7 CONCLUSIONS

7.1 SUMMARY
This dissertation focuses on the themes of location choice of households, the economic valuation of cultural heritage, and the housing market in the Netherlands. In the introduction, we set out several research questions that were investigated in the different chapters. The answers to these research questions will be discussed in this summary.

We start to explore the area of sorting models with application to house prices, location choices and amenities within a wider context of heterogeneous household preferences. We discuss two types of models that are mostly used in the literature. These are the so-called vertical sorting models, extensively used by Epple & Sieg, and horizontal sorting models, developed by Bayer and co-authors. In both types of models, the main focus is to investigate the demand for housing in different neighborhoods by heterogeneous households. In this way, one goes a step further than the conventional hedonic price analysis, where house prices are the starting point of the analysis. In the sorting framework, the house prices are an outcome of the analysis. The model explicitly explains the interaction of demand and supply that results in a price equilibrium and it accounts for unobserved location characteristics and heterogeneous household preferences. In addition, we propose ways to extend the models reviewed. These involve the development of dynamic sorting models for household location behavior, taking into account important aspects of choice, such as moving costs and life-cycle components.

We deal with the first research question in Chapters 3 and 4. It is formulated as follows: What is the contribution of cultural heritage to the location choice of households? We use municipalities and neighborhoods as our spatial units. We investigate the impact of cultural heritage on the attractiveness of cities by analyzing the location choice of Dutch households. Although the Netherlands is a small country, it has a very rich cultural background. A prime example, to which our empirical work refers, is the historic city centers of the towns. Some date as far back as to the 17th century – the Dutch Golden Age – or earlier. We use a horizontal sorting model to estimate the WTP of different types of households for living in or close to a historic city center. We find that, in terms of house prices, the MWTP for historic city centers is large and significant (€5,495/km²) on the municipal level. This implies that, ceteris paribus, houses in a municipality with one square kilometer of historic city center are €5,495 more expensive than houses in a municipality without a historic city center.
This includes the multiplier effect that cultural heritage has over other (endogenous) amenities, such as restaurants, shops, et cetera. On the neighborhood level, where we focus on the Amsterdam area, the MWTP is larger (€41,619/km$^2$). This is evident as the neighborhood covers fewer houses. Also note that the largest neighborhood in the historic city center is 1.08km$^2$, whereas the municipality can cover the whole historic city center which is around 7km$^2$ for Amsterdam. With average house prices in the Amsterdam area of €210,000 (in 2009), this implies that neighborhoods with one square kilometer of historic city center are €41,619 more expensive than houses in a neighborhood without a historic city center. This implies that the total effect of one square kilometer of historic city center explains, on average, almost 20% of the house prices in those neighborhoods. In our knowledge, this is the first empirical evidence about the impact of cultural heritage on the attractiveness of cities. This suggests that the success of a city does not only depend on the location of the job and accessibility to transport facilities, but also on cultural heritage.

We also investigate the heterogeneity of household preferences. For instance, we find that power couples and highly educated singles have a higher MWTP for historic city centers (of approximately +2% and +5%, respectively) than the average household. This implies that municipalities with a large area of historic city center attract highly educated households relative to the average household, but not by a large amount. However, it also seems important for highly educated households to live in areas that have high wages and good accessibility to intercity stations. We also do the analysis for the Amsterdam area where we include income and the social economic category of the household. We provide strong evidence that the multiplier effect of the historic city center exists. The results suggest that high income homeowners are not only attracted to the historic city center but also to a high concentration of high income households in the neighborhood. This increases the concentration of high income households in the neighborhood, which further attracts more high income homeowners. We also find that students who can afford to buy a house prefer to live in the historic city center.

Furthermore, we extend the sorting framework by incorporating spatial spillover effects. We account for both observed and unobserved characteristics of surrounding locations. We show that the impact of having a historic city center extends outside the border of the municipality in which it is located. We find positive and significant effects if we include the historic city center within a certain distance. In other words, it has the potential to improve the attractiveness of a wider area, for example the region. We argue that it is important to incorporate these spatial spillovers effects in the research of location behavior. The same is found on the neighborhood level in the Amsterdam area.
Finally, we make advantage of the general equilibrium property of the sorting framework to show how house prices react to changes in the spatial distribution of cultural heritage. This counterfactual analysis shows that if cultural heritage was evenly distributed over the municipalities in the Netherlands, house prices would fall by 17% in Amsterdam and 8% in Utrecht. Note that these figures refer to the overall effect that includes changes in other (endogenous) amenities. A similar counterfactual analysis is done for the neighborhoods in the Amsterdam area. We find that the standard house price of neighborhoods inside or close to the historic city center decreases substantially, but that the predicted prices are still higher than most other neighborhoods outside the city center. This is probably because of their favorable characteristics regarding their location close to other amenities. Considering all of the above, this suggests that cultural heritage (and its multiplier effect) have a large impact on the attractiveness of municipalities.

The second research question is dealt with in Chapter 5 and is formulated as follows: What is the effect of urban redevelopment of brownfield sites on surrounding residential areas? We perform a case study on the Amsterdam Western gas factory to investigate the effects of brownfield redevelopment on surrounding residential areas. This former industrial (brownfield) site changed from a desolated and polluted area to an anchor point for cultural activities attracting creative and innovative industries. This probably had consequences for the attractiveness of surrounding neighborhoods. In line with Florida's (2002) ideas, the media and local policy makers believe that the redevelopment of old factories could improve the quality of the surrounding neighborhoods. In this way, they found a policy tool to upgrade neighborhoods to attract highly educated residents and their employers, and tourists. However, the literature that links the redevelopment of an old factory and flourishing surrounding neighborhoods is scarce. In our knowledge, there is no literature that provides strong evidence that the revival of surrounding neighborhoods is caused by the redevelopment of Brownfield sites. Therefore, we investigate this issue and provide strong evidence that the price development of houses close to the Western gas factory were significantly higher than houses further away after the redevelopment of the Western gas factory. We report effects between 5 and 10% given the distance one's house is located from the Western gas factory. This effect is only noticeable for houses within 600m of the Western gas factory. We show that the effect increases the first 300m, and decreases rapidly after 500m.

We also show that the residential area north of the Western gas factory benefit as much as the residential area south of it. One could believe that the residential area north of the Western gas factory should have benefitted less from the redevelopment because the two areas are divided by a railway. We show that this is not the case. This
suggests that the railway is not a barrier for spillovers caused by the redevelopment of the Western gas factory and that the effect is a proximity effect.

The third research question is: **What is the impact of income shocks in the price developments of houses of different quality?** We deal with this research question in Chapter 6, where we first provide a theoretical framework that explains the price development of houses of different quality, and then provide empirical evidence. We develop a stylized model where there is perfect correlation between household income and housing quality (which can also be seen as a sorting mechanism). We then show that positive income shocks shift the housing demand from lower quality housing to higher quality housing. Given a fixed housing stock (which is a plausible assumption for the short run) a positive shock results in, relatively, more demand for higher quality housing and lower demand for lower quality housing. This results in an increase in convexity of the hedonic price function. In the empirical analysis, we provide strong evidence that the effect of income shocks can indeed explain the diverging price developments of low and high quality housing. We use the same data as in the previous chapter and we, therefore, investigate houses in Amsterdam. We exploit a crucial property of the theoretical model that the ranking of houses based on the housing services (quality measure of the house) is identical to the ranking of houses based on prices (perfect sorting process). Hence, we first estimate the number of housing services for each house in each year by exploiting the ranking. Next, we use the estimated number of housing services in a quadratic specification to explain the house prices. It is clear from the results that the housing price function became more convex between 1995 and 2007. When the prices dropped after those years, also the convexity of the housing price function decreased. The empirical results support the relevance of the theoretical model.

### 7.2 Relevance for policy

It is well-known that cultural heritage is one of the most important drivers that is associated with a unique atmosphere in cities. It is less clear how that translates itself in direct and indirect benefits for society. We show that cultural heritage is an important factor that drives location choices of Dutch households. We find evidence that historic city centers in the own municipality and surrounding municipalities is an important driver of household location choice. This means that not only the municipality itself, but also surrounding municipalities, benefit from cultural heritage. We are aware that policy makers cannot create (authentic) cultural heritage but there is a clear policy suggestion implied in this chapter. The maintenance of cultural heritage and exposing it to visitors and residents can contribute substantially to the attractiveness of the area.
If the costs of maintaining cultural heritage would have to be financed completely by the municipality in which it is located, this would likely result in underinvestment because of spillover effects which we show are present. However, in the Netherlands, the national government is heavily involved in these activities and therefore this conclusion may not be valid. By determining a part of the benefits of cultural heritage, as we did in this dissertation, we could help policy makers to determine whether enough public money is spent on this amenity.

In Chapters 3 and 4, we use somewhat rough measures for cultural heritage. We divide the conservation areas into historic city centers and historic sceneries. These areas get only selected after a thorough investigation and have to satisfy a large number of requirements. We expect that the atmosphere provided by cultural heritage is picked up by these different conservation areas. Where historic city centers seem to have a substantial impact on the municipality choice of households in the Netherlands, sensitivity analysis shows that historic sceneries seem not to be important for the location choice of the average household. The average household is a household where income, number of persons, and other household characteristics are set to the average value. This finding could be the result of using these rough measures for cultural heritage. It is also likely that households prefer cultural heritage more when other (important) factors of location choice are also present, such as the presence of a large labor market and good accessibility.

The policy relevant information, which we just discussed, can be obtained due to exploiting the advantages of the sorting framework. The framework allows for much more detail than the conventional monocentric urban economic model and hedonic price analysis. The sorting framework adopts a general equilibrium perspective and puts conventional hedonic price analysis into a solid market equilibrium setting, while explicitly accounting for heterogeneity of preferences and unobserved characteristics. The welfare measures are one of the policy-relevant outcomes of these models, notably the WTP of different types of households for different neighborhood characteristics. This is of some interest because it shows whether certain types of households are attracted by certain types of amenities. They also allow for policy simulations, in which the general equilibrium impact of changes in neighborhood characteristics can be analyzed through counterfactual analysis. The fundamental point is that residential sorting models of household location can help policy makers better understand the mechanics of the housing market and the consequences of policy interventions.

An advantage of the hedonic price analysis is that it needs less information than the sorting model presented in this dissertation. In case of the redevelopment of the Western gas factory, we investigate the house transactions of houses sold over 15
years. If one would prefer to use a sorting model to explain movers’ behavior over all these years, one should have information on these houses and households over all these years. This information is for obvious reasons difficult to obtain. We therefore use a hedonic price analysis to investigate the effect of the redevelopment of the Western gas factory on surrounding residential areas. We find strong positive effects for houses within 600m of the Western gas factory between 2002 and 2009. The prices of these houses increased 5 to 10% more than houses further away. We attribute these numbers due to the redevelopment of the Western gas factory. A part of the wasteland of the old factory became a beautiful park and the real estate was renovated and housed many creative events. What we observed was that not only firms from the creative industry were attracted but also many other amenities, such as shops and restaurants. This again suggests that cultural amenities have some sort of multiplier effect. This multiplier effect increases the attractiveness of the surrounding neighborhoods even further. However, there is no literature on how the mechanism of the multiplier effect exactly works. In Chapter 4, we attempt to relate the preferences for demographic composition (in our case, the concentration of high income households) and the historic city center. We provide strong evidence that the multiplier effect of cultural heritage exists through attracting high income households. This would suggest that the historic city center also has a multiplier effect through its impact on other consumer amenities, such as shops, restaurants, et cetera. However, we do not provide evidence for this.

7.3 FURTHER RESEARCH
7.3.1 SORTING FRAMEWORK
Although the literature on the sorting framework is relatively young, it has already made a substantial impact to our understanding of the urban housing market. In this dissertation, we have discussed the structure of these sorting models (Chapter 2) and provided examples of their application (Chapter 3 and 4). The main strengths of these models is that they allow for much more detail than the conventional monocentric urban economic model and hedonic price model. It deals with unobserved location characteristics and heterogeneity of preferences among households thereby enriching the possibilities for welfare and policy analysis.

We expect future research on the structure of the sorting framework. An important issue is the sorting framework, as is presented in literature, is static whereas housing decisions are inherently dynamic. There is some recent work on this by Bayer et al. (2010) and Epple, Romano & Sieg (2010). Bayer et al. (2010) make an interesting attempt to introduce dynamics into a horizontal sorting model by allowing for forward-looking behavior of households with respect to house prices and moving
costs. The main problem of their estimation of the dynamic sorting framework is that it ignores the endogeneity of prices. In a static framework – as we use in Chapters 3 and 4 – an instrumental variables strategy is used to control for the endogeneity issue between prices and unobserved characteristics of the location. The same instrumental variables strategy is not feasible if current prices are correlated with expected future utility. Epple, Romano & Sieg (2010) extend the vertical sorting framework to include moving costs and life-cycle components. The aim of their working paper is to study the intergenerational conflict over the provision of public education between younger households with children and older households without children. The extensions of the sorting framework enables them to predict the expenditures spent on education and other public goods in neighborhoods in the Boston Metropolitan Area, and which households will move to another neighborhood in the following period. In their conclusions, they argue that there is still scope for future work. For instance, relaxing assumptions, such as assuming there are only two periods and only two different types of households, would be interesting additions for future research on this topic.

The extension towards dynamic models is, in our view, the most important example in which future research should focus on. However, there are many other possibilities and challenges ahead for sorting models.\(^{59}\) We hope to have made clear that, even in its present state of development, the literature on household location choice has made an important contribution to the understanding of the sorting mechanism and the effects of local amenities. The sorting framework enables policy makers to better understand the mechanics of the housing market and the consequences of policy interventions. We are convinced that more theoretical, as well as empirical, work in this area will be extremely useful.

7.3.2 CULTURAL HERITAGE

As we mentioned before, in the quantitative research we use rough measures of cultural heritage. The available data allowed us to distinguish the conservation areas into historic city centers and historic sceneries. We hope that in the future there will be more information on these conservation areas, so it will be possible to distinguish even more different types of cultural heritage. We are aware that this is very labor intensive. In return, this means that researchers can provide a more detailed overview of the benefits of different types of cultural heritage. This would considerably improve the research on the economic valuation of cultural heritage.

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\(^{59}\) For an excellent survey on equilibrium sorting and its possibilities and challenges, see Kuminoff, Smith & Timmins (2010).
We mention the multiplier effect of cultural heritage in this dissertation. We argue that cultural heritage is an anchor point for economic activity. A cultural atmosphere attracts residents, firms and tourists. In this dissertation, we estimate the total effect of cultural heritage, including these multiplier effects. We do not exactly know how other amenities, such as shops and restaurants, are attracted by cultural heritage. We only know that they do as we can observe in many cultural cities. In Chapter 4, we provide the first steps to prove the existence of the multiplier effect of cultural heritage through demographic composition. To disentangle the multiplier effect from other effects would be an important aim with high policy relevance. A better understanding of the mechanism of the multiplier effect would substantially contribute to the understanding of the economic effects of cultural heritage.