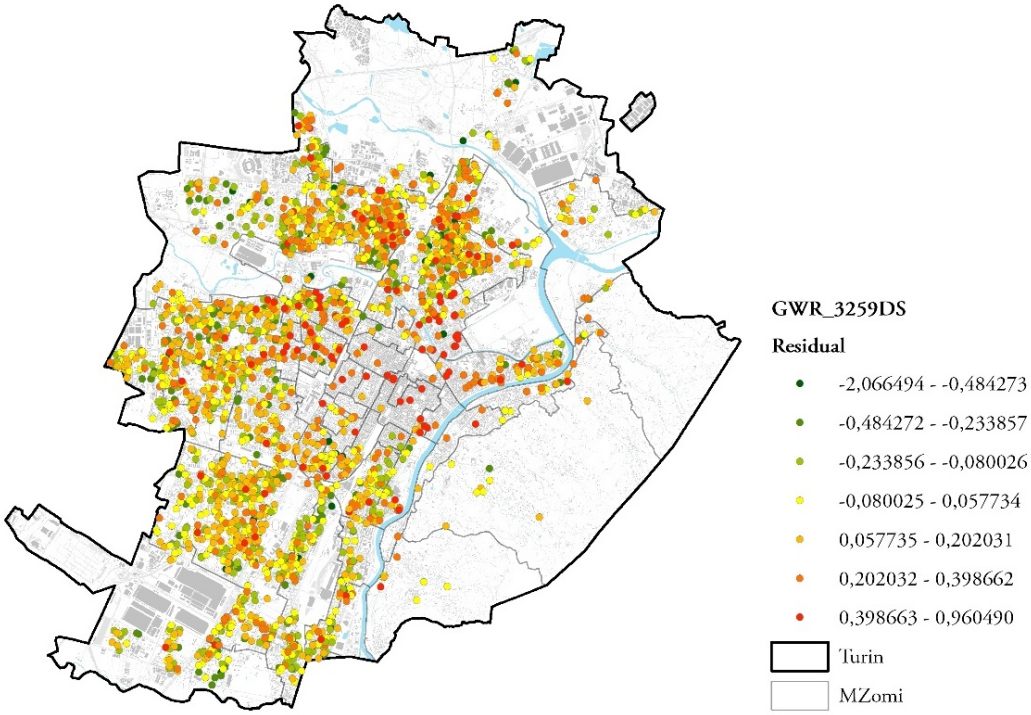


Figure 5.7. GWR Residuals Quantile Map. (Source: Author processing)

Residuals do not have a clear pattern and appear to be randomly distributed in space, so it can be assumed that no further latent variables can create discernible patterns among the residuals of the model.

One of the more interesting aspects of the GWR model is the prediction of the different coefficients of each variable analysed in the space. By focusing on the specific results of the GWR for each variable considered, it is possible to analyse the variability of the coefficient estimated by the model, both in the geographical space and in terms of normality distribution and histogram. The results of this analysis are reported in Appendix C

GWR coefficients *analysis*.

The results of the GWR model confirmed that - based on listings prices - the real estate market assumes the location of the building/unit as the most significant variable in the price formation process. It should be reminded that building production in the second half of the 20th century was based on a segmentation of demand by income brackets, which corresponded to specific types well represented by the cadastral categories (Classy, prestigious, etc.), distributed

in certain areas of the city (Curto, 1988). The market does not monetarily recognize the architectural quality of the heritage of the second half of the 20th century, while it monetizes the energy performance, which is the weakest element of the recent housing heritage: indeed, they usually have low energy performance, i. e. high operational costs and a low indoor comfort level.

In fact, comparing the results of the current research with a parallel one (Barreca, Fregonara and Rolando, 2021), the attention to the EPC label seems to have increased slightly in recent years, starting to be monetized by the real estate market. This means that the national energy policies and legal constrains (EPC has been mandatory for all transaction contracts since 2012 and minimum energy requirements have been mandatory for all types of building interventions in Turin since 2007), are increasingly gaining importance among the characteristics that guide the buyers' choices.

Therefore, new social models are emerging in Turin real estate market influenced by greater environmental awareness; in turn, there is a simultaneous loss of interest in locations characterized by natural contexts but without neighbourhood services (e.g., the Turin hills). This change, of course, is partially due also to modifications in the structure of families and the aging of the population. In this context, connoted by an increasingly selective demand, which favours central areas characterized by urban vibrancy (Barreca, Curto and Rolando, 2020a, 2020b), the architectural and construction qualities, seem to be completely neglected, as the model highlights.

However, it should be noted that the results of the model could be "distorted" by the small number of architectural quality residential buildings built in the second half of the 1900s. In fact, these represent a very low percentage of the building stock built during the quantitative growth of the cities determined by the processes of urbanization of the population. In the 70s, the concept that guided the buyers' choices was "better new than beautiful", that is, houses well equipped with services: e. g. new heating systems, concierge service and lift. Beyond the endowment of services and systems, the building production of those years is characterized by a low construction quality that does not mention the architectural one, obviously if is excluded the segment of prestigious houses built for the richest section of the population, which however, are irrelevant if considered in quantitative terms on the overall production of houses (Curto, 1988).

Ultimately, in the second half of the 20th century, prevailed a building production also aimed at the working class and in any case at social groups characterized by low solvency

thresholds, which access the property thanks to the absence of taxes and the low cost of money. The building and construction types are strongly conditioned by the distribution of income in the years of economic development, so much so for the middle-upper classes the assets differ according to the size of the apartments, the materials used, the equipment and the level of finishes. This dynamic starts from economic buildings up to classy and prestigious ones, which do not always associate the architectural quality with the building one.

The architectural quality is only perceived and not yet monetized, as one would expect, for several interrelated reasons. First, the percentage of buildings of architectural quality is too small compared to the overall building production achieved in the second half of the 1900s. Consequently, the number of housing of architectural quality offered on the market is too small, and this make the analyses more complex and therefore the models less robust. Secondly, the architectural quality, authorship and quality features of buildings are not considered as they should in the real estate advertisements, a fact that does not help the choices of the buyers, who instead perceive other qualities, including the energy one, which is increasingly influencing the market. Third, it should be emphasized that it is often difficult for non-experts to grasp the architectural quality by distinguishing it from the building one, if not for a group of buyers who, by virtue of their training, have particular tools. These considerations are also confirmed by the analysis conducted in paragraph 5.5 on the preferences of possible buyers.

The results of the applied global Spatial Error Model (SEM), however, must be rethought considering that the price formation mechanism is more articulated and complex than theoretically simplified. The "position" - represented from the POIs corresponding to each building - can determine variations in the marginal coefficients of the buildings and in the architectural characteristics. In other words, the same building with the same architectural characteristics can be appreciated differently depending on its spatial location.

In other words, the spatial influence and the weight of the marginal coefficients of the properties characteristics are not constant at the territorial level but vary point by point. Consequently, analyses that consider space using position as an explanatory variable or using territorial clusters - corresponding to territorial segments and sub-sets - can lead to distorted results and/or interpretations that underestimate the actual role played by space in the value formation mechanism.

Starting from these hypotheses, the GWR local spatial regression model was applied with the aim of trying to improve both the explanatory capacity of the model - also in relation to the architectural quality - and the predictive capacity of goods whose price was not known. To this

end, a sample of data was selected that best meets the objectives of the analysis. The predictive capability of the GWR model was applied. Full results per point are reported in Appendix D and Appendix E, while some maps and graphs follow to explain the main results.

5.3. Multiple Regression Analysis (MRA), Spatial Error Model (SEM) and Geographically Weighted Regression (GWR) applied on the XXQDB sample.

Following the same steps presented above, MRA, SEM and GWR models were performed on the whole XXQDB sample (3705 data). As already specified, this data sample is composed of priced observation, used in previous analyses, with the addition of 446 data related to quality buildings, with no listing price, because in 2019 they were not on the market.

By running MRA, SEM and GWR on the data without prices, the model, as expected, attributes negative values to the quality variables. Table 5.6 shows the results of these tentative models.

Table 5.6. OLS, SEM and GWR models results with absent prices for quality buildings.

Model	*R2*	*AIC*	*Degree of Freedom*	*Presence of Spatial Autocorrelation*	*Zero value prediction*
OLS	0.839	10350	3692	Yes	No
SEM	0.8433	10190.1	3692	No	No
GWR	0.8805	9180		No	No

Result reported in Figure 5.6 drive the need to estimate the LogLP even for the quality buildings that are not currently on the market. Therefore, the Kriging Interpolation Process was performed on the observed LogLP analysed in the XXQDB sub-sample (2359 data) (Figure 5.8): the estimated LogLP for each point of the 446 quality building data sample was extracted from the surface of the resulting values.

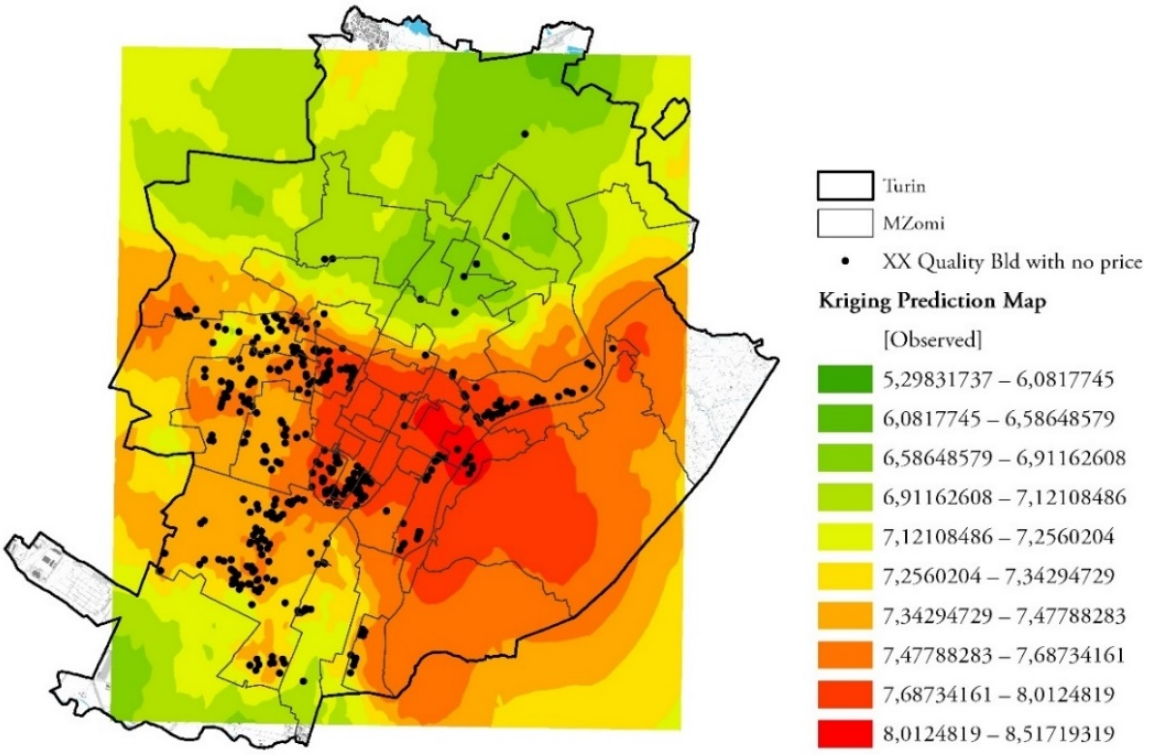


Figure 5.8. Kriging interpolation map on LogLP values (Author's processing)

The new completed data sample is composed by 3705 listing prices on both 3259 real estate listings of 2019 (of which 116 are also quality buildings) and estimated prices for the quality building sub-sample (446 quality buildings).

The MRA model results on the second sample are presented in the following Table 5.7.

Table 5.7. MRA model on XXQDB - 3705 data sample (Source: Author's processing)

Dependent variable:	***Housing Listing Prices per Square Meter (LOGLP)***			
Model:	***Ordinary Least Squares (OLS)***			
Variables	Coefficient	StdError	t-Statistic	Probability
Intercept	6.47974	0.02200	294.49802	0,000000*
BLDCAT 1	-0.08245	0.01558	-5.29134	0,000000*
BLDCAT 3	0.11484	0.01127	10.18997	0,000000*
LFT	0.15230	0.01108	13.74364	0,000000*
NRM	0.04717	0.00445	10.61113	0,000000*
MTL 1	-0.10635	0.01464	-7.26266	0,000000*
MTL 3	0.13408	0.01031	13.00958	0,000000*
LTR	0.08951	0.01498	5.97361	0,000000*
EPC 11	-0.09214	0.01132	-8.13902	0,000000*
EPC 3	0.16437	0.03551	4.62939	0,000005*
RecQ	0.06164	0.02775	2.22140	0,026368*

ObeQ	0.01284	0.01641	0.78268	0.43386
MZomi	0.35192	0.00861	40.87240	0,000000*
Number of observations	3705		Jarque-Bera Statistic:	574.71516
R square	0.55934		AIC:	810.18246
Adj R square	0.55791			

As shown in Table 5.7, the MRA model explains the 56% of the price variability (R2Adj= 0.557). The explanatory variables with the highest marginal coefficient are the locational indicator (OMI MZ= 0.352) and the EPC 3, that includes EPC labels from B to A4, (EPC 3=0.164). The high building category, the presence of the lift and the high level of maintenance have positive and medium-high coefficients, while their opposites (low maintenance level and economic building category) have little and negative coefficients.

It is worth noting that the indicators of quality performed differently from the first sample: in this case, the recognised quality seem to have a positive, even if small, influence on price formation; the observed quality resulted not significant. The results of this model, beyond the distortion due to spatial autocorrelation, nevertheless seem more likely and therefore allow, at least, to identify a sort of orientation/tendency of buyers in considering architectural quality, that could be consolidated in the future.

Also, in this case, since the MRA model is distorted due to the presence of spatial autocorrelation, the Lambda variable was introduced in the SEM model, to manage the spatial dependence of the variables. Results are reported in the following Table 5.8.

Table 5.8. SEM model on 3705 data sample (Source: Author's processing)

Dependent variable:	***Housing Listing Prices per Square Meter (LOGLP)***			
Model:	***Spatial Error Regression Model (SEM)***			
Variables	Coefficient	StdError	z-value	Probability
CONSTANT	6.65030	0.02927	227.20500	0.00000
BLDCAT 1	-0.02092	0.01297	-1.61262	0.10683
BLDCAT3	0.08372	0.00951	8.80261	0.00000
LFT	0.13666	0.00977	13.99260	0.00000
NRM	0.03905	0.00383	10.18710	0.00000
MTL 1	-0.12459	0.01182	-10.54070	0.00000
MTL 3	0.11836	0.00839	14.10770	0.00000
LRT	0.08221	0.01233	6.66734	0.00000
EPC 1	-0.08034	0.00921	-8.72658	0.00000
EPC 3	0.08678	0.03127	2.77538	0.00551
RecQ	0.00875	0.02409	0.36310	0.71653
ObeQ	0.05055	0.01445	3.49776	0.00047

MZomi	0.26796	0.01558	17.20190	0.00000
LAMBDA	0.65816	0.01704	38.61750	0.00000
Number of observations	3705		Jarque-Bera Statistic:	-
R square	0.69452		AIC:	-235.14700
Adj R square	-			
TEST		DF	VALUE	PROB
Breusch-Pagan test		12	276.52600	0
Likelihood Ratio Test		1	1043.21540	0

The results show that the SEM model can explain 69% of the price variation (R squared = 0.694), which is extremely significant even when compared to the explanatory power of previous models. The most significant variables and the highest marginal prices are reported for the two "locational" variables: the mean OMI MZ price seen above (OMI MZ = 0.268) and the Lambda coefficient (Lambda = 0.658) of the Error model. The presence of the lift (LFT = 0.137), the maintenance level of the housing unit (MTL3 = 0.118) and the group of EPC labels (EPC 3 = 0.087) are also significant and with positive marginal coefficients. As far as it concerns the quality indicators, the observed quality (ObeQ) is significant but has small and negative coefficients, while the variable RecQ has no significance. Other intrinsic features are significant with little marginal prices.

The results of the SEM model confirm once again that based on the property prices and according to the model presented in Chapter 5.2, on the XXQDBS sample - the real estate market recognises location as a foundational variable in the price formation process, able to absorb the most part of the prices variability.

The third and final step of the analysis is the application of the GWR model, to detect if and how marginal coefficients vary in the city of Turin. The Results of the GWR model are summarized in the following Table 5.9.

Table 5.9. GWR results on 3705 data sample (Source: Author's processing)

Dependent variable:	***Housing Listing Prices per Square Meter (LOGLP)***	
Model:	***Geographically Weighted Regression (GWR)***	
Variables	Coefficient	Definition
Bandwidth	0.01497	
ResidualSquares	185.14956	
EffectiveNumber	171.52976	
Sigma	0.22891	
AICc	-332.04004	
R2	0.69546	
R2Adjusted	0.68077	

Dependent Field	0	LOGLP
Explanatory Field	1	BCAT
Explanatory Field	2	ELEV
Explanatory Field	3	ROOMS
Explanatory Field	4	Status
Explanatory Field	5	terrace
Explanatory Field	6	EPC
Explanatory Field	7	QLT

The GWR model can "globally" explain the 68% of the price variation, which is quite the same of the SEM model. Nevertheless, the AIC is smaller, thus confirming the GWR as the better model. Given the best results of the GWR, however, it must be considered that the "global" result of a GWR model is less interesting than the local one, since the potential of GWR is precisely that of calculating a regression model for each point in space, also weighing it compared to the values of geographically close points. The maps and graphs relating to the different coefficients of the 7 explanatory variables with their different predicted values over the entire urban area are shown in Appendix C.

The following Figure 5.9 reports the distribution of Local R2 of the GWR model and the Kriging surface of the predicted values. The similarity of the distribution of the XXQDB Local R2 with that of the XXQDBS (3259 data), confirms that the regression model was not distorted by the introduction of the 446 quality buildings with an estimated price. The pattern of predicted values also corresponds to the observed values distribution and Standard Errors and Residuals appears randomly distributed in the urban area, this confirms the good fit of the model.

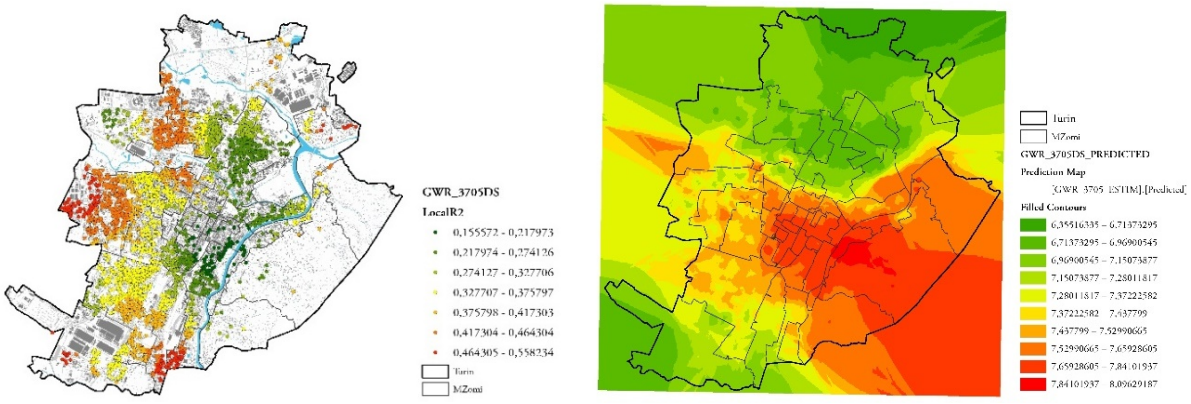


Figure 5.9. GWR Local R2 on 3705 data sample (Source: Author's processing)

5.4. Comparison of predictive power of MRA, SEM and GWR on the quality buildings offered on the market.

The present Paragraph develops a synthetic comparison of models and results, starting from the results exposed in the previous Paragraphs, that were obtained through the application of regression models both on the XXQDBS (3259 data) and on the XXQDB (3705 data) samples.

Table 5.10 presents the comparison between the models applied on the data sample of 3259 data (of which 116 observations are referred to quality buildings).

Table 5.10. Models performance comparison on 3259 DS (Source: Author's processing).

Data Sample: 3259 listings	***Variables: BLDCAT 1, BLD CAT 3, NRM, MTL 1, MTL 3, LRT, EPC 2, EPC 3, RecQ, ObeQ***				
	R2	***Aic***	***Prob(>F), degrees of freedom***	***Autocorr Spaziale***	***Local Multicollinearity***
OLS	0.307	2239	0.000*	0.356	
OLS + MZomi	0.5406	879	0.000*	0.435	
SEM	0.6498	130	0.000*	no	yes
GWR	0.6646	-83	0.000*	no	no

Table 5.11 introduces the comparison between the models applied on the data sample of 3705 data (of which 446 observations are referred to quality buildings).

Table 5.11. Models performance comparison on 3705 DS (Source: Author's processing)

Data Sample: 3705 listings	***Variables: BLDCAT 1, BLD CAT 3, NRM, MTL 1, MTL 3, LRT, EPC 2, EPC 3, RecQ, ObeQ***				
	R2	***AIC***	***Prob(>F), degrees of freedom***	***Spatial Autocorrelation***	***Local Multicollinearity***
OLS + MZomi	0.555	2437	0.000*	0.354	
SEM	0.694	-235.14	0.000*	no	yes
GWR	0.687	-373	0.000*	no	no

Finally, the subsample composed by ads related to residential units located inside quality buildings (116 data) was analysed to evaluate the prediction capability of OLS, SEM and GWR models (Figure 5.10).

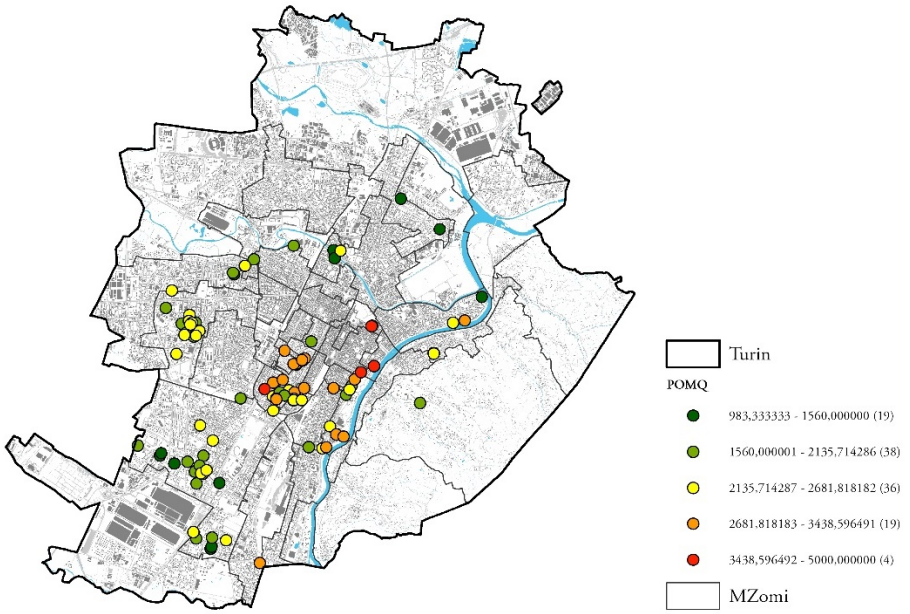


Figure 5.10. Quality buildings 116 data sub-sample (Source: Author's distribution)

The results of the comparison between the models demonstrate that GWR model has the lower residual values and OLS model the highest values. Since the residuals of OLS model are clustered, it is not totally correct considering their biased value, but these results were considered anyway to better clarify the potentialities of each model.

Table 5.12 shows that the prediction accuracy changes a lot above different regression models while total results are reported in Appendix E. The OLS model register the maximum residual error in 56 cases (on 116 observation) while the SEM model is the less accurate for 34 observations. The GWR model results the less accurate in only 25 cases, so it is possible to confirm its better prediction accuracy.

Table 5.12. Models Prediction Precision calculated on the 116 quality buildings offered on the market in 2019 (Source: Author's processing)

	OLS	***GWR***	***SEM***
Min	0.77150	0.79931	0.84149
Mean	0.00633	0.00930	0.03481
Max	0.77840	0.73841	0.69903
St.dev.	0.27797	0.24486	0.24909
N. of times than the model has the max residual coefficient in comparison with others	56.00000	25.00000	34.00000

5.5. Analysis of potential buyers' favourite housing physical features.

The last analysis of the research consists of the application of an MRA regression on the XXDB with the variable "Leads" as the dependent variable. The "Leads" represent the advertisements of the year 2019 preferred by the users of the Immobiliare.it platform. These advertisements become "favorites" by user's choice, who, with a personal account on Immobiliare.it, can save the ads in a private "favorite list". The goal is to understand if the analysis of Leads can help to better understand the choices of buyers in relation to architectural quality.

Therefore, of the database used for price analyzes, it was considered by how many users the individual goods were saved as favorites, a fact that is useful in any case to grasp the preferences of consumers. Leads can be representative of the demand more than the total amount of "visits" received by each ads, since the number of "visits" must be considered taking into account that it is influenced by paid advertising campaigns, that make some ads more visible than others. Nevertheless in Figure 5.11 are presented the spatial distribution of the more and less visited and favorite ads in 2019.

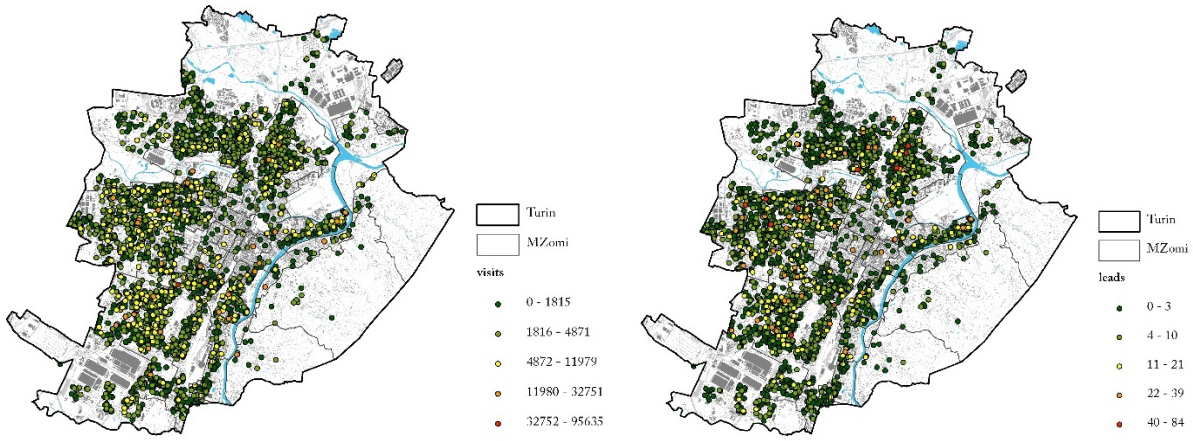


Figure 5.11. Spatial distribution of ads visits (a) and leads (b) (Source: Author's processing)

To apply OLS analysis on Leads, is verified the presence of spatial autocorrelation between the main variables and their lagged values (Leads and Vistis). As showed in Figure 5.12, no spatial autocorrelation between 'favorites' and 'visits' was found, but they are both randomly distributed throughout the city.

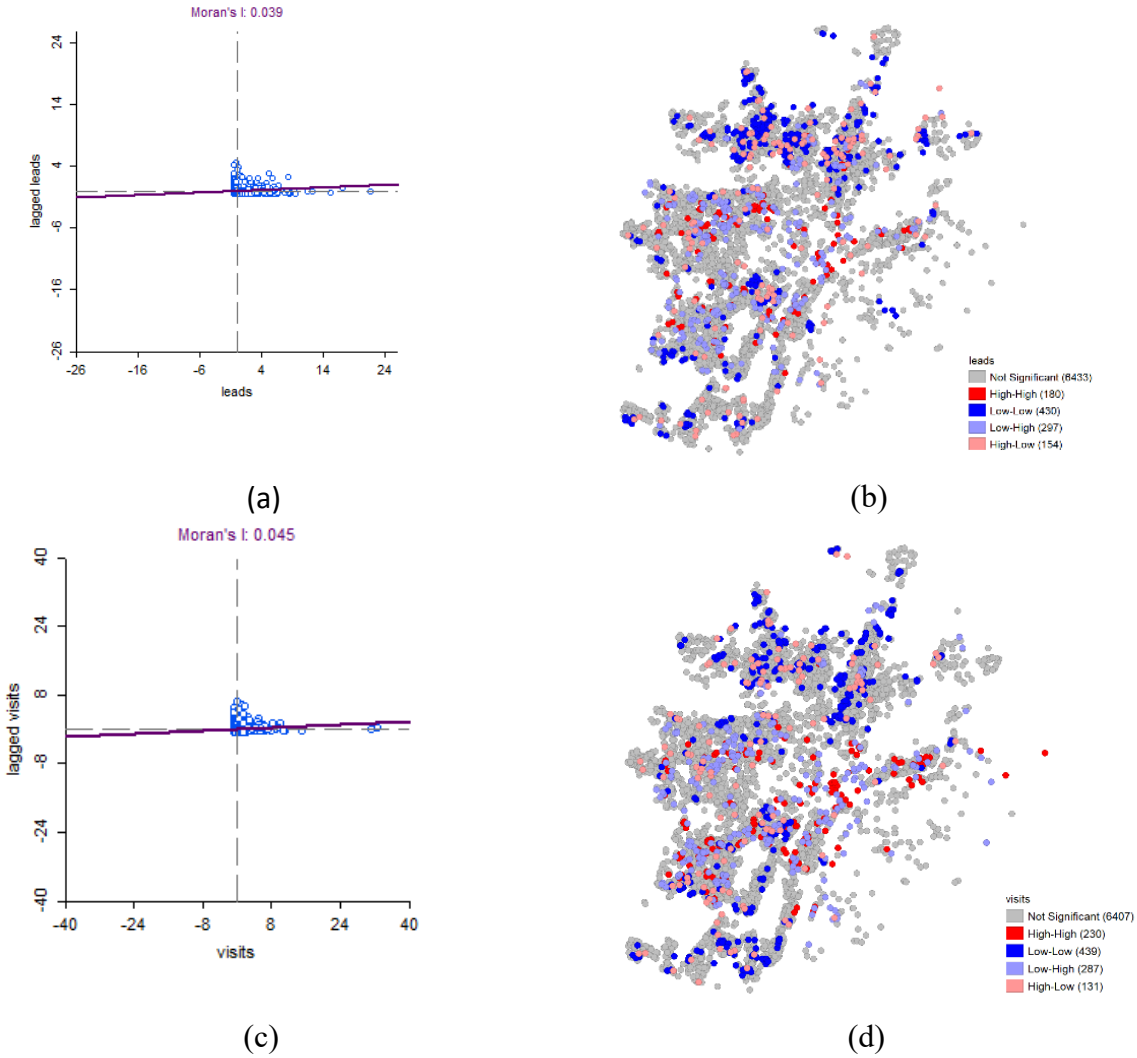


Figure 5.12. Moran's Index scatterplot and LISA cluster analysis of the visits and leads variables. a) Moran's Index scatterplot of visits; b) LISA cluster map of visits; c) Moran's Index scatterplot of leads; d) LISA cluster map of leads (Source: Author's processing)

Random distribution does not in itself help the understanding of consumer behavior, which probably requires specific analyzes and models more suited to understanding the variables underlying their choices, including those of a "psychometric" and cultural nature, which differentiate individuals. In this case, a linear regression is applied to define whether and which intrinsic characteristics of residential buildings are recognized by potential buyers. The model uses the "leads" indicator as a dependent variable and as explanatory variables, in addition to some intrinsic characteristics, the 16 Urban Zones used by Immobiliare.it in its advertisements were used as a qualitative *proxy* for the different sub-markets of Turin. The results show a rather low R-squared and a very limited number of significant variables, among which, however, the position is one of the most influential (as shown in Table 5.13). These data take on a particular significance in relation to the previous analyses, confirming and reinforcing

the definition of the locational variables as the most significant and with the highest marginal coefficients. The location would therefore still rank first in consumer choices, even if not all locations are appreciated in the same way (Table 5.13).

Table 5.13. OLS regression results (Source: Author's processing)

Dependent variable:	***Leads (potential buyers' preference)***				
Model:	***Ordinary Least Squares (OLS)***				
Variables	***Coefficient***	***StdError***	***t-Statistic***	***Probability***	***Signif***
(Intercept)	0.77700	0.20800	3.74300	0.00018	***
visits	0.00100	0.00002	51.65300	< 2e-16	***
LP	-0.00001	0.00000	-9.61800	< 2e-16	***
NRM	0.19800	0.04830	4.10800	0.00004	***
terrace1	0.63500	0.17300	3.67000	0.00025	***
air condit1	-1.39000	0.17900	-7.75000	0.00000	***
EPC CL3	-0.93800	0.37800	-2.47800	0.01320	*
RecQ	0.00294	0.85300	0.00300	0.99725	
ObeQ	0.08290	0.40600	0.20500	0.83795	
Zone Barriera di Lanzo, Falchera, Barca, Bertolla	-0.59000	0.31700	-1.86500	0.06224	.
Zone Borgo San Paolo, Cenisia	1.54000	0.31500	4.89300	0.00000	***
Zone Borgo Vittoria, Parco Dora	-0.10200	0.25000	-0.40800	0.68331	
Zone Campidoglio, San Donato, Cit Turin	1.88000	0.31400	5.99500	0.00000	***
Zone Cavoretto, Gran Madre	0.75000	0.55700	1.34800	0.17784	
Zone Centro	1.94000	0.45200	4.29100	0.00002	***
Zone Colle della Maddalena, Superga	0.69400	0.56400	1.23000	0.21863	
Zone Crocetta, San Secondo	1.44000	0.39000	3.68500	0.00023	***
Zone Le Vallette, Lucento, Madonna di Campagna	-0.70600	0.22600	-3.12900	0.00176	**
Zone Lingotto, Nizza Millefonti	0.61800	0.28900	2.13800	0.03255	*
Zone Madonna del Pilone, Sassi	0.73100	0.53200	1.37400	0.16954	
Zone Mirafiori Sud	-0.30200	0.25700	-1.17300	0.24087	
Zone Pozzo Strada, Parella	0.64600	0.22000	2.93700	0.00332	**
Zone Regio Parco, Vanchiglia, Vanchiglietta	0.37100	0.29700	1.24900	0.21180	
Zone San Salvario	0.82100	0.36500	2.25000	0.02449	*
Zone Santa Rita, Mirafiori Nord	0.52700	0.21500	2.45100	0.01426	*
Number of observations	3705		Jarque-Bera Statistic:	-	
R square	0.31440		AIC:	8346.18246	
Adj R square	0.31210				
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1					

The regression model, according to the results, is able to explain only 31% of the variability of preferences (R2 = 0.313). Nonetheless, the results concerning the intrinsic and extrinsic variables, even if more complex to be interpreted in terms of marginal coefficients, can be useful as they give a vision of the real estate market which is also useful for directing future research. First, however, they capture the positive influence of some intrinsic variables, particularly of the price, according to which it could be assumed that it is the buildings of higher

value that are most saved among the favorites. Furthermore, the number of rooms and the presence of air conditioning would also have a positive influence; they are consistent elements related with the price variable and allow to glimpse the types of "preferred" goods to which the characteristics of potential buyers, which seem to have greater economic capacities and greater cultural tools, can be associated.

These data are confirmed and are consistent also regarding the location, represented by the territorial sub-areas considered by the platform for real estate advertisements (Figure 5.13).

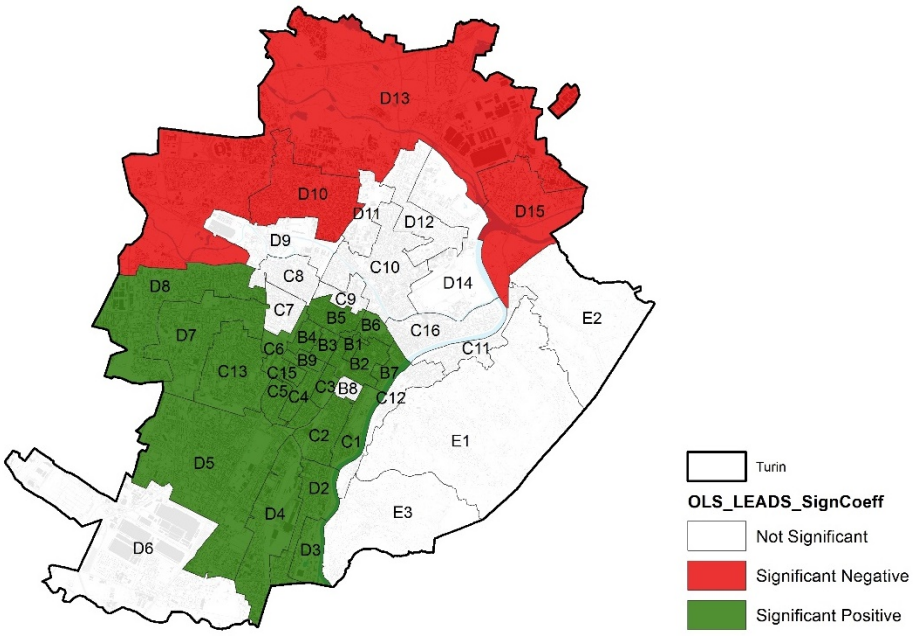


Figure 5.13. Significant zones (with positive and negative coefficient) resulted in the OLS model with Leads as dependent variables (Source: Author's processing)

Among the significant areas, showed in Figure 5.12, the Central Zone is certainly the one with the highest positive marginal coefficient. This is followed by Campidoglio, San Donato, Cit Turin, which includes the area on which the influence of the Metro and the new railway station was most related.

The Crocetta/San Secondo (C5 and C4) neighbourhood has a high architectural quality and was the favorite area of the Turin population middle-upper classes. In line with the Crocetta data is the San Paolo area (C13, D7and D8), where is present the Metropolitan line of the city and important urban transformation projects were carried out following the Regulatory Urban Plan of 1995. In general, as regards the areas, those that have a greater presence of urban

services, less phenomena of social vulnerability, better quality of public spaces and buildings are clearly preferred.

6. Conclusion and Discussion

In the following paragraphs some synthetic key points of the research will be presented to recall the path taken from the initial hypotheses and research questions to the results and the final discussion and therefore to suggest some possible developments for the future.

6.1. Statement of the problem and aim of the research.

In defining the disciplinary framework, in the bibliographic research carried out to establish the state of the art of the literature, regarding the different themes dealt with in this work, some shortcomings emerged, that were addressed with the research work.

The first gap concerns the absence of appropriate open-data to study the economic value of historical assets: in fact, currently, in several databases, there is not a clear link between the residential architectures pertaining to the historical heritage and the real estate market. The problem concerns in particular a lack of interoperability since the variables in the databases, aimed at classifying and filing of heritage assets from the historical point of view, are not compatible with those necessary for the cataloguing of real estate listings. The integration between these databases is entirely feasible, since they are on the same physical objects, and it could be extremely useful to have a public and shared database for the economic evaluation of the architectural heritage as well.

Another gap is related to the policies for the protection of contemporary architectural heritage: despite the continuous alerts for the "heritage at risk" given by international organizations are well known, the Italian law does not fully protect the residential heritage, even if designed by important authors. Moreover, a modern policy for the protection of contemporary heritage is still not fully widespread neither in Italy nor in Europe.

A further risk for the private residential heritage of the late 20th century comes from a different source: the Italian green retrofit policies in fact do not seem to be fully aware of the values and elements of modern and contemporary architecture that need to be maintained. The green retrofit interventions required to improve the buildings energy performance can put at risk the identity of many buildings not yet under protection. Very often, in fact, interventions on passive envelope led to the replacement of facade elements (e.g., windows, string courses, materials) that are fundamental distinctive elements for the architecture of the 20th century.

Moreover, in order to study the economic value of these assets, the architectural quality elements should be clearly outlined. Nevertheless, in the literature there are no transversal

qualitative-quantitative cross-sectional analyses of the residential heritage of the 20th century that define its architectural quality, but there are several very specific and monographic research that, while addressing the topic in depth, never put these architectures in a unique network of modern and contemporary heritage.

Finally, from the point of view of statistical and geostatistical analyses relating to the real estate market, no research has been found aimed at distinguishing the architectural quality and physical characteristics of buildings from their locational characteristics. Furthermore, as regards the analysis of the demand, while are known studies that relate the preferences of buyers with the historical characteristics of the dwellings, there are no corresponding studies that deal with the appreciation of quality characteristics of contemporary heritage.

All this, even if, in general, the building production and the contemporary built heritage is greater than the historical one, prior to 1945. From all these shortcomings in the literature, the work presented in this thesis has tried to fill some gaps and to trace a path for future developments and insights. Considering that the real estate market is the expression of behaviours and preferences of demand, it is assumed that it is constituted by individuals who choose how to spend within their budgetary constraints, according to models of a social and cultural nature.

Then, this research aims to study the residential heritage of the second half of the 20th century and its real estate market and to understand if, how and in what measure the building qualities that characterize this residential heritage are recognized and monetized by buyers. This is done by identifying models that are able, on the one hand of assess the weight of architectural quality in listing prices formation process and, and on the other hand, in view of mass appraisal, to predict the price of properties before to be offered on the market, always isolating the locational components from the architectural and building characteristics.

6.2. Main results

This research started with the creation of a new geodatabase, connecting different data sources, necessary to interlink the architectural quality and locational features with the real estate market.

The work developed in five steps:

- Sampling and setting of the geodatabase;
- Construction of two quality indicators: RecQ and ObeQ;
- Exploratory spatial regression and statistical prediction of the absent values;

- Global and local spatial models: SEM and GWR residuals verification and results interpretation, applied on the two data samples XXQDBS and XXQDB
- Analysis of the preferences of the possible buyers (demand) by applying a hedonic model (OLS) on the "leads" variable of the property listings web platform.

1. Sampling and setting of the geodatabase (XXQDB)

The setting up of the geospatial databases was particularly challenging. The databases relating to architecture of historical-architectural quality are extremely fragmented and, above all, there are no complete open databases that record the residential heritage of architectural quality of the second half of the 20th century. The absence of complete public databases led to a rather demanding first work to define the different data samples by joining five different sources: Turin geoportal, Museo Torino APIs, Sigec-web catalogue, Immobiliare.it portal and direct surveys. The total residential architectures of high quality collected in the city of Turin, built in the 20th century are 868, of which the architectures built in the second half of century and collected in the QDB database are 562 data.

All these data collected then become part, by spatial joining, of a new geographical database of housing built in the late 20th century and offered on the market in 2019 XXQDBS (3259 data) of which 116 are architectures of high quality. Finally, to include in the whole sample all the 562 quality buildings of the QDB sample, by means of the kriging surface prediction process, their listing price have been predicted, and the final XXQDB data sample (3705 data) it was defined.

2. Construction of two quality indicators: RecQ and ObeQ

The construction of the two indicators concerning the architectural and building quality (RecQ and ObeQ) of housing units built in the second half of the 20th century involved an important work in classifying their architectural quality, as this feature has not the necessary attention and it is not published in real estate advertisements. In particular, the analyses focused on housing that stands out for its architectural and building quality: materials used, the level of technology and workmanship.

The analyses were made possible by data extraction from existing open access databases, processing and harmonizing data from different sources and direct surveys. The "RecQ" indicator represents the recognised quality attributed by entities for the protection of cultural heritage and by experts, while "ObeQ" represents the quality observed by this researcher based

on a number of specific criteria. Criteria used during the surveys and filing of the architectures collected are derived from the criteria used for the *"National census of quality architecture of the second half of the 20th century"* (Directorate General for Contemporary Art and Architecture and Urban Peripheries) and from some metadata of the catalogue cards of the regional project "*Architecture of quality from 1945 to today*", launched in 2001 by MiBACT.

3. Exploratory spatial regression and statistical prediction of the absent values

Cities, including Turin, develop according to building and territorial stratifications, greater or lesser widely distributed on the spatial and temporal level, that are defined by clusters of buildings with homogeneous characteristics both in terms of historical, architectural, typological features and on the social and cultural level of the inhabitants. This is confirmed by classical literature in which is assumed that an observation, also related to the real estate market, is more similar with other observations nearby than ones faraway (called spatial dependence).

Spatial regression models can assess and manage the spatial dependence of data, but while global spatial regression models assume that explanatory variables act in the determination of prices with a uniform contribution in the whole city (homogenous coefficients), local spatial regression models, instead, can calculate different marginal coefficients for each feature in each observation point. Therefore, these last models are able to be more responsive to the real mechanism of formation of real estate values. According to these, residential units and buildings variables assume very different values across the city even with opposite signs. It may also happen that the effect of architectural quality, in different locations, can be hidden by the action of other factors specific to that location which can also be latent variables. Each location is subject to a multiplicity of concentrated and overlapping of historical, physical and social variables that it is not always possible to globally know and measure and that influence market values in different ways.

Assuming these premises exploratory regressions, by means of several statistical tests, helped to verify which spatial regression models were more suitable to the analysis of the XXQDB sample, moreover by means of a Stepwise process it was possible also to verify which variables, from the total, are more significant to explain listing prices variability. In this work the explanatory variables were: the building category, the presence of lift, the number of rooms, the maintenance level, the presence of large terrace, the EPC labels, RecQ and ObeQ and in global models the mean listing value of each OMI submarket.

Moreover, in this work it was be necessary to estimate part of the listing price of the architectural and building quality by means of Kriging geospatial prediction, that resulted appropriate because of the presence of spatially correlated distance and directional bias in the data. Results of the Kriging prediction was a continuous surface of values for the whole city of Turin, from which were extracted the predicted values corresponding to the high quality buildings (446 data) that were not offered on the market during 2019.

4. Global and local spatial models: SEM and GWR residuals verification and results interpretation.

The Geostatistical methodologies applied included Multiple Regression Analyses (MRA-OLS), Spatial Error Regression models (SEM) and Geographically Weighted Regression (GWR).

The same methodologies were applied both on the totally priced data sample XXQDBS (3259 data) and on the XXQDB (3705 data), the dependent variable was the logarithm of the listing prices and the explanatory variables were those presented above (Step 3).

All OLS regression models performed had to be discarded, biased by the presence of spatial autocorrelation both in the dependent variable (LogLP) and in the residuals. Although the presence of spatial autocorrelation leads to the exclusion of the models, it helps to better understand the mechanism of listing price formation, considering the proximity between the observations.

Even if the results of the global (SEM) and local (GWR) spatial regression models (on XXQDB) are not so different in terms of general R squared (SEM R^2=0,694 and GWR R^2= 0,687), the GWR model presents better significance and residual tests, allowing to state that the formation of prices really takes place in a point-like-way in the space, precisely due to the action of many latent variables. Based on the fact that even micro-spaces have a multiplicity of latent factors that influence prices, the R squared values are likely, considering that the real market cannot be represented by simple statistical models.

Furthermore, in all the application carried out, the GWR models, with logarithm of listings prices as dependent variable, gave the best results in terms of price explanation capacity and in terms of marginal coefficients.

Regression models were firstly applied on the XXQDBS that includes 3259 housing ads data of 2019 with 116 data related to quality housing. In the OLS model the indicators RecQ and ObeQ are significant with positive marginal coefficients, but the explanatory power is very low (OLS R^2=0.307) and residuals appeared clustered. In this model, made of intrinsic features

variables, was then added the mean listing price of each OMI Zone as a *proxy* of quality location variable; in this case, the explanatory power of the model arises (OLS R^2=0.541) but also in this case model residuals are spatially dependent.

The result of the Spatial Error Model, that add the Lambda variable to manage spatial autocorrelation, is better both in terms of R2 (SEM R2=0.649) and lower Aic value, but the quality indicators RecQ and ObeQ get a not-significant coefficients. Finally, to predict coefficients spatially varying, the GWR model was applied and results shows a good not clustered distribution of residuals and very interesting results for each explanatory variable.

The same models were then applied to the whole XXQDB (7305 data), of which 446 prices were estimated by Kriging interpolation, and confirm almost the same results with the big difference for the ObeQ indicator that, in this case, results significant with a little and positive coefficient (SEM model ObeQ = 0,05). This final result may indicate that, if properly reported in real estate ads and correctly classified, it is possible to isolate the effect of the architectural and building qualities in the prices of contemporary properties formation process.

In the results, among all the intrinsic variables, the building category (prestigious, classy, medium, etc.) is the one that mostly acts on the price formation process; this is a variable that can be considered a *proxy* of other characteristics such as the level of maintenance, the building quality and perhaps also the architectural quality. Another interesting result is that, despite the architectural quality is not perceived by the market as it should, the energy quality has significant marginal coefficients, which must also be evaluated in relation to the technological innovation processes that are currently affecting buildings. In the regression models analysed, the EPC label has a negative coefficient for the lower classes (E, F, G) while it has a very positive coefficient for the higher ones (B, A-A4).

5. *Analysis of the preferences of the possible buyers (demand) by applying a hedonic regression model on the "leads" variable of the property listings web platform.*

The final regression was performed on a different dependent variable. To verify if there are some buildings or urban characteristics able to "explain" buyers preference, the "visits" and "leads" variability in the XXQDBS were analysed . For each observation, which corresponded to an advertisement, were reported the number of visualizations that it has received in 2019 (visits) and the number of times in which it was saved as preferred by users (leads). The OLS model applied used the lumber of "leads" variable as dependent variable and the following explanatory variables: the number of visits, the listing price, number of rooms, the presence of

terrace, the presence of air conditioning, the EPC label, ObeQ RecQ and the 16 Urban sub-areas used by Immobiliare.it in its advertisements.

Results showed that the model is able to explain 31% of the variability of preferences (R2 = 0.313). Nonetheless, the results concerning the intrinsic and extrinsic variables, even if more complex to be interpreted in terms of marginal coefficients, can be useful as they give a vision of the real estate market which is also useful for guiding future research. It could be assumed that the buildings of higher value are mostly saved among the favorites and the number of rooms and the presence of air conditioning would also have a positive influence on users' preferences. The ObeQ and RecQ indicators are not significant while the most interesting result is the marginal coefficient attributed to each urban area. Representing results in a map is clear how central areas and those linked to the presence of metro stations have a positive marginal coefficient, while the less dense urban areas that presents less neighborhood services, presence of social vulnerability and low quality of public spaces shows negative marginal coefficients.

6.3. Discussion

As the main research aim, it is important to consider that in the results showed that neither architectural quality nor building quality are currently variables that are monetized by the real estate market and both were not perceived by models with significant marginal coefficients, as it is the case for other physical building features. This result can be explained by several reasons, also attributable to the limits of the databases, but in general terms, however, led to affirm that the residential heritage of the late 20th is neither recognized nor appreciated for its qualities by most buyers, regardless of the reasons. In fact, the non-expert buyers while can easily recognise the quality of the ancient building heritage or new building stock, commonly undervalue and unrecognize the modern and contemporary architectural elements that characterize the architectural heritage of the 1900s designed by architects belonging to the Modern Movement or subsequent architectural currents.

It should also be considered that the results may be partly conditioned by the too small number of quality residences built in the second half of the 20th century in Turin (562 data) and offered on the market in 2019 (116 data). This number is explained by the very small percentage of architectural quality housing stock on the total building production carried out between 1950-1999.

Models results allow to make some additional considerations. Results on energy quality demonstrates how consumer preferences are changing in appreciating intrinsic buildings

characteristics, a fact that does not exclude that, in the future, the market, appropriately solicited, may also consider the architectural quality. Refined cultural tools are required, in order to recognise and distinguish the architectural quality from the building one: their difference is very thin, especially in the residential heritage.

Architectural quality is confirmed as a particularly complex variable in itself, as it is often not made explicit by advertisement and as its translation into marginal coefficients depends on the interaction with other variables. In particular, the architectural quality, intended as design, composition and construction features of the 20th century buildings, is often a *proxy* variable of the building category and the maintenance level.

Considering the history of Turin, in the 60s and 70s the market demand was more attentive and interested in the construction qualities related to the importance of some construction companies, rather than the signature of important "modern" architects who built non-residential masterpieces in the city. The recognition of the architectural value of contemporary buildings is still now reserved for experts, who can only partially guarantee their protection, above all because these buildings are mainly private assets and consequently constant maintenance intervention is in the hands of the owners. Beyond the coefficients, the models highlighted the need to disseminate and promote the values of modern heritage with specific actions to overcome the current cultural gap.

The most interesting result that emerged from the research, also scalable to other Italian urban areas, is that the system of values of the 60s and 70s, that determined the grow of cities, is undergoing a deep modification, precisely from the spatial point of view. This mainly due to changes occurred in the distribution of income and in the structure of the society.

The system of values of Turin was determined, in those years, by the distribution of the income of the industrial cities and by the significant weight that the middle class still had. The current system of values equally depends on the distribution of income which, however, has profoundly changed and it is even more polarized due to the weakening of the middle and middle-upper classes. After all, the urban areas favoured by the middle class until a few years ago, are now progressively devaluing, in favour of the attractiveness of the more vibrant emerging urban areas. This spatial modification in the system of values is the result of both demographic factors and the emergence of new cultural models, which affect the younger population strata entering the real estate market.

Architectural quality is currently perceived but not monetised as it should; the market demand is instead driven by technological innovation. The results of this research work, even

if not fully corresponding to the original hypotheses, they are very useful to confirm the need and urgency to intervene in the recognition and safeguarding of contemporary residential heritage; furthermore, they are useful to better define the territorial sub-segments of the real estate market and provide opportunities for its possible restart.

6.4. General impact and future insight

The impacts of the results of this research work concern two main fields: public protection policies and the development of analyses on the real estate market. As regards public policies, in fact, can be identified some differentiated and integrated actions aimed at the dissemination and conservation of the 20th century heritage to be implemented at the building and territorial levels. Different types of policies: Cultural policies (for public and private buildings), Building policies and Territorial policies and some future insights are briefly presented below.

1. *Cultural policies (for public buildings)*

Public policies relating to cultural heritage aims at bridging the cultural gap in recognising both the value of modern and contemporary architecture and the importance of conservation, moreover, these policies educate on the necessity of energy retrofit of building heritage and of the sustainability for environmental protection. The actions that can be carried out are different for publicly owned or publicly usable assets (large buildings) and private (residential) assets that are bought and sold in the market. In the case of large buildings, often already recognised by architectural critics, it is possible to expand the existing collaborative platforms also by integrating them with user-generated contents, aimed at made the architectural heritage of the 20th century recognised and appreciated.

2. *Cultural policies (for private buildings)*

The platforms inherent to the great architectures built in the 1900s should be interconnected at an international level and to residential architecture, which have been forgotten by architectural critics, except in particular cases.

In fact, it is necessary to promote the diffusion of the values of the architecture created by the architects of the second half of the twentieth century belonging to movements conceived to unify the architectural language at an international level.

In these cases, the interventions could directly involve the inhabitants of the buildings themselves. Through the shared drafting of a "Building management report" and of a

"Tenant/owner guides" that could report the history of the building (from information about the architect or author, to all the subsequent transformations) and that can keep track of maintenance (and protection) interventions in the time and the related costs, it could be suggested a correct owner/tenant behaviour for conservation and for the environmental footprint reduction. When involved as stakeholders in the conservation project of their home, moreover if it is an important residential architecture, inhabitants themselves would become more aware and prouder of the building in which they live. Similar projects have been carried out as part of the Getty Foundation's "Keep it Modern" project developing best practices such as the John Allen intervention in London (from the conference contribution of Antoine Wilmering "Keeping it Modern: a deliberate approach toward preserving the modern past", 2021).

3. Building policies.

Action on energy redevelopment building policies would be necessary and urgent. The residential heritage of the 20th century is very energy - consuming and it therefore need green retrofit interventions. It is therefore necessary to drive and manage the energy retrofit interventions, also considering that buyers are becoming even more susceptible to environmental quality (higher EPC labels). Green policies must encourage retrofit interventions and at the same time protect the original value of the assets. The quality of the built heritage of the second half of the 20th century, which is a small part of the whole heritage built during the development of cities, must be distinguished. Taking into account the various urban and socio-economic contexts, it necessary to protect and preserve the identity of the architectural built heritage also in view of energy retrofit interventions.

In fact, Italy is implementing tax incentive policies aimed at the energy upgrading of the energy heritage, which can put at risk the architectural features that characterize the heritage of the 20th century that it is not currently protected. The "Super Eco-bonus" and "Sisma-Bonus" foreshadow important incentives for the qualification of existing assets, with the objective of increasing environmental sustainability, but without considering the architectural quality component of the built heritage, much less of the contemporary heritage. They do not consider the problem of the protection of values of architectural quality or even the possibility of "adding" quality to the existing buildings that does not have it, as in the case of some economic buildings of the 60s and 70s.

4. Territorial policies.

It is necessary that the resources that are available today, or that will be available with the "Next generation EU" funds, which can be invested in interventions on single assets or single buildings, will be territorially concentrated in vulnerable urban areas in order to favour the processes of urban redevelopment and regeneration and it can guide interventions on quality architectures that fall into difficult socio-cultural contexts that do not allow their enhancement.

Future insight

The presented research work also opens the way to various possible applications and insights for real estate market analysis, on a methodological and theoretical level for the formalization of new hypotheses concerning the mechanisms that regulate the real estate market.

The methodological approach presented could be applicated both to other urban areas and on areas at different scales. Surely the presented methodological approach can be applied, with few changes to other Italian urban contexts and this would allow its validation as well as offering interesting comparison results. Moreover, it could be applied to smaller and diversified urban sub-areas, to better read and interpret some micro-phenomena, which influence the transformations and the use of buildings at the district or neighbourhood scale.

Models could be strengthened by the introduction of variables related to the extrinsic features of buildings, as suggested by most of the literature. This would allow to describe different aspects of the surrounding/neighbourhood quality by the construction of different indicators: e.g., the quality of the views, the quality of public areas in the neighbours, the quality derived from the vicinity to green areas, the quality of accesses, etc. This would be useful for real estate operators and valuators for estimating the quality of the surroundings, exactly as that of the building.

In addition, the analyses could also consider the relationship between the system of values and the social values that make up the supply and demand of the real estate market. In a research already conducted in 2018, it has already been demonstrated how the social structure of the population influences the prices formation process and determines the formation of socially and economically homogeneous sub-segments of the market due to the presence of owners and tenants.

The relation between the real estate market and the urban *vibrancy*, is an ongoing research field which today offers various opportunities for analysing the urban and extra-urban heritage and environment.

The evolution of the social structure of cities explains many of the changes in the social composition of urban areas and in the territorial dynamics of the real estate market.

Finally, we could consider the use of spatial-temporal statistical models (GTWR), based on time series, to explain how ancient and modern heritage has been appreciated by different societies over time. Furthermore, other models could be used to analyse the stochastic and non-linear components of housing demand, also to assess the dynamism of urban and extra-urban areas. This, always with the aim of understanding the mechanisms that move preferences over time and space and therefore to direct the policies and interventions suitable to satisfy the needs related to living in its many forms.

6.5. Limitations

The research work was conditioned by the availability and quality of the existing databases that were essential to pursue the research objectives. The lack of digitized databases relating to the heritage of the twentieth century and the lack of public access to the official databases of the Italian Ministry of Economy and Finance (MEF) which contain the *universe of data* on sales made in all the national municipalities are not made available to researchers for privacy reasons. The availability of official databases would have made it possible to obtain more solid results also from a statistical and predictive point of view.

In fact, the use of listing prices, even if relative to the universe of homes offered in 2019 on the Turin real estate market, may have limited the results achieved by the analyses and certainly made the interpretation of the mechanisms more complex. The principal influence on price formation derives in fact from subject involved in the bargaining process.

The databases used have two fundamental limits: i) they do not capture the unsold phenomenon, ii) it does not allow us to know the actual price of the sold units, even though we know that the average difference between listing and sale prices in Turin was about 13% in 2019.

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Glossary of terms

Appraisal: a property market value estimation

Assessment: determining the tax level for a property based upon its relative market value.

Bargaining term: negotiating over the terms of a purchase, agreement, or contract.

Base map: a general purpose map upon which specific-purpose maps are based. A base map is usually made with reference to the national geodetic survey network and plotted in terms of national coordinate system.

Boundary: either the physical objects making the limits of a property or an imaginary line or surface making the division between two legal estates. Used to describe the division between features with different administrative, legal, land-use, topographic, etc. characteristics.

Building features: the structure, form, or appearance elements of a building.

Geographical Information System (GIS): a system for capturing, storing, checking, integrating, analysing and displaying data about the Earth that is spatially referenced. If is normally taken to include spatially referenced database and appropriate applications software.

Geographically Weighted Regression (GWR): The methodological framework underlying GWR is quite similar to that of local linear regression models, as it uses a kernel function to calculate weights for the estimation of local weighted regression models. Contrary to the standard regression model, where the regression coefficients are location-invariant, the specification of a basic GWR model for each location. As a result, GWR gives rise to a distribution of local estimated parameters.

Independent variables: generally, are not seen as depending on any other variable in the scope of the experiment in question. In this sense, are variables observation features of interest to predict future values. Models and experiments test the effects that the independent variables have on the dependent variables.

Listing price (LP): the price at which a residential unit is offered for sale.

Marginal effect: it tells us how a dependent variable (outcome) changes when a specific independent variable (explanatory variable) changes. Other covariates are assumed to be held constant. Marginal effects are often calculated when analysing regression analysis results.

Number of Normalized Transactions (NTN): number of property transaction, is one of the key indicators of Italian observatory of the real estate market (OMI)

Outliers: it is a data point that differs significantly from other observations. An outlier may be due to variability in the measurement, or it may indicate experimental error; the latter are sometimes excluded from the data set. An outlier can cause serious problems in statistical analyses.

Polarization: (of the market) division into two sharply contrasting groups on the extreme of the scale of values. Very low in contrast with very high values, without grey zones.

Property value: the economic value of real estate property.

Proximity effect: Dealing with point clouds, there is no explicit connectivity information between points. This means that all computations are based on spatial proximity between point samples instead of geodesic proximity between mesh vertices. The proximity effect is the influence may occur between observation near in the space.

Regression: is a frequently used statistical technique in economic, social, behavioural, physical, and biological sciences. Its main objective is to quantify the relationship between a dependent variable (usually denoted by Y) and one or more independent variables (which are also called 'predictors' or 'explanatory variables')

Selling price (SP): the price for which a residential unit is actually sells.

Spatial component: The spatial variation of both the dependent variable and the main predictor can be explored through exploratory spatial data analysis techniques. Central to the spatial framework is the choice of the matrix that describes the interaction structure of the cross-section units, i.e., the definition of proximity. For each spatial unit a relevant neighbouring set must be defined consisting of those units that potentially interact with it

Spatial join: a GIS operation that affixes data from one feature layer's attribute table to another from a spatial perspective. Spatial joins begin by selecting a target feature and comparing it spatially to other feature layers. The target features will inherit the attributes from the other features if and only if the two features share the same spatial reference.

Spatial referencing: the association on any entity with its absolute or relative location.

Spatial regression: Spatial regression deals with the specification, estimation, and diagnostic checking of regression models that incorporate spatial effects. Two broad classes of spatial effects may be distinguished, referred to as spatial dependence and spatial heterogeneity.

Stepwise: The stepwise regression (or stepwise selection) consists of iteratively adding and removing predictors, in the predictive model, in order to find the subset of variables in the data set resulting in the best performing model, that is a model that lowers prediction error.

Stratification: a process of creating several homogeneous segments from a larger heterogeneous database.

Sub-markets: geographic areas where (1) the price of housing (per unit of service) is constant and (2) individual housing characteristics are available for purchase.

Summary statistics: In descriptive statistics, summary statistics are used to summarize a set of observations, in order to communicate the largest amount of information as simply as possible. Statisticians commonly try to describe the observations in a measure of location, or central tendency, such as the arithmetic mean.

Variables (numerical and categorical): Categorical variables has categories or label values and place an individual observation into one of several groups. Quantitative (or numerical) variables take numerical values and represent some kind of measurement.

List of acronyms

ALL	Allocation Level
ARC	Air-conditioning system
BLDCAT	Building category
BLDTYP	Building Type
CBX	Car Box
CNSTM	Construction time period
ESDA	Exploratory spatial data analysis
GWR	Geogrphically Weighted Regression
GS	Gross surface
EPC	EPC label group
Leads	Number of Preference of an ADV
LFT	Lift
LISA	Local Indicator of spatial Association
LP	Listing Price
LogLP	Natural Logarithm of Listing Price
LTR	Large Terrace
MTL	Maintenance Level
MRA	Multiple Regression Analysis
NBT	Number of bathrooms
NRM	Number of rooms
ObeQ	Observed architectural and building Quality.
OLS	Ordinary Least Squares
QDB	Quality Data Base
RecQ	Recognised architectural and building Quality.
SEM	Spatial Error Model
TLP	Total Listing Price
Visits	Number of visits of an ADS
XXQDB	XX century Quality buildings Data Base
XXQDBS	XX century Quality buildings Data Base Sub-sample

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Appendix A

Spearman's Correlation Test

	LP	BLDCAT	LFT	NRM	LTR	EPC	RecQ	ObeQ
LP	1	0.307213	0.285557	0.181438	0.216798	0.077663	0.039192	0.160067
BLDCAT	0.307213	1	0.235926	0.095048	0.130653	0.111213	0.056762	0.178539
LFT	0.285557	0.235926	1	0.112128	0.07002	0.062336	0.022673	0.079969
NRM	0.181438	0.095048	0.112128	1	0.027997	-0.00718	0.008972	0.037945
LTR	0.216798	0.130653	0.07002	0.027997	1	0.071501	-0.0002	0.072144
EPC	0.077663	0.111213	0.062336	-0.00718	0.071501	1	0.02448	0.0425
RecQ	0.039192	0.056762	0.022673	0.008972	-0.0002	0.02448	1	0.019001
ObeQ	0.160067	0.178539	0.079969	0.037945	0.072144	0.0425	0.019001	1

Appendix B

Exploratory regression results

```
********************************************************************************
Choose 1 of 12 Summary
   Highest Adjusted R-Squared Results
AdjR2   AICc   JB K(BP)  VIF   SA   Model
 0,34 2067,47 0,00  0,00 1,00 0,00  +RMEDFAS***
 0,18 2756,64 0,00  0,52 1,00 0,00  +BCAT***
 0,13 2964,65 0,00  0,81 1,00 0,00  +BATHROOMS***
    Passing Models
AdjR2 AICc JB K(BP) VIF SA   Model
********************************************************************************
Choose 2 of 12 Summary
      Highest Adjusted R-Squared Results
AdjR2   AICc   JB K(BP)  VIF   SA   Model
 0,42 1640,15 0,00  0,00 1,07 0,00  +BCAT***  +RMEDFAS***
 0,41 1683,81 0,00  0,00 1,00 0,00  +STATUS***  +RMEDFAS***
 0,39 1781,87 0,00  0,00 1,03 0,00  +ELEV***  +RMEDFAS***
    Passing Models
AdjR2 AICc JB K(BP) VIF SA   Model
********************************************************************************
Choose 3 of 12 Summary
         Highest Adjusted R-Squared Results
AdjR2   AICc   JB K(BP) VIF   SA   Model
 0,47 1319,32 0,00  0,00 1,09 0,00  +BCAT***  +STATUS***  +RMEDFAS***
 0,46 1383,14 0,00  0,00 1,03 0,00  +ELEV***  +STATUS***  +RMEDFAS***
 0,45 1437,98 0,00  0,00 1,09 0,00  +BCAT***  +EPC_CL***  +RMEDFAS***
    Passing Models
AdjR2 AICc JB K(BP) VIF SA   Model
********************************************************************************
Choose 4 of 12 Summary
            Highest Adjusted R-Squared Results
AdjR2   AICc   JB K(BP)  VIF   SA   Model
 0,50 1134,10 0,00  0,00 1,16 0,00  +BCAT***  +ELEV***  +STATUS***  +RMEDFAS***
 0,49 1192,34 0,00  0,00 1,09 0,00  +ELEV***  +BATHROOMS***  +STATUS***  +RMEDFAS***
 0,49 1193,87 0,00  0,00 1,17 0,00  +BCAT***  +ROOMS***  +STATUS***  +RMEDFAS***
    Passing Models
AdjR2 AICc JB K(BP) VIF SA   Model
********************************************************************************
Choose 5 of 12 Summary
               Highest Adjusted R-Squared Results
AdjR2   AICc   JB K(BP)  VIF   SA   Model
 0,52 1019,98 0,00  0,00 1,23 0,00  +BCAT***  +ELEV***  +ROOMS***  +STATUS***  +RMEDFAS***
 0,52  1027,28  0,00   0,00  1,25  0,00   +BCAT***   +ELEV***   +BATHROOMS***   +STATUS***
+RMEDFAS***
```

0,52 1033,00 0,00 0,00 1,17 0,00 +BCAT*** +ELEV*** +STATUS*** +EPC_CL*** +RMEDFAS***
Passing Models
AdjR2 AICc JB K(BP) VIF SA Model
****
Choose 6 of 12 Summary
Highest Adjusted R-Squared Results
AdjR2 AICc JB K(BP) VIF SA Model
0,53 927,37 0,00 0,00 1,24 0,00 +BCAT*** +ELEV*** +ROOMS*** +STATUS*** +EPC_CL*** +RMEDFAS***
0,53 943,98 0,00 0,00 1,25 0,00 +BCAT*** +ELEV*** +BATHROOMS*** +STATUS*** +EPC_CL*** +RMEDFAS***
0,52 985,39 0,00 0,00 1,26 0,00 +BCAT*** +ELEV*** +ROOMS*** +STATUS*** +TERRACE*** +RMEDFAS***
Passing Models
AdjR2 AICc JB K(BP) VIF SA Model
****
Choose 7 of 12 Summary
Highest Adjusted R-Squared Results
AdjR2 AICc JB K(BP) VIF SA Model
0,54 896,09 0,00 0,00 1,26 0,00 +BCAT*** +ELEV*** +ROOMS*** +STATUS*** +TERRACE*** +EPC_CL*** +RMEDFAS***
0,54 909,66 0,00 0,00 1,24 0,00 +BCAT*** +ELEV*** +ROOMS*** -GARAGE*** +STATUS*** +EPC_CL*** +RMEDFAS***
0,54 912,25 0,00 0,00 1,86 0,00 +BCAT*** +ELEV*** +ROOMS*** +BATHROOMS*** +STATUS*** +EPC_CL*** +RMEDFAS***
Passing Models
AdjR2 AICc JB K(BP) VIF SA Model

****
********** Exploratory Regression Global Summary (LOGPOMQ_1) **********

Percentage of Search Criteria Passed
Search Criterion Cutoff Trials # Passed % Passed
Min Adjusted R-Squared > 0,50 3301 238 7,21
Max Coefficient p-value < 0,05 3301 2196 66,53
Max VIF Value < 7,50 3301 3301 100,00
Min Jarque-Bera p-value > 0,10 3301 0 0,00
Min Spatial Autocorrelation p-value > 0,10 24 0 0,00

Summary of Variable Significance
Variable % Significant % Negative % Positive
BCAT 100,00 0,00 100,00
ELEV 100,00 0,00 100,00
ROOMS 100,00 0,00 100,00
BATHROOMS 100,00 0,00 100,00
GARAGE 100,00 100,00 0,00
STATUS 100,00 0,00 100,00
TERRACE 100,00 0,00 100,00
AIR_CONDIT 100,00 0,00 100,00
EPC_CL 100,00 0,00 100,00
RMEDFAS 100,00 0,00 100,00
QLT_SCN 60,57 20,05 79,95

QLT_RIC 53,03 21,80 78,20

Summary of Multicollinearity

Variable	VIF	Violations	Covariates
BCAT	1,33	0	--------
ELEV	1,11	0	--------
ROOMS	1,77	0	--------
BATHROOMS	1,91	0	--------
GARAGE	1,02	0	--------
STATUS	1,11	0	--------
TERRACE	1,08	0	--------
AIR_CONDIT	1,04	0	--------
EPC_CL	1,13	0	--------
QLT_RIC	1,02	0	--------
QLT_SCN	1,15	0	--------
RMEDFAS	1,14	0	--------

Summary of Residual Normality (JB)

JB	AdjR2	AICc	K(BP)	VIF	SA	Model
0,012523	0,114305	3009,623834	0,033688	1,000811	0,000000	+ELEV*** +QLT_RIC***
0,011259	0,111703	3018,178781	0,013197	1,000000	0,000000	+ELEV***
0,010039	0,124318	2973,573848	0,057409	1,003041	0,000000	+ELEV*** +AIR_CONDIT*** +QLT_RIC***

Summary of Residual Spatial Autocorrelation (SA)

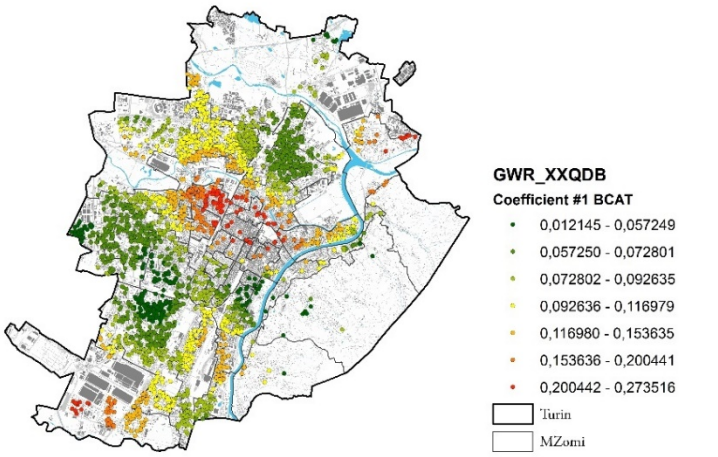
SA	AdjR2	AICc	JB	K(BP)	VIF	Model
0,000000	0,537658	896,086797	0,000000	0,000000	1,263173	+BCAT*** +ELEV*** +ROOMS*** +STATUS*** +TERRACE*** +EPC_CL*** +RMEDFAS***
0,000000	0,535729	909,657169	0,000000	0,000000	1,236920	+BCAT*** +ELEV*** +ROOMS*** -GARAGE*** +STATUS*** +EPC_CL*** +RMEDFAS***
0,000000	0,535359	912,254583	0,000000	0,000000	1,863807	+BCAT*** +ELEV*** +ROOMS*** +BATHROOMS*** +STATUS*** +EPC_CL*** +RMEDFAS***

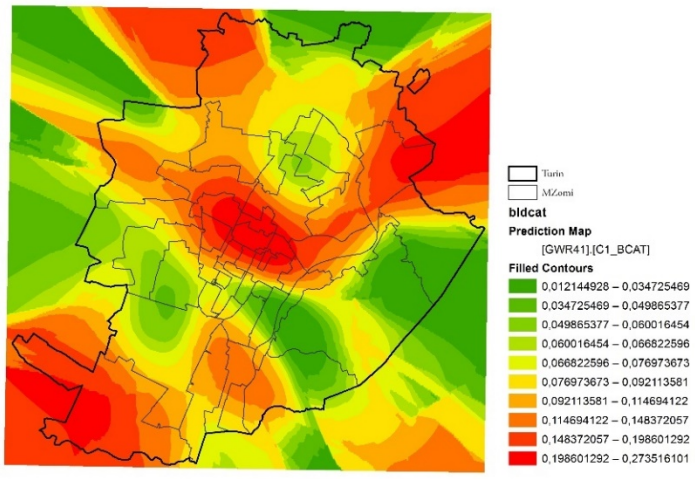
Table Abbreviations
AdjR2 Adjusted R-Squared
AICc Akaike's Information Criterion
JB Jarque-Bera p-value
K(BP) Koenker (BP) Statistic p-value
VIF Max Variance Inflation Factor
SA Global Moran's I p-value
Model Variable sign (+/-)
Model Variable significance (* = 0,10; ** = 0,05; *** = 0,01)

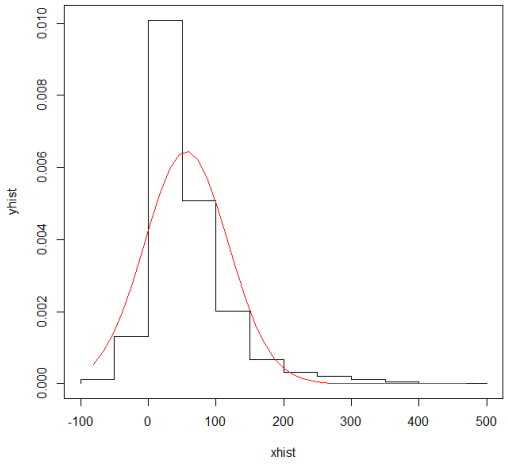
Appendix C

GWR coefficients analysis

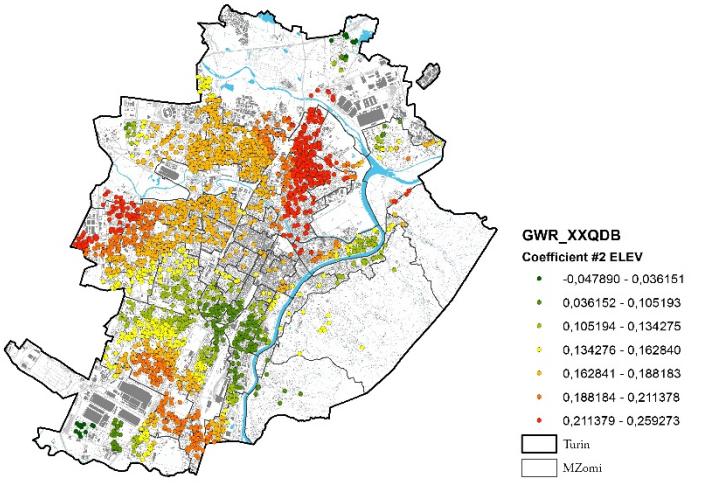
C1 – Building Category (BLTCT)

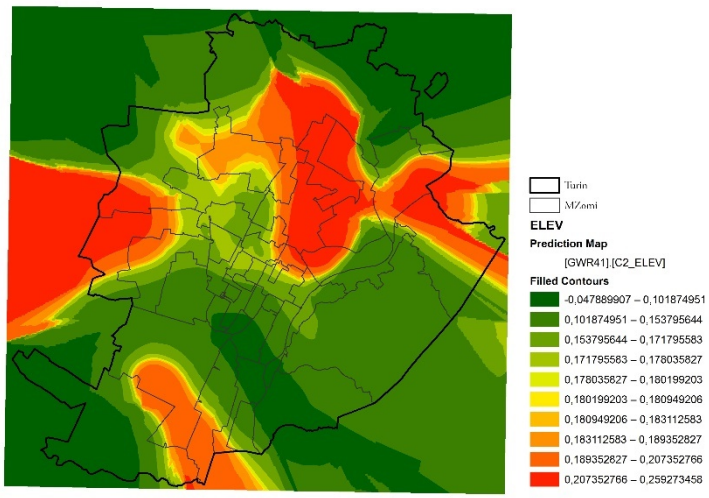


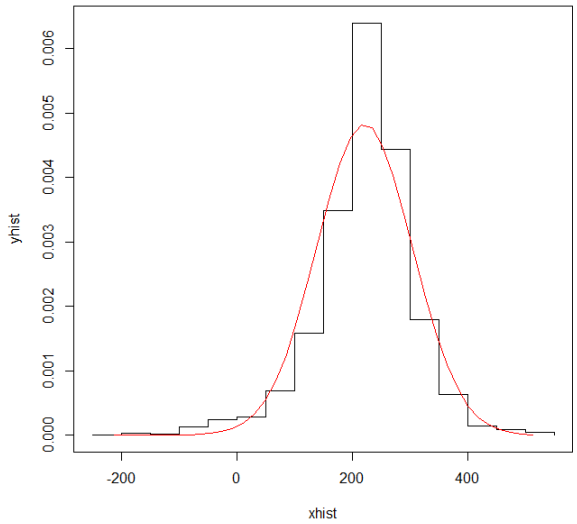




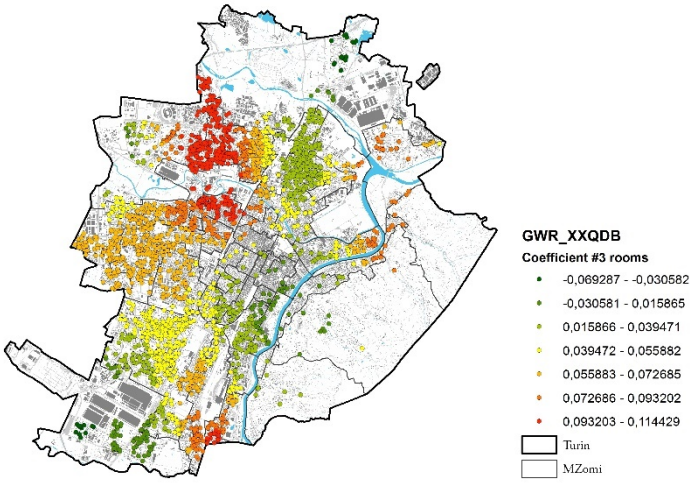
C2 – Presence of Elevator (ELV)

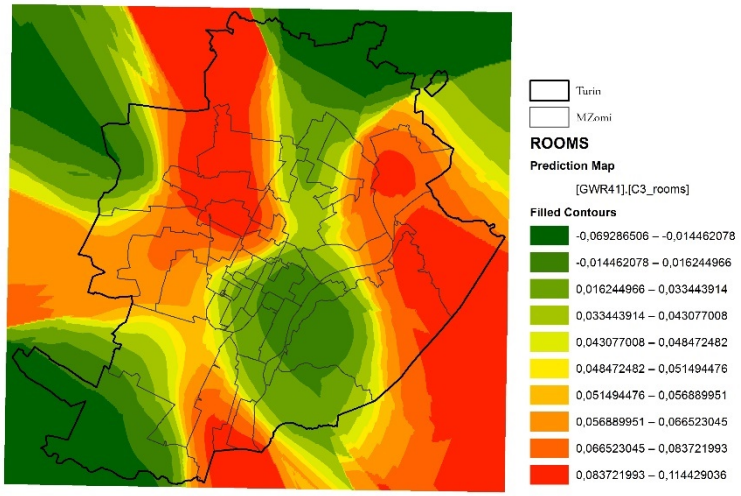


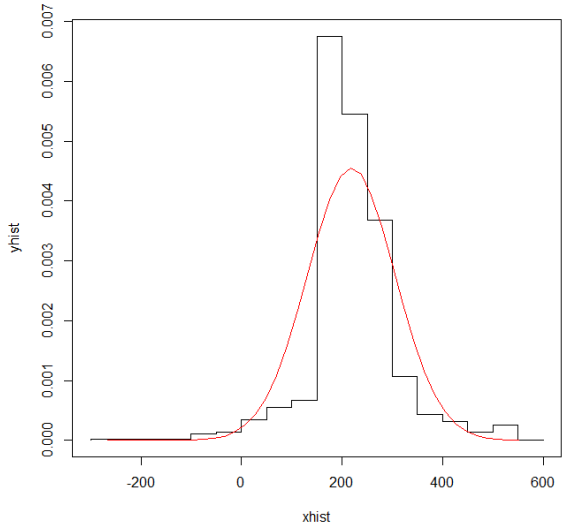




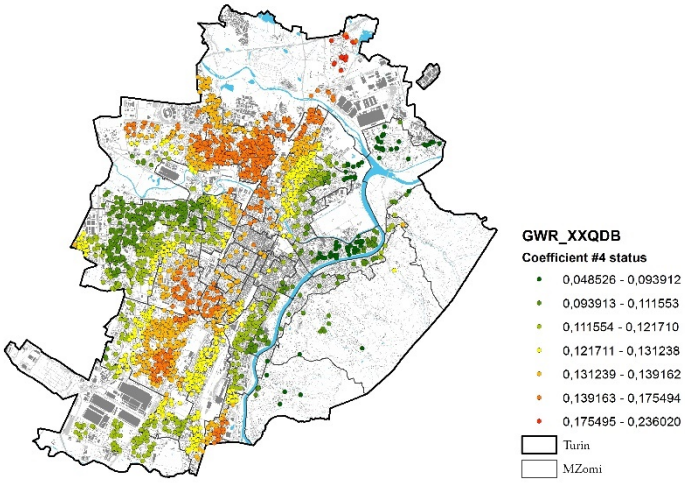
C3 – Number of Rooms (NRM)

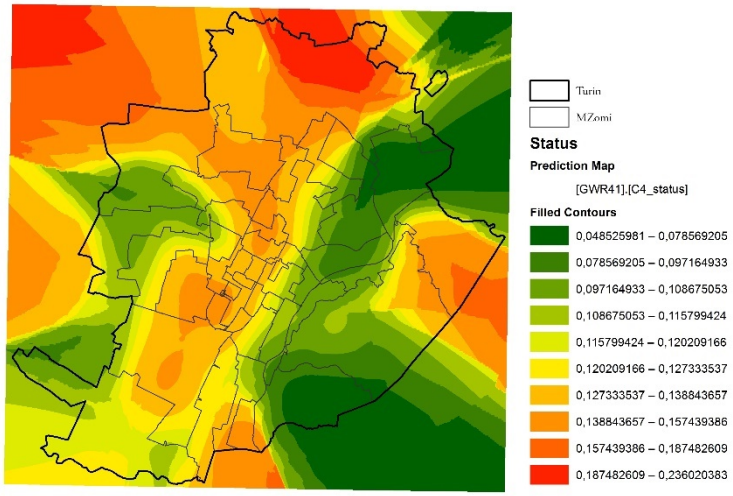


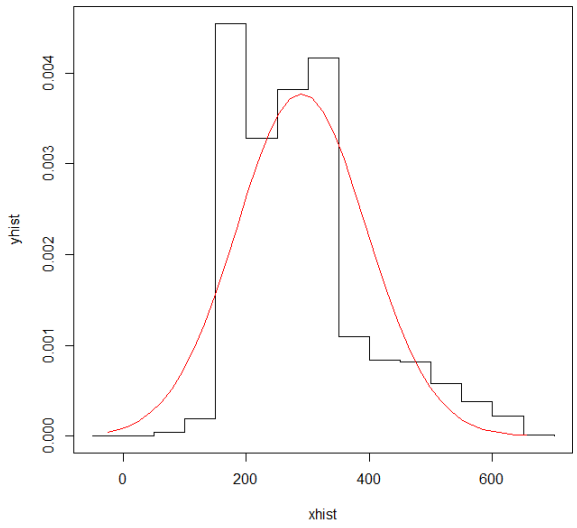




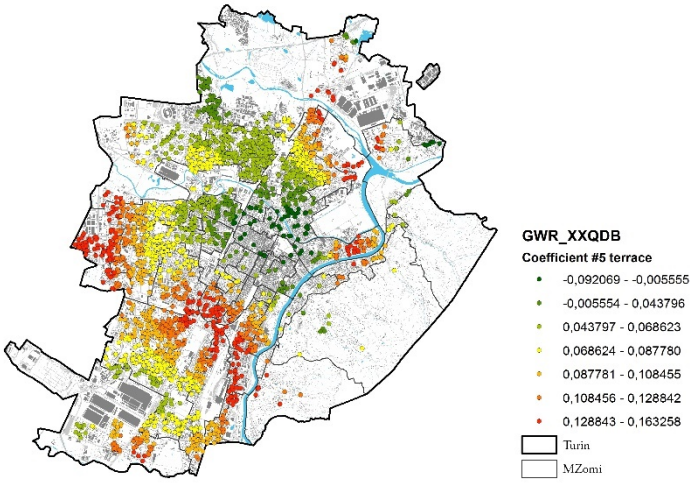
C4 – Level of maintenance (LMN)

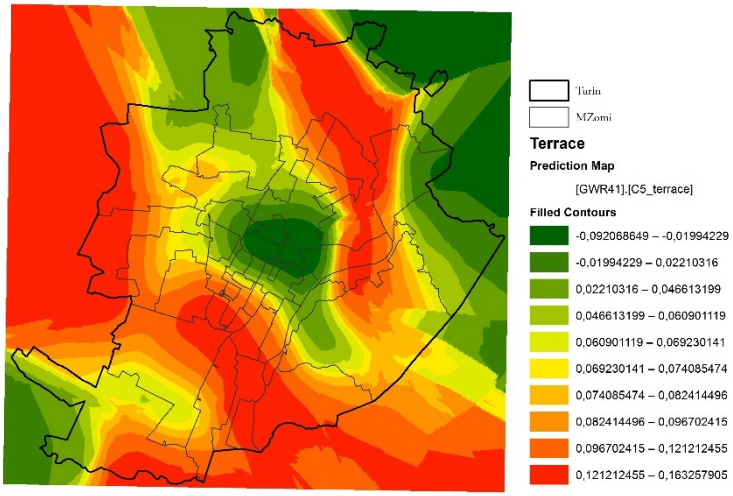


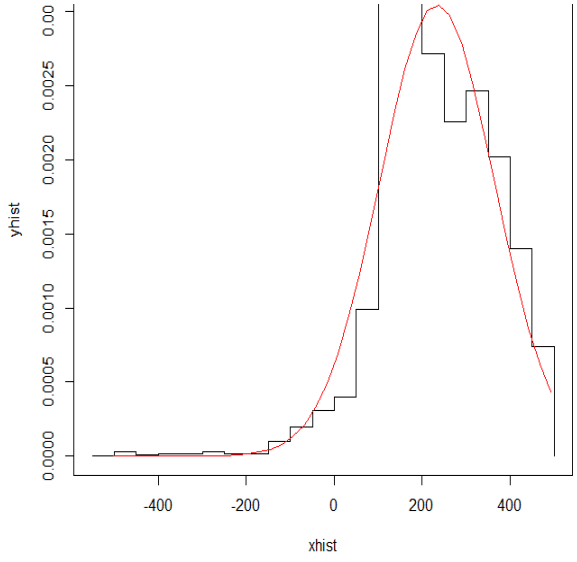




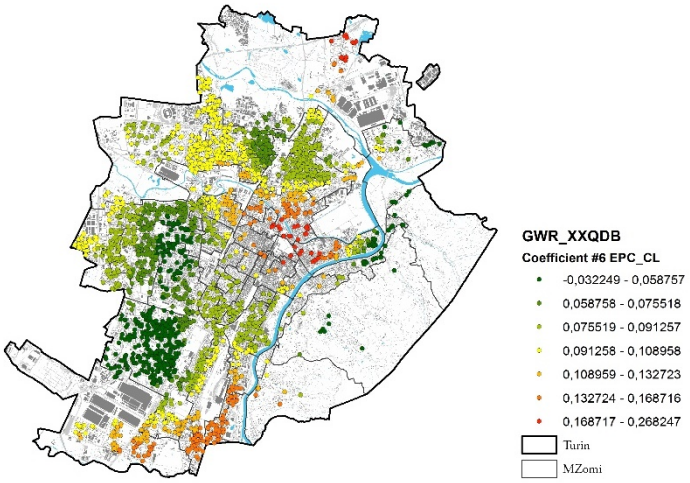
C5_Presence of LargeTerrace (LTR)

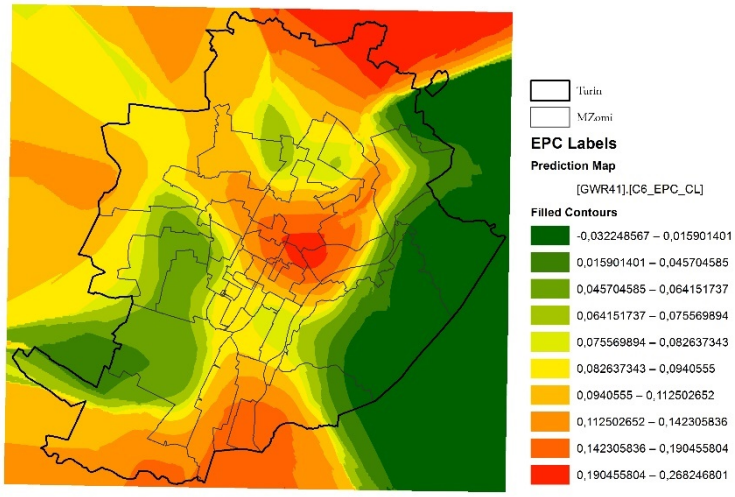


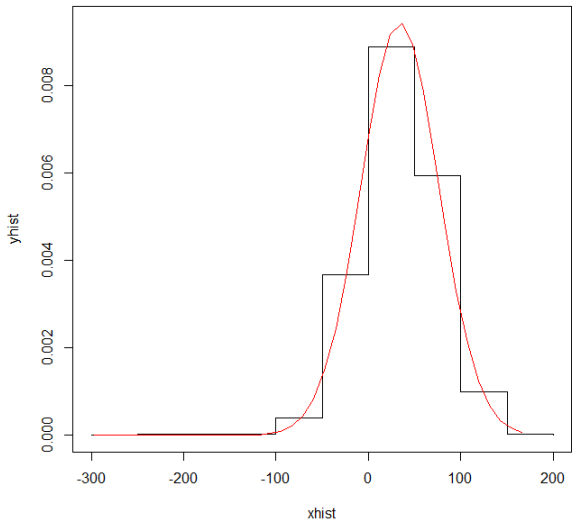




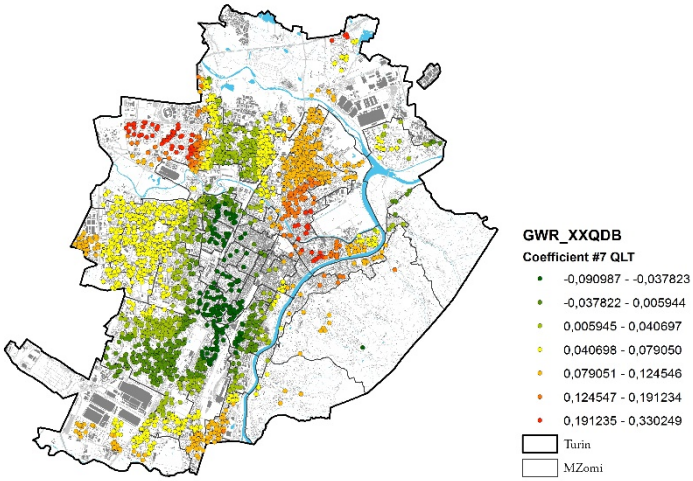
C7-EPC Labels Groups (EPC)

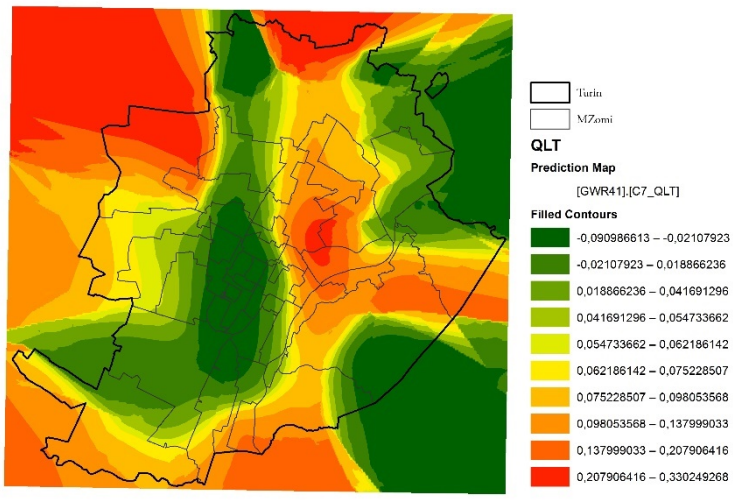


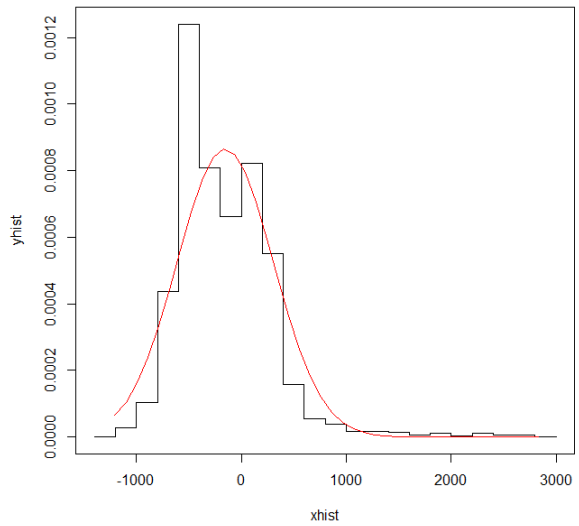




C7 – Architectural Quality (RecQ and ObeQ)







Appendix D

Results of OLS, SEM and GWR models on XXQDB sub-sample made of 116 priced quality building data.

FID	XXID	LP	LOGLP	MZ OMI	OLS PREDIC	OLS Residual	OLS StdResid
0	1011629	2878.788	6.864	2.000	7.456	-0.533	-1.930
1	1011573	2578.947	6.864	2.000	7.554	-0.632	-2.286
2	1011578	2727.273	6.864	2.000	7.452	-0.527	-1.907
3	1011632	2789.474	6.864	2.000	7.697	-0.772	-2.792
4	1009442	983.333	6.891	1.000	6.911	-0.031	-0.113
5	1010632	987.500	6.895	2.000	7.295	-0.397	-1.437
6	1001482	1154.545	7.051	1.000	7.454	-0.418	-1.515
7	1003394	1215.385	7.103	2.000	7.451	-0.356	-1.287
8	1009014	1250.000	7.131	1.000	7.039	0.143	0.519
9	1000069	1250.000	7.131	2.000	7.325	-0.210	-0.761
10	1002915	1285.714	7.159	2.000	7.576	-0.409	-1.480
11	1001965	1289.474	7.162	2.000	7.364	-0.210	-0.759
12	1006935	1306.667	7.175	1.000	6.989	0.156	0.566
13	1001866	1312.500	7.180	1.000	6.996	0.168	0.609
14	1005995	1312.500	7.180	2.000	7.619	-0.437	-1.583
15	1011617	2210.526	7.190	2.000	7.554	-0.305	-1.104
16	1008878	1352.941	7.210	2.000	7.402	-0.187	-0.676
17	1009538	1369.231	7.222	2.000	7.306	-0.094	-0.340
18	1004990	1396.226	7.242	2.000	7.451	-0.356	-1.287
19	1005067	1441.441	7.273	2.000	7.636	-0.313	-1.131
20	1010052	1500.000	7.313	2.000	7.449	-0.143	-0.516
21	1003598	1519.231	7.326	2.000	7.284	-0.155	-0.562
22	1003859	1550.000	7.346	2.000	7.416	-0.063	-0.227
23	1002834	1560.000	7.352	2.000	7.364	-0.210	-0.759
24	1001185	1627.273	7.395	2.000	7.652	-0.272	-0.983
25	1005447	1638.889	7.402	2.000	7.501	-0.146	-0.528
26	1007840	1642.857	7.404	2.000	7.402	-0.187	-0.676
27	1001118	1666.667	7.419	3.000	7.958	-0.486	-1.758
28	1005472	1666.667	7.419	2.000	7.775	-0.339	-1.225
29	1009006	1687.500	7.431	2.000	7.571	-0.239	-0.866
30	1006261	1733.333	7.458	2.000	7.523	-0.072	-0.262
31	1009058	1737.500	7.460	2.000	7.771	-0.297	-1.074
32	1007760	1741.803	7.463	2.000	7.501	0.023	0.084
33	1009180	1766.667	7.477	2.000	7.771	-0.297	-1.074
34	1001317	1793.333	7.492	2.000	7.422	-0.007	-0.024
35	1003365	1818.182	7.506	2.000	7.516	-0.049	-0.176
36	1008113	1833.333	7.514	1.000	7.310	0.204	0.738
37	1002920	1839.506	7.517	2.000	7.501	-0.030	-0.110
38	1006500	1850.000	7.523	2.000	7.487	-0.007	-0.026
39	1003635	1853.933	7.525	2.000	7.396	0.128	0.464
40	1005744	1862.745	7.530	2.000	7.707	-0.185	-0.671
41	1001774	1866.667	7.532	2.000	7.529	0.002	0.006
42	1005375	1866.667	7.532	2.000	7.765	-0.225	-0.815
43	1004652	1869.565	7.533	2.000	7.505	0.088	0.317
44	1009205	1876.923	7.537	2.000	7.619	-0.437	-1.583

45	1010248	1877.778	7.538	2.000	7.514	0.025	0.092
46	1009880	1888.889	7.544	2.000	7.483	0.057	0.205
47	1001428	1912.568	7.556	1.000	7.468	0.145	0.526
48	1010400	1940.000	7.570	2.000	7.722	-0.140	-0.507
49	1007771	1966.667	7.584	2.000	7.505	0.089	0.322
50	1002594	1976.471	7.589	2.000	7.561	0.015	0.055
51	1003303	1985.714	7.594	2.000	7.498	0.089	0.321
52	1008557	1996.000	7.599	2.000	7.734	-0.085	-0.309
53	1008731	2000.000	7.601	2.000	7.501	-0.030	-0.110
54	1010231	2000.000	7.601	2.000	7.761	-0.117	-0.424
55	1010944	2011.494	7.607	2.000	7.771	-0.150	-0.544
56	1010338	2027.273	7.614	2.000	7.820	-0.192	-0.694
57	1003873	2045.455	7.623	3.000	7.996	-0.354	-1.281
58	1003048	2100.000	7.650	2.000	7.595	0.033	0.118
59	1006915	2105.882	7.652	3.000	7.845	-0.335	-1.211
60	1007048	2124.183	7.661	1.000	7.482	0.213	0.769
61	1010450	2135.714	7.667	2.000	7.565	0.063	0.229
62	1005816	2151.079	7.674	1.000	7.468	0.263	0.951
63	1008321	2177.419	7.686	2.000	7.575	0.124	0.450
64	1006003	2208.333	7.700	2.000	7.820	-0.106	-0.384
65	1008696	2209.302	7.700	2.000	7.616	0.083	0.302
66	1003250	2225.000	7.708	1.000	7.124	0.587	2.123
67	1006734	2233.333	7.711	2.000	7.306	-0.094	-0.340
68	1009794	2239.130	7.714	2.000	7.546	0.160	0.578
69	1000304	2245.614	7.717	2.000	7.771	-0.040	-0.146
70	1008579	2275.000	7.730	2.000	7.614	0.101	0.367
71	1002356	2300.000	7.741	2.000	7.770	-0.028	-0.101
72	1005246	2307.692	7.744	3.000	7.813	-0.097	-0.352
73	1007714	2333.333	7.755	1.000	7.210	0.536	1.940
74	1008417	2333.333	7.755	2.000	7.541	0.225	0.814
75	1005104	2346.939	7.761	2.000	7.541	0.231	0.835
76	1000737	2350.515	7.762	2.000	7.445	0.313	1.133
77	1001088	2427.007	7.794	2.000	7.495	0.355	1.284
78	1009934	2457.143	7.807	3.000	8.085	-0.281	-1.018
79	1008794	2458.333	7.807	2.000	7.525	0.274	0.993
80	1009340	2458.824	7.807	2.000	7.667	0.137	0.497
81	1002219	2488.889	7.820	2.000	7.982	-0.110	-0.400
82	1007013	2500.000	7.824	2.000	7.471	0.349	1.264
83	1008623	2500.000	7.824	2.000	7.552	0.232	0.840
84	1005557	2500.000	7.824	2.000	7.873	-0.055	-0.199
85	1007249	2520.000	7.832	3.000	7.979	-0.128	-0.462
86	1001054	2541.667	7.841	2.000	7.689	0.210	0.758
87	1004306	2549.020	7.843	2.000	7.700	0.139	0.505
88	1005794	2560.000	7.848	2.000	7.783	0.126	0.456
89	1005257	2582.160	7.856	2.000	7.542	0.361	1.308
90	1000058	2592.593	7.860	2.000	7.733	0.141	0.511
91	1005197	2602.273	7.864	1.000	7.088	0.778	2.817
92	1004775	2622.222	7.872	2.000	7.982	-0.110	-0.400
93	1002859	2750.000	7.919	2.000	7.547	0.386	1.399
94	1000154	2760.000	7.923	2.000	7.707	0.205	0.742
95	1005299	2785.714	7.932	2.000	7.471	0.349	1.264
96	1003397	2800.000	7.937	3.000	8.090	-0.131	-0.473
97	1001235	2821.429	7.945	3.000	7.979	-0.128	-0.462
98	1010925	2920.000	7.979	2.000	7.910	0.121	0.439

99	1006654	2975.000	7.998	3.000	8.096	-0.046	-0.168
100	1000346	3000.000	8.006	3.000	7.906	-0.027	-0.096
101	1002041	3000.000	8.006	2.000	7.963	0.088	0.317
102	1012047	3151.515	8.056	2.000	7.697	0.421	1.522
103	1009908	3400.000	8.132	3.000	8.096	-0.046	-0.168
104	1009945	3438.596	8.143	3.000	7.997	0.159	0.575
105	1001234	3757.576	8.232	2.000	8.023	0.264	0.954
106	1002215	4125.000	8.325	3.000	7.968	0.428	1.548
107	1008745	4250.000	8.355	3.000	8.054	0.322	1.164
108	1009878	5000.000	8.517	4.000	8.363	0.156	0.564
109	1011888	2290.000	7.736	3.000	7.922	-0.119	-0.431
110	1012046	2613.793	7.869	2.000	7.505	0.423	1.530
111	1012045	2681.818	7.894	2.000	7.602	0.350	1.267
112	1012050	3152.866	8.056	1.000	7.373	0.736	2.664
113	1012051	3163.265	8.059	3.000	8.301	-0.170	-0.616
114	1012044	3016.393	8.012	2.000	7.656	0.395	1.428
115	1012049	3037.037	8.019	2.000	7.832	0.248	0.896

FID	XXID	ERR PRD	ERR PREDIC	ERR RESIDU
0	1011629	-0.337	7.201	-0.678
1	1011573	-0.420	7.284	-0.649
2	1011578	-0.295	7.158	-0.565
3	1011632	-0.547	7.411	-0.841
4	1009442	-0.264	7.155	-0.362
5	1010632	-0.180	7.075	-0.237
6	1001482	-0.513	7.564	-0.425
7	1003394	-0.155	7.258	-0.206
8	1009014	-0.028	7.159	0.164
9	1000069	0.014	7.117	0.020
10	1002915	-0.171	7.330	-0.326
11	1001965	-0.022	7.184	-0.206
12	1006935	0.026	7.149	-0.049
13	1001866	-0.004	7.184	0.063
14	1005995	-0.192	7.371	-0.219
15	1011617	-0.094	7.284	-0.433
16	1008878	0.009	7.201	-0.109
17	1009538	0.122	7.100	0.101
18	1004990	-0.155	7.258	-0.206
19	1005067	-0.096	7.369	-0.170
20	1010052	0.084	7.229	-0.108
21	1003598	0.079	7.246	-0.164
22	1003859	0.083	7.263	0.010
23	1002834	-0.022	7.184	-0.206
24	1001185	-0.009	7.404	-0.131
25	1005447	0.132	7.270	-0.042
26	1007840	0.009	7.201	-0.109
27	1001118	0.093	7.325	-0.271
28	1005472	-0.080	7.498	-0.191
29	1009006	0.016	7.415	-0.349
30	1006261	0.170	7.288	0.010
31	1009058	-0.029	7.489	-0.055
32	1007760	0.263	7.200	0.042
33	1009180	-0.029	7.489	-0.055
34	1001317	0.264	7.228	0.065

35	1003365	0.193	7.312	0.032
36	1008113	0.099	7.415	0.031
37	1002920	0.247	7.270	0.011
38	1006500	0.235	7.288	0.083
39	1003635	0.324	7.201	0.265
40	1005744	0.085	7.445	-0.071
41	1001774	0.244	7.288	0.091
42	1005375	0.043	7.489	-0.081
43	1004652	0.291	7.242	0.023
44	1009205	-0.192	7.371	-0.219
45	1010248	0.301	7.237	0.043
46	1009880	0.324	7.220	0.175
47	1001428	0.021	7.536	-0.053
48	1010400	0.085	7.485	-0.261
49	1007771	0.300	7.284	0.267
50	1002594	0.263	7.326	0.133
51	1003303	0.323	7.271	0.073
52	1008557	0.147	7.452	-0.060
53	1008731	0.247	7.270	0.011
54	1010231	0.118	7.483	-0.255
55	1010944	0.118	7.489	-0.101
56	1010338	0.084	7.531	-0.040
57	1003873	0.261	7.362	-0.035
58	1003048	0.278	7.371	0.080
59	1006915	0.283	7.370	-0.225
60	1007048	0.093	7.568	0.084
61	1010450	0.313	7.354	0.115
62	1005816	0.138	7.536	-0.029
63	1008321	0.408	7.278	0.276
64	1006003	0.169	7.531	0.054
65	1008696	0.338	7.362	0.179
66	1003250	0.461	7.246	0.664
67	1006734	0.122	7.100	0.101
68	1009794	0.401	7.312	0.007
69	1000304	0.228	7.489	0.146
70	1008579	0.359	7.371	0.160
71	1002356	0.243	7.498	0.105
72	1005246	0.498	7.246	0.153
73	1007714	0.426	7.329	0.270
74	1008417	0.467	7.288	0.290
75	1005104	0.473	7.288	0.326
76	1000737	0.576	7.187	0.392
77	1001088	0.595	7.200	0.243
78	1009934	0.337	7.470	0.097
79	1008794	0.491	7.316	0.360
80	1009340	0.393	7.415	0.231
81	1002219	0.215	7.604	-0.069
82	1007013	0.620	7.204	0.311
83	1008623	0.470	7.354	0.311
84	1005557	0.228	7.596	0.021
85	1007249	0.512	7.320	0.046
86	1001054	0.441	7.399	0.032
87	1004306	0.398	7.446	0.086
88	1005794	0.363	7.485	-0.042

89	1005257	0.573	7.284	0.319
90	1000058	0.404	7.456	0.194
91	1005197	0.622	7.242	0.446
92	1004775	0.215	7.604	-0.069
93	1002859	0.594	7.326	0.209
94	1000154	0.440	7.483	0.062
95	1005299	0.620	7.204	0.311
96	1003397	0.490	7.448	0.174
97	1001235	0.512	7.320	0.046
98	1010925	0.370	7.610	0.087
99	1006654	0.546	7.452	0.175
100	1000346	0.563	7.443	0.112
101	1002041	0.402	7.605	-0.017
102	1012047	0.645	7.411	0.220
103	1009908	0.546	7.452	0.175
104	1009945	0.732	7.411	0.285
105	1001234	0.585	7.646	0.199
106	1002215	0.997	7.328	0.385
107	1008745	0.911	7.443	0.357
108	1009878	1.131	7.387	0.512
109	1011888	0.453	7.284	0.173
110	1012046	0.626	7.242	0.276
111	1012045	0.569	7.325	0.200
112	1012050	0.606	7.450	0.699
113	1012051	0.441	7.619	0.232
114	1012044	0.621	7.391	0.237
115	1012049	0.492	7.526	0.086

FID	XXID	GWR Cond	GWR LocalR2	GWR Predicted	GWR Intercept	GWR Resid	GWR StdError
0	1011629	9.314	0.370	7.417	7.362	-0.553	0.239
1	1011573	9.260	0.340	7.525	7.409	-0.662	0.240
2	1011578	9.249	0.329	7.411	7.425	-0.547	0.235
3	1011632	9.286	0.349	7.663	7.399	-0.799	0.239
4	1009442	10.402	0.204	7.067	6.748	-0.176	0.047
5	1010632	9.543	0.335	7.113	7.205	-0.218	0.236
6	1001482	10.206	0.288	7.569	6.794	-0.518	0.175
7	1003394	10.772	0.329	7.307	7.229	-0.205	0.206
8	1009014	10.468	0.211	6.824	6.715	0.307	0.212
9	1000069	10.776	0.317	7.242	7.222	-0.111	0.233
10	1002915	10.359	0.351	7.428	7.200	-0.269	0.233
11	1001965	9.910	0.339	7.325	7.240	-0.163	0.218
12	1006935	10.055	0.353	7.236	7.030	-0.061	0.233
13	1001866	10.140	0.299	7.051	6.808	0.129	0.177
14	1005995	10.583	0.343	7.470	7.224	-0.290	0.236
15	1011617	9.300	0.372	7.504	7.346	-0.314	0.239
16	1008878	9.700	0.335	7.254	7.197	-0.044	0.241
17	1009538	9.911	0.339	7.219	7.240	0.003	0.215
18	1004990	10.772	0.329	7.307	7.229	-0.205	0.206
19	1005067	10.775	0.317	7.478	7.222	-0.204	0.234
20	1010052	9.892	0.388	7.446	7.161	-0.133	0.232
21	1003598	9.963	0.331	7.564	7.217	-0.238	0.198
22	1003859	9.564	0.335	7.251	7.201	0.095	0.232
23	1002834	9.910	0.339	7.325	7.240	-0.163	0.218
24	1001185	10.595	0.342	7.505	7.230	-0.111	0.238

25	1005447	9.913	0.389	7.633	7.145	-0.231	0.232
26	1007840	9.700	0.335	7.254	7.197	-0.044	0.241
27	1001118	9.367	0.203	7.698	7.620	-0.279	0.231
28	1005472	10.659	0.341	7.618	7.227	-0.200	0.235
29	1009006	9.232	0.333	7.755	7.413	-0.324	0.237
30	1006261	10.589	0.344	7.390	7.223	0.068	0.240
31	1009058	9.786	0.339	7.617	7.239	-0.157	0.235
32	1007760	9.270	0.359	7.429	7.375	0.034	0.235
33	1009180	9.786	0.339	7.617	7.239	-0.157	0.235
34	1001317	9.897	0.387	7.557	7.157	-0.065	0.233
35	1003365	9.891	0.389	7.588	7.161	-0.082	0.234
36	1008113	10.061	0.352	7.599	7.027	-0.085	0.236
37	1002920	9.907	0.388	7.631	7.149	-0.114	0.232
38	1006500	10.729	0.336	7.388	7.231	0.135	0.239
39	1003635	9.980	0.394	7.330	7.125	0.195	0.242
40	1005744	9.894	0.387	7.686	7.159	-0.156	0.240
41	1001774	10.415	0.346	7.421	7.230	0.111	0.238
42	1005375	10.471	0.344	7.630	7.231	-0.099	0.239
43	1004652	9.138	0.348	7.494	7.359	0.040	0.236
44	1009205	10.583	0.343	7.470	7.224	-0.290	0.236
45	1010248	9.628	0.380	7.452	7.261	0.086	0.231
46	1009880	9.890	0.389	7.473	7.163	0.071	0.230
47	1001428	10.052	0.400	7.739	6.909	-0.183	0.222
48	1010400	9.229	0.336	7.799	7.407	-0.229	0.235
49	1007771	10.668	0.302	7.366	7.203	0.218	0.221
50	1002594	9.916	0.393	7.739	7.142	-0.150	0.228
51	1003303	9.903	0.392	7.512	7.152	0.082	0.233
52	1008557	9.252	0.350	7.699	7.387	-0.100	0.237
53	1008731	9.907	0.388	7.631	7.149	-0.114	0.232
54	1010231	10.415	0.326	7.841	7.614	-0.240	0.171
55	1010944	9.906	0.386	7.671	7.151	-0.064	0.242
56	1010338	10.637	0.342	7.643	7.228	-0.028	0.239
57	1003873	9.370	0.220	7.815	7.588	-0.192	0.232
58	1003048	9.255	0.351	7.723	7.386	-0.074	0.234
59	1006915	9.264	0.304	7.949	7.374	-0.297	0.200
60	1007048	10.128	0.438	7.578	6.777	0.083	0.224
61	1010450	9.892	0.389	7.657	7.164	0.009	0.234
62	1005816	10.027	0.384	7.772	7.122	-0.099	0.230
63	1008321	9.927	0.387	7.516	7.141	0.170	0.240
64	1006003	10.609	0.344	7.642	7.224	0.058	0.239
65	1008696	9.963	0.392	7.524	7.157	0.176	0.240
66	1003250	10.208	0.255	7.127	6.804	0.581	0.235
67	1006734	9.911	0.339	7.219	7.240	0.003	0.215
68	1009794	9.310	0.310	7.639	7.439	0.075	0.205
69	1000304	10.471	0.344	7.630	7.231	0.086	0.239
70	1008579	9.913	0.389	7.625	7.145	0.105	0.241
71	1002356	9.889	0.386	7.765	7.163	-0.024	0.240
72	1005246	9.201	0.329	7.627	7.393	0.117	0.232
73	1007714	10.058	0.375	7.591	6.969	0.164	0.233
74	1008417	9.907	0.388	7.484	7.149	0.271	0.243
75	1005104	10.414	0.347	7.421	7.230	0.340	0.238
76	1000737	9.903	0.393	7.495	7.152	0.268	0.233
77	1001088	9.292	0.373	7.422	7.325	0.372	0.234
78	1009934	9.281	0.290	7.981	7.463	-0.174	0.185

79	1008794	9.599	0.345	7.459	7.143	0.348	0.235
80	1009340	10.567	0.345	7.534	7.222	0.273	0.239
81	1002219	9.225	0.318	7.881	7.436	-0.062	0.216
82	1007013	9.953	0.327	7.707	7.273	0.117	0.209
83	1008623	9.889	0.388	7.600	7.165	0.224	0.228
84	1005557	9.906	0.389	7.915	7.149	-0.091	0.231
85	1007249	9.347	0.196	7.817	7.631	0.015	0.213
86	1001054	9.310	0.308	7.686	7.440	0.154	0.235
87	1004306	9.890	0.288	7.939	7.293	-0.096	0.198
88	1005794	9.303	0.295	7.790	7.450	0.058	0.237
89	1005257	9.284	0.367	7.505	7.354	0.351	0.239
90	1000058	9.230	0.335	7.791	7.408	0.069	0.238
91	1005197	10.059	0.376	7.369	6.966	0.495	0.233
92	1004775	9.225	0.318	7.881	7.436	-0.062	0.216
93	1002859	9.281	0.366	7.590	7.354	0.330	0.235
94	1000154	9.366	0.340	7.778	7.374	0.145	0.229
95	1005299	9.953	0.327	7.707	7.273	0.117	0.209
96	1003397	9.332	0.292	7.875	7.460	0.062	0.232
97	1001235	9.347	0.196	7.817	7.631	0.015	0.213
98	1010925	9.254	0.301	7.923	7.465	0.056	0.233
99	1006654	9.231	0.322	7.746	7.406	0.252	0.229
100	1000346	9.401	0.244	7.817	7.293	0.190	0.227
101	1002041	9.288	0.232	7.974	7.558	0.032	0.203
102	1012047	9.701	0.297	7.869	7.402	0.186	0.204
103	1009908	9.231	0.322	7.746	7.406	0.252	0.229
104	1009945	9.407	0.286	7.832	7.473	0.311	0.229
105	1001234	9.346	0.382	7.956	7.327	0.276	0.205
106	1002215	9.391	0.244	7.586	7.297	0.738	0.229
107	1008745	9.321	0.197	7.900	7.637	0.455	0.231
108	1009878	9.350	0.210	8.305	7.632	0.212	0.154
109	1011888	9.372	0.209	7.678	7.608	0.059	0.234
110	1012046	9.700	0.298	7.737	7.403	0.132	0.213
111	1012045	9.306	0.295	7.597	7.447	0.297	0.238
112	1012050	9.439	0.423	7.808	7.017	0.248	0.192
113	1012051	9.316	0.317	7.907	7.432	0.152	0.226
114	1012044	9.298	0.290	7.653	7.452	0.359	0.213
115	1012049	9.307	0.296	7.829	7.448	0.189	0.236

Appendix E

XXQDBS - GWR results

ObjectID	*Observed*	*LocalR2*	*Predicted*	*Residual*	*StdError*	*StdResid*
0	5.298317	0.188218	7.393108	-2.09479	0.228164	-9.18107
1	5.75785	0.215816	6.718515	-0.96067	0.24421	-3.93377
2	5.805804	0.195168	6.767935	-0.96213	0.244693	-3.932
3	5.955097	0.184132	6.768089	-0.81299	0.244653	-3.32305
4	5.959716	0.381537	6.869335	-0.90962	0.240581	-3.78092
5	5.974657	0.187716	6.7852	-0.81054	0.244713	-3.31221
6	5.991465	0.179874	6.781682	-0.79022	0.244684	-3.22954
7	6.026556	0.16819	6.604026	-0.57747	0.240479	-2.40133
8	6.028948	0.202675	6.763239	-0.73429	0.244662	-3.00125
9	6.055543	0.195359	6.761421	-0.70588	0.244638	-2.8854
10	6.081077	0.38204	6.875985	-0.79491	0.242392	-3.27944
11	6.086775	0.234022	6.53149	-0.44472	0.240453	-1.84949
12	6.086775	0.249022	6.847807	-0.76103	0.240182	-3.16856
13	6.094322	0.322616	6.763489	-0.66917	0.240325	-2.78443
14	6.109248	0.177858	7.07848	-0.96923	0.242529	-3.99636
15	6.128666	0.175199	6.954567	-0.8259	0.243419	-3.39292
16	6.128666	0.187716	6.823666	-0.695	0.244018	-2.84815
17	6.160541	0.228158	6.778411	-0.61787	0.244536	-2.52671
18	6.173786	0.187716	6.7852	-0.61141	0.244713	-2.49849
19	6.18929	0.342145	7.152824	-0.96353	0.241244	-3.99402
20	6.18929	0.312817	7.061109	-0.87182	0.238393	-3.65706
21	6.192135	0.181319	6.728559	-0.53642	0.244143	-2.19717
22	6.197801	0.187716	6.746734	-0.54893	0.244433	-2.24574
23	6.2106	0.185436	6.594256	-0.38366	0.242018	-1.58524
24	6.212105	0.222569	6.954403	-0.7423	0.243959	-3.04271
25	6.214608	0.180347	6.643895	-0.42929	0.241956	-1.77424
26	6.214608	0.494573	6.625681	-0.41107	0.22023	-1.86656
27	6.214608	0.318975	7.097656	-0.88305	0.237378	-3.72001
28	6.227853	0.187716	6.7852	-0.55735	0.244713	-2.27755
29	6.236587	0.202484	6.699833	-0.46325	0.242608	-1.90944
30	6.236587	0.534856	6.443619	-0.20703	0.216271	-0.95728
31	6.237598	0.449709	6.803505	-0.56591	0.240037	-2.35759
32	6.262236	0.231167	6.834141	-0.5719	0.244663	-2.33752
33	6.267718	0.185965	6.592738	-0.32502	0.242037	-1.34285
34	6.271767	0.180671	6.915955	-0.64419	0.243946	-2.6407
35	6.271767	0.431219	6.926131	-0.65436	0.241251	-2.71237
36	6.276643	0.164136	6.780891	-0.50425	0.241303	-2.08969
37	6.279147	0.177506	6.818384	-0.53924	0.242135	-2.22701
38	6.294651	0.368375	6.852553	-0.5579	0.231243	-2.41262
39	6.296846	0.533304	6.450478	-0.15363	0.218901	-0.70183
40	6.298281	0.244193	6.795821	-0.49754	0.244575	-2.03431
41	6.299766	0.193693	6.761249	-0.46148	0.244609	-1.88661
42	6.30422	0.287173	6.814037	-0.50982	0.244545	-2.08476
43	6.304759	0.266763	6.720673	-0.41591	0.24287	-1.7125

44	6.317967	0.35267	6.739083	-0.42112	0.238491	-1.76575
45	6.319969	0.25555	6.801406	-0.48144	0.244515	-1.96895
46	6.319969	0.179238	6.695989	-0.37602	0.24275	-1.549
47	6.319969	0.241494	6.797074	-0.47711	0.244376	-1.95234
48	6.325834	0.177519	7.006295	-0.68046	0.242847	-2.80202
49	6.327937	0.367506	6.968605	-0.64067	0.243338	-2.63284
50	6.329677	0.414267	6.991481	-0.6618	0.244294	-2.70905
51	6.33721	0.37533	6.673393	-0.33618	0.24002	-1.40064
52	6.33721	0.176106	6.867598	-0.53039	0.242943	-2.18318
53	6.344286	0.19762	6.711189	-0.3669	0.239868	-1.52961
54	6.348139	0.173865	6.834009	-0.48587	0.241903	-2.00853
55	6.355484	0.195547	6.943507	-0.58802	0.242654	-2.4233
56	6.361212	0.178194	6.774056	-0.41284	0.242072	-1.70546
57	6.363028	0.407279	6.60078	-0.23775	0.239471	-0.99282
58	6.363028	0.220768	6.594283	-0.23125	0.241265	-0.95851
59	6.363028	0.240687	6.618149	-0.25512	0.241835	-1.05494
60	6.363028	0.397887	6.88185	-0.51882	0.243933	-2.12691
61	6.363028	0.171027	6.879414	-0.51639	0.243658	-2.1193
62	6.363028	0.188177	6.725144	-0.36212	0.244249	-1.48256
63	6.363028	0.167083	6.699613	-0.33659	0.242042	-1.3906
64	6.363028	0.18376	6.83748	-0.47445	0.241944	-1.961
65	6.368759	0.224496	6.578654	-0.2099	0.24066	-0.87216
66	6.368759	0.232084	6.984171	-0.61541	0.241737	-2.54579
67	6.371928	0.535436	6.443129	-0.0712	0.21819	-0.32633
68	6.374457	0.188397	6.636122	-0.26167	0.241917	-1.08163
69	6.374457	0.200075	6.762412	-0.38796	0.244661	-1.58568
70	6.377127	0.243164	6.900948	-0.52382	0.243374	-2.15233
71	6.380123	0.227517	6.879128	-0.49901	0.239007	-2.08783
72	6.382489	0.164621	6.77812	-0.39563	0.241491	-1.63828
73	6.384507	0.188278	6.696705	-0.3122	0.242676	-1.28648
74	6.393591	0.238909	6.722202	-0.32861	0.24296	-1.35253
75	6.39693	0.322298	6.633756	-0.23683	0.241777	-0.97952
76	6.39693	0.250642	6.627089	-0.23016	0.241703	-0.95224
77	6.39693	0.180889	6.588613	-0.19168	0.240778	-0.7961
78	6.39693	0.27514	6.808215	-0.41129	0.244543	-1.68185
79	6.39693	0.237595	6.788427	-0.3915	0.24453	-1.60102
80	6.39693	0.254378	6.778947	-0.38202	0.243237	-1.57056
81	6.39693	0.188776	6.791317	-0.39439	0.244711	-1.61165
82	6.39693	0.397525	6.66905	-0.27212	0.238675	-1.14013
83	6.39693	0.374759	6.845135	-0.44821	0.244234	-1.83515
84	6.39693	0.200214	6.797666	-0.40074	0.243936	-1.6428
85	6.40266	0.2735	6.729887	-0.32723	0.24303	-1.34645
86	6.408764	0.533893	6.587143	-0.17838	0.206881	-0.86223
87	6.420052	0.396217	6.7881	-0.36805	0.239908	-1.53412
88	6.423958	0.172845	6.916649	-0.49269	0.244039	-2.0189
89	6.424329	0.174619	6.611314	-0.18699	0.238188	-0.78503
90	6.426783	0.386598	6.669799	-0.24302	0.241494	-1.00631
91	6.426783	0.300409	6.723513	-0.29673	0.242048	-1.22592
92	6.428182	0.368145	6.747818	-0.31964	0.242795	-1.31649
93	6.432332	0.249699	6.940829	-0.5085	0.238727	-2.13003
94	6.433297	0.221248	6.716696	-0.2834	0.243009	-1.16621
95	6.433744	0.166577	6.786985	-0.35324	0.238595	-1.48051

96	6.434413	0.19762	6.752971	-0.31856	0.244479	-1.30301
97	6.435396	0.395052	6.825863	-0.39047	0.240478	-1.62371
98	6.43575	0.195547	7.021342	-0.58559	0.240583	-2.43406
99	6.437752	0.256557	6.772999	-0.33525	0.234566	-1.42922
100	6.437752	0.235571	6.792817	-0.35507	0.244568	-1.45181
101	6.437752	0.539721	6.58124	-0.14349	0.204028	-0.70328
102	6.448223	0.164751	7.095565	-0.64734	0.241825	-2.6769
103	6.450997	0.35492	6.992649	-0.54165	0.23511	-2.30383
104	6.45823	0.277647	6.62035	-0.16212	0.24188	-0.67025
105	6.461468	0.451742	6.666899	-0.20543	0.230044	-0.89301
106	6.463069	0.415356	6.729652	-0.26658	0.239274	-1.11413
107	6.465923	0.342596	7.151527	-0.6856	0.241336	-2.84087
108	6.468389	0.406801	6.864427	-0.39604	0.244249	-1.62145
109	6.468389	0.402551	6.60005	-0.13166	0.239431	-0.5499
110	6.468389	0.180877	6.728844	-0.26046	0.244134	-1.06686
111	6.476972	0.164685	6.76593	-0.28896	0.244014	-1.18418
112	6.476972	0.182155	6.88581	-0.40884	0.243635	-1.67807
113	6.476972	0.413704	6.893767	-0.41679	0.239256	-1.74205
114	6.476972	0.205394	6.719212	-0.24224	0.24424	-0.99181
115	6.476972	0.185118	6.735551	-0.25858	0.242752	-1.0652
116	6.476972	0.191582	6.761989	-0.28502	0.244565	-1.1654
117	6.478995	0.17553	6.792216	-0.31322	0.243949	-1.28396
118	6.482087	0.233928	6.654804	-0.17272	0.24151	-0.71515
119	6.482872	0.271068	6.684292	-0.20142	0.236106	-0.85309
120	6.487901	0.177858	6.956711	-0.46881	0.243416	-1.92596
121	6.489572	0.223679	7.028926	-0.53935	0.240102	-2.24636
122	6.489711	0.585343	6.654307	-0.1646	0.184616	-0.89156
123	6.49224	0.226049	6.534927	-0.04269	0.240201	-0.17771
124	6.49224	0.402551	6.681439	-0.1892	0.241376	-0.78383
125	6.49491	0.161033	6.978205	-0.48329	0.238522	-2.02621
126	6.50229	0.18638	6.594584	-0.09229	0.242078	-0.38126
127	6.50229	0.351703	7.090152	-0.58786	0.240949	-2.43978
128	6.50229	0.242822	6.794729	-0.29244	0.244575	-1.19571
129	6.50229	0.181406	6.698558	-0.19627	0.242257	-0.81016
130	6.508155	0.278492	7.039678	-0.53152	0.226146	-2.35035
131	6.51134	0.19511	6.73656	-0.22522	0.244421	-0.92144
132	6.51134	0.232481	6.856909	-0.34557	0.242073	-1.42754
133	6.513851	0.326472	6.851495	-0.33764	0.241477	-1.39825
134	6.522093	0.162236	6.739155	-0.21706	0.23906	-0.90799
135	6.528266	0.503908	6.904898	-0.37663	0.20927	-1.79974
136	6.528266	0.368702	6.759049	-0.23078	0.242652	-0.95109
137	6.528376	0.173843	6.775506	-0.24713	0.244591	-1.01038
138	6.530461	0.27471	6.721891	-0.19143	0.242904	-0.78809
139	6.533062	0.381845	6.767325	-0.23426	0.240578	-0.97375
140	6.533896	0.173744	6.860169	-0.32627	0.241589	-1.35054
141	6.54003	0.395394	6.869034	-0.329	0.242649	-1.35588
142	6.54003	0.433192	6.669691	-0.12966	0.234241	-0.55353
143	6.54003	0.38579	7.047815	-0.50778	0.242533	-2.09367
144	6.54003	0.274429	7.279387	-0.73936	0.238898	-3.09486
145	6.541511	0.25596	6.7795	-0.23799	0.243237	-0.97842
146	6.542641	0.189476	6.693985	-0.15134	0.239902	-0.63086
147	6.543112	0.205974	6.951411	-0.4083	0.243338	-1.67791

148	6.54485	0.380708	6.948754	-0.4039	0.229094	-1.76305
149	6.548219	0.170546	6.742086	-0.19387	0.24423	-0.79379
150	6.55108	0.179305	6.576771	-0.02569	0.240394	-0.10687
151	6.55108	0.195739	6.561708	-0.01063	0.240435	-0.0442
152	6.55108	0.352862	6.834406	-0.28333	0.244301	-1.15974
153	6.55108	0.356728	6.749402	-0.19832	0.242804	-0.8168
154	6.55108	0.176991	6.742406	-0.19133	0.242259	-0.78976
155	6.55108	0.188776	7.088187	-0.53711	0.242515	-2.21474
156	6.55108	0.378649	7.219492	-0.66841	0.23344	-2.86331
157	6.55108	0.161885	6.936904	-0.38582	0.23964	-1.61001
158	6.55108	0.180914	6.999583	-0.4485	0.242804	-1.84718
159	6.55108	0.224318	6.781241	-0.23016	0.244561	-0.94112
160	6.55108	0.203531	6.848209	-0.29713	0.242942	-1.22304
161	6.55108	0.369662	6.65802	-0.10694	0.24162	-0.44259
162	6.552934	0.248664	6.785566	-0.23263	0.243328	-0.95604
163	6.555535	0.223784	6.968248	-0.41271	0.239556	-1.72283
164	6.556357	0.196723	6.673243	-0.11689	0.237631	-0.49188
165	6.558704	0.261655	6.831393	-0.27269	0.198387	-1.37453
166	6.561233	0.177759	6.66335	-0.10212	0.241456	-0.42292
167	6.563984	0.304662	6.817095	-0.25311	0.244351	-1.03585
168	6.563984	0.41411	6.878804	-0.31482	0.244165	-1.28938
169	6.563984	0.2317	6.778569	-0.21459	0.24445	-0.87783
170	6.563984	0.226208	6.841648	-0.27766	0.241832	-1.14817
171	6.564811	0.193313	6.844494	-0.27968	0.242896	-1.15145
172	6.566829	0.230379	6.534291	0.032537	0.24062	0.135224
173	6.566829	0.555697	6.753057	-0.18623	0.221058	-0.84244
174	6.567429	0.175242	6.834765	-0.26734	0.242577	-1.10206
175	6.571283	0.16793	6.616789	-0.04551	0.241869	-0.18814
176	6.571283	0.171689	6.655422	-0.08414	0.241343	-0.34863
177	6.571283	0.384675	6.78852	-0.21724	0.240776	-0.90224
178	6.57611	0.17708	6.863386	-0.28728	0.242257	-1.18583
179	6.576723	0.593912	6.680059	-0.10334	0.213612	-0.48376
180	6.579251	0.533865	6.580203	-0.00095	0.016986	-0.05603
181	6.579251	0.191452	6.727886	-0.14864	0.244352	-0.60828
182	6.580068	0.323951	6.908362	-0.32829	0.244586	-1.34225
183	6.580068	0.27471	6.686485	-0.10642	0.241872	-0.43997
184	6.582333	0.231732	6.818143	-0.23581	0.242218	-0.97355
185	6.582333	0.242183	6.624598	-0.04227	0.241684	-0.17488
186	6.583516	0.352361	7.136979	-0.55346	0.242177	-2.28537
187	6.586172	0.250642	6.627089	-0.04092	0.241703	-0.16929
188	6.586172	0.188928	6.76914	-0.18297	0.244692	-0.74775
189	6.586172	0.255781	6.853016	-0.26684	0.227968	-1.17053
190	6.586172	0.172927	6.737695	-0.15152	0.244228	-0.62042
191	6.586172	0.197624	6.872099	-0.28593	0.243726	-1.17315
192	6.586798	0.192367	6.811918	-0.22512	0.240337	-0.93668
193	6.588034	0.185149	7.218145	-0.63011	0.234773	-2.68392
194	6.589302	0.412382	7.0019	-0.4126	0.243698	-1.69308
195	6.590844	0.221711	6.967663	-0.37682	0.239661	-1.5723
196	6.591086	0.404512	6.744583	-0.1535	0.195318	-0.78588
197	6.592238	0.245776	6.791107	-0.19887	0.239884	-0.82902
198	6.592674	0.282905	6.882788	-0.29011	0.244617	-1.18599
199	6.593045	0.174762	6.657569	-0.06452	0.241693	-0.26697

200	6.59364	0.191295	6.875413	-0.28177	0.242287	-1.16297
201	6.5976	0.2754	6.702651	-0.10505	0.241403	-0.43517
202	6.5976	0.213339	6.703528	-0.10593	0.24126	-0.43906
203	6.5976	0.37555	6.942303	-0.3447	0.244468	-1.41001
204	6.5976	0.240687	6.95338	-0.35578	0.237514	-1.49793
205	6.5976	0.173767	6.606272	-0.00867	0.239458	-0.03621
206	6.601025	0.400136	6.953532	-0.35251	0.235497	-1.49686
207	6.601025	0.195139	6.952697	-0.35167	0.242304	-1.45137
208	6.603266	0.407279	6.973848	-0.37058	0.244368	-1.51649
209	6.603266	0.170984	6.872888	-0.26962	0.243424	-1.10762
210	6.603266	0.168216	6.792607	-0.18934	0.244141	-0.77554
211	6.603266	0.395052	7.00004	-0.39677	0.244042	-1.62584
212	6.603266	0.187501	6.773403	-0.17014	0.244703	-0.69528
213	6.604374	0.239868	6.966628	-0.36225	0.240585	-1.50572
214	6.60665	0.183648	6.59578	0.010871	0.24203	0.044914
215	6.60665	0.199469	6.689	-0.08235	0.237045	-0.3474
216	6.60665	0.271635	7.014526	-0.40788	0.242107	-1.6847
217	6.607001	0.430796	7.065361	-0.45836	0.234364	-1.95576
218	6.6089	0.570433	6.746346	-0.13745	0.178336	-0.77072
219	6.609921	0.265738	6.910797	-0.30088	0.226919	-1.32592
220	6.609921	0.403031	6.939985	-0.33006	0.238204	-1.38563
221	6.616734	0.231732	7.01521	-0.39848	0.238042	-1.67397
222	6.616734	0.201434	6.953755	-0.33702	0.242408	-1.3903
223	6.617849	0.211699	6.72372	-0.10587	0.244292	-0.43338
224	6.618405	0.187818	6.891873	-0.27347	0.243255	-1.1242
225	6.620073	0.33255	7.031268	-0.4112	0.23349	-1.76108
226	6.620073	0.405962	7.163508	-0.54343	0.241196	-2.25308
227	6.620073	0.187915	6.935147	-0.31507	0.239457	-1.31579
228	6.620073	0.275101	6.723391	-0.10332	0.243153	-0.42491
229	6.620073	0.277315	6.723851	-0.10378	0.243081	-0.42693
230	6.620073	0.235588	6.712103	-0.09203	0.243792	-0.37749
231	6.623243	0.512568	6.5078	0.115443	0.219324	0.526359
232	6.625188	0.224086	6.764748	-0.13956	0.244531	-0.57072
233	6.625188	0.352679	7.101055	-0.47587	0.241891	-1.96728
234	6.627453	0.360606	7.100278	-0.47282	0.240948	-1.96235
235	6.627453	0.190686	6.79481	-0.16736	0.244712	-0.68389
236	6.627453	0.412976	6.960873	-0.33342	0.2421	-1.3772
237	6.628584	0.162239	6.793398	-0.16481	0.244326	-0.67457
238	6.629552	0.365182	6.931623	-0.30207	0.244525	-1.23534
239	6.631502	0.430796	6.997248	-0.36575	0.233686	-1.56511
240	6.632049	0.191484	6.762218	-0.13017	0.244605	-0.53216
241	6.633318	0.180693	6.552517	0.080801	0.240889	0.335428
242	6.633318	0.206359	6.932299	-0.29898	0.242583	-1.23249
243	6.633318	0.276712	6.939254	-0.30594	0.239975	-1.27487
244	6.635111	0.182652	6.951797	-0.31669	0.243352	-1.30135
245	6.635822	0.18	6.699255	-0.06343	0.242741	-0.26132
246	6.637465	0.503447	6.968202	-0.33074	0.221706	-1.49179
247	6.638092	0.284764	6.81334	-0.17525	0.244523	-0.7167
248	6.639491	0.411563	6.858412	-0.21892	0.241706	-0.90573
249	6.639491	0.413755	6.798514	-0.15902	0.235179	-0.67618
250	6.640692	0.27881	6.732529	-0.09184	0.243	-0.37793
251	6.642052	0.263982	6.868414	-0.22636	0.244487	-0.92587

252	6.642052	0.239798	6.792246	-0.15019	0.244573	-0.6141
253	6.643389	0.288702	7.225533	-0.58214	0.240006	-2.42553
254	6.644171	0.430796	7.065361	-0.42119	0.234364	-1.79716
255	6.646391	0.363326	6.653415	-0.00702	0.241642	-0.02907
256	6.646741	0.238789	6.672156	-0.02541	0.241858	-0.10508
257	6.647472	0.21274	6.80644	-0.15897	0.242395	-0.65582
258	6.648244	0.345578	6.987488	-0.33924	0.235478	-1.44066
259	6.650532	0.170724	6.679951	-0.02942	0.241561	-0.12179
260	6.65071	0.215265	6.807564	-0.15685	0.242879	-0.64581
261	6.651326	0.417532	7.107712	-0.45639	0.24323	-1.87636
262	6.651822	0.162613	6.84531	-0.19349	0.241823	-0.80012
263	6.652409	0.381972	6.886811	-0.2344	0.241355	-0.9712
264	6.653975	0.354861	6.833251	-0.17928	0.244436	-0.73343
265	6.654559	0.176559	7.019015	-0.36446	0.242676	-1.50182
266	6.656441	0.383774	7.157947	-0.50151	0.241469	-2.0769
267	6.659294	0.392226	6.668312	-0.00902	0.239232	-0.0377
268	6.659294	0.222147	6.715575	-0.05628	0.24411	-0.23056
269	6.659294	0.36389	7.273516	-0.61422	0.242496	-2.53292
270	6.659294	0.40444	6.953397	-0.2941	0.242133	-1.21464
271	6.659294	0.39708	6.687814	-0.02852	0.240609	-0.11853
272	6.659294	0.408015	6.669844	-0.01055	0.23763	-0.0444
273	6.659294	0.188352	6.724517	-0.06522	0.244218	-0.26707
274	6.659294	0.193492	6.697199	-0.03791	0.242678	-0.1562
275	6.659294	0.227777	6.777813	-0.11852	0.244535	-0.48467
276	6.661622	0.251911	6.830379	-0.16876	0.243854	-0.69204
277	6.661622	0.242146	6.725713	-0.06409	0.242768	-0.264
278	6.661622	0.390068	6.891028	-0.22941	0.243764	-0.9411
279	6.661622	0.232699	6.911273	-0.24965	0.243603	-1.02483
280	6.661622	0.401717	6.861913	-0.20029	0.244238	-0.82006
281	6.664525	0.430796	7.133474	-0.46895	0.231484	-2.02584
282	6.666593	0.253907	6.994163	-0.32757	0.241606	-1.3558
283	6.666593	0.355774	7.049076	-0.38248	0.243642	-1.56985
284	6.667805	0.241527	6.847501	-0.1797	0.244664	-0.73446
285	6.667805	0.217443	6.886447	-0.21864	0.242179	-0.90281
286	6.667805	0.171912	6.678752	-0.01095	0.241582	-0.04532
287	6.667805	0.232735	6.836246	-0.16844	0.244665	-0.68846
288	6.667805	0.190329	7.07751	-0.40971	0.242797	-1.68744
289	6.667805	0.21462	6.816292	-0.14849	0.244708	-0.6068
290	6.667805	0.299322	6.815183	-0.14738	0.243196	-0.606
291	6.671367	0.417731	6.933421	-0.26205	0.240924	-1.08771
292	6.672033	0.456047	6.593095	0.078938	0.225595	0.34991
293	6.67414	0.306112	6.911138	-0.237	0.241618	-0.98088
294	6.675423	0.241527	6.740128	-0.0647	0.238677	-0.2711
295	6.676856	0.391223	7.082756	-0.4059	0.241061	-1.6838
296	6.677484	0.22351	6.827452	-0.14997	0.244706	-0.61285
297	6.679971	0.365384	7.164742	-0.48477	0.243282	-1.99263
298	6.682109	0.305131	6.942162	-0.26005	0.243398	-1.06843
299	6.682205	0.17676	6.698331	-0.01613	0.242291	-0.06656
300	6.684612	0.221622	6.532362	0.15225	0.240629	0.632716
301	6.684612	0.295643	6.81289	-0.12828	0.244469	-0.52472
302	6.684612	0.244936	6.796169	-0.11156	0.244575	-0.45613
303	6.684612	0.221683	6.87318	-0.18857	0.24345	-0.77457

304	6.684612	0.271811	6.891485	-0.20687	0.225675	-0.91669
305	6.684612	0.485675	6.847036	-0.16242	0.138646	-1.1715
306	6.684612	0.384241	6.975361	-0.29075	0.237551	-1.22394
307	6.684612	0.160041	6.764186	-0.07957	0.243944	-0.3262
308	6.684612	0.203991	6.810359	-0.12575	0.242543	-0.51845
309	6.684612	0.193637	6.818287	-0.13368	0.242649	-0.5509
310	6.689502	0.318719	6.8499	-0.1604	0.235456	-0.68122
311	6.692047	0.244862	6.854513	-0.16247	0.244681	-0.66399
312	6.695581	0.195835	6.95248	-0.2569	0.242297	-1.06027
313	6.695911	0.392087	7.045589	-0.34968	0.242899	-1.4396
314	6.695911	0.210305	6.774649	-0.07874	0.236559	-0.33285
315	6.696446	0.218636	6.778474	-0.08203	0.244543	-0.33543
316	6.699211	0.248638	6.86552	-0.16631	0.244242	-0.68092
317	6.699211	0.21911	7.007929	-0.30872	0.242512	-1.273
318	6.699211	0.243969	6.785611	-0.0864	0.240181	-0.35973
319	6.699211	0.243085	6.903094	-0.20388	0.237089	-0.85994
320	6.700116	0.442498	7.028427	-0.32831	0.236337	-1.38917
321	6.700116	0.228368	6.77011	-0.06999	0.242964	-0.28808
322	6.701903	0.201434	6.698266	0.003638	0.242583	0.014995
323	6.702492	0.239951	6.885117	-0.18262	0.243233	-0.75082
324	6.705231	0.350749	7.035469	-0.33024	0.24092	-1.37073
325	6.705231	0.231157	6.790317	-0.08509	0.244563	-0.34791
326	6.705231	0.273761	6.975195	-0.26996	0.232892	-1.15918
327	6.705231	0.380261	6.847078	-0.14185	0.244288	-0.58066
328	6.705231	0.206359	6.752567	-0.04734	0.239693	-0.19749
329	6.705231	0.282564	6.532474	0.172757	0.240354	0.71876
330	6.705231	0.406959	6.890389	-0.18516	0.244014	-0.7588
331	6.705231	0.399363	6.867641	-0.16241	0.244102	-0.66534
332	6.705231	0.287173	6.821636	-0.11641	0.239142	-0.48676
333	6.705231	0.235315	6.711717	-0.00649	0.243718	-0.02661
334	6.705231	0.286566	6.811613	-0.10638	0.23846	-0.44612
335	6.705231	0.232586	6.910668	-0.20544	0.243661	-0.84313
336	6.707085	0.397055	6.695259	0.011826	0.240484	0.049175
337	6.707085	0.416939	7.084961	-0.37788	0.239241	-1.57948
338	6.707085	0.277598	6.933743	-0.22666	0.243687	-0.93012
339	6.707085	0.191832	6.788484	-0.0814	0.240896	-0.3379
340	6.707085	0.223906	6.997091	-0.29001	0.240885	-1.20392
341	6.707085	0.395109	6.812191	-0.10511	0.241339	-0.43551
342	6.707085	0.239855	6.790202	-0.08312	0.244529	-0.33991
343	6.707085	0.250494	6.989349	-0.28226	0.241901	-1.16686
344	6.707085	0.578215	6.914291	-0.20721	0.209837	-0.98746
345	6.709304	0.256101	6.716316	-0.00701	0.232269	-0.03019
346	6.712011	0.399926	6.911325	-0.19931	0.243804	-0.81752
347	6.712011	0.186724	6.948832	-0.23682	0.243483	-0.97264
348	6.71217	0.185101	6.911191	-0.19902	0.244092	-0.81536
349	6.717712	0.461005	7.045291	-0.32758	0.222551	-1.47193
350	6.718961	0.194203	6.842277	-0.12332	0.242749	-0.508
351	6.719703	0.187829	6.764373	-0.04467	0.244616	-0.18261
352	6.720498	0.15302	6.925232	-0.20473	0.24251	-0.84423
353	6.721169	0.187369	6.682388	0.038782	0.24004	0.161564
354	6.721426	0.37084	6.982887	-0.26146	0.233203	-1.12117
355	6.722352	0.398488	6.682772	0.03958	0.240903	0.164301

356	6.722352	0.357626	6.874062	-0.15171	0.232293	-0.6531
357	6.723326	0.245643	6.957414	-0.23409	0.238211	-0.98269
358	6.723326	0.270383	7.079636	-0.35631	0.231209	-1.54107
359	6.723326	0.243969	7.057426	-0.3341	0.235792	-1.41693
360	6.723432	0.229067	6.873226	-0.14979	0.242956	-0.61655
361	6.723563	0.286269	6.806488	-0.08293	0.23899	-0.34698
362	6.725434	0.344571	7.117957	-0.39252	0.237937	-1.64969
363	6.730421	0.165229	6.788582	-0.05816	0.244343	-0.23803
364	6.731569	0.39708	7.196709	-0.46514	0.23489	-1.98025
365	6.732953	0.279322	6.827735	-0.09478	0.194959	-0.48617
366	6.733402	0.22217	6.622897	0.110505	0.240816	0.458875
367	6.733402	0.315565	6.821558	-0.08816	0.244508	-0.36054
368	6.733402	0.40901	6.969157	-0.23576	0.244409	-0.96459
369	6.733402	0.31591	6.911649	-0.17825	0.2421	-0.73625
370	6.733402	0.357246	6.837588	-0.10419	0.244075	-0.42686
371	6.739874	0.39703	6.784376	-0.0445	0.241134	-0.18455
372	6.740701	0.287173	6.814037	-0.07334	0.244545	-0.29989
373	6.742676	0.262237	6.620279	0.122396	0.241411	0.507005
374	6.744126	0.180671	6.875185	-0.13106	0.243543	-0.53814
375	6.745236	0.38838	7.126332	-0.3811	0.243112	-1.56757
376	6.745236	0.181577	6.851133	-0.1059	0.244068	-0.43388
377	6.745236	0.593988	6.543225	0.202012	0.186312	1.084266
378	6.746487	0.252154	6.992067	-0.24558	0.241604	-1.01646
379	6.74915	0.370241	6.931722	-0.18257	0.244455	-0.74685
380	6.74915	0.393674	6.985464	-0.23631	0.24405	-0.9683
381	6.74915	0.172908	6.858185	-0.10903	0.240285	-0.45377
382	6.751595	0.182091	6.906584	-0.15499	0.241716	-0.6412
383	6.751751	0.19487	6.992038	-0.24029	0.242749	-0.98986
384	6.751937	0.278152	6.786023	-0.03409	0.243125	-0.1402
385	6.751937	0.20497	6.757752	-0.00582	0.244606	-0.02378
386	6.753605	0.242197	6.976387	-0.22278	0.239285	-0.93103
387	6.753605	0.192377	6.951705	-0.1981	0.242617	-0.81652
388	6.756205	0.325981	7.008718	-0.25251	0.242965	-1.0393
389	6.756932	0.345476	7.171335	-0.4144	0.243244	-1.70365
390	6.757815	0.182091	6.818995	-0.06118	0.244475	-0.25025
391	6.75872	0.368763	7.076541	-0.31782	0.237215	-1.3398
392	6.759335	0.18884	6.741495	0.01784	0.243074	0.073394
393	6.759835	0.263391	6.840354	-0.08052	0.217504	-0.37019
394	6.759835	0.317196	6.751125	0.00871	0.240438	0.036226
395	6.759835	0.279797	7.008149	-0.24831	0.243934	-1.01796
396	6.759835	0.194601	7.012663	-0.25283	0.240871	-1.04964
397	6.759835	0.39708	6.793044	-0.03321	0.240899	-0.13786
398	6.759835	0.237139	6.751243	0.008592	0.244165	0.03519
399	6.760598	0.370912	7.204775	-0.44418	0.239952	-1.85111
400	6.761573	0.357626	6.874062	-0.11249	0.232293	-0.48425
401	6.763115	0.18555	6.631987	0.131127	0.242079	0.541672
402	6.763174	0.198723	6.778706	-0.01553	0.24066	-0.06454
403	6.763174	0.41776	6.789597	-0.02642	0.242262	-0.10907
404	6.763506	0.238401	6.787555	-0.02405	0.244481	-0.09837
405	6.763861	0.160849	6.675474	0.088387	0.24163	0.365796
406	6.764654	0.298441	6.656254	0.1084	0.240713	0.450328
407	6.764654	0.163499	6.666995	0.09766	0.241794	0.403895

408	6.764654	0.353151	6.767771	-0.00312	0.241856	-0.01289
409	6.764654	0.327537	7.089257	-0.3246	0.241376	-1.3448
410	6.764654	0.286287	7.003382	-0.23873	0.243818	-0.97912
411	6.764654	0.395428	7.27995	-0.5153	0.242389	-2.1259
412	6.764654	0.392419	6.98205	-0.2174	0.231179	-0.94038
413	6.764654	0.175144	6.742846	0.021809	0.243433	0.089588
414	6.764654	0.314457	7.032971	-0.26832	0.243899	-1.10011
415	6.764654	0.246051	6.860342	-0.09569	0.23986	-0.39893
416	6.765785	0.367578	6.659764	0.106021	0.241342	0.439299
417	6.765785	0.366349	6.760176	0.005609	0.241165	0.023257
418	6.771623	0.460552	7.029522	-0.2579	0.241489	-1.06796
419	6.774224	0.27607	6.726842	0.047382	0.243049	0.194947
420	6.774224	0.357026	7.161489	-0.38727	0.242218	-1.59883
421	6.776727	0.399645	6.770421	0.006306	0.242561	0.025998
422	6.777393	0.327695	6.905068	-0.12767	0.244565	-0.52205
423	6.777393	0.215761	6.915095	-0.1377	0.237661	-0.5794
424	6.777393	0.208252	6.717164	0.06023	0.234268	0.257097
425	6.777393	0.386697	7.055752	-0.27836	0.243302	-1.14409
426	6.777393	0.271677	6.994658	-0.21726	0.2298	-0.94545
427	6.778544	0.362363	6.835179	-0.05664	0.244426	-0.23171
428	6.779922	0.220768	6.594283	0.185639	0.241265	0.769442
429	6.779922	0.282564	6.532474	0.247448	0.240354	1.029513
430	6.779922	0.164891	6.629973	0.149949	0.241443	0.621051
431	6.779922	0.174355	6.867408	-0.08749	0.243522	-0.35925
432	6.783703	0.394562	7.062904	-0.2792	0.24298	-1.14907
433	6.783703	0.214287	6.752229	0.031474	0.239298	0.131525
434	6.783703	0.244849	6.793068	-0.00937	0.244531	-0.0383
435	6.784376	0.314261	6.633478	0.150898	0.241751	0.624187
436	6.784695	0.166378	6.725193	0.059502	0.240436	0.247475
437	6.785153	0.393754	7.061295	-0.27614	0.234831	-1.17591
438	6.787127	0.227178	6.874417	-0.08729	0.24336	-0.35869
439	6.787469	0.192175	6.722062	0.065407	0.24412	0.26793
440	6.788721	0.483946	6.714789	0.073932	0.209125	0.353531
441	6.788721	0.200351	6.946867	-0.15815	0.243358	-0.64985
442	6.789972	0.383673	6.849324	-0.05935	0.244252	-0.24299
443	6.789972	0.357162	6.833429	-0.04346	0.244376	-0.17783
444	6.789972	0.388008	6.996129	-0.20616	0.243951	-0.84508
445	6.789972	0.356479	7.143637	-0.35366	0.237968	-1.48618
446	6.789972	0.34989	6.83523	-0.04526	0.243922	-0.18554
447	6.789972	0.249881	6.860626	-0.07065	0.244679	-0.28876
448	6.791221	0.413809	6.914066	-0.12284	0.240538	-0.51071
449	6.791221	0.575077	6.687482	0.103739	0.216432	0.479313
450	6.791221	0.580008	6.845893	-0.05467	0.173438	-0.31522
451	6.792242	0.221231	6.715076	0.077167	0.24303	0.31752
452	6.792242	0.394712	7.09231	-0.30007	0.243047	-1.23461
453	6.792242	0.228563	6.906638	-0.1144	0.243666	-0.46948
454	6.792242	0.239322	6.979103	-0.18686	0.238197	-0.78448
455	6.792242	0.17483	6.844297	-0.05205	0.240629	-0.21633
456	6.792242	0.354456	6.895593	-0.10335	0.240277	-0.43013
457	6.792242	0.416265	6.640634	0.151609	0.23872	0.63509
458	6.792242	0.397784	6.679886	0.112356	0.240947	0.466312
459	6.792242	0.389365	6.794387	-0.00215	0.241102	-0.0089

460	6.792242	0.23597	6.721348	0.070894	0.233832	0.303184
461	6.792242	0.416108	7.020819	-0.22858	0.243512	-0.93867
462	6.792242	0.398214	6.964278	-0.17204	0.239875	-0.71719
463	6.792242	0.412019	6.999487	-0.20724	0.243714	-0.85036
464	6.792242	0.398033	7.046735	-0.25449	0.243016	-1.04722
465	6.792242	0.224626	6.796683	-0.00444	0.240628	-0.01846
466	6.792242	0.388537	6.948803	-0.15656	0.242177	-0.64647
467	6.793092	0.362617	6.867271	-0.07418	0.242209	-0.30626
468	6.79496	0.335086	6.906709	-0.11175	0.244547	-0.45697
469	6.79496	0.213606	6.922941	-0.12798	0.24308	-0.5265
470	6.79496	0.360479	7.123416	-0.32846	0.23718	-1.38484
471	6.795277	0.261052	6.805723	-0.01045	0.244548	-0.04271
472	6.795837	0.160669	6.809054	-0.01322	0.244377	-0.05408
473	6.798056	0.266318	6.997183	-0.19913	0.243522	-0.81769
474	6.799542	0.487767	6.668356	0.131185	0.217854	0.60217
475	6.80017	0.180417	6.627243	0.172927	0.240972	0.717623
476	6.800783	0.361487	6.750805	0.049978	0.241671	0.206803
477	6.800783	0.186972	6.932449	-0.13167	0.242579	-0.54278
478	6.801146	0.384001	7.301414	-0.50027	0.243998	-2.0503
479	6.801283	0.288193	6.873601	-0.07232	0.238025	-0.30382
480	6.802395	0.435822	7.006549	-0.20415	0.231914	-0.8803
481	6.802395	0.218809	6.778609	0.023785	0.244544	0.097265
482	6.802395	0.337621	6.908502	-0.10611	0.24453	-0.43392
483	6.802395	0.409547	7.137326	-0.33493	0.239863	-1.39634
484	6.802395	0.398407	6.963982	-0.16159	0.241385	-0.66942
485	6.802395	0.174881	6.992778	-0.19038	0.240368	-0.79205
486	6.802395	0.354416	7.011889	-0.20949	0.234625	-0.89289
487	6.802395	0.325672	6.774662	0.027732	0.241222	0.114966
488	6.802395	0.301268	7.084063	-0.28167	0.238427	-1.18136
489	6.802395	0.409956	6.671797	0.130598	0.236962	0.551136
490	6.802395	0.392504	6.94573	-0.14334	0.235728	-0.60805
491	6.804571	0.343426	6.920667	-0.1161	0.214568	-0.54107
492	6.807672	0.263658	6.872677	-0.06501	0.244649	-0.26571
493	6.809775	0.212165	6.910567	-0.10079	0.243964	-0.41314
494	6.809775	0.190348	6.913289	-0.10351	0.244115	-0.42404
495	6.811611	0.170134	6.889097	-0.07749	0.242847	-0.31907
496	6.811611	0.553173	6.861993	-0.05038	0.218199	-0.2309
497	6.812445	0.435328	6.775922	0.036523	0.239376	0.152574
498	6.812445	0.371973	7.297529	-0.48508	0.243375	-1.99316
499	6.812445	0.401361	7.09899	-0.28655	0.240036	-1.19376
500	6.812445	0.17886	7.123074	-0.31063	0.196141	-1.5837
501	6.814665	0.227134	6.826719	-0.01205	0.243281	-0.04955
502	6.814665	0.195835	6.991717	-0.17705	0.242729	-0.72942
503	6.816784	0.260298	7.027393	-0.21061	0.239349	-0.87992
504	6.818808	0.275836	6.809585	0.009223	0.244555	0.037713
505	6.819463	0.242518	6.622884	0.196579	0.234612	0.837889
506	6.820744	0.402021	7.057364	-0.23662	0.242937	-0.974
507	6.820744	0.411616	6.927232	-0.10649	0.241687	-0.4406
508	6.820744	0.179073	7.013707	-0.19296	0.241583	-0.79874
509	6.820744	0.36771	7.196165	-0.37542	0.24354	-1.54151
510	6.820744	0.394676	6.969647	-0.1489	0.242166	-0.61488
511	6.820744	0.18576	7.120824	-0.30008	0.240891	-1.24571

512	6.820744	0.281569	6.811915	0.008829	0.244499	0.036111
513	6.820744	0.240349	7.052283	-0.23154	0.241404	-0.95914
514	6.821681	0.170724	6.603699	0.217982	0.23978	0.90909
515	6.821681	0.240345	6.716281	0.1054	0.238007	0.442844
516	6.821813	0.372653	6.982365	-0.16055	0.228046	-0.70403
517	6.821813	0.240214	6.751276	0.070537	0.244328	0.288697
518	6.821988	0.1592	6.907695	-0.08571	0.243078	-0.35259
519	6.822856	0.171634	6.777278	0.045578	0.244507	0.186408
520	6.823198	0.328079	6.886632	-0.06343	0.22925	-0.2767
521	6.824374	0.398201	6.86108	-0.03671	0.242872	-0.15113
522	6.824374	0.412382	6.780683	0.043691	0.242417	0.180229
523	6.824374	0.395394	6.966599	-0.14223	0.243063	-0.58514
524	6.824374	0.180285	6.773781	0.050593	0.244673	0.206776
525	6.824374	0.425625	7.06073	-0.23636	0.240206	-0.98397
526	6.824374	0.181992	6.779382	0.044991	0.244693	0.183869
527	6.824374	0.232084	6.960925	-0.13655	0.243783	-0.56014
528	6.824374	0.395094	7.094713	-0.27034	0.242833	-1.11327
529	6.826045	0.212983	6.876279	-0.05023	0.242414	-0.20723
530	6.82641	0.347177	7.126571	-0.30016	0.241616	-1.24231
531	6.827713	0.176926	6.783658	0.044055	0.244664	0.180061
532	6.827713	0.159579	6.740062	0.08765	0.242334	0.361691
533	6.829284	0.248587	6.794763	0.034521	0.244445	0.141221
534	6.829794	0.398503	6.963838	-0.13404	0.243137	-0.55131
535	6.832248	0.228004	6.906606	-0.07436	0.243726	-0.30509
536	6.83272	0.278668	6.878175	-0.04546	0.244569	-0.18586
537	6.833647	0.388412	7.211695	-0.37805	0.232885	-1.62332
538	6.833647	0.343015	7.050725	-0.21708	0.236733	-0.91697
539	6.834184	0.255035	6.860394	-0.02621	0.244467	-0.10721
540	6.834552	0.369658	6.94238	-0.10783	0.244173	-0.4416
541	6.834552	0.485619	7.083809	-0.24926	0.193667	-1.28704
542	6.834552	0.206526	7.041207	-0.20665	0.235974	-0.87575
543	6.834552	0.220252	6.762679	0.071873	0.244566	0.29388
544	6.834552	0.178333	6.876496	-0.04194	0.242921	-0.17267
545	6.834996	0.38675	7.148109	-0.31311	0.233575	-1.34052
546	6.836804	0.18008	6.754558	0.082246	0.244345	0.336597
547	6.837333	0.188928	6.76914	0.068193	0.244692	0.278688
548	6.837797	0.21462	6.943284	-0.10549	0.243981	-0.43236
549	6.838762	0.312779	6.854034	-0.01527	0.2352	-0.06493
550	6.838762	0.196067	6.739344	0.099418	0.244434	0.406729
551	6.838762	0.1799	6.812681	0.026082	0.243998	0.106894
552	6.838762	0.298728	7.324043	-0.48528	0.231565	-2.09565
553	6.838762	0.343589	7.239913	-0.40115	0.243255	-1.64909
554	6.841064	0.385131	6.771169	0.069895	0.242498	0.288227
555	6.842158	0.341833	6.726746	0.115412	0.242749	0.475436
556	6.842158	0.352361	6.867229	-0.02507	0.230351	-0.10884
557	6.842515	0.205755	6.809436	0.033079	0.243947	0.135597
558	6.843217	0.301086	7.016783	-0.17357	0.243794	-0.71194
559	6.843217	0.394065	7.187719	-0.3445	0.240881	-1.43018
560	6.843217	0.296104	6.706482	0.136735	0.241574	0.566016
561	6.843217	0.377534	6.985582	-0.14236	0.232941	-0.61116
562	6.843217	0.396044	6.984953	-0.14174	0.243738	-0.58151
563	6.843217	0.408951	7.080699	-0.23748	0.238871	-0.99418

564	6.84588	0.412288	7.022294	-0.17641	0.241647	-0.73005
565	6.84588	0.237749	7.031163	-0.18528	0.243122	-0.7621
566	6.84588	0.210287	7.085076	-0.2392	0.242783	-0.98522
567	6.847131	0.239335	6.966613	-0.11948	0.241011	-0.49576
568	6.848117	0.189965	7.193334	-0.34522	0.234812	-1.47018
569	6.848332	0.358042	6.726939	0.121392	0.242575	0.500434
570	6.848332	0.186853	6.783108	0.065224	0.239054	0.272844
571	6.848915	0.350336	6.736411	0.112504	0.240221	0.468336
572	6.850597	0.26926	7.037833	-0.18724	0.23832	-0.78565
573	6.850597	0.170676	6.959063	-0.10847	0.243237	-0.44593
574	6.851666	0.227246	6.717499	0.134167	0.243048	0.552016
575	6.851666	0.392027	7.237771	-0.3861	0.243624	-1.58484
576	6.853688	0.276013	7.137773	-0.28408	0.227811	-1.24702
577	6.854171	0.410685	7.064938	-0.21077	0.237814	-0.88627
578	6.854645	0.415385	6.936601	-0.08196	0.236737	-0.34619
579	6.854645	0.250343	6.798214	0.056431	0.244523	0.230781
580	6.855112	0.222695	7.12176	-0.26665	0.242184	-1.10102
581	6.856462	0.271811	6.945312	-0.08885	0.204145	-0.43523
582	6.856462	0.198924	6.925741	-0.06928	0.24215	-0.2861
583	6.856462	0.224496	6.896921	-0.04046	0.241744	-0.16737
584	6.856462	0.178271	6.751816	0.104646	0.241383	0.43353
585	6.856462	0.18048	6.920965	-0.0645	0.244047	-0.2643
586	6.858363	0.451312	6.649891	0.208472	0.21071	0.989378
587	6.858965	0.296252	6.954331	-0.09537	0.243512	-0.39163
588	6.861235	0.162111	6.830292	0.030943	0.241477	0.128141
589	6.862293	0.164238	6.746656	0.115637	0.24391	0.474095
590	6.862293	0.199444	6.929917	-0.06762	0.240481	-0.2812
591	6.862905	0.194203	6.881413	-0.01851	0.242032	-0.07647
592	6.863541	0.369904	7.416869	-0.55333	0.23901	-2.31508
593	6.863541	0.340395	7.525158	-0.66162	0.240278	-2.75355
594	6.863541	0.328865	7.410716	-0.54718	0.235048	-2.32793
595	6.863541	0.348915	7.662852	-0.79931	0.238658	-3.34918
596	6.863792	0.377031	6.764964	0.098828	0.24073	0.410537
597	6.863953	0.503731	7.041098	-0.17715	0.226301	-0.78279
598	6.864583	0.436724	7.238507	-0.37392	0.242902	-1.5394
599	6.864583	0.177966	7.030484	-0.1659	0.24079	-0.68899
600	6.865196	0.345279	7.234341	-0.36914	0.243726	-1.51459
601	6.866597	0.193663	6.839287	0.02731	0.24193	0.112885
602	6.866933	0.393826	7.058437	-0.1915	0.24292	-0.78834
603	6.866933	0.390743	6.92562	-0.05869	0.24363	-0.24088
604	6.868535	0.355506	7.300002	-0.43147	0.242472	-1.77945
605	6.868535	0.355456	7.299916	-0.43138	0.242472	-1.7791
606	6.868535	0.239164	6.846145	0.02239	0.244652	0.091517
607	6.870714	0.259112	6.99896	-0.12825	0.241987	-0.52997
608	6.870714	0.188195	6.841114	0.0296	0.238219	0.124257
609	6.871388	0.358445	7.112839	-0.24145	0.234636	-1.02905
610	6.872249	0.227164	6.819032	0.053216	0.242315	0.219616
611	6.87307	0.190686	6.633807	0.239263	0.24209	0.988324
612	6.873854	0.280444	6.840259	0.033595	0.241413	0.139159
613	6.873854	0.233574	7.010595	-0.13674	0.239137	-0.57181
614	6.873854	0.27439	7.00244	-0.12859	0.243929	-0.52715
615	6.873854	0.298728	6.917804	-0.04395	0.24122	-0.1822

616	6.873854	0.218422	6.749486	0.124368	0.244327	0.509021
617	6.873854	0.233718	6.774628	0.099225	0.244281	0.406194
618	6.873854	0.171634	6.838115	0.035739	0.242004	0.14768
619	6.874419	0.391497	7.1344	-0.25998	0.241955	-1.0745
620	6.876665	0.178694	6.931528	-0.05486	0.24389	-0.22495
621	6.878341	0.247861	6.808129	0.070212	0.243883	0.287893
622	6.878768	0.351679	7.113681	-0.23491	0.241504	-0.97271
623	6.878768	0.3748	7.26468	-0.38591	0.243795	-1.58294
624	6.882437	0.165585	6.982094	-0.09966	0.242923	-0.41024
625	6.882437	0.186064	6.984449	-0.10201	0.238879	-0.42704
626	6.882437	0.223715	6.826942	0.055496	0.244686	0.226803
627	6.882437	0.182695	6.78119	0.101248	0.244055	0.414857
628	6.882754	0.237139	6.914251	-0.0315	0.24335	-0.12943
629	6.883658	0.178716	6.697041	0.186617	0.242861	0.768409
630	6.885282	0.40137	7.057732	-0.17245	0.24294	-0.70984
631	6.887553	0.411939	6.864268	0.023285	0.244268	0.095326
632	6.887553	0.178103	6.821612	0.06594	0.237985	0.277076
633	6.887553	0.238582	6.711422	0.176131	0.242679	0.725778
634	6.887553	0.175406	6.700168	0.187384	0.241912	0.774597
635	6.887553	0.19077	6.722835	0.164717	0.244132	0.674706
636	6.887553	0.380052	6.844874	0.042679	0.244361	0.174655
637	6.887553	0.387448	7.048686	-0.16113	0.242603	-0.66419
638	6.889406	0.220299	6.772629	0.116777	0.244506	0.477603
639	6.889406	0.415353	7.084868	-0.19546	0.239336	-0.81668
640	6.889406	0.398217	6.870509	0.018897	0.244042	0.077432
641	6.889406	0.397454	6.868423	0.020983	0.244045	0.085979
642	6.889406	0.239649	6.91557	-0.02616	0.243727	-0.10735
643	6.890364	0.390537	7.01331	-0.12295	0.242977	-0.506
644	6.890364	0.313541	6.950874	-0.06051	0.243806	-0.24819
645	6.890513	0.171765	6.786268	0.104245	0.24462	0.426151
646	6.890948	0.203518	7.067277	-0.17633	0.046582	-3.78536
647	6.890948	0.413957	7.0319	-0.14095	0.242378	-0.58154
648	6.890948	0.402012	7.317201	-0.42625	0.24229	-1.75927
649	6.890948	0.404706	7.087654	-0.19671	0.242486	-0.8112
650	6.890948	0.447914	6.951092	-0.06014	0.243292	-0.24721
651	6.890948	0.416874	6.805509	0.08544	0.241976	0.353091
652	6.890948	0.269452	6.785701	0.105247	0.243255	0.432662
653	6.890948	0.378678	6.975901	-0.08495	0.243589	-0.34876
654	6.890948	0.348621	7.187396	-0.29645	0.241648	-1.22678
655	6.890948	0.428966	6.670008	0.220941	0.23488	0.940651
656	6.892251	0.570534	7.038707	-0.14646	0.203593	-0.71935
657	6.892488	0.390694	7.012507	-0.12002	0.242987	-0.49393
658	6.893367	0.325313	6.808603	0.084763	0.243159	0.348592
659	6.893367	0.453441	7.030188	-0.13682	0.235447	-0.58112
660	6.893367	0.414944	6.900827	-0.00746	0.242298	-0.03079
661	6.895176	0.410292	7.109471	-0.21429	0.243748	-0.87916
662	6.895176	0.244329	6.976891	-0.08171	0.243947	-0.33497
663	6.895176	0.3934	7.072195	-0.17702	0.240541	-0.73592
664	6.895176	0.334521	7.113226	-0.21805	0.236412	-0.92233
665	6.895176	0.238127	6.980875	-0.0857	0.238629	-0.35913
666	6.895921	0.224086	6.800505	0.095416	0.243734	0.391474
667	6.896582	0.398761	6.956235	-0.05965	0.243036	-0.24545

668	6.896582	0.213192	6.766268	0.130314	0.244621	0.532717
669	6.896582	0.403001	7.127255	-0.23067	0.242426	-0.95152
670	6.896705	0.234737	6.983222	-0.08652	0.236657	-0.36558
671	6.897705	0.359564	7.119401	-0.2217	0.240749	-0.92086
672	6.897705	0.280098	6.954079	-0.05637	0.240552	-0.23435
673	6.899387	0.195149	6.79016	0.109227	0.238216	0.45852
674	6.899387	0.298728	6.917804	-0.01842	0.24122	-0.07635
675	6.899387	0.360633	7.109275	-0.20989	0.230029	-0.91244
676	6.900033	0.359564	7.224855	-0.32482	0.234358	-1.38601
677	6.900587	0.22475	7.02573	-0.12514	0.239121	-0.52335
678	6.901486	0.172863	6.789234	0.112252	0.244095	0.459868
679	6.905935	0.224496	7.050564	-0.14463	0.242156	-0.59725
680	6.906504	0.268176	6.869936	0.036568	0.244622	0.14949
681	6.907755	0.363902	6.763439	0.144317	0.239516	0.602535
682	6.907755	0.392226	6.70734	0.200416	0.234753	0.85373
683	6.907755	0.393052	7.204261	-0.29651	0.238795	-1.24168
684	6.907755	0.390662	7.051623	-0.14387	0.242748	-0.59266
685	6.907755	0.369715	6.843222	0.064533	0.244056	0.26442
686	6.907755	0.437146	7.033292	-0.12554	0.242436	-0.51782
687	6.907755	0.236737	6.794043	0.113713	0.244558	0.464973
688	6.907755	0.40164	7.173562	-0.26581	0.229828	-1.15655
689	6.907755	0.332725	7.030675	-0.12292	0.233516	-0.52639
690	6.907755	0.394154	6.748961	0.158794	0.242934	0.653651
691	6.907755	0.168515	6.655015	0.25274	0.241213	1.047789
692	6.907755	0.45052	7.036725	-0.12897	0.241946	-0.53305
693	6.907755	0.38827	7.153403	-0.24565	0.233467	-1.05217
694	6.907755	0.423543	7.083965	-0.17621	0.238816	-0.73785
695	6.907755	0.359302	6.92332	-0.01556	0.244487	-0.06366
696	6.907755	0.315595	6.901161	0.006594	0.244607	0.026957
697	6.907755	0.409688	7.489656	-0.5819	0.236283	-2.46273
698	6.907755	0.313918	6.950326	-0.04257	0.243789	-0.17462
699	6.907755	0.411939	7.106979	-0.19922	0.243767	-0.81727
700	6.907755	0.375342	6.974063	-0.06631	0.243798	-0.27198
701	6.907755	0.408356	7.141643	-0.23389	0.234091	-0.99913
702	6.907755	0.15874	6.910136	-0.00238	0.241578	-0.00985
703	6.907755	0.399402	6.946753	-0.039	0.23723	-0.16439
704	6.907755	0.177225	6.702248	0.205508	0.240433	0.85474
705	6.907755	0.359157	6.873502	0.034253	0.232698	0.1472
706	6.907755	0.269545	6.721613	0.186142	0.243323	0.765
707	6.907755	0.403539	7.09833	-0.19058	0.241008	-0.79074
708	6.907755	0.40755	7.176835	-0.26908	0.243132	-1.10672
709	6.907755	0.316859	7.028297	-0.12054	0.242119	-0.49786
710	6.907755	0.390113	7.146255	-0.2385	0.243048	-0.98129
711	6.907755	0.234389	6.754329	0.153426	0.244424	0.627705
712	6.907755	0.381429	6.844217	0.063538	0.240454	0.264243
713	6.907755	0.172863	6.742146	0.165609	0.243586	0.67988
714	6.907755	0.404541	7.181443	-0.27369	0.242919	-1.12666
715	6.907755	0.377688	6.948344	-0.04059	0.244285	-0.16615
716	6.907755	0.401828	6.997052	-0.0893	0.243555	-0.36664
717	6.907755	0.452851	7.187265	-0.27951	0.239965	-1.1648
718	6.907755	0.376761	6.975293	-0.06754	0.243627	-0.27722
719	6.907755	0.447836	7.055593	-0.14784	0.23703	-0.62371

720	6.907755	0.439634	7.391326	-0.48357	0.238468	-2.02782
721	6.907755	0.407912	7.222209	-0.31445	0.238865	-1.31645
722	6.907755	0.408394	7.06847	-0.16071	0.242496	-0.66275
723	6.907755	0.223277	6.854487	0.053269	0.242279	0.219865
724	6.907755	0.40242	7.094731	-0.18698	0.242332	-0.77157
725	6.907755	0.173843	6.968435	-0.06068	0.242381	-0.25035
726	6.907755	0.348783	7.292771	-0.38502	0.241835	-1.59206
727	6.907755	0.256326	6.97561	-0.06785	0.240728	-0.28187
728	6.907755	0.575619	6.901226	0.00653	0.202677	0.032217
729	6.907755	0.510465	7.203451	-0.2957	0.211099	-1.40075
730	6.907755	0.365204	7.074602	-0.16685	0.24122	-0.69168
731	6.907755	0.383807	7.078967	-0.17121	0.239996	-0.7134
732	6.907755	0.2735	6.729887	0.177868	0.24303	0.731877
733	6.907755	0.218523	6.821379	0.086376	0.244707	0.352977
734	6.907755	0.343015	7.370474	-0.46272	0.242572	-1.90755
735	6.907755	0.236282	6.764366	0.14339	0.244055	0.587531
736	6.920494	0.165229	6.928176	-0.00768	0.243766	-0.03151
737	6.921001	0.380526	7.343474	-0.42247	0.243235	-1.73689
738	6.922354	0.343015	7.414311	-0.49196	0.242834	-2.0259
739	6.923756	0.386713	7.065976	-0.14222	0.241954	-0.5878
740	6.924562	0.343418	7.152743	-0.22818	0.242469	-0.94107
741	6.92485	0.321047	6.953366	-0.02852	0.243809	-0.11696
742	6.925147	0.397879	6.704801	0.220346	0.240407	0.916556
743	6.925147	0.410151	6.964689	-0.03954	0.240811	-0.1642
744	6.925147	0.277139	6.81106	0.114087	0.244552	0.466512
745	6.926447	0.425702	7.130499	-0.20405	0.232121	-0.87907
746	6.927958	0.382831	6.952555	-0.0246	0.229704	-0.10708
747	6.928164	0.239951	6.885117	0.043047	0.243233	0.176979
748	6.928164	0.240345	6.887252	0.040912	0.243248	0.168191
749	6.928234	0.171668	6.960297	-0.03206	0.240401	-0.13337
750	6.928375	0.307762	6.913544	0.01483	0.241576	0.061389
751	6.928589	0.195149	6.766711	0.161878	0.244236	0.662795
752	6.930228	0.162282	6.83262	0.097608	0.241479	0.404208
753	6.931012	0.324602	7.30234	-0.37133	0.243362	-1.52582
754	6.932448	0.407436	7.012957	-0.08051	0.239092	-0.33673
755	6.933398	0.441181	6.989545	-0.05615	0.240391	-0.23357
756	6.933398	0.340188	6.790004	0.143394	0.240517	0.59619
757	6.934073	0.229046	6.772444	0.161628	0.236748	0.682703
758	6.935154	0.166816	6.943265	-0.00811	0.241791	-0.03355
759	6.937169	0.441506	7.059879	-0.12271	0.241599	-0.50791
760	6.937169	0.234205	6.754922	0.182247	0.244428	0.745606
761	6.937608	0.177613	6.723637	0.213971	0.242751	0.881441
762	6.938061	0.355715	7.342982	-0.40492	0.244136	-1.65859
763	6.938061	0.38658	6.963018	-0.02496	0.239335	-0.10428
764	6.938527	0.365769	7.222663	-0.28414	0.241226	-1.17788
765	6.938527	0.437699	7.062426	-0.1239	0.235834	-0.52536
766	6.939844	0.2835	6.79136	0.148484	0.24327	0.610365
767	6.940545	0.157926	6.901405	0.03914	0.241669	0.161958
768	6.941657	0.381872	7.284855	-0.3432	0.23622	-1.45287
769	6.942241	0.228135	6.91036	0.031881	0.24369	0.130828
770	6.942241	0.392333	7.169113	-0.22687	0.227552	-0.99701
771	6.942241	0.353312	7.366241	-0.424	0.242337	-1.74963

772	6.942241	0.379037	7.188802	-0.24656	0.243085	-1.0143
773	6.943473	0.264505	6.803368	0.140106	0.244342	0.573402
774	6.943473	0.3438	7.189124	-0.24565	0.2345	-1.04755
775	6.943473	0.265141	6.931871	0.011602	0.243791	0.04759
776	6.943473	0.21448	6.763916	0.179557	0.239098	0.750978
777	6.943473	0.42856	6.827424	0.116049	0.240983	0.481567
778	6.943473	0.400581	7.1933	-0.24983	0.243564	-1.02571
779	6.944797	0.383124	6.858664	0.086132	0.240259	0.358496
780	6.944797	0.335617	7.20101	-0.25621	0.23092	-1.10953
781	6.945143	0.291497	7.204565	-0.25942	0.224207	-1.15706
782	6.945496	0.384093	7.202462	-0.25697	0.241649	-1.06339
783	6.946976	0.163052	6.791917	0.155059	0.244334	0.63462
784	6.946976	0.248053	6.795771	0.151205	0.244536	0.618332
785	6.946976	0.240197	6.789582	0.157394	0.244554	0.643598
786	6.946976	0.397749	6.973112	-0.02614	0.242076	-0.10796
787	6.949428	0.355344	6.940856	0.008572	0.24149	0.035495
788	6.949428	0.256642	6.802102	0.147326	0.238433	0.617891
789	6.95124	0.165456	6.659321	0.291919	0.234779	1.243379
790	6.95124	0.378956	6.866684	0.084556	0.226884	0.372685
791	6.95124	0.344367	7.355697	-0.40446	0.241899	-1.672
792	6.95124	0.222589	6.876463	0.074777	0.226111	0.33071
793	6.952207	0.408033	7.280832	-0.32862	0.237594	-1.38314
794	6.952876	0.503447	6.963722	-0.01085	0.193987	-0.05591
795	6.95374	0.211909	6.839316	0.114425	0.244448	0.468094
796	6.95374	0.286449	7.136886	-0.18315	0.22298	-0.82136
797	6.95374	0.175783	7.088908	-0.13517	0.241955	-0.55865
798	6.95374	0.401889	7.19412	-0.24038	0.24276	-0.99019
799	6.95374	0.392379	7.018318	-0.06458	0.243959	-0.26471
800	6.95374	0.419569	7.063981	-0.11024	0.240491	-0.4584
801	6.95374	0.190142	6.796417	0.157323	0.244706	0.642908
802	6.95374	0.229067	6.864679	0.089061	0.23921	0.372313
803	6.95374	0.188263	6.910903	0.042837	0.244061	0.17552
804	6.956545	0.397629	7.158867	-0.20232	0.243227	-0.83182
805	6.956545	0.188195	6.841114	0.115432	0.238219	0.484561
806	6.959049	0.397059	7.108042	-0.14899	0.240518	-0.61947
807	6.959715	0.392456	7.103591	-0.14388	0.241162	-0.5966
808	6.959715	0.402941	7.061496	-0.10178	0.237024	-0.42941
809	6.959715	0.244125	6.860926	0.098789	0.244273	0.40442
810	6.959715	0.389918	7.289582	-0.32987	0.24402	-1.3518
811	6.959715	0.222147	6.909872	0.049843	0.243813	0.20443
812	6.959715	0.34781	7.202232	-0.24252	0.239307	-1.01342
813	6.959715	0.392922	7.271135	-0.31142	0.243372	-1.2796
814	6.959715	0.184168	6.938237	0.021478	0.242992	0.088391
815	6.959715	0.243969	6.785611	0.174104	0.240181	0.724885
816	6.960123	0.386619	7.110143	-0.15002	0.242674	-0.6182
817	6.960865	0.392733	7.347386	-0.38652	0.241688	-1.59925
818	6.960865	0.385491	6.980355	-0.01949	0.243755	-0.07996
819	6.960865	0.197271	6.721181	0.239684	0.244244	0.981333
820	6.961823	0.252482	6.93436	0.027463	0.241947	0.113507
821	6.961823	0.349067	7.228998	-0.26718	0.24374	-1.09615
822	6.961823	0.288175	7.352628	-0.39081	0.204671	-1.90943
823	6.961823	0.219948	6.914034	0.047788	0.236883	0.201739

824	6.961823	0.239164	6.921121	0.040701	0.242352	0.167944
825	6.963325	0.179761	6.695985	0.26734	0.242754	1.101278
826	6.963325	0.387639	7.249433	-0.28611	0.24325	-1.17619
827	6.963325	0.224978	6.782961	0.180364	0.244564	0.737493
828	6.963325	0.166816	7.083249	-0.11992	0.242151	-0.49524
829	6.964914	0.323951	6.824981	0.139932	0.244494	0.572334
830	6.964914	0.193115	6.876737	0.088177	0.242045	0.364299
831	6.964914	0.399655	7.16515	-0.20024	0.236832	-0.84548
832	6.964914	0.24236	6.875134	0.08978	0.241345	0.371998
833	6.964914	0.170669	7.082187	-0.11727	0.199735	-0.58715
834	6.967475	0.450393	7.103988	-0.13651	0.243676	-0.56022
835	6.967475	0.447904	7.156505	-0.18903	0.24002	-0.78756
836	6.967475	0.391999	7.334571	-0.3671	0.227673	-1.61238
837	6.967475	0.347915	7.141337	-0.17386	0.235844	-0.73719
838	6.96838	0.235941	6.776392	0.191988	0.243238	0.789302
839	6.96838	0.373768	7.194652	-0.22627	0.22344	-1.01268
840	6.96838	0.396709	7.145498	-0.17712	0.243236	-0.72818
841	6.96838	0.219828	6.82261	0.14577	0.244705	0.595695
842	6.970059	0.16641	6.915454	0.054605	0.239002	0.228471
843	6.971043	0.196437	6.865195	0.105848	0.235948	0.448605
844	6.972294	0.348007	7.419346	-0.44705	0.241613	-1.85028
845	6.972294	0.390845	7.367771	-0.39548	0.24089	-1.64173
846	6.972294	0.447698	7.283726	-0.31143	0.236187	-1.31858
847	6.972294	0.340706	7.286869	-0.31458	0.241337	-1.30347
848	6.972294	0.38777	7.30743	-0.33514	0.239106	-1.40162
849	6.972294	0.344866	7.153366	-0.18107	0.242409	-0.74697
850	6.972294	0.443353	6.928585	0.043709	0.243461	0.17953
851	6.973353	0.345156	7.162163	-0.18881	0.235518	-0.80168
852	6.974766	0.242821	6.92841	0.046356	0.23884	0.194089
853	6.976748	0.416297	7.167683	-0.19093	0.242581	-0.7871
854	6.97796	0.190113	6.979752	-0.00179	0.24001	-0.00747
855	6.97796	0.397571	6.856808	0.121151	0.244275	0.495963
856	6.97796	0.401809	7.189256	-0.2113	0.243179	-0.86889
857	6.97796	0.389322	6.954106	0.023854	0.244436	0.097588
858	6.97796	0.260517	6.84077	0.137189	0.241433	0.568228
859	6.97796	0.228158	6.906202	0.071757	0.243665	0.294491
860	6.97796	0.395364	7.167449	-0.18949	0.241237	-0.78549
861	6.97796	0.443855	7.158087	-0.18013	0.240453	-0.74912
862	6.97796	0.231572	6.847395	0.130564	0.241706	0.540179
863	6.97796	0.296914	6.721921	0.256039	0.24215	1.057356
864	6.97796	0.405881	7.17965	-0.20169	0.243223	-0.82924
865	6.978373	0.421191	7.224785	-0.24641	0.242356	-1.01674
866	6.979214	0.365018	7.081378	-0.10216	0.241304	-0.42338
867	6.980076	0.399231	7.110863	-0.13079	0.235435	-0.55551
868	6.980076	0.433413	7.007918	-0.02784	0.243533	-0.11432
869	6.980076	0.184014	7.055747	-0.07567	0.240104	-0.31516
870	6.980076	0.271407	7.332165	-0.35209	0.226361	-1.55544
871	6.980515	0.370749	6.970466	0.010049	0.243793	0.041218
872	6.981863	0.243097	7.137432	-0.15557	0.237408	-0.65528
873	6.982657	0.579911	6.858522	0.124134	0.215493	0.576047
874	6.982979	0.398499	7.056736	-0.07376	0.24292	-0.30363
875	6.982979	0.396664	6.854927	0.128052	0.2443	0.524158

876	6.982979	0.25441	7.155911	-0.17293	0.239466	-0.72216
877	6.984716	0.31961	6.641774	0.342942	0.241524	1.419913
878	6.984716	0.177027	6.989316	-0.0046	0.240221	-0.01915
879	6.984716	0.245739	7.0609	-0.07618	0.235148	-0.32398
880	6.986296	0.396809	6.9934	-0.0071	0.244094	-0.02911
881	6.986398	0.327467	7.068266	-0.08187	0.240962	-0.33975
882	6.986744	0.177549	6.749774	0.236969	0.241609	0.980795
883	6.987798	0.439672	6.949327	0.038471	0.236109	0.162939
884	6.987798	0.382879	6.766909	0.220889	0.240254	0.919398
885	6.987798	0.34312	6.73112	0.256678	0.237369	1.081345
886	6.987798	0.373589	7.301094	-0.3133	0.243308	-1.28765
887	6.987798	0.3793	7.273107	-0.28531	0.243903	-1.16976
888	6.987798	0.258288	6.798943	0.188855	0.244348	0.772895
889	6.987798	0.327467	6.899587	0.088211	0.242017	0.364483
890	6.987798	0.352697	7.245123	-0.25733	0.23987	-1.07277
891	6.987798	0.27635	6.810979	0.176819	0.239538	0.738167
892	6.987798	0.393233	6.976423	0.011375	0.241234	0.047155
893	6.987798	0.403361	7.092896	-0.1051	0.242421	-0.43353
894	6.987798	0.384376	7.13067	-0.14287	0.23962	-0.59624
895	6.987798	0.275929	6.891051	0.096747	0.24217	0.399501
896	6.988724	0.394613	7.38599	-0.39727	0.241404	-1.64565
897	6.991137	0.331793	6.797487	0.19365	0.234408	0.826122
898	6.991137	0.260014	6.986373	0.004764	0.241662	0.019713
899	6.991637	0.188886	6.911289	0.080348	0.244034	0.329248
900	6.992913	0.384497	6.709189	0.283724	0.239954	1.18241
901	6.992913	0.403304	7.236284	-0.24337	0.242011	-1.00562
902	6.992913	0.242573	6.724118	0.268795	0.242982	1.106236
903	6.992913	0.205755	6.809436	0.183477	0.243947	0.752117
904	6.992913	0.419121	7.155074	-0.16216	0.242811	-0.66785
905	6.992913	0.252831	6.937698	0.055215	0.241217	0.2289
906	6.993698	0.232225	6.834743	0.158955	0.24464	0.649748
907	6.993933	0.276274	7.270877	-0.27694	0.230028	-1.20396
908	6.993933	0.170413	6.941633	0.0523	0.24224	0.2159
909	6.993933	0.170724	7.069489	-0.07556	0.242095	-0.31209
910	6.994767	0.346427	7.288358	-0.29359	0.242258	-1.2119
911	6.994767	0.350686	7.139617	-0.14485	0.242232	-0.59798
912	6.996309	0.346547	7.174996	-0.17869	0.235536	-0.75864
913	6.996309	0.171912	6.700344	0.295965	0.242093	1.222526
914	6.996986	0.384067	7.336398	-0.33941	0.243796	-1.3922
915	6.997367	0.340127	6.828434	0.168933	0.244464	0.691034
916	6.997704	0.391344	6.966014	0.031689	0.243846	0.129956
917	6.998727	0.401026	7.036664	-0.03794	0.242379	-0.15652
918	7.000537	0.26388	6.868263	0.132274	0.244671	0.540618
919	7.000537	0.448085	7.03898	-0.03844	0.243899	-0.15762
920	7.001942	0.314493	7.275101	-0.27316	0.241372	-1.13169
921	7.002156	0.216443	7.120342	-0.11819	0.242263	-0.48784
922	7.003065	0.413796	6.979584	0.023482	0.244368	0.096091
923	7.003065	0.403721	7.108923	-0.10586	0.239512	-0.44197
924	7.003065	0.380232	7.293365	-0.2903	0.242481	-1.1972
925	7.003065	0.245774	6.794934	0.208132	0.244567	0.85102
926	7.003065	0.32216	6.981726	0.021339	0.238581	0.089442
927	7.003065	0.159631	6.844767	0.158298	0.243581	0.649878

928	7.003065	0.293173	6.923798	0.079267	0.241204	0.328632
929	7.003065	0.176296	7.155474	-0.15241	0.240381	-0.63403
930	7.003065	0.207951	7.116145	-0.11308	0.242357	-0.46658
931	7.003065	0.400154	7.141559	-0.13849	0.242922	-0.57011
932	7.003065	0.385587	6.980414	0.022651	0.243754	0.092927
933	7.004605	0.417563	7.091479	-0.08687	0.239208	-0.36317
934	7.004919	0.362722	7.133269	-0.12835	0.237008	-0.54154
935	7.005394	0.355848	7.487988	-0.48259	0.241109	-2.00156
936	7.005736	0.367105	7.152021	-0.14629	0.23697	-0.61732
937	7.005736	0.382286	7.292149	-0.28641	0.24338	-1.17681
938	7.007839	0.394524	6.969317	0.038522	0.221888	0.17361
939	7.008399	0.380181	7.241143	-0.23274	0.243526	-0.95573
940	7.009108	0.191582	6.91098	0.098128	0.244018	0.402133
941	7.010034	0.342827	7.240825	-0.23079	0.235986	-0.97799
942	7.014239	0.267447	7.200444	-0.1862	0.241631	-0.77062
943	7.014365	0.370016	7.175208	-0.16084	0.241569	-0.66583
944	7.014365	0.178807	6.926172	0.088193	0.243575	0.362077
945	7.014365	0.334474	7.432781	-0.41842	0.237692	-1.76033
946	7.014365	0.182325	6.936391	0.077974	0.243831	0.319786
947	7.014365	0.26257	7.014031	0.000334	0.215033	0.001555
948	7.014365	0.393333	7.13908	-0.12472	0.161678	-0.77138
949	7.014523	0.377688	7.050793	-0.03627	0.242328	-0.14967
950	7.014727	0.178115	7.05187	-0.03714	0.240573	-0.15439
951	7.014727	0.420546	7.126257	-0.11153	0.239726	-0.46524
952	7.014727	0.421191	7.20293	-0.1882	0.236945	-0.79429
953	7.014727	0.284132	6.941384	0.073343	0.243748	0.300897
954	7.014727	0.367616	7.106168	-0.09144	0.241389	-0.37881
955	7.015001	0.449902	7.4531	-0.4381	0.239941	-1.82586
956	7.015386	0.409465	7.174182	-0.1588	0.243024	-0.65342
957	7.015969	0.34836	7.318117	-0.30215	0.240356	-1.25709
958	7.018103	0.223706	6.754788	0.263315	0.244273	1.077956
959	7.018103	0.195041	6.983713	0.03439	0.239225	0.143757
960	7.018103	0.170724	6.827538	0.190566	0.240992	0.790754
961	7.018103	0.380151	7.119582	-0.10148	0.240705	-0.42159
962	7.018981	0.240717	6.835793	0.183188	0.242566	0.755208
963	7.018981	0.400068	7.187388	-0.16841	0.243463	-0.69171
964	7.018981	0.233297	6.776094	0.242887	0.243178	0.998804
965	7.018981	0.393817	7.230074	-0.21109	0.242353	-0.87102
966	7.018981	0.384214	7.166631	-0.14765	0.242501	-0.60886
967	7.020233	0.400128	6.990749	0.029485	0.243715	0.12098
968	7.021084	0.378733	7.272207	-0.25112	0.243893	-1.02965
969	7.021084	0.381167	7.275188	-0.2541	0.243928	-1.04172
970	7.021084	0.323855	7.03784	-0.01676	0.243894	-0.0687
971	7.021084	0.347828	7.160387	-0.1393	0.243221	-0.57274
972	7.021084	0.256203	7.021819	-0.00073	0.232122	-0.00317
973	7.022636	0.230431	6.899891	0.122744	0.243807	0.503447
974	7.022636	0.366892	7.03591	-0.01327	0.239803	-0.05535
975	7.023827	0.177469	7.166997	-0.14317	0.234839	-0.60965
976	7.025538	0.261185	6.723316	0.302222	0.243063	1.243389
977	7.025538	0.390203	7.393776	-0.36824	0.242326	-1.5196
978	7.025538	0.351528	7.338069	-0.31253	0.244187	-1.27988
979	7.025538	0.340297	6.957376	0.068162	0.24372	0.279674

980	7.025538	0.184168	7.062614	-0.03708	0.176848	-0.20965
981	7.025538	0.396282	6.835983	0.189556	0.210559	0.900248
982	7.025538	0.228976	7.022534	0.003004	0.242548	0.012385
983	7.028383	0.344108	7.344166	-0.31578	0.24279	-1.30064
984	7.028708	0.359603	6.930307	0.098401	0.244507	0.402447
985	7.031369	0.301887	6.988061	0.043308	0.241872	0.179055
986	7.031741	0.201451	7.0175	0.014241	0.240668	0.059173
987	7.031808	0.277476	7.402879	-0.37107	0.239664	-1.5483
988	7.032918	0.345279	7.131072	-0.09815	0.241653	-0.40618
989	7.032918	0.388699	7.243608	-0.21069	0.233486	-0.90236
990	7.032918	0.430603	6.980701	0.052217	0.237277	0.220069
991	7.032918	0.453244	7.335498	-0.30258	0.237339	-1.27488
992	7.032918	0.160508	7.000085	0.032833	0.241963	0.135695
993	7.032918	0.337644	7.175089	-0.14217	0.238663	-0.5957
994	7.032918	0.363326	6.929489	0.10343	0.244526	0.422981
995	7.032918	0.393765	7.146531	-0.11361	0.240343	-0.47271
996	7.032918	0.31981	7.240603	-0.20768	0.240085	-0.86504
997	7.032918	0.409937	7.198121	-0.1652	0.242166	-0.68219
998	7.034049	0.420546	7.04026	-0.00621	0.240954	-0.02578
999	7.036967	0.448821	7.496074	-0.45911	0.235451	-1.9499
1000	7.037433	0.370059	7.121174	-0.08374	0.24163	-0.34657
1001	7.037433	0.350686	7.249487	-0.21205	0.240027	-0.88346
1002	7.038784	0.392226	6.908794	0.12999	0.237657	0.546964
1003	7.038784	0.385618	7.287826	-0.24904	0.23702	-1.05072
1004	7.038784	0.395109	6.881467	0.157316	0.243885	0.645042
1005	7.038784	0.414343	7.008084	0.030699	0.243631	0.126007
1006	7.038784	0.349231	7.284027	-0.24524	0.241796	-1.01426
1007	7.039332	0.39556	7.135961	-0.09663	0.235035	-0.41113
1008	7.039683	0.390845	7.28228	-0.2426	0.24185	-1.00309
1009	7.039683	0.229509	6.965379	0.074304	0.243954	0.304581
1010	7.039683	0.366066	7.167766	-0.12808	0.242052	-0.52916
1011	7.039683	0.263731	6.933669	0.106014	0.231595	0.457755
1012	7.039815	0.270377	7.076551	-0.03674	0.242478	-0.1515
1013	7.041287	0.272924	7.153542	-0.11225	0.23528	-0.47711
1014	7.041287	0.354929	6.998428	0.042859	0.235654	0.181872
1015	7.041287	0.390342	7.184165	-0.14288	0.240712	-0.59356
1016	7.042488	0.447611	7.035464	0.007024	0.244043	0.028782
1017	7.043097	0.297805	6.945445	0.097652	0.243737	0.400644
1018	7.043557	0.401258	7.36069	-0.31713	0.23631	-1.34202
1019	7.044956	0.344562	7.154023	-0.10907	0.241678	-0.45129
1020	7.044956	0.430844	7.23159	-0.18663	0.242103	-0.77089
1021	7.045226	0.317271	6.903997	0.14123	0.244591	0.577412
1022	7.045226	0.289089	6.780003	0.265223	0.241883	1.096491
1023	7.045226	0.263982	7.074284	-0.02906	0.238847	-0.12166
1024	7.045377	0.290832	6.815155	0.230222	0.244464	0.941744
1025	7.046341	0.34573	6.939204	0.107137	0.243728	0.439578
1026	7.046868	0.399444	7.280951	-0.23408	0.230546	-1.01535
1027	7.047517	0.362396	7.129307	-0.08179	0.241375	-0.33885
1028	7.047517	0.179799	7.045411	0.002106	0.24119	0.008733
1029	7.047517	0.212554	6.914689	0.132829	0.194825	0.681785
1030	7.047517	0.290905	6.948454	0.099063	0.234035	0.423285
1031	7.047517	0.300409	6.723513	0.324005	0.242048	1.338598

1032	7.047517	0.39073	7.058723	-0.01121	0.241236	-0.04645
1033	7.047517	0.447818	7.07392	-0.0264	0.243937	-0.10824
1034	7.047517	0.367202	7.19453	-0.14701	0.243513	-0.60372
1035	7.047517	0.220923	6.776179	0.271338	0.24455	1.109543
1036	7.047517	0.216884	6.971155	0.076362	0.24185	0.315742
1037	7.047517	0.361858	7.125126	-0.07761	0.237872	-0.32626
1038	7.047517	0.224685	6.897678	0.149839	0.243331	0.615784
1039	7.047517	0.404815	6.943399	0.104118	0.205455	0.50677
1040	7.047517	0.407198	7.174868	-0.12735	0.241413	-0.52752
1041	7.047517	0.390725	6.981252	0.066265	0.243023	0.272669
1042	7.048528	0.344846	7.333664	-0.28514	0.24305	-1.17316
1043	7.048834	0.237785	6.787435	0.261399	0.237406	1.101065
1044	7.049406	0.324096	7.075097	-0.02569	0.241386	-0.10643
1045	7.050856	0.373331	7.109914	-0.05906	0.240928	-0.24513
1046	7.050856	0.170134	6.889097	0.161759	0.242847	0.666094
1047	7.050856	0.394588	6.856859	0.193997	0.24305	0.798178
1048	7.050856	0.208773	6.953505	0.097351	0.242316	0.401752
1049	7.050856	0.348652	7.160932	-0.11008	0.241991	-0.45487
1050	7.051462	0.28801	7.569151	-0.51769	0.175452	-2.9506
1051	7.052337	0.412325	7.159271	-0.10693	0.241087	-0.44355
1052	7.052337	0.395164	7.14155	-0.08921	0.235557	-0.37874
1053	7.052337	0.342159	7.319927	-0.26759	0.241867	-1.10635
1054	7.052337	0.426093	7.155669	-0.10333	0.24292	-0.42538
1055	7.053709	0.39718	7.510767	-0.45706	0.237525	-1.92425
1056	7.056175	0.39703	6.974003	0.082172	0.244176	0.336527
1057	7.056791	0.193912	6.952605	0.104186	0.242049	0.430435
1058	7.057287	0.3971	6.993147	0.06414	0.244099	0.262762
1059	7.057695	0.403361	6.996523	0.061173	0.243629	0.251089
1060	7.057695	0.340573	7.110378	-0.05268	0.241036	-0.21857
1061	7.058328	0.233057	7.087705	-0.02938	0.242621	-0.12108
1062	7.059305	0.355128	7.177503	-0.1182	0.243115	-0.48618
1063	7.059947	0.230026	6.752212	0.307735	0.244226	1.260045
1064	7.060224	0.381284	7.390774	-0.33055	0.231075	-1.43049
1065	7.060224	0.357057	7.099527	-0.0393	0.241989	-0.16242
1066	7.061906	0.420546	6.928769	0.133137	0.241015	0.552401
1067	7.061906	0.419063	6.9942	0.067706	0.238254	0.284175
1068	7.061906	0.271367	7.250564	-0.18866	0.232695	-0.81075
1069	7.061906	0.316706	7.383099	-0.32119	0.239815	-1.33934
1070	7.061906	0.297341	7.136691	-0.07479	0.236689	-0.31597
1071	7.061906	0.323305	7.42942	-0.36751	0.237416	-1.54798
1072	7.064101	0.358821	7.100791	-0.03669	0.241602	-0.15186
1073	7.064101	0.39348	7.065899	-0.0018	0.240728	-0.00747
1074	7.064324	0.362671	7.061538	0.002786	0.242317	0.011498
1075	7.064941	0.360897	7.193007	-0.12807	0.243216	-0.52655
1076	7.065147	0.570905	7.181815	-0.11667	0.209892	-0.55584
1077	7.065979	0.387598	7.084277	-0.0183	0.243816	-0.07505
1078	7.065979	0.365182	7.026022	0.039958	0.242278	0.164924
1079	7.067087	0.281551	7.214973	-0.14789	0.230777	-0.64082
1080	7.067087	0.389143	7.278803	-0.21172	0.240607	-0.87993
1081	7.070274	0.37465	7.504051	-0.43378	0.243201	-1.78362
1082	7.071385	0.425201	7.239038	-0.16765	0.210298	-0.79722
1083	7.071385	0.21523	6.99529	0.076095	0.236668	0.321525

1084	7.072058	0.283245	7.059489	0.012569	0.239454	0.05249
1085	7.072511	0.371007	7.49756	-0.42505	0.237472	-1.7899
1086	7.07327	0.373347	6.973433	0.099837	0.243683	0.409699
1087	7.07327	0.413564	7.215847	-0.14258	0.234942	-0.60686
1088	7.07327	0.215592	6.900778	0.172492	0.243728	0.707722
1089	7.07327	0.449569	7.087666	-0.0144	0.242584	-0.05935
1090	7.07327	0.378114	7.197685	-0.12441	0.243555	-0.51083
1091	7.07327	0.435364	6.993478	0.079791	0.2436	0.327551
1092	7.07327	0.194077	6.679611	0.393659	0.242377	1.624162
1093	7.07327	0.443167	7.043565	0.029705	0.214193	0.138681
1094	7.07327	0.401101	7.260009	-0.18674	0.240664	-0.77593
1095	7.07327	0.358151	7.102789	-0.02952	0.241627	-0.12217
1096	7.07327	0.391433	6.972751	0.100519	0.241066	0.416976
1097	7.074203	0.33566	7.404112	-0.32991	0.241191	-1.36783
1098	7.074809	0.398791	7.185695	-0.11089	0.243105	-0.45612
1099	7.074809	0.339763	7.106867	-0.03206	0.238828	-0.13423
1100	7.074809	0.408043	7.514294	-0.43948	0.234184	-1.87666
1101	7.074809	0.389682	7.125251	-0.05044	0.241835	-0.20858
1102	7.074809	0.370264	7.185388	-0.11058	0.241423	-0.45803
1103	7.074809	0.207073	7.048848	0.025962	0.235907	0.110051
1104	7.074809	0.171518	6.891412	0.183398	0.241905	0.75814
1105	7.074809	0.367182	7.183089	-0.10828	0.243203	-0.44522
1106	7.074809	0.581151	6.977237	0.097573	0.226009	0.431719
1107	7.076832	0.448307	7.21425	-0.13742	0.228505	-0.60138
1108	7.077173	0.379085	6.895292	0.181881	0.237735	0.765059
1109	7.077315	0.370819	6.932244	0.145071	0.24447	0.593411
1110	7.077654	0.400852	7.126011	-0.04836	0.243389	-0.19868
1111	7.078713	0.234627	7.050265	0.028448	0.241538	0.117778
1112	7.078904	0.345279	7.131072	-0.05217	0.241653	-0.21588
1113	7.078904	0.356307	7.270147	-0.19124	0.243845	-0.78429
1114	7.078904	0.230146	6.844927	0.233977	0.244681	0.956251
1115	7.078904	0.392456	7.103591	-0.02469	0.241162	-0.10237
1116	7.078904	0.356018	7.187066	-0.10816	0.237169	-0.45606
1117	7.078904	0.349712	7.28607	-0.20717	0.243823	-0.84966
1118	7.078904	0.1867	6.850201	0.228703	0.240919	0.949293
1119	7.078904	0.40901	7.064837	0.014067	0.242417	0.058027
1120	7.078904	0.193604	6.740406	0.338498	0.242379	1.396567
1121	7.078904	0.378979	7.258247	-0.17934	0.243657	-0.73605
1122	7.078904	0.188263	6.910903	0.168001	0.244061	0.688356
1123	7.079606	0.3981	6.809411	0.270195	0.240761	1.122254
1124	7.079606	0.18188	6.924571	0.155035	0.243582	0.636478
1125	7.079606	0.32832	6.983449	0.096157	0.242731	0.396145
1126	7.079606	0.19411	7.075962	0.003644	0.24282	0.015006
1127	7.079606	0.236296	6.862773	0.216833	0.239596	0.904993
1128	7.079606	0.359439	7.481458	-0.40185	0.243229	-1.65216
1129	7.079606	0.232273	7.037255	0.04235	0.242187	0.174865
1130	7.081419	0.400916	6.995564	0.085855	0.243556	0.352505
1131	7.081709	0.383246	7.243553	-0.16184	0.241593	-0.6699
1132	7.081709	0.390964	7.228738	-0.14703	0.234862	-0.62603
1133	7.082109	0.392743	7.272945	-0.19084	0.241411	-0.7905
1134	7.083388	0.334718	6.943301	0.140087	0.22858	0.612858
1135	7.084035	0.394163	7.286781	-0.20275	0.243766	-0.83173

1136	7.084506	0.360479	7.25231	-0.1678	0.227602	-0.73727
1137	7.085436	0.394201	7.402236	-0.3168	0.224946	-1.40834
1138	7.087341	0.380358	7.162606	-0.07527	0.242989	-0.30975
1139	7.087548	0.433234	7.161128	-0.07358	0.233329	-0.31535
1140	7.088965	0.174548	6.927033	0.161932	0.243621	0.664689
1141	7.089072	0.299673	7.052302	0.03677	0.241093	0.152515
1142	7.090077	0.156859	6.582148	0.507929	0.23926	2.122911
1143	7.090077	0.3721	7.183353	-0.09328	0.241843	-0.38569
1144	7.090077	0.39408	7.094887	-0.00481	0.243045	-0.01979
1145	7.090077	0.399473	7.189104	-0.09903	0.243516	-0.40666
1146	7.090077	0.33573	7.541733	-0.45166	0.226253	-1.99625
1147	7.090077	0.348598	7.183131	-0.09305	0.241823	-0.3848
1148	7.090077	0.152928	6.849335	0.240742	0.243823	0.987366
1149	7.090077	0.357019	7.132177	-0.0421	0.237486	-0.17727
1150	7.090077	0.240477	7.053491	0.036586	0.241801	0.151307
1151	7.090077	0.314261	6.949708	0.140369	0.243783	0.575796
1152	7.090077	0.471689	6.995556	0.094521	0.200613	0.471159
1153	7.090077	0.56849	7.004546	0.085531	0.114832	0.744834
1154	7.090077	0.153693	7.146869	-0.05679	0.236056	-0.24059
1155	7.090077	0.288235	7.135424	-0.04535	0.23904	-0.18971
1156	7.090077	0.252331	6.999701	0.090376	0.241577	0.37411
1157	7.092184	0.449569	7.28861	-0.19643	0.241555	-0.81317
1158	7.092327	0.334973	7.399675	-0.30735	0.242694	-1.2664
1159	7.093472	0.437007	7.019803	0.073669	0.231206	0.318631
1160	7.093472	0.375145	7.303465	-0.20999	0.243289	-0.86314
1161	7.094085	0.334698	6.849583	0.244502	0.24239	1.008714
1162	7.095115	0.282351	7.315535	-0.22042	0.240694	-0.91577
1163	7.096012	0.391691	7.374177	-0.27817	0.23907	-1.16353
1164	7.096156	0.250494	7.050796	0.04536	0.242386	0.187141
1165	7.096997	0.399563	6.970877	0.126121	0.241888	0.521401
1166	7.097376	0.4057	7.241993	-0.14462	0.229585	-0.62991
1167	7.098109	0.41027	7.22942	-0.13131	0.235228	-0.55823
1168	7.098109	0.297805	7.033922	0.064187	0.242066	0.265165
1169	7.098274	0.455069	7.091004	0.00727	0.243582	0.029846
1170	7.098811	0.373098	7.096874	0.001937	0.241125	0.008031
1171	7.098811	0.378148	6.975909	0.122902	0.243623	0.504473
1172	7.098811	0.412323	7.109357	-0.01055	0.24376	-0.04327
1173	7.099293	0.394518	7.281287	-0.18199	0.242383	-0.75085
1174	7.099293	0.182652	6.951797	0.147497	0.243352	0.606105
1175	7.099646	0.355364	7.28673	-0.18708	0.243694	-0.7677
1176	7.099833	0.193324	6.935634	0.164199	0.24153	0.679828
1177	7.10044	0.414883	6.870086	0.230354	0.236522	0.973922
1178	7.101462	0.314675	7.363622	-0.26216	0.238266	-1.10028
1179	7.101911	0.401931	7.331084	-0.22917	0.242135	-0.94647
1180	7.101911	0.422862	7.498431	-0.39652	0.235486	-1.68384
1181	7.101911	0.186301	7.017855	0.084056	0.241236	0.34844
1182	7.101911	0.184773	6.805517	0.296394	0.239213	1.239039
1183	7.101911	0.355533	7.318383	-0.21647	0.241517	-0.8963
1184	7.101911	0.398991	7.586746	-0.48484	0.23674	-2.04797
1185	7.101911	0.338222	7.180784	-0.07887	0.243053	-0.32451
1186	7.102816	0.341561	7.336509	-0.23369	0.237258	-0.98498
1187	7.102816	0.328899	7.307363	-0.20455	0.205553	-0.99511

1188	7.102816	0.400068	7.226239	-0.12342	0.238164	-0.51823
1189	7.102816	0.406591	7.079329	0.023487	0.241835	0.09712
1190	7.102816	0.405198	7.106296	-0.00348	0.228644	-0.01522
1191	7.102816	0.398891	6.837558	0.265258	0.241172	1.099869
1192	7.102816	0.287662	7.07683	0.025986	0.239367	0.108561
1193	7.10387	0.291048	7.251508	-0.14764	0.234077	-0.63073
1194	7.104923	0.351184	7.317655	-0.21273	0.244098	-0.8715
1195	7.105115	0.331871	7.255192	-0.15008	0.233111	-0.6438
1196	7.105115	0.404541	7.181443	-0.07633	0.242919	-0.31421
1197	7.105115	0.23697	7.160064	-0.05495	0.237411	-0.23145
1198	7.105581	0.156861	7.003616	0.101965	0.242747	0.420045
1199	7.107368	0.309937	6.820696	0.286672	0.243166	1.178914
1200	7.108426	0.385814	6.955316	0.15311	0.235401	0.650421
1201	7.108426	0.258627	6.878325	0.230101	0.242165	0.950186
1202	7.108426	0.387296	7.190701	-0.08228	0.240472	-0.34214
1203	7.108426	0.412861	6.984088	0.124338	0.241688	0.514455
1204	7.108426	0.225245	6.885087	0.223338	0.242241	0.921968
1205	7.108426	0.381888	6.895562	0.212864	0.227925	0.933919
1206	7.108426	0.186557	7.003148	0.105278	0.237353	0.443551
1207	7.109495	0.337599	7.198221	-0.08873	0.243321	-0.36465
1208	7.110696	0.3951	7.155446	-0.04475	0.231627	-0.1932
1209	7.111851	0.352831	7.136311	-0.02446	0.242162	-0.10101
1210	7.112056	0.381493	7.156317	-0.04426	0.241325	-0.18341
1211	7.112056	0.319755	7.034174	0.077881	0.243889	0.319331
1212	7.112056	0.290218	7.384663	-0.27261	0.233489	-1.16754
1213	7.113199	0.339391	7.264739	-0.15154	0.242395	-0.62518
1214	7.113607	0.212331	7.081197	0.032411	0.242778	0.133499
1215	7.113607	0.40797	7.100343	0.013264	0.220183	0.060241
1216	7.114092	0.319836	7.249889	-0.1358	0.233317	-0.58203
1217	7.114144	0.195149	7.043709	0.070435	0.241437	0.29173
1218	7.115395	0.342845	7.240474	-0.12508	0.235976	-0.53005
1219	7.116847	0.344186	7.157011	-0.04016	0.24336	-0.16504
1220	7.119064	0.426487	7.261607	-0.14254	0.240672	-0.59227
1221	7.119726	0.448085	7.472974	-0.35325	0.241552	-1.46241
1222	7.119726	0.169389	6.817394	0.302331	0.238137	1.269567
1223	7.11993	0.244849	6.919212	0.200717	0.243714	0.823579
1224	7.11993	0.383498	7.224787	-0.10486	0.243157	-0.43123
1225	7.120317	0.22145	7.428685	-0.30837	0.224437	-1.37396
1226	7.120848	0.241527	6.847501	0.273347	0.244664	1.117234
1227	7.120848	0.198786	7.035748	0.085101	0.240311	0.354127
1228	7.120848	0.383208	7.204743	-0.08389	0.242116	-0.34651
1229	7.120848	0.385538	7.207882	-0.08703	0.242192	-0.35936
1230	7.120848	0.341425	7.148076	-0.02723	0.241606	-0.11269
1231	7.120848	0.396075	6.999809	0.121039	0.244062	0.495936
1232	7.120848	0.402771	7.12587	-0.00502	0.222718	-0.02255
1233	7.120848	0.359594	7.329391	-0.20854	0.243898	-0.85504
1234	7.120848	0.305969	6.990062	0.130786	0.242228	0.539929
1235	7.122867	0.363322	6.985156	0.137711	0.20322	0.677646
1236	7.122867	0.568876	7.084474	0.038393	0.165738	0.231646
1237	7.12421	0.407337	7.073465	0.050745	0.238081	0.213142
1238	7.124563	0.24527	6.830389	0.294174	0.239884	1.226319
1239	7.125168	0.381429	7.015679	0.10949	0.243833	0.449036

1240	7.125328	0.371057	7.544933	-0.41961	0.221976	-1.89032
1241	7.125757	0.309549	7.06417	0.061588	0.238421	0.258314
1242	7.126237	0.394378	7.266237	-0.14	0.243249	-0.57554
1243	7.126444	0.407912	7.222209	-0.09576	0.238865	-0.40091
1244	7.130899	0.433413	6.89388	0.237019	0.240235	0.986612
1245	7.130899	0.445938	6.932799	0.198099	0.243772	0.812642
1246	7.130899	0.312401	7.418146	-0.28725	0.241319	-1.19032
1247	7.130899	0.233938	6.902737	0.228162	0.243819	0.935784
1248	7.130899	0.441387	7.270916	-0.14002	0.24079	-0.58149
1249	7.130899	0.211404	6.824162	0.306737	0.211639	1.449344
1250	7.130899	0.426487	7.261607	-0.13071	0.240672	-0.5431
1251	7.130899	0.312921	6.9825	0.148399	0.24359	0.609216
1252	7.130899	0.239461	7.072023	0.058876	0.237753	0.247636
1253	7.130899	0.316541	7.241584	-0.11068	0.233296	-0.47444
1254	7.130899	0.449081	7.051886	0.079013	0.243985	0.323842
1255	7.130899	0.358719	7.251598	-0.1207	0.240095	-0.50271
1256	7.130899	0.403477	7.18264	-0.05174	0.24336	-0.21261
1257	7.132296	0.334698	7.029271	0.103025	0.2385	0.43197
1258	7.133562	0.45035	7.281268	-0.14771	0.2406	-0.61391
1259	7.133562	0.220923	6.824752	0.30881	0.244707	1.261958
1260	7.133562	0.223712	6.929858	0.203703	0.243634	0.836104
1261	7.133712	0.334418	7.286602	-0.15289	0.243429	-0.62807
1262	7.133712	0.37916	7.115168	0.018543	0.238748	0.077669
1263	7.134068	0.350358	7.284485	-0.15042	0.243775	-0.61703
1264	7.134529	0.381507	7.080105	0.054423	0.243076	0.223893
1265	7.134529	0.343275	7.275638	-0.14111	0.243744	-0.57893
1266	7.134529	0.401673	6.876383	0.258145	0.244042	1.057788
1267	7.134529	0.364581	7.365928	-0.2314	0.242591	-0.95387
1268	7.134529	0.342566	7.147422	-0.01289	0.23651	-0.05452
1269	7.134529	0.358231	7.101205	0.033323	0.24161	0.137922
1270	7.134529	0.387017	6.8503	0.284229	0.244287	1.163504
1271	7.134529	0.404077	6.781444	0.353085	0.242427	1.45646
1272	7.134529	0.378114	7.321229	-0.1867	0.242786	-0.76899
1273	7.134529	0.343553	7.431583	-0.29705	0.243439	-1.22024
1274	7.134529	0.352697	7.272889	-0.13836	0.237351	-0.58293
1275	7.134529	0.427686	7.322129	-0.1876	0.237213	-0.79085
1276	7.134529	0.223599	7.155705	-0.02118	0.239801	-0.08831
1277	7.134529	0.400963	7.048346	0.086183	0.242785	0.354978
1278	7.134529	0.405566	7.179999	-0.04547	0.243002	-0.18712
1279	7.134529	0.42455	7.146757	-0.01223	0.208619	-0.05861
1280	7.135145	0.375278	7.417053	-0.28191	0.242321	-1.16337
1281	7.135539	0.262424	6.92973	0.205809	0.243468	0.845321
1282	7.136597	0.343294	7.154766	-0.01817	0.238236	-0.07626
1283	7.13733	0.42967	7.124545	0.012785	0.243885	0.052422
1284	7.13733	0.354671	6.999531	0.137799	0.23771	0.579694
1285	7.137772	0.343468	7.467423	-0.32965	0.240269	-1.37201
1286	7.138867	0.350199	7.200752	-0.06188	0.243502	-0.25414
1287	7.138867	0.431221	7.160334	-0.02147	0.241526	-0.08888
1288	7.138867	0.369655	7.170819	-0.03195	0.239374	-0.13348
1289	7.138867	0.357054	7.287732	-0.14886	0.243711	-0.61083
1290	7.138867	0.25005	7.127543	0.011324	0.234	0.048394
1291	7.139557	0.342991	7.348202	-0.20865	0.234407	-0.8901

1292	7.140087	0.380622	7.332859	-0.19277	0.239264	-0.80569
1293	7.140087	0.299712	6.85766	0.282427	0.233174	1.21123
1294	7.14137	0.374921	7.134522	0.006848	0.24099	0.028417
1295	7.14137	0.341675	7.226164	-0.08479	0.2412	-0.35155
1296	7.141749	0.271723	6.96146	0.180289	0.22304	0.808325
1297	7.141749	0.319972	7.20276	-0.06101	0.237622	-0.25676
1298	7.143584	0.381777	7.528487	-0.3849	0.235082	-1.63731
1299	7.144144	0.389132	6.996254	0.14789	0.243964	0.606195
1300	7.144144	0.248236	6.866088	0.278056	0.244224	1.138527
1301	7.144144	0.400911	7.06418	0.079964	0.237077	0.337293
1302	7.144144	0.176752	6.914348	0.229796	0.244086	0.941456
1303	7.144144	0.405831	7.323985	-0.17984	0.239887	-0.74969
1304	7.144144	0.365256	7.293482	-0.14934	0.243606	-0.61303
1305	7.144144	0.266962	6.807672	0.336473	0.244523	1.376035
1306	7.144144	0.373231	7.403042	-0.2589	0.242669	-1.06688
1307	7.145427	0.340358	7.192713	-0.04729	0.243114	-0.1945
1308	7.145714	0.348964	7.116664	0.02905	0.234031	0.124129
1309	7.146166	0.269988	6.93555	0.210617	0.227603	0.925369
1310	7.146166	0.349409	7.363241	-0.21708	0.243388	-0.89189
1311	7.146647	0.401569	6.869778	0.27687	0.244115	1.134176
1312	7.146985	0.388615	7.409419	-0.26243	0.229068	-1.14566
1313	7.147896	0.379598	7.428567	-0.28067	0.242684	-1.15653
1314	7.147896	0.289337	6.814524	0.333373	0.244449	1.363771
1315	7.147896	0.187617	7.175614	-0.02772	0.238077	-0.11642
1316	7.147896	0.392913	7.45281	-0.30491	0.242099	-1.25945
1317	7.148917	0.376758	7.057782	0.091135	0.241964	0.376647
1318	7.150069	0.352881	7.238565	-0.0885	0.238779	-0.37062
1319	7.151377	0.395043	7.186061	-0.03468	0.242295	-0.14315
1320	7.152447	0.374499	7.145359	0.007088	0.23309	0.030409
1321	7.152447	0.311883	6.876929	0.275519	0.239127	1.152187
1322	7.152878	0.247861	6.963436	0.189442	0.238775	0.79339
1323	7.152878	0.28492	7.092449	0.060429	0.213958	0.282432
1324	7.152878	0.384454	7.286298	-0.13342	0.241628	-0.55217
1325	7.152878	0.290905	7.147099	0.005779	0.241261	0.023954
1326	7.152878	0.261831	7.006726	0.146152	0.234332	0.623694
1327	7.153573	0.374152	7.356481	-0.20291	0.225228	-0.9009
1328	7.154279	0.38281	7.368584	-0.2143	0.243187	-0.88124
1329	7.154615	0.263219	6.806687	0.347929	0.244527	1.422864
1330	7.154996	0.3934	7.163446	-0.00845	0.239529	-0.03528
1331	7.156452	0.394688	7.186928	-0.03048	0.240625	-0.12665
1332	7.156452	0.382686	7.217619	-0.06117	0.240549	-0.25428
1333	7.156452	0.345674	7.262189	-0.10574	0.243781	-0.43374
1334	7.156452	0.358196	7.259505	-0.10305	0.233867	-0.44065
1335	7.156452	0.301998	7.099709	0.056743	0.242353	0.234135
1336	7.156452	0.32364	7.231652	-0.0752	0.232034	-0.32409
1337	7.156651	0.352807	7.245259	-0.08861	0.243538	-0.36384
1338	7.157216	0.347806	7.130948	0.026268	0.238972	0.109923
1339	7.157567	0.236424	7.027073	0.130494	0.242236	0.538705
1340	7.157806	0.339989	7.112317	0.045489	0.239525	0.189913
1341	7.15907	0.3508	7.428432	-0.26936	0.233	-1.15607
1342	7.15907	0.390203	7.393776	-0.23471	0.242326	-0.96856
1343	7.160752	0.207066	6.871855	0.288897	0.24364	1.185752

1344	7.161029	0.355836	7.418038	-0.25701	0.241116	-1.06592
1345	7.161536	0.362904	7.113872	0.047664	0.24064	0.198073
1346	7.161989	0.338916	7.324963	-0.16297	0.218265	-0.74668
1347	7.162397	0.371642	7.404685	-0.24229	0.235533	-1.02868
1348	7.1648	0.394493	7.197564	-0.03276	0.24365	-0.13447
1349	7.165896	0.352947	7.447348	-0.28145	0.241985	-1.1631
1350	7.166329	0.349781	7.435495	-0.26917	0.243426	-1.10574
1351	7.166769	0.194085	6.801563	0.365207	0.243985	1.496844
1352	7.17012	0.327897	7.252527	-0.08241	0.234728	-0.35107
1353	7.17012	0.221683	6.717904	0.452215	0.244162	1.852109
1354	7.17012	0.358491	7.348432	-0.17831	0.237255	-0.75156
1355	7.17012	0.45035	7.281268	-0.11115	0.2406	-0.46196
1356	7.17012	0.31961	6.641774	0.528346	0.241524	2.187553
1357	7.17012	0.358096	7.289217	-0.1191	0.243691	-0.48872
1358	7.17012	0.419129	7.167138	0.002982	0.242695	0.012287
1359	7.17012	0.430411	7.22216	-0.05204	0.240684	-0.21622
1360	7.17012	0.408842	6.997878	0.172241	0.243719	0.706721
1361	7.17012	0.382842	7.497177	-0.32706	0.241326	-1.35525
1362	7.17012	0.416558	7.109143	0.060977	0.242369	0.251587
1363	7.17012	0.396097	7.215458	-0.04534	0.243569	-0.18614
1364	7.17012	0.387902	7.180458	-0.01034	0.239277	-0.04321
1365	7.17012	0.35341	7.477497	-0.30738	0.242161	-1.26931
1366	7.17012	0.402343	7.140423	0.029696	0.178294	0.166558
1367	7.17134	0.247023	6.996084	0.175256	0.241931	0.724405
1368	7.171721	0.335118	7.316668	-0.14495	0.243642	-0.59492
1369	7.171721	0.308385	7.29819	-0.12647	0.237105	-0.53339
1370	7.173458	0.295693	6.785906	0.387553	0.24013	1.61393
1371	7.175235	0.352504	7.235796	-0.06056	0.233414	-0.25946
1372	7.175235	0.398055	7.258967	-0.08373	0.243761	-0.3435
1373	7.175235	0.193356	6.796639	0.378596	0.243301	1.55608
1374	7.175235	0.373098	7.272272	-0.09704	0.243642	-0.39828
1375	7.175235	0.41455	7.065535	0.109699	0.240693	0.455765
1376	7.176019	0.418726	7.223046	-0.04703	0.234524	-0.20052
1377	7.176019	0.349158	7.35923	-0.18321	0.24188	-0.75744
1378	7.176019	0.297947	7.314889	-0.13887	0.234227	-0.59289
1379	7.177088	0.390111	7.10099	0.076099	0.241697	0.314851
1380	7.177088	0.346372	7.259744	-0.08266	0.243619	-0.33928
1381	7.177231	0.437244	7.23686	-0.05963	0.242962	-0.24542
1382	7.17863	0.401613	7.18859	-0.00996	0.243088	-0.04097
1383	7.17863	0.278505	7.018202	0.160428	0.240763	0.666331
1384	7.17863	0.378001	7.114167	0.064464	0.241492	0.266939
1385	7.17863	0.17616	6.746867	0.431764	0.24433	1.767131
1386	7.17863	0.401767	6.82859	0.35004	0.241377	1.450177
1387	7.17863	0.353523	7.174714	0.003916	0.240922	0.016254
1388	7.17863	0.377944	7.384719	-0.20609	0.229725	-0.89711
1389	7.178908	0.396593	7.212998	-0.03409	0.243546	-0.13997
1390	7.179689	0.299065	7.05074	0.128949	0.176809	0.729314
1391	7.179689	0.38238	7.14655	0.033139	0.243061	0.13634
1392	7.179689	0.169062	6.923762	0.255927	0.243974	1.048991
1393	7.179689	0.433615	7.467583	-0.28789	0.239943	-1.19985
1394	7.179689	0.34277	7.469976	-0.29029	0.235689	-1.23165
1395	7.180263	0.221711	6.824879	0.355383	0.244705	1.452295

1396	7.181049	0.388165	7.36533	-0.18428	0.241654	-0.76258
1397	7.181049	0.33725	7.491226	-0.31018	0.239223	-1.29661
1398	7.182486	0.346047	7.306067	-0.12358	0.236597	-0.52233
1399	7.182859	0.339598	7.258731	-0.07587	0.242396	-0.31301
1400	7.182859	0.334698	6.759739	0.42312	0.242101	1.747698
1401	7.182859	0.41341	7.303442	-0.12058	0.241114	-0.50011
1402	7.182859	0.344303	7.431855	-0.249	0.243505	-1.02255
1403	7.182859	0.34597	7.155837	0.027022	0.241946	0.111686
1404	7.182859	0.381048	7.378007	-0.19515	0.242233	-0.80563
1405	7.183167	0.395349	7.159971	0.023196	0.243247	0.095362
1406	7.183603	0.388567	6.693191	0.490411	0.239741	2.045591
1407	7.183603	0.296329	6.892608	0.290995	0.244608	1.189636
1408	7.184009	0.358488	7.198319	-0.01431	0.224411	-0.06377
1409	7.184009	0.385196	7.231382	-0.04737	0.238801	-0.19838
1410	7.185387	0.162115	6.793142	0.392245	0.244341	1.605319
1411	7.185387	0.364818	7.322448	-0.13706	0.243855	-0.56206
1412	7.185387	0.387461	7.069466	0.115921	0.242536	0.477956
1413	7.185387	0.380636	7.123993	0.061394	0.242022	0.253672
1414	7.185387	0.314784	6.904043	0.281344	0.244579	1.150321
1415	7.185387	0.393251	7.242972	-0.05758	0.23835	-0.2416
1416	7.185387	0.268728	7.21829	-0.0329	0.214708	-0.15325
1417	7.185387	0.401101	7.260009	-0.07462	0.240664	-0.31007
1418	7.185387	0.402088	7.539821	-0.35443	0.237423	-1.49284
1419	7.185387	0.374879	7.238841	-0.05345	0.238014	-0.22458
1420	7.185387	0.409903	7.208044	-0.02266	0.242805	-0.09331
1421	7.185909	0.223954	6.752222	0.433687	0.244434	1.77425
1422	7.187069	0.334849	7.447291	-0.26022	0.24075	-1.08088
1423	7.187069	0.343895	7.272142	-0.08507	0.233664	-0.36408
1424	7.188057	0.400518	7.265761	-0.0777	0.243655	-0.31891
1425	7.188269	0.175482	6.908945	0.279323	0.240839	1.159795
1426	7.188658	0.393005	7.09222	0.096438	0.242773	0.397234
1427	7.189168	0.348495	7.73421	-0.54504	0.236772	-2.30197
1428	7.189945	0.371671	7.504188	-0.31424	0.239266	-1.31336
1429	7.190322	0.450988	7.145275	0.045047	0.241749	0.186339
1430	7.190618	0.186972	7.144661	0.045957	0.235919	0.194801
1431	7.190618	0.391447	7.173533	0.017085	0.241339	0.070792
1432	7.190882	0.405501	7.32199	-0.13111	0.241792	-0.54224
1433	7.190882	0.35171	7.248116	-0.05723	0.239962	-0.23852
1434	7.191699	0.337855	7.185579	0.00612	0.241288	0.025365
1435	7.192492	0.375184	7.224901	-0.03241	0.240757	-0.13461
1436	7.192934	0.453433	7.056005	0.136929	0.238689	0.57367
1437	7.195437	0.388117	7.328842	-0.1334	0.24273	-0.5496
1438	7.195437	0.187949	6.914428	0.281009	0.244115	1.151135
1439	7.195437	0.279138	7.151881	0.043556	0.239705	0.181708
1440	7.195437	0.186721	6.890236	0.305202	0.242323	1.25948
1441	7.195437	0.354154	7.15085	0.044588	0.241932	0.184298
1442	7.195437	0.354154	7.210321	-0.01488	0.242093	-0.06148
1443	7.195437	0.337644	7.231879	-0.03644	0.243581	-0.14961
1444	7.195437	0.338327	7.153862	0.041576	0.243058	0.171052
1445	7.195437	0.334436	7.351291	-0.15585	0.241516	-0.64531
1446	7.195437	0.376955	7.378529	-0.18309	0.243053	-0.7533
1447	7.195437	0.566831	7.260468	-0.06503	0.173196	-0.37548

1448	7.195437	0.35353	7.000445	0.194992	0.239107	0.8155
1449	7.195437	0.390466	7.335612	-0.14017	0.235885	-0.59425
1450	7.195437	0.336559	7.053481	0.141956	0.218726	0.649016
1451	7.195437	0.332761	7.471389	-0.27595	0.233767	-1.18046
1452	7.198557	0.379413	7.059606	0.138952	0.241364	0.575694
1453	7.199276	0.383933	6.891696	0.307581	0.243632	1.262481
1454	7.199276	0.284817	7.221968	-0.02269	0.239965	-0.09456
1455	7.199462	0.373959	7.376806	-0.17734	0.237483	-0.74677
1456	7.20028	0.387087	7.231121	-0.03084	0.241811	-0.12754
1457	7.200425	0.393134	7.24612	-0.04569	0.240132	-0.19029
1458	7.200425	0.369355	7.504194	-0.30377	0.242237	-1.25402
1459	7.201302	0.404978	7.270744	-0.06944	0.224722	-0.30901
1460	7.201302	0.384584	7.292396	-0.09109	0.241743	-0.37682
1461	7.202126	0.372098	7.378752	-0.17663	0.234083	-0.75454
1462	7.204021	0.424868	7.142011	0.06201	0.242852	0.25534
1463	7.204021	0.279905	6.983163	0.220858	0.239368	0.922671
1464	7.204487	0.400281	6.958221	0.246267	0.240579	1.023641
1465	7.204654	0.45418	7.27294	-0.06829	0.240284	-0.28419
1466	7.205007	0.377158	7.242076	-0.03707	0.242947	-0.15258
1467	7.206737	0.246271	6.919942	0.286795	0.243688	1.176896
1468	7.207272	0.362363	6.966541	0.240731	0.243801	0.987409
1469	7.20786	0.432426	7.193947	0.013913	0.233306	0.059636
1470	7.20786	0.222406	7.083998	0.123862	0.242692	0.510368
1471	7.210036	0.349161	7.480797	-0.27076	0.236422	-1.14524
1472	7.210036	0.335491	7.253595	-0.04356	0.240699	-0.18097
1473	7.210036	0.341818	7.19821	0.011827	0.243523	0.048565
1474	7.210036	0.440795	7.227673	-0.01764	0.241428	-0.07305
1475	7.210036	0.393233	7.088609	0.121427	0.23215	0.523057
1476	7.210036	0.376048	7.384131	-0.17409	0.24117	-0.72188
1477	7.210036	0.239652	6.914738	0.295298	0.243284	1.213801
1478	7.210705	0.377708	7.173773	0.036932	0.236769	0.155982
1479	7.210705	0.383346	7.359489	-0.14878	0.241697	-0.61558
1480	7.210705	0.394045	7.332771	-0.12207	0.241499	-0.50545
1481	7.211221	0.164957	7.038459	0.172763	0.240724	0.717679
1482	7.211438	0.385721	7.40854	-0.1971	0.242517	-0.81273
1483	7.212416	0.37734	7.200113	0.012303	0.235342	0.052277
1484	7.213137	0.386582	7.130941	0.082195	0.229384	0.358331
1485	7.213137	0.420546	7.04026	0.172877	0.240954	0.71747
1486	7.213137	0.393998	7.408164	-0.19503	0.24162	-0.80716
1487	7.213137	0.349094	7.310531	-0.09739	0.244084	-0.39902
1488	7.213137	0.432697	7.383734	-0.1706	0.231751	-0.73612
1489	7.213137	0.393553	7.311612	-0.09848	0.239215	-0.41166
1490	7.213137	0.231111	6.830605	0.382532	0.24163	1.583132
1491	7.213485	0.348672	7.414003	-0.20052	0.238916	-0.83928
1492	7.214014	0.273826	7.15066	0.063354	0.241418	0.262425
1493	7.21524	0.3487	7.24942	-0.03418	0.24356	-0.14033
1494	7.21524	0.378754	7.387262	-0.17202	0.241305	-0.71288
1495	7.21524	0.278794	6.889263	0.325977	0.241567	1.349425
1496	7.216057	0.244862	6.87282	0.343236	0.242224	1.417019
1497	7.216057	0.351034	7.194731	0.021326	0.242501	0.08794
1498	7.21676	0.350061	7.078966	0.137794	0.23528	0.585662
1499	7.21676	0.357227	7.101445	0.115315	0.241618	0.477262

1500	7.21676	0.391447	7.173533	0.043227	0.241339	0.179113
1501	7.21676	0.339639	7.03038	0.18638	0.23726	0.785552
1502	7.217077	0.390203	7.194062	0.023014	0.242021	0.095092
1503	7.217077	0.43808	7.229009	-0.01193	0.241613	-0.04939
1504	7.217077	0.401101	7.329255	-0.11218	0.237151	-0.47303
1505	7.217077	0.39876	6.98081	0.236267	0.244165	0.967652
1506	7.217077	0.194215	6.936264	0.280813	0.243927	1.15122
1507	7.217077	0.209797	6.990951	0.226126	0.242754	0.931504
1508	7.217077	0.33096	7.22377	-0.00669	0.241621	-0.0277
1509	7.217077	0.320136	7.310296	-0.09322	0.238328	-0.39114
1510	7.217256	0.294802	7.185024	0.032233	0.241153	0.133661
1511	7.21791	0.418916	6.982956	0.234954	0.239101	0.982654
1512	7.21791	0.183301	6.959453	0.258458	0.243028	1.063491
1513	7.21791	0.248769	7.042934	0.174976	0.240757	0.726774
1514	7.21791	0.403916	7.385215	-0.1673	0.241015	-0.69417
1515	7.21791	0.425713	7.16812	0.04979	0.241822	0.205897
1516	7.21791	0.437648	7.028905	0.189005	0.242345	0.779903
1517	7.21791	0.394376	7.19277	0.02514	0.242518	0.103661
1518	7.21791	0.385385	7.36529	-0.14738	0.240437	-0.61297
1519	7.21791	0.368823	7.121538	0.096373	0.241673	0.398773
1520	7.219289	0.404692	7.70927	-0.48998	0.216515	-2.26303
1521	7.22013	0.390953	7.443492	-0.22336	0.235998	-0.94646
1522	7.22013	0.428378	7.084639	0.135491	0.238486	0.568132
1523	7.220354	0.381828	7.322498	-0.10214	0.239435	-0.42661
1524	7.220971	0.401621	7.254468	-0.0335	0.243671	-0.13747
1525	7.221413	0.329693	7.185927	0.035486	0.238185	0.148985
1526	7.222004	0.23519	6.775648	0.446356	0.243282	1.83473
1527	7.222004	0.380283	7.111594	0.11041	0.241258	0.457642
1528	7.222004	0.390535	7.23058	-0.00858	0.241565	-0.0355
1529	7.222004	0.289921	7.302918	-0.08091	0.23483	-0.34456
1530	7.222004	0.338929	7.219275	0.002729	0.215384	0.012672
1531	7.222836	0.3771	7.153864	0.068973	0.236934	0.291104
1532	7.222836	0.400281	6.958221	0.264616	0.240579	1.099912
1533	7.223608	0.440315	6.931604	0.292004	0.236027	1.237167
1534	7.224996	0.164476	7.010266	0.21473	0.241431	0.889405
1535	7.22521	0.390728	7.067153	0.158056	0.242658	0.651355
1536	7.226209	0.349964	7.172476	0.053733	0.242322	0.221743
1537	7.226209	0.368297	7.609217	-0.38301	0.233	-1.64381
1538	7.226209	0.267246	6.885262	0.340947	0.23978	1.421916
1539	7.226209	0.353247	7.240531	-0.01432	0.242149	-0.05915
1540	7.226209	0.313447	6.820817	0.405392	0.24318	1.667047
1541	7.226209	0.397254	7.170382	0.055827	0.241976	0.230711
1542	7.226209	0.435329	7.301245	-0.07504	0.242058	-0.30999
1543	7.226209	0.315159	7.625136	-0.39893	0.235634	-1.69299
1544	7.227109	0.173843	7.033017	0.194092	0.239312	0.811043
1545	7.227186	0.379589	7.36567	-0.13848	0.240974	-0.57469
1546	7.227607	0.387875	7.193209	0.034397	0.232977	0.147643
1547	7.228063	0.287969	7.241251	-0.01319	0.23674	-0.05571
1548	7.228088	0.231157	6.790317	0.437771	0.244563	1.790016
1549	7.229839	0.346465	7.172908	0.056931	0.243267	0.234025
1550	7.229839	0.378908	7.373853	-0.14401	0.242164	-0.5947
1551	7.229839	0.263142	6.806649	0.42319	0.244527	1.730645

1552	7.229839	0.38234	7.216358	0.013481	0.232401	0.058007
1553	7.229839	0.38519	7.414933	-0.18509	0.240654	-0.76913
1554	7.230982	0.343733	7.277694	-0.04671	0.238061	-0.19622
1555	7.231995	0.448238	7.203512	0.028483	0.240219	0.118569
1556	7.232251	0.390405	7.297238	-0.06499	0.241215	-0.26941
1557	7.232682	0.324222	7.361949	-0.12927	0.242649	-0.53274
1558	7.233178	0.400336	7.332011	-0.09883	0.241322	-0.40955
1559	7.233178	0.348933	7.284208	-0.05103	0.243715	-0.20939
1560	7.233847	0.231111	6.760169	0.473678	0.244464	1.937617
1561	7.233971	0.253746	6.833268	0.400703	0.239378	1.673931
1562	7.234152	0.436832	7.06919	0.164962	0.240829	0.684975
1563	7.234232	0.407878	7.389855	-0.15562	0.231621	-0.67189
1564	7.235789	0.375845	7.233642	0.002146	0.234944	0.009135
1565	7.235789	0.371412	7.254586	-0.0188	0.236465	-0.07949
1566	7.236259	0.287719	7.179922	0.056338	0.240146	0.234597
1567	7.236259	0.330255	7.411581	-0.17532	0.238384	-0.73546
1568	7.236259	0.384442	7.11798	0.118279	0.241487	0.489796
1569	7.237059	0.400242	7.309699	-0.07264	0.241731	-0.3005
1570	7.237059	0.222706	6.790693	0.446366	0.243712	1.831529
1571	7.237997	0.34103	7.286969	-0.04897	0.242644	-0.20183
1572	7.239112	0.380708	7.310767	-0.07165	0.238619	-0.30029
1573	7.239112	0.372351	7.590944	-0.35183	0.21192	-1.66021
1574	7.241247	0.403914	7.182516	0.058731	0.243364	0.241331
1575	7.241528	0.328899	7.201793	0.039736	0.203158	0.19559
1576	7.242124	0.407878	7.190531	0.051594	0.239674	0.215266
1577	7.24284	0.376161	7.387682	-0.14484	0.220144	-0.65794
1578	7.243016	0.37665	7.362652	-0.11964	0.24293	-0.49247
1579	7.244228	0.368267	7.258089	-0.01386	0.243694	-0.05688
1580	7.244228	0.449569	6.959721	0.284506	0.243541	1.168206
1581	7.244228	0.393277	7.458722	-0.21449	0.239956	-0.89389
1582	7.244228	0.403134	7.373145	-0.12892	0.237962	-0.54176
1583	7.244228	0.188532	7.160465	0.083763	0.24161	0.346685
1584	7.244228	0.227615	6.751784	0.492443	0.244414	2.014788
1585	7.244228	0.397451	7.012222	0.232005	0.241404	0.961069
1586	7.244228	0.323643	7.53141	-0.28718	0.240415	-1.19453
1587	7.244228	0.19434	7.223581	0.020647	0.237991	0.086753
1588	7.244228	0.367182	7.368713	-0.12449	0.241227	-0.51605
1589	7.244228	0.355425	7.273314	-0.02909	0.243462	-0.11947
1590	7.244228	0.409903	6.986819	0.257409	0.24428	1.053747
1591	7.244228	0.279247	7.07524	0.168987	0.240669	0.702155
1592	7.245233	0.287092	6.904176	0.341057	0.23518	1.450194
1593	7.245562	0.357032	7.08225	0.163312	0.234974	0.695023
1594	7.248682	0.388615	7.180448	0.068233	0.212894	0.320504
1595	7.250041	0.396952	7.055684	0.194358	0.242979	0.799896
1596	7.250246	0.338674	7.338294	-0.08805	0.237208	-0.37119
1597	7.251718	0.322906	7.300113	-0.0484	0.237643	-0.20365
1598	7.251851	0.324284	7.448681	-0.19683	0.237822	-0.82763
1599	7.251851	0.381811	7.374948	-0.1231	0.24024	-0.51239
1600	7.251851	0.256494	7.232873	0.018978	0.222577	0.085266
1601	7.2523	0.398875	7.860648	-0.60835	0.237326	-2.56335
1602	7.252596	0.38606	7.204488	0.048108	0.235205	0.204536
1603	7.252596	0.398217	6.976328	0.276268	0.244192	1.131355

1604	7.252596	0.390099	7.062997	0.189599	0.242345	0.78235
1605	7.254032	0.333681	7.17583	0.078202	0.241212	0.324203
1606	7.25438	0.347498	7.270669	-0.01629	0.243791	-0.06682
1607	7.25438	0.345502	7.235753	0.018627	0.243729	0.076424
1608	7.25438	0.430797	7.231609	0.022771	0.242106	0.094055
1609	7.25438	0.435102	7.229481	0.024899	0.241834	0.102958
1610	7.25438	0.208657	7.571147	-0.31677	0.238763	-1.3267
1611	7.25438	0.350776	7.189488	0.064892	0.242481	0.267617
1612	7.254951	0.397299	6.892531	0.36242	0.243875	1.486092
1613	7.256062	0.359602	7.343363	-0.0873	0.244093	-0.35766
1614	7.256062	0.402941	7.163484	0.092578	0.241185	0.383845
1615	7.256062	0.402941	7.335523	-0.07946	0.23959	-0.33165
1616	7.256062	0.355157	7.516425	-0.26036	0.226646	-1.14876
1617	7.256062	0.405128	7.300805	-0.04474	0.239766	-0.18661
1618	7.256062	0.412368	7.012903	0.243159	0.219558	1.10749
1619	7.256062	0.400716	7.190454	0.065608	0.23641	0.27752
1620	7.256062	0.42528	7.056639	0.199423	0.242684	0.821741
1621	7.256062	0.33575	7.318705	-0.06264	0.244035	-0.2567
1622	7.256062	0.314493	7.413053	-0.15699	0.236588	-0.66356
1623	7.25694	0.347767	7.277737	-0.0208	0.237835	-0.08745
1624	7.257131	0.370568	7.412509	-0.15538	0.241481	-0.64344
1625	7.257131	0.338151	7.054501	0.20263	0.239593	0.845728
1626	7.257651	0.413784	7.138325	0.119326	0.243901	0.489238
1627	7.257932	0.239109	7.194771	0.063161	0.240131	0.263028
1628	7.257958	0.40445	7.324659	-0.0667	0.241903	-0.27573
1629	7.258161	0.419459	7.492183	-0.23402	0.242459	-0.96521
1630	7.260577	0.234031	7.145095	0.115482	0.239385	0.482411
1631	7.261395	0.392892	7.189287	0.072108	0.238231	0.302683
1632	7.261927	0.405317	7.230268	0.031659	0.241246	0.131232
1633	7.261927	0.446721	7.153316	0.108611	0.24116	0.450369
1634	7.26443	0.313741	7.188573	0.075857	0.241862	0.313639
1635	7.26543	0.225146	7.168536	0.096894	0.24132	0.401516
1636	7.266533	0.362591	7.158205	0.108328	0.232132	0.466666
1637	7.267129	0.394718	7.176891	0.090239	0.18562	0.486148
1638	7.267411	0.570619	7.353659	-0.08625	0.159564	-0.54053
1639	7.267758	0.32598	7.151894	0.115864	0.236763	0.489369
1640	7.267758	0.361937	6.922018	0.34574	0.236865	1.459651
1641	7.267758	0.269257	7.200462	0.067296	0.217892	0.308849
1642	7.267758	0.393094	7.189542	0.078216	0.238207	0.328354
1643	7.267758	0.337523	7.217438	0.05032	0.243541	0.206618
1644	7.267758	0.219736	6.913752	0.354006	0.243834	1.45183
1645	7.26837	0.386713	7.301268	-0.0329	0.241973	-0.13596
1646	7.269257	0.345502	7.235753	0.033504	0.243729	0.137464
1647	7.269257	0.354072	7.231603	0.037654	0.24346	0.154662
1648	7.269545	0.254486	6.978493	0.291053	0.242728	1.199089
1649	7.26987	0.384409	7.192811	0.077059	0.240592	0.320289
1650	7.26987	0.368632	7.206698	0.063172	0.23823	0.265172
1651	7.26987	0.390925	7.234747	0.035123	0.243525	0.144227
1652	7.26987	0.401828	6.870216	0.399654	0.244116	1.637147
1653	7.26987	0.353914	7.28749	-0.01762	0.243726	-0.07229
1654	7.26987	0.284534	7.342297	-0.07243	0.238944	-0.30311
1655	7.26987	0.371534	7.444931	-0.17506	0.242998	-0.72042

1656	7.26987	0.399511	7.105895	0.163975	0.241968	0.677671
1657	7.26987	0.361914	7.291102	-0.02123	0.243657	-0.08714
1658	7.26987	0.350773	7.24752	0.02235	0.22857	0.097781
1659	7.26987	0.414442	7.391589	-0.12172	0.219619	-0.55423
1660	7.26987	0.228508	7.125452	0.144418	0.241838	0.597169
1661	7.26987	0.333433	7.306104	-0.03623	0.225348	-0.16079
1662	7.26987	0.341097	7.413926	-0.14406	0.240644	-0.59863
1663	7.270161	0.335474	7.241298	0.028863	0.240848	0.11984
1664	7.270239	0.380151	7.501357	-0.23112	0.241926	-0.95533
1665	7.270661	0.197739	6.927664	0.342996	0.242568	1.41402
1666	7.270661	0.34191	7.177432	0.093228	0.243117	0.383472
1667	7.270661	0.250967	6.856973	0.413687	0.244556	1.691589
1668	7.270661	0.41567	6.998234	0.272427	0.244267	1.115284
1669	7.270661	0.407431	6.984293	0.286368	0.24427	1.172343
1670	7.270661	0.372858	7.463052	-0.19239	0.240712	-0.79926
1671	7.270661	0.402771	7.12587	0.144791	0.222718	0.650108
1672	7.270661	0.437235	7.292388	-0.02173	0.233697	-0.09297
1673	7.270661	0.384659	7.323949	-0.05329	0.243806	-0.21857
1674	7.271149	0.34255	7.331308	-0.06016	0.244172	-0.24638
1675	7.272398	0.324602	7.30234	-0.02994	0.243362	-0.12303
1676	7.272398	0.384473	7.224165	0.048233	0.233666	0.206421
1677	7.272398	0.378628	7.245173	0.027226	0.24355	0.111787
1678	7.272869	0.327467	6.98032	0.292549	0.237497	1.231803
1679	7.273399	0.410093	7.508328	-0.23493	0.237493	-0.98921
1680	7.273399	0.31668	7.477573	-0.20417	0.234275	-0.87152
1681	7.273806	0.412018	7.230342	0.043464	0.243155	0.178752
1682	7.273859	0.249727	6.924454	0.349405	0.240281	1.45415
1683	7.274	0.391009	6.98155	0.29245	0.241825	1.209344
1684	7.27486	0.383435	7.17882	0.096039	0.241541	0.397612
1685	7.27548	0.18442	6.729655	0.545825	0.243733	2.239439
1686	7.27548	0.335972	7.153025	0.122455	0.236907	0.516891
1687	7.27548	0.217845	6.912187	0.363293	0.243882	1.489628
1688	7.27548	0.371832	7.167125	0.108355	0.239259	0.452877
1689	7.276179	0.286214	6.841795	0.434384	0.236302	1.838263
1690	7.276663	0.217315	7.267036	0.009626	0.238032	0.040442
1691	7.276663	0.329471	7.266299	0.010364	0.242966	0.042656
1692	7.276663	0.403673	7.303428	-0.02677	0.240076	-0.11149
1693	7.276751	0.320483	7.302397	-0.02565	0.240517	-0.10663
1694	7.277288	0.208338	7.117514	0.159774	0.242353	0.659262
1695	7.279319	0.210989	7.053049	0.22627	0.23783	0.951395
1696	7.279319	0.31192	7.200066	0.079253	0.226239	0.350306
1697	7.279319	0.231111	6.724951	0.554368	0.244107	2.271002
1698	7.279319	0.30742	7.435135	-0.15582	0.228552	-0.68175
1699	7.279319	0.282205	7.306521	-0.0272	0.235789	-0.11537
1700	7.28016	0.36248	7.498366	-0.21821	0.243578	-0.89583
1701	7.280431	0.311889	7.559107	-0.27868	0.236981	-1.17594
1702	7.280431	0.386619	7.314463	-0.03403	0.235581	-0.14446
1703	7.281269	0.376457	7.308161	-0.02689	0.242425	-0.11093
1704	7.281615	0.423543	7.215842	0.065773	0.233814	0.281306
1705	7.281615	0.39146	7.184663	0.096952	0.2427	0.399471
1706	7.281615	0.44125	7.2284	0.053215	0.24127	0.220562
1707	7.281615	0.44975	7.278326	0.003289	0.240562	0.013671

1708	7.281615	0.414343	7.210239	0.071376	0.242828	0.293936
1709	7.281615	0.390303	7.225585	0.05603	0.241904	0.231622
1710	7.282449	0.282079	6.875494	0.406954	0.239562	1.698745
1711	7.282449	0.354635	7.397203	-0.11475	0.242212	-0.47377
1712	7.282449	0.373183	7.426172	-0.14372	0.241558	-0.59498
1713	7.282449	0.393	7.319886	-0.03744	0.242506	-0.15438
1714	7.282449	0.357319	7.134459	0.147989	0.236971	0.624503
1715	7.283924	0.384014	7.636451	-0.35253	0.241301	-1.46094
1716	7.28505	0.382344	7.567858	-0.28281	0.240398	-1.17642
1717	7.28505	0.330517	7.671277	-0.38623	0.240595	-1.6053
1718	7.285518	0.401931	7.332337	-0.04682	0.242083	-0.1934
1719	7.285632	0.346335	7.152346	0.133286	0.236597	0.563346
1720	7.286192	0.377106	7.38263	-0.09644	0.242254	-0.39809
1721	7.286729	0.410004	7.517446	-0.23072	0.236107	-0.97717
1722	7.286787	0.382334	7.551675	-0.26489	0.242426	-1.09265
1723	7.287245	0.346669	7.154434	0.132811	0.243364	0.545729
1724	7.287245	0.373533	7.506822	-0.21958	0.234225	-0.93746
1725	7.287903	0.391133	7.193765	0.094137	0.243431	0.386709
1726	7.28803	0.37089	7.196308	0.091722	0.242368	0.378442
1727	7.288219	0.372345	7.377358	-0.08914	0.241491	-0.36912
1728	7.288219	0.309507	7.242618	0.045601	0.240022	0.189986
1729	7.288352	0.403987	7.25438	0.033972	0.236888	0.143411
1730	7.288405	0.337328	7.45014	-0.16173	0.241894	-0.66862
1731	7.289466	0.437495	6.940836	0.348631	0.237869	1.465643
1732	7.289964	0.571945	7.139733	0.150231	0.18055	0.832074
1733	7.290231	0.360196	7.401954	-0.11172	0.237817	-0.46979
1734	7.290748	0.384904	7.191751	0.098996	0.240901	0.410941
1735	7.290748	0.42575	7.250976	0.039771	0.224276	0.177332
1736	7.290748	0.403394	7.323144	-0.0324	0.24229	-0.13371
1737	7.290748	0.398743	7.389549	-0.0988	0.239913	-0.41182
1738	7.290748	0.336547	7.324705	-0.03396	0.238635	-0.1423
1739	7.290748	0.382974	7.650455	-0.35971	0.241151	-1.49163
1740	7.291621	0.182209	6.950308	0.341313	0.243463	1.401913
1741	7.292722	0.284534	7.280192	0.01253	0.241422	0.051901
1742	7.293418	0.197456	6.830266	0.463152	0.237801	1.947646
1743	7.293418	0.406034	7.032659	0.260759	0.233956	1.114563
1744	7.293418	0.324281	7.11539	0.178028	0.24255	0.733984
1745	7.293418	0.173962	6.877743	0.415675	0.243693	1.705732
1746	7.293418	0.394615	7.333084	-0.03967	0.241002	-0.16459
1747	7.293418	0.355059	7.104142	0.189276	0.238074	0.795027
1748	7.293418	0.344782	7.453434	-0.16002	0.243445	-0.6573
1749	7.293418	0.264129	7.369751	-0.07633	0.235125	-0.32465
1750	7.294528	0.376058	7.087837	0.206691	0.236981	0.872183
1751	7.296413	0.340712	7.448004	-0.15159	0.239673	-0.63249
1752	7.296413	0.405881	7.17965	0.116763	0.243223	0.480065
1753	7.29722	0.276472	6.928934	0.368286	0.239948	1.534855
1754	7.29722	0.337391	7.423487	-0.12627	0.240714	-0.52455
1755	7.298622	0.341074	7.438489	-0.13987	0.240739	-0.58099
1756	7.299522	0.231111	7.221242	0.078279	0.23985	0.326367
1757	7.299797	0.373853	7.144794	0.155003	0.243278	0.637145
1758	7.299797	0.348594	7.252706	0.047091	0.242525	0.194169
1759	7.300798	0.375311	7.316002	-0.0152	0.235636	-0.06453

1760	7.301099	0.36532	7.348681	-0.04758	0.24397	-0.19503
1761	7.301099	0.398874	7.192481	0.108618	0.243594	0.445897
1762	7.302047	0.352818	7.094649	0.207398	0.241596	0.858446
1763	7.302047	0.213898	7.179339	0.122709	0.229698	0.534218
1764	7.302047	0.345085	7.256043	0.046004	0.23181	0.198458
1765	7.302047	0.353502	7.352465	-0.05042	0.2414	-0.20886
1766	7.302047	0.400133	7.319872	-0.01783	0.242441	-0.07352
1767	7.302047	0.390451	6.983833	0.318214	0.243486	1.306908
1768	7.302047	0.434223	7.289931	0.012116	0.238547	0.050793
1769	7.302047	0.350656	7.338768	-0.03672	0.241581	-0.152
1770	7.302047	0.384986	7.159778	0.142269	0.23967	0.593605
1771	7.304171	0.21045	6.909048	0.395122	0.243967	1.619571
1772	7.304171	0.332761	7.510069	-0.2059	0.23795	-0.8653
1773	7.304852	0.352562	7.391079	-0.08623	0.242177	-0.35605
1774	7.304852	0.401101	7.187174	0.117678	0.240716	0.488868
1775	7.304852	0.38927	6.958742	0.34611	0.244294	1.416775
1776	7.304852	0.365378	7.303396	0.001456	0.237539	0.006129
1777	7.304852	0.35656	7.479947	-0.1751	0.243509	-0.71905
1778	7.304852	0.335312	7.186502	0.118351	0.236231	0.500995
1779	7.304852	0.389397	7.060376	0.244476	0.24241	1.00852
1780	7.304852	0.341113	7.327887	-0.02303	0.243973	-0.09441
1781	7.304852	0.348584	7.3222	-0.01735	0.243809	-0.07115
1782	7.304852	0.409903	7.208044	0.096808	0.242805	0.398705
1783	7.304922	0.412018	7.566705	-0.26178	0.238631	-1.09702
1784	7.306531	0.447108	7.036031	0.2705	0.240003	1.127071
1785	7.307141	0.368397	7.372331	-0.06519	0.237198	-0.27483
1786	7.307141	0.379779	7.434563	-0.12742	0.242876	-0.52464
1787	7.307649	0.410093	7.661162	-0.35351	0.234347	-1.5085
1788	7.308882	0.209777	6.909022	0.39986	0.243974	1.638945
1789	7.309196	0.435155	7.511412	-0.20222	0.234039	-0.86403
1790	7.30963	0.383836	7.421828	-0.1122	0.243089	-0.46155
1791	7.311417	0.342099	7.383531	-0.07211	0.240844	-0.29942
1792	7.31322	0.400155	6.963244	0.349976	0.243044	1.439968
1793	7.31322	0.32405	6.906068	0.407153	0.242322	1.680211
1794	7.31322	0.36168	7.352287	-0.03907	0.243537	-0.16041
1795	7.31322	0.455789	7.131566	0.181655	0.241922	0.750881
1796	7.31322	0.376589	7.350314	-0.03709	0.24133	-0.1537
1797	7.31322	0.262481	6.929834	0.383386	0.243316	1.575674
1798	7.31322	0.325332	7.1033	0.20992	0.23967	0.875872
1799	7.31322	0.407878	7.190531	0.12269	0.239674	0.511902
1800	7.31322	0.350002	7.50027	-0.18705	0.242362	-0.77178
1801	7.31322	0.353151	7.066707	0.246513	0.241706	1.01989
1802	7.31322	0.416138	7.039389	0.273831	0.23658	1.157456
1803	7.31322	0.297857	7.254441	0.05878	0.234093	0.251095
1804	7.31322	0.38942	7.162026	0.151194	0.242835	0.62262
1805	7.31322	0.355135	7.432106	-0.11889	0.240793	-0.49373
1806	7.31322	0.42942	7.337156	-0.02394	0.213831	-0.11194
1807	7.31322	0.212414	7.20768	0.105541	0.240314	0.439177
1808	7.31322	0.400487	7.261369	0.051851	0.240664	0.215451
1809	7.31322	0.401101	7.54348	-0.23026	0.24066	-0.95678
1810	7.31322	0.434685	7.444918	-0.1317	0.238431	-0.55235
1811	7.31322	0.388475	7.446415	-0.13319	0.231526	-0.57529

1812	7.31322	0.211937	6.816848	0.496372	0.244718	2.028344
1813	7.31322	0.389364	7.34501	-0.03179	0.241017	-0.1319
1814	7.31322	0.369617	7.503138	-0.18992	0.242442	-0.78335
1815	7.31322	0.370737	7.322205	-0.00898	0.240078	-0.03742
1816	7.31322	0.413613	7.306594	0.006627	0.241051	0.027492
1817	7.31322	0.406362	7.43752	-0.1243	0.238199	-0.52183
1818	7.31322	0.406677	7.705242	-0.39202	0.240381	-1.63083
1819	7.316582	0.415903	7.227247	0.089335	0.243159	0.367392
1820	7.316798	0.361613	7.241127	0.075671	0.240236	0.314987
1821	7.317134	0.265443	7.001079	0.316056	0.243849	1.296114
1822	7.317134	0.385672	7.6468	-0.32967	0.240603	-1.37017
1823	7.317485	0.395326	7.426736	-0.10925	0.240472	-0.45432
1824	7.318335	0.392673	7.22435	0.093986	0.241612	0.388993
1825	7.318854	0.209293	6.864791	0.454063	0.218373	2.079296
1826	7.319263	0.409616	7.099305	0.219957	0.242404	0.907399
1827	7.320942	0.352814	7.458083	-0.13714	0.242334	-0.56592
1828	7.321589	0.349307	7.290955	0.030634	0.241588	0.126801
1829	7.321731	0.339332	7.302838	0.018893	0.243878	0.07747
1830	7.321731	0.404308	7.385843	-0.06411	0.241008	-0.26602
1831	7.322189	0.31924	7.333768	-0.01158	0.239802	-0.04829
1832	7.324916	0.180258	7.060886	0.26403	0.237249	1.112883
1833	7.324916	0.374129	7.570526	-0.24561	0.242496	-1.01284
1834	7.324916	0.324281	7.11539	0.209527	0.24255	0.863849
1835	7.324916	0.394261	7.333963	-0.00905	0.241688	-0.03743
1836	7.324916	0.320292	7.241055	0.083862	0.241897	0.346683
1837	7.324916	0.321147	7.288056	0.03686	0.24274	0.151851
1838	7.324916	0.2164	6.976622	0.348294	0.239967	1.451422
1839	7.324916	0.237828	6.988297	0.33662	0.238828	1.409464
1840	7.324916	0.295091	7.530971	-0.20605	0.227871	-0.90426
1841	7.325055	0.352814	7.594472	-0.26942	0.237378	-1.13497
1842	7.325959	0.331334	7.564277	-0.23832	0.198435	-1.20099
1843	7.325959	0.39318	7.231826	0.094134	0.243602	0.386423
1844	7.325959	0.390927	7.385512	-0.05955	0.242677	-0.2454
1845	7.326466	0.379193	7.287125	0.039341	0.243293	0.161703
1846	7.327014	0.450852	6.996605	0.330409	0.243219	1.358482
1847	7.327014	0.406677	7.349214	-0.0222	0.241245	-0.09202
1848	7.327609	0.352814	7.51149	-0.18388	0.239331	-0.76832
1849	7.327609	0.247437	7.217618	0.109991	0.240217	0.457883
1850	7.328488	0.40168	7.307251	0.021237	0.240053	0.088467
1851	7.328488	0.38005	7.496173	-0.16769	0.241147	-0.69537
1852	7.32935	0.345318	7.375645	-0.0463	0.241686	-0.19155
1853	7.33017	0.367322	7.385308	-0.05514	0.241451	-0.22836
1854	7.33017	0.31531	7.030558	0.299612	0.243895	1.228443
1855	7.330612	0.370127	7.49161	-0.161	0.242071	-0.66508
1856	7.330612	0.394205	7.307231	0.023381	0.241549	0.096798
1857	7.330612	0.364191	7.331091	-0.00048	0.24081	-0.00199
1858	7.330612	0.366378	7.476082	-0.14547	0.239253	-0.60802
1859	7.331239	0.351313	7.468869	-0.13763	0.242771	-0.56691
1860	7.331239	0.353901	7.437957	-0.10672	0.243432	-0.43839
1861	7.33157	0.383802	7.688842	-0.35727	0.239074	-1.4944
1862	7.33157	0.422678	7.555299	-0.22373	0.240276	-0.93114
1863	7.332089	0.348651	7.51068	-0.17859	0.240498	-0.74259

1864	7.332269	0.207254	7.295986	0.036283	0.23932	0.151608
1865	7.332638	0.343161	7.317194	0.015444	0.237525	0.065021
1866	7.332638	0.330021	7.397452	-0.06481	0.242472	-0.2673
1867	7.332638	0.32364	7.27917	0.053468	0.239579	0.223176
1868	7.332967	0.309972	7.094557	0.238411	0.237101	1.005525
1869	7.333526	0.350881	7.43687	-0.10334	0.236967	-0.43612
1870	7.333526	0.231506	7.126193	0.207333	0.241782	0.85752
1871	7.335199	0.394648	7.285057	0.050142	0.24376	0.205703
1872	7.335199	0.383933	7.403036	-0.06784	0.235873	-0.2876
1873	7.335199	0.349019	7.482275	-0.14708	0.243392	-0.60427
1874	7.335199	0.390621	7.443537	-0.10834	0.242205	-0.4473
1875	7.335199	0.345671	7.248733	0.086466	0.243666	0.354856
1876	7.335199	0.433556	7.322563	0.012637	0.237322	0.053248
1877	7.335199	0.447013	7.4438	-0.1086	0.236783	-0.45865
1878	7.335199	0.357196	6.990797	0.344403	0.237583	1.449608
1879	7.335199	0.337601	7.33265	0.002549	0.240795	0.010586
1880	7.335949	0.377879	7.308203	0.027745	0.24162	0.11483
1881	7.335949	0.443589	7.285485	0.050464	0.237113	0.212827
1882	7.335949	0.345492	7.451697	-0.11575	0.242663	-0.47699
1883	7.336751	0.383949	7.521276	-0.18452	0.240477	-0.76733
1884	7.337485	0.334064	7.196057	0.141428	0.241215	0.586316
1885	7.338538	0.387126	7.318163	0.020375	0.238761	0.085336
1886	7.338538	0.380151	7.626035	-0.2875	0.240611	-1.19486
1887	7.339538	0.217036	6.982367	0.35717	0.242078	1.475433
1888	7.339687	0.408198	7.246326	0.093361	0.243396	0.383577
1889	7.34162	0.367982	7.203534	0.138086	0.235232	0.587021
1890	7.342208	0.383658	7.288171	0.054037	0.243375	0.22203
1891	7.34242	0.385638	7.490416	-0.148	0.241865	-0.6119
1892	7.34242	0.209784	6.938931	0.403489	0.242545	1.663559
1893	7.34242	0.400315	7.317645	0.024775	0.229414	0.107992
1894	7.34242	0.363585	7.432786	-0.09037	0.242899	-0.37203
1895	7.34242	0.400794	7.289211	0.053208	0.241829	0.220024
1896	7.34242	0.184014	7.157527	0.184892	0.240007	0.770362
1897	7.34242	0.402848	7.307413	0.035007	0.241409	0.145011
1898	7.343073	0.403815	7.320882	0.022192	0.24225	0.091606
1899	7.343073	0.44758	7.396423	-0.05335	0.24036	-0.22196
1900	7.343073	0.389502	7.461757	-0.11868	0.234431	-0.50626
1901	7.344684	0.386399	7.416277	-0.07159	0.240633	-0.29752
1902	7.345377	0.45306	7.037037	0.30834	0.241761	1.27539
1903	7.34601	0.171497	7.205137	0.140873	0.240568	0.585585
1904	7.34601	0.326612	7.520416	-0.17441	0.189146	-0.92207
1905	7.34601	0.334532	7.251484	0.094526	0.232301	0.406913
1906	7.34601	0.382788	7.468576	-0.12257	0.242834	-0.50473
1907	7.34601	0.375846	7.679972	-0.33396	0.240236	-1.39014
1908	7.34601	0.37028	7.2449	0.10111	0.241895	0.41799
1909	7.34601	0.361613	7.381171	-0.03516	0.23611	-0.14892
1910	7.34601	0.337245	7.423053	-0.07704	0.233858	-0.32944
1911	7.347122	0.333681	7.17583	0.171292	0.241212	0.71013
1912	7.347122	0.38297	7.320971	0.026151	0.24392	0.107209
1913	7.347545	0.314974	7.043954	0.303591	0.220633	1.375999
1914	7.348727	0.366141	7.247757	0.10097	0.243457	0.414736
1915	7.349588	0.404263	7.428615	-0.07903	0.22182	-0.35627

1916	7.349588	0.399679	7.322368	0.02722	0.23154	0.11756
1917	7.349588	0.399805	7.418435	-0.06885	0.239422	-0.28755
1918	7.349588	0.327941	7.397142	-0.04755	0.242016	-0.19649
1919	7.349588	0.354223	7.503751	-0.15416	0.239512	-0.64366
1920	7.351091	0.387347	7.291579	0.059512	0.240683	0.247261
1921	7.351091	0.383975	7.432491	-0.0814	0.243027	-0.33495
1922	7.351248	0.368726	7.438506	-0.08726	0.232335	-0.37557
1923	7.352441	0.345589	7.171734	0.180707	0.243259	0.742861
1924	7.352441	0.378707	7.399027	-0.04659	0.243026	-0.19169
1925	7.352441	0.449844	7.423721	-0.07128	0.24135	-0.29534
1926	7.352441	0.433782	7.028221	0.32422	0.213333	1.519785
1927	7.352441	0.338916	7.398715	-0.04627	0.212883	-0.21737
1928	7.353066	0.398553	7.469087	-0.11602	0.232534	-0.49894
1929	7.35334	0.34461	7.355608	-0.00227	0.241957	-0.00937
1930	7.354042	0.390537	7.100009	0.254034	0.242716	1.046627
1931	7.354042	0.384855	7.417968	-0.06393	0.238808	-0.26769
1932	7.354042	0.426439	7.334196	0.019846	0.239358	0.082916
1933	7.354042	0.324149	7.444414	-0.09037	0.242443	-0.37275
1934	7.354042	0.319818	7.308843	0.045199	0.238172	0.189776
1935	7.354769	0.399292	7.330895	0.023875	0.238661	0.100036
1936	7.354769	0.400698	7.32804	0.026729	0.23901	0.111832
1937	7.355185	0.342952	7.310417	0.044768	0.231393	0.19347
1938	7.356705	0.345524	7.34733	0.009375	0.237771	0.039429
1939	7.356705	0.369598	7.531918	-0.17521	0.238517	-0.73459
1940	7.358683	0.364657	7.064004	0.294679	0.243848	1.208449
1941	7.358943	0.330916	7.367379	-0.00844	0.243219	-0.03469
1942	7.35974	0.347927	7.085748	0.273992	0.240871	1.137508
1943	7.35974	0.347812	7.160688	0.199053	0.241916	0.822817
1944	7.35974	0.396745	7.269776	0.089965	0.239428	0.375749
1945	7.35974	0.291731	7.755393	-0.39565	0.228447	-1.73192
1946	7.35974	0.219267	7.084466	0.275274	0.242791	1.133792
1947	7.360473	0.349509	7.714168	-0.3537	0.240571	-1.47023
1948	7.360952	0.355505	7.276176	0.084776	0.243875	0.34762
1949	7.360952	0.345361	7.299461	0.061491	0.236364	0.260152
1950	7.361011	0.406701	7.511618	-0.15061	0.239673	-0.62839
1951	7.362011	0.345783	7.255269	0.106742	0.242177	0.440759
1952	7.362228	0.371552	7.713491	-0.35126	0.235124	-1.49395
1953	7.362817	0.353403	7.569019	-0.2062	0.213342	-0.96653
1954	7.362944	0.368726	7.438506	-0.07556	0.232335	-0.32523
1955	7.363231	0.398055	7.394542	-0.03131	0.240763	-0.13005
1956	7.364514	0.346632	7.447773	-0.08326	0.243381	-0.3421
1957	7.364514	0.174217	6.873518	0.490995	0.242915	2.021261
1958	7.364514	0.373183	7.202941	0.161573	0.243072	0.66471
1959	7.364514	0.379224	7.370456	-0.00594	0.24215	-0.02454
1960	7.364514	0.384979	7.3024	0.062114	0.2378	0.261201
1961	7.364892	0.280941	7.132599	0.232294	0.239931	0.968168
1962	7.36518	0.367977	7.312119	0.053061	0.242616	0.218704
1963	7.36518	0.392994	7.383104	-0.01792	0.204693	-0.08756
1964	7.36518	0.369743	7.578829	-0.21365	0.236987	-0.90152
1965	7.36518	0.355409	6.991185	0.373995	0.233796	1.599665
1966	7.36518	0.279344	7.525853	-0.16067	0.234182	-0.6861
1967	7.36518	0.341329	7.1494	0.21578	0.243103	0.887608

1968	7.365336	0.157326	7.167216	0.19812	0.240575	0.823527
1969	7.365588	0.374501	7.409131	-0.04354	0.235475	-0.18491
1970	7.365588	0.388901	7.407413	-0.04182	0.241152	-0.17344
1971	7.365588	0.355408	7.322476	0.043113	0.235893	0.182764
1972	7.36633	0.381811	7.374948	-0.00862	0.24024	-0.03587
1973	7.36633	0.345315	7.468439	-0.10211	0.242193	-0.4216
1974	7.367288	0.372003	7.374647	-0.00736	0.243126	-0.03027
1975	7.367709	0.404511	7.323029	0.04468	0.242246	0.184439
1976	7.367809	0.339102	7.300339	0.06747	0.239909	0.281231
1977	7.368097	0.209143	7.530959	-0.16286	0.22498	-0.7239
1978	7.369391	0.374262	7.547188	-0.1778	0.242345	-0.73365
1979	7.369391	0.411596	7.106446	0.262944	0.243769	1.078663
1980	7.369391	0.388263	7.378152	-0.00876	0.241846	-0.03623
1981	7.369391	0.365374	7.63073	-0.26134	0.241135	-1.08379
1982	7.369391	0.326403	7.240472	0.128918	0.232083	0.555484
1983	7.370379	0.387685	7.435713	-0.06533	0.240381	-0.2718
1984	7.370379	0.418131	7.407642	-0.03726	0.17812	-0.2092
1985	7.370379	0.364837	7.498199	-0.12782	0.233109	-0.54833
1986	7.371489	0.392657	7.17443	0.197059	0.240327	0.819962
1987	7.371489	0.25454	7.273205	0.098285	0.239253	0.410798
1988	7.372061	0.401809	7.399648	-0.02759	0.240766	-0.11458
1989	7.372061	0.395667	7.396299	-0.02424	0.239504	-0.1012
1990	7.372061	0.335876	7.286268	0.085793	0.240916	0.356113
1991	7.372061	0.410852	7.606008	-0.23395	0.23006	-1.0169
1992	7.375256	0.245862	7.221404	0.153851	0.23671	0.649958
1993	7.376469	0.404341	7.438574	-0.0621	0.242473	-0.25613
1994	7.376734	0.380861	7.487411	-0.11068	0.241668	-0.45797
1995	7.377759	0.501444	7.177558	0.200201	0.200253	0.999739
1996	7.377759	0.379893	7.426804	-0.04904	0.242671	-0.2021
1997	7.377759	0.226993	6.955055	0.422704	0.243913	1.733008
1998	7.377759	0.398946	7.311055	0.066704	0.222863	0.299307
1999	7.377759	0.328079	7.500327	-0.12257	0.241827	-0.50684
2000	7.377759	0.372155	7.236587	0.141171	0.242734	0.58159
2001	7.377759	0.396545	7.169318	0.20844	0.24197	0.861431
2002	7.377759	0.369327	7.424109	-0.04635	0.241972	-0.19155
2003	7.377759	0.376027	7.313911	0.063848	0.242477	0.263316
2004	7.379102	0.376953	7.41639	-0.03729	0.227683	-0.16377
2005	7.379264	0.353412	7.349138	0.030126	0.240922	0.125043
2006	7.379595	0.391607	7.549367	-0.16977	0.242221	-0.7009
2007	7.380009	0.336828	7.334766	0.045243	0.231673	0.195289
2008	7.380115	0.32073	7.485855	-0.10574	0.239977	-0.44063
2009	7.380662	0.344367	7.483849	-0.10319	0.242445	-0.42561
2010	7.380662	0.343424	7.242175	0.138486	0.241714	0.572934
2011	7.382213	0.347581	7.436711	-0.0545	0.241872	-0.22532
2012	7.383694	0.407961	7.580542	-0.19685	0.238195	-0.82642
2013	7.383838	0.304313	7.421086	-0.03725	0.230048	-0.16191
2014	7.384095	0.366579	7.204531	0.179564	0.238254	0.753664
2015	7.384679	0.38338	7.304057	0.080622	0.240782	0.334834
2016	7.384679	0.189175	7.038633	0.346046	0.240588	1.438338
2017	7.384679	0.345577	7.499748	-0.11507	0.242164	-0.47517
2018	7.384679	0.385367	7.585635	-0.20096	0.241208	-0.83312
2019	7.384679	0.252362	7.294149	0.09053	0.23877	0.379152

2020	7.384679	0.208774	7.211384	0.173295	0.237985	0.728175
2021	7.385541	0.455721	7.011016	0.374525	0.227913	1.643279
2022	7.385541	0.382229	7.326832	0.058709	0.24336	0.241245
2023	7.385541	0.308933	7.032033	0.353508	0.243468	1.451968
2024	7.385541	0.277476	7.494869	-0.10933	0.239076	-0.4573
2025	7.385541	0.451425	7.107429	0.278112	0.238386	1.166645
2026	7.385541	0.514702	7.489377	-0.10384	0.186081	-0.55802
2027	7.385541	0.450207	7.472743	-0.0872	0.238447	-0.36571
2028	7.385541	0.433704	7.445056	-0.05952	0.238544	-0.24949
2029	7.385541	0.389279	7.396814	-0.01127	0.223588	-0.05042
2030	7.385541	0.38308	7.278628	0.106913	0.240737	0.444105
2031	7.385791	0.369697	7.507842	-0.12205	0.242443	-0.50342
2032	7.386648	0.347582	7.36835	0.018298	0.241886	0.075646
2033	7.387328	0.393439	7.232083	0.155245	0.243672	0.637107
2034	7.387328	0.346807	7.280494	0.106835	0.243624	0.438523
2035	7.387328	0.341544	7.515511	-0.12818	0.242629	-0.52831
2036	7.387328	0.336472	7.442355	-0.05503	0.240321	-0.22897
2037	7.387328	0.380391	7.141586	0.245743	0.241331	1.018282
2038	7.387328	0.342654	7.415073	-0.02774	0.242825	-0.11426
2039	7.387328	0.336618	7.441309	-0.05398	0.240245	-0.22469
2040	7.387882	0.379079	7.287044	0.100838	0.243521	0.414085
2041	7.388122	0.324599	7.403705	-0.01558	0.24205	-0.06438
2042	7.388122	0.386045	7.480519	-0.0924	0.241245	-0.383
2043	7.389058	0.323185	7.337765	0.051293	0.238079	0.215447
2044	7.389058	0.179375	7.00321	0.385849	0.242802	1.589151
2045	7.389058	0.230956	7.015952	0.373107	0.243156	1.534433
2046	7.389058	0.346167	7.485446	-0.09639	0.242466	-0.39753
2047	7.389058	0.287693	7.249722	0.139337	0.234072	0.595273
2048	7.389058	0.424867	7.469202	-0.08014	0.191884	-0.41767
2049	7.389058	0.165181	6.794707	0.594351	0.243597	2.439895
2050	7.389058	0.354635	7.43728	-0.04822	0.243455	-0.19807
2051	7.389058	0.383544	7.362597	0.026462	0.240319	0.11011
2052	7.389058	0.401449	7.328663	0.060395	0.237298	0.254513
2053	7.389058	0.388556	7.290941	0.098117	0.237057	0.413898
2054	7.389593	0.35064	7.51639	-0.1268	0.242321	-0.52326
2055	7.391552	0.333049	7.218092	0.17346	0.241797	0.717378
2056	7.392001	0.210608	7.425643	-0.03364	0.230682	-0.14584
2057	7.392001	0.229716	7.060574	0.331427	0.239764	1.382303
2058	7.392264	0.337706	7.236434	0.15583	0.241733	0.644637
2059	7.392358	0.374395	7.402556	-0.0102	0.240528	-0.0424
2060	7.393263	0.433271	7.230806	0.162457	0.241929	0.671506
2061	7.393263	0.388615	7.764181	-0.37092	0.223827	-1.65717
2062	7.393263	0.419895	7.320855	0.072408	0.229973	0.314854
2063	7.393263	0.35492	7.193993	0.19927	0.23386	0.85209
2064	7.394189	0.335608	7.290171	0.104018	0.240401	0.432688
2065	7.394411	0.354402	7.341521	0.052889	0.231445	0.228518
2066	7.394661	0.359175	7.448032	-0.05337	0.239224	-0.2231
2067	7.394661	0.342389	7.505291	-0.11063	0.238397	-0.46406
2068	7.394661	0.386915	7.156269	0.238392	0.24156	0.986885
2069	7.395458	0.395827	7.520787	-0.12533	0.240762	-0.52055
2070	7.395912	0.401904	7.530649	-0.13474	0.239559	-0.56244
2071	7.396108	0.374937	7.550276	-0.15417	0.237634	-0.64876

2072	7.398378	0.348304	7.369399	0.028979	0.235655	0.122971
2073	7.399265	0.374131	7.624629	-0.22536	0.240891	-0.93554
2074	7.399578	0.340248	7.319627	0.079951	0.244112	0.327517
2075	7.399578	0.274485	7.135343	0.264235	0.239518	1.103191
2076	7.399578	0.34575	7.333455	0.066123	0.244114	0.27087
2077	7.399578	0.270116	7.076577	0.323001	0.24244	1.332292
2078	7.399578	0.314711	6.904364	0.495214	0.244556	2.024946
2079	7.399578	0.332461	7.261961	0.137617	0.234154	0.587719
2080	7.399578	0.337196	7.476714	-0.07714	0.243473	-0.31682
2081	7.399578	0.309616	7.340797	0.058781	0.240986	0.243918
2082	7.399835	0.371794	7.34952	0.050314	0.240026	0.20962
2083	7.400232	0.354657	7.286283	0.113949	0.243742	0.467497
2084	7.400232	0.347144	7.090467	0.309765	0.234507	1.32092
2085	7.401146	0.360729	7.674639	-0.27349	0.23196	-1.17905
2086	7.401774	0.391462	7.309564	0.09221	0.243886	0.378085
2087	7.401774	0.389148	7.633004	-0.23123	0.232157	-0.996
2088	7.403077	0.383335	7.351654	0.051422	0.239498	0.214709
2089	7.403077	0.325921	7.362803	0.040273	0.241392	0.166838
2090	7.404192	0.440992	7.10638	0.297812	0.243856	1.221262
2091	7.404192	0.335491	7.357084	0.047108	0.238939	0.197154
2092	7.404192	0.385336	7.371616	0.032576	0.238734	0.136454
2093	7.404192	0.348087	7.313861	0.090331	0.240092	0.376235
2094	7.40457	0.262352	7.039479	0.365091	0.240071	1.520764
2095	7.405158	0.403936	7.372725	0.032433	0.241686	0.134193
2096	7.406746	0.396423	7.400077	0.00667	0.241314	0.027638
2097	7.406746	0.337726	7.476589	-0.06984	0.243413	-0.28693
2098	7.406746	0.337397	7.317583	0.089163	0.244055	0.365341
2099	7.406746	0.394124	7.265768	0.140978	0.24387	0.578088
2100	7.406746	0.347648	7.457424	-0.05068	0.242292	-0.20916
2101	7.406746	0.385013	7.706846	-0.3001	0.237088	-1.26577
2102	7.407152	0.411916	7.335682	0.071471	0.238112	0.300156
2103	7.407152	0.345071	7.434911	-0.02776	0.240683	-0.11533
2104	7.407485	0.375508	7.543836	-0.13635	0.239593	-0.56909
2105	7.408531	0.446086	7.334608	0.073923	0.226519	0.326343
2106	7.408531	0.169159	7.394428	0.014102	0.235417	0.059904
2107	7.409364	0.363201	7.233971	0.175393	0.241007	0.727753
2108	7.409612	0.349551	7.513945	-0.10433	0.240653	-0.43354
2109	7.409847	0.358327	7.572096	-0.16225	0.239212	-0.67826
2110	7.410859	0.384268	7.49562	-0.08476	0.242788	-0.34912
2111	7.411201	0.346703	7.376761	0.03444	0.238865	0.14418
2112	7.411412	0.33575	7.318705	0.092708	0.244035	0.379895
2113	7.411412	0.30577	7.482331	-0.07092	0.222577	-0.31862
2114	7.41166	0.348515	7.611657	-0.2	0.241334	-0.82871
2115	7.411892	0.34652	7.311478	0.100414	0.244099	0.411366
2116	7.411892	0.39262	6.984198	0.427694	0.244029	1.752633
2117	7.411892	0.351019	7.471602	-0.05971	0.241341	-0.24741
2118	7.411892	0.334849	7.596247	-0.18436	0.241374	-0.76377
2119	7.411892	0.291952	7.194006	0.217886	0.230384	0.945751
2120	7.412311	0.404692	7.272245	0.140066	0.2422	0.578307
2121	7.41285	0.330978	6.941314	0.471536	0.239054	1.972507
2122	7.414573	0.363835	7.283934	0.130639	0.243115	0.537353
2123	7.41576	0.190686	6.92474	0.49102	0.244047	2.011988

2124	7.41598	0.335339	7.19016	0.225821	0.243411	0.927733
2125	7.41598	0.339008	7.20975	0.20623	0.243557	0.846741
2126	7.416078	0.446531	7.401231	0.014847	0.241305	0.061527
2127	7.416473	0.458976	7.26875	0.147723	0.233751	0.631966
2128	7.418581	0.202629	7.697506	-0.27893	0.230738	-1.20884
2129	7.418581	0.348973	7.29637	0.122211	0.244	0.500865
2130	7.418581	0.401907	7.401977	0.016603	0.239053	0.069455
2131	7.418581	0.443484	7.225256	0.193325	0.242843	0.796087
2132	7.418581	0.34315	7.319132	0.099449	0.236627	0.420276
2133	7.418581	0.341424	7.618439	-0.19986	0.235418	-0.84895
2134	7.418581	0.348535	7.448345	-0.02976	0.242266	-0.12286
2135	7.418581	0.382348	7.266449	0.152132	0.243441	0.624924
2136	7.418581	0.357551	7.399036	0.019545	0.243485	0.080273
2137	7.418581	0.37437	7.640668	-0.22209	0.242009	-0.91768
2138	7.418581	0.379326	7.237231	0.18135	0.236376	0.76721
2139	7.418581	0.39034	6.98382	0.434761	0.24351	1.785395
2140	7.418581	0.39034	7.184465	0.234116	0.240738	0.972494
2141	7.418581	0.422473	7.62958	-0.211	0.236235	-0.89317
2142	7.418581	0.33523	7.302494	0.116087	0.243754	0.476246
2143	7.420579	0.364152	7.310005	0.110574	0.242264	0.456419
2144	7.420931	0.386188	7.372762	0.048169	0.232508	0.207172
2145	7.422211	0.390114	7.238951	0.18326	0.243527	0.752522
2146	7.422211	0.375082	7.304966	0.117244	0.241192	0.486102
2147	7.423221	0.395018	7.263749	0.159472	0.241429	0.660533
2148	7.423389	0.347967	7.486807	-0.06342	0.243616	-0.26032
2149	7.423568	0.376589	7.287655	0.135914	0.236214	0.575384
2150	7.423762	0.385666	7.245295	0.178467	0.241421	0.739238
2151	7.423762	0.3889	7.297877	0.125885	0.244014	0.515894
2152	7.424279	0.390725	7.184166	0.240113	0.240972	0.996436
2153	7.426549	0.369598	7.484881	-0.05833	0.239085	-0.24398
2154	7.426549	0.344269	7.274465	0.152084	0.243743	0.623954
2155	7.426549	0.385368	7.233371	0.193178	0.242629	0.796185
2156	7.427631	0.382943	7.369643	0.057988	0.23842	0.243217
2157	7.427631	0.369519	7.47355	-0.04592	0.240989	-0.19055
2158	7.427631	0.371477	7.496215	-0.06858	0.237053	-0.28932
2159	7.427949	0.322924	7.438298	-0.01035	0.240109	-0.0431
2160	7.428979	0.378437	7.509636	-0.08066	0.242017	-0.33327
2161	7.429754	0.364881	7.406727	0.023027	0.234085	0.098372
2162	7.429945	0.335945	7.123697	0.306248	0.240811	1.271738
2163	7.431003	0.413611	7.007229	0.423774	0.244211	1.735277
2164	7.431003	0.347322	7.264285	0.166719	0.242051	0.688775
2165	7.431003	0.399622	7.079221	0.351783	0.240309	1.46388
2166	7.431003	0.333159	7.75475	-0.32375	0.236836	-1.36696
2167	7.431003	0.303267	7.403696	0.027307	0.237145	0.11515
2168	7.431003	0.341914	7.31618	0.114823	0.244104	0.470386
2169	7.431003	0.342781	7.651971	-0.22097	0.238379	-0.92696
2170	7.431003	0.267447	7.200444	0.23056	0.241631	0.95418
2171	7.431003	0.368984	7.363258	0.067745	0.238878	0.283597
2172	7.43228	0.415167	7.17278	0.2595	0.242522	1.070005
2173	7.432484	0.355281	6.993478	0.439006	0.223391	1.965191
2174	7.433022	0.404692	7.319884	0.113138	0.242149	0.467224
2175	7.43318	0.373933	7.383414	0.049765	0.241623	0.205962

2176	7.433619	0.409205	7.486111	-0.05249	0.242469	-0.21649
2177	7.433848	0.392114	7.42145	0.012398	0.243071	0.051007
2178	7.433848	0.378135	7.375669	0.058179	0.240332	0.242077
2179	7.433848	0.341056	7.327764	0.106084	0.24418	0.43445
2180	7.433848	0.393543	7.34942	0.084429	0.242153	0.348659
2181	7.434454	0.367493	7.664518	-0.23006	0.241728	-0.95175
2182	7.434454	0.392831	7.265595	0.168859	0.239978	0.703643
2183	7.434454	0.435668	7.444818	-0.01036	0.238312	-0.04349
2184	7.43551	0.394478	7.265434	0.170076	0.232786	0.73061
2185	7.43551	0.386309	7.346485	0.089025	0.237191	0.375329
2186	7.435578	0.374	7.456667	-0.02109	0.241494	-0.08733
2187	7.43628	0.381471	7.095392	0.340889	0.240972	1.41464
2188	7.438384	0.370399	7.563846	-0.12546	0.237669	-0.52789
2189	7.438384	0.344789	7.393322	0.045062	0.2424	0.185898
2190	7.438384	0.44705	6.989187	0.449196	0.23679	1.89702
2191	7.438384	0.203041	6.766097	0.672287	0.244671	2.747713
2192	7.438384	0.413666	7.182927	0.255457	0.236483	1.080234
2193	7.438384	0.349372	7.25682	0.181564	0.243618	0.745279
2194	7.441054	0.235392	7.175754	0.265299	0.209404	1.266925
2195	7.441181	0.330957	7.065775	0.375406	0.240914	1.558259
2196	7.441838	0.452711	7.479984	-0.03815	0.216315	-0.17634
2197	7.442297	0.356099	7.153021	0.289277	0.242121	1.194762
2198	7.442297	0.392114	7.292048	0.150249	0.244019	0.615728
2199	7.442297	0.275694	7.08024	0.362058	0.242446	1.493357
2200	7.442297	0.376417	7.438763	0.003535	0.243008	0.014546
2201	7.442432	0.320613	7.448371	-0.00594	0.235259	-0.02525
2202	7.442534	0.332278	7.34411	0.098424	0.236979	0.415326
2203	7.442678	0.344595	7.457626	-0.01495	0.24279	-0.06156
2204	7.443274	0.355577	7.640819	-0.19755	0.204188	-0.96747
2205	7.443717	0.354072	7.231603	0.212114	0.24346	0.871246
2206	7.444556	0.415888	7.016642	0.427914	0.244178	1.75247
2207	7.445148	0.352507	7.436791	0.008357	0.243468	0.034327
2208	7.44571	0.402461	7.400058	0.045652	0.241688	0.188887
2209	7.445793	0.350181	7.174639	0.271154	0.241881	1.121025
2210	7.446752	0.414258	7.307644	0.139108	0.242299	0.574118
2211	7.446752	0.339168	7.225492	0.221259	0.231661	0.955101
2212	7.447877	0.335594	7.395267	0.05261	0.242625	0.216838
2213	7.447995	0.337601	7.45506	-0.00707	0.239515	-0.0295
2214	7.44814	0.277476	7.509288	-0.06115	0.237216	-0.25778
2215	7.44814	0.344595	7.278976	0.169164	0.24184	0.699484
2216	7.448562	0.395836	7.285035	0.163527	0.240683	0.679429
2217	7.449022	0.372148	7.533744	-0.08472	0.230773	-0.36712
2218	7.45008	0.356799	7.372478	0.077602	0.242722	0.319714
2219	7.45008	0.374125	7.459225	-0.00915	0.242452	-0.03772
2220	7.45008	0.355999	7.548226	-0.09815	0.242931	-0.40401
2221	7.45008	0.405911	7.391478	0.058601	0.240587	0.243576
2222	7.45008	0.155532	6.866985	0.583094	0.243296	2.396645
2223	7.450842	0.395461	7.11321	0.337632	0.240838	1.401903
2224	7.451371	0.385338	7.370978	0.080393	0.243574	0.330056
2225	7.451371	0.353241	7.545569	-0.0942	0.242783	-0.38799
2226	7.452687	0.337328	7.398937	0.05375	0.242124	0.221993
2227	7.452687	0.316575	7.529774	-0.07709	0.239184	-0.32229

2228	7.452982	0.450323	6.977744	0.475238	0.243002	1.955696
2229	7.452982	0.378502	7.702848	-0.24987	0.240082	-1.04075
2230	7.452982	0.366992	7.590787	-0.1378	0.240802	-0.57227
2231	7.454299	0.348584	7.349685	0.104614	0.2412	0.433721
2232	7.454299	0.336449	7.48152	-0.02722	0.238722	-0.11403
2233	7.455537	0.39975	7.372246	0.083291	0.237539	0.35064
2234	7.456321	0.377217	7.685611	-0.22929	0.240285	-0.95424
2235	7.456321	0.367005	7.287095	0.169226	0.230667	0.733637
2236	7.457802	0.39031	7.316966	0.140836	0.242314	0.581214
2237	7.457802	0.436832	7.396844	0.060958	0.241062	0.252871
2238	7.457802	0.379193	7.658898	-0.2011	0.241295	-0.8334
2239	7.457802	0.344413	7.389745	0.068057	0.239534	0.284121
2240	7.457802	0.418131	7.477645	-0.01984	0.149308	-0.1329
2241	7.458586	0.338063	7.226122	0.232464	0.242163	0.95995
2242	7.459824	0.38272	7.391152	0.068672	0.238792	0.287582
2243	7.460203	0.38204	7.285929	0.174273	0.243985	0.714277
2244	7.460203	0.415059	7.247913	0.212289	0.243124	0.873174
2245	7.460203	0.160698	7.211237	0.248966	0.236729	1.051689
2246	7.460203	0.362197	7.493705	-0.0335	0.242238	-0.1383
2247	7.460203	0.338685	7.616841	-0.15664	0.234543	-0.66784
2248	7.461141	0.429464	7.384797	0.076343	0.236078	0.323381
2249	7.461141	0.394721	7.655797	-0.19466	0.238235	-0.81708
2250	7.46164	0.180416	6.918433	0.543207	0.24284	2.236888
2251	7.46164	0.390968	7.05649	0.40515	0.242862	1.66823
2252	7.46164	0.345229	7.340532	0.121109	0.241332	0.501835
2253	7.46164	0.390754	7.396739	0.064901	0.242389	0.267755
2254	7.462316	0.363479	7.550906	-0.08859	0.242013	-0.36605
2255	7.462316	0.416829	7.318246	0.14407	0.238803	0.603301
2256	7.462676	0.359096	7.428618	0.034059	0.234522	0.145226
2257	7.463793	0.359505	7.764337	-0.30054	0.226643	-1.32607
2258	7.463793	0.327941	7.458812	0.004982	0.238232	0.020911
2259	7.46659	0.388615	7.692337	-0.22575	0.22596	-0.99906
2260	7.467371	0.380556	7.19067	0.276701	0.240738	1.14939
2261	7.467371	0.340114	7.386756	0.080615	0.237504	0.339424
2262	7.467371	0.412611	7.085929	0.381442	0.239522	1.592509
2263	7.467371	0.385219	7.224831	0.24254	0.243765	0.994973
2264	7.467371	0.355202	7.331162	0.136209	0.244095	0.558019
2265	7.467371	0.318327	7.194329	0.273042	0.241814	1.129143
2266	7.467371	0.341405	7.429172	0.038199	0.242945	0.157233
2267	7.467371	0.361825	7.450149	0.017222	0.241285	0.071378
2268	7.467371	0.374875	7.276771	0.1906	0.219694	0.867569
2269	7.467371	0.343733	7.206799	0.260572	0.240966	1.081365
2270	7.46905	0.261029	7.195231	0.273819	0.241827	1.132295
2271	7.46905	0.220005	6.940773	0.528277	0.22968	2.300061
2272	7.46905	0.385376	7.312215	0.156835	0.236818	0.662259
2273	7.46905	0.26628	7.25802	0.21103	0.239005	0.882951
2274	7.46905	0.444851	7.400674	0.068376	0.220962	0.309449
2275	7.46905	0.392285	7.477274	-0.00822	0.240625	-0.03418
2276	7.470406	0.349121	7.258697	0.211709	0.243782	0.868438
2277	7.470406	0.337073	7.399473	0.070933	0.242213	0.292853
2278	7.470541	0.381708	7.296738	0.173803	0.243169	0.714743
2279	7.470541	0.390526	7.368944	0.101597	0.240899	0.42174

2280	7.470541	0.239616	6.914977	0.555563	0.243772	2.279033
2281	7.470541	0.399326	7.637252	-0.16671	0.237491	-0.70197
2282	7.470541	0.348246	7.325793	0.144748	0.243887	0.593504
2283	7.470541	0.354223	7.422467	0.048073	0.242608	0.198151
2284	7.470541	0.341703	7.30873	0.161811	0.242043	0.668521
2285	7.470541	0.349509	7.505279	-0.03474	0.24146	-0.14387
2286	7.470541	0.407421	7.553683	-0.08314	0.240042	-0.34636
2287	7.472781	0.472092	7.612511	-0.13973	0.125673	-1.11185
2288	7.473069	0.390729	7.595284	-0.12222	0.239515	-0.51026
2289	7.473069	0.215167	7.372131	0.100938	0.235668	0.428308
2290	7.473069	0.42188	7.283353	0.189716	0.235056	0.80711
2291	7.473844	0.380065	7.254665	0.219179	0.243542	0.899962
2292	7.474151	0.54648	7.718778	-0.24463	0.170505	-1.43472
2293	7.475133	0.346726	7.413621	0.061512	0.24337	0.25275
2294	7.475133	0.385587	7.37994	0.095194	0.240922	0.395121
2295	7.475133	0.35144	7.474425	0.000708	0.242063	0.002924
2296	7.475739	0.422473	7.526459	-0.05072	0.236941	-0.21406
2297	7.475739	0.359629	7.483482	-0.00774	0.243272	-0.03183
2298	7.47685	0.377453	7.45608	0.02077	0.241481	0.08601
2299	7.47685	0.380193	7.671572	-0.19472	0.241314	-0.80693
2300	7.47685	0.348289	7.438427	0.038423	0.241668	0.15899
2301	7.47685	0.371248	7.391211	0.085639	0.234288	0.365526
2302	7.47685	0.338685	7.477898	-0.00105	0.237495	-0.00441
2303	7.47685	0.347498	7.311723	0.165127	0.2441	0.676473
2304	7.47685	0.4019	7.469176	0.007674	0.23846	0.032182
2305	7.47685	0.332807	7.471309	0.005541	0.233771	0.023702
2306	7.477523	0.418071	7.279504	0.198019	0.240978	0.821733
2307	7.477523	0.417389	7.552303	-0.07478	0.240052	-0.31151
2308	7.4783	0.384862	7.487851	-0.00955	0.241082	-0.03962
2309	7.4783	0.399444	7.33687	0.14143	0.230685	0.613088
2310	7.4783	0.247437	7.150061	0.32824	0.23987	1.368407
2311	7.479206	0.332846	7.388897	0.090308	0.232461	0.388488
2312	7.480616	0.340874	7.391983	0.088633	0.242558	0.36541
2313	7.481101	0.230379	6.735846	0.745255	0.243358	3.062376
2314	7.481101	0.369192	7.564363	-0.08326	0.224445	-0.37097
2315	7.481556	0.313312	7.659519	-0.17796	0.240968	-0.73854
2316	7.482297	0.356099	7.395283	0.087013	0.242751	0.358448
2317	7.483566	0.37936	7.552268	-0.0687	0.236554	-0.29043
2318	7.483566	0.245862	7.237467	0.246099	0.237575	1.035879
2319	7.484178	0.357427	7.259495	0.224683	0.242958	0.924781
2320	7.484369	0.353123	7.04395	0.440419	0.237102	1.857511
2321	7.484369	0.366704	7.20219	0.282178	0.243607	1.158333
2322	7.484369	0.389533	7.323578	0.160791	0.230399	0.697881
2323	7.484369	0.160873	6.832305	0.652063	0.242928	2.684187
2324	7.484369	0.324206	7.248349	0.23602	0.241605	0.976882
2325	7.484643	0.17957	7.044317	0.440326	0.241833	1.820786
2326	7.485272	0.323735	7.386076	0.099196	0.239232	0.414646
2327	7.485833	0.361584	7.281882	0.203951	0.241567	0.844286
2328	7.48624	0.329825	7.496583	-0.01034	0.241733	-0.04279
2329	7.487574	0.380453	7.210841	0.276733	0.23519	1.176637
2330	7.487574	0.39204	7.161946	0.325628	0.243278	1.3385
2331	7.487574	0.391656	7.472521	0.015052	0.214632	0.070131

2332	7.488424	0.353968	7.316927	0.171498	0.242385	0.707543
2333	7.489677	0.370127	7.269126	0.220551	0.243693	0.905035
2334	7.49004	0.352655	7.339828	0.150212	0.244171	0.615191
2335	7.49004	0.350132	7.305301	0.184739	0.241563	0.764765
2336	7.490902	0.341781	7.464049	0.026853	0.226695	0.118453
2337	7.490902	0.347006	7.351458	0.139444	0.238282	0.585206
2338	7.490902	0.345546	7.535048	-0.04415	0.240244	-0.18376
2339	7.490902	0.290926	7.651245	-0.16034	0.229354	-0.69911
2340	7.490902	0.321246	7.721127	-0.23023	0.236055	-0.9753
2341	7.491831	0.386818	7.556501	-0.06467	0.233441	-0.27703
2342	7.492861	0.340546	7.377843	0.115018	0.241906	0.475466
2343	7.493382	0.252086	7.279681	0.213701	0.236414	0.903925
2344	7.493804	0.346989	7.431822	0.061983	0.243349	0.254707
2345	7.495542	0.370399	7.556781	-0.06124	0.222307	-0.27547
2346	7.495542	0.327989	7.412098	0.083444	0.242638	0.343904
2347	7.495542	0.277801	7.647578	-0.15204	0.236246	-0.64355
2348	7.495542	0.340712	7.227213	0.268329	0.24214	1.108155
2349	7.495542	0.384862	7.364919	0.130623	0.243712	0.53597
2350	7.495542	0.385721	7.299299	0.196243	0.244006	0.804255
2351	7.495542	0.313888	7.563965	-0.06842	0.239895	-0.28522
2352	7.495542	0.352856	7.340574	0.154968	0.237414	0.652732
2353	7.495542	0.374735	7.366509	0.129033	0.243177	0.530612
2354	7.495542	0.384409	7.4629	0.032642	0.242495	0.134608
2355	7.495542	0.353464	7.426053	0.069489	0.243097	0.285848
2356	7.495542	0.179891	7.018478	0.477064	0.242591	1.966539
2357	7.495542	0.399105	7.590179	-0.09464	0.240834	-0.39295
2358	7.495542	0.417877	7.500259	-0.00472	0.23637	-0.01996
2359	7.498424	0.380823	7.403808	0.094615	0.241557	0.391689
2360	7.498424	0.408798	7.052208	0.446216	0.240496	1.8554
2361	7.499008	0.377217	7.593555	-0.09455	0.23909	-0.39544
2362	7.499008	0.366718	7.740037	-0.24103	0.235597	-1.02306
2363	7.50058	0.379261	7.554393	-0.05381	0.238753	-0.22539
2364	7.500819	0.361604	7.658346	-0.15753	0.241714	-0.65171
2365	7.502057	0.397137	7.580608	-0.07855	0.241286	-0.32555
2366	7.502462	0.339763	7.29363	0.208832	0.236564	0.882772
2367	7.502462	0.277476	7.578337	-0.07587	0.238416	-0.31824
2368	7.502462	0.39486	7.363311	0.139151	0.242557	0.573685
2369	7.502841	0.317025	7.510572	-0.00773	0.238796	-0.03237
2370	7.503739	0.355299	7.413526	0.090213	0.239083	0.377329
2371	7.504571	0.438537	7.043831	0.46074	0.203946	2.259133
2372	7.504674	0.340821	7.574626	-0.06995	0.237408	-0.29465
2373	7.504759	0.38799	7.352129	0.15263	0.236872	0.644356
2374	7.504759	0.326462	7.513176	-0.00842	0.236622	-0.03557
2375	7.504759	0.375705	7.313549	0.19121	0.242463	0.788614
2376	7.504982	0.161297	7.006065	0.498918	0.242768	2.055124
2377	7.505592	0.404851	7.319179	0.186414	0.242138	0.769866
2378	7.505592	0.388656	7.587607	-0.08202	0.234279	-0.35008
2379	7.505592	0.375311	7.427326	0.078266	0.234915	0.333166
2380	7.505592	0.375311	7.427326	0.078266	0.234915	0.333166
2381	7.507812	0.245227	7.389536	0.118276	0.237978	0.497004
2382	7.508529	0.349996	7.499805	0.008724	0.242351	0.035998
2383	7.508529	0.370626	7.323132	0.185397	0.237113	0.781896

2384	7.508529	0.345367	7.407831	0.100698	0.242894	0.414574
2385	7.508529	0.370963	7.396005	0.112524	0.232748	0.483456
2386	7.508529	0.32254	7.332655	0.175874	0.239919	0.733055
2387	7.509235	0.388623	7.601771	-0.09254	0.178644	-0.51799
2388	7.509335	0.343302	7.407275	0.10206	0.241228	0.423086
2389	7.509335	0.344924	7.490822	0.018513	0.232414	0.079657
2390	7.509931	0.321559	7.375728	0.134203	0.237341	0.565443
2391	7.509931	0.390962	7.406041	0.10389	0.241201	0.43072
2392	7.510174	0.355758	7.481039	0.029134	0.242709	0.120038
2393	7.510248	0.367514	7.333077	0.177171	0.243796	0.726719
2394	7.510518	0.382974	7.353213	0.157306	0.242036	0.649927
2395	7.510751	0.343401	7.592551	-0.0818	0.241374	-0.33889
2396	7.511099	0.367896	7.74321	-0.23211	0.238231	-0.97431
2397	7.51129	0.376762	7.44269	0.0686	0.241762	0.28375
2398	7.511671	0.422473	7.732701	-0.22103	0.234332	-0.94324
2399	7.512107	0.340633	7.650536	-0.13843	0.233208	-0.59359
2400	7.512492	0.437614	7.374339	0.138152	0.239094	0.577815
2401	7.513891	0.369313	7.446988	0.066903	0.239658	0.279159
2402	7.513891	0.370127	7.300713	0.213178	0.240697	0.885669
2403	7.513891	0.339567	7.433254	0.080637	0.211395	0.381451
2404	7.513891	0.375147	7.52822	-0.01433	0.236765	-0.06052
2405	7.513891	0.351835	7.599253	-0.08536	0.23621	-0.36138
2406	7.513891	0.366973	7.327894	0.185997	0.242715	0.766319
2407	7.513891	0.313389	7.483517	0.030374	0.237447	0.127919
2408	7.513891	0.367533	7.231936	0.281955	0.238671	1.181353
2409	7.513891	0.332761	7.642022	-0.12813	0.234031	-0.54749
2410	7.515041	0.340759	7.197612	0.31743	0.243514	1.303539
2411	7.515041	0.358776	7.417842	0.097199	0.242939	0.400096
2412	7.515823	0.36044	7.55017	-0.03435	0.241606	-0.14216
2413	7.515909	0.363958	7.417018	0.098891	0.240892	0.41052
2414	7.516561	0.31801	7.592946	-0.07638	0.241735	-0.31599
2415	7.516684	0.213391	7.496872	0.019812	0.231323	0.085646
2416	7.516684	0.360729	7.653793	-0.13711	0.232372	-0.59004
2417	7.517252	0.388326	7.631073	-0.11382	0.232318	-0.48994
2418	7.519072	0.413694	7.396118	0.122954	0.238615	0.515283
2419	7.519072	0.370014	7.600582	-0.08151	0.241544	-0.33745
2420	7.519476	0.340606	7.689731	-0.17025	0.231755	-0.73463
2421	7.519933	0.331027	7.520417	-0.00048	0.238839	-0.00203
2422	7.519933	0.379634	7.387227	0.132706	0.242375	0.547523
2423	7.52086	0.345485	7.341413	0.179447	0.237493	0.755588
2424	7.52086	0.382545	7.375299	0.14556	0.242215	0.600955
2425	7.52086	0.404179	7.227186	0.293674	0.239362	1.226901
2426	7.521765	0.359885	7.548914	-0.02715	0.241602	-0.11237
2427	7.522009	0.393976	7.660075	-0.13807	0.238657	-0.57852
2428	7.522571	0.190932	7.313926	0.208645	0.235227	0.886995
2429	7.522941	0.335985	7.388314	0.134627	0.23942	0.562302
2430	7.522941	0.347828	7.316417	0.206523	0.238985	0.864171
2431	7.522941	0.179251	7.251565	0.271376	0.237821	1.141094
2432	7.525064	0.393515	7.329903	0.195161	0.2418	0.807118
2433	7.525553	0.378524	7.106722	0.418831	0.243373	1.720947
2434	7.525553	0.183234	6.73991	0.785643	0.242444	3.240509
2435	7.526794	0.375618	7.508635	0.01816	0.242428	0.074909

2436	7.526794	0.351512	7.243994	0.282801	0.239894	1.178857
2437	7.527699	0.384084	7.57703	-0.04933	0.241686	-0.20411
2438	7.527996	0.33177	7.344379	0.183617	0.238092	0.771201
2439	7.528332	0.334497	7.276012	0.25232	0.243413	1.03659
2440	7.528849	0.352295	7.375404	0.153445	0.237607	0.645793
2441	7.528929	0.354223	7.503751	0.025178	0.239512	0.105121
2442	7.529246	0.368836	7.384639	0.144608	0.241469	0.598867
2443	7.529675	0.412497	7.515601	0.014074	0.223892	0.06286
2444	7.529675	0.328068	7.668293	-0.13862	0.236944	-0.58502
2445	7.529675	0.382183	7.308655	0.22102	0.243974	0.905916
2446	7.529675	0.420989	7.354253	0.175421	0.241726	0.725703
2447	7.529675	0.440839	7.294904	0.234771	0.233232	1.006598
2448	7.529675	0.427515	7.359542	0.170133	0.231498	0.734919
2449	7.529807	0.387395	7.685578	-0.15577	0.239803	-0.64958
2450	7.530028	0.346578	7.112608	0.41742	0.238429	1.75071
2451	7.530944	0.364818	7.248397	0.282547	0.243548	1.160128
2452	7.530944	0.342204	7.12353	0.407414	0.236413	1.723317
2453	7.53191	0.346349	7.42051	0.111399	0.238404	0.46727
2454	7.53191	0.324198	7.355567	0.176342	0.236699	0.745008
2455	7.53191	0.324198	7.355567	0.176342	0.236699	0.745008
2456	7.53191	0.343606	7.630459	-0.09855	0.23854	-0.41314
2457	7.53191	0.375508	7.808384	-0.27647	0.240722	-1.14852
2458	7.533461	0.34794	7.493697	0.039764	0.236274	0.168296
2459	7.534008	0.341331	7.324772	0.209236	0.244169	0.85693
2460	7.534008	0.337887	7.467342	0.066666	0.243511	0.273771
2461	7.534008	0.367639	7.490776	0.043233	0.242099	0.178574
2462	7.534008	0.314846	7.483194	0.050814	0.228003	0.222866
2463	7.534008	0.438573	7.201568	0.33244	0.232969	1.42697
2464	7.534008	0.29515	7.19672	0.337288	0.226465	1.489361
2465	7.534211	0.393115	7.291811	0.2424	0.241585	1.003374
2466	7.535151	0.363601	7.385246	0.149905	0.241583	0.620511
2467	7.535151	0.349843	7.297723	0.237428	0.242562	0.978835
2468	7.535305	0.338076	7.197988	0.337318	0.243298	1.38644
2469	7.536364	0.298583	7.48969	0.046674	0.109047	0.42802
2470	7.536364	0.387548	7.320581	0.215783	0.240078	0.898803
2471	7.536364	0.382696	7.430248	0.106116	0.236075	0.4495
2472	7.536364	0.451657	7.417583	0.118781	0.241894	0.491047
2473	7.536364	0.361975	7.301101	0.235263	0.241853	0.972753
2474	7.537389	0.34277	7.437177	0.100212	0.239752	0.417984
2475	7.537844	0.365837	7.274881	0.262964	0.241653	1.088188
2476	7.537844	0.379784	7.452284	0.08556	0.231316	0.369884
2477	7.537844	0.431253	7.423802	0.114043	0.233744	0.487894
2478	7.53866	0.356265	7.369723	0.168937	0.234372	0.720808
2479	7.539027	0.24989	7.412515	0.126512	0.235907	0.53628
2480	7.540278	0.330578	7.412802	0.127476	0.241692	0.527432
2481	7.540278	0.310833	7.406353	0.133925	0.239015	0.560322
2482	7.542254	0.386366	7.521681	0.020573	0.242755	0.084749
2483	7.542254	0.386366	7.521681	0.020573	0.242755	0.084749
2484	7.543144	0.307935	7.596763	-0.05362	0.235813	-0.22738
2485	7.543144	0.23697	7.434427	0.108716	0.162385	0.669497
2486	7.543744	0.356475	7.251932	0.291812	0.243642	1.197708
2487	7.543744	0.280991	7.49013	0.053614	0.241442	0.222059

2488	7.543744	0.366215	7.576945	-0.0332	0.235604	-0.14092
2489	7.543744	0.315674	7.656393	-0.11265	0.226843	-0.49659
2490	7.543744	0.388845	7.473147	0.070597	0.230449	0.306348
2491	7.544332	0.373603	7.578495	-0.03416	0.241398	-0.14152
2492	7.544332	0.23697	7.25721	0.287122	0.238974	1.201475
2493	7.545333	0.437885	7.68396	-0.13863	0.238855	-0.58038
2494	7.545843	0.349071	7.52119	0.024653	0.242776	0.101546
2495	7.546094	0.364771	7.496091	0.050003	0.24223	0.206428
2496	7.546178	0.359787	7.548614	-0.00244	0.241603	-0.01008
2497	7.546244	0.436832	6.998393	0.547852	0.243549	2.249453
2498	7.546974	0.291731	7.601452	-0.05448	0.233384	-0.23343
2499	7.54806	0.387263	7.510072	0.037988	0.242466	0.156675
2500	7.549018	0.21564	7.189246	0.359771	0.238478	1.508617
2501	7.549609	0.35503	7.469904	0.079705	0.237169	0.336068
2502	7.549609	0.225406	6.982579	0.56703	0.24157	2.347274
2503	7.549609	0.277667	7.349043	0.200566	0.237208	0.84553
2504	7.549609	0.408116	7.593725	-0.04412	0.237081	-0.18608
2505	7.549609	0.317209	7.536455	0.013154	0.239427	0.054939
2506	7.549609	0.343518	7.409597	0.140012	0.243304	0.575463
2507	7.549609	0.348307	7.667567	-0.11796	0.241957	-0.48751
2508	7.549609	0.317675	7.539297	0.010312	0.239952	0.042976
2509	7.551631	0.379948	7.470225	0.081407	0.238554	0.34125
2510	7.551846	0.415564	7.396725	0.155121	0.236228	0.65666
2511	7.552112	0.227137	7.09308	0.459032	0.240046	1.91227
2512	7.5527	0.351348	7.458985	0.093715	0.243448	0.38495
2513	7.5527	0.36913	7.439811	0.112889	0.242383	0.465747
2514	7.553112	0.352552	7.291514	0.261598	0.243718	1.073362
2515	7.553986	0.424867	7.622363	-0.06838	0.202901	-0.337
2516	7.554382	0.357027	7.241404	0.312979	0.24305	1.287711
2517	7.554382	0.351348	7.514259	0.040123	0.242588	0.165398
2518	7.554382	0.361012	7.34794	0.206443	0.241414	0.855141
2519	7.554382	0.393154	7.232348	0.322034	0.243612	1.321913
2520	7.554382	0.323835	7.536184	0.018198	0.238408	0.076332
2521	7.554993	0.365349	7.550933	0.00406	0.242744	0.016726
2522	7.555782	0.377453	7.79933	-0.24355	0.234926	-1.0367
2523	7.555905	0.36584	7.312223	0.243682	0.242315	1.005643
2524	7.556202	0.399824	7.738996	-0.18279	0.221731	-0.82439
2525	7.5571	0.421588	7.459092	0.098008	0.222676	0.440138
2526	7.558343	0.352286	7.926357	-0.36801	0.230517	-1.59647
2527	7.558343	0.424961	7.541364	0.016979	0.239813	0.070799
2528	7.558343	0.370729	7.457401	0.100942	0.23863	0.423006
2529	7.559744	0.347741	7.434383	0.125361	0.243435	0.514968
2530	7.56008	0.345651	7.513585	0.046495	0.242581	0.191669
2531	7.560317	0.33177	7.481125	0.079193	0.233177	0.339624
2532	7.560317	0.304675	7.326992	0.233325	0.234047	0.996915
2533	7.561682	0.454187	7.224893	0.336789	0.242481	1.38893
2534	7.561682	0.290905	6.932471	0.629211	0.239603	2.626052
2535	7.561682	0.334999	7.399189	0.162492	0.236366	0.687461
2536	7.561682	0.384799	7.406436	0.155246	0.242519	0.64014
2537	7.563631	0.257837	7.521499	0.042132	0.240524	0.175168
2538	7.564088	0.34824	7.424786	0.139303	0.24184	0.576012
2539	7.564535	0.387341	7.332105	0.23243	0.229959	1.010745

2540	7.564535	0.371242	7.573555	-0.00902	0.240679	-0.03748
2541	7.564535	0.370759	7.387103	0.177432	0.243	0.730171
2542	7.567001	0.33111	7.433713	0.133288	0.22722	0.586605
2543	7.567001	0.343327	7.603211	-0.03621	0.242063	-0.14959
2544	7.567001	0.213391	7.514142	0.052859	0.237356	0.222698
2545	7.567001	0.364476	7.668672	-0.10167	0.23872	-0.4259
2546	7.567001	0.434415	7.285056	0.281945	0.241195	1.168951
2547	7.568113	0.34856	7.48757	0.080542	0.242496	0.332139
2548	7.569154	0.257837	7.542316	0.026838	0.228762	0.117319
2549	7.569154	0.346129	7.405273	0.163881	0.242608	0.675497
2550	7.569439	0.398329	7.603699	-0.03426	0.240819	-0.14227
2551	7.56994	0.365491	7.201335	0.368605	0.238529	1.54533
2552	7.570131	0.345922	7.506546	0.063585	0.241587	0.263198
2553	7.570443	0.335647	7.798991	-0.22855	0.234529	-0.97449
2554	7.570443	0.355863	7.343362	0.227082	0.2415	0.940295
2555	7.570793	0.318354	7.528205	0.042588	0.235655	0.18072
2556	7.571049	0.428771	6.961755	0.609295	0.241131	2.52682
2557	7.571049	0.38272	7.425295	0.145754	0.242553	0.600917
2558	7.571049	0.312498	7.451576	0.119474	0.242273	0.493136
2559	7.571049	0.430882	7.325016	0.246033	0.230388	1.067908
2560	7.571049	0.366441	7.877738	-0.30669	0.202518	-1.51438
2561	7.571246	0.345117	7.598447	-0.0272	0.239064	-0.11378
2562	7.572034	0.33723	7.749409	-0.17737	0.238851	-0.74262
2563	7.572732	0.365526	7.581293	-0.00856	0.242066	-0.03537
2564	7.572732	0.385145	7.529551	0.04318	0.241819	0.178564
2565	7.572732	0.381563	7.654646	-0.08191	0.237115	-0.34546
2566	7.573251	0.337407	7.273943	0.299307	0.24357	1.228834
2567	7.573251	0.402248	7.184621	0.38863	0.243415	1.596579
2568	7.573353	0.360047	7.518512	0.054841	0.242433	0.22621
2569	7.573353	0.437737	7.454831	0.118522	0.239021	0.495864
2570	7.574234	0.293858	7.647469	-0.07323	0.242437	-0.30208
2571	7.574234	0.223662	7.52747	0.046764	0.223766	0.208988
2572	7.574234	0.382394	7.513111	0.061123	0.241925	0.252654
2573	7.574234	0.385483	7.358159	0.216075	0.243162	0.888606
2574	7.575585	0.353393	7.467922	0.107663	0.241068	0.44661
2575	7.575585	0.424225	7.650199	-0.07461	0.230972	-0.32305
2576	7.576805	0.349635	7.517517	0.059288	0.235675	0.251567
2577	7.576805	0.338126	7.630107	-0.0533	0.193475	-0.2755
2578	7.577186	0.385834	7.405385	0.171801	0.242701	0.707869
2579	7.57843	0.386371	7.357279	0.221151	0.23684	0.933755
2580	7.57843	0.386502	7.308587	0.269842	0.24313	1.10987
2581	7.579849	0.388615	7.684983	-0.10513	0.232159	-0.45285
2582	7.5807	0.268539	7.497977	0.082722	0.229251	0.360837
2583	7.5807	0.38338	7.437358	0.143342	0.242485	0.591137
2584	7.581484	0.409205	7.486111	0.095374	0.242469	0.393343
2585	7.584095	0.341914	7.51889	0.065206	0.242679	0.268691
2586	7.584095	0.302131	7.365751	0.218344	0.221097	0.987547
2587	7.584095	0.335617	7.462015	0.12208	0.24337	0.501623
2588	7.584095	0.335287	7.583601	0.000494	0.201314	0.002454
2589	7.584282	0.339606	7.669063	-0.08478	0.237247	-0.35736
2590	7.585029	0.326638	7.55313	0.031899	0.236549	0.134853
2591	7.585398	0.332495	7.584418	0.00098	0.242258	0.004045

2592	7.585635	0.246857	7.561617	0.024018	0.23607	0.101743
2593	7.586514	0.344231	7.368421	0.218092	0.230035	0.948081
2594	7.586514	0.372348	7.25211	0.334404	0.241492	1.384739
2595	7.587172	0.38813	7.477601	0.109571	0.241997	0.452779
2596	7.587479	0.417875	7.080632	0.506848	0.24049	2.107559
2597	7.588217	0.34768	7.64958	-0.06136	0.236848	-0.25908
2598	7.588324	0.343856	7.34914	0.239183	0.241358	0.990989
2599	7.588324	0.379694	7.514322	0.074002	0.243188	0.3043
2600	7.58848	0.379491	7.48764	0.10084	0.242211	0.41633
2601	7.589068	0.392724	7.738613	-0.14955	0.228051	-0.65575
2602	7.589729	0.230145	7.426912	0.162817	0.236166	0.689418
2603	7.589729	0.399994	7.404263	0.185466	0.240991	0.769597
2604	7.590852	0.212253	7.749471	-0.15862	0.237004	-0.66927
2605	7.590852	0.32939	7.411177	0.179675	0.242677	0.740386
2606	7.590852	0.385468	7.415139	0.175713	0.242669	0.724085
2607	7.59177	0.355346	7.424965	0.166805	0.24331	0.685565
2608	7.59177	0.389192	7.33334	0.25843	0.242918	1.063859
2609	7.592244	0.357294	7.426839	0.165405	0.243089	0.68043
2610	7.592534	0.296584	7.528841	0.063693	0.233019	0.27334
2611	7.592534	0.394613	7.461228	0.131306	0.236933	0.55419
2612	7.592534	0.345257	7.332529	0.260005	0.241962	1.074568
2613	7.592934	0.34826	7.169633	0.423301	0.237082	1.785463
2614	7.59318	0.351951	7.762856	-0.16968	0.240608	-0.70519
2615	7.59318	0.350558	7.716574	-0.12339	0.228448	-0.54014
2616	7.59318	0.371154	7.389818	0.203363	0.234421	0.867511
2617	7.593374	0.358575	7.643393	-0.05002	0.234813	-0.21302
2618	7.593734	0.345815	7.199814	0.39392	0.238843	1.64928
2619	7.593734	0.393578	7.453582	0.140151	0.242113	0.578867
2620	7.593734	0.392202	7.512084	0.08165	0.233285	0.35
2621	7.593734	0.394	7.476547	0.117187	0.241295	0.485657
2622	7.593734	0.32254	7.472977	0.120757	0.240398	0.502321
2623	7.594213	0.383882	7.505561	0.088653	0.242867	0.365026
2624	7.594213	0.387836	7.621553	-0.02734	0.203956	-0.13405
2625	7.594213	0.370729	7.457401	0.136813	0.23863	0.573325
2626	7.594633	0.427786	7.228334	0.366299	0.243171	1.506342
2627	7.594633	0.354679	7.341461	0.253172	0.244118	1.037087
2628	7.594633	0.356415	7.397309	0.197324	0.242067	0.815162
2629	7.594633	0.356098	7.396885	0.197747	0.242087	0.816844
2630	7.594633	0.359323	7.446033	0.1486	0.236753	0.627658
2631	7.594633	0.392165	7.333848	0.260785	0.241259	1.080936
2632	7.595003	0.334978	7.596797	-0.00179	0.241798	-0.00742
2633	7.595003	0.294157	7.260598	0.334405	0.235621	1.419251
2634	7.595204	0.337245	7.656463	-0.06126	0.230964	-0.26523
2635	7.595331	0.380236	7.361358	0.233974	0.23794	0.983333
2636	7.595625	0.387836	7.610966	-0.01534	0.204927	-0.07486
2637	7.595625	0.354679	7.492661	0.102964	0.243618	0.422648
2638	7.59589	0.339104	7.37884	0.21705	0.243412	0.891698
2639	7.596727	0.354559	7.449913	0.146814	0.241964	0.606759
2640	7.596894	0.370935	7.561542	0.035353	0.234239	0.150926
2641	7.597629	0.346674	7.605729	-0.0081	0.239066	-0.03388
2642	7.5989	0.350485	7.699221	-0.10032	0.237473	-0.42245
2643	7.600236	0.394618	7.570599	0.029637	0.236901	0.125101

2644	7.600902	0.378568	7.327944	0.272958	0.242444	1.125862
2645	7.600902	0.212905	7.323529	0.277373	0.239206	1.159557
2646	7.600902	0.364826	7.332779	0.268124	0.235036	1.140775
2647	7.600902	0.356296	7.541082	0.059821	0.242802	0.246376
2648	7.600902	0.396763	7.399212	0.20169	0.241405	0.835483
2649	7.600902	0.422456	7.685732	-0.08483	0.235803	-0.35975
2650	7.600902	0.422473	7.423338	0.177564	0.236459	0.750931
2651	7.600902	0.422473	7.526459	0.074443	0.236941	0.314185
2652	7.600902	0.422473	7.526459	0.074443	0.236941	0.314185
2653	7.600902	0.422473	7.62958	-0.02868	0.236235	-0.12139
2654	7.600902	0.388326	7.484138	0.116764	0.24272	0.481065
2655	7.600902	0.325608	7.840511	-0.23961	0.170774	-1.40307
2656	7.600902	0.387898	7.506291	0.094612	0.242514	0.390129
2657	7.600902	0.227699	7.732324	-0.13142	0.238496	-0.55104
2658	7.600902	0.3807	7.492614	0.108288	0.242772	0.446049
2659	7.600902	0.413987	7.639818	-0.03892	0.238655	-0.16306
2660	7.600902	0.364889	7.827252	-0.22635	0.23423	-0.96636
2661	7.600902	0.400322	7.726749	-0.12585	0.236361	-0.53243
2662	7.604894	0.396534	7.583979	0.020915	0.209724	0.099727
2663	7.605357	0.334531	7.644974	-0.03962	0.241583	-0.16399
2664	7.606323	0.393078	7.350589	0.255734	0.242155	1.056076
2665	7.606505	0.382946	7.573697	0.032808	0.240699	0.136301
2666	7.606633	0.194337	6.889134	0.717499	0.243645	2.944859
2667	7.606633	0.386216	7.671116	-0.06448	0.241651	-0.26684
2668	7.606716	0.363308	7.803198	-0.19648	0.234439	-0.83809
2669	7.607212	0.446177	7.479163	0.128049	0.213519	0.599707
2670	7.607375	0.324602	7.30234	0.305035	0.243362	1.253421
2671	7.607823	0.358327	7.619093	-0.01127	0.238127	-0.04733
2672	7.611485	0.375903	7.804731	-0.19325	0.237675	-0.81307
2673	7.612076	0.343774	7.393832	0.218244	0.236523	0.922718
2674	7.612553	0.385561	7.627188	-0.01463	0.239919	-0.061
2675	7.612553	0.437542	7.507314	0.105239	0.235732	0.446433
2676	7.613325	0.383495	7.505002	0.108323	0.241805	0.447975
2677	7.614325	0.372358	7.532867	0.081458	0.231076	0.352517
2678	7.614447	0.342464	7.642681	-0.02823	0.238696	-0.11829
2679	7.614696	0.258301	6.928714	0.685982	0.243776	2.813987
2680	7.614696	0.220613	6.865756	0.74894	0.222643	3.363861
2681	7.615361	0.357541	7.431902	0.183459	0.241052	0.761075
2682	7.615501	0.376678	7.431339	0.184163	0.242189	0.760408
2683	7.616569	0.293858	7.647469	-0.0309	0.242437	-0.12746
2684	7.618602	0.382635	7.649645	-0.03104	0.236674	-0.13117
2685	7.619252	0.370468	7.407863	0.211389	0.240887	0.877544
2686	7.619422	0.355341	7.407912	0.21151	0.242818	0.871065
2687	7.621242	0.320264	7.810267	-0.18903	0.241015	-0.78429
2688	7.621242	0.363671	7.347932	0.27331	0.244006	1.120093
2689	7.621522	0.384321	7.631813	-0.01029	0.239398	-0.04299
2690	7.621809	0.398592	7.479474	0.142335	0.24228	0.587482
2691	7.622409	0.346341	7.268711	0.353698	0.236115	1.49799
2692	7.623375	0.219924	7.815433	-0.19206	0.232421	-0.82634
2693	7.624433	0.388559	7.515331	0.109102	0.242634	0.449659
2694	7.625595	0.33866	7.451761	0.173834	0.242616	0.716497
2695	7.625595	0.379409	7.635909	-0.01031	0.239449	-0.04308

2696	7.625595	0.401335	7.322935	0.30266	0.242394	1.248627
2697	7.626878	0.358003	7.744962	-0.11808	0.238488	-0.49514
2698	7.626878	0.345885	7.436758	0.19012	0.233786	0.813225
2699	7.62722	0.341638	7.463749	0.163471	0.243532	0.671252
2700	7.628301	0.380955	7.560782	0.06752	0.241618	0.279449
2701	7.628301	0.373652	7.547877	0.080424	0.242356	0.331844
2702	7.628301	0.376128	7.676254	-0.04795	0.241493	-0.19857
2703	7.629073	0.363277	7.563691	0.065382	0.232703	0.280967
2704	7.629146	0.360394	7.721068	-0.09192	0.231834	-0.3965
2705	7.629521	0.349527	7.643869	-0.01435	0.240787	-0.05959
2706	7.62989	0.340668	7.60408	0.02581	0.241959	0.106672
2707	7.631465	0.371794	7.721672	-0.09021	0.24088	-0.37449
2708	7.631674	0.352986	7.487168	0.144506	0.243659	0.593067
2709	7.632651	0.388696	7.254841	0.37781	0.240663	1.56987
2710	7.633692	0.334833	7.593849	0.039843	0.237776	0.167567
2711	7.633692	0.306836	7.641171	-0.00748	0.153487	-0.04872
2712	7.634804	0.412299	7.454316	0.180488	0.23847	0.756857
2713	7.634804	0.365526	7.761258	-0.12645	0.240624	-0.52552
2714	7.634804	0.355016	7.438321	0.196483	0.243437	0.807118
2715	7.634804	0.355016	7.438321	0.196483	0.243437	0.807118
2716	7.635994	0.346979	7.409207	0.226787	0.241795	0.937927
2717	7.636621	0.293214	7.502124	0.134496	0.237164	0.567103
2718	7.63746	0.278832	7.814485	-0.17702	0.233787	-0.7572
2719	7.637716	0.448822	7.459639	0.178078	0.239727	0.742837
2720	7.638643	0.380444	7.519444	0.119199	0.242485	0.491572
2721	7.639054	0.388383	7.578816	0.060238	0.241899	0.249023
2722	7.639617	0.208657	7.69386	-0.05424	0.236505	-0.22935
2723	7.639617	0.243857	7.86831	-0.22869	0.235344	-0.97174
2724	7.640123	0.345961	7.756769	-0.11665	0.195487	-0.59669
2725	7.640997	0.378397	7.584797	0.0562	0.237386	0.236745
2726	7.640997	0.335709	7.547965	0.093032	0.23585	0.394454
2727	7.640997	0.369578	7.711675	-0.07068	0.241785	-0.29232
2728	7.641724	0.35503	7.397607	0.244118	0.230441	1.059349
2729	7.641724	0.217727	7.474508	0.167216	0.235843	0.709015
2730	7.641724	0.353123	7.825638	-0.18391	0.238273	-0.77186
2731	7.641724	0.286262	7.866977	-0.22525	0.241227	-0.93378
2732	7.641724	0.340723	7.550867	0.090857	0.239442	0.379455
2733	7.643722	0.293365	7.474941	0.168781	0.24186	0.697846
2734	7.643828	0.343302	7.506346	0.137482	0.211413	0.650299
2735	7.644302	0.298137	7.808361	-0.16406	0.237325	-0.69129
2736	7.644388	0.358789	7.331197	0.313191	0.243729	1.284996
2737	7.645354	0.278089	7.712366	-0.06701	0.240165	-0.27902
2738	7.647422	0.378909	7.502245	0.145178	0.241989	0.599936
2739	7.647422	0.393816	7.470706	0.176717	0.241838	0.730724
2740	7.64797	0.400182	7.541869	0.106101	0.23758	0.446592
2741	7.648155	0.366876	7.498953	0.149203	0.243478	0.612797
2742	7.649693	0.33111	7.47137	0.178323	0.226949	0.785738
2743	7.649693	0.36326	7.425643	0.224049	0.23871	0.938583
2744	7.649693	0.381123	7.359691	0.290002	0.243147	1.192703
2745	7.649693	0.364007	7.411145	0.238547	0.19651	1.21392
2746	7.649693	0.346871	7.435053	0.21464	0.241555	0.888577
2747	7.649693	0.351251	7.723211	-0.07352	0.234165	-0.31396

2748	7.649693	0.251433	7.571734	0.077958	0.234994	0.331745
2749	7.650436	0.42975	7.484826	0.16561	0.236576	0.700031
2750	7.651333	0.364184	7.706851	-0.05552	0.241819	-0.22958
2751	7.652196	0.266665	7.788574	-0.13638	0.239891	-0.5685
2752	7.65249	0.304093	7.94937	-0.29688	0.200087	-1.48375
2753	7.65249	0.316839	7.58346	0.06903	0.232981	0.296289
2754	7.65249	0.374677	7.506261	0.146229	0.243314	0.600989
2755	7.652728	0.434724	7.017287	0.635441	0.243436	2.610294
2756	7.652862	0.404692	7.566696	0.086166	0.220385	0.390979
2757	7.653088	0.336996	7.40382	0.249268	0.237511	1.0495
2758	7.653349	0.334531	7.500115	0.153234	0.241237	0.635202
2759	7.65497	0.363356	7.416856	0.238114	0.242395	0.982339
2760	7.655627	0.38308	7.50016	0.155467	0.234659	0.662524
2761	7.655627	0.387836	7.610966	0.044661	0.204927	0.217938
2762	7.655627	0.339616	7.3982	0.257427	0.241991	1.063786
2763	7.655627	0.380065	7.525203	0.130424	0.24145	0.54017
2764	7.655627	0.349149	7.506777	0.14885	0.242493	0.613831
2765	7.655627	0.346999	7.405436	0.250191	0.242595	1.031311
2766	7.656472	0.350743	7.430441	0.226031	0.242549	0.931901
2767	7.656472	0.411017	7.510605	0.145867	0.239804	0.608278
2768	7.656694	0.347424	7.743923	-0.08723	0.222994	-0.39117
2769	7.656882	0.350788	7.659443	-0.00256	0.241169	-0.01062
2770	7.658061	0.256494	7.393105	0.264956	0.239671	1.105498
2771	7.659171	0.341395	7.471671	0.1875	0.243624	0.769627
2772	7.659171	0.294157	7.335697	0.323475	0.236215	1.36941
2773	7.659346	0.352803	7.375636	0.28371	0.243042	1.16733
2774	7.659743	0.422456	7.788739	-0.129	0.237	-0.54429
2775	7.661143	0.43832	7.577783	0.083359	0.223506	0.372963
2776	7.661527	0.434859	7.661036	0.000491	0.241374	0.002034
2777	7.661527	0.354654	7.656175	0.005352	0.23386	0.022884
2778	7.661527	0.33775	7.397081	0.264446	0.242662	1.089772
2779	7.661527	0.413987	7.385991	0.275537	0.238752	1.154068
2780	7.663206	0.358647	7.180773	0.482433	0.241255	1.999686
2781	7.664081	0.378834	7.634236	0.029845	0.24208	0.123287
2782	7.664416	0.40005	7.891194	-0.22678	0.236454	-0.95908
2783	7.664416	0.347014	7.581912	0.082504	0.20915	0.394472
2784	7.665441	0.277286	7.723631	-0.05819	0.229915	-0.25309
2785	7.666556	0.389059	7.657375	0.009182	0.233801	0.039272
2786	7.66686	0.393315	7.671463	-0.0046	0.24176	-0.01904
2787	7.667477	0.386671	7.458272	0.209205	0.242691	0.86202
2788	7.667842	0.218348	7.304604	0.363238	0.237236	1.531124
2789	7.667842	0.345928	7.436937	0.230905	0.236108	0.977965
2790	7.669895	0.38799	7.49132	0.178576	0.235664	0.757754
2791	7.669895	0.440977	7.179854	0.490041	0.241795	2.026678
2792	7.671107	0.41234	7.454016	0.21709	0.238485	0.910289
2793	7.671433	0.372424	7.641881	0.029552	0.242046	0.12209
2794	7.673223	0.379838	7.684334	-0.01111	0.235779	-0.04712
2795	7.673223	0.227137	7.206287	0.466936	0.23157	2.016389
2796	7.673223	0.337958	7.416552	0.256672	0.23734	1.08145
2797	7.673725	0.384458	7.772285	-0.09856	0.230269	-0.42802
2798	7.674153	0.397474	7.395831	0.278322	0.239971	1.159813
2799	7.674514	0.252362	7.294149	0.380365	0.23877	1.593017

2800	7.67501	0.373446	7.737641	-0.06263	0.224044	-0.27955
2801	7.67501	0.348304	7.481995	0.193016	0.242334	0.796486
2802	7.67501	0.436709	7.415412	0.259599	0.231924	1.119328
2803	7.675626	0.283354	7.261411	0.414215	0.238683	1.73542
2804	7.677092	0.381401	7.621958	0.055134	0.241254	0.228529
2805	7.679546	0.343593	7.537644	0.141901	0.238477	0.595033
2806	7.680152	0.387374	7.739801	-0.05965	0.230441	-0.25885
2807	7.680945	0.395373	7.644827	0.036118	0.241297	0.149682
2808	7.680945	0.358278	7.418672	0.262273	0.232141	1.129802
2809	7.680945	0.358565	7.652956	0.027989	0.240419	0.116419
2810	7.680945	0.377256	7.401245	0.2797	0.236798	1.181173
2811	7.680945	0.381368	7.314873	0.366072	0.212668	1.721334
2812	7.680945	0.30074	7.684974	-0.00403	0.240105	-0.01678
2813	7.681872	0.387015	7.390985	0.290887	0.243283	1.195672
2814	7.683738	0.351625	7.540048	0.14369	0.242559	0.592393
2815	7.683738	0.381687	7.680647	0.003091	0.24091	0.012831
2816	7.684284	0.333136	7.519475	0.164809	0.242344	0.680063
2817	7.684284	0.363082	7.713107	-0.02882	0.204484	-0.14095
2818	7.685163	0.372858	7.635406	0.049756	0.240738	0.206683
2819	7.685163	0.432002	7.517324	0.167838	0.236718	0.709021
2820	7.68546	0.384091	7.405118	0.280342	0.242515	1.155976
2821	7.68546	0.266596	7.854292	-0.16883	0.240833	-0.70103
2822	7.685896	0.387226	7.516006	0.169889	0.239606	0.709037
2823	7.68708	0.331963	7.514842	0.172238	0.240522	0.716102
2824	7.687653	0.372988	7.869513	-0.18186	0.240849	-0.75508
2825	7.687653	0.346687	7.817849	-0.1302	0.237768	-0.54757
2826	7.687653	0.388655	7.574353	0.113301	0.241309	0.469525
2827	7.689456	0.388349	7.761417	-0.07196	0.240266	-0.29951
2828	7.69033	0.373433	7.722123	-0.03179	0.24087	-0.13199
2829	7.690515	0.355346	7.424965	0.26555	0.24331	1.091404
2830	7.690515	0.368294	7.42478	0.265734	0.242093	1.097654
2831	7.690515	0.365526	7.76754	-0.07703	0.241492	-0.31896
2832	7.690515	0.164784	7.089009	0.601506	0.241887	2.486722
2833	7.691149	0.324991	7.588363	0.102786	0.24092	0.426641
2834	7.691657	0.385682	7.613725	0.077932	0.241987	0.322048
2835	7.691874	0.394721	7.468307	0.223567	0.239058	0.935202
2836	7.693178	0.353062	7.792395	-0.09922	0.238347	-0.41627
2837	7.695737	0.310856	7.688247	0.007489	0.213728	0.035041
2838	7.696213	0.202353	7.486851	0.209361	0.218306	0.959025
2839	7.696213	0.292519	7.4758	0.220412	0.241831	0.911431
2840	7.696213	0.280088	7.450016	0.246197	0.216048	1.139549
2841	7.696213	0.381709	7.481066	0.215147	0.240973	0.892827
2842	7.696213	0.360399	7.288824	0.407389	0.241622	1.68606
2843	7.696213	0.373262	7.475507	0.220706	0.241736	0.913004
2844	7.696213	0.322133	7.626834	0.069379	0.242523	0.286072
2845	7.696213	0.384119	7.515453	0.180759	0.243138	0.743443
2846	7.696213	0.373804	7.579261	0.116952	0.241983	0.483305
2847	7.696213	0.349811	7.497759	0.198454	0.240368	0.825623
2848	7.697632	0.352984	7.604461	0.093171	0.236453	0.394037
2849	7.697752	0.42835	7.930031	-0.23228	0.226718	-1.02453
2850	7.698883	0.323105	7.614835	0.084047	0.234835	0.357899
2851	7.699574	0.362835	7.655487	0.044087	0.241113	0.182847

2852	7.699748	0.434801	7.271398	0.428351	0.242485	1.7665
2853	7.699993	0.343727	7.642461	0.057533	0.238569	0.241157
2854	7.700432	0.392111	7.524158	0.176274	0.240365	0.733361
2855	7.70125	0.393153	7.607903	0.093348	0.241987	0.385756
2856	7.702685	0.36	7.496633	0.206052	0.243603	0.845854
2857	7.702685	0.376112	7.451008	0.251677	0.241632	1.041574
2858	7.702685	0.406701	7.741373	-0.03869	0.237811	-0.16268
2859	7.703797	0.388662	7.919555	-0.21576	0.235895	-0.91464
2860	7.706263	0.422576	7.684717	0.021546	0.23578	0.09138
2861	7.707125	0.364645	7.660656	0.046468	0.240413	0.193286
2862	7.707512	0.368119	7.181679	0.525833	0.242075	2.172193
2863	7.707512	0.254949	7.126545	0.580968	0.234548	2.476963
2864	7.708408	0.288326	7.738875	-0.03047	0.237942	-0.12805
2865	7.710717	0.353062	7.716854	-0.00614	0.239206	-0.02565
2866	7.711251	0.338929	7.415384	0.295866	0.214914	1.376671
2867	7.712128	0.274213	7.756821	-0.04469	0.235643	-0.18966
2868	7.712424	0.209502	7.325702	0.386722	0.238711	1.62004
2869	7.712606	0.33306	7.602381	0.110225	0.240688	0.457958
2870	7.71282	0.403433	7.158806	0.554015	0.2405	2.303595
2871	7.71338	0.346823	7.528674	0.184706	0.239473	0.771301
2872	7.713843	0.309968	7.63925	0.074593	0.204634	0.36452
2873	7.714109	0.352984	7.604461	0.109648	0.236453	0.46372
2874	7.714847	0.352755	7.604328	0.110519	0.241657	0.45734
2875	7.715506	0.415564	7.726937	-0.01143	0.233684	-0.04892
2876	7.716734	0.343598	7.63043	0.086304	0.238541	0.361801
2877	7.717346	0.352984	7.732803	-0.01546	0.239754	-0.06447
2878	7.718097	0.28221	7.770515	-0.05242	0.237155	-0.22103
2879	7.718685	0.212082	7.335276	0.383409	0.239363	1.601791
2880	7.718685	0.286722	7.700152	0.018533	0.241576	0.076718
2881	7.718685	0.396178	7.51201	0.206676	0.235515	0.877548
2882	7.718685	0.313405	7.784681	-0.066	0.236511	-0.27904
2883	7.718685	0.472092	7.659788	0.058897	0.205195	0.28703
2884	7.718685	0.338235	7.486192	0.232494	0.240781	0.965582
2885	7.718685	0.288326	7.738875	-0.02019	0.237942	-0.08485
2886	7.718685	0.354223	7.422467	0.296218	0.242608	1.220973
2887	7.718685	0.343795	7.58027	0.138416	0.241578	0.572967
2888	7.719651	0.394578	7.46817	0.251481	0.236418	1.063713
2889	7.720166	0.393872	7.590636	0.12953	0.241747	0.535808
2890	7.720704	0.373227	7.53416	0.186543	0.242039	0.770715
2891	7.720862	0.176486	7.103403	0.617459	0.238423	2.589758
2892	7.721392	0.365892	7.591567	0.129825	0.239801	0.541387
2893	7.721684	0.383445	7.517304	0.20438	0.243115	0.840672
2894	7.721855	0.360337	7.383379	0.338476	0.241477	1.401691
2895	7.722263	0.233959	7.105992	0.616271	0.213929	2.880734
2896	7.72312	0.36653	7.508435	0.214685	0.239527	0.896288
2897	7.724516	0.365773	7.492982	0.231534	0.242154	0.956146
2898	7.724516	0.380636	7.429213	0.295303	0.243188	1.214302
2899	7.724728	0.294769	7.674174	0.050554	0.233973	0.216068
2900	7.725131	0.282803	7.770314	-0.04518	0.23715	-0.19052
2901	7.726066	0.354223	7.422467	0.303598	0.242608	1.251393
2902	7.726066	0.332761	7.780812	-0.05475	0.233473	-0.23449
2903	7.726882	0.350915	7.495004	0.231878	0.241639	0.959604

2904	7.727079	0.351617	7.520167	0.206913	0.23749	0.871246
2905	7.728164	0.328352	7.446259	0.281905	0.242346	1.163233
2906	7.728164	0.347449	7.577253	0.150911	0.237665	0.634975
2907	7.728164	0.352378	7.600176	0.127989	0.237788	0.538246
2908	7.728736	0.372563	7.579924	0.148812	0.23591	0.630802
2909	7.728736	0.378414	7.684424	0.044312	0.241355	0.183598
2910	7.729735	0.389143	7.624671	0.105065	0.241282	0.435444
2911	7.730114	0.306903	7.825495	-0.09538	0.241586	-0.39481
2912	7.731931	0.278677	7.432172	0.299759	0.238122	1.258847
2913	7.731931	0.391961	7.332698	0.399233	0.241313	1.654419
2914	7.732238	0.415319	7.441104	0.291135	0.221643	1.313529
2915	7.732238	0.399563	7.430906	0.301333	0.240477	1.253065
2916	7.732291	0.352984	7.692847	0.039444	0.240554	0.163974
2917	7.734434	0.213074	7.175568	0.558866	0.240599	2.322814
2918	7.734434	0.326443	7.715006	0.019428	0.240738	0.0807
2919	7.736307	0.330857	7.586738	0.149569	0.242304	0.617277
2920	7.736307	0.330857	7.586738	0.149569	0.242304	0.617277
2921	7.736307	0.330857	7.72662	0.009688	0.240968	0.040203
2922	7.736307	0.325955	7.732811	0.003496	0.240995	0.014508
2923	7.736307	0.330857	7.807723	-0.07142	0.241613	-0.29558
2924	7.737035	0.348032	7.648208	0.088826	0.240475	0.36938
2925	7.737314	0.417012	7.659531	0.077784	0.2394	0.324911
2926	7.740664	0.212082	7.287763	0.452902	0.237021	1.910806
2927	7.740664	0.385729	7.765148	-0.02448	0.240066	-0.10199
2928	7.740664	0.316009	7.783372	-0.04271	0.240512	-0.17757
2929	7.740664	0.372437	7.740917	-0.00025	0.197343	-0.00128
2930	7.740664	0.373251	7.709581	0.031084	0.241653	0.128629
2931	7.742553	0.191449	7.225344	0.517209	0.238266	2.170721
2932	7.742783	0.354381	7.474851	0.267932	0.242016	1.107082
2933	7.744003	0.429035	7.687741	0.056263	0.241004	0.233451
2934	7.744003	0.329098	7.627153	0.11685	0.232079	0.503493
2935	7.744003	0.397589	7.689836	0.054168	0.220664	0.245475
2936	7.746488	0.376179	7.544796	0.201692	0.242061	0.83323
2937	7.747506	0.401652	7.499981	0.247525	0.237233	1.043381
2938	7.747885	0.277476	7.647386	0.100498	0.236246	0.425397
2939	7.747885	0.271593	7.707964	0.039921	0.230983	0.172831
2940	7.748712	0.352984	7.604461	0.144251	0.236453	0.610062
2941	7.749322	0.332761	7.478227	0.271095	0.238892	1.134802
2942	7.75028	0.361881	7.399993	0.350287	0.242658	1.443545
2943	7.751021	0.408477	7.341099	0.409922	0.235561	1.740194
2944	7.751336	0.256591	7.571684	0.179651	0.238042	0.754704
2945	7.751475	0.348878	7.514952	0.236524	0.236186	1.00143
2946	7.752192	0.387027	7.614981	0.137211	0.233622	0.58732
2947	7.75301	0.398788	7.505969	0.247042	0.240825	1.025813
2948	7.755053	0.210856	7.436221	0.318832	0.216517	1.472553
2949	7.755053	0.375213	7.590831	0.164222	0.233384	0.703655
2950	7.755053	0.391404	7.453788	0.301265	0.237985	1.265896
2951	7.755053	0.388309	7.484171	0.270882	0.24272	1.116025
2952	7.756387	0.284281	7.730072	0.026316	0.240192	0.10956
2953	7.757535	0.244746	7.893679	-0.13614	0.240449	-0.56621
2954	7.759507	0.315937	7.891854	-0.13235	0.231788	-0.57098
2955	7.759507	0.315419	7.919887	-0.16038	0.198132	-0.80946

2956	7.760234	0.388615	7.613139	0.147096	0.235697	0.624087
2957	7.760533	0.381878	7.681537	0.078996	0.232153	0.340274
2958	7.760867	0.346503	7.42064	0.340227	0.238391	1.427182
2959	7.761914	0.32424	7.813	-0.05109	0.241633	-0.21142
2960	7.76239	0.392764	7.494881	0.267509	0.233277	1.146743
2961	7.76285	0.350485	7.86099	-0.09814	0.239159	-0.41035
2962	7.763183	0.395643	7.329817	0.433366	0.242713	1.785507
2963	7.763421	0.352605	7.590834	0.172587	0.242317	0.712237
2964	7.765206	0.36012	7.613908	0.151297	0.216582	0.698568
2965	7.765206	0.32579	7.649241	0.115964	0.241123	0.480935
2966	7.765206	0.383584	7.642573	0.122633	0.241437	0.50793
2967	7.766417	0.254378	7.310647	0.45577	0.238376	1.911978
2968	7.767476	0.349656	7.315165	0.452311	0.244103	1.852949
2969	7.767476	0.40007	7.41627	0.351205	0.237578	1.478272
2970	7.768282	0.383283	7.64632	0.121962	0.236832	0.514974
2971	7.768986	0.386397	7.760178	0.008808	0.241311	0.036501
2972	7.772753	0.378994	7.466094	0.306659	0.24252	1.26447
2973	7.772753	0.350839	7.576634	0.196119	0.240937	0.813983
2974	7.774856	0.322893	7.453712	0.321144	0.240778	1.333778
2975	7.776793	0.336895	7.678794	0.097999	0.242078	0.404825
2976	7.778584	0.383201	7.539475	0.239109	0.241347	0.990726
2977	7.778584	0.349817	7.535757	0.242827	0.242936	0.99955
2978	7.778584	0.293013	7.596182	0.182402	0.23951	0.761564
2979	7.780243	0.380791	7.578816	0.201428	0.242198	0.831665
2980	7.780696	0.189764	7.134712	0.645983	0.241121	2.679081
2981	7.783224	0.225067	7.252035	0.531189	0.238669	2.225627
2982	7.783224	0.349858	7.555127	0.228097	0.240703	0.947626
2983	7.783224	0.200178	7.581807	0.201417	0.234504	0.858905
2984	7.783224	0.351209	7.433998	0.349226	0.241791	1.444332
2985	7.785894	0.410341	7.837745	-0.05185	0.223815	-0.23167
2986	7.787005	0.290556	7.685512	0.101493	0.241083	0.420986
2987	7.7876	0.37835	7.421606	0.365994	0.24323	1.504725
2988	7.7876	0.399561	7.405925	0.381675	0.242713	1.572538
2989	7.790144	0.383925	7.707437	0.082707	0.234928	0.352054
2990	7.79257	0.443709	7.661334	0.131236	0.231888	0.565946
2991	7.793274	0.23167	7.477432	0.315842	0.156864	2.013483
2992	7.794414	0.37314	7.422226	0.372189	0.233901	1.59122
2993	7.795058	0.362815	7.943146	-0.14809	0.239218	-0.61905
2994	7.796211	0.316353	7.440475	0.355736	0.240184	1.481098
2995	7.797613	0.365375	7.538674	0.258939	0.206675	1.252882
2996	7.798538	0.376866	7.661834	0.136704	0.241695	0.565604
2997	7.798538	0.277476	7.745979	0.052559	0.22524	0.233346
2998	7.798728	0.277476	7.592475	0.206254	0.235329	0.87645
2999	7.798728	0.397293	7.864135	-0.06541	0.237379	-0.27554
3000	7.798728	0.398967	7.669532	0.129196	0.239057	0.540441
3001	7.799298	0.366877	7.554076	0.245222	0.236462	1.037046
3002	7.800516	0.39581	7.159202	0.641313	0.237514	2.700109
3003	7.801573	0.412157	7.291127	0.510446	0.240386	2.123444
3004	7.801986	0.21533	7.749505	0.052481	0.232524	0.225701
3005	7.803843	0.320331	7.711753	0.092091	0.20287	0.45394
3006	7.803843	0.340807	7.424761	0.379082	0.242649	1.562264
3007	7.803843	0.34637	7.660486	0.143358	0.228769	0.626648

3008	7.803843	0.266492	7.736059	0.067785	0.22984	0.294922
3009	7.805315	0.391787	7.659342	0.145973	0.234814	0.621654
3010	7.805697	0.395789	7.504904	0.300793	0.242032	1.242781
3011	7.805697	0.215639	7.449365	0.356332	0.232766	1.530859
3012	7.806755	0.29001	7.980552	-0.1738	0.184891	-0.94
3013	7.807239	0.34524	7.459181	0.348058	0.235227	1.479673
3014	7.807438	0.345446	7.534082	0.273356	0.238689	1.145242
3015	7.807438	0.180704	7.288955	0.518483	0.237024	2.187474
3016	7.808542	0.250799	7.698342	0.1102	0.234928	0.469081
3017	7.809657	0.387359	7.592348	0.217309	0.242131	0.897487
3018	7.810623	0.345567	7.531358	0.279265	0.238736	1.169767
3019	7.810623	0.395746	7.653087	0.157536	0.241214	0.653095
3020	7.811467	0.339532	7.639008	0.17246	0.240247	0.717843
3021	7.812485	0.33177	7.593862	0.218623	0.237905	0.918949
3022	7.815312	0.416351	7.614764	0.200548	0.234936	0.853631
3023	7.816611	0.385196	7.648572	0.168039	0.239573	0.701412
3024	7.817357	0.358818	7.604066	0.213291	0.236603	0.901469
3025	7.819384	0.248361	7.746948	0.072436	0.238689	0.303474
3026	7.819592	0.317531	7.881118	-0.06153	0.216329	-0.28441
3027	7.819592	0.317531	8.024953	-0.20536	0.213979	-0.95973
3028	7.820038	0.346289	7.552635	0.267403	0.240326	1.112668
3029	7.820038	0.384583	7.573471	0.246567	0.242036	1.018721
3030	7.820038	0.27714	7.642103	0.177935	0.234128	0.759992
3031	7.820468	0.377145	7.567451	0.253017	0.238877	1.059195
3032	7.824046	0.376347	7.465196	0.35885	0.240322	1.493206
3033	7.824046	0.332207	7.523564	0.300482	0.241585	1.243794
3034	7.824046	0.213677	7.764862	0.059184	0.223603	0.264683
3035	7.824046	0.33401	7.746325	0.077721	0.23614	0.329134
3036	7.824046	0.411017	7.510605	0.313441	0.239804	1.307072
3037	7.824046	0.326515	7.707301	0.116745	0.209449	0.557391
3038	7.824046	0.35336	7.567628	0.256418	0.242309	1.058228
3039	7.824046	0.400231	7.472289	0.351757	0.236181	1.489349
3040	7.824046	0.404038	7.845766	-0.02172	0.235194	-0.09235
3041	7.824046	0.396116	7.605442	0.218604	0.237175	0.9217
3042	7.824046	0.422576	7.787926	0.03612	0.236978	0.15242
3043	7.824046	0.422456	7.994755	-0.17071	0.235826	-0.72388
3044	7.824046	0.388496	7.600002	0.224044	0.227664	0.984101
3045	7.824046	0.389338	7.915408	-0.09136	0.231031	-0.39545
3046	7.824046	0.378414	7.684424	0.139622	0.241355	0.578494
3047	7.830978	0.298529	7.910996	-0.08002	0.192568	-0.41553
3048	7.832014	0.330615	7.891935	-0.05992	0.203698	-0.29417
3049	7.832014	0.196443	7.817342	0.014672	0.212581	0.069019
3050	7.832014	0.264553	7.866866	-0.03485	0.241273	-0.14445
3051	7.833525	0.352632	7.541614	0.291911	0.239783	1.217396
3052	7.833525	0.294375	7.86008	-0.02656	0.241118	-0.11014
3053	7.834975	0.400694	7.470427	0.364548	0.242325	1.504375
3054	7.835574	0.386671	7.669818	0.165755	0.240948	0.68793
3055	7.836949	0.28016	7.934345	-0.0974	0.236077	-0.41256
3056	7.837291	0.378289	7.464446	0.372845	0.238981	1.560144
3057	7.837984	0.326468	7.612354	0.225629	0.224445	1.005278
3058	7.840575	0.308347	7.686287	0.154288	0.235081	0.656319
3059	7.842738	0.333661	7.776732	0.066006	0.241512	0.273303

3060	7.842816	0.423888	7.610596	0.23222	0.239974	0.967691
3061	7.843464	0.287943	7.938968	-0.0955	0.197724	-0.48302
3062	7.846025	0.294988	7.861443	-0.01542	0.235634	-0.06543
3063	7.846025	0.400833	7.524276	0.321749	0.241665	1.331383
3064	7.847763	0.382543	7.455188	0.392575	0.242721	1.617388
3065	7.847763	0.294819	7.789534	0.058228	0.237427	0.245246
3066	7.847763	0.322278	7.654693	0.193069	0.237612	0.81254
3067	7.848506	0.374511	7.502304	0.346202	0.238984	1.448642
3068	7.848739	0.34637	7.743181	0.105558	0.222996	0.473362
3069	7.848739	0.367966	7.92982	-0.08108	0.163793	-0.49502
3070	7.849799	0.367115	7.408971	0.440827	0.243429	1.81091
3071	7.850157	0.250326	7.77086	0.079297	0.236573	0.33519
3072	7.850363	0.275343	7.407097	0.443266	0.238297	1.860138
3073	7.850591	0.210774	7.848756	0.001835	0.236277	0.007768
3074	7.851259	0.341375	7.617729	0.23353	0.240534	0.97088
3075	7.854055	0.447108	7.841635	0.01242	0.236724	0.052465
3076	7.854176	0.444787	7.694158	0.160018	0.182721	0.875751
3077	7.855545	0.381267	7.479028	0.376517	0.241487	1.559162
3078	7.855545	0.401117	7.61885	0.236695	0.221354	1.069303
3079	7.855723	0.395373	7.738186	0.117537	0.238953	0.491882
3080	7.856381	0.366653	7.505362	0.35102	0.23948	1.46576
3081	7.856381	0.385385	7.658157	0.198224	0.238988	0.829433
3082	7.856836	0.386343	7.734874	0.121961	0.215604	0.565674
3083	7.858732	0.354223	7.381826	0.476906	0.2427	1.964999
3084	7.85921	0.398718	7.584753	0.274457	0.241437	1.136764
3085	7.859385	0.368692	7.649249	0.210136	0.242091	0.868004
3086	7.859413	0.366604	7.7402	0.119213	0.237478	0.501996
3087	7.859892	0.39101	7.875341	-0.01545	0.214194	-0.07213
3088	7.860414	0.335296	7.791158	0.069256	0.23762	0.291457
3089	7.860699	0.296262	7.885675	-0.02498	0.241668	-0.10335
3090	7.860699	0.372752	7.907239	-0.04654	0.23794	-0.19559
3091	7.861786	0.348502	7.478077	0.383709	0.237986	1.612319
3092	7.86243	0.32004	7.785322	0.077108	0.232969	0.33098
3093	7.863267	0.379624	7.72835	0.134917	0.240682	0.560563
3094	7.863267	0.287314	7.580281	0.282985	0.228675	1.237499
3095	7.863267	0.360062	7.677783	0.185484	0.234085	0.792377
3096	7.863267	0.362742	7.857263	0.006004	0.194982	0.030794
3097	7.863267	0.295184	7.674709	0.188557	0.239948	0.785825
3098	7.86414	0.376072	7.369342	0.494798	0.232911	2.124411
3099	7.864868	0.384207	7.663784	0.201084	0.234424	0.857778
3100	7.865289	0.373613	7.744868	0.120421	0.240048	0.501655
3101	7.867531	0.359416	7.937854	-0.07032	0.238007	-0.29546
3102	7.867531	0.362295	7.547612	0.319919	0.233627	1.369355
3103	7.871331	0.402442	7.267753	0.603579	0.242541	2.488567
3104	7.871777	0.317531	7.881118	-0.00934	0.216329	-0.04318
3105	7.876006	0.35041	7.741025	0.134981	0.240665	0.560866
3106	7.878534	0.368887	7.720338	0.158197	0.240376	0.658121
3107	7.880216	0.251841	7.63393	0.246287	0.239598	1.027915
3108	7.880286	0.379624	7.790197	0.090089	0.24073	0.374232
3109	7.880862	0.435879	7.438363	0.442499	0.240652	1.838749
3110	7.882315	0.401142	7.690389	0.191926	0.222601	0.862196
3111	7.882315	0.290425	8.025955	-0.14364	0.224227	-0.6406

3112	7.884409	0.381709	7.437407	0.447002	0.243016	1.839391
3113	7.884409	0.210856	7.74464	0.139769	0.231675	0.603296
3114	7.884409	0.449772	7.687973	0.196436	0.24024	0.817666
3115	7.888585	0.353954	7.674882	0.213702	0.241639	0.884387
3116	7.890536	0.410726	7.768383	0.122152	0.238561	0.512038
3117	7.89425	0.330475	7.964197	-0.06995	0.231154	-0.3026
3118	7.89425	0.338328	7.733818	0.160432	0.236057	0.679634
3119	7.894872	0.373613	7.885506	0.009366	0.240932	0.038873
3120	7.898669	0.36608	7.262557	0.636111	0.240181	2.648468
3121	7.898826	0.377127	7.770918	0.127908	0.236538	0.540749
3122	7.905015	0.374013	7.630489	0.274526	0.24144	1.137036
3123	7.906284	0.207354	7.684993	0.221291	0.225849	0.97982
3124	7.906738	0.206078	7.586968	0.31977	0.222995	1.433978
3125	7.907718	0.451847	7.78844	0.119278	0.236913	0.503469
3126	7.907718	0.311903	7.112362	0.795357	0.242805	3.275702
3127	7.907718	0.283756	7.772106	0.135613	0.229402	0.591158
3128	7.910601	0.370678	7.733092	0.177508	0.149507	1.18729
3129	7.912599	0.387216	7.811844	0.100755	0.241524	0.417165
3130	7.915854	0.426722	7.575017	0.340837	0.237968	1.432276
3131	7.919356	0.366438	7.589725	0.329632	0.235323	1.400762
3132	7.919356	0.378995	7.609583	0.309773	0.240738	1.286767
3133	7.919356	0.306185	7.781731	0.137625	0.239127	0.575532
3134	7.922486	0.38775	7.909813	0.012673	0.234152	0.054125
3135	7.922986	0.340128	7.778242	0.144744	0.229365	0.631062
3136	7.924129	0.334566	7.115999	0.80813	0.235506	3.431458
3137	7.92469	0.178966	7.026953	0.897736	0.241295	3.720488
3138	7.924875	0.365604	7.457048	0.467827	0.241854	1.934334
3139	7.925399	0.230899	7.996701	-0.0713	0.150281	-0.47446
3140	7.925679	0.330962	7.844122	0.081557	0.236676	0.344591
3141	7.927424	0.321559	7.681747	0.245678	0.240994	1.019436
3142	7.929407	0.387019	7.532626	0.396781	0.241324	1.644182
3143	7.930989	0.391787	7.782398	0.148591	0.236832	0.627412
3144	7.93226	0.326515	7.707301	0.224958	0.209449	1.07405
3145	7.933797	0.43176	7.565824	0.367973	0.241719	1.52232
3146	7.937375	0.251841	7.610746	0.326629	0.236847	1.379074
3147	7.937375	0.203146	7.744655	0.19272	0.228833	0.842184
3148	7.937375	0.291677	7.875217	0.062157	0.232097	0.267808
3149	7.941385	0.357072	7.549077	0.392308	0.237491	1.651884
3150	7.941639	0.385366	7.698502	0.243137	0.241861	1.005277
3151	7.942546	0.390014	7.565888	0.376658	0.241018	1.562777
3152	7.943657	0.397662	7.47827	0.465387	0.236588	1.967077
3153	7.944674	0.456127	7.938415	0.006259	0.049992	0.125201
3154	7.944999	0.196443	7.86198	0.083019	0.222899	0.37245
3155	7.945743	0.396549	7.664371	0.281371	0.24164	1.164424
3156	7.949209	0.337071	7.638853	0.310356	0.235283	1.319078
3157	7.952183	0.376071	7.815966	0.136217	0.240285	0.566899
3158	7.959848	0.290556	7.919186	0.040662	0.240754	0.168893
3159	7.960905	0.291595	7.648232	0.312674	0.227617	1.373683
3160	7.960905	0.398912	7.520997	0.439908	0.227301	1.935356
3161	7.960905	0.392379	7.927984	0.032921	0.205173	0.160456
3162	7.961916	0.233959	7.651387	0.310528	0.230361	1.348006
3163	7.965546	0.314022	7.97989	-0.01434	0.235149	-0.061

3164	7.967147	0.314768	7.939247	0.0279	0.240292	0.11611
3165	7.970649	0.337664	7.514074	0.456575	0.241314	1.892041
3166	7.975115	0.3984	7.6024	0.372715	0.241633	1.542481
3167	7.975596	0.401708	7.738542	0.237054	0.240584	0.985324
3168	7.979339	0.300955	7.92328	0.056059	0.233033	0.240561
3169	7.98227	0.342733	7.786258	0.196012	0.238216	0.822832
3170	7.984389	0.316555	7.487639	0.49675	0.235968	2.105158
3171	7.984768	0.29689	7.682672	0.302097	0.239519	1.261263
3172	7.98509	0.381845	7.728158	0.256932	0.237319	1.082643
3173	7.987675	0.317617	7.692911	0.294764	0.236173	1.248088
3174	7.988457	0.37314	7.790701	0.197756	0.240966	0.82068
3175	7.988668	0.34888	7.763987	0.224681	0.239262	0.93906
3176	7.9911	0.371852	7.862095	0.129005	0.241153	0.534951
3177	7.9911	0.522647	7.926611	0.064489	0.089305	0.722116
3178	7.992381	0.398257	7.902923	0.089458	0.222654	0.40178
3179	7.992945	0.363038	7.873955	0.11899	0.235841	0.504534
3180	7.995896	0.367058	7.886165	0.109731	0.237992	0.461069
3181	7.997999	0.321785	7.746303	0.251697	0.22934	1.097481
3182	7.998705	0.311983	7.933937	0.064768	0.236224	0.274179
3183	8.003333	0.351533	7.878888	0.124445	0.237569	0.523824
3184	8.006368	0.243832	7.816523	0.189845	0.227437	0.834714
3185	8.006368	0.232058	7.974225	0.032143	0.203028	0.158316
3186	8.006368	0.242407	7.78251	0.223857	0.216862	1.032258
3187	8.006368	0.397045	7.786942	0.219425	0.2372	0.925064
3188	8.008696	0.252934	7.241246	0.767449	0.222391	3.450899
3189	8.013915	0.362244	7.705396	0.308519	0.23538	1.310726
3190	8.024717	0.362244	7.705396	0.319321	0.23538	1.356617
3191	8.025786	0.341309	7.921341	0.104444	0.240767	0.433799
3192	8.025786	0.210903	7.740776	0.285009	0.230701	1.235406
3193	8.036031	0.397662	7.47827	0.557761	0.236588	2.357516
3194	8.040854	0.294819	7.916848	0.124006	0.240834	0.514903
3195	8.041459	0.333421	7.663255	0.378204	0.240158	1.574817
3196	8.042735	0.382282	7.717583	0.325153	0.234482	1.386684
3197	8.048927	0.426394	7.427743	0.621184	0.235491	2.63783
3198	8.055639	0.297119	7.86919	0.186449	0.203944	0.914215
3199	8.060435	0.323079	7.716974	0.343461	0.226904	1.513681
3200	8.060956	0.287153	7.678768	0.382188	0.241648	1.581592
3201	8.061718	0.355036	7.622381	0.439337	0.234113	1.876602
3202	8.065208	0.398424	7.468984	0.596224	0.239155	2.493042
3203	8.066992	0.263317	7.842173	0.224819	0.238983	0.940735
3204	8.079393	0.393546	7.922789	0.156604	0.235387	0.665304
3205	8.081875	0.398424	7.468984	0.612891	0.239155	2.562734
3206	8.082557	0.38249	7.829086	0.253471	0.2362	1.07312
3207	8.08641	0.24412	7.906453	0.179958	0.236424	0.761165
3208	8.09598	0.373682	7.918923	0.177057	0.237577	0.74526
3209	8.097339	0.202469	7.549026	0.548313	0.233958	2.343636
3210	8.098483	0.351715	7.438588	0.659895	0.23785	2.774416
3211	8.098643	0.36248	7.783037	0.315606	0.240514	1.312215
3212	8.101972	0.436895	7.562343	0.539628	0.238036	2.267002
3213	8.105039	0.443766	7.570792	0.534247	0.23607	2.263087
3214	8.108274	0.281341	7.624886	0.483388	0.24048	2.0101
3215	8.111728	0.352689	7.584028	0.5277	0.238267	2.214739

3216	8.111728	0.228564	7.818325	0.293403	0.22399	1.309891
3217	8.124151	0.229204	7.881491	0.24266	0.11494	2.111186
3218	8.125714	0.393546	7.834891	0.290823	0.235531	1.234756
3219	8.126996	0.216666	7.711685	0.41531	0.208038	1.996318
3220	8.131531	0.19699	7.985844	0.145687	0.185774	0.784218
3221	8.131531	0.321785	7.733833	0.397698	0.22966	1.731685
3222	8.134201	0.362064	7.651369	0.482832	0.2291	2.107515
3223	8.142819	0.286432	7.831697	0.311122	0.228673	1.360551
3224	8.152079	0.318582	7.817996	0.334083	0.239771	1.393339
3225	8.160518	0.354457	7.828721	0.331797	0.240434	1.379991
3226	8.169997	0.234902	7.79724	0.372757	0.236774	1.574319
3227	8.176267	0.208744	7.623319	0.552947	0.234498	2.358007
3228	8.181932	0.202451	7.744723	0.43721	0.235134	1.859407
3229	8.184049	0.424261	7.654027	0.530022	0.239374	2.214199
3230	8.186161	0.358984	7.895644	0.290517	0.210535	1.379899
3231	8.190437	0.393546	7.983769	0.206669	0.230603	0.896211
3232	8.192954	0.365692	7.711228	0.481725	0.241474	1.994939
3233	8.200097	0.314897	7.606587	0.59351	0.229459	2.586562
3234	8.212704	0.393546	7.983769	0.228935	0.230603	0.992769
3235	8.223432	0.354185	7.479998	0.743434	0.239603	3.102774
3236	8.229511	0.393546	7.834891	0.39462	0.235531	1.67545
3237	8.231529	0.381799	7.955651	0.275878	0.205235	1.344204
3238	8.241	0.362931	7.80039	0.44061	0.240994	1.828304
3239	8.25149	0.24412	7.66915	0.58234	0.235713	2.47055
3240	8.260897	0.247582	7.942843	0.318055	0.237393	1.33978
3241	8.274632	0.247582	7.741191	0.533441	0.228279	2.336792
3242	8.279235	0.360942	7.761293	0.517941	0.239223	2.165101
3243	8.29405	0.250261	7.876861	0.417188	0.225867	1.847053
3244	8.305099	0.25006	7.614666	0.690434	0.231538	2.981947
3245	8.31005	0.196735	7.940197	0.369853	0.235702	1.56916
3246	8.324821	0.244419	7.586409	0.738412	0.228873	3.226291
3247	8.354674	0.19675	7.899927	0.454747	0.230949	1.969039
3248	8.356263	0.289846	7.94328	0.412983	0.232248	1.778194
3249	8.420343	0.202917	7.739379	0.680964	0.236052	2.884803
3250	8.451053	0.362027	7.497964	0.953089	0.242277	3.933874
3251	8.517193	0.209914	8.304944	0.21225	0.154435	1.374362
3252	7.736307	0.209158	7.677537	0.05877	0.234264	0.250871
3253	7.868558	0.297852	7.73663	0.131928	0.212724	0.620186
3254	7.89425	0.294704	7.59681	0.29744	0.238301	1.248168
3255	8.056067	0.42332	7.807639	0.248429	0.19182	1.295115
3256	8.05936	0.31724	7.90747	0.15189	0.225759	0.672796
3257	8.011817	0.289884	7.652695	0.359122	0.213138	1.684928
3258	8.018638	0.296131	7.8293	0.189338	0.235626	0.803551