TI 2007-078/3
Tinbergen Institute Discussion Paper

The Effect of Consumers' Expectations on a Booming Housing Market: Space-time Patterns in the Netherlands, 1999-2000

Jan Rouwendal[*]
Simonetta Longhi[**]

** Department of Spatial Economics, Free University Amsterdam*
*** ISER, University of Essex, Colchester*

Tinbergen Institute
The Tinbergen Institute is the institute for economic research of the Erasmus Universiteit Rotterdam, Universiteit van Amsterdam, and Vrije Universiteit Amsterdam.

Tinbergen Institute Amsterdam
Roetersstraat 31
1018 WB Amsterdam
The Netherlands
Tel.: +31(0)20 551 3500
Fax: +31(0)20 551 3555

Tinbergen Institute Rotterdam
Burg. Oudlaan 50
3062 PA Rotterdam
The Netherlands
Tel.: +31(0)10 408 8900
Fax: +31(0)10 408 9031

Most TI discussion papers can be downloaded at http://www.tinbergen.nl.

The effect of consumers' expectations in a booming housing market

Space-time patterns in the Netherlands, 1999-2000

Jan Rouwendal* and Simonetta Longhi**

*Department of Spatial Economics
Free University
Amsterdam

** ISER
University of Essex
Colchester

This version: September 26, 2007

Keywords: House Prices, Consumer Confidence, Bubbles

Abstract
Even though economic models have been relatively successful in explaining the long run patterns of house prices, they have more difficulties in explaining short run developments of the housing markets. However, the fact that during such 'bubbles' the spatial pattern of house prices, which can mainly be attributed to accessibility differences, usually remains unchanged, suggests that the irrational forces that are presumably responsible for unexplained movements in house prices obey some regularities: they seem to affect the level of house prices, but not their spatial pattern. This suggests that it is worthwhile to consider the explanatory power of psychological variables like those reflecting general (nation wide) feelings of optimism or pessimism.
This paper considers the development of Dutch house prices in the years 1999 and 2000, when house prices increased fast. Existing explanations of the long run development of Dutch house prices on the basis of economic fundamentals (notably income and the mortgage interest rate) would suggest a much more modest development of house prices over these years. We also show that commonly used housing market indicators, notably the number of vacancies (houses for sale) and the time on the market, are unable to explain the development of house prices during this period. However, we find a strong relationship between the development of house prices and the Dutch index of consumer confidence.

Acknowledgement
The authors are grateful to Rosan van Wilgenburg for preparing the maps and to four anonymous referees for constructive comments on a previous version of the paper. The usual disclaimer applies.

1 Introduction

The price of housing is an important economic variable, both at the micro and the macro level. For owner-occupiers the house is usually the most important asset in their wealth portfolio and changes in house prices can have important consequences for their total wealth position. Related to this is the importance of house price changes for the macro economy: house prices are often regarded as an important determinant of consumption (see Campbell and Cocco, 2005, and Case, Quigley and Shiller, 2005, for recent contributions). It is therefore of some interest to study the determination of house prices.

The housing market has a number of special features which complicate the analysis of price determination. One of them is that house prices are determined at the level of a specific unit: selling a house implies announcing that it is for sale, waiting for potential buyers and, if they arrive, negotiating with them in order to determine the price. This specific process of price determination is related to the extreme heterogeneity of housing. A second important aspect is the durability of housing. If housing were non-durable, the cost of construction should be the main determinant of house prices. However, empirical research has experienced many difficulties in relating the supply of new housing to construction cost (see, for instance, DiPasquale and Wheaton, 1994). In any case, for existing houses, such a natural anchoring point is absent. Still another feature of the housing market is that most buyers are also sellers. A change in the general level of house prices implies therefore for many actors on this market that losses on one side of the market are compensated by gains on the other side. This makes trade on the market less sensitive to price movements. Finally, user costs, which are generally regarded as the proper indicator of the price of housing services, decrease when house prices are expected to go up. Expectations of price increases may therefore stimulate demand (see, for instance, Dusansky and Koç, 2007), possibly leading to a 'bubble.'

These features of the housing market point to a degree of indeterminateness of house prices, and help to explain why the development of house prices is often difficult to relate to economic forces, at least in the short run. In the present paper we concentrate on Dutch house prices in the years 1999 and 2000, when they increased by 19% and 13% respectively. It seems hard to relate such increases to changes in economic fundamentals, and references to 'fads' or 'irrational exuberance' are often heard in discussions of house price development (see, for instance, Poterba, 1991).

In sharp contrast to the difficulties economists experience when attempting to explain the development of the house price level over time, is the robust explanation they provide for the spatial pattern of house prices. The monocentric model is remarkably successful in explaining house price patterns in metropolitan areas, and it is easily generalized to the statement that house prices are determined by accessibility to employment centers and other amenities (see, for instance, Case and Mayer, 1996). The underlying reasoning is that buyers of a house trade off location and other housing characteristics in a rational way and that their search for the best alternative available leads the market towards an equilibrium in which proximity to valuable amenities is reflected in higher house prices.

The two observations made in the previous paragraphs might seem paradoxical. It seems highly improbable that irrational actions lead to the stable spatial pattern of house prices we observe; on the other hand, if actors are rational we would expect house prices to be linked to market fundamentals. However, there is a possibility to explain the two observations simultaneously: if the behavior of all actors deviates from that of the standard rational beings assumed in economics in one aspect – say their willingness to pay for housing in general – but conforms to it in other aspects – for instance when they compare two houses that are for sale –

then it seems possible to 'save' the two observations and their suggested interpretations. The implication is, then, that we should be able to attribute the deviations from rationality to a common factor that is relevant to all – or at least to many – actors.

It is the aim of the present paper to do so by linking the development of house prices in the Netherlands in the years 1999 and 2000 to an indicator of consumer confidence in the state of the economy. The indicator is published monthly by Statistics Netherlands and is widely regarded as a useful indicator of consumers' expectations of economic developments in the near future and their willingness to spend money.[1] We find that this variable does a remarkably good job in explaining the course of Dutch house prices in 1999 and 2000, outperforming a number of other potential explanatory variables. The paper thus adds to the literature on house price development by investigating the role of such a psychological variable – the above mentioned index of consumer confidence – in the context of an explanatory framework based on economic theory

The paper is organized as follows. In the next section a review of relevant literature is provided. In Section 3 the context of the Dutch housing market is sketched and the data are introduced. This section contains a number of preliminary investigations that foreshadow the main results that are reported in section 5. Section 4 explains the derivation of national and regional quality adjusted price indices. Section 5 reports on a number of multivariate analyses that substantiate the results of section 3. Moreover, in this section the spatial dimension is introduced. Section 6 concludes.

2 Literature review

2.1.1 Macro literature

The movement of house prices has often been studied from an aggregate perspective. This branch of the literature stresses the relationship between house prices and market fundamentals. The efficient market hypothesis, according to which all available information is incorporated into the current house price, was rejected in Case and Shiller (1989) and in many later studies, for instance, Hill et al. (1999) and Englund et al. (1999). More recent studies of the development of house prices use error correction models, in which house prices are viewed as fluctuating around a long run relationship determined by market fundamentals. An early example is Abraham and Hendershott (1996) who based their equation for market fundamentals on urban economic theory (more specifically on the exposition in Capozza and Helsley, 1989). A recent example of such a study is Capozza, Hendershott and Mack (2004).

Boelhouwer et al. (2001) applied this approach to house prices in the Netherlands. According to their long run relationship, the ratio between net capital cost of a house and household income is constant and equal to 0.27.[2] Net capital cost is defined as the product of the house price and the after tax mortgage interest rate. This relationship implies that the (long run) elasticities of the house price with respect to income and the mortgage interest rate are equal to plus and minus one, respectively. The value 0.27 is close to the share of mortgage payments in income that is regarded as acceptable by banks.[3] The study by Boelhouwer et al. (2001) therefore suggests that a representative household buys a house that could just be financed by the

[1] Similar indicators exist in other countries, for instance the United States and have been found useful in the analysis of consumer behaviour. See, among others, Howrey (2001), Ludvigson (2004) and Souleles (2004).

[2] This long run relationship was postulated, since these authors felt that the observation period (1985-2000) was too small to enable estimation.

[3] The critical values used in practice are somewhat higher, but they refer to total mortgage payments, not only to interest payments.

maximum mortgage loan the bank would be willing to give. If this is true, and the study provides a number of arguments in favor of this line of reasoning, changes in the maximum borrowing capacity, and therefore changes in the mortgage interest rate and in income should be the major determinant of the development of house prices.

Verbruggen et al. (2004) presents results for an alternative error correction model in which a long run relationship for the development of house prices is estimated. It relates the long run equilibrium of house prices to income, the real interest rate, wealth other than housing and the housing stock. The estimation results suggest that house prices are somewhat more sensitive to income changes and less sensitive to changes in the real interest rate than was suggested by the study of Boelhouwer et al. (2001).

A general conclusion from the macro literature is that the short run development of house prices may differ substantially from a long run relationship that is determined by market fundamentals like income, the mortgage interest rate and the supply of new housing. Short run developments are modeled by means of autoregressive processes for which no economic theory is provided.

2.2 Micro literature

A different branch of the literature is concerned with the bargaining process involved in selling a house. The role of the list price was clarified in an early study by Horowitz (1992). Horowitz assumes that the list price determines the distribution of the bids that will be received on the house that is for sale. The offered price will never exceed the reservation price. A higher reservation price shifts the offer distribution upwards, but decreases the frequency of these offers. The optimal list price is found by maximization of the value function. Knight et al. (1994) concentrate on the demand side of the market and develop a model in which heterogeneous searchers use the information provided in the list price to decide on making an offer.

Arnold (1999) integrates both sides of the market by developing a bargaining model in which searchers visit houses for sale with announced list prices. A visit reveals the value of the house for the searcher. If this value and the list price are not too far apart, a bargaining process will result in a sales price. In this model an outside option, implying the possible decision to abstain from bargaining for the searchers as well as the seller is explicitly included. The model is embedded in a market environment by linking the seller's outside option to the distribution of potential buyers who visit the house.

This micro-oriented literature does not provide a fully fledged model of price formation in a market equilibrium setting. The bargaining process is modeled in a static environment and the literature hardly considers the connection between the price of a specific house and the development of the macro-economic indicators. Since the macro-studies use house price indicators that are based on micro-information, the question arises how price formation at the micro-level incorporates such macro-economic information. The micro literature that concentrates on list pricing and time on the market of individual houses does not provide direct answers to this question. However, some interesting suggestions for such answers may be derived from it.

For instance, a general increase in income may result in a larger number of transactions and a smaller number of houses for sale. In the model by Arnold (1999) this will result in a lower value of the outside option of a searcher on the housing market. This increases the probability that a searcher will offer a bid when visiting a house that is for sale and also the average value of such a bid. In the model by Horowitz (1992) a decrease in the number of vacant houses leads a seller to expect higher bids and therefore to determine his own list price at a higher level. In the

model by Knight et al. (1994) higher list prices lead to higher bids. A similar reasoning gives an idea of the effect of a change in the mortgage interest rate. A decrease in this variable implies that the user cost of housing goes down and also perhaps that credit constraints are relaxed. This stimulates demand with similar consequences as an increase in income.

The micro literature may thus be interpreted for the purposes of this paper as suggesting that changes in macro variables lead to changes in the values of housing market indicators – like the number of vacancies or the average time on the market – that induce changes in the level of both list prices and transaction prices.

2.3 Other studies

There exist some attempts to model price formation on the housing market in an equilibrium setting. For instance, Wheaton (1990) provides a model in which households have to search for another house when they become mismatched. In this model all households are buyers as well as sellers, which is one of the reasons why large price changes can be caused by relatively small changes in exogenous variables. His price equation[4] suggests that the interest rate is an important determinant of house prices, as well as the tightness of the market and the rate at which households become mismatched in their house. The latter variable may be related to changes in (permanent) income. The dynamic model developed in Williams (1995) leads to similar conclusions. One of the extensions discussed in that paper concerns the distinction between hot and cold markets and the associated difference in liquidity in the housing market, an issue that was investigated further in Krainer (2001).

Krainer's analysis suggests that in a hot market the average list price will be closer to the sales price than in a cold market. Imperfect information about markets values may result in a list price that is lower than the sales price. Indeed, this situation occurs regularly in our data set.

Some recent studies have called attention for behavioral or psychological aspects behind the different functioning of the housing market in hot and cold periods. The primary example is Genesove and Mayer (2001) who argue that loss aversion plays a large role in the determination of trade volumes on this market. Other studies, for instance Engelhardt (2003), confirmed this result. This literature connects housing market analysis to behavioral economics. It may, however, be noted that the behavior implied by Krainer's optimizing actors is in some respects close to that of loss averse human beings studied in this literature.

3 Context and data

3.1 House prices in 1999 and 2000

House prices in the Netherlands have gradually increased since 1985. Figure 1 shows that the growth rate was especially high in the years to which our data refer, 1999 and 2000. At the beginning of the 1980s there was a large downfall in Dutch housing prices which remained at a relatively low level until the second half of the 1980s when they started to rise again. In the Netherlands the rental part of the housing market is regulated and real rents were increasing through the 1980s and part of the 1990s. This has contributed to the recovering interest in owner occupation and to the steadily increasing homeownership rate among Dutch households in the second half of the 1980s. In the course of the 1990s demand for owner occupied housing remained strong while interest rates gradually went down and the Dutch economy flourished. During these years supply of new housing stagnated.

[4] Equation (24) on page 1281.

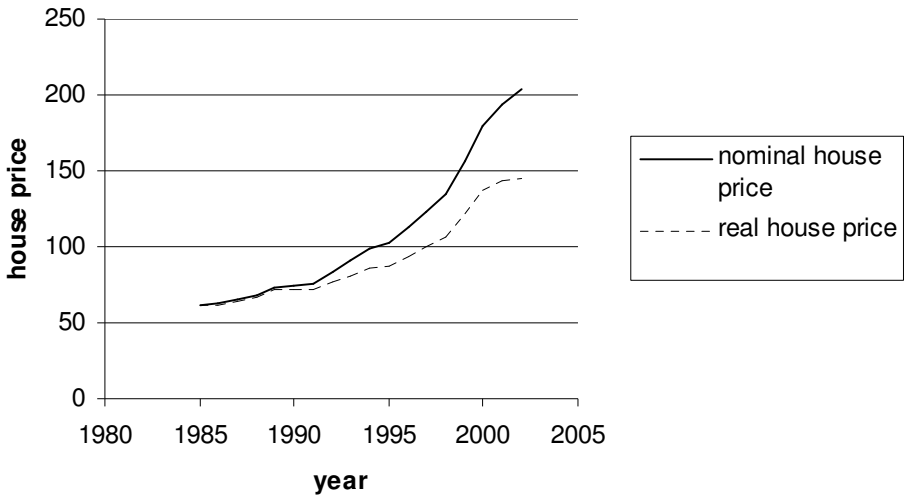


Figure 1 Median Dutch house prices 1985-2002 (Source: NVM)

The house price indicator that is commonly used in the Netherlands is the median sales price of houses sold by members of the Dutch Association of Realtors, shown in Figure 1. The majority of the Dutch realtors are members of this association, which is usually abbreviated in Dutch as NVM. The analysis that follows is based on the micro data underlying this indicator. These data refer to more than 120,000 house sales and inform us – among other things – about the day the house was (first) listed, the day on which it was sold, the list price, the transaction price and a large number of characteristics of the house, including its location. Data on the postcode of the area where the property is located allows the analysis of house prices at the regional level.

Figure 2 shows the development of the average sales price by the month in which the property was sold. The average monthly sales price increased from 154,100 euros in January 1999 to 184,100 in January 2000 and then to 208,200 in December of that year, an increase of 19% in the first period and 13% in the second. The figure shows that the increase was not monotonic. In 1999 there are four months in which the average sales price hardly changed and in 2000 there are four months in which it decreased. In the second half of 2000, sales prices increased much slower than in the previous 18 months. Indeed, in December 2000 the average sales price was at the same level as in July of that year.

The figure also shows the development of the list price by the month in which the property was first listed. This curve shows roughly the same pattern as the sales price, but with some interesting differences. Changes in the average list price seem to predict changes in the average sales price in the next month. For instance, the accelerated increase in the list prices in March 1999 is followed by a similar acceleration of the increase in the sales prices in April 1999; the drop in list prices in December 1999 is followed by a similar drop in sales prices in January

2000. The slight drop in house prices that occurred at the end of 1999 may have been caused by anxiousness about the millennium change.[5]

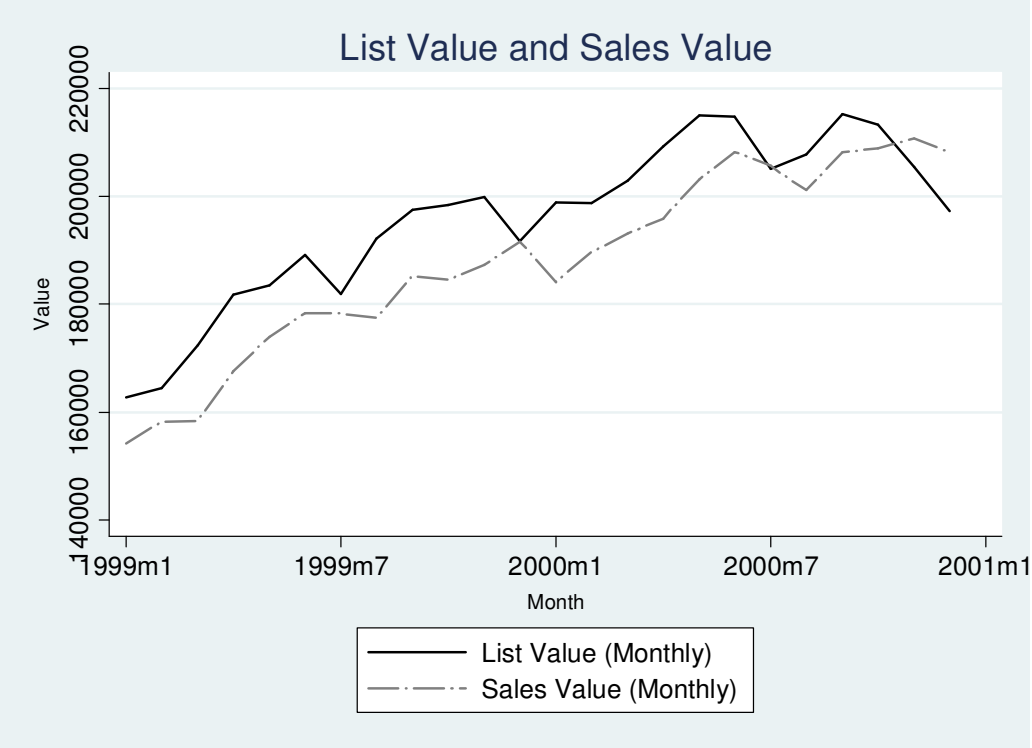


Figure 2 Average Sales Prices and Average List Prices in 1999 and 2000.
(Source: own computations based on NVM data)

3.2 The spatial pattern

Figure 3 shows two maps of the Netherlands showing the spatial pattern of average values of sold houses at the beginning (the first three months of 1999) and the end (the last three months of 2000) of the period considered here.[6] Even though the average national price levels differ considerably between these two periods, the spatial pattern is stable, as was noticed in the introduction. This should not be taken to imply that the development of house prices was completely identical in all regions. There are non-negligible differences in the total change in house prices over the two years between regions, which can presumably be attributed to differences in employment, housing construction, et cetera, cf. Case and Mayer (1996). It should be noted that the numbers shown are not yet corrected for differences in housing quality.

[5] At the end of 1999 there was a general feeling of uncertainty, related to the general idea that humanity entered a new era. The fear that computer systems might collapse as a consequence of the switch from 1999 to 2000 added to this feeling.

[6] We aggregated to periods of three months because the monthly number of observed sales in some regions is small. We have 90 regions and 24 months, which implies that the average monthly number of observed sales per region is approximately equal to 60.

Consistent with the monocentric model, the figure shows that housing prices tend to be higher in the center of the country, and lower in the periphery.

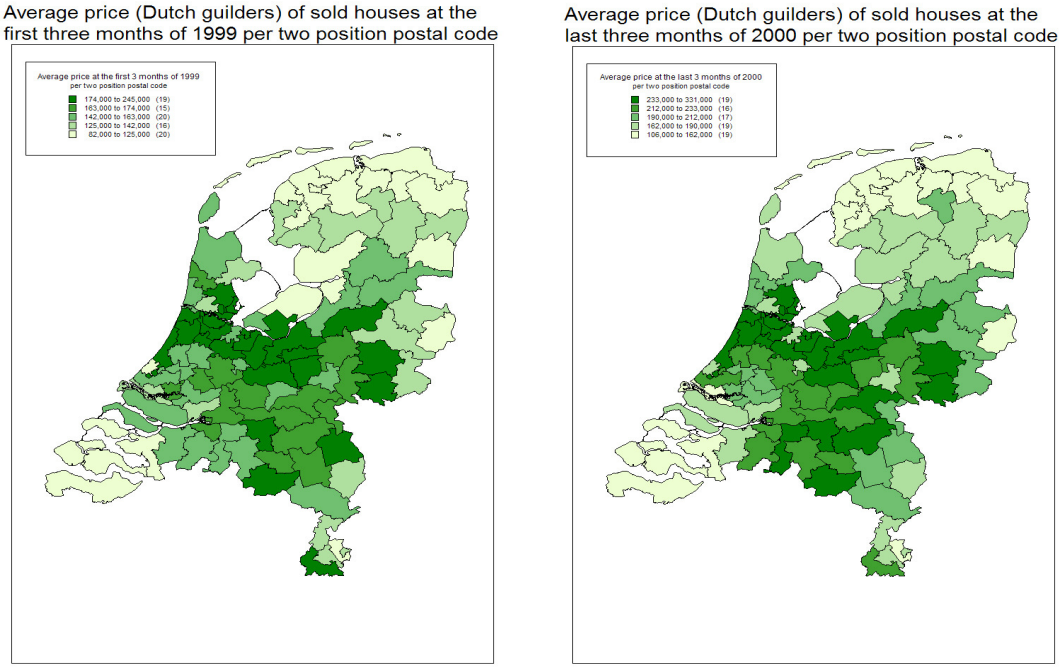


Figure 3 Spatial pattern of Dutch house prices

3.3 What do market fundamentals suggest?

The macro-economic context of the housing market in 1999 and 2000 is indicated by the national average mortgage interest rate and per capita income. Figure 4 shows the average interest rate on new mortgages during these two years. The data is provided by Statistics Netherlands. The mortgage interest rate is slowly decreasing during the first half of 1999. From June 1999 onwards, there is a gradual increase from about 5% per year to more than 6% per year. There are strong arguments for expecting a negative effect of the mortgage rate on the house price, at least in the short run, when supply is inelastic. Note, for instance that a 1% increase in the mortgage interest rate from 5% to 6% implies that interest payments for a loan of a given size increase by 20%.

A comparison of Figures 2 and 4 shows that the increase in the mortgage interest rate is unable to explain the development of house prices since both variables move roughly in the same direction. We note, however, that it is possible that there are more subtle effects of the development of the mortgage rate in our data. For instance, the turning point in the development of the mortgage interest rate that occurred around the middle of 1999 is perhaps related to the drop in the list prices that occurred around the same time. We will return to the possible effects of the increasing mortgage interest rate on the development of house prices in section 5.

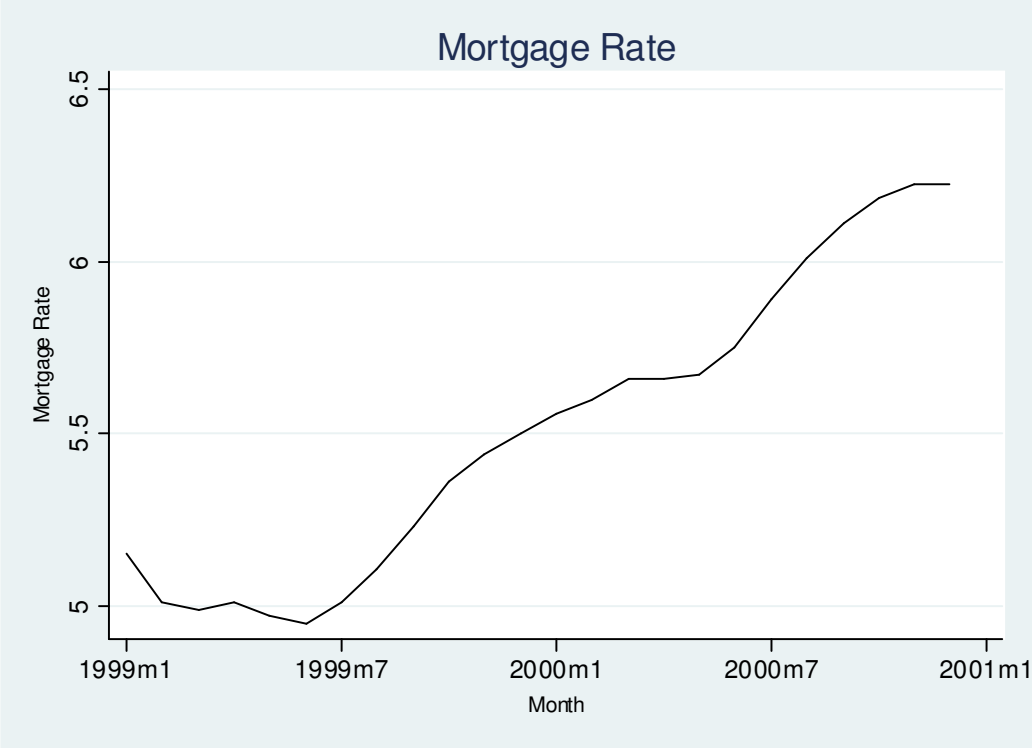


Figure 4: Mortgage interest rate for the Netherlands by month
(Source: Statistics Netherlands)

Even though no monthly figures are available for per capita income, it is worthwhile to point out that the long-term relationships estimated by Boelhouwer et al. (2001) and Verbruggen et al. (2004) are unable to explain the development of house prices over 1999 and 2000. The increase in per capita income in these two years was high: 6.8% and 5.9%, respectively. However, this growth is smaller than the percentage increase in the mortgage interest rate and the long term equation of Boelhouwer et al. (2001) would thus predict a *decrease* in the house price in both years. The study by Verbruggen et al. (2004) implies a modest increase in house prices. We conclude therefore that the market fundamentals that have been identified in these studies are unable to explain the rapid increase in Dutch house prices during these two years.

3.4 Consumer confidence

The index of consumer confidence constructed by Statistics Netherlands is based on the answers given by roughly one thousand respondents to five questions. Two of them concern the economic situation in the previous and next 12 months, two their own financial situation in the previous and next 12 months and the fifth their opinion about the statement that this it the right time to realize big purchases. These big purchases are not specified further, but it is natural to relate them to durable consumer goods. The subindices of each of these five questions are determined as the difference between the number of positive and negative answers, expressed as a percentage of the total number of respondents. The total index is the average of these five subindices. Even though one expects this index to be correlated with the development of (permanent) income, it will be clear that the index of consumer confidence is more properly

regarded as a psychological indicator of the economic climate as perceived by consumers. [7] It is not possible to disaggregate the index by regions.

Figure 5 shows that in the years 1999 and 2000 consumers were exceptionally optimistic, relative to previous and later years. Even though this coincided with the rapid growth in per capita income in this period it must be stressed that there is no formal relation between this conventional indicator and the index of consumer confidence.

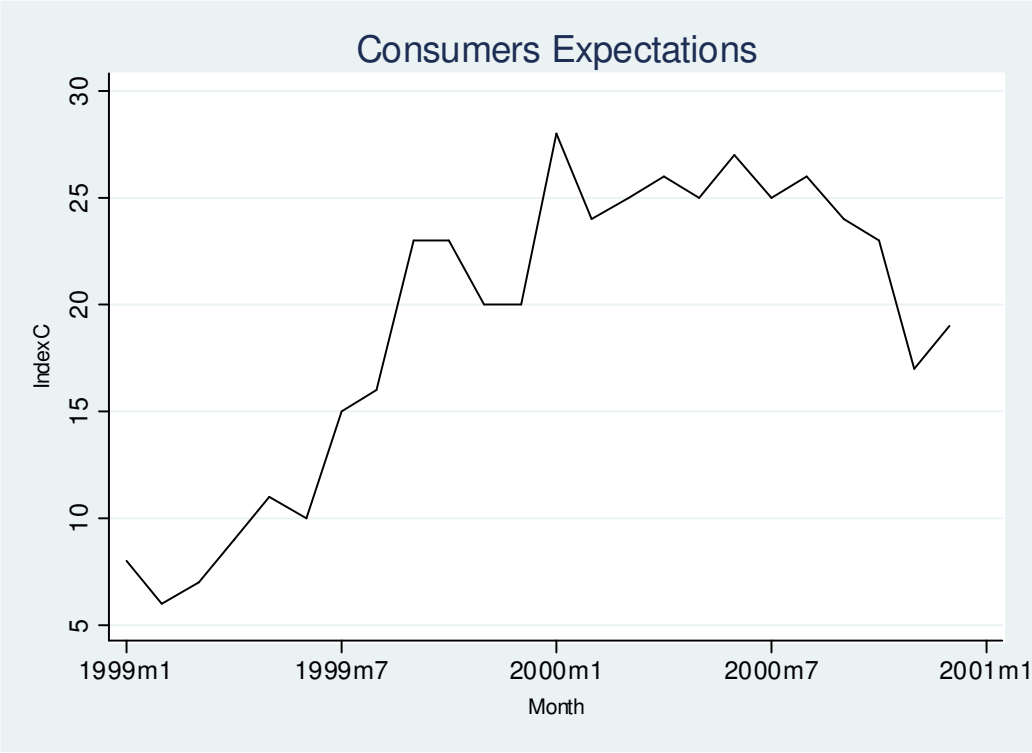


Figure 5: Index of consumer confidence in the Netherlands by month
(Source: Statistics Netherlands)

Comparison of Figures 2 and 5 supports the intuition that consumers' expectations and the development of house prices are positively correlated. A simple OLS regression results in a statistically significant coefficient for consumers' expectations and an R^2 of 0.64. Indeed, the correspondence between the development of house prices and consumer expectations is remarkable. There appears to be some hesitation around the middle of 1999 when the mortgage interest rate turned upwards. There is a slight decrease around the millennium change. There is a moderate change over the year 2000. The drop in consumer expectations at the end of 2000 coincided with falling house prices.

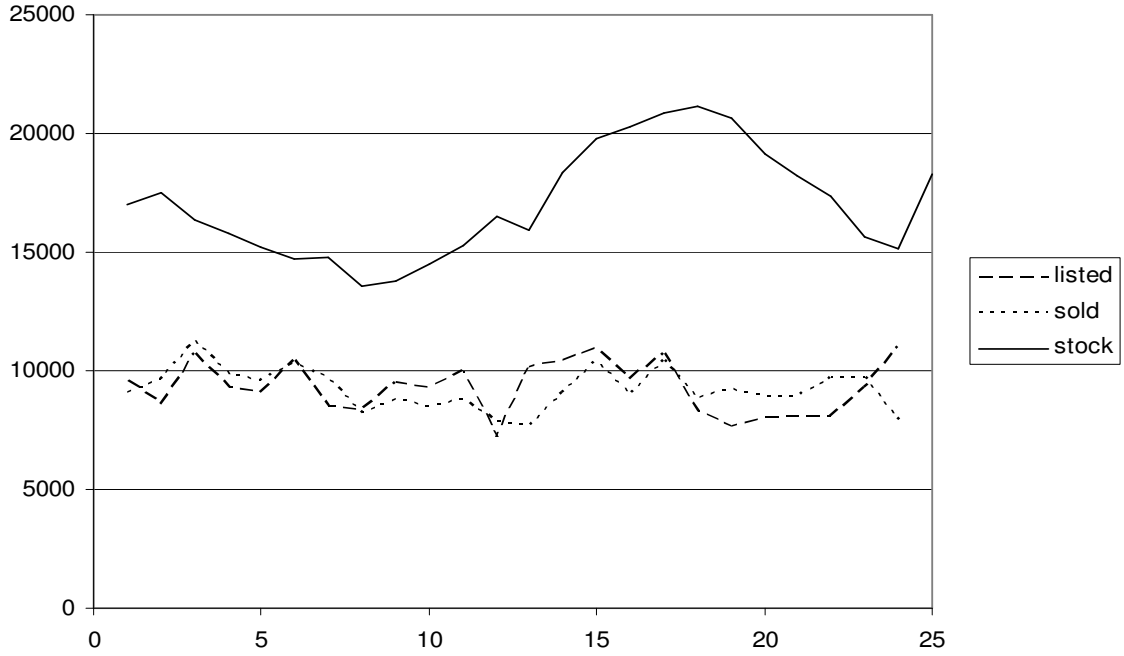
Our first impression of the data is therefore that consumer expectations were the most important determinant of the increase in house prices that occurred over the two years considered

[7] Statistics Netherlands uses the Index of Consumer Confidence as part of its Business Cycle Tracer. See www.cbs.nl.

here. Before we proceed to a more formal analysis of their relations, we consider some other possible explanations.

3.5 Housing market indicators

The micro literature about price formation in the housing market suggests that internal variables such as the volume of the stock of houses for sale or the time on the market are important determinants of house prices. In the present subsection we consider some of these variables.



Legend. Listed = monthly number of newly listed houses. Sold = monthly number of sold houses. Stock = number of houses for sale at the beginning of the month.

Figure 6 Development of stock of houses for sale
(Source: own computations based on NVM data)

Figure 6 shows the development of the stock of houses that are for sale. The number of houses sold during one month's time was relatively constant over these two years. The number of newly listed houses has a bit more variation. Differences between these two variables have cumulative effects on the stock of unsold dwellings, which explains the considerable variation in this variable. During the first half of 1999 slightly more houses were sold than newly listed, which resulted in a decrease of the stock of unsold houses. At the end of 1999 and the beginning of 2000 a slight dip occurred in the number of sold dwellings. Since the number of newly listed houses remained constant, with the exception of December 1999, the stock of houses for sale increased rapidly in the second half of 1999 and the beginning of 2000. In the second half of 2000 the number of newly listed houses shifted to a lower level and the number and the stock of

unsold houses decreased again.[8] The substantial drop in the number of newly listed houses at the end of 1999 may have been related to the approaching millennium change, which caused some anxiousness at the time. It reduced the growth in the stock of unsold houses at the beginning of 2000. The rapid growth of that stock in later months is probably responsible for the decrease in the number of newly listed houses occurring around the middle of the year 2000. Towards the end of the year 2000 the volume of the stock has decreased towards the level of the beginning of that year, and the flow of newly listed houses increases again.

A comparison of Figures 2 and 6 does not convey the impression that the stock of unsold dwellings has a dominant impact on the development of house prices. In particular, it is clear that there is no inverse relationship in our data between house prices and the stock of unsold dwellings.

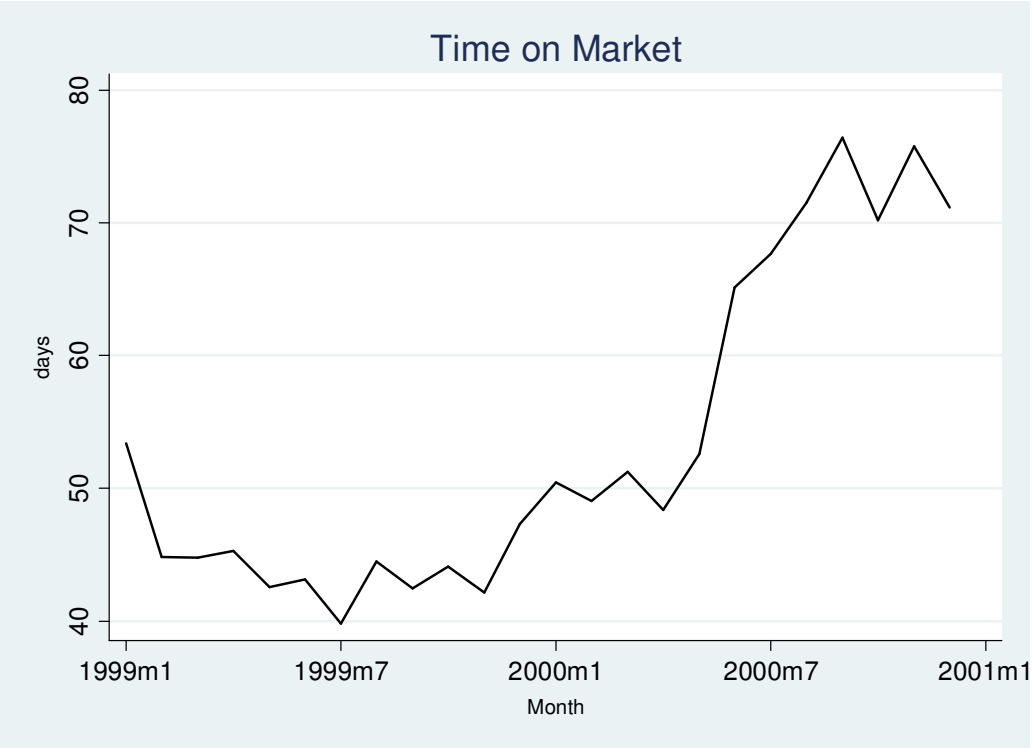


Figure 7 Development of time on the market of sold houses
(Source: own computations based on NVM data)

The time on the market of sold houses during these two years is shown in Figure 7. Unsurprisingly, its development is closely related to that of the stock of unsold dwellings. There is a relatively strong increase around the middle of the year 2000, when the stock of unsold houses is large and the flow of newly listed houses falls. The absence of a decrease in the time on

[8] Since we only observed houses sold during the years 1999 and 2000, the monthly number of newly listed dwellings in the second half of 2000 was estimated on the basis of the survivor function for houses for sale. Since the month of December is somewhat exceptional, the number of newly listed dwellings for that month and the implied increase in the stock of unsold dwellings at the end of 2000, is perhaps less credible.

the market at the end of 2000 is consistent with the fact that the decrease in the stock of unsold dwellings was caused mainly by the decreased inflow of newly listed dwellings.

The relatively sudden increase in the time on the market of sold homes occurring around the middle of 2000 may well be related to the drop in the average list price that occurred in the same period and was followed, one month later, by a drop in the average sales price. Nevertheless, it is clear that the development in house prices over the period considered here was not driven by that of the time on the market: house prices increased fast when the time on the market was relatively constant, and decreased modestly (to recover soon) when time on the market increased suddenly in the middle of 2000.

The final indicator of the housing market situation to be considered here is the ratio of the number of sold houses to the stock of houses for sale. It is clearly related to the time on the market: a high value of this ratio indicates that the time that elapses between the date a house is first listed and the date on which it is sold is short on average. Figure 8 shows that over the two years considered here more than 33% of the stock of houses for sale was sold in each month. In many months in 1999 even more than 50% of the stock was sold each month. This confirms the impression of high demand pressure over the whole course of the period considered here, but especially in the first year. This indicator is therefore the only one that, at first sight, may be able to help explain the development of house prices over the years 1999 and 2000.

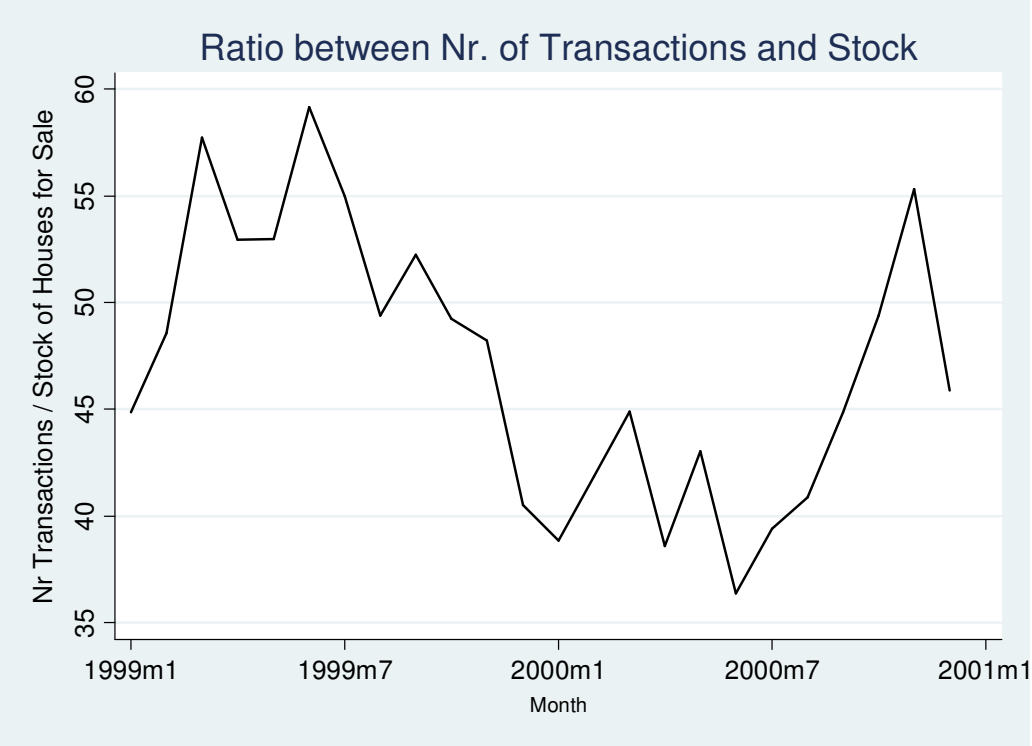


Figure 8 Development of the ratio between the number of transactions and the stock of unsold houses (Source: own computations based on NVM data)

3.6 Conclusion

The information presented in the current section strongly suggests that increasing demand – pushed up by exceptionally positive consumer confidence – was the main cause behind the rapid increase in house prices in the Netherlands in 1999 and 2000. However, it must also be admitted that the results presented thus far are only correlations between house prices and a single explanatory variable at the national level. A more convincing analysis would have to be based on multivariate regression analysis and make used of quality adjusted house prices and pay more attention to local housing market circumstances. To be able to carry out such a more formal analysis we will discuss in the next section the method we used to derive such a price index at the level of regional housing markets. Results of the more elaborate analysis are presented in section 5.

4 Value, Price and Quality

4.1 Spatial and temporal price indexes

In this section we discuss a decomposition of the sales value of a house into a (pure) price component, a spatial component and a quality component. In an attempt to keep the terminology clear, we refer to what is commonly known as the list price and the sales price as list value and sales value, respectively. The price refers to the component of the value that remains after correction for space and quality. In contrast to the value, the price, space and quality components are not directly observable. We will measure them as follows.

We start by estimating a loglinear hedonic price function that explains the sale value V^{sale} (that is: the amount of money for which the house is sold) on the basis of a vector X of characteristics of the house, a vector T of time dummies, and a vector R of regional dummies:[9]

$$\ln V^{sale} = \alpha X + \beta T + \gamma R + \varepsilon, \qquad (1)$$

where ε denotes the usual error term. The j-th element of T, T_j equals 1 if the house is sold in month j and 0 otherwise. Similarly, the k-th element of R equals 1 of the house is located in region k, and 0 otherwise.

For each house we then define the quality component Q of its value in logarithmic form by:

$$\ln Q(X) = \hat{\alpha} X \,. \qquad (2)$$

Similarly, we define the pure price component of the sales value of a house as:

$$\ln P^{sale} = \hat{\beta} T, \qquad (3)$$

and the regional component as:

$$\ln S = \hat{\gamma} R \,. \qquad (4)$$

In the previous equations, $\hat{\alpha}$, $\hat{\beta}$ and $\hat{\gamma}$ are the estimation of the parameters α, β and γ in equation (1). The constant term in (1) is included in the quality component. Taking month 1 as the reference, enables us to define the price component as the logarithm of a price index that shows the development of a (quality and space corrected) house price over time. Similarly, by taking Amsterdam as the reference, we can regard the space component as a spatial index that shows how the price of a house in a particular region relates to that of a similar house sold in the same month in Amsterdam. For month j the value of the price index is: $P^{sale}(j) = \exp(\hat{\beta}_j)$, for region k the space index is $S(k) = \exp(\hat{\gamma}_k)$.

[9] Estimation results for the hedonic price function are available upon request.

We assume that the differences between list prices and sales prices should be attributed exclusively to the price components. In other words: the quality and space components that we estimated for the sales prices are assumed to be equally valid for the list prices.[10] We define a similar index for the list price by regressing the difference between the list price and the logarithm of the quality index $\ln Q(X)$ defined in (2) on *T*:

$$\left(\ln V^{list} - \ln Q(X) - \ln S\right) = \delta T + \varepsilon'. \quad (5)$$

The resulting price indicator is $\ln P^{list} = \hat{\delta} T$. It indicates the value of the price component in list values in a particular month relative to the price component of the sales prices in month 1. As such, it can also be interpreted as a (list) price index. The value of the list price index in month *j* is therefore $P^{list}(j) = \exp(\hat{\delta}_j)$.[11]

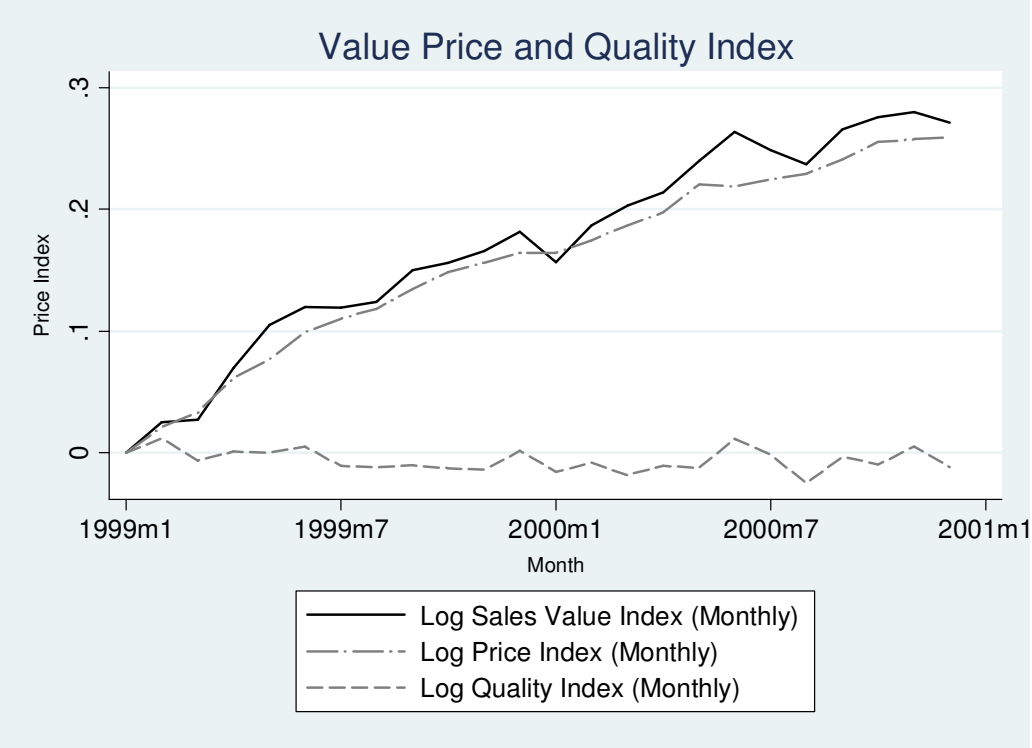


Figure 9 Development over time of Value, Price Component and Quality Component

Figure 9 shows the development of the price index (3) over time as well as that of the average of the logarithms of the sales value of houses sold in a particular month (denoted as the Log Sales value Index) and the average of the logarithm of the quality component (2) of the houses sold in a particular month. The latter variable has been scaled (by taking the ratio to its value in month 1) in order to facilitate comparison with the other two time series and is referred to in Figure 9 as the Log Quality Index. It appears from the figure that the average quality of sold

[10] We could also have started by estimating the three components on the basis of the list prices. Our reason for starting with the sales prices is that they reflect market valuations better than list prices.

[11] There is no constant term on the right-hand-side of (5) so that we can estimate δ_1.

houses did not change much. There is a slight deterioration in the quality over these 24 months. The sales price index shows a gradual increase over the first 18 months.

Figure 10 compares the development of the sales price index and the list price index. The former is the price component of the sales value defined in (3), which was also shown in Figure 9. In order to facilitate the comparison of the development of both price components, the list price index has been scaled so that it takes on the value 1 in month 1. It is referred to as the Log List Price Index in the Figure.

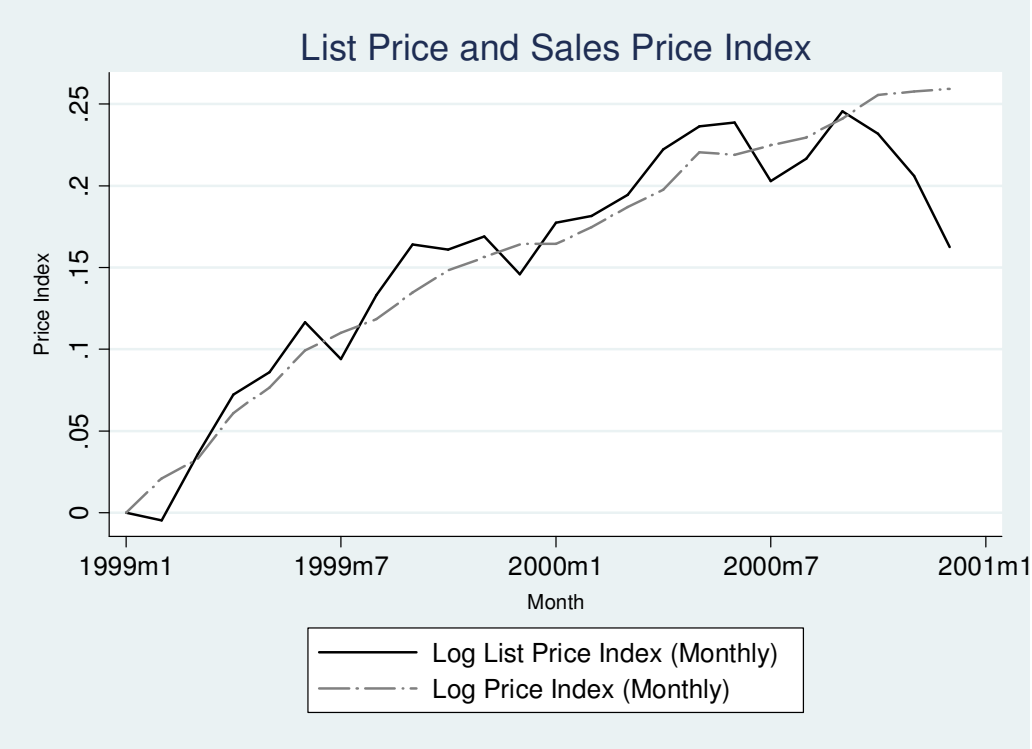


Figure 10 Development over time of List Price and Sales Price

It is remarkable that the sales price index shows a more gradual development over time than the list price index. There is no indication that the development of list price leads that of sales prices, and it is particularly striking that in some months sales prices kept increasing after list prices decreased. We interpret this as a confirmation of our impression that price development was largely demand driven and return to the relationship between list prices and sales price in subsection 5.3.

4.2 Time- varying spatial indexes

Even though we have seen, in Figure 3, that the spatial pattern of house prices remained fairly constant over the two years considered here, it is nevertheless of some interest to disaggregate the (temporal) price index over space. This would allow for a more detailed analysis of the development of house prices over time. In particular, we can use indicators of the local housing market situation and a spatial lag model to get some insight into the spatial transmission mechanism of house price changes.

To be able to do this, we need region-specific price indexes. Such a set of indexes was derived on the basis of a regression of the form:

$$\ln V^{sale} = \alpha X + \sum_k \varphi_k T_k + \varepsilon'' . \qquad (6)$$

where φ_k is a vector of coefficients that are specific for region k and T_k is a vector of dummy variables specific to region k. The j-th element of T_k takes on the value 1 if a house is sold in region k and in month j and equals 0 otherwise. Since we have 90 regions and 24 months we have 90*24-1=2159 coefficients. The region-specific price indexes are defined analogous to those discussed in the previous subsection.[12]

5 A formal analysis

In the present section we present a more formal analysis of the development of Dutch house prices during the years 1999 and 2000. In the next subsection we sketch a model that motivates the relationship between house prices and the consumer confidence index. The subsections that follow present results of regression analysis, both at the national and regional level.

5.1 Life cycle consumers and the connection between house prices and consumer confidence

The demand for durable goods, of which housing is a major example, must be studied in the context of an intertemporal model of consumer behavior. The life cycle hypothesis developed by Modigliani and the permanent income hypothesis formulated by Milton Friedman were seminal for the development of modern life cycle theory of consumer behavior as reviewed by Deaton (1992) and Browning and Lusardi (1996). This theory provides the appropriate framework for the study of housing demand.

According to the life cycle hypothesis, consumers attempt to maximize their lifetime utility by smoothing consumption expenditure over time. The main idea is that they shift consumption to periods in which they need the additional expenditure most. In modern variants of the theory, expectations with respect to future income play a major role. These expectations are reflected in the marginal utility of income, which is a key variable in the model. When consumers get more optimistic, this implies a relaxation of the perceived lifetime budget constraint, which results in a decrease in the marginal utility of income. First order conditions for lifetime utility maximization then imply that the demand for consumption increases. The Appendix sketches a model in which two consumption goods are distinguished: housing and a composite commodity. It seems reasonable to assume that the increased demand for the composite commodity can be served without substantial increases in prices, but the housing stock is fixed in the short run. This means that the first-order conditions can only be restored by increasing house prices. If more optimistic expectations with respect to future incomes also increase consumer confidence, as seems probable, this establishes a relationship between house prices and the consumer confidence index that provides the theoretical foundation for our statistical analysis.

It may be observed that the first order conditions imply that either the increased demand for housing must be satisfied, or the prices should increase. As a consequence, there can only be a limited role for other housing market indicators like the time on the market of the stock of

[12] The small number of observed sales in some regions implies that the estimated price index has a larger variance in these regions than in regions with a larger number of observations. This effect may be counteracted to some extent by less heterogeneity of the housing stock in these regions.

dwellings that are for sale when housing demand of all households increases through improved economic prospects.

It may also be observed that the model outlined in the appendix is consistent with a limited effect of an increase in the interest rate. This variable appears in the first order condition with respect to housing as part of the user cost. An increase in the interest rate counteracts that of a decrease in the marginal utility of income and is therefore similar to that of an increase in the current house prices. However, when the current house price increases and such an increase leads the consumers to expect an increase in next period's house price, this latter effect may easily compensate for the negative effect of the increase in the interest rate.[13]

Summarizing, the life cycle model of consumption behavior and the impossibility to change the housing stock immediately to changes in demand seem to be consistent with the somewhat crude observations of section 3 of the current paper. We will therefore use them as a guide for the more elaborate empirical work that is reported below.

5.2 Sales price

To get a sharper picture of the development of Dutch house prices at the national level, we regressed the sales price index on consumer expectations and a number of other variables. The results of these multivariate analyses by and large confirmed the findings reported in section 3 above. Whenever the mortgage rate was introduced its coefficient had the wrong sign. After removal of the interest rate from the right-hand-side of the estimation equation, introduction of time on the market (either its current values or lagged one month) consistently resulted in a coefficient with the wrong sign, apparently for the reasons discussed in section 3. The ratio of the number of sold houses to the stock of houses for sale was the only market indicator that received a coefficient of the expected sign, but it was never statistically significant after the interest rate had been removed from the estimation equation. Model (1) illustrates these findings by an equation that contains the consumer confidence index, the interest rate, the ratio between the number of sold dwellings and the stock of dwellings for sale and the time on the market as explanatory variables. The interest rate has a large significant coefficient, which has the wrong sign. This causes difficulties in the interpretation of the estimation results as a whole. The consumer confidence index has a significant[14] coefficient of the expected sign, as has the national transactions to stock ratio. Time on the market does not have a significant coefficient.

When we removed the interest rate from the equation, the coefficient for time on the market became positive and significant, while the adjusted R^2 dropped to 0 .84. After removing this variable, the transactions to stock ratio was insignificant. Model (2) reports results of a regression with this index as the only explanatory variable. The table shows that 64% of the variation in the sales price index over the two years considered can be explained by the development of consumers' expectations.[15] The relatively large increase in the coefficient for consumer expectations is – of course – related to the correlation between the consumer confidence index, the interest rate and the time on the market that is apparent from Figures 4,5 and 7.

[13] Things may be different with binding borrowing constraints.

[14] Throughout the paper the word 'significant' always means: statistically significant. Substantive significance is indicated by referring to a 'large' coefficient, or similar phrases.

[15] This result is similar to that reported in section 3, which concerned the median sales price. Note that the dependent variable in Table 1 is the quality adjusted price index.

Dependent Variable:	(1) **National Log Sales Price Index**	(2) **National Log Sales Price Index**	(3) **Regional Log Sales Price Index**
Consumer Confidence	0.0050 (0.0014)	0.0089 (0.0014)	0.0062 (0.0004)
Interest rate	0.141 (0.027)		
National Transaction to Stock Ratio	0.0029 (0.0009)		
Regional Transactions to Stock Ratio			0.00036 (0.00004)
Time on the Market	-0.00065 (0.0009)		
Spatial lag of the dependent variable			0.6032 (0.014)
Constant	-0.812 (0.10)	-0.013 (0.027)	-0.0023 (0.0016)
N	24	24	2060
Loglikelihood			2301.65
Adjusted R^2	0.93	0.64	

Standard errors in parentheses. *N* is the number of observations.

Table 1 Regression results for sales price index

One reason for concern over the validity of the consumer confidence index as an explanatory variable for house prices is that it may itself be influenced by the increase in house prices. If consumers regard increasing house prices as an indication of a flourishing economy, this may increase their confidence in the economic situation. To investigate this possibility, we have used the one month lagged value of the consumer confidence index in the regression equation. This resulted in the loss of one observation, a somewhat lower coefficient (0.0084 instead of 0.0089), with a higher t-value (6.5 instead of 7.4) and a higher adjusted R^2 (0.70 instead of 0.64). Using the two-months lagged consumer expectations results in the loss of an additional observation, a further drop of the coefficient (to 0.0081) and a further increase in both the t-value (to 9.5) and the R^2 (to 0.81). We conclude therefore that there is little reason to believe that the relationship between consumer confidence and house prices was caused by an effect of current house prices on this variable. The stronger relationship between the lagged consumer confidence index and house prices can be interpreted as the result of a bargaining process that often takes a number of weeks or months.

To investigate the robustness of our conclusions for the incorporation of more detailed information about regional housing market circumstance, we have also used spatially disaggregated indices of house prices and market circumstances. To deal with spatial autocorrelation, we constructed a spatial weight matrix. The weights are the inverses of the distances between regions, as long as they do not exceed 25 kilometers. This definition ensures that every region has at least one neighbor. The rows of this matrix were scaled so as to make their sum equal to one. This spatial weight matrix has also been used in all other regressions at the spatially disaggregated level.

The results of the regionally disaggregated analysis confirm those of the national analysis with one exception: the ratio of the number of transactions to the stock of unsold houses for sale

now has a significant effect on prices.[16] Column (3) of Table 1 is our preferred regression on the disaggregated price indexes. The results are based on a fixed effects estimation with spatial lag of the dependent variable. The coefficient for consumer confidence reported in column (3) is somewhat smaller than the one found in the aggregate analysis, but of the same order of magnitude. To interpret the coefficient of the ratio of the number of transactions to the stock of unsold houses for sale, note that the average value of this variable is approximately equal to 45 (implying that 45% of the houses for sale were sold within a month). A 1% point increase in this ratio (for instance, from 45 to 46) will increase regional house prices by 0.004%, which means that the effect is small. Since introduction of other local housing market indicators did not lead to meaningful results, we conclude that such indicators had a very limited effect on price developments in the period considered here.

Spatial economic theory strongly suggests that house prices are determined by accessibility to employment. This is true for the monocentric model, but also in more general cases in which workers can commute to different employment centers from a given residential location (see, for instance, Rouwendal, 1998, section 6). The large and highly significant spatial lag coefficient can be interpreted as a confirmation of this idea. The familiar arbitrage process leading to the 'rent gradient' causes correlation between house prices in adjacent locations in settings that are much more general than that considered by the monocentric model. If this mechanism works well, upward pressure on house prices at one or a few locations spreads over space in much the same way as if the same upward pressure were present at other locations as well. The resulting situation may be hard to distinguish from the one that would result if the same upward pressure resulting from a force operating at the national level – such as the consumer confidence - were present in all places. Nevertheless, the coefficients for consumer confidence and the spatial lag are precisely estimated. If we omit the spatial lag variable from the regression equation, the coefficient for the consumer confidence index increases substantially. This confirms the idea that some of its effect is realized via spatial housing market arbitrage.

5.3 List price

We carried out the same analyses for the list price and reached similar results. Whenever it is included, the mortgage interest rate enters consistently with the wrong sign. Other variables were either insignificant or had the wrong sign, except for the transactions to stock ratio. Model (1) in Table 2 has the consumer confidence index as the only explanatory variable. This results in a very significant coefficient and a high R^2. Adding the transactions to sales variable improves the results somewhat and results in an even higher coefficient for consumer confidence. Adding other variables does not further improve the equation.

These results suggest that house sellers are a bit more sensitive to housing market indicators when setting their price than buyers are when bargaining over the sales price. This finding may be related to the fact – noted above – that the development of list prices over time is less smooth than that of sales prices. Using the one-month lagged consumer confidence index results in a modest improvement of model (1): the coefficient is somewhat smaller, its t-value unchanged and the R^2 somewhat higher. Using the two-month lagged consumer confidence index does not result in further improvement (the coefficient decreases further, as do its t-value and the R^2).

When we use the disaggregated price indexes we find a smaller coefficient for consumer confidence, as was the case for the sales price. Somewhat to our surprise, the coefficient for the

[16] The value of this variable is determined separately for each region and month.

ratio of the number of transactions to the stock of unsold houses also decreases substantially, but remains statistically significant. This coefficient now has the same order of magnitude as in the spatially disaggregated sales price regression. Also here we find a large and highly significant coefficient for the spatial lag variable.

Dependent Variable:	(1) **National Log List Price Index**	(2) **National Log List Price Index**	(3) **Regional Log List Price Index**
Consumer Confidence	0.0094 (0.00094)	0.011 (0.012)	0.0069 (0.0004)
National Transactions/Stock		0.003 (0.001)	
Regional Transactions/Stock			0.00030 (0.00004)
Spatial lag			0.5579 (0.015)
Constant	-0.025 (0.019)	-0.21 (0.08)	0.0027 (0.0017)
N	24	23	2060
Loglikelihood			2288.28
Adjusted R^2	0.81	0.84	

Standard errors in parentheses. *N* is the number of observations.

Table 2 Regression results for list price index

5.4 The difference between sales price and list price

In this subsection we take a closer look at the relationship between list prices and sales prices. First, we should note that the list price is usually a very good predictor of the sales price of a house. Horowitz (1992) observed that predicting the sales price on the basis of the hedonic price function implies a much larger error than predicting the sales price on the basis of the list price. This is also true for our data.[17] The probable explanation is that the seller of the house also takes into account relevant characteristics that are unknown to the researcher and therefore cannot be incorporated into the hedonic price function.

Figure 11 shows that the development over time of the list price and the sales price is similar, but not identical. This evokes the question whether there are systematic differences between these two variables. To analyze this issue, we concentrate on difference between the logarithms of the list price and the sales price, to be referred to as DIF. This variable is approximately equal to the percentage difference between the list price and the sales price. Its average value is equal to 0.027 with a standard deviation of 0.045, implying that the sales price is on average 2.7% below the list price, but that the difference can be much larger in specific cases.

Figure 12 shows the development of DIF as a function of the month in which the house was sold. It shows that houses sold in May 1999 for almost 98% of their list price. Around the turn of the year (and the millennium) the difference between sales price and list price was on average more than 3%, whereas it decreased again in the first months of 2000. In the second half of that year the difference again became larger than 3% on average. It has repeatedly been observed in the literature that the difference between the list price and the sales price is an

[17] The hedonic price function has $R^2 = 0.75$, whereas a regression of the logarithm of the sales price on the logarithm of the list price gives $R^2 = 0.99$, with a coefficient 0.997 and intercept -0.01.

increasing function of the time on the market. This is consistent with the increase in this difference around the middle of the year 2000, although it cannot explain the peak occurring in the first month of that year.

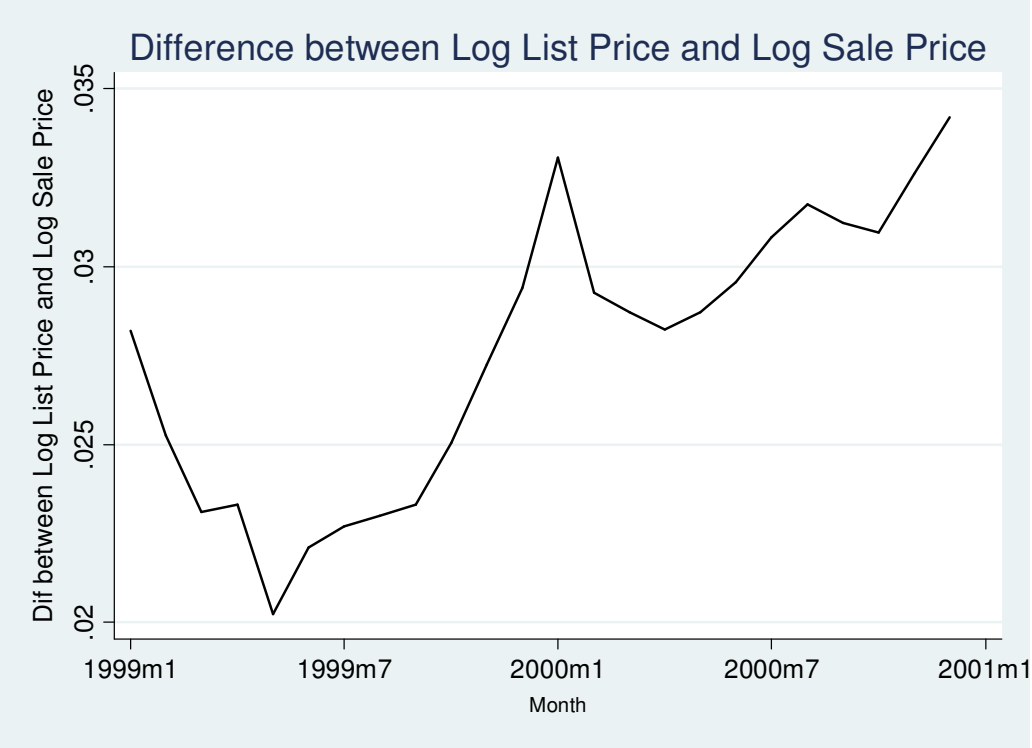


Figure 11 Difference between the logarithm of the list price and the logarithm of the sales price

The relatively large variance in DIF suggests that the sales price may sometimes be higher than the list price, as is confirmed by Figure 12. The numbers referring to 1999 are higher than those referring to 2000. Figures 11 and 12 confirm our earlier observation that the development of the house prices during the years 1999 and 2000 was driven by strong demand, especially in the first of these two years.

To substantiate these interpretations, we carried out some regressions. The first two columns of Table 3 show regression results for the DIF, the average value at the national level of the difference between the list price and the sales price based on the aggregate price indexes. In the first column the current values of the explanatory variables are used, in the second the (one month) lagged values. The results are qualitatively similar. It is remarkable that consumers' confidence does not have a significant coefficient in these regressions, whereas the mortgage rate has a significant coefficient of the expected sign. Experiments with other specifications made it clear that the mortgage interest rate was indeed the only variable for which a significant effect on the difference between the list price and the sales price could be obtained.

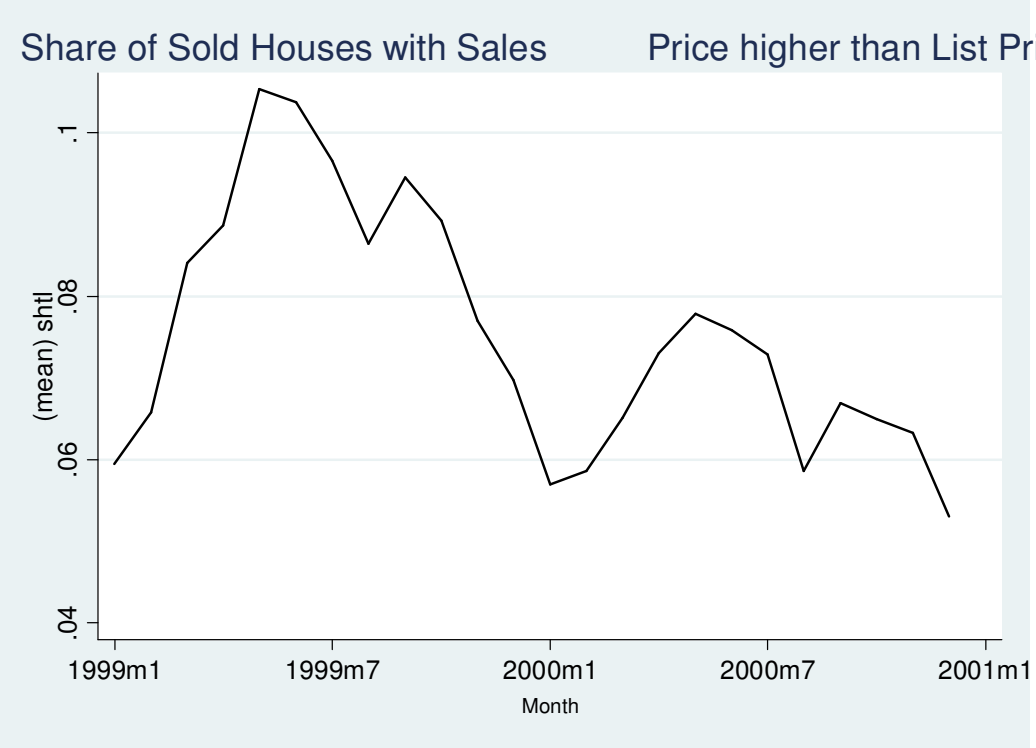


Figure 12 Share of sold houses with sales price higher than list price

The models of Table 3 have also been estimated on the regionally disaggregated price indexes and on the micro-data (i.e. on individual transactions), with similar results. In particular, the mortgage rate has a coefficient of comparable magnitude in all equations, which are estimated with OLS. When we estimate a probit equation for the 0-1 variable that indicates that a house is sold for a price that exceeds the list price on the micro-data, we find again a highly significant coefficient for the mortgage rate.

So ultimately we have identified an indication that market fundamentals had a – limited – effect on the development of house prices in these two years. The results of Table 3 suggest that the increase in the average difference between the list price and the sales price was largely due to the increase in the mortgage rate. The coefficient of the mortgage interest rate is close to 0.01, which implies that an increase in this rate of 1% point would result in an increase of the difference between list and sales price by 1%.

6 Conclusion

This paper considers the development of house prices in the Netherlands in a period of exceptional increase: the years 1999 and 2000. We argued that it is difficult to attribute this development to market fundamentals. The stability of the spatial pattern of house prices – that reflects accessibility of employment and other amenities – suggests, nevertheless, that house prices are not completely determined by irrational factors. We suggested that an explanation can be found in a common feeling of overly optimism during these years, when the growth rates of per capita income exceeded 5%. An index of consumer confidence developed by Statistics Netherlands was used as an indicator of this phenomenon.

Dependent variable	Difference between log of list price and sales price		Share of sold houses with sales price higher than list price	
	(1)	(2)	(3)	(4)
Consumers' Expectations	-0.00002 (0.0001)		0.00057 (0.0006)	
Lagged Consumers' Expectations		-0.00005 (0.0001)		0.00052 (0.0006)
Mortgage Rate	0.0088 (0.003)		-0.0336 (0.015)	
Lagged Mortgage rate		0.011 (0.002)		-0.0427 (0.014)
Time on Market	-0.00003 (0.00008)		0.0002 (0.0005)	
Lagged Time on Market		-0.00012 (0.0007)		0.0005 (0.0004)
Constant	-0.019 (0.008)	-0.027 (0.007)	0.24 (0.05)	0.27 (0.05)
N	24	23	24	23
Adjusted R^2	0.78	0.93	0.42	0.59

Standard errors in parentheses.

Table 3 Regression results for the difference between sales price and list price

Actual price movements during these two years were indeed closely associated to the development of this variable, which is widely regarded as a good indicator of short run economic foresights. We showed that alternative explanations, based on housing market indicators, were unable to provide such an explanation. The present paper therefore documents that the development of Dutch house prices during this period was determined in large part by consumer sentiments. There seems to be no need to invoke speculative behavior, as was done for instance by Roehner (1999), to explain the rapid increase in house prices.

The only effect of the increasing mortgage interest rate we could detect was an increase in the average difference between the list price and the sales prices, and a decrease in the share of houses that were sold for a higher price than listed. It is probable that this development is one of the reasons of the slight decrease in the volume of sales in the second half of 1999, the associated increase in the stock of unsold houses and the decrease in the ratio between the number of transactions and the volume of the stock. If true, this would imply a somewhat larger role of the mortgage interest rate in the development of house prices over these two years than was suggested by our preliminary analysis in section 3. However, even in this case, our results suggest that the influence of consumer confidence was overwhelming.

Before concluding the paper we note that we should interpret our findings as an explanation for a specific episode in the development of the Dutch housing market. During these years consumers were exceptionally optimistic about their economic circumstances. Indeed, the way the consumer confidence index is generated ensures that this feeling was relatively uniform in the Dutch population, while values of this index that are closer to 0 can be generated more easily by widely differing expectations. Even though similar episodes may occur, or have occurred in other times and other places, this observation suggests that there will not necessarily

be a close relationship between the index of consumer confidence and house prices. We expect the validity of our explanatory framework to be restricted to 'hot' markets with more or less uniform expectations concerning economic development, and perhaps to 'cold' markets with similar uniformity. During the years 1999 and 2000 this condition appears to have been satisfied, but not the years that followed. The index of consumer confidence in the Netherlands decreased sharply in the year 2001. House prices remained at the high level reached by the end of 2000, and even increased somewhat. The explanation for this price stickiness must - in our opinion - be sought in the restrictions on the supply side of the market. Moreover, the high house prices were sustainable because the mortgage interest rate remained at a relatively low level (it decreased in 2001). The mortgage qualification constraint used in the Dutch financial system ensured that the ratio of housing payments to income was kept at a reasonable level, provided that household income does not fall, which is consistent with the long run equations of Boelhouwer et al (2001) and Verbruggen et al. (2004).

In our view, the results of the present paper are consistent with an error correction framework linking long run housing development to economic fundamentals, while allowing short run fluctuations around this level that may be related to psychological variables like the index of consumer confidence in a useful way.

References

Abraham and Hendershott (1996) Bubbles in Metropolitan Housing Markets. *Journal of Housing Research*, **7**, 191-207.

Arnold, M.A. (1999) Search, Bargaining and Optimal Asking Prices. *Real Estate Economics*, **27**, 453-481.

Boelhouwer, P.J., M.E.A. Haffner, P. Neuteboom and P. de Vries (2001) Koopprijsontwikkleing en de Fiscale Behandeling van het Eigen Huis (Development of House Prices and the Fiscal Treatment od Homeownership), report, OTB. (in Dutch)

Browning M. and A. Lusardi (1996) Household Saving: Micro Theories and Micro Facts. *Journal of Economic Literature*, **34**, 1797-1855.

Campbell, J.Y. and J. Cocco (2005) How Do House Prices Affect Consumption? Evidence from Micro Data. NBER working paper 11534.

Case. K.E. and Mayer (1996) Housing Price Dynamics within a Metropolitan Area. *Regional Science and Urban Ecnomics*, **26**, 387-407.

Case, K.E., J.M. Quigley and R.J. Shiller (2005) Comparing Wealth Effects: The Stock Market versus the Housing Market. In: *Advances in Macroeconomics*, **5**, 1-32.

Case, K.E. and R.J. Shiller (1989) The Efficiency of the Market for Single Family Homes. *American Economic Review*, **79**, 125-137.

Capozza, D.R. and R. Helsley (1989) The Fundamentals of Land Prices and Urban Growth. *Journal of Urban Economics*, **26**, 295-306.

Capozza, D.R., P.H. Hendershott en C. Mack (2004) An Anatomy of Price Dynamics in Illiquid Markets: Analysis and Evidence from Local Housing Markets. *Real Estate Economics*, **32**, 1-32.

Deaton, A. (1992) *Understanding Consumption*. Oxford University Press.

DiPasquale and Wheaton (1994) Housing Market Dynamics and the Future of Housing Prices. *Journal of Urban Economics*, **35**, 1-27.

Dusansky, R. and Ç. Koç (2007) The Capital Gains Effect in the Demand for Housing. *Journal of Urban Economics*, **61**, 287-298.

Engelhardt, G.V. (2003) Nominal Loss Aversion, Housing Equity Constraints, and Household Mobility: Evidence from the United States. *Journal of Urban Economics*, **53**, 171-195.

Englund, P., T.M. Gordon and J.M. Quigley (1999) The Valuation of Real Capital: A Random Walk Down Kungsgaten? *Journal of Housing Economics*, **8**, 205-216.

Genesove,D. and C. Mayer (2001) Loss Aversion and Seller behavior: Evidence from the Housing Market. *Quarterly Journal of Economics*, **116**, 1233-1260.

Hill, R., C.F. Sirmans and J.R. Knight (1999) A Random Walk Down Mainstreet. *Regional Science and Urban Economics*, **29**, 89-103.

Horowitz, J.L. (1992) The Role of the List Price in Housing Markets: Theory and an Econometric Model. *Journal of Applied Econometrics*, **7**, 115-129.

Howry, E.P. (2001) The Predicitive Power of the Index of Consumer Sentiment. *Brookings Papers on Economic Acticity*, **1**, 175-216.

Knight, J.R., C.F. Sirmans and G.K. Turnbull (1994) List Price Signaling and Buyer Behavior in the Housing Market. *Journal of Real Estate Finance and Economics*, **9**, 177-192.

Krainer, J. (2001) A Theory of Liquidity in Residential Real Estate Markets. *Journal of Urban Economics*, **49**, 32-53.

Ludvigson, S.C. (2004) Consumer Confidence and Consumer Spending. *Journal of Economic Perspectives*, **18**, 29-50.

Poterba, J. (1991) House Price Dynamics: The Role of Tax Policy and Demography' *Brookings Papers on Economic Activity*, 143-203.

Roehner (1999) Spatial Analysis of Real estate Bubbles: Paris, 1984-1993. *Regional Science and Urban Economics*, **29**, 73-88.

Rouwendal (1998) Search Theory, Spatial Labor Markets and Commuting. *Journal of Urban Economics*, **43**, 1-22.

Souleles, N.S. (2004) Expectations, Heterogeneous Forecasts Errors and Consumption: Micro vidence from the Michigan Consumer sentiment Survey. *Journal of Money, Credit and Banking*, **36**, 39-72.

Verbruggen, J., H. Kranendonk, M. van Leuvensteijn en M. Toet (2004) Welke Factoren Bepalene Ontwikkeling van de Huizenprijs in Nederland? (What Determines the Course of House Prices in the Netherlands?) CPB document. (In Dutch)

Wheaton, W.C. (1990) Vacancy, Search, and Prices in a Housing Market Matching Model. *Journal of Political Economy*, **98**, 1270-1292.

Williams, J.T. (1995) Pricing real Assets with Costly Search. *Review of Financial Studies*, **8**, 55-90.

Appendix

In this appendix we sketch a simple model of the relationship between consumer confidence and house prices.

We assume a population of life cycle consumers. Each consumer *i* maximizes a life time utility function *U*, which is specified as:

$$U = \sum_t \left(\frac{1}{1+\rho} \right)^t u(c_t, h_t). \tag{A1}$$

In this utility function where ρ is the consumer's rate of time preference, *u* is utility experienced in a particular period *t* that is determined by the consumption of housing , *h*, and a composite commodity, *c*, that represents all other consumption goods. Housing is measured as a quality index that gives the equivalent number of standard units of housing consumed by the household.

The development of the consumer's wealth *A* over the life cycle time is described by:

$$A_{t+1} = (1+r)A_t + y_t - c_t - h_t \left(P_t - \frac{1}{1+r} P_{t+1} + k \right). \tag{A2}$$

In this equation *r* is the interest rate, where *y* the consumer's income, *P* the price of a standard unit of housing and *k* the annual cost of maintenance, taxes, et cetera per standard unit of housing. The expression between parentheses behind *h* is – of course – the user cost of a standard unit of housing in period *t*. Since the price at the beginning of *t*+1 is unknown at the beginning of period *t*, expectations with respect to P_{t+1} are the relevant argument of the user cost. For simplicity we start by assuming that these expectations are the same for all households and independent of the current price level.

A household attempts to maximize its lifetime utility while being uncertain about the future development of income and other variables. Adopting a dynamic programming approach, we may write the value function *V* at the beginning of period *t* as:

$$V_t = u(c_t, h_t) + E(V_{it+1}(A_{t+1} \mid I_t)) \tag{A3}$$

where the expectation of the value function in *t*+1 is conditional upon the consumer's information set *I* in period *t*. First order conditions with respect to c_t and h_t are:

$$\frac{\partial u}{\partial c_t} = \lambda \tag{A4}$$

$$\frac{\partial u}{\partial h_t} = \lambda \left(P_t - \frac{1}{1+r} P_{t+1} + k \right) \tag{A5}$$

Here λ is the Lagrange multiplier that indicates the perceived tightness of the lifetime budget constraint, given the consumer's information set. The value of this variable, often referred to as the marginal utility of income, therefore depends on the consumer's expectations with respect to future incomes. When the perceived constraint is relaxed, λ decreases, and vice versa. A lower marginal utility of income implies (under conventional assumptions with respect to utility function *u*) that the volume of consumption of normal[18] goods increases. For the composite good, it is assumed that this can be realized at unchanged prices.[19] The increased consumption of

[18] That is, goods with a positive income elasticity.

[19] This assumes that the production capacity for these goods can be expanded with negligible delay and without substantial increase in the unit costs. For many nondurables this is a reasonable assumption, for housing it obviously is not.

nondurable will probably have a nonnegative effect on the marginal utility of housing, thereby increasing the pressure on the housing market that resulted from the lower marginal utility of income.

Since the housing stock is given in the short run, the immediate reaction to the lower marginal utility of income must be an increase in the house price P_t if all consumers experience a similar change in their expectation with respect to future income. The increase should be sufficient to restore the equality sign in (A5) after the decrease in the marginal utility of income. It is easy to verify from (A5) that the required increase will be larger if the increase in the current price level P_t induces the consumer to expect higher prices in the next period t+1 as well. The increase in the current price level predicted by this model is therefore higher under these circumstances.

Until now we did not explicitly introduce the consumer confidence index. However, this is easy to do. It seems natural to assume that an improvement in expectations with respect to future income will increase consumer confidence at the individual level. If expected future incomes of all consumers change in the same way, their marginal utilities of income will decrease and the average consumer confidence index will be high. The above analysis then establishes a short-run relationship between the consumer confidence index and house prices.

A few remarks are in order. First it may be noted that we did not assume rational expectations. In fact the model outlined above is silent on the way consumers form these expectations. It is therefore able to deal with situations in which consumers are more optimistic than can be justified on the basis of information about economic fundamentals, although this is not a necessary condition for realizing a relationship between the consumer confidence index and house prices.

Second, a change in the marginal utility of income does not change the consumer's ranking of houses. The relative position of houses of different qualities in the consumer's preference ordering remains unchanged when the marginal utility of income varies. The model is therefore consistent with a constant spatial pattern of house prices during periods of booms and busts, when location is interpreted as one of the determinants of housing quality h.