For many housing markets, the most recent years apparently do not give any cause to think in terms of risk. In the Netherlands, for example, house prices doubled in 8 years time. A less myopic view, however, would provide a different perception, since price developments have not always been this favorable. For longer horizons, the standard deviation of annual house price changes is about half the standard deviation of stock values. However, general housing market fluctuations only concern one aspect of the total risk. Besides macro-level influences, uncontrollable micro-level factors could cause price changes as well. Consider, for example, what would happen to house prices if the local government would announce the construction of a nuclear power plant. And would property values be the same before and after the explosion of a nearby fireworks factory?

We study housing market risk at a macro-level for very long time periods in the first part of this thesis. The second part focuses on housing market externality analysis at a micro-level.

**Macro-level housing market risk**

For analysis of the housing market in the long run, we developed indices reflecting rents and house prices of residential properties in Amsterdam. An abundance of literature has made clear that constant-quality indices, like a hedonic or a repeat-sales index, are the best methodologies for this, since they are theoretically superior to simple mean or median indices. In practice, the decision to opt for one specific constant-quality index method is likely to depend on data availability. For the very long-run data requirements for a hedonic index are too stringent, since many details about property attributes are needed, such that a repeated-measures index is the most appropriate to reflect the housing market in the long run.

In Chapter 3, we applied the repeated-measures methodology to rents for Amsterdam properties between 1550 and 1850, and call the resulting constant-quality index the Repeated-Rent index. This had not been done before at the moment of the first presentation. Since the index only considers changes in rents, it will reflect current market values. The specific characteristics of the data we use meet most important drawbacks of this index construction method, and biases arising from sample selection bias and temporal aggregation are avoided. The indices constructed for verification describe roughly the same pattern, although considerable differences exist. Moreover, the verification indices are not constant-quality and do not reflect market values.
The constructed rent index and a repeat-sales index for Amsterdam property prices are used to study the historical housing market in Chapter 4. Most long-run housing market studies concern time periods of at most a few decades, which seldom show more than one boom and one bust. This might yield an incorrect perception of housing risk. According to the 300-year rent index, the development of residential rents over time is quite volatile, and rent volatility has shown remarkable differences over time. The same conclusions apply to the prices of owner-occupied properties, which are studied for 350 years. The housing market tracks the economy amazingly well in the long run. Moreover, in case of major socio-economic events, the housing market is able to adjust very quickly. In those circumstances, residential real estate does not provide any protection, and faces the investor with large risks. The focus of modern real estate research on the most recent and very prosperous decades probably yields an overly optimistic view on real estate performance.

Besides being affected in nominal terms, housing market returns could be eroded by inflation. Chapter 5 clearly showed that owning a house only offers inflation protection in the long run, and only if inflation is persistent. In periods when inflation is not persistent, as was the case before this century, house price changes are not positively related to the inflation rate. Now, however, the economy shows signs of moving towards a state in which inflation is no longer persistent, or at least not as persistent as it has been in the last decades. That is generally heralded as a very positive thing, but this chapter shows that it will also have an important drawback: home-ownership will no longer offer inflation protection, not even in the long run.

**Micro-level housing market risk**

Although macro-level market forces could be a serious threat to house prices, this is only one aspect of housing market risk. At a micro-level, prices could be affected as well. Two potentially harmful externalities receiving a lot of attention in the Dutch media concern accommodation centers for asylum seekers, and traffic noise generated by increasing intensity of traffic by air, road and rail. In Chapter 6, we explained how hedonic regression can be used to estimate the impact of externalities on house prices, and discussed how methods applying spatial information could improve this analysis. Although many studies used hedonic regression to study housing market externalities, and many other studies showed how spatial techniques could improve hedonic regression, the combination of both techniques has not been used in real estate literature. A simulation illustrated how this combination could yield a more reliable externality analysis.

In this thesis, we studied both mentioned externalities for the Netherlands. In Chapter 7, we analyzed the impact of accommodation centers for asylum seekers on the sales prices of surrounding properties. Since current accommodation centers are overcrowded and the inflow of asylum seekers seems to remain high, a growing need for new centers is likely. This might cause an increasing number of incidents and financial claims by
opponents of new centers. This is not just a matter for the Netherlands, but for many rich countries, especially in Europe.

To study whether financial claims for affected property prices are correct, we used information from 113,574 residential property transactions that occurred in the western part of the Netherlands during the years 1997 through 1999, and studied all 55 accommodation centers that were in operation during this period. In the majority of all cases, we found that the proximity of these centers did not influence property prices significantly. Additional analysis shows the time it took to sell a property near a center did not differ from comparable properties elsewhere, and the difference between the original ask price and actual sales price was not significant either. Despite all prejudices, we conclude that centers for asylum seekers are no NIMBYs, and that, generally speaking, claims to the contrary could not be justified in financial terms.

The annoyance citizens perceive from noise has become another national topic in the Netherlands. Currently, large infrastructural projects are planned, like expansion of the main airport and the construction of railroads for high-speed international trains. These projects face strong opposition from pressure groups. Moreover, in the near future, local governments will be allowed to determine and enforce differentiated noise limits for specific areas within their municipality. This validates a study after the impact of new infrastructure and more compliant noise limits on values of surrounding properties, as a reference for potential compensation to harmed homeowners. Alternatively, the capitalized value of noise in house prices could be used to estimate the benefits of noise reduction, for example by construction of noise barriers along highways or by more rigid noise contours for airports. In Chapter 8, we find that noise levels above 65 decibels appear to be capitalized into prices, with a maximum discount of approximately 10 percent. We derive this conclusion by allowing for a nonlinear relationship between prices and noise levels, which has not been done before, to our knowledge. This approach reveals that reducing noise from a loud (71-75 dB) to moderately loud level (66-70 dB) has a larger impact on property values than reducing noise from very loud (over 75 dB) to loud level, or a reduction from moderately loud to quiet. Apart from the nonlinear relationship, our findings are in line with results from international studies.

Future research
All kinds of studies can be performed with the data used for this thesis, or with the constructed indices. For example, the rent index and the Amsterdam property sales price index can be used to study market efficiency for over 200 years. The data used to construct the rent index provides a lot of information on lease terms. We already indicated regularities in lease terms over time, related to economic conditions. The property rent and sales price indices may be used as well in comparative performance studies with stock and bond returns for the long run. We performed our micro-level risk analysis by means of a hedonic regression, to test whether properties located nearby an externality sell for a lower price than similar properties elsewhere. However, additional
insights could be gained from a study analyzing property prices both before and after the opening of an accommodation center for asylum seekers, or before and after large infrastructural changes. This type of analysis is possible if our rather short data period is extended by new data. Besides, the existing studies can be refined, by taking smaller threshold distances for properties surrounding asylum seekers’ centers, for example. Moreover, since we linked property attributes to the exact location of properties, other spatial studies are possible. For example, these data allow tests for housing market sub-markets. Therefore, a lot of housing market risk is still to be studied.

At this very moment, at a worldwide level, people consider trading housing market risk. Products like home equity insurance, shared appreciation mortgages and derivatives on house price indices could be of great practical use for investors and homeowners, in order to manage housing market risk. We will have to wait and see what the future will bring to housing market participants.