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Measuring and explaining house price developments

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TU Delft

Delft Centre for Sustainable Urban Areas

Delft University of Technology

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Preface

Exceptional, what does that mean? The fact that I am getting a PhD, is that exceptional? And is exceptional a deviation from what is normal? But what is normal? Is it the same as average? Questions. Questions to which science provides answers. But what is science? What is scientific research?

These are questions that you ask yourself when you are learning to be a scientist. However, when I started out at OTB Research Institute for the Built Environment in May 1988, I had not been educated as a scientist. Johan Conijn and Oscar Papa hired me as a member of the research staff because of my statistical knowledge. At that time, I shared a computer with Johan and SPSS slowly displayed – in a little blue frame – the current record number in the database.

The first study I was involved in made a historical and spatial analysis of market-sector dwellings and included a regression model for estimating the number of housing starts in the market sector[1].

To compile the proper time series, I delved into the archives of Statistics Netherlands for days on end. That information later turned out to be important for explaining the development of the house price. In those days I was not a scientist yet.

That all changed in 1999. I wanted more responsibility and less of a research task. I took part in an assessment and it revealed that I had more than enough ability to be a good scientist. Peter Boelhouwer and Johan Conijn proposed that I follow the post-doctoral program in Housing, Urban and Mobility Studies. There I grappled with philosophy of science, argumentation, and methods and techniques. I learned the difference between exceptional and normal. From Karl Popper I learned that a scientist makes observations, formulates a theory, derives premises from it and then tests them; from Henny Coolen I learned statistical testing. In 2001 I graduated with good grades. I had to get used to the idea that I could call myself a scientist.

I test hypotheses mainly with the aid of statistics. Statistical relations are strengthened as soon as exceptional observations are left out of the picture. These outliers distort the more-or-less normal relations that I, as a scientist, am looking for to make generalizing statements. But wasn't I an exception in 1999!? I was a researcher without a university education who wanted to become a scientist. That is not commonplace. Still, Johan Conijn and Peter Boelhouwer saw the exceptional pathway that I then took and ultimately led me to this dissertation. For that I remain grateful to both of them. They could have overlooked it because it lies too far off the normal scientific career track.

One nagging question remains, whether I am exceptional. I think I am. As a humanist I believe that people distinguish themselves from one another

1 Conijn, J.B.S. and P. de Vries (1989), D*e vrije-sectorwoningen: een historische en ruimtelijke analyse,* Volkshuisvestingsbeleid en Bouwmarkt 6, Delft, DUP.

in that each person forms his or her own moral judgments and is guided by one's own norms and values. In this sense, every person is exceptional, just as Hugo Priemus pointed out back in 1978 that every dwelling is unique and exceptional[2].

You might then wonder, what does the average house price mean?

Paul de Vries
November 2010

2 Priemus, H. (1978), *Volkshuisvesting; begrippen, problemen en beleid,* Alphen aan den Rijn, Samsom Uitgeverij.

Voorwoord

Uitzonderlijk, wat is dat? Het feit dat ik promoveer, is dat uitzonderlijk? En is uitzonderlijk een afwijking van wat normaal is? Maar wat is normaal? Is dat hetzelfde als het gemiddelde? Vragen. Vragen die de wetenschap beantwoordt. Maar wat is wetenschap? Wat is wetenschappelijk onderzoek?

Deze vragen stel je je zelf als je opgeleid wordt tot wetenschapper. Echter, toen ik in mei 1988 begon bij het OTB Research Institute for the Built Environment was ik niet opgeleid tot wetenschapper. Johan Conijn en Oscar Papa namen mij aan als onderzoeksmedewerker vanwege mijn statistische kennis. In die tijd deelde ik de computer met Johan en SPSS toonde sloom – in een blauw kadertje – het actuele recordnummer uit het databestand.

Het eerste onderzoek waarbij ik betrokken was, gaf een historische en ruimtelijke analyse van de vrijesectorwoningen inclusief een regressiemodel waarmee het aantal begonnen vrije-sectorwoningen werd geschat[1].

Om de adequate tijdreeksen samen te stellen, heb ik dagen lang CBS-archieven doorgespit. Later bleek die informatie van belang om de ontwikkeling van de woningprijs te duiden. In die tijd was ik nog geen wetenschapper. Dat veranderde in 1999. Ik wilde meer verantwoordelijkheid en minder onderzoeksmedewerker zijn. Ik deed een assessement en daaruit bleek dat ik meer dan voldoende capaciteiten bezit om een goede wetenschapper te zijn. Peter Boelhouwer en Johan Conijn stelden voor dat ik de na-doctorale opleiding Housing, Urban and Mobility Studies zou volgen. En zo kreeg ik te maken met wetenschapsfilosofie, argumentatieleer en methoden en technieken. Ik leerde het verschil tussen uitzonderlijk en normaal. Van Karl Popper leerde ik dat een wetenschapper waarnemingen doet, een theorie formuleert, daaruit veronderstellingen afleidt en die vervolgens toetst; het statistisch toetsen leerde ik van Henny Coolen. In 2001 slaagde ik met mooie cijfers. Ik moest er wel aan wennen om hardop te zeggen dat ik wetenschapper ben.

Ik toets hypotheses vooral met behulp van statistiek. Statistische verbanden worden sterker zodra uitzonderlijke waarnemingen buiten beschouwing blijven. Deze zogenaamde outliers verstoren de min of meer normale verbanden die ik, als wetenschapper, zoek om generaliserende uitspraken te doen.

Maar was ik in 1999 geen uitzondering!? Ik was een onderzoeksmedewerker zonder universitaire opleiding die wetenschapper wilde worden. Dat is niet alledaags. Toch zagen Johan Conijn en Peter Boelhouwer de uitzonderlijke weg die ik toen insloeg en die mij uiteindelijk bracht naar dit proefschrift. Beiden ben ik tot op de dag van vandaag hiervoor dankbaar. Zij hadden deze weg ook niet kunnen zien omdat deze ver afstaat van een normale wetenschappelijke loopbaan.

Rest nog de prangende vraag of ik uitzonderlijk ben. Ik denk van wel. Als

1 Conijn, J.B.S. en P. de Vries (1989), *De vrije-sectorwoningen: een historische en ruimtelijke analyse*, Volkshuisvestingsbeleid en Bouwmarkt 6, Delft, DUP.

humanist ga ik ervan uit dat mensen zich van elkaar onderscheiden doordat ieder voor zichzelf morele oordelen vormt en zich laat leiden door eigen normen en waarden. Hierdoor is ieder mens uitzonderlijk, net zoals Hugo Priemus al in 1978 aangeeft dat iedere woning uniek en uitzonderlijk is[2].

Je kunt je afvragen wat dan de gemiddelde woningprijs voorstelt.

Paul de Vries
November 2010

2 Priemus, H. (1978), *Volkshuisvesting; begrippen, problemen en beleid,* Alphen aan den Rijn, Samsom Uitgeverij.


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1 Introduction

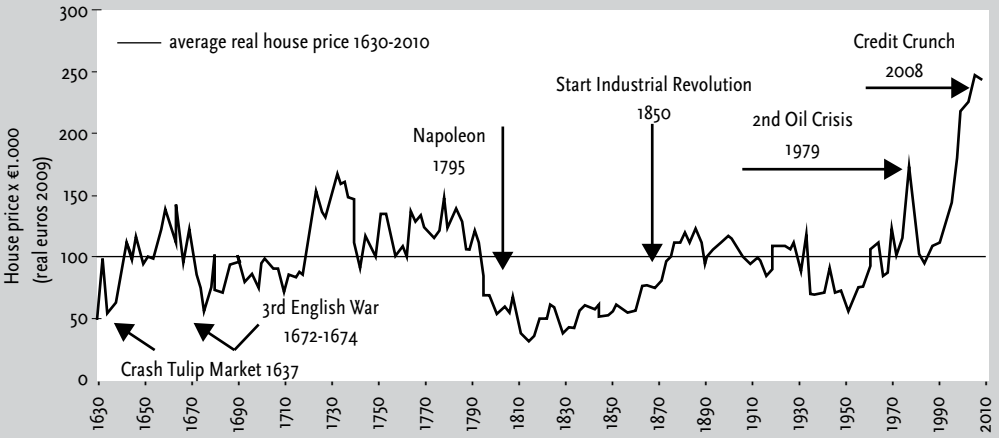
1.1 Background

This dissertation is about the calculation and explanation of trends in house prices against the background of the Dutch housing market. Calculation is related to the price index literature, while explanation is couched in the literature on methods such as time-series analysis. Interest in this topic has been increasing in the Netherlands since the 1970s, both in the scientific community and in society at large (Section 1.2). The market share of the Dutch homeowner sector has been growing rapidly (Section 1.2) and the economic effect of that growth has been strong. For example, the Nederlandsche Bank (Dutch central bank) estimated this effect at a full percentage point extra growth in GNP for the year 2000. For this reason, among others, the need arises to measure real price development and subsequently explain it. That is what this dissertation is all about. The instruments with which house price development can be measured are examined in Chapters 2 and 3; specifically, these chapters discuss models that are used to estimate a price index. Then Chapters 4 and 5 present a statistical model to explain the average house price development for the Netherlands. The general model-based assumptions are further specified in Chapters 6, 7, and 8.

Scholarship on both the price index and time series analysis has a long history, particularly in the American literature. For the Dutch housing market, however, scholarship on calculating and explaining the development of house prices is still young; the first research into a housing price index for the Netherlands was published in 1997 (Eichholtz, 1997). His *Herengracht Index* covers trends in prices from 1628 till 1973 and demonstrates that the house price reflects upswings and downturns in the economy. This may be seen in Figure 1.1, which uses the *Herengracht Index* to depict real house prices. Wars and economic crises cause prices to decline; economic recovery makes them rise. Two scientific publications on a house price index appear in the first years of the 21st century (Francke and Vos, 2000; Francke and Vos, 2004). In 2008, with the aid of the weighted repeat sales method, researchers at OTB – namely Sylvia Jansen, Paul de Vries, Henny Coolen, Cor Lamain, and Peter Boelhouwer – estimated a house price index for the Netherlands (Jansen *et al.,* 2008). This index is treated extensively in Chapter 2. Two years later, two scientific publications prepared jointly by OTB and Statistics Netherlands were published on the SPAR method, which is used to model the current house price index for the Netherlands (Vries *et al.,* 2009; Haan *et al.,* 2009) (see Chapter 3). Each month, the Internet sites of both the Kadaster (Dutch Land Registry Office and Statistics Netherlands post this house price index for the Netherlands and for numerous regions and housing types.

The first scientific study to explain the house price appeared a mere 23 years ago (Spit and Needham, 1987), with a more comprehensive follow-up in Janssen (1992) regarding house price models for four Dutch cities. However,

Figure 1.1 Development of real house price in the Netherlands, 2009=100, 1630-2009



Source: Eichholtz 1997, Statistics Netherlands, NVM, computation OTB Reserach Institute

both studies explained the level of house prices for cities, not for the country as a whole. The first model geared to the development of the national house price appeared in 1996 (Boelhouwer *et al.*, 1996). The article by Peter Boelhouwer, Johan Conijn and Paul de Vries presented, among other things, a model that explained the price development since the end of the 1970s and made a prediction for the coming two years. That model has been evolving ever since. Every half year, the model is estimated anew and the NVB Building Contractors and Developers publishes its *NVB Thermometer Koopwoningmarkt*, giving its prediction of trends in the owner-occupier market for the coming four half-year periods. This dissertation describes that model and applies it in Chapters 4 and 5. Chapter 4 deals with estimating the effects of the house price in the event of a change in tax regimes for home ownership, while Chapter 5 interprets the relation between housing costs and household income.

This dissertation is based on research carried out over the past fifteen years on the development of house prices. Thus, it overlaps the period in which research on the development of Dutch house prices came of age. Several of the chapters have already been published, either as an article in a scientific journal or as a chapter in a scientific book. Chapter 8 has been submitted for publication to an academic journal. This introductory chapter gives an overview of the study (Section 1.2 and 1.3) and then outlines the relations between the chapters before presenting the research questions (Section 1.4).

1.2 Housing market and market forces

The growth in the rate of home ownership in the Netherlands since 1970 has precipitated scholarly interest in the development of house prices (Vries, 2009). A mere 15 percent of the population owned their own home in 1930, rising to 30 percent in 1970. Thus, the share of home ownership doubled slowly in the course of 40 years. In the 1970s, a home of one's own started to be-

come a serious alternative to the rental dwelling. That shift is visible in the extensive adjustment made in the fiscal treatment of home ownership in 1971. The current fiscal regime, roughly speaking, was instated in that year; some adjustments were made afterwards, mostly in the 21st century.[1]

Then, in 1974, the Vereniging Eigen Huis (association for owner-occupiers – VEH) was established to serve as an interest group for homeowners as a counterweight to the influence that developers had on the market at the time. Since 1977, more houses had been built for sale than for rent, and only in 1997 did the share of rented dwellings surpass 50 percent. In 1980 the proportion of owner-occupied dwellings rose to 48 percent; nowadays (2010) 58 percent of all homes in the Netherlands are owner-occupied. Historically, this growth may be deemed spectacular; the market has had to adapt continuously and seek a new equilibrium.

The growth in home ownership is closely connected with the social value of having a home of one's own and the associated introduction of market forces in the Dutch building policy since the 1990s. In 1930 it was still normal to rent rather than to buy a house (Bijvoet, 2001). And after the Second World War, Dutch housing policy was preoccupied with the quantitative shortage of homes. House building was strongly driven by the government and market forces at the demand side of housing markets were largely neglected.

Market forces were introduced at the end of the 1980s, when the housing associations became independent and object subsidies in housing construction were substantially reduced (Heerma, 1989). In the 1990s, State Secretary for Housing Johan Remkes continued the policy of his predecessor (Enneüs Heerma). This meant promoting the free market by strengthening the position of the consumer. The policy document *Mensen, Wensen, Wonen* [What people want, where people live] gives greater scope to freedom of choice and the voice of ordinary citizens in custom-built owner-occupied housing (Remkes, 2001). The Dutch government has chosen to encourage the introduction of more market forces on the housing market, because participation in housing and the residential environment is considered a social-cultural imperative in keeping with an emancipated society.

Thus, since 1990 great emphasis has been placed on the facilitative power of the market, in which the efficiency of the price mechanism ensures that

1 1997-2000: Phasing out financing for non-housing consumption; 2001: restricted to 30 years and primary residence; 2004: Top-up mortgage regulation; 2005: incentive to pay off mortgage: no debt, then no addition of imputed rent to taxable income either. In 2010 the fiscal treatment of home ownership is widely debated. As requested by the Dutch government, in 2010 a working group of civil servants has identified ways to save at least 20 percent (€2.5 billion) by 2015 on the housing market. The point of departure for all five of its scenarios is a limitation on mortgage interest deductibility, with the presumed consequence of a decline in prices ranging from 9 to 13 percent in 2015.

supply and demand balance out at the macro level (Boelhouwer, 2002, 2005). The demand for owner-occupied dwellings in particular was stimulated. These demand-side incentives, in combination with falling interest rates, rising purchasing power, and the introduction of dual-earner and interest-only mortgages, set the stage for spectacular price increases.

When a market develops efficiently, the market processes will immediately produce an equilibrium price. In other words, the price will be an optimal reflection of the supply-demand relation on the market. With an efficiently operating housing market, it may thus be assumed that in the long term the price development of dwellings will be determined by the development of construction costs. Many scientific studies carried out in the 1990s or later place the conditions in which an efficiently operating market is created and the characteristics of the housing market side by side (see, among others, Cho, 1996; Barr, 1998; Priemus, 2000). The most commonly cited conditions for a perfect or efficiently operating market are as follows. The first is the possibility for the actors to make allowance in their deliberations for all the relevant information; they must therefore have access to perfect information, both now and in the future. The second condition is that the actors must have equal market power. This is possible when there are many customers and many suppliers active in the market. The third one is homogeneity. When the product is heterogeneous, as it is in the housing market, the concept of 'market' is not precisely defined.

It has been investigated in many countries whether the housing market works efficiently (Cho, 1996). It appears that the housing market is imperfect, as the hypothesis of an efficiently operating market has been rejected time after time. This imperfection or inefficiency is due to the fact that the economic forces have not played out, thereby leading to changes from within, which in turn will lead to imbalance in the housing market. Economic forces mainly react with some delay as buyers and sellers on the housing market bring their market information up to date and adjust their ask and bid prices accordingly. This information deficit is part of the reason for the dynamism in the price-setting process on the owner-occupied housing market. Clearly, some of the market information available to the actors is outdated, so their bid and ask prices has been overtaken by events. That is what 'shocks' house prices in the short term, especially under the influence of the price expectation, mortgage interest rate, and changes in income position (Hort, 2000).

The market in the Netherlands does not operate efficiently either. The housing market is segmented in most Western economies, as we know, and the Netherlands is no exception. We also know that within those housing market segments, various factors of demand and supply play a significant role in price-setting. In the context of this dissertation, I therefore concur with Goodman (1998), who defines a local housing market as a geographical area in which the demand for and supply of dwellings is independent of that

in other geographical areas. In that sense, distinguishing of separate housing market areas is a direct result of the fact that the dwelling is literally fixed to the place and that the purchase involves a large investment. The geographical boundaries of the housing market areas usually depend on distances in the journey to work and on social structures.

Indeed, the situation in the Netherlands gives good reason to draw borders around housing markets. The Dutch association of brokers and real estate experts (NVM) recognizes 76 housing market areas, each operating according to a more or less independent price-setting process. Those areas are dependent on, among other things, the income of the potential homebuyer. The Dutch Intramax areas circumscribed by Roland Goetgeluk (1997) have been used to develop the repeat sales Price Index (Chapter 2). The Intramax areas are based on number of moves, journey-to-work patterns, and the pressure on regional housing markets.

1.3 House price development

In view of the growing size of the owner-occupied sector, it is more important than ever to understand the development of prices in this sector. Section 1.2 sketches how market forces were introduced into the Dutch housing market and poses some questions about the possibility of its efficient operation. Actually, market forces always lead to price-setting. That is because market forces represent a rational process within market parameters, boundaries that are drawn by the government. Thus, the operation of the market depends on the character of the good. The question should nonetheless be raised just what the economic framework of the housing market looks like. In this regard, I side with the kind of theory-building whereby 'the dwelling' is analyzed as an economic entity (Fair, 1972; Meen, 2002).

Neoclassical framework

The economic framework of the owner-occupied housing market may be typified as a neoclassical regime. Neoclassical economic theories refer to the utility of a product. In a competitive market, house price is the result of interacting demand and supply (Girouard *et al.,* 2006; Chen, 1998). Factors influencing these two entities are usually called fundamentals or the underlying determinants that affect house prices. Factors such as disposable income, interest rates, and demographic development influence demand; factors affecting supply, such as the price of land and the impact of building costs, influence the availability of dwellings. These 'drivers' may influence the house price in the short-term, the medium-term, and/or the long-term.

On the demand side, an argument analogous to the one underlying the general price theory can be made: the demand for goods is a function of (house-

hold) income and of the price of the good or service relative to other prices (Fair, 1972). Various studies demonstrate that in the long term house price and income level are indeed in equilibrium (Malpezzi, 1999). Gallin (2006), however, shows that he cannot prove the co-integration between house price and income in the US.

Although the assumptions underlying neoclassical thought are clear, we may discern two incompatible directions within the international neoclassical literature. In part, they are diametrically opposed to each other with respect to the impact of demand and supply on the equilibrium price.

The one assigns great significance to supply, specifically to the supply market (Boelhouwer, 2005). This theory revolves around supply and demand on the housing market and the resulting equilibrium price. In the long term, it may be assumed that house prices will be determined by production costs in an efficient housing market (see also Shiller, 2007). The literature presents this relation as one of the first explanations of the development of house prices (for an overview, see Meen, 1998; McAvinchey & Maclennan, 1982; Thorson, 1997). This approach is based on the idea that when the housing supply is elastic, house prices will follow the trend in construction costs in the long run, thereby achieving an equilibrium price. Much research has been conducted on this relation, notably in the United Kingdom during the 1970s and 1980s. Yet the studies revealed that the house prices fluctuated far more strongly than the construction costs and that there is virtually no direct statistical relation between the two variables. The most plausible explanation for the absence of a correlation is that spatial planning has made the housing supply inelastic, so it responds insufficiently to changes in the demand for owner-occupier dwellings. Yet in other countries – the US, for example – econometric research definitely did find a significant relation between the development of the construction costs and sales prices. For instance, Abraham and Hendershott (1996) discovered a correlation of 0.35 between the two variables in the short term at the national level, while for the long term they even established a correlation of 0.6. For coastal areas, where there is a chronic shortage of building land, however, these relations are far less strong or even altogether absent. This result sustains the assumption that as government influence declines and building land is made available without many restrictions, the relation between the development of house prices and the development of construction costs will gain strength. The supply-directed approach is – in theory – an efficiently functioning housing market.

The second direction is the idea that the market for owner-occupier housing is a stock market, a characteristic that derives directly from the long life span of the dwelling. This idea forms the point of departure in most Western economies and certainly in the Netherlands. It applies particularly to countries where the housing and house-building markets are highly regulated where building land is scarce. For instance, spatial planning policy could

severely distort the supply and demand relations on the housing market, causing the realized supply to fall short of the amount desired by the market. Thereby, the tie between construction costs and house prices would be broken; in a stock market (where market forces are inefficient), the development of house prices is determined mainly by demand-side variables. It is then no surprise that the international housing market literature also emphasizes how small the influence of the supply (the new construction) may be on price development in the existing stock. Accordingly, the development of aggregated house prices is largely influenced by household incomes, mortgage interest rates, and the lag in house prices (Abraham & Hendershott, 1996; Hort, 1998; Malpezzi, 1999). Apparently, demand in the Netherlands rose during the 1990s because of the strong economic growth and the historically low interest rates. This interpretation is borne out by the sharp rise in prices during that decade in the market for both existing and newly built houses. The supply side proved incapable of responding to this increased demand; the production of dwellings even declined.

In an inefficiently operating market, the development of house prices in the stock strongly influences developments on the market for new construction. This is thus the opposite of what happens on the supply market. The reason is that the development of prices for existing dwellings determines the scope that the building contractor has to sell a dwelling of a given quality at a commensurate price on the market. As Meen (1998) notes in this regard, more recent life-cycle analyses emphasize the equilibrium in the existing stock, with new construction merely having a limited effect on price development.

House price index

The choice of a method to calculate an index depends on the 'target' (Wang & Zorn, 1997) and the characteristics of the available dataset (Abraham & Schauman, 1991). The target is the statistic that users of an index need to know regardless of the method (Wang & Zorn, 1997). Worldwide, the most frequently used methods for calculating house price indexes are the following: (1) a summary measure of central tendency (e.g., mean, median); (2) hedonic price models; (3) repeat sales models; (4) variants on and hybrids of the latter two; and (5) the Sale Price Appraisal Ratio (SPAR) method.

Firstly, summary methods have one intrinsic flaw: they are not adjusted for quality. They are unable to distinguish between price movements and changes in the composition of sold dwellings from one period to the next (Bourassa *et al.*, 2006). The shortcomings in the summary methods mean that other methods are preferable, if available datasets so allow.

The second option, hedonic regression analysis, is based on the principle that the price of a house can be accurately estimated from its characteristics. The selling price is regressed on a set of important qualitative variables, e.g., the number of rooms and lot size, and several variables for measuring

time effects (Rosen, 1974). Since the valuation of these quality characteristics varies through time, a hedonic index, especially a model with time dummies plus invariant regressors can give a distorted view of the real price development.

Thirdly, Bailey *et al.* (1963) argue that a repeat sales method is more efficient than alternative methods because it utilizes information on prices from earlier periods and includes it in selling prices in later periods. Actually, the OFHEO house price index for the US and the repeat sales index for the Netherlands (Chapter 2) were estimated using a weighted version of the repeat sales approach (Case & Shiller, 1987; Abraham & Schauman, 1991; Calhoun, 1996). However, there are a number of drawbacks which, if left unresolved, make these indexes unsuitable for official statistics or as input for the Harmonized Index of Consumer Prices (HICP). Perhaps the most serious drawback is revision, which means that past values of the index are revised by present-day information (Baroni, 2004). In other words, additional sales reverberate on the index values because new pairs provide information on movements in the house prices which goes beyond the information obtained from the sample.

Fourthly, hybrid models avoid the inefficiency of the repeat sales model because they also use information from houses that are only sold once (Wang & Zorn, 1997). Both might avoid the problem of misspecification to which the hedonic method is susceptible. However, like the hedonic method, hybrid models require a large database with a detailed set of property attributes.

Lastly, Bourassa *et al.* (2006), who also discuss the problem of revision and other drawbacks, present the SPAR index as an alternative to hedonic or repeat sales indexes. Like the repeat sales method, the SPAR method is based on matched pairs but, in contrast, uses (nearly) all price data that is available for the period under observation. Since the majority of the houses sold during the observation period were not sold during the index reference or base period, there is a general shortage of transaction prices for the base period. The base period prices are therefore estimated using appraisals of the houses. In contrast to a repeat sales index, the SPAR index is not revised when data for new periods is added. Bourassa *et al.* (2006) "maintain that the advantages and the relatively limited drawbacks of the SPAR model make it an ideal candidate for use by government agencies in developing house price indexes."

Several other house price indexes exist for the Netherlands, based upon different sources and index construction methodologies. For an overview, see Francke *et al.* (2009).

House price models

In order to corroborate the theoretical correlation between the house price and its fundamentals, the evidence must be statistically sound. Numerous factors affect how prices are set on the housing market, and the relation between those factors is complex. Therefore, the argumentation makes use of

mathematical models. A model may be seen as a summary of the relations between a number of influential factors, the fundamentals, and the house price.

It should be kept in mind that models can do no more than their contents allow. The major disadvantage of model analyses thus lies in the shortcomings with regard to a complete representation of reality. A model cannot contain all aspects that one might want to include in it, for several reasons. For instance, data might be missing or influences might not be quantifiable.

House price models explain the price development. In so doing, they distinguish between short-run fundamentals and long-run fundamentals. Evidence indicates that both have an impact on house prices.

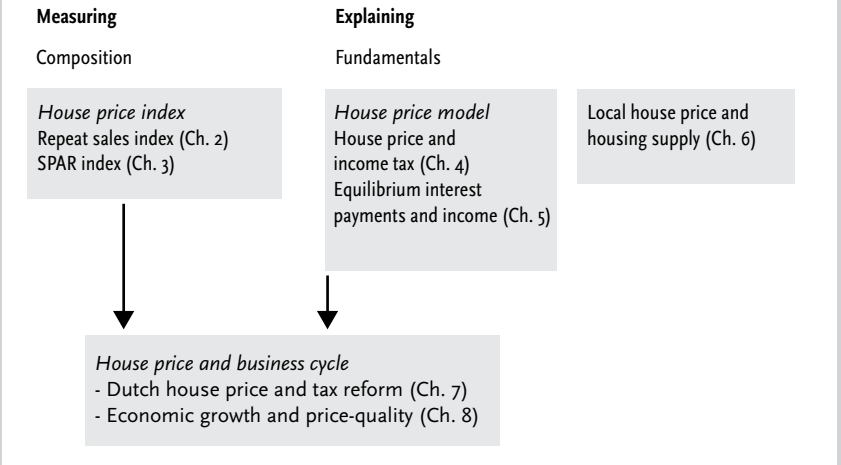
In the short term, significant upward or downward movements (shocks) appear, due to speculative or psychological effects (see Hendry, 1984; Reichert, 1990; Levin & Wright, 1997; Meen, 1998; Hort, 1998; Shiller, 2005; Vries & Boelhouwer, 2009). These shifts, along with the abovementioned effects of the gradual adjustment of the market for (new) construction, offer an explanation for the mutations – sometimes strong – in sales prices that occur in the short term. For example, when prices continue to increase, consumers tend to act swiftly in anticipation of further increases. Because of speculation and the meager possibilities for adjustment in the market for new construction, as set forth above, many econometric models take the price development of the recent past as an explanatory variable. In this way, they can provide a statistical explanation for the strong price mutations occurring in the short term. Reichert (1990) and Boelhouwer *et al.* (1996) were among the first model builders to include this variable in their explanatory model. For instance, it turned out that the development of prices over the last four quarters could partly be explained by the price trend of the four preceding quarters. As Meen (1998) also notes, this effect is known in the international literature. It has been demonstrated in work by Abraham and Hendershott (1996), Malpezzi (1999), Hort (1998), and Vries and Boelhouwer (2009), among others. All these studies are based on time series analysis and take the price development from the last period as an explanatory variable for the future price development. Also Muellbauer and Murphy (1994) offer an explanation for the effect that the development of the house prices in the recent past has an influence on the development of prices in the future. Because of the rise in prices, they assert, the assets of owner-occupiers grow, enabling them to take the next step in their housing career. Consequently, the increased demand then pushes up prices. Shiller (2005) subsequently introduced the term 'bubble builder' in this context. In addition, according to Hort (1998), the equilibrium price is unstable because actors on the housing market have an information deficit as soon as they enter the market as buyer or seller. In the course of the buying/selling process, they fill this information gap and then adjust their ask/bid price accordingly.

Long-run fundamentals, in addition to short-run price effects, play a role in the development of house prices. Many analytical models include income and inflation as explanatory variables for price trends (see Reichert, 1990; Peng & Wheaton, 1994; Cho, 1996; Gallin, 2003; Vries & Boelhouwer, 2009; Vries, 2002; Malpezzi, 1999; Hort, 2000; Meen, 2002). However, these factors have much less influence on the development of prices. To ensure that long-run price developments can also be explained by permanent factors, such models incorporate a deviation from equilibrium as a corrective variable (error-correction models). The long-run equilibrium is usually expressed as a price-to-income-ratio. As early as 1972, Fair drew attention to the significance of the long-run equilibrium between house prices and incomes. Long-run equilibrium, as he states, stems directly from the premises of general price theory, which proposes that the demand for an object is a function of income and the price of the object or service in relation to other prices (Fair 1972). This idea is commonly formalized in the housing literature by positing a co-integration relationship between house prices and fundamentals (e.g., income) with subsequent estimation of an error-correction model (Abraham & Hendershott, 1996; Malpezzi, 1999; Hort, 1998; Meen, 2002; Boelhouwer *et al.,* 2004). Gallin (2003) suggests, however, that the co-integration relationship between income and house prices that is commonly found in the literature may be inappropriate. In particular, Gallin questions the validity of the associated error-correction models, which are based on long-run equilibrium in the price-to-income ratio. Lastly, Vries and Boelhouwer (2009) present a long-run equilibrium between interest payments and income (interest-to-income ratio) over the error-correction term. It is thought that interest payments are linked to income levels by a stable long-run relationship. This process forms the basis for a house price model that may serve to explain and predict fluctuations in Dutch house prices.

1.4 The plan of the book

The goal of this study is to develop a methodological framework for studying the development of house prices. Figure 1.2 gives a schematic representation of the plan of the book. A distinction is made between calculating the development of house prices (with a house price index) and explaining that development (with house price models). Both Chapter 2 and Chapter 3 deal with the methodology of the house price index. A house price index does not take any change in quality into account. In other words, the house price index indicates the degree to which the price of a dwelling increases or decreases without a change in quality being the cause. Thus, the main question in the literature on the house price index is how to correct for changes in the composition. This dissertation presents two methods for constructing a house

Figure 1.2 Relationships between the chapters of the book



price index. First, Case and Shiller's geometric weighted repeat sales method is discussed in Chapter 2. This method can correct for changes in the composition because it is based on the difference in price for the same dwelling at different selling times. A monthly index is designed to detect changes in the price of the overall stock of owner-occupied dwellings. Chapter 2 also deals with accuracy, heteroskedasticity, and revision, which is the major drawback. Then the SPAR method is discussed, a method that combines real sales information with appraisal values (Chapter 3). Furthermore, this chapter draws a comparison with the repeat sales method, as presented in the preceding chapter, and goes on to assess the reliability of the official Dutch appraisal values.

Chapters 4 and 5 deal mainly with the fundamentals that are used to explain the development of house prices. Based on a literature study, Chapter 4 identifies the factors influencing the development of house prices and presents a house price model. To apply it in practice, this chapter investigates the degree to which the house price declines in response to modeled changes in the income tax treatment of homeowners. Besides dealing with the house price model, Chapter 4 gives an overview of the changes that have taken place in the personal income tax situation in several European countries. Notably, the design of the house price model and the calibration of fiscal scenarios for the future are of particular importance for this dissertation. Chapter 5 resents an alternative to the formalized notion of a co-integration relationship between house price and income; that alternative is the long-run relationship between interest payments and income.

One of the fundamentals that has little if any influence on the development of house prices – and is therefore not included in the house price models covered in Chapters 4 and 5 – is supply. Intuitively, supply and price should be in equilibrium in the long run. Chapter 6 identifies the relationship between local housing supply and local house price developments. Chapters 7 and 8 draw connections with the business cycle. The central question in Chapter 7

is whether house prices would start falling in the Netherlands as well as in the US after the credit crunch (starting in the 4th quarter of 2008). First, the chapter explores whether there is a house price bubble that is ready to burst. Secondly, it considers the likelihood of house prices decreasing in response to the credit crisis that began in 2007. The third concern is the likelihood of a fall in Dutch house prices in response to modeled changes in the income tax treatment of homeowners. Chapter 8 outlines the mechanism of trade-offs made between quality and affordability, showing that the price – quality relationship changes with the level of economic growth.

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2 Developing a house price index for the Netherlands

A practical application of weighted repeat sales

S.J.T. Jansen, P. de Vries, H.C.C.H. Coolen, C.J.M. Lamain & P.J. Boelhouwer, *Published online: 11 July 2007, Springer Science + Business Media, LLC 2007*

Abstract
This paper describes the development of a house price index that has been introduced in May 2005 in the Netherlands. This monthly index, called *Woningwaarde Index Kadaster* (house price index Kadaster), is designed to detect changes in the price of the overall stock of owner-occupied homes. Fifty-five indices are calculated: one overall index, four regional indices, 12 provincial indices and 38 indices based on combinations of region/province and dwelling type. We used Case and Shiller's geometric weighted repeat sales model to calculate monthly house price indices. We used recorded data on the sales of over 500,000 owner-occupied homes in the Netherlands, all representing repeat sales between January 1993 and December 2006. The accuracy of the index was determined using the 95 percent confidence interval. We observed that accuracy might become a problem in smaller sub samples. Revision volatility was explored by comparing the index values computed from all available data until December 2005 with the index values computed from the data available until December 2006. Our analysis showed that revision volatility does not seem to be a major problem to the index. We also explored heteroskedasticity in the repeat sales method but did not find conclusive evidence for the proposed heteroskedasticity. Given our target (a geometric mean index value) and the characteristics of the dataset (very large but without property characteristics) the repeat sales method seems to be adequate for calculating a house price index for the Netherlands.

2.1 Introduction

In the Netherlands, as elsewhere, there is a need for a house price index that would, amongst other things, enable financial organizations to value the collateral behind mortgage portfolios. In fact *De Nederlandsche Bank* (the Dutch central bank), requires that financial institutions specify their risks with regard to their mortgage portfolios by estimating the actual liquidation value for every home in their portfolio. Another application of a house price index in the Netherlands is to allow brokers and homeowners to calculate the current value of an individual dwelling as well as the amount of equity gained (or lost) through house price appreciation (or depreciation). These two arguments apply to regional or provincial indices. Next to these indices, a national index

would be useful to keep track of the national development of house prices in the Netherlands from year to year. Furthermore, regional or provincial indices could be compared to the national index to examine whether they differ from the national tendency of growth in house prices. Lastly, Eurostat, the Statistical Office of the European Communities, recommends associated European countries to develop a national house price index in order to be able to make comparisons between European countries. The goal of our index is to follow the mean price development of an existing home in the entire stock of owner-occupied homes in the Netherlands.

Worldwide, the most frequently used methods for calculating house price indices are: (1) a summary measure of central tendency (e.g., mean, median); (2) hedonic price models; (3) repeat sales models; and (4) variants on and hybrids of the latter two.

Until recently, only the summary methods were applied in the Netherlands. Once a month the Kadaster[1] (Dutch Land Registry Office) published the mean selling price and the Dutch association of brokers and real estate experts (NVM) published the median selling price of existing homes. However, one intrinsic flaw in the summary methods is that they are not adjusted for quality. They are unable to distinguish between price movements and changes in the composition of sold dwellings from one period to the next (Bourassa *et al.,* 2006). For example, if for some reason, a disproportionate number of high-priced homes were sold in a given month, the mean or median price would still rise, even though not a single house had increased in value (Case and Shiller, 1987). Furthermore, the quality of new houses is likely to rise. Since these houses ultimately become existing houses, the median or mean price of existing houses will rise even if individual properties are not appreciating (Bailey *et al.,* 1963; Case and Shiller, 1987). The shortcomings in the summary methods meant that an alternative method had to be found for calculating a house price index for the Netherlands.

The second option, hedonic regression analysis, is based on the principle that the price of a house can be accurately estimated from its characteristics. The selling price is regressed on a set of important qualitative variables, e.g., the number of rooms and lot size, and several variables for measuring time effects (Rosen, 1974). The regression coefficients can be interpreted as implicit price attributes; for example, an extra room will push up the value of the property by a specific amount. However, the challenge posed by this method is to compute a functionally correct mathematical model for house prices. A correct set of explanatory variables must be specified and the relation-

1 Kadaster collects information about registered properties in the Netherlands, records them in public registers and in cadastral maps and makes this information available to members of the public, companies and other interested parties in society.

ships between these and the response variable must be correctly determined beforehand (Wang and Zorn, 1997). Another drawback of this method is that quality characteristics are both numerous and difficult to measure. Hence the hedonic model may not yield useful results (Bailey *et al.,* 1963).

Bailey *et al*. (1963) state that most of the difficulties of specifying and measuring quality characteristics can be avoided by basing the price index on the selling prices of the same properties at different times. This method – the repeat sales model – checks quality characteristics by comparing the same property over time. It uses data on properties that have actually been sold more than once during the period in question and focuses on price changes rather than prices themselves (Wang and Zorn 1997). The greatest drawback of repeat sales is that it wastes data by only using information on repeat sales (Wang and Zorn, 1997).

Finally, hybrid models avoid the inefficiency of the repeat sales model because they also use information from houses that are only sold once (Wang and Zorn 1997). They might avoid the problem of misspecification to which the hedonic method is susceptible. However, like the hedonic method, hybrid models require a large database with a detailed set of property attributes.

In 2004, yet another method for calculating house price indices was introduced in the Netherlands. It was developed by Von Dewall *et al*. (2004) and called the integrated house price index *(Geïntegreerde Woningprijs Index – GWI)*. Basically, the GWI calculates the mean appreciation rate of groups of properties that are purchased in the same period (e.g., month, quarter, year) and re-sold later. The appreciation rate is obtained for the various time periods by comparing the appreciation rates of groups of properties with the same purchase date and a different selling period, and by repeating this procedure for every purchase period. The method uses properties that are sold at least twice. The calculation method for the GWI seems to have a lot in common with the chain index described in Bailey *et al*. (1963). One benefit of such a method is that it is computationally simple. However, it is also inefficient, especially in the earlier periods, because it neglects index data for earlier periods contained in price relatives with final sales in later periods. Another drawback of such a method is that it does not provide standard errors for the index values.

The choice of method for calculating an index depends on the 'target' (Wang and Zorn, 1997) and the characteristics of the available dataset (Abraham and Schauman, 1991). The target is the statistic that users of an index need to know regardless of the method (Wang and Zorn, 1997). Our target is the geometric mean index value – which matches well with the repeat sales model. Moreover, whereas the hedonic and hybrid methods can be used only if information is available on the characteristics of individual homes (e.g., number of rooms, lot size), repeat sales can be applied when only the purchase and selling prices and the dates of sale are known. In the Nether-

lands, data on all houses sold are recorded by the Dutch Land Registry Office since January 1993. However, as no details are recorded on house characteristics apart from built surface area and type of dwelling (detached house, corner house, terraced house, apartment, semi-detached house), hedonic and hybrid methods cannot be applied. For these reasons, repeat sales seems a logical choice for a house price index for the Netherlands. One disadvantage of repeat sales is that it requires a large dataset, because only houses that are sold more than once are used to calculate the index values. Fortunately, the dataset of the Dutch Land Registry Office is quite large, containing all the sales of owner-occupied homes since January 1993 in the Netherlands (more than 2.5 million transactions, more than 700,000 of which are repeat sales). This is why we chose the repeat sales model as the method for calculating a house price index for the Netherlands. In the next section, our practical application of the (weighted) repeat sales method will be described.

2.2 Materials and methods

2.2.1 Weighted repeat sales model

As the (weighted) repeat sales model is extensively addressed in the literature (see e.g., Bailey *et al.*, 1963; Case and Shiller, 1987, 1989; Goetzmann, 1992; Calhoun, 1996; Dreiman and Pennington-Cross, 2004), we believe that a brief description here will suffice. A more detailed description of our application of the (weighted) repeat sales method can be found in Jansen *et al.* (2005).

Bailey *et al.* (1963) were the first to develop a house price index that was based on the repeat sales model. Essentially, repeat sales uses a collection of the prices paid for single properties at different points in time to estimate a vector of numbers that 'best' explains the observed changes in price over the sample period (Abraham and Schauman, 1991). In practice, the repeat sales model uses ordinary least squares regression analysis in which the dependent variable is the logarithm of the price relative from the twice-sold property. The log price relatives are then regressed on a set of dummy variables corresponding with the time periods. A dummy variable is added for each period, except the first (base) period. The dummy variable for the first sale has the value '–1' and the dummy variable for the second sale has the value '+1'. All other dummy variables have the value '0'. There is no constant term in the analysis, the coefficients are estimated only on the basis of changes in house prices over time. The estimated coefficients represent the log of the cumulative price index for each period. The time dummy for the initial period is set at zero to normalize the index at 1. The regression equation is (Bailey *et al.*, 1963):

$$r_{itt'} = \sum_{j=1}^{T} b_j x_j + u_{itt'} \quad (1)$$

where $r_{itt'}$ is the log of the ratio of the final sales price in period t' to initial sales price in period *t* for the *ith* pair of transactions with initial and final sales in these two periods, *b* is a column vector of unknown logarithms on the index numbers to be estimated, and *x* is an $n \times T$ matrix with values –1, 0, and 1, as explained above. Finally, u_{itt} are the residuals in log form with zero means, equal variances, and uncorrelated with each other.

In 1987, Case and Shiller published an adapted version of the repeat sales model of Bailey *et al.* (1963): the weighted repeat sales method. Case and Shiller argued that the longer the time between transactions the more variance there is in individual house price appreciation; for example, because some houses are very well maintained whereas others are not maintained at all. As a result, the variance of the residuals (i.e., the differences between predicted and observed house prices) will increase with the length of the holding period. This phenomenon – known as heteroskedasticity – undermines efficiency as the variance of the index values becomes too great (Wang and Zorn, 1997). This may not be a problem if the application relies solely on the indices themselves and are based on plentiful data (Wang and Zorn, 1997). However, heteroskedasticity is certainly a problem if confidence intervals are calculated (Wang and Zorn, 1997). To minimize the effect of heteroskedasticity, Case and Shiller (1987) proposed a three-step procedure, which is described below.

The first step is exactly the same as the first step of the repeat sales model described by Bailey *et al.* (1963). In the second step, a regression analysis is performed on the squared residuals from the first step. Time is incorporated as an independent variable (predictor) in the model and a constant term (intercept) is also included. This intercept is an estimate of the variance of twice the house-specific random error variance, once for the first sale and once for the second sale (Case and Shiller, 1987). The time coefficient is an estimate of the increase in variance for each additional period. This is called the 'Gaussian Random Walk'. The random walk model implies that the variance of house prices (and growth rates) increases linearly with time (Wang and Zorn, 1997). Thus, the second step explores the assumption that the error variance increases linearly with the holding interval and that there is a fixed component to the property specific variance that is not related to the holding period (Goetzmann, 1992).

In the third step of the procedure, a weighted regression analysis (generalized least squares regression) is applied where the weights are the reciprocals of the square roots of the fitted values of the second-stage regression. This procedure minimizes the impact of houses with a relatively long holding period on the regression analysis (Abraham and Schauman, 1991). The log price of the i_{th} house at time *t* is given by (Case and Shiller, 1987):

$$P_{it} = C_t + H_{it} + N_{it} \quad (2)$$

where C_t is the log of the citywide level of housing prices at time t; H_{it} is an Gaussian random walk that represents the drift in individual housing value through time, and N_{it} is a house-specific random error that has zero mean and equal variance and is serially uncorrelated.

Various authors have proposed additions and corrections to (weighted) repeat sales. In 1991, Abraham and Schauman (1991) argued that the variance of the error term associated with any repeat sales pair would not indefinitely increase linear to the holding period. Instead, they proposed a quadratic model so that the increase in variance would decrease as the holding period increased:

$$E[d_i^2] = A(t-s) + B(t-s)^2 + 2C \quad (3)$$

where d_i^2 refers to the squared residuals, *t–s* refers to the number of periods between acquisition and sale, the constant term *2C* provides an indication of the variance of twice the house-specific random error, *A* is an estimate of the increase in variance for each additional period, and, finally, *B* is an estimate of the increase in variance foreach additional period squared. We followed this approach in the second step of our calculation of the *Woningwaarde Index Kadaster*, just like Calhoun (1996) for the OFHEO index.

Furthermore, in 1992, Goetzmann proposed an ex-post correction to the model by Case and Shiller (1987). Goetzmann states that the repeat sales method provides an estimate of the geometric mean growth rate and not of the arithmetic mean growth rate. Because the log function is concave, the average of the logs is less than the log of the average, when there is any variance in the data (Goetzmann, 1992). The log transformation results in a downward bias of the arithmetic mean at each point in time (Goetzmann, 1992). Goetzmann (1992) argues that the geometric return has a natural interpretation for a times series where it represents the growth rate of an investment over time. However, for a cross-sectional interpretation an arithmetic return seems more natural. Goetzmann (1992) suggests a relatively simple scalar adjustment to the estimated geometric means based on adding half the variance in house price growth rates associated with the diffusion of house prices over time. Calhoun (1996) proposes to also include a term in this calculation for time squared, as in the second step of the procedure.

We do not directly apply the Goetzmann correction in our calculation of the house price index for various reasons. Firstly, one goal of the *Woningwaarde Index Kadaster* is to provide a measure for homeowners and brokers to calculate the growth rate for an individual dwelling. In such a longitudinal context the geometric mean is an adequate measure of center (Wang and Zorn, 1997). Secondly, the parameters needed to calculate the Goetzmann correc-

tion have to be provided separately if the value of a portfolio of dwellings is to be calculated, because the form of the correction function is non-linear (e.g., the increase in the variance between the first two periods is larger than for the last two periods). Thus, the parameters are dependent upon the beginning and ending dates of the particular portfolio. In such a case, e.g., when banking institutions want to calculate the value of their entire portfolio of mortgages at once, the necessary parameters can be provided separately and the Goetzmann correction can be calculated for the particular portfolio. This is the strategy that is followed by the OFHEO house price index (Calhoun, 1996).

2.2.2 The dataset

The Dutch Land Registry Office is responsible for the administration of all properties sold in the Netherlands (including all owner-occupied homes). The dataset contains information on 2,599,449 individual transactions regarding owner-occupied homes between January 1993 and December 2006. A total of 121,666 transactions were deleted because information on either the type of dwelling or the Intramax region (see next section for an explanation of the term Intramax region) was missing, resulting in 2,477,783 transactions.

Table 2.1 shows the owner-occupied stock in November 2006, the number of dwellings sold at least once between January 1993 and December 2006, the number of dwellings sold twice or more, and the number of pairs of repeat sales for the different types of dwellings. It may be deduced from the table that, between January 1993 and December 2006, 47 percent of all owner-occupied homes were sold at least once. Fifteen percent of dwellings (n=549,993) were sold at least twice. Of the dwellings sold since January 1993, 32 percent were at least sold twice.

Then, the number of transactions related to repeat sales were calculated. First, all transactions (n=1,057) related to dwellings that were sold more than ten times (n=46) were deleted. This was done for reasons of validity. Dwellings that are frequently resold may not be representative, for example, because they have hidden drawbacks that become overt only after sale (so-called 'lemons'). This resulted in 2,476,726 transactions. Next, transactions that related to only one sale or that related to the first sale of multiple sales were deleted (n=1,740,685) in order to obtain pairs of repeat sales (two successive sales form one pair). This resulted in 736,041 pairs of repeat sales.

Next, we deleted 54,518 pairs of repeat sales (7.4 percent) that were transactions related to dwellings that were sold within 12 months, because a short interval between the acquisition and divestment of a house may imply an unusual transaction (Englund *et al.,* 1998). On the one hand, these may represent distressed sales arising from divorce or job loss. On the other hand, they may be speculative sales. No conveyance tax needs to be paid in the Netherlands if a house is resold within 6 months. In a period of rapidly rising house

Table 2.1 Owner-occupied stock (November 2006), number of dwellings sold and not sold, and number of pairs of repeat sales up till December 2006

	Owner-occupied stock	Number of dwellings not sold	%	Number of dwellings sold at least once	%	Number of dwellings sold twice or more	%	Pairs of repeat sales
Overall	3,709,921	1,968,995	53%	1,740,926	47%	549,993	15%	735,796
Types								
- apartments	520,384	161,470	31%	358,914	69%	157,364	30%	235,394
- single-family homes	3,189,573	1,807,561	57%	1,382,012	43%	392,629	12%	482,829
Sub-types								
- terraced houses	1,326,070	661,489	50%	664,581	50%	211,760	16%	265,310
- corner houses	525,916	273,235	52%	252,681	48%	72,695	14%	89,142
- semi-detached houses	569,560	347,010	61%	222,550	39%	57,953	10%	69,734
- detached houses	767,991	525,791	68%	242,200	32%	50,221	7%	58,643

prices, as observed between 1998 and 2001 in the Netherlands, a number of sales will have taken place purely for speculative reasons. Clapp and Giacotto (1999) advise that transactions, which they refer to as 'flips', be removed or weighed down. Flips are houses that are resold within 1 or 2 years of purchase. Clapp and Giacotto suggest that flips are (cosmetically) improved after purchase and have therefore appreciated at a higher rate when they are sold again soon afterwards. Thus, they introduce an upward bias to the index values. Finally, Steele and Goy (1997) argue that the opportune buyer rationale for the existence of bias in the price change of repeat sales properties implies that the bias should be greater the shorter the holding period. They too suggest eliminating very short holds from the dataset.

To explore the potential impact of very short holds, we calculated the monthly growth rate for every dwelling (including the 'flips'):

$$\text{Monthly growth rate} = (((Pt / Pt\text{-}1)^{**}(1/t)) - 1) * 100 \quad (4)$$

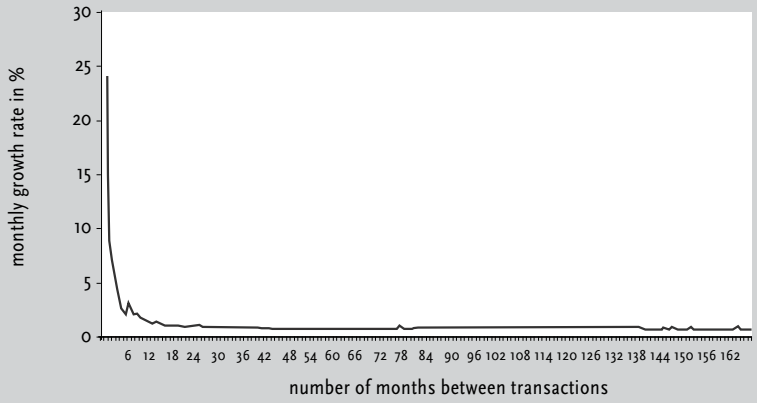
where P_t represents the price at the second sale, P_{t-1} represents the price at the first sale, and t indicates the period in months between sales.

Figure 2.1 confirms that deviating changes occur in the growth rate of homes resold within 12 months. For example, the mean growth rates are 8.3, 5.3, 1.2, and 0.9 percent for houses sold within 6 months, within 12 months, within all periods, and between 12 months and the end of period, respectively. Homes sold within a few months realize, on average, a very high increase in value per month, which may bias the index.

2.2.3 Transaction or sample selection bias

The repeat sales sample consists of a selection of houses that have been sold at least twice between January 1993 and December 2006. This sample may not, however, be representative of the overall stock of owner-occupied homes in the Netherlands. In other words, a problem will arise if the price changes in the sample are different from those in the rest of the housing stock. This phenomenon is known as 'sample selection bias' or 'transaction bias'. For example, Table 2.1 shows that 30 percent of the apartments have been sold at least

Figure 2.1 The mean growth rate value per month (percent) across the number of months between two transactions



twice since January 1993 whereas only 7 percent of detached homes were sold at least twice in that same period.

Samples of repeat sales may differ from the overall housing stock for different reasons (Bourassa *et al.,* 2006). First, properties may have been bought explicitly for the purpose of renovation and resale. Second, properties that are repeatedly sold may not meet buyer expectations (so-called lemons), and third, starter homes sell more frequently as the owners tend to move on to larger (and better) dwellings. Costello and Watkins (2002) discuss the 'starter home hypothesis' (2002) and point out that houses which are sold more frequently tend to be smaller and cheaper and to appreciate more rapidly than houses which are sold less frequently. One of the explanations for this finding is that younger homeowners may upgrade their home more frequently (Costello and Watkins, 2002). Thus, in general, properties in the repeat sales sample may be in a poorer condition and worth less (at least at the time of the purchase; Bourassa *et al.,* 2006).

As stated in Section 2.1 (Introduction), the goal of our index is to follow the mean price development of an existing home in the entire stock of owner-occupied homes in the Netherlands. One can imagine that houses with different values will show different appreciation rates; however, the value of houses in the overall stock of owner-occupied homes is not known until the actual sale is transacted. Thus a correction according to value is not possible. Another factor worth considering is that the rate at which house prices appreciate may vary from region to region. Houses from different regions may not be represented in the repeat sales sample in the same proportion as they are represented in the overall stock of owner-occupied homes.

It is for these reasons that we decided to weigh the repeat sales sample so that it resembles the overall stock of owner-occupied homes as closely as possible. However, as only a few characteristics were available in the dataset of the Dutch Land Registry Office, we were only able to weigh for type of dwelling (corner house, detached house, semi-detached house, terraced house, apartment) and region. Type of dwelling is used as a proxy for value because apartments are more strongly represented in the lower price classes and detached homes in the higher price classes. With regard to weighing

Table 2.2 Distribution of dwellings and pairs of repeat sales over Intramax regions and types of dwellings

	Intramax regions					
Dwelling types	**North**	**East**	**Arnhem-Nijmegen**	**Noord-west Veluwe**	**Utrecht**	**Amstellanden**
Entire owner-occupied stock						
Apartments	0.8%	0.6%	0.7%	0.3%	0.9%	2.9%
Terraced houses	2.3%	3.5%	1.9%	1.5%	2.9%	5.2%
Corner houses	1.1%	1.5%	1.0%	0.7%	0.9%	1.8%
Semi-detached houses	2.2%	2.9%	1.4%	0.6%	1.0%	1.0%
Detached houses	4.5%	3.5%	1.5%	0.8%	1.1%	0.9%
Total	10.9%	12.0%	6.5%	3.9%	6.8%	11.8%
Pairs of repeat sales						
Apartments	1.8%	1.6%	2.0%	0.8%	2.6%	4.7%
Terraced houses	3.4%	4.2%	2.1%	1.9%	3.4%	4.2%
Corner houses	1.3%	1.4%	0.8%	0.7%	0.8%	1.3%
Semi-detached houses	1.8%	1.8%	0.8%	0.4%	0.6%	0.7%
Detached houses	2.2%	1.2%	0.4%	0.3%	0.4%	0.4%
Total	10.4%	10.2%	6.1%	4.1%	7.9%	11.4%

▸

by region, we considered regional classification on the basis of four regions (north, east, south, west) and on the basis of our 12 provinces. However, these classifications are based on administrative borders, which may be of little or no importance to house-seekers. For this reason, appreciation rates may differ more within than between provinces. Accordingly, we turned to a classification that is not based on administrative borders but on movements, working and living patterns, and the pressure on regional housing markets (Masser and Scheurwater, 1978). This classification, called the Intramax Regions, is used by, among others, Van Kempen *et al.* (1995) and Goetgeluk (1997). The most recent Intramax classification in 13 Intramax regions was compiled by Utrecht University.

In practice, the weighing procedure ensures that the distribution over the 13 Intramax housing market regions and the five dwelling types is reflected in the repeat sales sample as in the overall stock of owner-occupied homes. This procedure reduces the selection bias by down weighting observations from housing types that are sampled 'too frequently' in the repeat sales sample. For example, in our national analysis apartments have a weighing factor of 0.43, which indicates that they are overrepresented in the repeat sales sample in comparison with the overall stock. Conversely, detached houses are underrepresented (factor of 2.67) in the repeat sales sample. Higher weights indicate more impact in the regression analyses. Table 2.2 shows the distribution over Intramax regions and types of dwelling in the owner-occupied stock and in the entire repeat sales sample. Table 2.3 shows the resulting weights for the data up to December 2006. Note that with every additional month of data, the weights are determined anew. Note further that in the case when results are calculated for sub samples, such as provinces and regions, the weights, based on type of dwelling and Intramax region, are calculated for every subsample separately.

Intramax regions							
Kop Noord-Holland	Haag-landen	Rottelanden	Zeeland	West-Brabant	Remaining Brabant	Limburg	Total
0.3%	3.6%	2.2%	0.2%	0.3%	0.7%	0.5%	14.0%
1.6%	4.4%	3.4%	0.9%	1.6%	3.8%	2.7%	35.7%
0.7%	1.5%	1.3%	0.4%	0.8%	1.7%	0.8%	14.2%
0.5%	0.6%	0.5%	0.5%	0.7%	1.7%	1.7%	15.4%
1.0%	0.7%	0.6%	0.9%	1.1%	2.3%	1.7%	20.7%
4.1%	10.9%	8.1%	3.0%	4.5%	10.1%	7.4%	100.0%
0.6%	8.6%	5.7%	0.3%	0.8%	1.9%	1.2%	32.5%
1.8%	3.6%	2.9%	1.1%	1.9%	4.5%	2.5%	37.5%
0.6%	1.1%	1.0%	0.4%	0.8%	1.6%	0.7%	12.6%
0.3%	0.3%	0.3%	0.3%	0.5%	1.0%	0.9%	9.6%
0.4%	0.2%	0.2%	0.4%	0.4%	0.7%	0.4%	7.7%
3.6%	13.8%	10.2%	2.5%	4.4%	9.7%	5.7%	100.0%

Furthermore, to eliminate random bias due to, e.g., typing errors, we omitted pairs of cases in which the logarithm of the price relative from the twice-sold property (i.e., the dependent variable in the regression analysis) showed more than five standard deviations from the mean value. In the case of normally distributed data, the odds of that occurring are only about one in a million. However, such cases can distort the analyses since the sum of squares is being minimized in the regression analysis and such cases may obtain too much weight. In the national sample, about 0.5 percent of cases (n=3,329) were deleted because they were outliers and 678,194 pairs of repeat sales remained for use in the regression analyses. In the case when results are calculated for sub samples, such as provinces and regions, the outliers are determined for every sub sample separately.

2.2.4 The weighted repeat sales regression analysis

The results of the three steps of the weighted repeat sales method for the national index and for the 12 provinces of the Netherlands are summarized in Tables 2.4 and 2.5. In the first step of the weighted repeat sales method, an ordinary least squares (OLS) regression analysis is performed in which the log price relatives are regressed on a set of dummy variables corresponding with the time periods. The residuals are saved. The results are presented in the first row of Tables 2.4 and .25.

In a subsequent regression analysis, the squared residuals obtained in the first step are included as dependent variables and the number of months and squared number of months since previous sale are included as predictors in the model (as proposed by Abraham and Schauman, 1991). A constant term was also included. Unfortunately, our results show that the estimated coefficient for holding period squared is positive instead of negative for 11 out of

Table 2.3 Weights based on Intramax region and type of dwelling

	Intramax regions					
Dwelling types	**North**	**East**	**Arnhem-Nijmegen**	**Noord-west Veluwe**	**Utrecht**	**Amstellanden**
Apartments	0.44	0.40	0.36	0.42	0.35	0.61
Terraced houses	0.68	0.83	0.92	0.78	0.86	1.22
Corner houses	0.87	1.01	1.18	1.01	1.09	1.36
Semi-detached houses	1.25	1.60	1.78	1.76	1.56	1.55
Detached houses	2.05	2.99	3.40	2.56	2.63	2.27
Total	1.05	1.17	1.06	0.96	0.87	1.04

▸

13 indices. This indicates that the error variance increases more than linearly with the holding period and therefore contradicts the assumption by Abraham and Schauman (1991) of diminishing growth. Furthermore, the coefficient for holding period is negative for six indices, indicating that there is a negative effect of holding period on the growth of variance. This is also contradictory to the theory. The results are presented in the second row of Tables 2.4 and 2.5 (method Abraham and Schauman).

Calhoun (1996) encountered a similar problem; he observed that the constant turned out to be negative. As the constant represents variance and variance cannot be negative, he formulated an alternative assumption that the normally distributed error term that represents cross-sectional dispersion in housing values arising from purely idiosyncratic differences in the valuation of individual houses at any given point in time is constant for every house (Calhoun 1996). Under this assumption, this term is cancelled from the equation and the squared residuals are estimated only on the basis of 'holding period' and 'holding period squared.' When we follow this procedure, the resulting coefficients are in agreement with the assumption posed by Abraham and Schauman (1991) for all 13 indices. The results are presented in the third row of Tables 2.4 and 2.5 (method Calhoun).

The fourth row of Tables 2.4 and 2.5 presents the results for the regression analyses based on the method of Case and Shiller. The results are in accordance to the theory, i.e., the amount of variance increases with the holding period.

Note, however, that irrespective of the method that is used to predict the relationship between the squared residuals and the holding period, the amount of explained variance is very small, ranging from 0.03 to 0.5 percent. So, even in the best situation, only a half percent of the spread in variance is explained by the holding period. Therefore, significant effects may be an effect of the large sample size.

In the third and final step of the weighted repeat sales method, a weighted regression is performed (generalized least squares) by repeating the regression analysis from the first step and by dividing each case by the square root of the predicted value that was fitted in the second step (in our case calculated using the 'Calhoun' method).

The resulting index (including 95 percent confidence intervals) for the Netherlands is shown in Figure 2.2. The general pattern of the index shows

Intramax regions							
Kop Noord-Holland	Haag-landen	Rottelanden	Zeeland	West-Brabant	Remaining Brabant	Limburg	Total
0.44	0.42	0.39	0.60	0.42	0.37	0.44	0.43
0.93	1.24	1.17	0.84	0.83	0.83	1.07	0.95
1.17	1.41	1.27	1.09	.98	1.02	1.28	1.13
1.72	1.91	1.59	1.47	1.41	1.76	1.86	1.59
2.74	3.20	2.48	2.30	2.58	3.35	3.82	2.67
1.12	0.79	0.79	1.18	1.02	1.04	1.31	1.00

Table 2.4 Results of the three steps of the weighted repeat sales method

Model	National index (n = 678,194)	Groningen (n = 25,138)	Friesland (n = 27,415)	Drenthe (n = 21,701)
Step 1: OLS regression (no intercept)*				
R^2	82.0	78.9	76.4	76.0
Step 2: Abraham & Schauman				
R^2	0.2	0.3	0.1	0.2
Intercept	0.0535900, $p < 0.01$	0.0514047, $p < 0.01$	0.0508910, $p < 0.01$	0.0434, $p < 0.01$
Coefficient period	0.0000865, $p = 0.03$	0.0004885, $p = 0.03$	0.0011986, $p < 0.01$	0.0013064, $p < 0.01$
Coefficient period^2	0.0000017, $p < 0.01$	0.0000003, $p = 0.83$	0.0000006, $p = 0.75$	-0.0000058, $p < 0.01$
Step 2: Calhoun*				
R^2	5.7	7.4	9.1	6.6
Coefficient period	0.0016693, $p < 0.01$	0.0020384, $p < 0.01$	0.0027023, $p < 0.01$	0.0026009, $p < 0.01$
Coefficient period^2	-0.0000080, $p < 0.01$	-0.0000092, $p < 0.01$	-0.0000085, $p < 0.01$	-0.0000137, $p < 0.01$
Step 2: Case & Shiller				
R^2	0.1	0.3	0.1	0.2
Intercept	0.0470691, $p < 0.01$	0.0501529, $p < 0.01$	0.0484060, $p < 0.01$	0.0655498, $p < 0.01$
Coefficient period	0.0003235, $p < 0.01$	0.0005352, $P < 0.01$	0.0012894, $p < 0.01$	0.0004887, $p < 0.01$
Step 3: GLS regression (no intercept)*				
R^2	78.2	74.5	71.2	72.6

▸

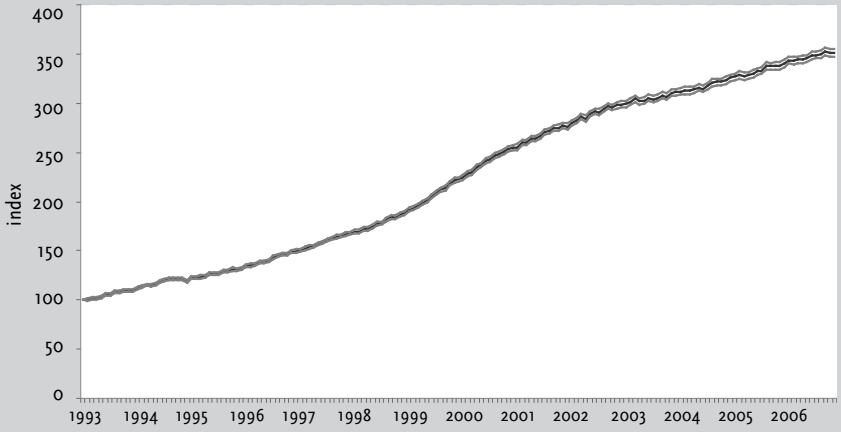
that house prices in the Netherlands increased gradually between January 1993 and December 2006. A relatively large increase in house prices was observed between 1998 and 2001. Figure 2.3 shows the indices for the 12 provinces of the Netherlands. The figure shows that although in all provinces house prices have gone up since 1993, there are two provinces (Flevoland and Limburg) in which the growth of house prices has been less than in the other provinces, especially after 2004.

Table 2.4 - Continued

Drenthe (n = 21,701)	Overijssel (n = 41,673)	Flevoland (n = 18,214)	Gelderland (n = 71,152)	Utrecht (n = 58,384)
76.0	81.5	73.4	86.5	80.1
0.2	0.1	0.2	0.1	0.2
0.0434, p < 0.01	0.0606008, p < 0.01	0.0670979, p < 0.01	0.0501290, p < 0.01	0.0402052, p < 0.01
0.0013064, p < 0.01	0.0000447, p = 0.80	-0.0002596, p = 0.47	-0.0002099, p = 0.02	0.0008933, p < 0.01
-0.0000058, p < 0.01	0.0000020, p = 0.08	0.0000064, p = 0.01	0.0000028, p < 0.01	-0.0000025, p = 0.03
6.6	5.9	4.0	5.8	5.9
0.0026009, p < 0.01	0.0018388, p < 0.01	0.0018578, p < 0.01	0.00125289, p < 0.01	0.0020560, p < 0.01
-0.0000137, p < 0.01	-0.0000090, p < 0.01	-0.0000073, p < 0.01	-0.00000609, p < 0.01	-0.0000096, p < 0.01
0.2	0.1	0.2	0.1	0.2
0.0655498, p < 0.01	0.0526579, p < 0.01	0.0451934, p < 0.01	0.0390801, p < 0.01	0.0505111, p < 0.01
0.0004887, p < 0.01	0.0003330, p < 0.01	0.0005910, p < 0.01	0.0001871, p < 0.01	0.0005283, p < 0.01
72.6	77.8	67.9	83.1	76.8

▸

Figure 2.2 Index values for owner-occupied homes in The Netherlands and 95% confidence interval



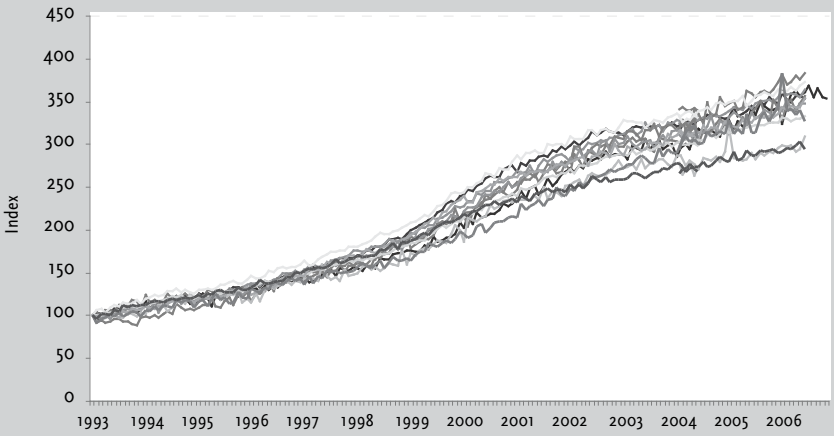
2.2.5 The search for heteroskedasticity

As described before, Case and Shiller (1987) proposed an adapted version of the repeat sales model to correct for heteroskedasticity. They argued that the residuals would increase with the holding period. However, our results showed that, at best, only 0.5 percent of the spread in variance of the residu-

Noord-Holland (n = 92,077)	Zuid-Holland (n = 168,077)	Zeeland (n = 16,361)	Noord-Brabant (n = 99,037)	Limburg (n = 38,965)
84.0	83.9	81.3	84.7	82.3
0.03	0.1	0.5	0.1	0.5
0.0593466, p < 0.01	0.0481065, p < 0.01	0.0478480, p < 0.04	0.0592625, p < 0.01	0.0417772, p < 0.01
-0.0000552, p = 0.61	-0.0000344, p = 0.61	0.0002297, p = 0.21	-0.0002552, p = 0.01	-0.0001519, p = 0.11
0.0000014, p = 0.06	0.0000017, p < 0.01	0.0000013, p = 0.29	0.0000034, p < 0.01	0.0000032, p < 0.01
5.0	5.4	10.7	4.8	8.7
0.0017032, p < 0.01	0.0013836, p < 0.01	0.0016638, p < 0.01	0.0014924, p < 0.01	0.0010767, p < 0.01
-0.0000094, p < 0.01	-0.0000070, p < 0.01	-0.0000075, p < 0.01	-0.0000072, p < 0.01	-0.0000042, p < 0.01
0.03	0.1	0.5	0.1	0.4
0.0539732, p < 0.01	0.0415072, p < 0.01	0.0427321, p < 0.01	0.0457489, p < 0.01	0.0291200, p < 0.01
0.0001405, p < 0.01	0.0002040, p < 0.01	0.0004192, p < 0.01	0.0002356, p < 0.01	0.0003083, p < 0.01
81.2	80.6	77.2	81.0	77.6

* The amount of explained variance cannot be interpreted in the usual way because no intercept is included.

Figure 2.3 Index values for the 12 provinces of the Netherlands



als could be explained by the holding period. For this reason, we explored the assumed heteroskedasticity in more detail.

First, we explored whether heteroskedasticity was indeed present, irrespective of the presumed cause. The most simple way to explore heteroskedasticity is to make a scatter plot of the residuals. Note that SPSS was not able to generate scatter plots for the whole sample (sample size to large) so for

the national sample we used random samples of 10 percent of the data. All scatter plots showed that the variance was not spread evenly over the levels of the predictors. Instead, the largest variance was generally observed for the middle category, i.e., the category of dwellings that had not been bought or sold in that particular month. This was also by far the category with the largest number of observations, so this may explain the observed heteroskedasticity.

Another method to explore heteroskedasticity is the Breusch-Pagan test. For this test, the squared residuals are divided by the sum of the residuals that is divided by the number of observations (in, e.g., Greene, 1993, p. 395):

$$z_i^2 = u_i^2 / s^2 \tag{5}$$

$$s^2 = \sum u_i^2 / n \tag{6}$$

where i relates to the observations, u_i^2 to the squared residuals and n relates to the number of cases. Next, a regression analysis is performed on the transformed residuals. In the context of the Breusch-Pagan test, a Lagrange multiplier test can be calculated (in, e.g., Greene 1993, p. 394). The results of this test show that heteroskedasticity is present in the data for all 13 indices. Note, however, that for all indices the amount of explained variance in the regression analysis does not exceed 1 percent.

Thus far, we explored in general whether heteroskedasticity is present in the data. However, Case and Shiller argue that the heteroskedasticity is related to the holding period. To test this assumption, we made a scatter plot of the residuals against the holding period. We did not find the suggested form in which the variance widens out with time. In fact, the figure suggested the opposite, i.e., that the spread of the residuals would decrease with longer periods between sales. The Breusch–Pagan test indicated heteroskedasticity in the data but, again, the percentage of explained variance was in all cases less than 1 percent.

We also performed the Goldfeld-Quant Test (see Greene, 1993, p. 394). This test is based on the assumption that the sample consists of various groups with different residuals. The holding period ranges from 12 to 168 months. In accordance to the Goldfeld-Quant Test, we made three groups of almost similar group size. Next, we performed the first step of the repeat sales regression analysis in the first and third group separately and compared the amount of squared residuals in both groups. The tests showed that heteroskedasticity was indeed present.

Related to the problem of heteroskedasticity, we encountered a problem with regard to the estimated variance in the second step of the procedure. For example, for the national index, we observed a value of the coefficients for period of 0.0016693 and for period squared of –0.0000080 (see Tables 2.4 and

Table 2.5 Actual and needed number of repeat sales, actual and needed standard error, accuracy, and revision volatility for the national index and the twelve indices for the provinces

	Actual			Needed		Revision volatility Dec. 2005-Dec. 2006
Index	n	Mean SE	Accuracy	Mean SE	n	Mean % change (range)
The Netherlands	678,194	1.2	2.1%	5.7	31,006	-0.23% (-0.82 – 0.17)
Groningen	25,138	7.0	12.7%	5.2	40,572	0.03% (-3.36 – 2.28)
Friesland	27,415	8.0	13.8%	5.8	52,438	-1.03% (-4.45 – 0.93)
Drenthe	21,701	7.7	13.6%	5.7	40,029	0.99% (-2.54 – 3.00)
Overijssel	41,673	5.2	9.1%	5.7	34,244	-0.07% (-3.17 – 1.60)
Flevoland	18,214	9.2	18.0%	5.2	58,248	0.14% (-2.31 – 6.02)
Gelderland	71,152	3.7	6.0%	6.2	25,465	-0.66% (-1.60 – 0.61)
Utrecht	58,384	4.3	7.6%	5.7	33,556	0.06% (-1.36 – 1.16)
Noord-Holland	92,077	3.2	5.3%	5.9	25,975	-0.21% (-1.33 – 0.62)
Zuid-Holland	168,077	2.1	3.8%	5.5	24,964	-0.13% (-1.02 – 0.56)
Zeeland	16,361	7.8	14.6%	5.3	34,786	-0.09% (-4.56 – 1.60)
Noord-Brabant	99,037	3.3	5.5%	5.9	30,574	-0.02% (-1.02 – 0.97)
Limburg	38,965	4.0	7.6%	5.3	22,408	0.10% (-1.72 – 1.55)

2.5, method Calhoun). Based on these coefficients the squared residuals are estimated:

$$\hat{d}_i^2 = 0.0016693 * t + -0.0000080 * t^2 \quad (7)$$

where t relates to holding period. We calculated a graph of the estimated squared residuals and observed that they increased with a longer holding period and that this increase leveled off as assumed. However, when the holding period is about 107 months, the estimated variance starts to decrease. This means that the weighing procedure in the third step is at stake. Cases are weighted on the basis of the value of the estimated squared residuals, to correct for the heteroskedasticity that is the result of the length of the holding period (according to the theory). The assumption is that cases with longer periods between sales should obtain less weight in the regression analyses. However, cases with a holding period of more than 107 months will now obtain more weight in the analysis instead of less weight. This effect was also observed for the indices of the individual provinces. The point where the estimated variance starts to decrease ranges from 91 to 159 months. A solution to this problem would be to keep the variance constant from the point where the variance starts to decrease. For the national index, we examined whether this finding was dependent upon the number of periods. However, irrespective of whether we calculated a monthly, quarterly, semi-annual or annual index, the decrease in estimated variance took place at about 107 months.

2.2.6 Confidence intervals and accuracy

The repeat sales model requires a large number of repeat sales in a market segment to yield reliable estimates. Segmentation according to region, province and type of dwelling will reduce the number of repeat sales upon which the index is based. The accuracy of the measured estimates depends on

the sample size, the distribution of the parameter scores in the population (standard error) and the level of confidence considered. A 95 percent confidence interval was used for the Woningwaarde Index Kadaster, because it is the most commonly used value and because it offers the best compromise between a high level of confidence on the one hand and a high level of accuracy on the other. We determined the accuracy of an index on the basis of the 95 percent confidence interval around the estimated index value. The estimated index value It is calculated as follows (Calhoun, 1996):

$$I_t = 100.e^{\hat{\hat{\beta}}_t} \tag{8}$$

in which $\hat{\hat{\beta}}_t$ is the estimated coefficient from the 'generalized least squares' regression analysis. The standard error of the index figures thus derived is calculated as follows (Calhoun, 1996):

$$\sigma_{It} = I_t.\sigma_{\hat{\beta}_t} \tag{9}$$

in which σ_{It} is the standard error of the index figure for period t; I_t is the index figure for period t; and σ_{It} relates to the standard error of the estimated coefficient from the third step of the 'generalized least squares' regression analysis.

The borders of the confidence interval (CI) can then be calculated by combining the standard error with the common procedure for obtaining the 95 percent confidence interval (Cohen *et al.*, 2003).

$$Upper\ CI_t = I_t + (1.96 * \sigma_{I_t}) \tag{10}$$

$$Lower\ CI_t = I_t - (1.96 * \sigma_{I_t}) \tag{11}$$

The distance between the upper and lower border indicates the width of the confidence interval (*Wci*). To determine the accuracy per period, the width of the confidence interval for the *Woningwaarde Index Kadaster* was then divided by the value of the index itself and multiplied by 100:

$$\text{Accuracy } (Wci_t / I_t) * 100 \tag{12}$$

We found no indications in the literature on how narrow a confidence interval had to be in order to be described as 'accurate.' Nor was there any consensus on the minimum required accuracy of a sample. Table 2.5 shows the actual number of repeat sales, the mean standard error (i.e., the mean over all 168 periods) and the accuracy of the national index and the indices for the provinces. The mean actual standard error (SE) was calculated by taking the average of the standard errors of the 168 index values (I_t) for the various months.

The results show that the accuracy ranges between 2 and 18 percent, which we believe is acceptable.

2.2.7 Minimum number of repeat sales

Related to the topic of confidence intervals is the number of pairs of cases needed to obtain an accurate estimate. For example, the OFHEO house price index is published only if at least 1.000 homes are sold in the region (Calhoun, 1996) and at least ten houses are sold per quarter.

However, it is possible to determine the minimum sample size that is needed to obtain acceptable values for the standard error and the confidence interval. We determined a minimum number of repeat sales by applying the following formula (Cohen *et al.*, 2003):

$$n^* = n\left(\frac{SE}{SE^*}\right)^2 \tag{13}$$

in which n^* is the minimum sample size needed; n is the original sample size; SE is the original standard error; and SE* is the desired standard error.

The desired standard error (SE*) can be calculated. If we calculate SE* on the basis of 10 percent accuracy, the SE* for the Netherlands as a whole is 5.7. By applying Eq. 13, the minimum needed number of repeat sales (n^*) is:

$$n^* = 678{,}194\left(\frac{1.223813996}{5.723631797}\right)^2 = 31{,}006 \text{ cases} \tag{14}$$

Table 2.5 shows the actual and needed numbers for the 15 indices published by the Dutch Land Registry Office, based on 10 percent accuracy. The table shows that the number of pairs of repeat sales needed to calculate an accurate index is quite different for the various segmentations (range 22,408–58,248). The accuracy of the measurement depends besides on the size of the sample also on the distribution of the parameter scores in the population (standard error). Thus, more homogeneous sub samples will require fewer cases. The picture that emerges does not justify a minimum number of observations, as applied, for example, by the OFHEO. The table also shows that, for a chosen accuracy of 10 percent, five provinces would have an actual number of cases that is lower than the needed number of cases.

2.2.8 Effect of revisions: revision volatility

According to Bailey *et al.* (1963), the repeat sales model is more efficient than other methods because it utilizes information about the price index for earlier periods that is contained in sales prices in later periods. Thus, the index values gain precision. Similarly, Shiller (1991) argues that such a revision is the result of increased efficiency in the estimators. However, present-day in-

formation changes the past values of the index (Baroni *et al.* 2004). Thus, additional sales have implications for the index values because new pairs will provide additional information about changes in the price level beyond that obtained from the previous sample. This is termed revision volatility and it may induce problems to the interpretability of the index, as the new index values may not be similar to the old ones. Clapp and Giacotto (1999) showed that revisions may be large, insensitive to sample size, and systematically downwardly directed. Clapp and Giacotto (1999) observed that properties with only 1 or 2 years between sales (so-called 'flips') appreciate at a higher rate than other properties and may therefore be partly responsible for the downward revision of the index. Abraham and Schauman (1991) argue that in periods of weak real estate markets, most of the properties that do trade will be the strongest performers within the market ('winners'). An index based on these transactions will therefore overstate the rate of property appreciation. However, eventually the preliminary estimates of price appreciation will be revised downwards as the sample expands from the price information for properties held, but not sold, during that period (Abraham and Schauman, 1991).

To obtain an impression of the scale of these changes for the *Woningwaarde Index Kadaster*, we calculated the index values with all the data up to December 2005, and again with all the data up to December 2006 (thus with 12 additional months) for all previously described 13 indices. The mean percentage change and the range for every index is presented in Table 2.5, last column. The results show that the volatility of the coefficients is usually small when data are added for 12 additional months. The mean percentage change for the Netherlands is –0,23 percent, thus less than a quarter of a percent. The largest mean revision is 1.3 percent and is observed for the province of Friesland. The largest individual revision is observed for the province of Flevoland with a value of 6 percent. 788 revisions (39 percent) are directed upwards and 1,227 downwards (61 percent; total=13 indices×155 months=2,015 potential revisions).

2.3 Concluding remarks

After a thorough literature study and based on the characteristics of our data set (very large but without property characteristics) and the target of our study (a geometric mean index value), we chose the weighted repeat sales method to calculate monthly indices for house prices in the Netherlands.

One major benefit of the (weighted) repeat sales model is that it theoretically removes quality differences between packages of homes sold in different periods (Bailey *et al.,* 1963). It so distinguishes differences in quality from differences in price (Abraham and Schauman, 1991). All the characteristics that could be included in a hedonic regression analysis or in a hybrid method

are corrected (theoretically) by the repeat sales model (Abraham and Schauman, 1991). By comparing the same dwelling over time, the procedure also corrects for the possibility of a progressive improvement in quality in new-built houses. (Bailey *et al.,* 1963). However, the index is only corrected for quality if properties retain the same physical attributes and if these attributes are accorded the same value by the market over time (Stephens *et al.,* 1995). It is highly plausible that, for some dwellings, the characteristics will be different on the two dates of sale. This would then undermine one of the assumptions that makes for consistency in the repeat-sales approach. On the one hand, houses may depreciate through time, either physically or because of new tastes and fashions. On the other hand, they may have been modernized and upgraded, thereby gaining in value.

However, for estimating the risk of their mortgage portfolio, banking institutes in the Netherlands are interested only in the current value of houses in their portfolio. According to Hwang and Quigley (2004), the quality change issue is not relevant if an index is intended to measure the market value of dwellings transacted in a given time interval. Similarly, Wang and Zorn (1997) argue that researchers looking for an estimate of the change in the value of housing – as we are – may prefer to include the impact of improvements and depreciation in their indices. For this reason, this disadvantage of the repeat sales method seems less important for our application of the *Woningwaarde Index Kadaster.*

We observed that in the second step of the weighted repeat sales regression analysis the coefficient for holding period squared is positive instead of negative for 11 out of 13 indices. A similar observation was also made by Clapp and Giaccotto (1999), who found that the coefficient for period squared was positive in all six combinations of region (Fairfax and Los Angeles) and sample size (three different sample sizes for each region) that they analyzed. These findings contradict the assumption of Abraham and Schauman (1991) that the increase in the variance of the residuals will decrease as the holding period increases. Furthermore, the coefficient for holding period was negative for six indices, indicating that there is a negative effect of holding period on the amount of variance. This is also contradictory to the theory. These results call into question the suggested form of the diffusion of the variance of appreciation rates over time. Another argument against the current use of the second step of the weighted repeat sales procedure is our finding that the proposed heteroskedasticity cannot be conclusively demonstrated in the data. Tests show that heteroskedasticity seems to be present, but the amount of explained variance is less than 1 percent. Significant results may have been the result of the large sample size. Furthermore, we observed a problem with the weights necessary to correct for heteroskedasticity in the third step of the procedure.

With the highest value of 18 percent, the accuracy of the 13 indices was rea-

sonably acceptable. However, accuracy may become a problem with smaller sub samples. We have no gold standard of which level of accuracy is still acceptable.

We observed that the revision volatility observed for the *Woningwaarde Index Kadaster* was reasonably small and acceptable. Whereas most of the revisions are downwards directed, even after removing the 'flips', it seems that excluding transactions with a holding period of less than 12 months may not be sufficient. In a previous study, Hoesli *et al.* (1997) examined the effect of revisions on the index. Because they did not observe statistically significant systematic deviations in the revisions, they concluded that each of the original indices is unbiased and that the revised index is a more efficient estimator of the price level. Abraham and Schauman (1991) found similar results. They conclude that while there is a fair bit of volatility in the indices, transactions-bias (responsible for revision volatility) does not appear to be a problem, even down at the city level.

Finally, note that we performed Chow tests to explore whether the data for the 12 separate provinces could be pooled for the calculation of the national index. Our results showed statistically significant differences, indicating that the data could not be pooled. But, the number of cases used for calculating these statistics is so large that significant results will quickly be found, even in the absence of relevant practical differences. In fact, sensitivity analyses showed that in random samples of the data with a sample size of about 12 percent at largest, the Chow test consistently did not indicate significant differences between provinces. For this reason, we decided that we could calculate a national index but that we have to keep in mind that the house price development in separate provinces can deviate from the national tendency. This is a limitation to the national index.

In conclusion, given the characteristics of the available dataset and our target, the repeat sales model seems to be an adequate method for calculating a house price index for the Netherlands.

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3 A house price index based on the SPAR method[1]

Paul de Vries, Jan de Haan, Erna van der Wal & Gust Mariën, 2009, Journal of Housing Economics 18, pp. 214-223

Abstract
Within the European Union there has been a push to provide European governments and the European Central Bank with the statistics they need for monitoring the owner-occupied sector. This paper reports on the results of a project to develop a house price index for the Netherlands. From January 2008, the Dutch Land Registry Office and Statistics Netherlands began jointly publishing house price index numbers for the whole country and for some specific dwelling types and regions. A number of special institutional features of the situation in the Netherlands contributed to the choice of index construction method. The indexes are computed using the Sale Price Appraisal Ratio (SPAR) method, which utilizes the ratios of transaction prices and previous appraisal values. We describe the SPAR method, compare it with repeat sales methods and assess the reliability of the official Dutch appraisal values. Empirical results for January 1995–March 2009 are presented. The SPAR method performs well compared to repeat sales, and the results reported will be of interest to other countries that have, or could instigate, institutional arrangements similar to those in the Netherlands.

3.1 Introduction

In 2004, the Netherlands initiated a project to develop a house price index for the owner-occupied sector. The efforts were part of a broader, and urgent, push within the European Union to provide European governments and the European Central Bank with the statistics they need for monitoring the owner-occupied sector[2].

The current credit crunch has underlined the importance of having reliable house price indexes. The objectives of the Dutch project have recently been achieved and are being reported on in this paper. From January 2008, the

1 The views expressed in this paper are those of the authors and do not necessarily reflect the policies of Statistics Netherlands. We gratefully acknowledge constructive comments from Henny Coolen, Martijn Dröes, Sylvia Jansen, Paul Knottnerus, Cor Lamain, and Alice Nakamura as wells as from participants at the EMG workshop (December 13-15, 2006, Sydney, Australia) and at the 2008 World Congress on National Accounts and Economic Performance Measures for Nations (May 12-17, 2008, Key Bridge Marriott Hotel, Arlington, USA).

2 Apart from house prices as such, the treatment of owner-occupied housing in the HICPs, the consumer price indexes produced in European Union Member States on the basis of harmonized standards, is also of interest. HICPs are needed in particular for the assessment of price convergence, for monitoring inflation and for conducting monetary policy in the euro zone. For an extensive discussion on alternative methods to incorporate owner-occupied housing into a consumer price index, see Diewert (2003).

Dutch Land Registry Office and Statistics Netherlands began jointly publishing house price index numbers for the whole country and for some specific dwelling types and regions. The indexes are computed using the so-called Sale Price Appraisal Ratio (SPAR) method. A number of special institutional features of the situation in the Netherlands contributed to the choice of index construction method. The results reported may be of interest to other countries that have, or could institute, similar institutional arrangements.

Prior to the introduction of the SPAR indexes, Kadaster already started publishing house price index numbers for the owner-occupied sector in May 2005. A set of 55 monthly indexes was computed, consisting of a nationwide index, four regional indexes and indexes based on combinations of region and dwelling type. These indexes, described extensively in Jansen *et al.* (2008), were estimated using a weighted version of the repeat sales approach (Case and Shiller, 1987; Abraham and Schauman, 1991; Calhoun, 1996). The repeat sales method was originally developed by Bailey *et al.* (1963). They argue that this method is more efficient than other methods as it utilizes information on prices from earlier periods and includes it in selling prices in later periods. However, there are a number of drawbacks, which make repeat sales indexes unsuitable for official statistics. One of the most serious drawbacks is revision, which means that past values of the index will be revised by present-day information (Baroni *et al.,* 2004). In other words, additional sales reverberate on the index values because new pairs provide information on movements in the house prices which goes beyond the information obtained from the sample.

Bourassa *et al.* (2006), who also discuss the problem of revision and other drawbacks, present the SPAR index as an alternative to hedonic or repeat sales indexes. Like the repeat sales method, the SPAR method is based on matched pairs but, in contrast, uses (nearly) all price data that is available for the period under observation. Since the majority of the houses sold during the observation period were not sold during the index reference or base period, there is a general shortage of transaction prices for the base period. The base period prices are therefore estimated using appraisals of the houses. In the Netherlands official government appraisals are collected under the Real Estate Law [Wet waardering onroerende zaken]. In contrast with a repeat sales index, the SPAR index is not revised when data for new periods is added. Bourassa *et al.* (2006) "maintain that the advantages and the relatively limited drawbacks of the SPAR model make it an ideal candidate for use by government agencies in developing house price indexes."

Price indexes can be either value weighted or equally weighted. A value-weighted price index explicitly or implicitly weights the indexes of individual dwellings by their base period prices (values). The literature stresses that the choice between a value weighted and an equally weighted index should depend on the aim of the index (see e.g., Wang and Zorn, 1997). Our focus

is on an index that aims at measuring the price change of the owner-occupied housing stock, and the weighted (arithmetic) variant of the SPAR method seems a suitable choice. Some users, on the other hand, may wish to have a price index for a 'mean dwelling'.[3]

An unweighted (geometric) mean index, which arises for example from a standard repeat approach, might be more appropriate in that case. The intention of Kadaster and Statistics Netherlands, however, was to produce house price index numbers according to a single method.

The paper is organized as follows: Section 3.2 contains a brief review of the literature on two 'traditional' methods, hedonic modelling and the repeat sales method, and gives background information on the SPAR method. Section 3.3 argues that in the Netherlands individual property appraisals can be used for constructing the SPAR index and presents some empirical evidence on their reliability. Section 3.4 compares repeat sales and SPAR index numbers. Section 3.5 concludes.

3.2 Three approaches to measuring house price indexes

Houses are sold infrequently and the composition, or 'quality mix', of the properties sold usually varies substantially from period to period. This introduces bias in simple price index measures such as the mean or median. For example, if in the current period a disproportionate number of high-priced houses were sold, then the mean or median price would rise, even if not a single house had increased in value (Case and Shiller, 1987). This drawback has led to the development of alternative methods, particularly to hedonic and repeat sales methods. An advantage of the hedonic approach over other methods is that, at least in principle, it can adjust for quality changes of the individual properties.

3.2.1 Hedonics

Hedonic regression models were initially used to separate price and quality changes in capital goods and for durable consumer goods such as cars to calculate quality-adjusted price indexes (see e.g., Griliches, 1971). Later, hedonic modelling came to be widely used in housing market research (Mason and Quigley, 1996). A hedonic model expresses the price P_{it} of house i in period t as a function of a set of physical (and possibly also other) characteristics, Q_i, and

3 This most likely holds for the Dutch central bank that requires financial institutions to specify their risks by estimating the actual liquidation value for every single dwelling in their mortgage portfolio.

time *t*:

$$P_{it} = f(Q_i, t) \tag{1}$$

The hedonic coefficients can be interpreted as shadow prices which reflect the value of a characteristic.[4]

For example, an extra room will push up the value of the property by a specific amount. Specifying the correct functional form and including the correct set of quality characteristics is an essential element of hedonic modelling. Mason and Quigley (1996) argue that the functional form assumption is particularly awkward in the housing context because the hedonic price function summarizes not only consumer preferences and production technologies but also various quantities which are historically determined, hard to measure, and inaccessible to economic theory (see also de Vries and Boelhouwer, 2005). They furthermore argue that the existence of sub-markets might go some way towards explaining why the standard hedonic specification may not work. Despite the drawbacks, researchers have examined numerous datasets and model specifications to determine the marginal effect of housing characteristics on house prices and to construct house price indexes. For a recent review, see Sirmans *et al.* (2005).

In the Netherlands, the prices of all houses sold are recorded by the Dutch Land Registry Office. Unfortunately, dwelling characteristics other than built surface area and type of dwelling (detached house, corner house, terraced house, semi detached house) are not registered. This prevents the use of hedonic modelling for the construction of quality-adjusted house price indexes.

3.2.2 Repeat sales

The repeat sales model is extensively addressed in the literature (see Bailey *et al.,* 1963; Case and Shiller, 1987, 1989; Goetzmann, 1992; Calhoun, 1996; Dreiman and Pennington-Cross, 2004), so a brief description will suffice here. Bailey *et al.* (1963) laid the foundations for the repeat sales method. As the name already suggests, the repeat sales approach models the price changes of houses that are repeatedly sold. Essentially, it uses a collection of prices

4 The multi-period time dummy variable hedonic price index seems to have dominated the literature. There are other types of hedonic indexes that may be more suitable. Hill and Melser (2007) argue that 'double' hedonic imputation might be a better choice: the characteristics parameters are allowed to change over time, and this method seems to be less prone to omitted variables bias. However, just like repeat sales indexes (see Section 3.4), multi-period time dummy indexes are subject to revision – they violate 'temporal fixity'. Nevertheless, the advantage of the multi-period time dummy method is its efficiency since data across different time periods are pooled.

paid for single properties at different points in time to estimate a vector of numbers that best explains the observed price changes over the sample period (Abraham and Schauman, 1991). Specifically, it expresses the logarithm of the ratio of the house price P_{is2} in the second sale period s_2 and the price P_{is1} in the initial or first period s_1 ($s_1 < s_2$) as

$$\ln(P_{is2} / P_{is1}) = f(D_{it}) \quad (2)$$

where D_{it} is a set of time dummy variables. For the first sale of a particular house the time dummy has the value -1, for the second sale it has the value +1. All other dummies have the value 0.

Case and Shiller (1987) proposed the weighted repeat sales method, an adapted version of the unweighted method described by Bailey *et al.*(1963). They argue that the longer the holding period becomes, the greater the variance in individual house price change will be. This type of heteroskedasticity may undermine the efficiency of the repeat sales index (Wang and Zorn, 1997). Calhoun (1996) distinguishes three stages in the estimation of the weighted repeat sales model. In the first stage the original model of Bailey *et al.* is calculated. The second and third stages aim to improve the efficiency of the first-stage parameter estimates, accounting for the possibility that the estimation error is positively related to the time interval between subsequent transactions.[5]

3.2.3 SPAR

The Sale Price Appraisal Ratio (SPAR) method has been applied in New Zealand since the early 1960s. It is advocated by Bourassa *et al.* (2006) as an alternative approach to measuring house price indexes. Like repeat sales methods, the SPAR method is based on matched pairs but, in contrast, uses (nearly) all price data that is available for the period of observation. Since the vast majority of houses that are sold during the current period were not sold during the index reference or base period, there is a lack of transaction prices for the base period. The base period prices are therefore estimated using (official government) appraisals of the properties.

De Haan *et al.* (2008) indicate that there are various types of SPAR indexes; they can be either value weighted or equally weighted. If an equally weight-

5 Jansen et al. (2008) found that heteroskedasticity was of little importance in the Dutch data – the amount of explained variance was less than one percent. They also encountered a problem with the weights necessary to correct for heteroskedasticity. In conclusion, Jansen *et al.* (2008) argue that the original repeat sales method of Bailey *et al.* (1963) seems more appropriate for calculating a house price index in the Netherlands than its weighted counterpart.

ed index is preferred, the geometric variant would be the best choice. For an index that tracks the changes in the value of the housing stock, in which we are particularly interested here, the weighted arithmetic variant seems a natural choice. The value-weighted arithmetic SPAR index can be written in the following three ways:

$$I_{SPAR,t} = \frac{\sum_{j=1}^{n_t} P_{jt} \Big/ \sum_{j=1}^{n_t} A_{j0}}{\sum_{i=1}^{n_0} P_{i0} \Big/ \sum_{i=1}^{n_0} A_{i0}} = \frac{\sum_{j=1}^{n_t} w_{j0} \left(\frac{P_{jt}}{A_{j0}} \right)}{\sum_{i=1}^{n_0} w_{i0} \left(\frac{P_{i0}}{A_{i0}} \right)} = \left[\frac{\sum_{i=1}^{n_0} A_{i0} / n_0}{\sum_{j=1}^{n_t} A_{j0} / n_t} \right] \frac{\sum_{j=1}^{n_t} P_{jt} / n_t}{\sum_{i=1}^{n_0} P_{i0} / n_0} \tag{3}$$

where P_{jt} and P_{i0} denote the transaction prices for houses j and i in the current period t and the period 0 in which the houses were valued (the appraisal or base period); A_{j0} and A_{i0} are the respective appraisals; n_t and n_0 are the number of houses sold in period t and 0 (the sample sizes). The second expression on the right-hand side of Eq. (3) shows the basic idea behind the value-weighted SPAR index. In the numerator a price change is computed for each house sold in period t as the ratio of the actual transaction price and the appraisal. These house-specific price ratios are then weighted by their (base period) value share $w_{j0} = A_{j0} / \sum_{j=1}^{n_t} A_{j0}$ which explains the name 'value-weighted index'. Thus, more valuable houses have a greater impact on the index than less valuable houses. The denominator of (3) is a scaling factor, independent of time t, which is needed to make the index equal to 1 in the base period. It can alternatively be interpreted as a factor that corrects the numerator for possible over-estimation or under-estimation of the appraisals with respect to the transaction prices. Obviously, the denominator of (3) goes to 1 if in period 0 the appraisals would approach the transaction prices.[6]

The third expression on the right of (3) shows that the value-weighted SPAR index can also be viewed as the product of the simple ratio of mean transaction prices and a factor between square brackets. This bracketed factor is a ratio of mean appraisals and adjusts the ratio of mean sale prices for compositional change. In practice it may be desirable to apply the SPAR method to relatively homogeneous strata, since stratification by itself reduces the effect of compositional changes.

Though the SPAR method controls for changes in the quality mix of the sample, it does not control for quality changes of individual houses; the same goes for the repeat sales approach. It has been suggested that we adjust the

6 The underlying assumption of the SPAR method is in fact that a linear relation through the origin exists in the base period between appraisal values and transaction prices for all houses sold in both the base period and the current period. See also Section 3.3, where we address the reliability of the Dutch appraisals.

valuations to take account of home improvements that require planning permission. Unfortunately, such adjustments are infeasible in the Netherlands because planning permission data are available only at aggregate (project) level and not for individual dwellings. Note that the SPAR method (as well as the repeat sales method) automatically controls for location as it is based on the matched pairs principle. This is an advantage compared to the hedonic method where it is often difficult to control for micro location.

3.3 Representativity of the data

To estimate repeat sales and SPAR house price indexes, we exploited the dataset of the Dutch Land Registry Office. We call this dataset the 'transaction dataset'. For the SPAR method, in addition we used an 'appraisal dataset' with official appraisal values from the municipalities. An important question of course is whether the quality of the appraisals is satisfactory. Before explaining how the appraisals were determined and presenting evidence on their reliability, we first describe the transaction dataset.

3.3.1 Transaction dataset

Our (national) transaction dataset contains data on approximately 2.7 million individual transactions regarding second-hand, or resold, houses between January 1995 and March 2009.[7]

A number of transactions were removed for reasons of validity. We applied price limits between 10,000 and 5 million euros. Dwellings that were sold more than twice in the same month were excluded. For the SPAR index, dwellings for which the corresponding appraisal values could not be found due to problems with merging the data files, could of course not be used. For the repeat sales index, dwellings with an extremely large surface area (over 1000 square meters) were excluded. Obviously, only dwellings sold twice or more could be used here, pertaining to about half of all transactions.

The literature suggests that repeated transactions with a short time interval might be 'unusual' in the sense that they may be distressed sales arising from, for example, divorce or job loss or that they may be speculative transactions (Englund *et al.*, 1998; Steele and Goy, 1997; Clapp and Giacotto, 1999). In the Netherlands no conveyance tax needs to be paid on a house that is resold within 6 months. Jansen *et al.* (2008) have shown that a number of speculative sales took place during the boom between 1998 and 2001. Clapp and

7 Transactions for newly built houses are not recorded by Kadaster. That s, houses have to be resold before they enter the transactions dataset.

Giacotto (1999) and Steele and Goy (1997) suggest eliminating very short holds from the dataset. Jansen *et al.* (2008) explored the potential impact of such very short holds by calculating the monthly growth rate for each house sold. The mean growth rates were 8.2 percent, 5.2 percent, 1.2 percent and 0.9 percent for houses sold within 6 months, within 12 months, within all periods, and between 12 months and the end of the period, respectively. Thus, houses resold within 12 months typically realize a huge increase in value per month, which can potentially bias the index.

3.3.2 Appraisal dataset

In the real estate literature there has been some discussion about appraisal values and their use in house price measurement (Geltner, 1991; Edelstein and Quan, 2006; Leventis, 2006). Most studies are based on appraisals of dwellings that are about to be re-financed. That is why, in general, the findings suggest that appraisals tend to be positively biased – they tend to overpredict the actual selling price of the property (Leventis, 2006). In the Netherlands official appraisals are collected under the Real Estate Law [Wet waardering onroerende zaken] for tax purposes, not for re-financing. Dutch households pay local tax according to the value of their dwelling. Households who feel that the appraisal value is too high may lodge an appeal. Though legally appraisals should reflect the market values of the houses, we expected local authorities to underestimate them in order to avoid court procedures. So initially we assumed that the appraisal values would tend to under-predict the market values of the properties. However, an investigation into this issue proved us wrong (van der Wal *et al.,* 2006; de Vries *et al.,* 2006). Dutch municipalities are legally obliged to have up-todate estimates of the value of each real estate object in January 1995, 1999, 2003, 2005, and 2007. As of January 2007, houses are appraised on an annual basis. Appraisal values are determined ex post. For example, preliminary appraisals for January 2007 were determined at the beginning of 2008. The definitive values were available at the end of 2008 after taking into account any appeals lodged by home-owners.[8]

At the time of this study, appraisals for 2008 were thus not yet available, so we distinguish five appraisal periods when computing SPAR index numbers (van der Wal, 2008). The records need continuous updating to be complete and 'correct'.

The entire process is monitored on the government's behalf by Council for Real Estate Assessment, the *Waarderingskamer*. There is no prescribed meth-

8 As the appraisals are determined ex post, they include home improvements carried out between the date of valuation (for example January 2007) and the date upon which the property was accorded an official value (here at the end of 2008)

Table 3.1 Difference between real house prices and appraisal values

Appraisal date	Mean A_j	Mean rP_j	Fraction rP_j/A_j	Change in standard deviation	R^2
January 1995	€87,607	€90,538	€0.968	16.2%	0.903
January 1999	€133,901	€130,532	€1.026	11.4%	0.940
January 2003	€202,695	€200,167	€1.012	10.7%	0.951

Source: Kadaster Netherlands, computation OTB Research Institute (TU Delft) and Statistics Netherlands

od of appraisal, but most municipalities appraise the objects using (hedonic type) valuation models in combination with visual inspections and local market information. For privacy reasons we are not allowed to publish research findings based on appraisal data without explicit permission from the Dutch municipalities – it is they who own the appraisals. For this study all municipalities in the province of Overijssel, except Hengelo and Dinkelland, granted us permission to publish the results, using definitive appraisal values for 1995, 1999, and 2003. Unpublished research has shown that our results are representative for the Netherlands as a whole.

A problem when comparing the current sale price P_{it} and the appraisal value A_{i0} is the difference in observation period. We therefore computed a 'real' house price, RP_{i0}, using the repeat sales house price index (HPI) which was published by Kadaster until January 2008[9]:

$$RP_{i0} = (HPI_0 / HPI_t) P_{it} \tag{4}$$

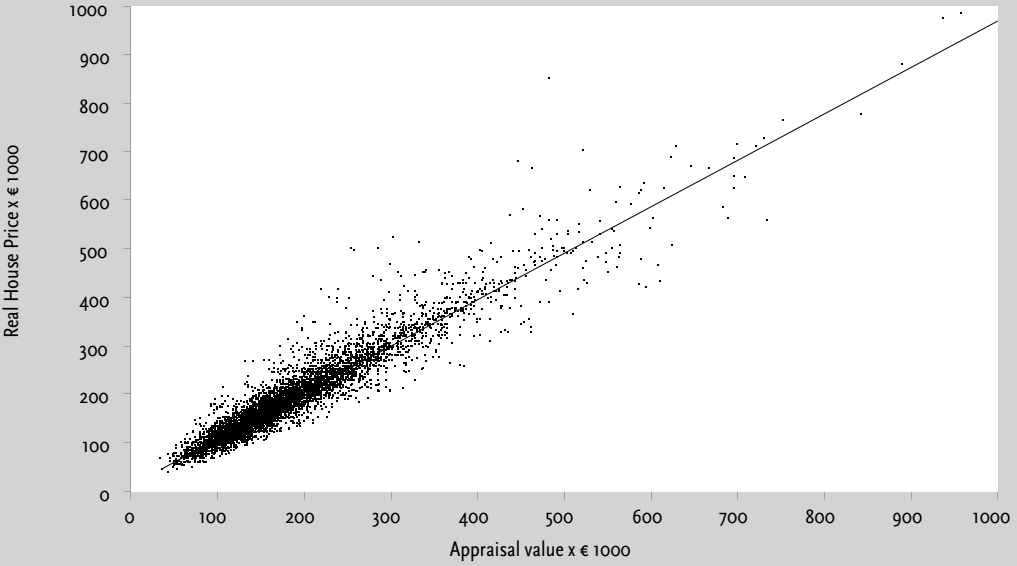
The scatter plot in Figure 3.1, which is based on data of January 2003 for the Province of Overijssel, shows the coherence between these values. For the SPAR approach to work well, the relation between appraisals and actual (real) house prices should be linear with a zero intercept term (apart from any random disturbances). The linear regression line is also shown in Figure 3.1. The line almost crosses the origin, and the fit is satisfactory with an R^2 value of 0.91. For 1995 and 1999 the R^2 values are slightly lower: 0.86 and 0.88.

We conducted another simple but efficient comparison of the real house prices and the appraisals, again for January 1995, 1999, and 2003. The percentage differences between the mean appraisal and the mean real house price declined over time, indicating that the reliability of the appraisals has improved (Table 3.1). The decrease in the standard deviation endorses these findings. In the first period, the appraisal value underestimated the price by more than one percent on average. In the second period, starting in 1999, the appraisal values overestimated the sale prices, but the absolute difference between the transaction prices and the appraisals and the standard deviation decreased considerably. The same pattern is observable in the third period.

Finally, we analyzed the ratio F_{i0} of the real house price and the appraisal value:

9 The repeat sales house price index, published by Kadaster, has been calculated by OTB Research Institute for Housing, Urban and Mobility Studies. For this study, we extended the time series to March 2009.

Figure 3.1 Real house prices and appraisal values in January 2003



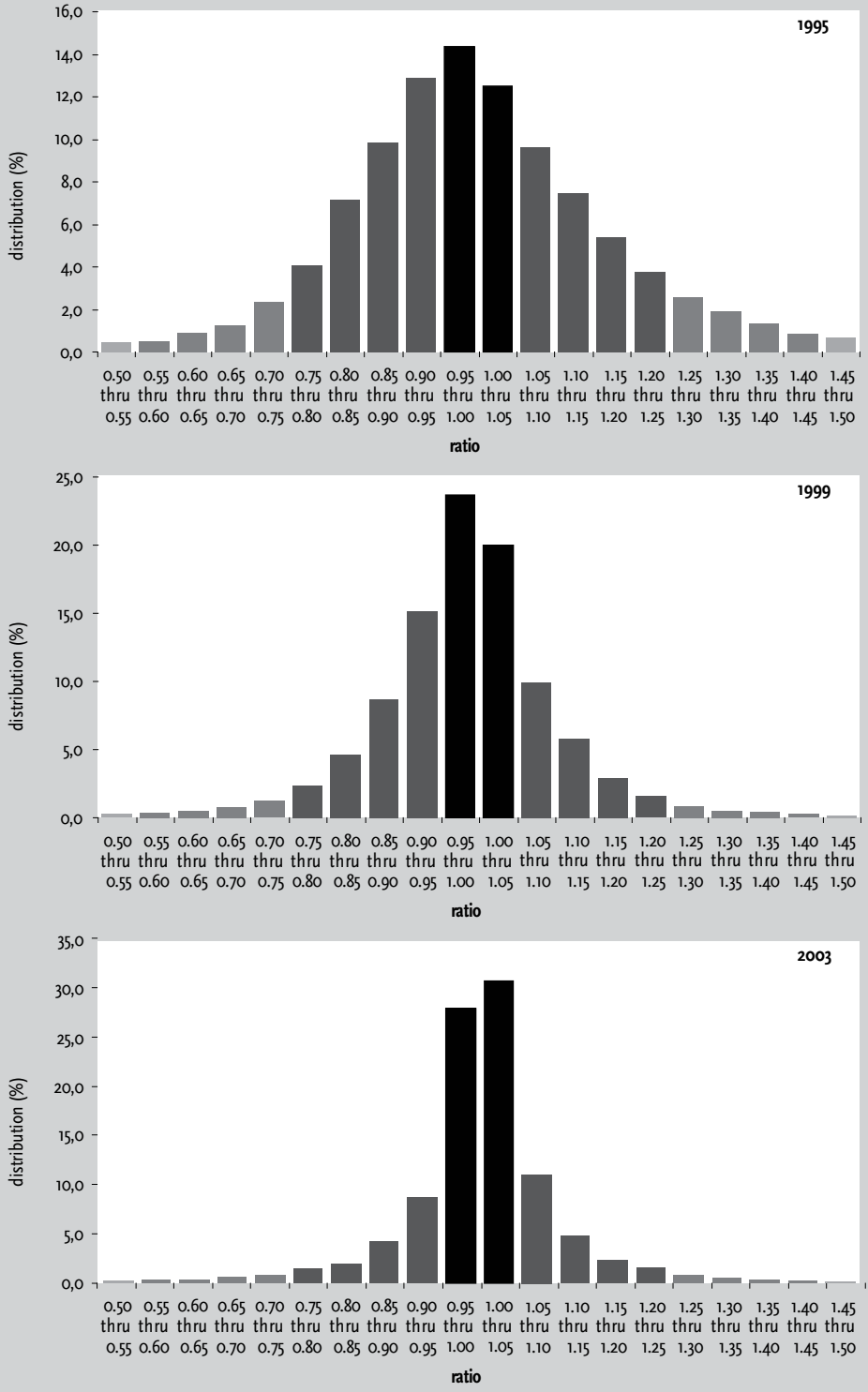
Source: Kadaster Nederland, computation OTB Reserach Institute and Statistics Netherlands (10% sample)

$$F_{i0} = (RP_{i0} / A_{i0}) \tag{5}$$

In line with the principles of the Dutch Real Estate Law, we expect the ratio F_{i0} to be approximately equal to 1. Figure 3.2 depicts the distribution of the ratios for each appraisal date using 20 classes of equal size on the x axis. The two middle classes (0.95–1.00 and 1.00–1.05) are in black to indicate the anticipated mid-point. The three graphs show that the distribution became increasingly steeper over time, indicating that more and more dwellings acquired a 'normal' fraction. In 1995 the ratio F_{i0} was between and 1.10 for only 56 percent of all properties while it rose to 79 percent in 2003. Thus, the (real) house price and the appraisal value have drawn closer together.

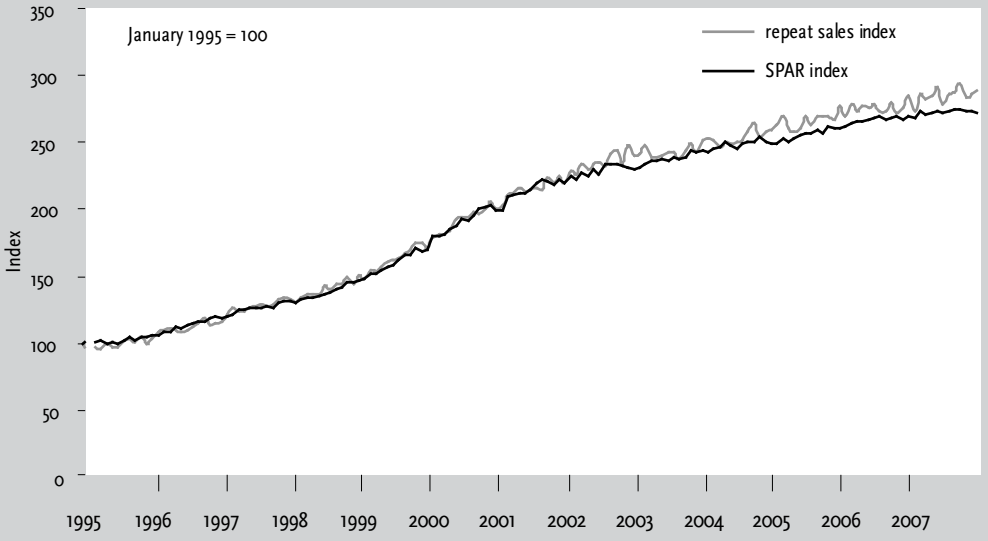
We believe that the quality of the official Dutch appraisals – certainly as of January 2003 – is sufficient for calculating a house price index based on the SPAR method. The quality has undoubtedly improved over time, which should have a positive impact on the statistical accuracy of the resulting SPAR indexes. Note that we excluded unrealistic ratios between sale prices and appraisals, which might bias the SPAR index, by using a minimum value for the sale price of 10,000 euros and a maximum value of 5 million euros. This largely eliminates questionable transactions.

Figure 3.2 Distribution of the ratio of real house price appraisal value in the province of Overijssel (the Netherlands)



Source: Kadaster Nederland, computation OTB Research Institute and Statistics Netherlands

Figure 3.3 House price indexes for the province of Overijssel (the Netherlands), January 1995-December 2007



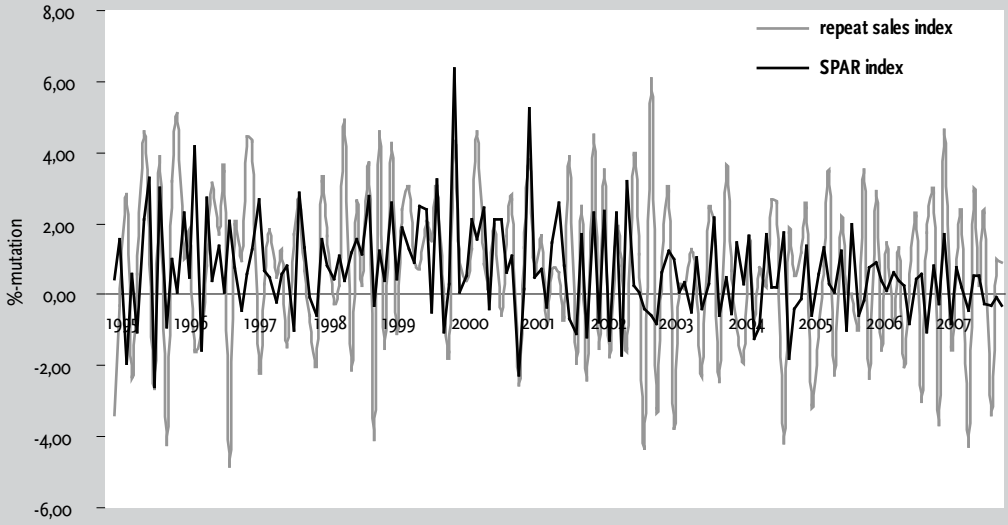
3.4 A comparison of SPAR and repeat sales index numbers

3.4.1 Trends and fluctuations

For the province of Overijssel we computed value weighted (arithmetic) SPAR indexes and (geometric) repeat sales indexes; the repeat sales method is comparable to that used for the OFHEO house price index (Calhoun, 1996). Unpublished research has confirmed that our findings are representative for the Netherlands as a whole. The two indexes are shown in Figure 3.3 for January 1995 to March 2009. Like in most countries (and in other provinces in the Netherlands), house prices increased very rapidly. During the last couple of years house price appreciation slowed down and, probably influenced by the financial crises and the economic downturn, came to a stop in 2009. The SPAR and repeat sales index numbers exhibited quite similar trends until 2002. Since then, however, the SPAR method measures a much slower increase.

A striking feature of the SPAR index is that it is much less erratic than the repeat sales index. This becomes clearer from Figure 3.4, which depicts the month-to-month index changes. A possible explanation is the 'waste of data' that has frequently been cited as a drawback of the repeat sales approach – only data of houses that were sold twice or more (after January 1995 in our case) can be used. To compute the repeat sales index for the province of Overijssel we had 43,386 pairs of repeat sales, whereas for the SPAR index we used the data of all 159,894 sales that took place between January 1995 and March 2009.

Figure 3.4 Monthly %-change of the house price indexes for the province of Overijssel (the Netherlands), January 1995-December 2007



3.4.2 Precision

Figure 3.4 indicates that the SPAR method provides a more accurate picture of the short run house price changes than the repeat sales method. It would be interesting to know the statistical accuracy of the index numbers. The mean square error of an estimator – the square root of the sum of the variance and the squared bias – is an inverse measure of its accuracy: it measures how far the estimator is expected to be from the population target it is aiming at. Here we focus on the variance component, or rather the square root thereof, the standard error (SE). This is an inverse measure of precision: the greater the standard error of an estimator, the lower its precision is. Using the standard errors we calculated 95 percent-confidence intervals around the estimated index values with bounds $I_{(.)t}$ *±1.96 x SE*. The width of the confidence interval gives an idea of the 'uncertainty' surrounding the estimates. Since the standard error depends on the sample size, a very wide interval may indicate that too few data were available to draw any definite conclusions about (changes in) the index values.

Standard errors and the corresponding 95 percent-confidence interval for the SPAR index were estimated using Taylor linearization techniques (see de Haan, 2007)[10].

The estimation of the confidence interval for the geometric repeat sales (RS) index is less straightforward. The index number $I_{RS;t}$ is estimated by (Cal-

10 It is assumed that the sets of houses sold in different periods are independently drawn random samples from the housing stock. Furthermore, we assume that the relative distribution of the sale prices in the base period and current period is equal to the distribution of the appraisals (in the base period).

houn, 1996)

$$I_{RS,t} = \exp(\hat{\hat{\beta}}_t)(\times 100) \tag{6}$$

where $\hat{\hat{\beta}}_t$ denotes the estimated parameter from a generalized least squares regression. The corresponding standard error is

$$\sigma_{I_{RS,t}} = I_{RS,t}\sigma_{\hat{\beta}_t} \tag{7}$$

where $\sigma_{\hat{\beta}_t}$ pertains to the standard error of the estimated coefficient from the third step of the generalized least squares regression.

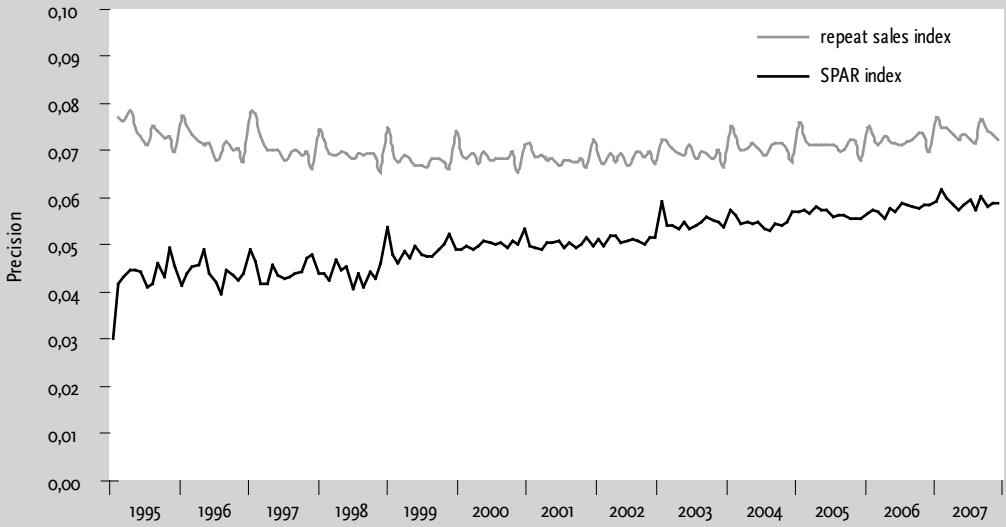
Since the magnitude of the standard error depends on the level of the index, a relative measure of precision would be more appropriate. One such (inverse) measure, $PREC_t$, is obtained by dividing the width of the confidence interval, W_{Ct} , by the index number (and multiplying by 100):

$$PREC_t = (W_{C_t} / I_{(.),t}) \times 100 \tag{8}$$

Figure 3.5 displays the precision of both price indexes according to this relative measure. The SPAR index was more precise than the repeat sales index across the entire period. At first glance, this seems obvious given that the SPAR index utilizes all data. But there is a caveat. Each time houses were revalued – in our case in January 1999, January 2003, January 2005, and January 2007 – a new short-term SPAR index series was compiled, based on the most recent appraisal values. The five short-term series were subsequently multiplied to obtain the long-run series that is shown in Figure 3.3. This type of 'chaining' will in general raise the standard error of the long-run SPAR series because each time a new source of sampling error, and maybe also non-sampling error, is added (see also Shi, 2008, who describes something similar). This cumulative effect can be seen in Figure 3.5: the precision clearly decreases in subsequent valuation periods.

If the 'uncertainty' of the chained SPAR index increases over time, why do we use the newly available appraisals in the first place? Why not stick to the old ones and compute a direct, unchained index? The reason is that newly built houses that are resold can only be incorporated through chaining as, by definition, they have not been valued in the past. A direct SPAR index would thus become less and less representative for the (changing) housing stock. Furthermore, it would have been strange not to benefit from the improved quality of the appraisals, the more so because many users are interested in short-term house price movements rather than in very long time series.

Figure 3.5 Precision of the house price indexes for the province of Overijssel (the Netherlands), January 1995-December 2007



3.4.3 Cause and effect

There are three potential explanations for the difference in the trend of the two indexes. Firstly, the repeat sales approach leads to an index based on a geometric mean of the individual appreciation rates, whereas our SPAR index has an arithmetic structure. It is well known that a geometric index is smaller than its arithmetic counterpart unless all appreciation rates are the same (Wang and Zorn, 1997). To check this, we also estimated arithmetic repeat sales index numbers (Shiller, 1991). These indexes scarcely deviated from the usual geometric repeat sales index numbers. Conversely, geometric SPAR index numbers appeared to differ only marginally from the arithmetic SPAR numbers. Thus, in our dataset the effect of using geometric or arithmetic means was negligible.

Secondly, the two indexes are computed from different samples. The SPAR index uses all transaction data, whereas the repeat sales index only uses data of houses that have been repeatedly sold. The mean house price in the repeat sales dataset was approximately 8 percent lower than the mean house price in the SPAR dataset. Jansen *et al.* (2008) observed that Dutch properties resold within short time intervals appreciate at a higher rate than properties resold within longer time intervals (see also Clapp and Giacotto, 1999). In a repeat sales index, after additional sales come available, new matched pairs of houses provide additional information about price changes beyond that found with the previous data. Since these properties apparently appreciate at a lower rate, we would expect the revised repeat sales index numbers to be lower than the initially computed numbers. Put differently, we expect the repeat sales index to be revised downwards as time passes and to come closer to the SPAR index. In an earlier paper (van der Wal *et al.*, 2006) it was shown that

this revision effect is indeed important: a SPAR index re-calculated on the repeat sales dataset was much less different from the repeat sales index than the original SPAR index.

Thirdly, our SPAR index is value weighted, whereas the repeat sales index is unweighted. As long as cheaper houses undergo the same price change as more expensive houses, weighting does not matter. However, there is some evidence that more expensive houses appreciated less than cheaper ones, which has a downward effect on a value-weighted index (van der Wal *et al.*, 2006).

3.5 Conclusion

This paper reports on a project to develop a house price index for the owner-occupied sector. Some special institutional features of the situation in the Netherlands contributed to the choice of index number method. The SPAR approach to constructing a house price index has been used in New Zealand since the early 1960s and is also applied in Sweden and Denmark. Recent experiences in Australia with the SPAR method are promising as well (Rossini and Kershaw, 2006). Like the repeat sales method, the SPAR method is an alternative to hedonic methods when insufficient data is available on the characteristics of dwellings. In their standard form, both methods have at least two things in common: they are based solely on price changes of matched pairs, and thus adjust for compositional change, but they make no adjustment for changes in the quality of individual dwellings. Sample selection bias is most likely to be smaller for the SPAR index than for a repeat sales index as the latter excludes houses that have been sold only once. Also, SPAR index numbers are not subject to revision. From a practitioner's point of view the simplicity and transparency of the SPAR method can be seen as an advantage.

Two main results emerge from our study.

- The quality of the official Dutch appraisal values, while subject to certain limitations, is sufficient enough for computing a SPAR index.
- For the Netherlands the difference in trend between the (geometric) repeat sales index and the (value-weighted arithmetic) SPAR index is not negligible in the long run. In the shorter run, the SPAR index is less volatile and more precise than the repeat sales index.

From May 2005 to January 2008 the Dutch Land Registry Office, published house price indexes based on the repeat sales index method. Based on the results of this study, Kadaster decided to change over to the SPAR index, which is computed monthly by Statistics Netherlands. As of January 2008 the two organizations jointly publish SPAR house price index numbers for the whole country and for different types of dwellings and regions.

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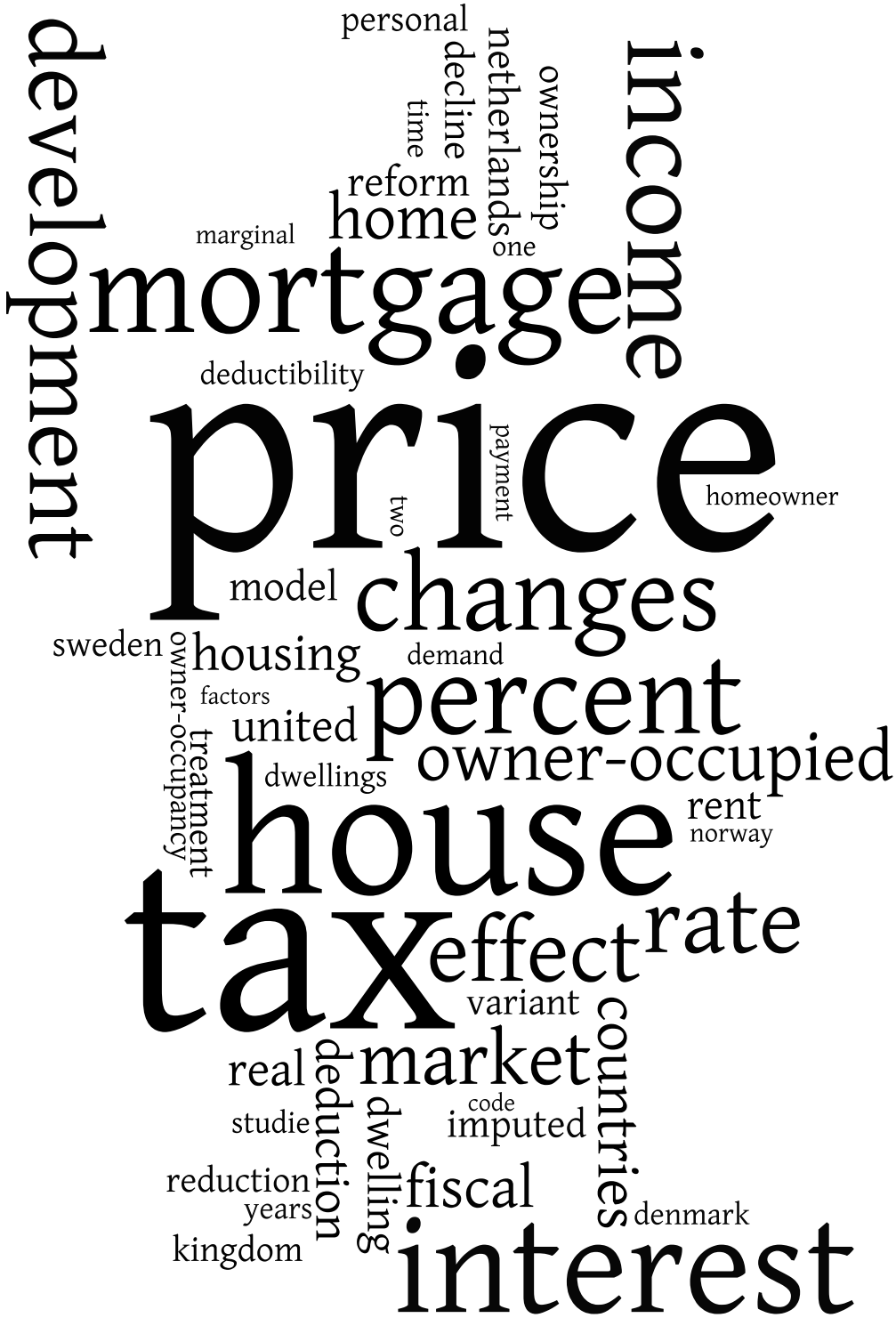
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4 House prices and income tax in the Netherlands
An international perspective

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Abstract
A sharp drop in prices on the home owner market is not only hard to predict but also the reason why many politicians would prefer to implement any tax changes gradually, if at all. Against this backdrop, the present study explores the relationship between a change in the personal income tax treatment of home ownership and a change in house prices. First, based on a literature study, it identifies the factors in the development of house prices. Then, using data from several European countries, it compares the effects of personal income tax reform on the development of house prices. As the comparison reveals, the method and timing of adjustments in the tax system have a strong influence on house price development. Furthermore, econometric modelling of the Dutch home owner market suggests that when the restrictions on tax concessions are less stringent, the real decline in house prices is not as steep and does not last as long.

4.1 Introduction

The recession of the late 1980s and early 1990s compelled many European countries to start rounds of austerity measures. In parallel with these measures, they usually carried out a general tax reform. Their intention was to combat unemployment by lowering the rates for personal income tax. The foregone tax revenues were to be compensated (in part) by expanding the base for personal income tax. In practice, this usually meant restricting the deductibility of mortgage interest payments, thus a revision of the treatment of home ownership. Despite the similarity of their actions, European countries differ remarkably in their tax treatment of home ownership. The differences are not only due to their specific starting positions in the tax system; their housing market situations and their interventions in the tax code have also differed. For instance, the UK and the Netherlands are polar opposites with respect to the mortgage interest relief and imputed rent taxation. Whereas the British home owner is not entitled to a mortgage interest deduction and there is no imputed rent taxation, both are a part of the Dutch tax system.

When a country permits the deduction of mortgage interest payments (mortgage tax relief) when filing personal income tax, home owners pay less for mortgage financing. In turn, the mortgage expenses determine the effective demand exerted by housing consumers. Thus, these expenses affect the price of owner-occupied dwellings. Changes in the way the owned home is treated in personal income tax will thus have immediate repercussions on

the way the home owner market operates. Indeed, this is the central topic of this paper: the relation between these repercussions and a change in the way home ownership is treated in personal income tax. The research question is as follows: how could changes in the regime of personal income tax for home owners influence the price development of owner occupier dwellings? Ultimately, this paper answers this question for the Netherlands, approaching it from three angles: theory, the experiences of other countries and model calculations for the Netherlands (Boelhouwer *et al.,* 2001).

Specifically, from a theoretical perspective, the next section of the paper first considers the role that taxation and other factors play in price changes on the home owner market. The following section considers how several European countries treat home ownership in their tax code. Eight countries were selected for this purpose: the Netherlands, Belgium, Denmark, Germany, France, Norway, the UK and Sweden. The analysis focuses on the changes in personal income tax with regard to the treatment of home ownership over the past two decades. The fourth section takes a closer look at the possible effects of an income tax change on the development of prices for owner-occupied dwellings in these countries. The next section presents an econometric analysis of how a change in personal income tax affects house prices in the Netherlands. For that analysis, two scenarios of tax change have been worked out. In the final section, the obtained insights are applied to answer the research question as stated above.

4.2 Theory

This section presents a typology of studies of house price development and briefly comments on the various explanations that have been offered for the changes in the development of prices for owner-occupied dwellings. As income tax changes are national policy, the focus here is on studies from the perspective of the (local) housing market as a whole, thus the macro house price development.

The studies that have been conducted so far on house price development may be placed under two headings: modelling studies, which are strongly oriented toward econometric analysis and descriptive studies, which view the development of house prices from a qualitative housing market perspective. The great majority of studies analyse the development of house prices for the whole country or at the level of the region or urban agglomeration. The material on which these analyses are based consists of statistics at the national and local level. Studies that compare the price development in different countries based on international statistics are few (see for instance Ball & Grilli, 1997). Some studies give an overview of findings from various countries, comparing the results and methods of analysis that have been used (see

for instance Meen, 1998, 2002).

4.2.1 Neo-classical Price Theory

Based on neo-classical economic theory, it may be assumed that in a well-functioning housing market, the long-term price development of dwellings will be determined by the development of construction costs. When scarcity (oversupply) causes prices to rise (decrease) in the short term, the supply of newly-built houses will increase (decrease) slowly. An expanding supply puts pressure on the price level (the opposite will occur when demand declines), which leads to a new equilibrium price on the housing market in the longer run.

The literature casts the relation between the development of construction costs and that of house prices in a leading role in the development of house prices (for an overview of the literature, see Meen, 1998, 2002). In the 1970s, many studies were carried out on this relationship, particularly in the UK. These studies show that house prices fluctuate much more than construction costs and that there is hardly any evidence of a direct statistical relation between the two variables. The most probable explanation for the absence of a relationship is that housing supply is inelastic because of spatial planning and thus reacts insufficiently to changes in the demand for owner occupier dwellings. Another plausible explanation is that the development of house prices is primarily influenced by the equilibrium in the existing stock, while new construction has a minor effect.

Interestingly, econometric studies carried out in the US do actually demonstrate a significant relation between the development of the construction costs and the house prices (Abraham & Hendershott, 1996). This result lends credence to the assumption that as the government exerts less influence and building land is available without many restrictions, the relation between the development of house prices and that of construction costs will increase.

4.2.2 Speculative or psychological effects

The development of house prices has also been explained in terms of speculative or psychological effects (see, among others, Abraham & Hendershott, 1996; Hort, 1998; Levin & Wright, 1997; Malpezzi, 1999; Meen, 1998; Reichert, 1990). Along with the effects of the slow adjustment of the market for newly-built homes, as mentioned above, the psychological effects explain why prices fluctuate, sometimes widely, in the short term. The underlying idea is that the recent development of house prices also exerts an influence on future demand for owner occupier dwellings. Obviously, when prices are rising, the consumer will want to act swiftly. In an expanding market, the sooner a decision is made, the sooner one can profit from capital gains. Such calculating

behaviour on the part of the home buyers will have the opposite effect when the prices are decreasing; the consumer will postpone the decision to buy as long as possible in order to avoid incurring a capital loss.

4.2.3 Economic developments

The third explanation for the development of house prices lies in the state of the economy. Economic developments play a role in both the short term and the middle range. For instance, real income (be it permanent or temporary, personal or household), inflation and mortgage interest rates (both real and nominal) are taken as explanatory variables in the development of house prices (see, among other sources, the study by Reichert, 1990, mentioned earlier).

4.2.4 Demographic factors

Another explanation for the development of house prices is found in demographic factors. It is acknowledged that most of their impact shows up in the long term, but opinions differ on the magnitude of their effects. This is illustrated by Meen's (1998) comments on the study by Mankiw & Weil (1989), who explain the development of house prices in the US entirely in demographic terms. Based on their findings, these authors predicted that real housing prices in the US would have declined 47 percent by 2007. Not surprisingly, these findings caused quite a stir. Afterwards, a great deal of criticism was levelled at the operationalisation of this model; investigations in other countries did not find similar relations. Despite this criticism, however, demographic factors remain important in any analysis of the development of house prices.

4.2.5 Institutional policy

The fifth explanation of the development of house prices is structural in nature; it is sought in the policy of government and key institutions (see, among others, Abraham & Hendershott, 1996; Muellbauer & Murphy, 1997). For example, this type of explanation cites the important role that government plays by releasing sufficient amounts of building land (Winky & Ganesan, 1998) and in implementing spatial planning policy.

In addition, access to capital and the conditions under which households can borrow money play an important role. Meen (1998), for instance, draws the conclusion that in both the UK and the US, access to capital has affected house prices in the past. Since the 1980s, however, financial markets have been largely liberalised, and restrictive rules on eligibility for mortgages have lost much of their impact. In reaction, the influence of exogenous factors such as the development of income and interest rates has increased (see,

among others, Muellbauer & Murphy, 1997).

Tax regulations can play a significant role in government policy. Various studies have explained the development of house prices in terms of the influence of income tax regulations (see, among others, the above-mentioned review studies by Meen, 1998, 2002). In particular, governments are deeply concerned about the relation between abolishing the mortgage interest relief and a strong decline in house prices.

In a recent article on the situation in the US, Bourassa & Grigsby (2000) consider which income tax concessions for home ownership could be abolished. They argue as many others do (see for instance Glaeser & Shapiro, 2002), that the deductibility of mortgage interest does little to stimulate home ownership; moreover, they believe that this concession puts large sums of money in the pockets of those who need it least, namely higher-income households.

According to Bourassa & Grigsby (2000), the degree to which fundamental changes in the tax treatment of home ownership impact the development of house prices depends greatly on the extent to which the existing tax advantage is capitalised in the house prices. These authors cite recent calculations that place the rate of capitalisation for the US around 14 percent. Thus, if mortgage interest payments are no longer deductible, the effects on house prices may be expected to be just as modest.

Other calculations to which Bourassa & Grigsby (2000) refer suggest that drops in house prices could be steeper. The decline in house prices due to the simultaneous termination of the home mortgage interest deduction and the real estate tax deduction in personal income tax in the US is estimated to be between 10 and 20 percent. According to these estimates, the greatest losses would occur in expensive cities such as Boston (over 15 percent) and San Francisco (more than 20 percent).

Bourassa & Grigsby (2000) argue that the effect of capital losses will be felt in the top segment of the owner-occupied market because that is where the interest deduction is quite high; demand for owner-occupied dwellings would then shift to houses in a lower price range. This diverted demand would be directed toward the middle segment of the housing market. On the other hand, there would be a reduction in demand because lower priced dwellings have to be sought here too. At the bottom of the market for owner-occupied dwellings, the increased demand might cause the prices to rise.

In order to avoid disadvantageous effects, Bourassa & Grigsby (2000) propose abolishing the mortgage interest deduction in stages. A period of 15 to 20 years would be sufficient. On this basis, they suggest that the year to terminate mortgage interest deductions in the US would be 2021. Until then, everyone would still be able to deduct mortgage interest payments, and after that year, no one would.

Vandell (2000, p. 569) criticises their proposal: “I feel that rather than reducing the stock price effect, such a transition would instead simply delay it,

render it less noticeable by individual households over time." He concludes that households will, nonetheless, take action in anticipation of the change in policy.

Åsberg & Åsbrink (1994) have attempted to measure such proactive behaviour. They estimated the effects of income tax reform, all other things being equal, on house prices in Sweden. In their estimates, they distinguish between home owners' reactions to an expected and an unexpected revision in the tax code. If the home owners expect the revision, then a further distinction is made in the reaction, taking into account the timing of the announcement (1989) and the time at which the revision actually came into force (1991). In all three situations, the simulation calculations show a house price decline of less than 10 percent (8.7 to 9.9 percent) with inflation running at 2 percent. The unexpected revision in the tax code thereby leads to the greatest decline in house prices (9.9 percent). This is also the case when inflation is at 6 percent. In that event, the decline in the unexpected situation is estimated to be 25.4 percent. It is around 24 percent in the situation where the revision is expected (23.3 percent in the period of announcement; 24.7 percent from the moment of implementation).

In fact, no price response occurred when the reform of the tax system was announced; the price declines only set in after the tax reform had been implemented (1991). Real house prices dropped quickly, by 26 percent between 1991 and 1993 at inflation rates of 10.3 percent in 1991, 2.2 percent in 1992, and 5.7 percent in 1993. A 'lagged' response such as this raises some questions about whether the owner occupiers were actually able to understand the tax changes adequately and in good time. In this regard, it should be noted that in the Swedish case, the changes in the tax treatment of home ownership coincided with an overall reduction in taxes (see below). This implies that it would be hard to assess the degree to which owner occupiers understood how the changes would affect their income and housing expenditure.

4.3 The owner-occupied dwelling in personal income tax

This section gives an overview of the changes that have taken place in the personal income tax situation in the countries investigated; specifically, it deals with changes that are important to home owners. On the one hand, these changes may be specific to the own home; on the other hand, they may pertain to more general taxation measures that have a certain impact on the financing expenditure of owner occupiers. In the former case, specific adjustments are made in the tax treatment of the own home; this might entail a change in the mortgage interest deduction or in the taxation of the imputed rent of the own home. A general measure might be to lower the tax rates,

Table 4.1 Personal income tax treatment of homeownership and main policy changes in selected European countries

	Mortgage interest deduction		Imputed	Main policy changes	
	Maximum	Average	rent	Year	Content
Belgium	Marginal rate up to 55% max. 12 years	45%	Yes	1989	Reduction of highest rate. Repayment of principal (limited deductibility)
Denmark	Proportional rate	31%	No	1987	Dual system (reduction of highest rate
				2000	Imputed rent abolished and replaced by property tax
France	None	0%	No	1997	Mortgage interest deduction abolished for new homes
				1998	Mortgage interest deduction abolished for purchase and improvement
Germany	None	0%	No	1987	More room for deductions. Imputed rent abolished
				1996	Fiscal concessions terminated
Netherlands	Marginal rate up to 52%	39.5%	Yes	1990	Reduction of highest rate
				2001	Mortgage interest deduction limited to 30 years
Norway	Proportional rate	28%	Yes	1992	Dual system introduced (reduction of highest rate)
Sweden	Proportional rate	30%	No	1991	Dual system introduced (reduction of highest rate)
					Imputed rent abolished and replaced by property tax
United Kingdom	None	0%	No	As of 1991	Mortgage interest tax relief phased out

Note: Capital gains taxation is excluded from the table.

Sources: Boelhouwer *et al.* (2001); Haffner (2002); see also European Central Bank (2003)

although not necessarily in the framework of a general tax reform. Table 4.1 provides an overview of such changes that have taken place over the past 20 years in the countries studied. The taxation of any capital gains that may have accrued is not taken into account here because most of the countries do not impose such a tax on owner-occupied dwellings, whether or not by way of a special status for home owners (Boelhouwer *et al.,* 2001; Bourassa & Grigsby, 2000). Other tax measures are also excluded (such as the increase in VAT), which might compensate for or reinforce a certain change in the treatment of home ownership.

4.3.1 Dual versus global income tax

The reduction of the marginal income tax rates took two forms in the countries under review here. In the Netherlands (1990), Belgium (1989), Germany (1990), France (1990s), and the UK (1988), the tax code was not changed in principle. This means that a uniform system of income tax rates was in effect, regardless of the source of that income. A system such as this is known as global income tax. In contrast, the Scandinavian countries introduced a dual income tax system: Denmark (1987), Sweden (1991), and Norway (1992). Here income derived from capital (stock, saving accounts, housing etc.) is taxed differently and usually at a lower rate than income from other sources, such as earned income (Sørensen, 1994).

In 2001, the Netherlands in principle abandoned the systematic approach of a global income tax, since earned income was taxed at a rate that was not only progressive but also higher than the rate for income from capital, which was taxed at a proportional rate (Haffner, 2002). However, this strategy was not pursued with respect to home ownership. The deduction for mortgage

interest and the tax on imputed rent are still subject to progressive tax rates.

Overall, the marginal tax rates were lowered in all of the countries studied, whereby mortgage interest deductions were reduced (perhaps amounting to a gradual abolition of the concession?). This was compensated by an overall reduction in the tax burden in the Netherlands, Norway and Sweden. In Belgium, lowering the rates had to be financed in a budgetary neutral manner by broadening the tax base, among other measures.

4.3.2 Imputed rent

As of the year 2000, the Netherlands, Belgium and Norway (still) formally apply imputed rent taxation to home ownership. The UK and France no longer imposed tax on imputed rent, having abolished it in 1963 and 1965, respectively. The other countries abolished it more recently. Germany took this measure in 1987, Sweden in 1991 and Denmark in 2000.

The abolition of taxation on imputed rent in principle amounts to a reduction in the home owner's tax burden. While Sweden and Denmark abolished imputed rent, they also introduced or increased a property tax for home owners at the same time.

In Germany, the abolition of imputed rent went hand in hand with the termination of mortgage interest deduction, which had been restricted to the amount of imputed rent, and with the extension of allowances for depreciation and with the reduction of the tax bill for households with children. Overall, home owners came out ahead in subsequent years because both measures were expanded. Afterwards, restrictions were again introduced; higher-income groups in particular were excluded from the measures. In 1996, the owner-occupied dwelling was no longer eligible for tax concessions, which meant that a new regulation, outside the tax code but with a similar effect, was introduced.

Mortgage interest deduction

Two countries have increased the tax burden by abolishing the deduction for mortgage interest payments, namely France (in 1997–98) and the UK (2000). The French intervention was presumably fairly painless, in view of the fact that the mortgage interest tax credit was rather limited (one-fourth of the interest up to a maximum amount, taking the number of children into account, and eligibility for up to five years).

In the UK, it was a drawn-out process. The process started after 1983 when a maximum was placed on the deductibility of mortgage interest payments; the maximum was set on interest paid for a mortgage of £30,000 and was never increased thereafter. In 1988, the marginal tax rates were lowered from 60 to 40 percent. In 1991, the deductibility of mortgage interest was limited to the lowest rate of 25 percent; this rate was then slowly phased out until 2000.

Table 4.2 Real house price changes four years prior and after a major tax reform (yearly average %)

	Main policy changes	Real house price developments	
		Before	After
Belgium	1989	4.7	5.2
Denmark	1987	5.6	-6.9
France	1997	-2.1	1.9
Germany	1987	5.7	3.2
	1996	-2.7	-5.7
Netherlands	1990	3.4	2.6
Norway	1992	-9.1	2.0
Sweden	1991	7.8	-3.5
United Kingdom	1991	-3.0	3.4

Sources: Boelhouwer *et al.* (2001); Haffner (2002)

In four other countries, the Netherlands, Denmark, Norway and Sweden, the total amount of mortgage interest paid remained tax deductible throughout the entire period under review. The exception was Belgium, where two other issues were in play. First, a 'special' interest deduction was introduced for new construction and renovation. From 1992 onwards, the deduction also applied to the acquisition of dwellings in the existing stock. Second, the tax deduction for repaying the principal was expanded. Whereas this amounts to an improvement in the deductibility for home owners, it should be remembered that the rates have been lowered. On balance, the effect will in any case have been negative for home owners who did not make any changes.

4.3.4 Development of house prices in international perspective

The analysis will now focus on the development of house prices in the countries studied immediately before and after the revision(s) in the tax code (see Table 4.2). The intention is to determine whether the latter changes might have caused short-term changes in the development of house prices, because of a relatively inelastic supply. As many other factors, as well as personal income tax, affect house prices, this exercise cannot be more than a partial one (see also European Central Bank, 2003). Perhaps because a partial analysis is being applied, in six of the eight countries investigated no clear price effect can be distinguished. It could of course also be the case that the changes in tax deductibility had a relatively minor effect on housing costs and hence on house prices.

4.3.5 Countries where tax reform did not affect house prices

In Belgium, tax rates dropped slightly, while the tax concessions were expanded for new cases of home ownership. In the four years after 1989 real house prices on average rose more (5.2 percent, see Table 4.2) than in the four years before the tax changes (4.7 percent). As the tax changes were not major changes, it is unlikely that the expanded tax incentives can be seen as the

(sole) explanation for the house price increase.

In France, the tax deduction for mortgage interest payments was abolished in 1997 and 1998. Apparently, this increase in the tax bill had no negative repercussions on house prices, as the average decrease in real house prices (-2.1 percent) in the four years before 1997 changed to an average increase in house prices (1.9 percent) in the four years after this measure.

In Germany, house prices increased between the late 1980s and the early 1990s. The expectation that house prices would increase because of an improvement in tax regulations in 1987 is not apparent in Table 4.2. The increase in real house prices before the change was more (5.7 percent) than after the change (3.2 percent). Whether or not there was a causal connection between the change in tax regime as of 1996 and the development of house prices did not emerge from a study of the literature. But the average real prices per year dropped more in the four years after the change than in the four years before the change.

House prices in the Netherlands have been rising steadily since 1990. One projected effect of the 1990 decline in marginal rates, that is, a reduction of the net effect of the deductibility of mortgage interest payments, could have occurred, even though on balance disposable household income increased because of the lower tax rates. The average annual increase in real house prices in the four years before 1990 (3.4 percent) was slightly higher than the average rise after 1990 (2.6 percent).

As one of the consequences of the introduction of a dual system in 1992, Norwegian mortgage interest payments remained deductible though at a lower rate than previously (a proportional rate of 28 percent versus marginal rates that could run as high as 40.5 percent). This limited reduction in deductibility was compensated for the majority of Norwegians by putting a freeze on imputed rent and by lowering taxes across the board. On balance, home owners in Norway came out ahead, in terms of purchasing power, even though the tax advantage of owning a home was reduced. Thus, Norway was shielded from a crisis on the housing market, as was experienced by Denmark and Sweden (see below).

Mortgage interest tax relief was phased out very gradually in the UK. In 1991 it was completely abolished. There does not seem to be any relationship between the house price movements and the year of abolition. Real house prices decreased on average per year by 3 percent before 1991, and they rose on average annually by 3.4 percent after the complete abolition of the mortgage interest relief.

4.3.6 Countries where tax reform affected house prices

It is only in Denmark and Sweden that there seems to be a close correlation between the tax reform and house prices developments. This outcome may

be due to several factors. More often than not the tax reform took place in a general economic downturn and/or in times with a high level of mortgage interest rates. It is difficult to distinguish these more general effects from the effects of the tax reform. On the other hand, tax reforms often led to an overall reduction in the tax burden for households or tax incentives were phased out over a long period, which in turn lowered the impact of the tax reform.

The Danish case begins in the autumn of 1986. At that time, Denmark (like many European countries) was in a state of recession, and the direct results were high inflation, high unemployment and stagnating incomes. The government decided on severe austerity measures (autumn 1986) and a comprehensive tax reform (spring 1987). Although the measures were not directly aimed at a different tax treatment of the owner-occupied sector, both measures did have far-reaching consequences for this sector.

The effort to rein in inflation, which was running at an average of 8 percent per year in the early 1980s, included a more cautious approach to mortgage lending (Christiansen, 1990). From 1986 onward, the only home loan available was a mixed loan (60 percent annuity +40 percent linear). As a direct consequence of this package, homebuyers were confronted with considerably higher initial housing costs than before.

The tax reform of 1987 also prompted a change in the treatment of home ownership. One result was that home owners could then only deduct mortgage interest payments at a rate of (a mere) 50 percent, which amounted to a sizeable reduction compared to the marginal rates that previously could have run up to over 70 percent. The marginal tax rates dropped considerably, while the imputed rent for a person's own home remained in place for the time being. Overall, this worsened the situation for the average home owner.

These developments, higher initial costs and lower tax compensation, combined with a recession led to a huge drop in the demand for owner-occupied dwellings. By 1989, the number of transactions had declined by nearly 70 percent relative to the situation prior to the changes in the tax code. The number of compulsory sales increased explosively from fewer than 1000 per year to three times that number at the end of the 1980s. Other than these individual problem cases, the predominant response of the Danes was 'over wintering': waiting for better times (Christiansen, 1990). While this behaviour further reduced the volume of transactions, it prevented prices from dropping even lower. It was not until the second half of the 1990s that the number of transactions started to rise again. In that period, home ownership had declined by five percentage points to less than 50 percent. By the end of the 1990s, this figure had risen slightly to 51 percent.

House prices bottomed out in 1992, when the average price had dropped in real terms by 25 percent from 1985 levels (see also Table 4.2). The subsequent increase, largely initiated by the persistent decline in mortgage interest rates, eventually ushered in a recovery in the home owner market. By 1999,

real house prices had risen to the levels prevailing before the changes in the tax code.

Just as in Denmark, the changes that were made in Sweden in the tax treatment of home ownership were more or less the result of an overall tax reform and a round of budget cuts. Specific to Sweden, however, was the government's explicit aim to cut back the generous tax subsidies that had been available to the owner-occupied sector. Expressed differently, the aim was to remove the distortions that had arisen over time in housing subsidisation. The basic premise was to treat owning and renting equally (tenure neutrality; Agell *et al.,* 1996; Englund *et al.,* 1995).

Prior to the 1991 tax reform, Swedes could deduct their mortgage interest payments from their personal income at marginal rates that could run as high as 70 percent. After the introduction of the dual tax system, the mortgage interest relief was lowered from an average of 47 percent to a standard rate of 30 percent. In addition, imputed rent taxation was traded in for a property tax.

Even though the income tax was lowered, the tax changes made in 1991 had far-reaching consequences on the market for owner-occupied dwellings (Englund, 1994). Englund *et al.* (1995) estimated the short-term impact on the house prices of the tax reform, based on static expectations and forward-looking behaviour of households, between 10 and 15 percent up until 1993, while the real house prices declined in total by 25 percent since the tax reform (see also Table 4.2). During the same period, the number of transactions dropped dramatically. This situation was comparable to that seen in Denmark. The production of new housing in the owner-occupied sector virtually came to a standstill in 1992 (Agell *et al.,* 1996; Englund *et al.,* 1995). Since then, the situation had stabilised in Sweden; by the end of the 1990s the owner-occupied sector had largely recovered.

4.4 Development of house prices in the Netherlands: A scenario analysis

Various modelling studies in the international literature analyse the development of house prices from the perspective of the housing market as a whole (Abraham & Hendershott, 1996; Hort, 1998; Malpezzi, 1999; Meen, 1998). As described in the second section, short-term and long-term price effects can be distinguished. Short-term price effects are brought about by speculative investment and the time lag with which the supply side (i.e., new construction) responds to price fluctuations. In order to model these effects, the lagged price development is usually incorporated into the model as an explanatory variable (as bubble builder). In the long term, structural features should explain the rate of price development. To ensure this, an error-correction model

Figure 4.1 Schematic diagram of the model of house prices for existing owner-occupied dwellings

Effects		Describes
Housing market, speculative or psychological effets House price (t-1)	→	The reaction to the previous market situation for both buyer and seller. The assumption is that market conditions at time t-1 will affect the market at time t.
Long-term effect on the housing market Relation between interest payments and income	→	Income largely determines the housing costs. It is assumed that in the long run, housing costs will show the same development as income. The house prices vary around this long-term trend.
Seasonal effect on the housing market Season-correction variable	→	The price usually changes more in the first half of the year than in the second half.
Economic developments Income effect Change in income	→	A change in income means a similar change in price.
Economic developments Cost effect Change in mortgage interest rate	→	The chance of entry into the owner-occupancy market in terms of the cost of financing. An increase in financing costs (interest) causes the house price to decline.

Source: Model of house price for existing owner-occupied dwellings (OTB Research Institue)

usually incorporates the deviation from the price equilibrium, generally based on the relation between house price and household income that has been determined for a stable period (the bubble buster). Other factors that are more structural in nature play a role in the long term as well: interest, income, and inflation (other economic factors) and demographic developments.

The model that has been built for the Netherlands on this basis explains and forecasts the percentage of change in the macro real house price of existing owner-occupied dwellings. The core of the regression model is the deviation of prices from the long-term price equilibrium, as described above. An effort was made to include all of the variables discussed in the second section (Figure 4.1 depicts these steps schematically). The working model includes mainly economic variables, next to the speculative effects. In comparison with other studies on macro house prices, this is a parsimonious number of explanatory variables. Models including variables such as rent, demographic characteristics, housing supply and the rate of unemployed persons of working age were also used; they showed no extra explanatory value to model. Altogether, this had no influence on the explanatory power of the model; in comparison with similar studies, the R^2 of 0.84 is even quite high. In addition, commonly used statistical tests for autocorrelation (the presence of autocorrelation in price changes could lead to a misspecified model) and heteroskedasticity (testing the assumption that the residual variance is constant across time) yield good results.

The percentage of change in the real house price because of a change in the personal income tax system (institutional factor), is explained by first taking into account a break in an ongoing rise or decline in prices. A long-term equilibrium is sought. Various studies demonstrate that in the long term the house price and the household income level are in equilibrium (e.g., Malpezzi, 1999; Meen, 2002). For the house price model, that equilibrium is sought in a

simple relationship between net interest payment and income. The net interest payment is the product of the mortgage interest rate and the house price, corrected for the tax advantage or the income tax relief. The tax conditions for home owners in the Netherlands were very stable during the last few decades; thus the tax advantage was held constant at 40.5 percent for the entire period.

$$NIP_t = P_t * IR_t * (1-F) \quad (1)$$

where:
NIP_t = net interest payment
P_t = house price
IR_t = mortgage interest rate
F = tax advantage (40.5 percent)

Subsequently, the net interest payment ratio was calculated for each period; this ratio forms the basis for the long-term equilibrium variable in our equation:

$$NIPR_t = NIP_t/Y_t \quad (2)$$

where:
Y_t = household income

The deviation between the net interest payment ratio in a period ($NIPR_t$) and the long-term equilibrium (LTE) breaks the ongoing price development. For example, Malpezzi (1999) was able to estimate a stochastic model for long-term equilibrium. He used those periods in which market equilibrium prevailed. However, an analysis along these lines must be based on a large number of observations. In the present case, a limited number of observations (46) had to be dealt with; these are far too few observations for a error regression equation. In order to deal with this problem, a decision was made to estimate the long-term equilibrium and the model simultaneously. First, this involved estimating a model, including the net interest payment ratio and including a constant term. Subsequently, by means of a mathematical transformation of the constant term, β0, and the regression coefficient of $NIPR_t$, β1, we estimated the value of LTE (LTE = β0/β1). According to the model, the long-term equilibrium is found at a ratio of 27.1. This relationship is taken as a good and true estimate of the long-term equilibrium. The mathematical form of the variable that restores the long-term equilibrium is as follows:

$$\Delta LTE_t = NIPR_t - LTE \quad (3)$$

where:
ΔLTE_t = deviation long-term equilibrium
LTE = long-term equilibrium (= 27.1)
If the net interest payment ratio will be higher than the market equilibrium prices will tend to drop, and when the net interest payment ratio is smaller than market equilibrium, prices will rise. One consequence is that the regression coefficient, β1, for the correction of the long-term equilibrium in the model must be negative. The coefficient lies between -1 and 0, which implies that the equilibrium between housing costs and income will be restored in the long term. A second consequence is that in the model the constant term is incorporated in the long-term variable. Ultimately, the long-term equilibrium was incorporated with a lagged effect into the model.

In its final formulation, the equation takes the following form (showing the statistically significant t-value in brackets below):

$$dPr_t = \underset{(7.26)}{0.56}\, d\,Pr_{t-1} - \underset{(-4.12)}{0.22}\, d\,LTE_{t-2} - \underset{(-2.37)}{1.54}\, d\,IR_t + \underset{(2.25)}{0.71}\, d\,Y_t + \underset{(4.56)}{1.29} S_t \qquad (4)$$

where:
dPr_t = percentage of change in real house price
$dLTE_t$ = deviation long-term equilibrium
dIR_t =change in real mortgage interest rate
dY_t = percentage of change in real household income
S_t = semi-annual effect (first half -1, second half +1)
t = time indicator (half years)

The household income is included as a percentage of the change in real income. An increase in that variable leads to an increase in the real house price. The absolute change in real interest is also included in the model in order to show that if the mortgage interest rate increases, the house price will decline. Most data come from Statistics Netherlands (CBS). Only the house price series is collected by NVM Dutch association of brokers and real estate experts. The relation between interest payments and income is calculated with households in the Housing Demand Survey 1998.

In addition, a seasonal variable corrects for the semi-annual effect. Finally, in order to show the speculative effects and the lagging supply, the dependent variable is lagged. The coefficient is lower than one, which tempers the effect. In order to establish the possible effects that a limitation on the deductibility of mortgage interest payments could have on the development of house prices, two scenarios (A and B) have been worked out. They are summarised in Table 4.3.

In variant A, the owner-occupied dwelling loses its tax advantages; the imputed rent and the tax deduction for mortgage interest are cancelled. The

Table 4.3 Assumptions underlying the personal income tax policy variants

Basic variant	Variant A	Variant B
No changes in fiscal policy	Imputed rent value and interest deduction abolished Generic tax reduction of € 909	Imputed rent value and interest deduction taxed at one rate of 32.25% (first bracket). Generic tax reduction of € 181
	■ Minimum effect is based on mortgage payments, debt, and interest rate for all homeowners ■ Maximum effect is based on the average higher mortgage payments, debt, and interest rate for households that had recently moved	

point of departure is that the tax reform should have a financially neutral effect; this means that there is room for a generic tax reduction for all households, amounting in this variant to 909 per household on an annual basis.

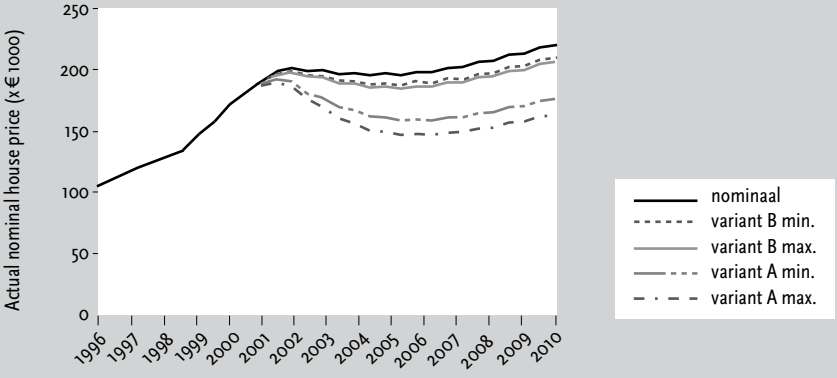
In the second variant (B), the balance of mortgage interest and the imputed rent is calculated at the rate of the first tax bracket (32.25 percent). This is a tax credit. This means that all income categories benefit equally from the possibilities to deduct mortgage interest payments. Therefore, higher-income groups lose the greater advantage they enjoy because of progressive rates. This variant amounts to a generic tax reduction of more than 1 billion euros. Calculated per household, this means a feedback effect of 181. This makes variant B more moderate than variant A.

As the tax code is not included in the model as an explanatory variable, it first has to be translated into a variable that has in fact been included in the model. As a rule, the effect of a limitation on the deductibility of mortgage interest is translated as an interest supplement: the more stringent the restriction, the higher the supplement. In other words, the retraction of the tax advantages of home ownership translates into a higher rate of interest because of the higher housing expenses incurred. For variant A, there is a minimum effect of 1.5 percentage points and a maximum of 2.1 percentage points. Variant B has a smaller range: a minimum of 0.3 percentage points and a maximum of 0.4 percentage points. Through the interest supplement, the two tax scenarios (A and B whereby a distinction is drawn between a minimum and a maximum effect) receive a translation into a price change.

Figure 4.2 shows the results of the calculation of the two policy variants on the estimated price development. The good values for statistical significance found for the model of house prices suggests that the model is robust enough to extrapolate. However, extrapolation always entails some uncertainties. The figures obtained for the years 2001 and 2002 are predictions, while the figures for the years after 2002 can be called indicative outcomes.

Upon closer examination of the development of the house price, the first thing to be noted is that the basic variant also assumes a moderate increase in house prices through 2002. After that time, the nominal house price declines by about 1 percent per year and then stabilises in 2005 (incidentally, real prices drop by 4 to 5 percent annually). For subsequent years, the model reveals a progressive increase in the nominal house price; from 1 percent in 2006, it rises to 3 percent in 2010. It should be remembered that relative to the rate of inflation, these increases are very small. Therefore, the real house

Figure 4.2 Actual nominal house price (1986-2000) and two future fiscal variants A and B (until 2010) based on a minimum and maximum fiscal effect



Source: OTB model of house price for existing owner-occupied dwellings

price continues to decline through 2006. Not until 2007 does the increase in price rise above the increase in the rate of inflation.

Variant A deviates more than B from the basic variant. This was to be expected, because variant A is based on the assumption of complete abolition of the tax advantages of home ownership. Consequently, the home owner is confronted with considerably higher housing costs. In this variant, the nominal price declines after 2002 and then starts climbing again in 2006. At this point, the price is 20 to 25 percent below the level of the basic variant. The effect of variant B is more marginal. Between 2002 and 2005, the decline in the price is somewhat steeper than in the basic variant, but after that period the tax effect has run its course. In 2005, the nominal price finishes 5 to 6 percent below that in the basic variant. Afterwards, the price rises to the same degree as in the basic variant.

It may be concluded that the tax scenarios do have a visible effect on the price of existing owner-occupied dwellings. The effects that the tax variants have on the development of house prices continue for about six years. Their impact is greatest during the first years; afterwards, the consequences of the tax reform dissipate and the price changes in the basic variant are equal to those in variants A and B. The revision does in fact result in a permanent reduction in house prices.

4.5 Conclusions

The possible repercussions of an expected decline in the price of owner-occupied dwellings are difficult to project. Moreover, they have induced many politicians to introduce changes in the tax system gradually or even to refrain from making such changes at all. This observation prompted the authors to trace the relationship between a change in personal income tax with respect to the treatment of the owner-occupied dwelling and a change in the development of house prices and to depict that relationship in various ways.

First, in light of the theory, the variables that influence the development

of house prices have been studied. Besides the (sometimes lagged) relation between the price of newly-built houses and the market price for existing owner-occupied dwellings, it is also known that speculative behaviour on the part of home buyers leads to short-term effects on house prices. Like government policy, economic developments (for instance, household income and mortgage interest rates) play a role in the short term as well as the long term, while the effect of demographic developments on the development of house prices is notably structural.

A review of the literature shows that the fear that deterioration of the deductibility of mortgage interest payments will lead to sharp drops in the house prices might well be exaggerated. Clearly, if the supply is not entirely inelastic, no full capitalisation of the tax deduction will take place in the house prices. If the deductibility is restricted, the converse will apply. The latter statement is supported by the observed decreases in house prices by 10 to 20 percent on average in the US. Nonetheless, significant decreases in the top segment of the housing market are certainly realistic if housing becomes more expensive and shifts in demand occur in the direction of cheaper housing.

The comparison of the consequences of a tax reform for the development of house prices in a number of European countries reveals that the means and timing of the implementation of the tax adjustments largely determine the possible effects on the development of house prices. For instance, changes in the UK in particular, but also in the Netherlands and Norway, were introduced much more gradually than in Denmark and Sweden, for example. The latter two countries had the misfortune that the change in the tax code coincided to a high degree with a severe stagnation of the economy (recession). This manifested itself in various ways, including high unemployment and inflation alongside a recession on the housing market.

The results of the econometric model analysis for the Netherlands also show that with moderate limitations of the tax concession, the decline in nominal house prices is less steep, 6 versus 25 percent, and that the period of decline does not last as long.

In light of the findings, it seems that governments would be wise to implement any tax limitations they might envision in small steps and to keep an eye on the timing. From this perspective, it would be better to implement a limitation of the mortgage interest relief when the market for owner-occupied dwellings is overheated than it would be in hard times.

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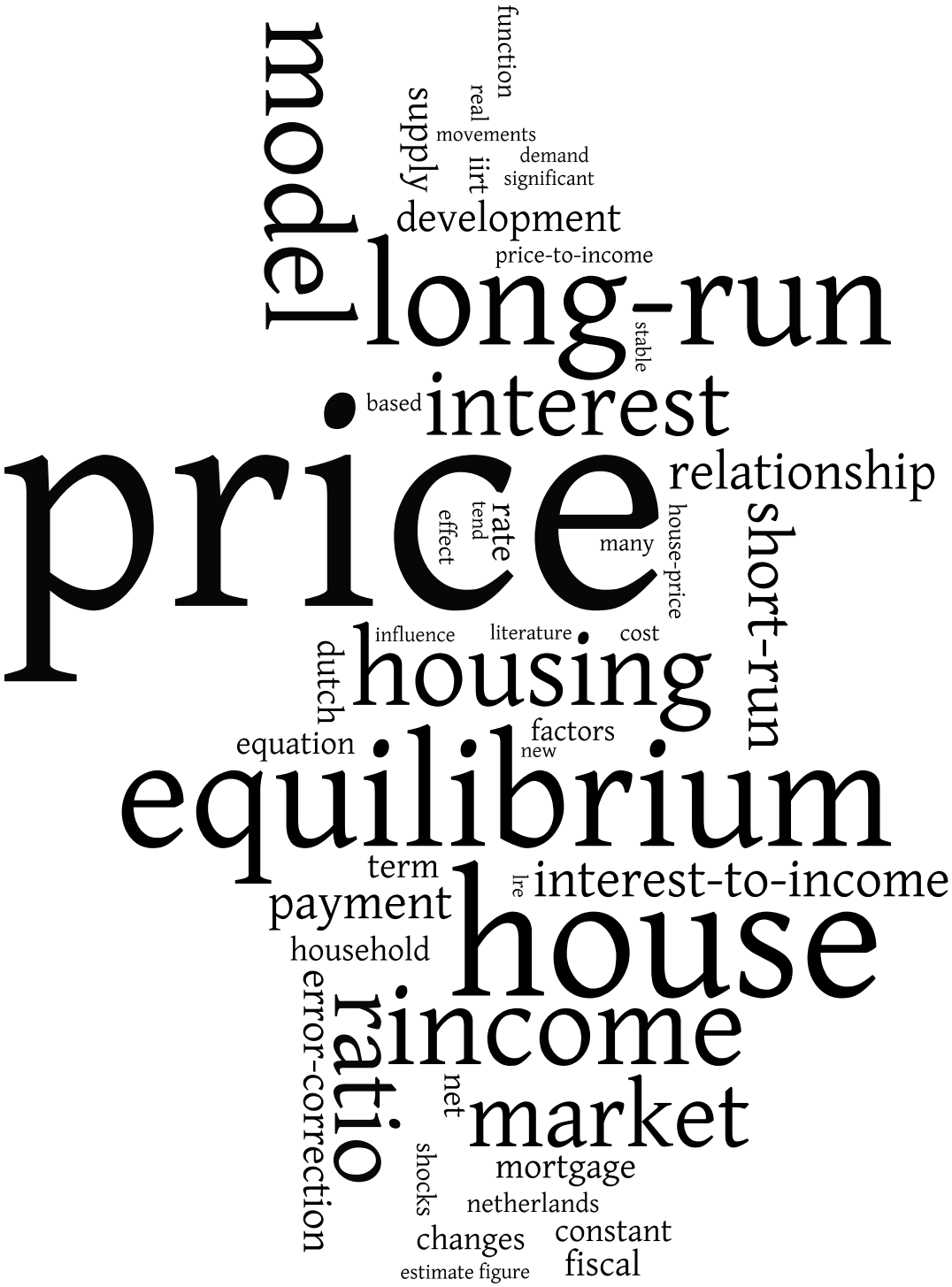
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5 Equilibrium between interest payments and income in the housing market

Paul de Vries & Peter Boelhouwer, 2009, Journal of Housing and the Built Environment 24, pp. 19-29

Abstract
The literature on housing markets suggests that house prices in almost all western economies can be explained by short-run demand-oriented variables and a longrun term. The basic principles of the theory are that the short-run fluctuations, which are based on recent price developments (shocks), occur due to market imperfection, while over the long term, causality with such fundamentals as income will recover. Nonetheless, many of the interesting questions in housing economics concern adjustments toward equilibrium. This paper seeks to identify a long-run equilibrium between interest payments and household income (interest-to-income ratio) instead of between house prices and income (price-to-income ratio).

5.1 Introduction

House prices have been studied extensively and with a variety of methods. Evidence indicates that both short-run fundamentals and long-run fundamentals have an impact on houses prices. In the short term, significant upward or downward movements ('shocks') appear, due to speculative or psychological effects (for example, see Reichert, 1990; Levin and Wright, 1997; Meen, 1998; Hort, 1998; De Vries and Boelhouwer, 2005). For example, when prices continue to increase, consumers tend to act swiftly in anticipation of further increases. Recent price developments have been used to compile models of such short-run price fluctuations (Abraham and Hendershott, 1996; Hort, 1998; Malpezzi, 1999). The term 'bubble builder' is often used in this context.

In addition to short-run price effects, other more permanent factors play a role in the development of house prices. Many analytical models include income and inflation as explanatory variables for price trends (see Reichert, 1990; Peng and Wheaton, 1994; Cho, 1996; Gallin, 2003; Boelhouwer and De Vries, 2002; De Vries, 2002; Malpezzi, 1999; Hort, 2000; Meen, 2002). To ensure that long-run price developments can also be explained by permanent factors, such models incorporate a deviation from equilibrium as a corrective variable (error-correction models). The long-run equilibrium is usually expressed as a price-to-income ratio. As early as 1972, Fair drew attention to the significance of the longrun equilibrium between house prices and incomes. This equilibrium, as he states, stems directly from the premises of general price theory, which proposes that the demand for an object is a func-

tion of income and the price of the object or service in relation to other prices (Fair, 1972).

This idea is commonly formalized in the housing literature by positing a co-integration relationship between house prices and fundamentals (e.g., income) with subsequent estimation of an error-correction model (Abraham and Hendershott, 1996; Malpezzi, 1999; Hort, 1998; Meen, 2002; Boelhouwer *et al.,* 2004). Gallin (2003) of the Federal Reserve Board suggests, however, that the co-integration relationship between income and house prices that is commonly found in the literature may be inappropriate. He shows that extensive panel data tests in the US have found no evidence of co-integration. "This does not mean that fundamentals do not affect house prices, but it does mean that the level of house prices does not appear to be tied to the level of fundamentals." Gallin questions the validity of the associated error-correction models, which are based on long-run equilibrium in the price-to-income ratio. However, according Holly and Yamagata (2006), the bootstrap panel unit root tests reported by Gallin can be subject to large size distortions. After additional research, they conclude that the log of real house prices and the log of real disposable income are co-integrated. On the other hand, Chen *et al.* (2007) found no co-integration relationship from the empirical results of Taiwan's data.

This paper presents a long-run equilibrium between interest payments and income (interest-to-income ratio). It is thought that interest payments are linked to income levels by a stable long-run relationship. Although they may drift apart temporarily, they tend to return to a long-run equilibrium. The equilibrium path may also shift over time. This process forms the basis for a model that may serve to explain and predict fluctuations in house prices. The model takes account of the ability of low nominal interest rates in recent years to support higher than average price-to-income ratios.

Especially in the Dutch context, modelling the house price development including the interest-to-income ratio instead of the price-to-income ratio has grounds. For instance, OECD mentions that house prices do not appear to be linked to income by stable long-run relationships, possibly because the cost of carrying a mortgage varies over time (OECD, 2005). Furthermore, Dutch households have strong incentives to maintain mortgages at high levels given the favorable tax treatment of debt-financed owner-occupied housing (Ter Rele and van Steen, 2001). Van Rooij (2002) concludes that recent house buyers in the Netherlands face the highest loan-to-value ratio of more than 75 percent, with a mean ratio of 92 percent for the most recent buyers. Despite the stimulation of market forces after 1990, we mention the absence of an adequate supply reaction to the steep rise in house prices, the scarcity of newly built dwellings and the policy of the financial institutions imposing more or less the maximum house price by adopted ceilings for the interest-to-income ratio.

The following section (5.2) provides a brief description of the serial correlation in house prices as one of the main causes of the short-run shocks, which serve to overshadow and obscure the equilibrium between prices (or interest payments) and income. We then proceed to consider the long-run relationship between house prices and income (price-to-income ratio) in greater depth (Section 5.3), presenting an alternative in the form of the interest-to-income ratio, as a basis for the term in the main section of this paper (Section 5.4). The conclusions are presented in Section 5.5.

5.2 House-price models and short-run shocks

House-price development can be explained according to a neo-classical theoretical formulation. Demand and supply in the housing market and the resulting equilibrium price are central components of this theory. Demand for housing is a function of factors such as demography, income, interest payments, user cost and availability of substitutes. Supply for housing in the short run is inelastic, but in the long run, supply is a function of the factors influencing building constructors to construct new houses. Therefore, it can be assumed that, in the long run, house-price development will be determined by production costs in a competitive housing market. When prices rise in response to (temporary) scarcity, building contractors react to this favorable situation by adding attractively priced, newly built housing to the stock. This extra supply of new housing depresses prices, creating a new equilibrium on the housing market. This proposition implicitly assumes that the housing market operates as a supply market. House prices function as a trigger, inducing movement towards equality between housing supply and demand. The idea behind this supply-directed approach is that, in the long run, price follows the production costs. The factors that determine the costs of new construction (including both land and construction costs) mark the starting point for a new price equilibrium.

When a lack of building opportunities renders the supply of newly built housing incapable of adequately anticipating the changed housing demand, house prices will be formulated primarily within the existing housing stock. This applies particularly to countries (such as the Netherlands) in which the housing and house-building market are strongly regulated and in which building land is scarce. The housing market is an inefficient market (Case and Shiller, 1989). The international housing market literature also emphasizes how little influence supply (e.g., new construction) may have on price development in the existing stock. The development of aggregated house prices is thus heavily influenced by household income, mortgage interest rates and the lag in house prices (Abraham and Hendershott, 1996; Hort, 1998; Malpezzi, 1999).

With regard to dynamics, the price equation exhibits short-run positive autocorrelation with some evidence of longer-term mean reversion. This is a widely observed feature of univariate house-price models (see Englund and Ioannides, 1997, for an international comparison). Many models therefore use lagged house price as an explanatory variable, thereby constantly accounting for significant short-run price movements. This effect is modeled in the context of the US in studies by Abraham and Hendershott (1996) and Malpezzi (1999). Hort (1998) applies the model to the Swedish context, using the term 'speculative' price movements.

Various articles have sought to analyze these (short-run) speculative price movements and the associated market inefficiency (Boelhouwer *et al.,* 2004; Hort, 1998). In combination with the slow adaptation process of the new-build market, these effects serve to explain the short-run price movements, which are sometimes extremely significant. When prices are perceived to be rising, consumers wish to act swiftly. The sooner the decision to buy is made in such an expanding market, the greater will be the capital gain. The opposite effect can be observed when prices are falling; consumers tend to delay the purchase Equilibrium between interest payments and income in the housing market decision for as long as possible in an attempt to preclude equity losses. Short-run shocks are an indicator of inefficient markets.

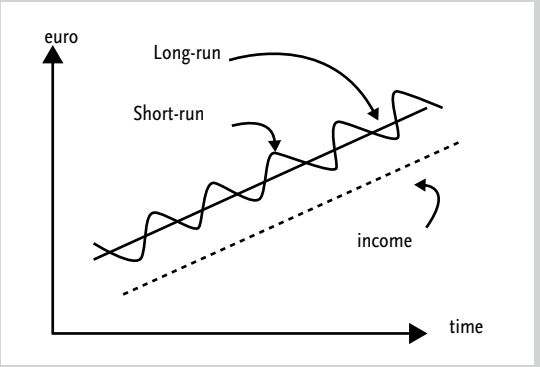
The literature is replete with evidence of housing-market inefficiency (Cho, 1996). One of the main indicators is the fact that house-price movements correlate with historical price levels. Such a relationship would be impossible in an optimally functioning market. This basic function is designated as Eq. 1:

$$(P_t) = \beta_0 + \beta_1 (P_{t-1}) + \varepsilon_t \qquad (1)$$

where P_t is percentage of change real (lagged) house price, and et is error term.

This autoregressive model tests whether the coefficient (β1) of the lagged house price (P_{t-1}) is zero, in order to demonstrate market efficiency, given that historical price movement, P_{t-1}, has (or should have) no effect on current price movement, P_t. As many studies have shown, however, there is indeed a situation in which $\beta 1 \neq 0$, thus demonstrating serial correlation (Case and Shiller 1990; Hort 2000; Berg 2002; Meen 2002). The term 'bubble builder' was coined in this context and means that the housing market is a market in which prices are never stable, but are always shifting in the direction of long-run equilibrium. Lagged house-price change is obviously not the only determinant of price changes. Adding the other variables to the autoregressive model results in an autoregressive distributed lag model.

Figure 5.1 The long-run relationship between house price and income and the short-run shocks on the housing market



Source: De Vries & Boelhouwer, 2003

5.3 Towards long-run equilibrium

The results of house-price models are dominated by short-run effects, in which the market is never in perfect balance. Recurrent short-run shocks (serial correlation) ensure that prices continue to shift one way or the other. This impedes the likelihood of achieving long-run equilibrium among house price and such fundamentals as income, interest rate, population growth, or user costs. This suggests that a couple of variables disrupt the equilibrium.

Hendry (1984), Drake (1993) and Abraham and Hendershott (1996) were among the first to use model analyses to investigate long-run relationships. Especially Abraham and Hendershott proposed two models, one of which was based on equilibrium price and the other on deviations from that price. As shown in Figure 5.1, the first model results in a straight line (the long-run equilibrium) and the second in the difference between this line and the wavy short-run price development (short-run shocks). Abraham and Hendershott estimate equilibrium price as a function of construction costs, income, the unemployment rate and changes in the net interest-rate payments (corrected for tax deductibility). They then set these estimated equilibrium prices against the actual house prices in each period, using the difference as a measure of the imbalance that provides insight into the adaptation process. Finally, they formulated a function for this adaptation process.

5.3.1 Price-to-income ratio

Recent models incorporate a variable that represents the balance between house price and income. Specifically, this variable seeks to bring house price back towards equilibrium. Prices and income are thus linked by a stable long-run relationship: they may drift apart temporarily, but they tend to return to their long-run equilibrium. Models based on this approach have been applied in the UK, Finland, Sweden and the Netherlands. In the US, the literature has also placed a marked emphasis on the aggregated ratio between house price

and income (Case and Shiller, 1990; Abraham and Hendershott, 1996; Malpezzi, 1999; Meen, 2002).

However, these findings are not established by all researchers. Gallin (2003), for instance, finds no evidence for co-integration. He suggests that the error-correction specification for house price and income based on the price-to-income ratio may be inappropriate.

5.3.2 Net interest payments

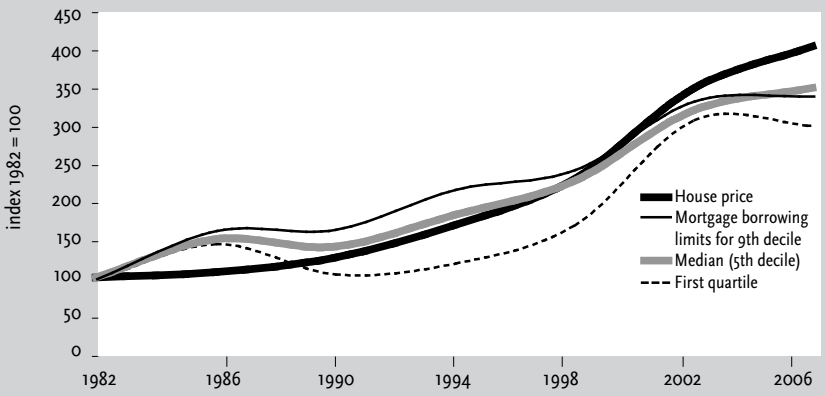
We assume a long-run equilibrium between net interest payments (rather than house price) and income (Boelhouwer and De Vries, 2002). The Dutch central bank (Van Rooij, 2002) concludes that especially recently moved house buyers faced very high loan-to-value ratios, indicating that the maximum borrowing capacity based on household income leads to the final house price. To obtain an impression of the development of the financing space of a household, the maximum obtainable mortgage is depicted for three income groups at five points in time (Figure 5.2). Here we have made use of the *Woningbehoeftenonderzoek* (WBO) (housing demand survey – WBO) commissioned by the Dutch government and carried out every 4 years. The maximal obtainable mortgage takes the rules applied by mortgage brokers and banks into account, as well as interest rates and income. Borrowing limits, which had come under severe pressure during the previous period, rose over the 1982-1986 period. Prices, which were also emerging from a deep dip, did not immediately respond to the increase in opportunity, presumably because most households were still mindful of the severe recession. During the next period, the difference disappeared again, then in the 1990s prices and borrowing limits kept reasonably in step. Another interesting point is that the gap between borrowing limits and prices has gradually narrowed.

Figure 5.3 demonstrates that, in the Netherlands, there is indeed a simple long-run relationship between net interest payments (NIP_t) and household income (I_t). In respect to the long term, it may be seen that both factors follow a parallel development, especially in the 1990s. Because net interest payments are the product of three factors – house price, mortgage interest rates and fiscal arrangements (deductibility) – a direct correlation with house price may be drawn. The philosophy of the long-run relationship is that there are periods that indicate the strength and direction of a linear relationship and that there are periods out of equilibrium.

Eqs. 2 and 3 show how net interest payments (NIP_t) and interest-to-income ratio (IIR_t) are calculated. The net interest payments must be calculated first (Eq. 2).

$$NIP_t = P_t * IR_t * (1 - F) \qquad (2)$$

Figure 5.2 Mortgage borrowing limits for housholds with a perceived household income of 25, 50 and 90% of income distribution and prices in the existing housing stock during the 1982-2006 periode (index 1982=100)



Source: OTB computation based on data from various housing surveys, mortgage brokers, the National Mortgage Guarantee Scheme and NVM

where *NIP* is net interest payment (at time of purchase), *P* is house price, *IR* is interest rate, and F is fiscal advantage (0.405).

According to this function, the net interest payments (NIP_t) at the time of purchase will depend on the current house price (P_t), the current mortgage interest rate (IR_t) and a non-time-dependent fiscal benefit in the form of tax deductibility. Because fiscal arrangements for owner-occupiers in the Netherlands have remained largely unchanged over the past decade, the fiscal benefit (F) can be applied over the entire period. Owners are responsible for 59.5 percent of the interest liability; the remaining 40.5 percent is paid by the government (Boelhouwer *et al.*, 2004). The fiscal advantage is therefore a constant (40.5 percent).

The net interest payments (NIP_t) can then be used to establish the interest-to-income ratio (IIR_t) (Eq. 3); the result forms the basis for the long-run equilibrium in the final model.

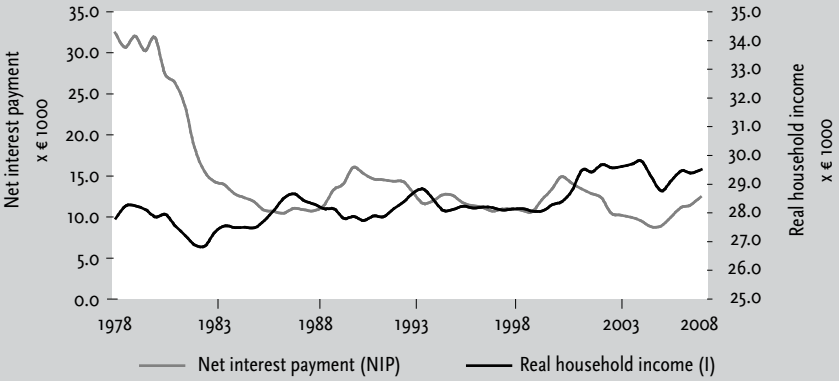
$$IIR_t = NIP_t / I_t \qquad (3)$$

where *IIR* is interest-to-income ratio (at time of purchase), *NIP* is net interest payments (mortgage debt only), and *I* is household income (per household).

We deliberately chose the interest-to-income ratio (IIR_t) over the price-to-income ratio as our correction term. The price-to-income ratio is influenced by a variety of factors that cannot be expressed or explained in simple terms (see Gallin, 2003).

The Dutch housing market at the end of the 1990s showed a rapid rise in prices against a relatively stable interest-to-income ratio (see also Figure 5.4). In practice, supply has not responded to the steep rise in house prices. Intuitively, production and price should be in equilibrium in the long run; however, this notion has not been adequately proven in research. Goodman (1998), DiPasquale and Wheaton (1994) indicate that, as a rule, the relation-

Figure 5.3 Development of real household income and net interest payments (in euros, 2000), half-year periodes,1978-first half year 2008



ship between house price and new housing supply leads to weak analyses on an aggregate level. In the Netherlands, the influence exerted by housing supply was also not significant. Only the large numbers of newly built housing in the areas surrounding the major Dutch cities have had any influence on the development of (regional) house prices (De Vries and Boelhouwer, 2005). On the aggregate level, the price increase was primarily the result of a decrease in mortgage rates and an increase in average incomes. Our hypothesis is that the Dutch housing consumer assesses the price of a house in terms of the affordability of the payments.

5.4 Modelling the long-run equilibrium

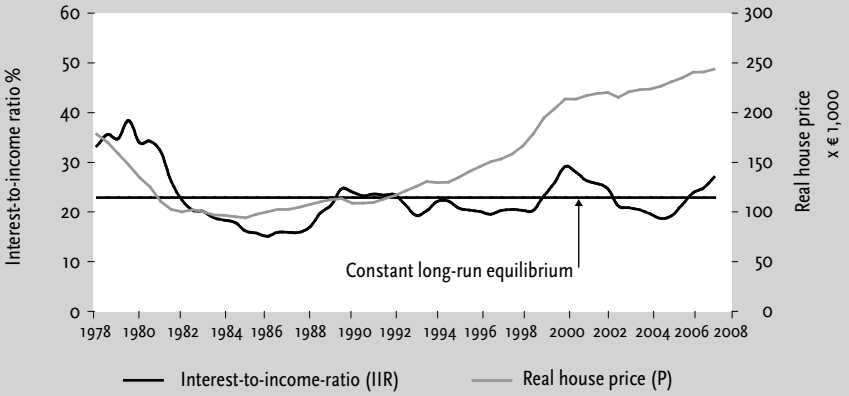
One basic assumption of these models is that, although the interest-to-income ratio (IIR_t) may drift up and down, they will tend to return to a constant long-run equilibrium.[1]

Using a stochastic model, Malpezzi (1999) was able to propose a constant long-run equilibrium based on the price-to-income ratio by using averages for periods in which a significant degree of market equilibrium could be observed. Finally, the deviation between the observed price-to-income ratio and the constant long-run equilibrium could be incorporated into a house price model.

Such analyses require large historical data resources, while our model is estimated for the period from the first half of 1978 through the first half

1 In the Netherlands, the constant character of long-run equilibrium raises a number of questions. A follow-up study formulated a model in which the long-run equilibrium was given a more dynamic character (De Vries and Boelhouwer, 2004). The basic idea of the model is that the interest-to-income ratio is never in true equilibrium, but it will also never deviate enormously from the mean, as households would then experience severe financial difficulty in meeting interest payments. However, the output of models with a non-fixed interest-to-income ratio does not differ greatly from a model that applies a constant ratio.

Figure 5.4 Interest-to-income ratio, real house price (euros, 2000) and the constant long-run equilibrium, half-year period, 1978-first half year 2008



Source: NVM , Statistics Netherlands, House-price model OTB Research Institute (TU Delft), adapted by OTB

of 2008 (61 6-monthly observations). We estimated the long-run equilibrium (*LRE*) simultaneously with our autoregressive distributed lag model (for a detailed explanation, see Boelhouwer *et al.,* 2004). The basic idea is that the LRE can be determined by dividing the regression coefficient of the constant term by the regression coefficient of the interest-to-income ratio (IIR_t).

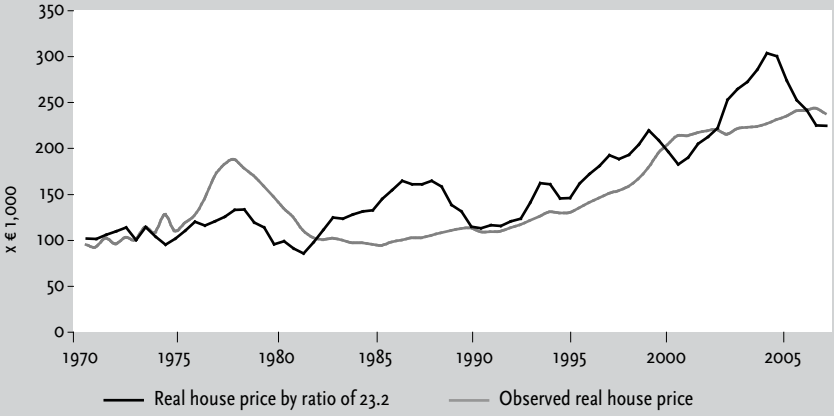
First, the model (Eq. 4) is formulated to include the interest-to-income ratio (IIR_t) and a constant term. In addition to the interest-to-income ratio, the model takes into account a number of other economic and housing market effects: the percentage of change in real house prices (P_t), which is a function of the lagged dependent variable (P_{t-1}), the change in real interest rate (IR_t) and the change in real household income (I_t). The statistically significant t-value is shown in brackets below:

$$P_t = 5.41 + 0.50P_{t-1} - 0.23IIR_{t-1} - 1.50IR_t + 0.64I_t \quad (4)$$
$$(+3.74)(+5.38) \quad (-3.86) \quad (-2.09) \quad (+1.88)$$

Of course, it is well known that other price measures are available (e.g., housing supply, building costs and demographic characteristics). In the Dutch context, however, the influence exerted by these variables on the variation in house prices was either absent or statistically insignificant. Altogether, this had no influence on the explanatory power of the model; the R^2 of 0.70 is good. Also, the tests for autocorrelation (the presence of autocorrelation in price changes could lead to a misspecified model) yield good results (Durbin Watson of 2.14).

Secondly, the long-run equilibrium can then be determined by dividing the regression coefficient of the constant term (5.41) by the regression coefficient of the interest-to income ratio (0.23). According to this calculation, the long-run equilibrium (LRE) is 23.2 (see also Figure 5.4). In other words, the interest payment liability in each period is 23.2 percent of income. This ratio is seen as a good and reliable estimate. The *Woningbehoefteonderzoek* (housing demand survey – WBO), which was commissioned every 4 years by the government

Figure 5.5 Observed real house price and the real house price ratio of 23.2, half-year periodes, 1970-first half year 2008



Source: House price model OTB Research Institute (TU Delft)

and which contains information from more than 50,000 households, provided for the owner-occupied sector quotes of 22.9, 25.5, 24.5 and 25.0 for respectively 1994, 1998, 2002 and 2006.

Finally, the difference between the actual (known) ratio (IIR_t) and this constant equilibrium (LRE) is calculated as follows (Eq. 5):

$$DLRE_t = IIR_t - LRE \tag{5}$$

where *DLRE* is deviation from long-run equilibrium, *IIR* is interest-to-income ratio, and *LRE* is long-run equilibrium (23.2).

Notice that if the interest-to-income ratio (IIR_t) is higher than the market long-run equilibrium (*LRE*), prices will tend to fall. Conversely, prices tend to rise when IIR_t is lower than *LRE*. Alternatively, for Eq. 4 we can estimate a model, incorporating the deviation from the long-run equilibrium (*DLRE*) instead of the interest-to-income ratio (IIR_t) with no constant.

Using Eqs. 2 and 3, we calculate the real house price in a situation in which the interest-to-income ratio is in equilibrium (23.2 percent in each period). Figure 5.5 presents the actual development of real house price and projected equilibrium house price. We see that house prices have been out of equilibrium for some time – as in the situation that was predicted by the theory. Lower interest rates and higher incomes have, to some extent, compensated for the significant price increases of the 1990s; the interest-to-income ratio has thus remained reasonably stable, or has even developed at a rate below that of the equilibrium line. Because interest payment liabilities began to rise somewhat more rapidly in 2000, an imbalance begins to emerge in that year. In order to achieve long-run equilibrium, house prices therefore begin to adjust downward gradually.

5.5 Conclusion

Many housing market researchers seek to shed light on short-run and long-run relationships between house prices and income. The basic principles of the theory are that short-run fluctuations ('shocks') occur due to market imperfection, while over the long term, causality with such fundamentals as income or population growth will recover. One of the strongest indicators of these short-run shocks is the evidence that pricing on the current housing market correlates with prices in the past. Were the market functioning optimally, this relationship could not exist. In the practice of house-price modelling, this serial correlation is corrected by a variable that establishes long-run equilibrium between house price and income (price-to-income ratio). Although market imperfection may render this ratio artificially high or artificially low during certain periods, market corrections eventually take effect, restoring the overall equilibrium between house price and income. This long-run equilibrium has been applied in many price models. The use of the relationship as (part of) an error-correction mechanism, however, is not without criticism.

With regard to the situation in the Netherlands, we have assumed a long-run relationship between net interest payments and income, whereby affordability becomes the key factor in long-run equilibrium. Boelhouwer and De Vries (2002) arrived at a long-run equilibrium ratio of 23.2. The output of the model, including the interest-to-income ratio instead of the price-to-income ratio, gives a good statistical result.

The presented model could also be used for more policy-orientated purposes. An example of this application is a calculation of the effects of the abolishing of the deduction of the mortgage tax relief interest from taxable income. In contrast with almost all West European countries, the Dutch government did not change this policy during the last decades. However, many analysts and institutions have called this generous subsidizing of home ownership into question when considering the need to create a more stable market situation. Such respectable institutions as the Dutch central bank and the VROM-*raad* (the Dutch Council for Housing, Spatial Planning and the Environment) have in the last few years advocated restraint of the fiscal subsidizing for home ownership. In addition to the objections of political parties who foresee serious problems being raised by their electoral supporters, many opponents to such a radical change draw attention to the possible negative consequences of the curtailment of mortgage interest deduction. They expect a dramatic fall of house prices as a result of such a policy. To get an indication of this effect, the house price model could be used in the following way. Eq. 4 includes a parameter for the fiscal benefit *(F)*. Because fiscal arrangements for owner-occupiers have remained largely unchanged over the past decade, fiscal benefit, *F*, is a constant factor in the model (Eq. 2). However, changes in

the fiscal system could affect movements in house prices in the Netherlands. Using the house price model, in 2007, we estimated the effect of abolishing or curtailing the deduction (De Vries, 2007) by taking a fiscal policy variant that operates by a way of housing costs and translated it into an interest supplement. In other words, the retraction of the fiscal advantages of home ownership translates into a (constant) higher rate of interest because of the higher housing costs incurred. According to the model calculations, Dutch house prices will decline over the next years by a maximum of 32 percent.

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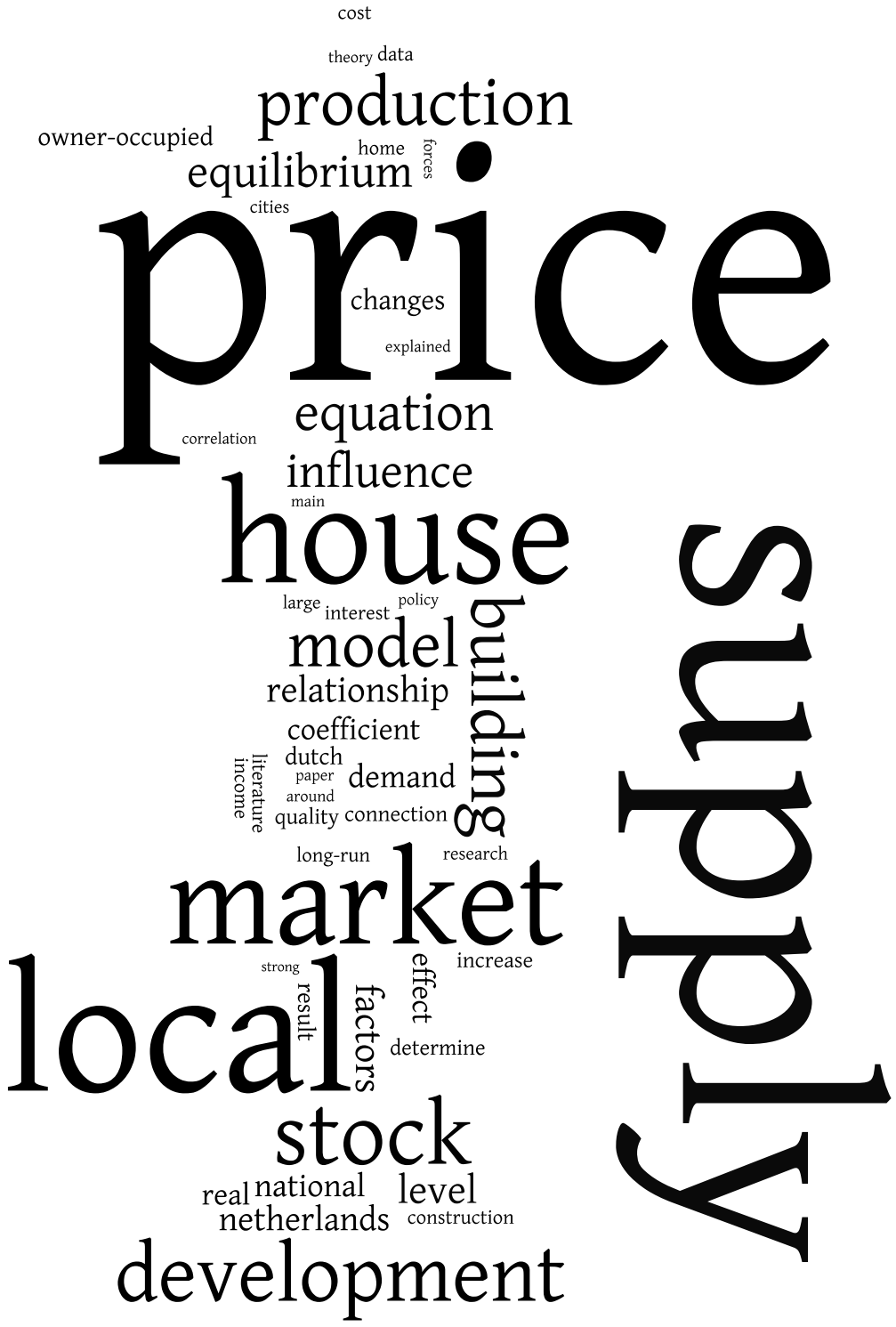
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development

6 Local house price developments and housing supply

Paul de Vries & Peter Boelhouwer, 2005, Property Management 23 (2), PP. 80-96

Abstract

Purpose – In this paper, we identify the relationship between (local) housing supply and (local) house price developments, especially in the Netherlands.

Design/methodology/approach – We measure the influence of new building on house prices by comparing areas designated for concentrated new building (main Dutch cities) with areas where no large housing projects are developed. On the basis of classical economic theory, if the housing market is functioning as it should, then supply will soon respond to a shock in demand and restore stability in house prices.

Findings – For the main Dutch cities, we found that an increase in supply triggers a fall in prices. In other areas the correlation coefficients are more or less zero, which can lead us to conclude that the expansion of the housing stock is market-compliant.

Research limitations/implications – The housing market is not functioning, as it should: new supplies depend on the complex decisions of the suppliers, thus making it difficult to express statistically the causality between the house price developments and the new supplies.

Practical implications – Most studies suggest that macro data are unable to measure the true dependency between the house prices and the new building and claim at the same time that micro data sets are incomplete. Also our research was hampered by a shortage of usable data.

Originality/value – New building can push up the value of the surrounding housing because it is associated with a qualitatively better housing stock. We conclude that in regions where new building has been concentrated in designated areas, the relationship between housing production and price development is inverse.

6.1 Introduction

Explaining the relationship between new housing supplies and house prices is a classic problem in housing market theory. Intuitively, one would expect that, in the long-run, production and price would be in equilibrium; however, this notion has not been adequately proven by research. Goodman (1998) and DiPasquale and Wheaton (1994) indicate that, as a rule, the relationship between the house prices and the new housing supplies leads to weak analyses on an aggregated level. A similar conclusion for the Netherlands was also confirmed. In a study of the determinants of house price developments, Boelhouwer and De Vries (2001) concluded that it is impossible to design a national model, which includes a significant role for building costs or new produc-

tion. One of the main reasons for this is the national scale. The notion that the causal relationship between the house prices and the new housing supplies can only be proven with databases at a low level of scale (region, neighbourhood) is widely quoted and paraphrased. After all, as the need for new building depends mainly on local factors, new housing supplies are bound to affect property prices, especially in the Netherlands, where the flow is spasmodic.

Theoretically, prices are assumed to develop within a neo-classical economic structure in which the core concepts are supply and demand, market forces, and the equilibrium price. In neo-classical economic theory, the variation in the house price is the result of the disequilibrium between supply and demand, in which the demand for housing services is a function of demographic factors, income, interest rates and the housing stock, and the supply is a function of the price of land, building costs and credit conditions (Chen, 1998). However, at the national level, we can discern strong connections between only the price and the demand-oriented factors. At micro level it is the quality of the housing that appears to be the primary instrument in determining the price. The causality between the house price developments and the new housing supplies is difficult to express in statistics.

There are two schools of thought in the international literature, which appear to be at odds with each other with regard to the influence of the supply on price.

The first claims that, in many cases, price equilibrium develops in the existing housing stock, implying that new supplies scarcely have any effect or none at all on price developments. This applies particularly to countries, such as the Netherlands, with a strongly regulated housing and house-building market and where building land is scarce. The international housing market literature also emphasizes, how small the influence of the supply (of the new construction) may be on price development in the existing stock, so that the development of aggregated house prices stands largely under the influence of household incomes, mortgage interest rates, and the lag in house prices (Abraham and Hendershott, 1996; Hort, 1998; Malpezzi, 1999). Plainly, in this context, it is impossible to discern the effect of the new supply on prices.

The second approach sees the housing market as supply-based and attaches heavy significance to new housing supplies. It can be assumed that, in the long term, house price development will be determined by production costs in a well-functioning housing market. When prices rise through (temporary) scarcity, building contractors react to this favourable situation by adding attractively-priced newly-built housing to the stock. This extra supply of new housing depresses prices, so that a new equilibrium on the housing market is created. It is implicitly assumed here that the housing market operates as a supply market. House prices function as a trigger, inducing rapid movement towards the equality of housing supply and demand. Since building a

house takes from one to three years, fine-tuning problems can arise so that severe short-term price mutations may occur. With mounting demand, several years may elapse before the required supply is available. Since some housing is already in production, for a period of one or two years more housing is added to the stock than the market requires. As a result, the price of existing owner-occupied housing falls further. The idea behind this supply-directed approach is that in the long term the price of newly-built housing follows the production costs. The factors which determine the costs of new building (including land and construction costs) mark the starting point for a new price equilibrium.

The problem here is that the local spatial planning policy often seriously disrupts the balance between supply and demand on the housing market, with the result that the supply is not at the right place at the right time. Consequently, though causality between price and production can be formulated as a theory, it is in practice difficult to prove with statistical models.

In this paper, we attempt to identify the relationship between (local) housing supply and (local) house price developments in the Netherlands. To do so we use data from our real estate agents. Since the last decade, Dutch housing policy has been more geared towards the market and has framed its objectives accordingly. Despite the liberalization of the housing market, house prices in the Netherlands rocketed in the 1990s and – although there were local differences – the supply turned out to be incapable of an adequate response.

The rest of the paper is organized as follows. Section 6.2 contains a review of the literature on house price development and new housing supplies. Section 6.3 discusses the present situation in the Netherlands, including our own results. Finally, in a summary Section 6.4.

6.2 Literature review

In practice, it is difficult to measure the influence of new housing on house prices on a national scale. As described, on a national scale, house price developments are strongly influenced by macro-economic factors such as anticipated prices, income and interest rates. Conversely, house prices at district and street level are determined by the qualitative characteristics of individual homes and neighbourhoods. It is difficult to demonstrate the relationship between the house price developments and the supply at these two levels. Goodman (1998) defines “a housing market” as a geographical area in which housing supply and demand operate independently of other regions. It is conceivable that the relationship between price and new supplies can be demonstrated at this regional 'interim' level.

6.2.1 Macro level

The literature on housing markets indicates that in almost all western economies, the house price can be explained only by demand-oriented variables. Particular attention is paid to the speculative or psychological effects (see for example, Reichert, 1990; Levin and Wright, 1997; Meen, 1998; Hort, 1998). These effects could explain the – sometimes heavy – short-term shocks. When prices continue to increase, consumers speculate on further rises and act swiftly. Muellbauer and Murphy (1994) offer a second theory to explain why house price developments from the recent past influence house price developments in the future. They argue that the price rises enlarge the capital of owner-occupiers and enable them to take the next step on the housing ladder. Models have been compiled of these short-term price fluctuations on the basis of recent price developments (Abraham and Hendershott, 1996; Hort, 1998; Malpezzi, 1999). The terms 'bubble builder' and 'bubble burster' are often used in this context.

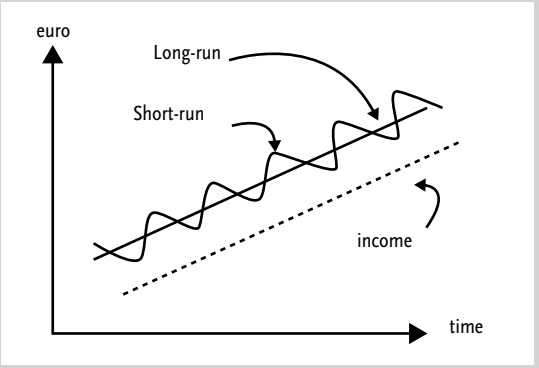
Besides the short-term price effects, other more permanent factors play a role in the development of house prices. Many analytical models include income, inflation and mortgage interest rates as explanatory variables for trends in the purchase prices (see for example, Reichert, 1990; Peng and Wheaton, 1994; Cho, 1996). To ensure that price developments in the long term are again explained by permanent factors, these models incorporate the deviation from price equilibrium with the permanent characteristic as the corrective variable (error-correction models). This long term equilibrium is usually expressed as a price-income ratio. Fair (1972) had already pointed out the broad attention to the equilibrium in the long term between the house prices and incomes – an equilibrium which, according to him, stems directly from the premise of the general price theory in which the demand for an object is a function of the income of the prospective purchaser and the price of the object or service in relation to other prices.

Following on from the literature, we describe house-price appreciation rates for the Netherlands as a function of their lagged values, a measure of deviation from long term equilibrium, mortgage interest rates, household income and seasonal effects (Boelhouwer and De Vries, 2001):

$$P_t = f(P_{t-1}, LTE_t, R_t, I_t, S_t) \quad (1)$$

On the basis of the above description, we can conclude that our findings correspond fairly well with other house-price models described in the literature (see also Meen, 1998). The final equation accounts for 84 percent of the variance, and estimates have been compiled for the period from the first half of 1978 through 2002. Statistical tests to check for serial auto-correlation and hetero-scedasticity yielded good results. The very strong links in our model

Figure 6.1 The long-run relationship between house price and income and the short-run shocks on the housing market



Source: De Vries & Boelhouwer, 2003

between demand-oriented variables and price prevent the supply from exercising any significant influence on price developments.

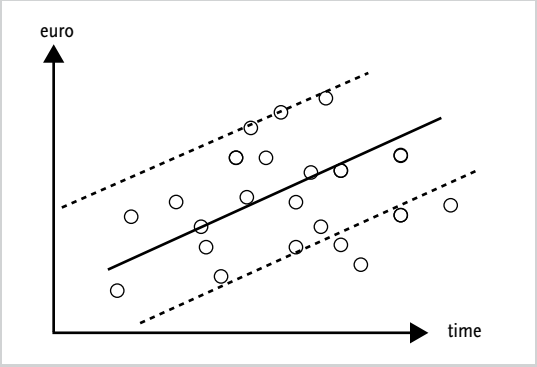
The national (macro) models are strongly dependent on the price effect in the short-term. In our model, the lagged price (P_{t-1}) explains 47 percent of the percentual change in the house price. Chen (1998) indicates that, for Taiwan, 66 percent of the variance in the change in the selling price can be explained by the lagged price. The other 34 percent is due largely to other factors on the demand side; his supply variable explained only 10 percent of the change in the selling price.

Briefly, Cho's review paper (1996) concludes that researchers are agreed on the inefficient nature of the housing market. This manifests itself in systematic short and long-term behaviour (Figure 6.1). Due to their strong connection with demand-oriented variables, the house prices are especially influenced by household income, mortgage interest rates and the lagged house prices.

6.2.2 Housing level

Several studies stress that the house price is influenced by the quality of the housing and the neighbourhood (see for example, Costello, 2001; Din *et al.,* 2001; Luttik, 2000; De Vries, 2002, 2003; Kauko, 2002). Most of these observations are based on hedonic price analyses in which the house price is expressed as a function of a set of characteristics. Hence, the hedonic coefficients can be interpreted as shadow prices which reflect the value of a characteristic. One striking example of such a connection is the presence of new building in a neighbourhood. This has a positive effect on the price of the existing housing because new building is associated with an attractive environment (Simons *et al.,* 1998). In their analysis Simons *et al.,* saw new building as one of the environmental factors which determine value – together with the physical characteristics of the home. Over three years (1992-1994) 12,100 sales were analysed with the aid of hedonic price analysis. The study ascer-

Figure 6.2 Local house price and national mean house price (trend)



Source: De Vries & Boelhouwer

tained significantly higher house prices in the direct vicinity of new buildings, also when corrections were applied for quality characteristics. However, the results were of such a nature that the researchers themselves concluded that the models they used were sensitive to measuring errors. For instance, the number of sales around concentrations of new building turned out to be relatively low.

The explanations offered by these kind of micro analyses are not particularly strong, but they are still strong enough to show that the house price is related to the subjective appreciation for the quality of the home and its surroundings (housing services). The national house price serves as a benchmark in this valuation process. As a result, the price of a home is strongly influenced by the national average house price (Figure 6.2).

6.2.3 Models of price and construction

As explained in the introduction, in neo-classical economics and in an effective market, developments in house prices are explained in the long term by the building costs. In periods of (temporary) shortage, prices rise and construction firms respond by stepping up the supply. This extra supply then puts pressure on the prices and creates a new equilibrium in the market. We are implicitly assuming here that the housing market operates as a supply market. Thus, the factors that determine new building (such as the price of land and building costs) lie at the source of a new price equilibrium.

In 1999, DiPasquale published a review paper entitled *Why Don't We Know More About Housing Supply?*, in which she presents the main empirical literature on housing production and exhaustively addresses the theory behind the empirical work. She also deals with the key question of the relationship between the house prices and the production levels. She concludes that much of the literature has focused on aggregate data because information is so scarce when the unit of observation is the builder, investor, or landlord. We

shall make use of her work in this section.

According to DiPasquale (1999), Muth was, in 1960, one of the first researchers to explore the statistical connection between the house prices and the housing production. His findings were inconclusive. He then turned the causal connection around and formulated a model in which the housing production was explained by the house prices and a set of supply and demand variables. Again, he failed to establish any significant statistical connection between production and price. He concluded from these results – which were confirmed by Follain in 1979 – that supply was entirely elastic and that it operated independently of house prices.

Both Muth and Follain had aggregated databases at their disposal. In 1986 Stover argued (DiPasquale, 1999) that regional differences could influence the relationship between supply and demand and hence the development of price. He designed a regional model in which he distinguished between 61 housing market regions. But these models also failed to establish any causal connection between the prices and the production. His conclusions echoed those of Muth and Follain: supply operates independently of house prices.

Follain and Strover compiled a model which assumed that the price of housing was dependent on the production costs and the quality of the home. The basis was as follows:

$$\text{Price} = f(\text{quality; production costs}) \qquad (2)$$

In 1987 Olson claimed that if the relationship between the price and costs is correctly reflected in models in which the explanatory variables are quality as well as costs, then the coefficient for the quality of the home is always zero. This means that a choice needs to be made between costs and quality as the determinants of the price. The models that had been used until then contained this misspecification with the result that the elasticity was incorrectly determined. Most of the models that came after this turning point explained the price with quality characteristics (see for example, Costello, 2001; Din *et al.*, 2001).

Poterba (1984) introduced the asset market approach. In his paper, he sets out a housing market model which analyses the effect of a shock on a stable housing market. Figure 6.3 depicts the effect of a decline in user costs, leading to a greater demand for housing services at each real price P. This then leads to the new steady state, which is labelled A**. But Poterba pointed out that in models with rational expectations, the steady state is disturbed. There is a unique path, the stable arm curve b, along which the system will return to a steady state. The figures show that, in a fixed housing stock, the price will first increase and then the housing stock will grow and the real price will decline. Eq. (3) determines the expected real capital gain that is needed in order to induce individuals to hold the entire housing stock for a given initial stock

of houses *H* and real house price *P*. Eq. (4) represents the flow of the housing stock. Poterba's (1984) model consists of two functions:

$$\Delta P = -R(H) + \nu P \quad (3)$$

$$\Delta H = \beta_1 P - \delta H \quad (4)$$

in which *P* = real price; *H* = housing stock; *R* = real rental price of housing services; and δ = demolition.

6.2.4 Stock flow models

Dipasquale and Wheaton (1994) are critical of the asset market approach, which was developed with the aim of estimating investment levels. They point out that this approach implies that a rise in house prices will lead to a permanent rise in the number of newly-built homes (β_1 in eq. (4)). Market equilibrium was sought in order to break this ongoing rise in prices. Stock-flow models implicitly assume the existence of an equilibrium between the number of households and the housing stock; hence, at the regional level the number of households determines a priori the new housing supply. The housing supply follows a mutation model shown in eq. (5) (DiPasqual and Wheaton, 1994). This shows that the supply (ΔS) changes due to a gradual increase in new housing construction (C) and declines slowly due to, e.g., demolition or fire (δS). In this equation the new building is dependent on exogenous factors (X_2) and the house price (P). Exogenous factors on the supply side include building costs and interest rates.

$$\Delta S = C(X_2, P) - \delta S \quad (5)$$

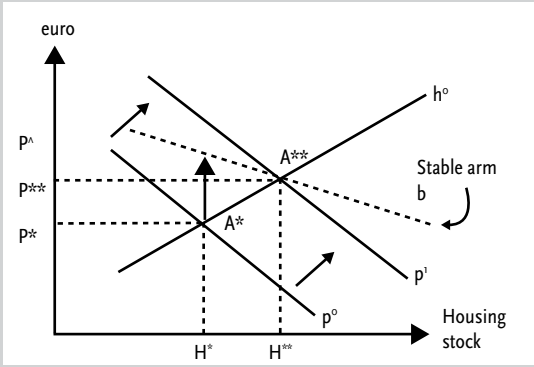
in which S is the supply; C the new housing construction; X_2 the exogenous factors; P the house price; and δ the demolition.

Because of ineffective market forces, the response of the supply to the market impulses is gradual and delayed, thus creating a deviation between the actual housing stock (S) and the housing stock based on market equilibrium (S*). DiPasquale and Wheaton (1994) introduced a market equilibrium and the gradual process to the market equilibrium and rewrote eq. (5) as:

$$\Delta S = C - \delta S = \alpha[S^*(X_2, P) - S]) - \delta S \quad (6)$$

Here new housing construction (C) is replaced by the difference between the equilibrium stock in the long term (S*) and the current housing stock (S) in which (S*) is dependent on exogenous factors (X2) and the house price (P). The speed at which the housing stock adapts under the influence of the new supply is determined by α.

Figure 6.3 Effect of a shock



Source: De Vries & Boelhouwer, 2003

This means that in a situation of equilibrium (S = S*) there would be no impulses to develop new housing construction. This conclusion sheds new light on the influence of house prices on the supply. In eq. (6), house prices only generate new housing supply if the housing stock deviates from the equilibrium (S*). Hence, in towns and regions where the current housing stock (S) is the same as the market equilibrium (S*) prices will have absolutely no effect on production.

Each region probably responds in its own way to changes in the market. These individual housing market dynamics have been proven in American (Goodman, 1998) and Swedish (Berg, 2002) research. Meen (2002) also identified regional dynamics in England. Meen designed a model for the English housing market, in which he distinguished various regions with the result that the influence of regional market forces is reflected in the elasticity in prices in the region concerned. The greater the elasticity, the stronger the response of new supply to a price change. The lowest price elasticity in the south of England is a clear indication that the stringent spatial planning policy in this area is impacting on the regional market forces.

The existence of the 'ripple effect' in the UK (Meen, 1999) and Sweden (Berg, 2002) also confirms regional market dynamics. At the same time, however, it proves the interdependence of the different regions. A price change in the dominant region reverberates on other regions. These kinds of connection are confirmed by causality tests, such as the Granger test. Goodman (1998) even suggests that it is improbable that a linear connection exists between the housing markets; he argues for the plausibility of a log-linear connection.

The literature suggests that new housing supply is not an adequate statistic to determine house price. There appear to be too many other market indicators that influence supply and price. Weston (2002) carried out important research in this area when he studied the response of English building contractors to price changes. His provisional conclusion is that the contractor's first concern is maximization of profits and that he therefore places more expensive homes on the market without raising the quantity of production.

6.3 The Dutch market

6.3.1 History

Between 1945 and 1990, Dutch housing policy was geared to solving the housing shortage. The government exercised a substantial influence during this period in which it largely determined the size and type of production and the property ownership relationship production so that there could not be a perfect interaction between price and production. Since then, market forces have been stimulated and a causal link between price and new supply was, in theory, observable. However, it transpires in practice that the recent supply has not responded to the steep rise in house prices. The main explanation for this phenomenon is that there are obstacles in many areas of government policy that hinder the adequate working of market forces. This vision is reinforced by our earlier model calculations for estimating the production level. Our models predicted consistently higher production quantities than was actually the case. This led us to conclude that even though the market conditions were favourable, production was being slowed down by other factors which hindered market forces in the new building sector (Boelhouwer and De Vries, 2002). Figure 6.4 shows the real situation regarding real house price developments and the growth of the owner-occupied housing stock. Here we see that, from 1997, the lines go in different directions, even though there is more scope for market forces on the Dutch housing market. This should actually lead to a similar development in both lines.

The geographical concentration of the regional spatial planning policy may be one reason why the new housing supply might have been stagnating from this particular date. As in 1990, this policy is a typical example of Dutch 'polder' politics. In other words, agreements were reached with all the relevant parties on increasing the housing stock by an average of 65,000 homes per year between 1995 and 2005. Additional agreements were reached later for the period up to 2009.

A second consequence of concentrating new supplies is competition with the existing stock. Simons *et al.* (1998) pointed out that new building pushes up the prices of existing housing in the vicinity. It all revolves around the elasticity b1 in the equation:

$$P_i = \alpha + \beta_1 C_i + \ldots\ldots. \qquad (7)$$

in which P is the price; C the new building; and *i* the region.

According to Simons *et al.,* if β_1 is positive, new building in the immediate vicinity adds to the attraction of a neighbourhood and pushes up house prices. This argument does not work for Dutch regional housing markets. The concentration of new building in large-scale locations creates competition

Figure 6.4 Development of real house prices and changes in the owner-occupied housing stock in the Netherlands, 1965 -2001

Sources: NVM, CBS (Statistics Netherlands)

and makes the nearby housing market less attractive. In the Dutch situation we can therefore expect a negative relationship between new housing supplies and house prices ($\beta_1 < 0$).

A third consequence of concentrating house building is its effect on the regional housing shortage. At the local level the concentration of newbuilding can turn a housing shortage into a surplus ($S > S^*$): As DiPasquale and Wheaton (1994) demonstrate in eq. (6), the building sector then no longer responds to changes in house prices.

6.3.2 Regional model

In this section, we present the results of the model which we used to explore the causal link between the house prices and the house production at the housing market level. It is not easy to establish such a link at housing market level because new housing is the result of complex decision-making by construction companies, project developers, politicians and individuals. To complicate things further, the housing market is functioning ineffectively with the result that house prices are being constantly influenced and knocked out of balance by endogenous developments. The models for these endogenous developments (inelasticity in the building production, inadequate information services) usually include the price delay. It is perfectly plausible that this mechanism also appears in the local housing market.

In the Netherlands, and also elsewhere in the world, there are no high-quality micro databases that include the price, quantity and the quality of the housing production in addition to the factors that determine and/or influence the decision-making of the players.

Though we had access to the micro data of real estate agents (members of

NVM) for this study, the data files on regional housing stock proved reliable only at the year level. A combination of both data sources eventually yielded only 14 usable observations (1989-2002), not nearly enough for applying advanced regression techniques.

The need for new housing depends primarily on the local and regional factors such as the need for more or higher quality housing. It is therefore logical that the development of the owner-occupied stock will have a measurable impact on prices, notably at the local level, and that the relationship between the growth of the owner-occupied stock and the price development will differ from region to region. After all, regional circumstances have a direct influence on house prices and house-building decisions. The previously mentioned research results of Goodman (1998), Berg (2002) and Meen (2002) indicate that though the regional housing market has its own dynamics, the national trend still has a strong influence on local prices. This national trend is easily explainable by developments in inflation, mortgage interest rates and income (see for example, Abraham and Hendershott, 1996; Boelhouwer and De Vries, 2001; Hort, 1998; Malpezzi, 1999). In other words, in each region, developments in inflation, mortgage interest rates and income translate into price changes in the same way. This implies that it is the conditions on the regional market which are responsible if prices at the regional level develop differently from prices at the national level (eq. (8.4)). "Our hypothesis is that a change in regional circumstances is traced by a change in the owner-occupied stock" (eq. (8.2)). The structure is shown in Model 8.

Equilibrium

$$\Delta_{\%}P_{rt} = f(\Delta_{\%}S_{rt}) \tag{8}$$

in which housing stock

$$_{\%}S_{rt} = (S_{rt} - S_{rt\text{-}1}) / S_{rt\text{-}1} \tag{8.1}$$
$$\Delta_{\%}S_{rt} = {}_{\%}S_{.t} - {}_{\%}S_{.t\text{-}1} \tag{8.2}$$

house price

$$_{\%}P_{rt} = (P_{rt} - P_{rt\text{-}1}) / P_{rt\text{-}1} \tag{8.3}$$
$$\Delta_{\%}P_{rt} = {}_{\%}P_{rt} - {}_{\%}P_{.t} \tag{8.4}$$

where *S* is the number of owner-occupied homes in the regional stock (*r*) at a given time (*t*); and *P* the real house price in the region (*r*) at a given time (*t*).

The consequence of eq. (8) is that, in a region where there are no significant changes, the trend in house prices will reflect the national trend. Moreover, if the owner-occupied stock grows faster than the national average, then the regional price of property will fall, as a relative expansion of the supply will

Table 6.1 Connection between house price and new building per region, 1989-2002

	Owner-occupied housing stock			Property price			
	Addition			Real		Production-price ratio	
Region	Average	% stock	Volatility	Average x 1000 euro	Deviation of Netherlands (percentage points)	Correlation coefficient (R)	R^2
The Netherlands	83809	2.8%	0.13	92.3			
Large cities							
The Hague	3948	3.1%	0.33	98.6	-2.2	-0.80	0.64
Utrecht	2966	3.3%	0.23	98.0	-0.8	-0.51	0.26
Rotterdam	6201	4.0%	0.37	88.4	-1.3	-0.43	0.19
Amsterdam	8355	4.6%	0.23	95.1	0.2	0.34	0.12
Others							
Utrecht region	1259	2.1%	0.27	116.9	-0.2	-0.30	0.09
Groningen province	2840	2.6%	0.18	62.7	-0.6	-0.13	0.02
West Netherlands	39083	3.2%	0.15	96.9	-0.3	-0.03	0.00

Sources: NVM; Statistics Netherlands

upset the relationship between supply and demand. Afterwards, the regional housing market will probably recover gradually until it gains a new, stable equilibrium.

When we sketched out our local housing market areas, we used data from NVM. They work with 80 housing market areas where the price development processes are more or less independent – according to Goodman (1998), this is a basic criterion for qualifying as a housing market area. We also took account of the heterogeneity of the housing stock, which leads to the emergence of sub-domains in a housing market. Eventually we selected seven regions on the basis of the development of the owner-occupied stock. The first group consisted of the regions around the four main Dutch cities (Amsterdam, Rotterdam, The Hague and Utrecht), where it is customary for local authorities and construction firms to agree on large housing projects. No such systems exist in the other three regions; so these could be used for comparison. We chose this approach because of the underlying assumption that the ratio of supply to demand in large cities is upset by regional housing production, which can then affect the prices. No such effect can be expected in the other three regions where there is no concentrated production.

With the aid of key statistics, such as the correlation coefficient supported by diagrams, we can demonstrate the effects of a new housing supply on the development of the price.

6.3.3 Results

Table 6.1 lists the real house price, the housing stock and the connection between the two for the Netherlands as a whole and the selected regions between 1989 and 2002. The strongest average increase in the housing stock occurred in Amsterdam (4.6 percent annually) followed by the other large cities. As expected, the average increase was lower in the other three regions. Only West Netherlands (3.2 percent) exceeds 3 percent. This in itself is hardly surprising as pressure on the housing stock is heaviest in West Netherlands.

Figure 6.5 Real house price and change in owner-occupied housing stock, The Hague, standardized values

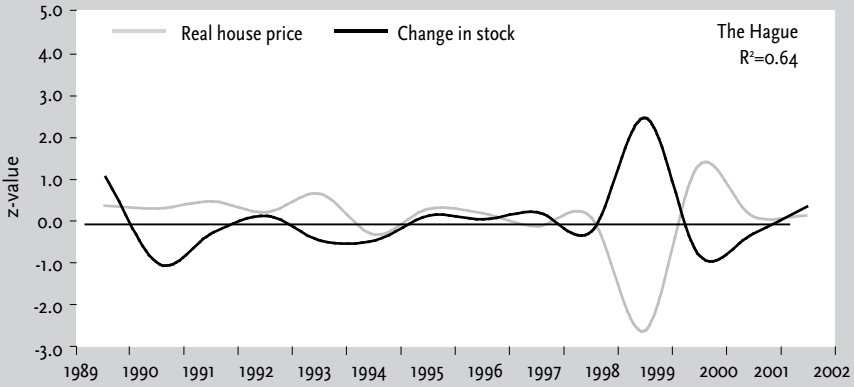
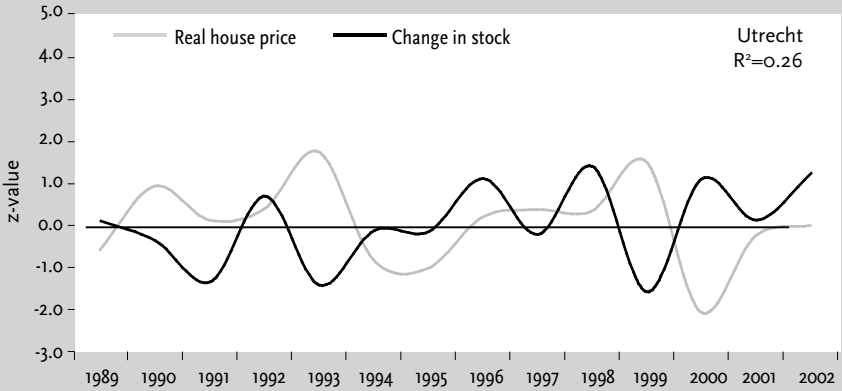


Figure 6.6 Real house price and change in owner-occupied housing stock, Utrecht, standardized values



The average increase in the owner-occupied housing stock says nothing about volatility. It is precisely in urban regions, where large sites can be developed at once, that production can be concentrated in time. To allow for this, the table incorporates a variation coefficient, which measures the spread of production throughout the entire period: hence, the smaller the coefficient, the more even the production. The variation coefficient thus provides information on the depth and height of the peaks and troughs. Volatility is low at the national level. The variation coefficient of only 0.13 means that the annual spread in the change of the owner-occupied stock is 13 percent. The figures for the production around the four main Dutch cities tell a different story. Rotterdam (0.37) and The Hague (0.33) have higher coefficients than Amsterdam (0.23) and Utrecht (0.23). This indicates that the supply is entering the market spasmodically and can therefore, affect the price development.

The real house price rose in all regions in the Netherlands between 1989 and 2002. In the urban regions the price development in The Hague shows the

Figure 6.7 Real house price and change in owner-occupied housing stock, Rotterdam, standardized values

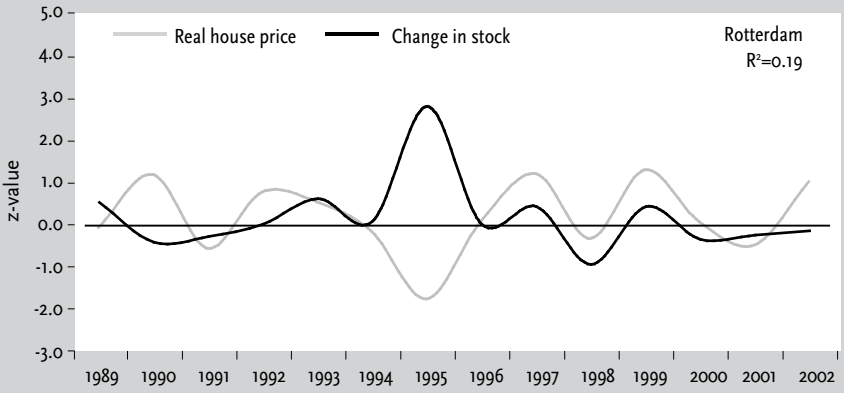
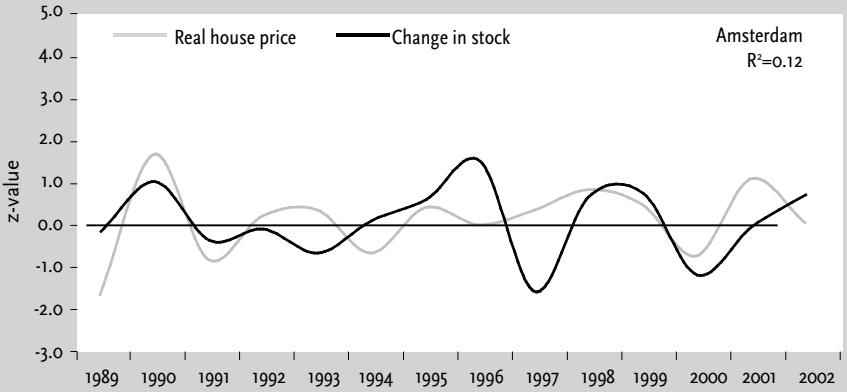


Figure 6.8 Real house price and change in owner-occupied housing stock, Amsterdam, standardized values



strongest deviation. The real house price in The Hague rose by 2.2 percentage points less than in the Netherlands as a whole. It is followed by Rotterdam (21.3) and Utrecht (20.8).Amsterdam experienced a faster rise (+0.2).

Finally, the ratio between the price and the owner-occupied housing stock is shown in the last two columns, which present the correlation coefficient between the owner-occupied housing stock (eq. (8.2): $\Delta_{\%}S_{rt}$) and the house price (eq. (8.4): $\Delta_{\%}P_{rt}$) for each region. The correlation coefficient (R) tells us about the strength and the trend of the relationship between prices and changes in the housing stock. R^2 indicates the variance in percentages: the higher the R^2 the stronger the connection.

The realized relationship (R) between the price development and the housing production is generally inverse (negative correlation coefficient). This means that an increase in supply (broadening the market) triggers a fall in prices. Interestingly, the highest correlation coefficients are for the urban regions (The Hague, 0.64; Utrecht, 0.26; Rotterdam, 0.19; Amsterdam, 0.12),

Figure 6.9 Real house price and change in owner-occupied housing stock, Utrecht surroundings, standardized values

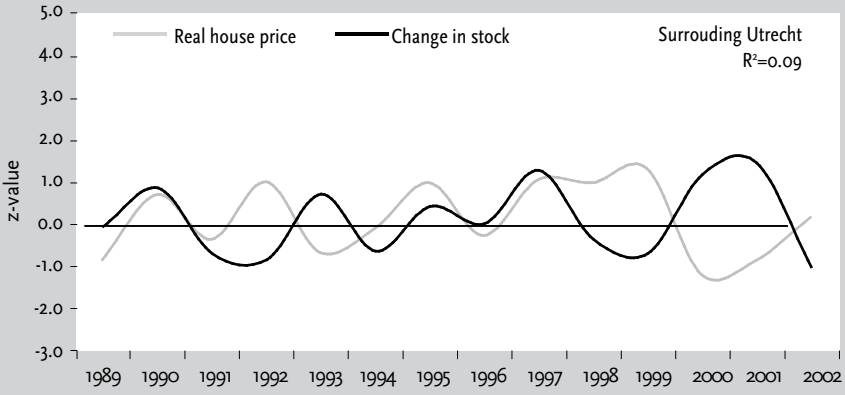
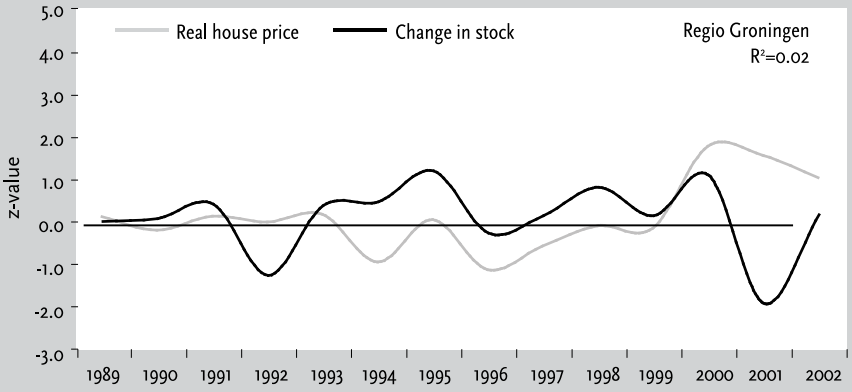


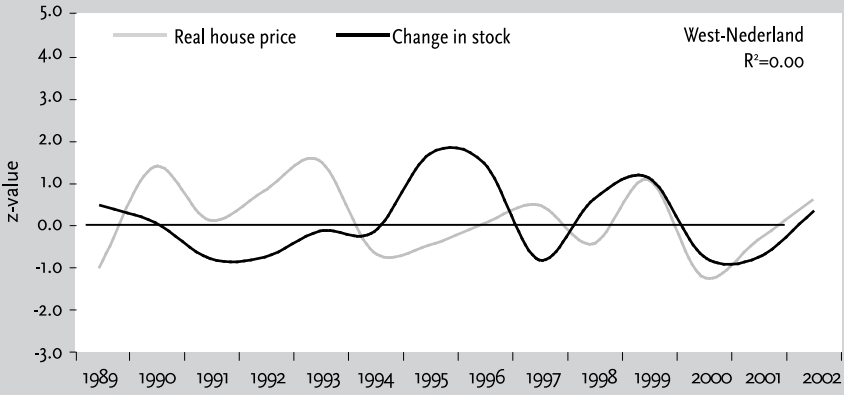
Figure 6.10 Real house price and change in owner-occupied housing stock, region Groningen, standardized values



where it is assumed that prices will respond to an expansion of the housing market. In the other areas the correlation coefficients are more or less than zero, which can lead us to conclude that the expansion of the housing stock is market-compliant in these areas. The regional developments are shown in Figures 6.5-6.11.

To facilitate comparison the values are standardized to z values. As the developments vary considerably from region to region, it is difficult to discern a consistent pattern. We can, however, see – particularly around the large cities – the occurrence of a presupposed response of a fall in prices when there is an increase in the supply of owner-occupied housing (Figures 6.5-6.11).

Figure 6.11 Real house price and change in owner-occupied housing stock, West-Netherlands, standardized values



6.4 Conclusion

The price of housing (*P*) has different determinants on different scales. At macro (national) level these are primarily macro-economic factors, such as demand-oriented variables as interest rates, income and the anticipated prices (P_{t-1}): The anticipated price has a strong influence on the way prices develop. At street level the price is determined by negotiations between the seller and the buyer. Price models on this low-level scale are based largely on significant connections between the price (*P*) and a multiplicity of qualitative features. Here, the national average house price acts as a benchmark. Though new housing supplies depend on many factors that cannot be easily registered in databases, the effect of new housing supplies on house prices can still be analysed at housing market levels. One regional housing market functions more or less independently of others. On the one hand, new building can push up the value of the surrounding housing because it is associated with a qualitatively better housing stock; on the other, it can increase the supply of houses in the neighbourhood and actually put pressure on the prices. The latter situation seems to apply in the Netherlands where new building has been concentrated in designated areas (around the large cities, i.e., Amsterdam, Rotterdam, The Hague and Utrecht) since the 1990s. We hoped to measure the influence of new building on house prices by comparing areas designated for concentrated new building with areas where no large housing projects are developed.

Though our research was hampered by a shortage of usable data, it appears that the large numbers of newly-built housing around the four main Dutch cities do influence the development of property prices. The realized relationship between price development and housing production is inverse, what means that an increase in supply triggers a fall in prices. In other areas the correlation coefficients are more or less than zero, which can lead us to conclude that the expansion of the housing stock is market-compliant in these areas.

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7 Dutch house prices and tax reform

Marietta Haffner and Paul de Vries, in: Miranda Stewart (ed.) (2010), Housing and tax policy, Conference series 26, Sydney, Australian Tax Research Foundation

Abstract
This paper discusses the likely impact of tax reform, in particular the removal of home mortgage interest deductibility, on Dutch house prices in the context of recent local and global house price developments. We analyse three aspects: first whether there is a house price bubble in the Netherlands ready to burst; secondly, whether Dutch house prices will decline in response to the global credit crisis; and finally, in this context, what impact would the reform of income tax treatment of home owners – in particular reduction of the advantage of home mortgage interest deductibility – be on Dutch house prices. We conclude that prices were already under pressure before the credit crunch started affecting the housing market and that changing the fiscal treatment of home owners in this context would cause a further decline in house prices. This would be unfortunate timing for such a reform, especially because the global credit crunch also seems to have started to have an effect on the Dutch housing market.

7.1 Introduction

One year after the start of the global credit crisis in the US, rising interest rates and tightening mortgage markets had led to falling house prices in a number of countries, including the United Kingdom and Spain, but not as yet in the Netherlands (DNB, 2008). This paper analyses whether house prices will start falling in the Netherlands at the end of 2008 and the beginning of 2009 and the potential impact of tax reform on house prices. We first explore whether a house price bubble exists in the Netherlands that is ready to burst and whether house prices are likely to decrease in response to the credit crisis. We then examine the likelihood of a fall in Dutch house prices in response to modelled changes that would reduce the favourable income tax treatment of home owners. To address these aspects, we analyse the literature.

Section 7.2 contains a general discussion of underlying determinants affecting the movement of house prices, including both psychological and non-psychological effects, and the factors that contribute to the phenomenon of house price bubbles. Section 7.3 summarises the general theory and evidence as to the relationship between house prices and income taxation of home ownership. Section 7.4 discusses the possibility of a house price bubble bursting and the anticipated reaction of house prices to the credit crunch in the Netherlands. Section 7.5 examines the impact of income tax treatment of home owners on house prices in the Dutch situation, in particular in

light of various proposals (not yet enacted) to reduce or remove the tax benefit of home mortgage interest deductibility. We begin by setting out the context and describing the relevant income tax rules. We then present the outcomes of two Dutch models that predict the movement of house prices following restrictions to the tax treatment of the owner-occupied dwelling.

7.2 Underlying determinants of house prices and causes of housing bubbles

In a competitive market, house prices are the result of interacting demand and supply (Girouard *et al.,* 2006; Chen, 1998). Factors, or 'drivers', influencing demand and supply are usually called fundamentals or the underlying determinants. Factors such as disposable income, interest rates and demographic development influence demand, while factors affecting supply, such as the price of land and the level of building costs, influence the availability of dwellings. These drivers may influence the house price in the short-term, the medium-term and the long-term.

On the demand side, an argument analogous to the one underlying the general theory of price can be made: the demand for goods is a function of (household) income and of the price of the good or service relative to those of other goods or services (Fair, 1972). Various studies demonstrate that in the long-term, house price and income level are indeed in equilibrium (e.g., Malpezzi, 1999)[1].

In addition, access to capital and the conditions under which households can borrow money can play an important role. Meen (1998) draws the conclusion that in the United Kingdom and the US, access to capital has affected house prices in the past. Since the 1980s, however, financial markets have largely been liberalised and restrictive rules on eligibility for mortgages have lost much of their impact. In response, the influence of exogenous factors such as the development of income and interest rates has increased (e.g., Muellbauer & Murphy, 1997).

On the supply side, neoclassical economic theory predicts that the housing market operates as a supply market (Boelhouwer, 2005). This means that the long-term price development of dwellings will be determined by the development of construction costs (Muth, 1960; see also Shiller, 2007). When scarcity of dwellings causes prices to rise, the supply of newly built dwellings will increase, causing prices to fall to a new equilibrium price. Econometric studies carried out for the US demonstrate a significant relation between the

1 Gallin (2006) suggests, however, that the co-integration relationship between house price and income that is commonly assumed in the literature may be inappropriate.

development of construction costs and sales price (Abraham & Hendershott, 1996). This result strengthens the assumption that as the government exerts less influence and building land is made available without many restrictions, the influence of construction costs on house prices will increase.

On the other hand, if a government intervenes in the housing market, Boelhouwer (2005) speaks of a 'stock' market in which the price of newly built dwellings follows the price of dwellings in the existing stock. An example of such government intervention is when the government prevents the release of sufficient building land (Winky & Ganesan, 1998) by implementing restrictive spatial planning policy (see, among others, Muellbauer & Murphy, 1997; Abraham & Hendershott, 1996).

House prices appear not only to be influenced by 'rational' economic or policy drivers, but also by some 'irrational' considerations that work in the short term. A house price bubble might be formed because "excessive public expectations of future [house] price increases cause [current] prices to be temporarily elevated" (Case & Shiller, 2003: 299). The bubble grows because homebuyers will buy a dwelling that "they would normally consider too expensive" in the expectation that they will be compensated by future price rises. Himmelberg *et al.* (2005: 67-68) quote Stigler's definition of a bubble (1990): "[I]f the reason that the price is high today is only because investors believe that the selling price is high tomorrow – when 'fundamental' factors do not seem to justify such a price – then a bubble exists." They continue (p. 68): "We think of a housing bubble as being driven by homebuyers who are willing to pay inflated prices for houses today because they expect unrealistically high housing appreciation in the future." In this context, first-time buyers may expect that houses will quickly become unaffordable and in order to prevent this, they will act swiftly to purchase a house (Case & Shiller, 2003). House prices could then fall when people realise that constantly rising prices in the future are not realistic because "home prices are inherently unstable", and this may burst the bubble.

The irrational belief that nominal house prices always appreciate more than inflation, and that this explains the fast-rising house prices in recent decades, is a psychological or speculative short-run effect that 'infects' the development of house prices (Shiller, 2005; see also Levin & Wright, 1997). This idea that housing is a great investment – which accompanies a speculative bubble – seems actually to be caused by the bubble itself. Shiller argues that 'boom psychology' helps to spread such thinking (2007: 7).

The reverse effect would be the story fuelled by pessimistic expectations of the possible duration of a recession and how far house prices might fall enforcing these expectations. In a downturn situation, the consumer may also postpone the decision to buy for as long as possible in order to avoid incurring capital loss. Such speculative behavior may force prices to decline further (Boelhouwer *et al.*, 2004; Levin & Wright, 1997).

However, not every house price rise will make a bubble (see also Himmelberg *et al.,* 2005). A bubble is created only when expectations keep the market going in the sense that they stimulate buyers to buy a dwelling and only if the fundamentals in the market do not explain the increase.[2]

Whether market fundamentals get a chance to work will also depend on the elasticity of supply. Based on a simple model of house price bubbles, Glaeser *et al.* (2008) conclude that their observation of more volatile house prices (or bubbles) than observable changes in fundamentals appears to be more likely in situations of less elastic supply.

7.3 Evidence of the effect on house prices of changing the tax treatment of home ownership

A separate discussion of the fiscal treatment of home ownership is warranted here, as one of our aims is to analyse how house prices may develop when the income tax treatment of home ownership is made less favorable. In particular, the issue to be analysed in more detail in Section 7.5 is the impact on house prices of limiting or removing the deductibility of home mortgage interest, which is currently allowed in the Dutch income tax system.

In general, the expectation is that house prices will start falling if tax treatment of home ownership is made less favourable. However, according to Bourassa & Grigsby (2000), the degree to which changes in the tax treatment of home ownership impact on the development of house prices will depend greatly on the extent to which the existing tax advantage is capitalised into house prices. Capozza et al.'s (1998) results for the US support the hypothesis that income tax advantages are fully capitalised into house prices. Bourassa & Grigsby (2000) argue that such a result requires a fully inelastic longterm supply curve, an implication that they consider questionable.

In the Netherlands, a lower proportion of households live in a home that they own or are purchasing than in some other countries (54 percent of about 7 million Dutch households are home owners). Of these, however, the majority are purchasing their homes with mortgage debt and so the home mortgage interest deduction has a significant effect on the cost of this mortgage debt. Indeed, 85 percent of home owners are purchasing their home with a mortgage loan, resulting in an average loan-to-value ratio (LTV) of 0.52 and an average loan-to-income ratio (LTI) of 2.52 as at 1 January 2006 (Haffner *et al.,* 2008).

In this context, for the Netherlands, Brounen & Neuteboom (2008) estimate

2 Shiller (1981) reports excessive volatility of stock prices in relation to underlying determinants.

a considerable average capitalisation rate of almost three-quarters of the home mortgage interest tax deduction to households. For first-time buyers, this share, at almost 96 percent, is calculated to be bigger than average. This suggests that first-time buyers are translating most of the expected mortgage interest tax deduction into their house price bid. In contrast, for a home owner who is moving house, the share of capitalisation is estimated to be far lower, at 57 percent. This is because such home movers usually need a smaller mortgage loan than first-time buyers as they have some equity in their first home.

Previous capitalisation of tax benefits allows for house price falls when the tax benefits are restricted. Bourassa & Grigsby (2000) cite on the one hand calculations that place the capital losses at between 10 to 20 percent or more, depending on market conditions and other factors. On the other hand, using a simulation model which integrates short term and long-term impacts of tax reform on the housing market, Bruce & Holtz-Eakin (1999) find only a slight decline in house prices of a little over 1 percent in the short term after a tax reform.

Capozza *et al.* (1998) with their model find a decline of house prices of 14 percent with an average LTV of 0.41 in the US in 1992 when they include only the repeal of the home mortgage interest deduction. If the LTV were assumed to be 0.25 on average, the price decline is estimated at almost 10 percent, running from almost 13 to 20 percent and more. They find that the greatest losses would occur in expensive cities such as Honolulu and San Francisco.

If house prices do fall after such a change in the tax system, the question becomes: when does the decline begin? This depends on how households behave when they become aware of proposals for a tax reform. Vandell (2000) argues that households will take action in anticipation of the change in policy. Åsberg & Åsbrink (1994) have attempted to model such proactive behavior. They estimated the effects of income tax reform, all other things being equal, on house prices in Sweden. In their estimates they distinguish between home owners' reactions to both an expected and an unexpected revision in the tax code. If home owners expect the revision, then a further distinction is made in the reaction, taking into account the timing of the announcement (1989) and the time at which the revision actually came into force (1991). In all three situations, the researchers expected to see the house prices decline by less than 10 percent (8.7 percent to 9.9 percent) with inflation running at 2 percent. They predicted that an unexpected revision in the tax code would lead to the greatest decline in house prices (9.9 percent). This was also the case when inflation was assumed to be 6 percent. In that event, the expected decline amounted to between 23.3 and 25.4 percent.

However, in reality, the actual development of Swedish house prices proved that no house price response occurred when the reform of the tax system was announced; instead, the house price decline only set in after the tax

Table 7.1 Main policy changes in personal income tax treatment of home ownership in selected European countries

Country	Year	Policy change
No observed relation to house price change		
Belgium	1989	System change: reduction of highest tax rate affecting mortgage interest deduction
	1992	Mortgage interest deduction extended
France	1997	Mortgage interest deduction abolished for new homes
	1998	Mortgage interest deduction abolished for purchase and improvement
Germany	1987	More room for deductions. Imputed rent abolished
	1996	Fiscal concessions terminated
Netherlands	1990	System change: reduction of highest tax rate affecting mortgage interest deduction
	2001	Mortgage interest deduction limited to 30 years
Norway	1992	System change: reduction of highest rate affecting mortgage interest deduction
United Kingdom	As of 1991 up to 2000	Mortgage interest tax relief phased out
Observed relation to house price change		
Denmark	1987	System change: reduction of highest rate affecting mortgage interest deduction
	2000	Imputed rent abolished and replaced by property tax
Sweden	1991	System change: reduction of highest rate affecting mortgage interest deduction
		Imputed rent abolished and replaced by property tax

Note: Capital gains taxation is excluded from the table.

Source: Boelhouwer *et al.* (2004)

reform had been implemented in 1991. At that time, selling prices dropped quickly – by 26 percent between 1991 and 1993 at inflation rates of 10.3 percent in 1991, 2.2 percent in 1992, and 5.7 percent in 1993 (Eurostat, Economic Outlook). A 'lagged' response such as this raises questions as to whether the owner-occupiers were actually able to understand the tax changes adequately and in good time. It should be noted that in the Swedish case, the changes in tax treatment of home ownership were combined with an overall reduction in tax rates. The economic recession that commenced soon after may also have obscured the evaluation of owner-occupiers about effects of the housing tax reform measures.

More generally, however, a comparative descriptive study (Boelhouwer *et al.*, 2004) found that in many countries, there was no observed house price impact from housing tax reform. This study observed whether a change in average house price could be detected after a change in the income tax treatment of home owners in eight countries: Belgium, England, Denmark, Finland, France, Germany, the Netherlands and Sweden. The reforms to income tax that were studied, and whether there was any observed house price change, are summarised in Table 7.1.

This broad comparison also revealed that the means and timing of the implementation of the tax reform largely determines the impact on the development of house prices. Only in Denmark and Sweden (see above) could an annual decline in house price be observed to take place in the four years after the year of the change in income tax treatment. In the other countries studied, the effects of the changes were either too small to be traceable (e.g., Belgium, England, France and Germany) or were compensated for by general

tax measures (the Netherlands and Norway).

It must also be noted that changes were introduced more gradually in some countries, in particular in the United Kingdom (see also Gale, 1997) and in the Netherlands and Norway, compared to both Denmark and Sweden. The latter two countries also had the misfortune that the tax reforms coincided with a recession. This manifested in various ways, including high unemployment and inflation alongside a recession in the housing market. In Norway, in contrast, the tax reform carried out in 1992 made a positive contribution to economic recovery. On balance, home owners were better off – in terms of purchasing power – even though the mortgage interest deduction for home owners was reduced as a result of the reduction of the highest individual marginal tax rate.

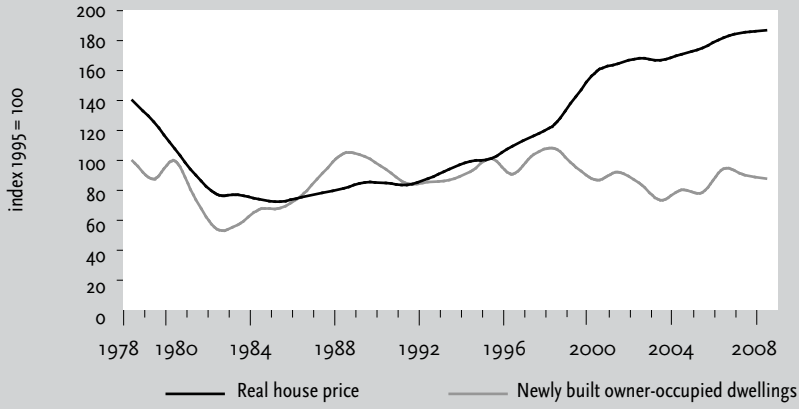
7.4 Dutch house price development and expectations

In this section, we discuss the expectations of various researchers about the movement of house prices in the Netherlands. The International Monetary Fund (IMF) has suggested that in 2007 there may have been a house price bubble in the Netherlands (IMF, 2008). Dutch models, however, draw different conclusions about current house price trends.

Dutch house price developments over the past three decades are illustrated in Figure 7.1. In the 1970s, house price development was characterised by steep price rises shortly before the second oil crisis, followed by equally steep price decreases in the period from 1978 to 1983 (Boelhouwer & De Vries, 2001). This is the starting point for Figure 7.1. Prices then rose for more than 2 decades (see also Girouard *et al.,* 2006), until the third quarter of 2008, with the exception being a fall in the first half of 1990 (the time of the Gulf War). This relatively long period of price rises was brought about by favorable economic conditions combining rising household incomes and falling interest rates. In addition, mortgage requirements eased during this time. For example, in 1993, a second household income was allowed to be included when determining eligibility for a home loan. Increasingly, mortgage loans were developed in which the full amount of income-tax-deductible interest was paid during the loan term, in first 'endowment loans' and later, interest-only mortgages. These new mortgage products maximised the benefit of the home mortgage interest deduction for households. As a result, house prices could rise without generating liquidity problems for households, whose monthly housing or mortgage expenses remained affordable.

During the period 1991 to 2000, house prices increased substantially, with average yearly growth rates of 9.7 percent in nominal terms and 7.1 percent in real terms. From 2001 to 2007, house price increases were more moder-

Figure 7.1 Real house price and newly built owner-occupied dwellings, 1978-2008 (index 1995=100)



ate, with average yearly growth rates of 3 percent above inflation. The most important factor in this period was the increase in household disposable incomes. Furthermore, during this period, the increase in dwelling supply was relatively small. The downward pressure on prices therefore was also relatively small.

7.4.1 Was there a Dutch house price bubble in 2007?

The recent IMF assessment of the vulnerability of various countries to housing market corrections was based on two housing market indicators (IMF, 2008). The first indicator shows the overvaluation of house prices in relation to the following housing market fundamentals for the period 1997-2007: the affordability ratio (the lagged ratio of house prices to disposable incomes), the growth of disposable income per capita, the short-term and long-term interest rates, the credit growth, and the changes in equity prices and working-age of population. The IMF estimated the gap between real house prices and house prices justified by the fundamentals to be approximately 30 percent in Ireland, the Netherlands and the United Kingdom. This was the largest gap estimated in the countries examined. If this estimated gap may be interpreted as a measure of house price overvaluation, it is then an indication of house prices being prone to correction in these countries. It must be noted that the IMF (2008: 11) cautioned that the unexplained increase in house prices might reflect variables omitted from the model, such as macroeconomic volatility, household formation and inward migration.

The second indicator used by the IMF shows the development in the past 10 years of the residential investment-to-GDP ratio in each country. One assumption underlying this indicator is that large house price increases are accompanied by large increases in residential investment in 2007. However, Boelhouwer (2005; see also Ball, 2008) shows that this is not the case in the Netherlands, where house prices have risen exuberantly while residential investment stagnated as a result of the abolition in supply-side subsidies in combination with barriers in the planning, sales and building phases of

the production process. Figure 7.1 also illustrates this stagnation in supply of newly built housing. As this indicator does not apply to the Netherlands, only the question of the 30 percent gap remains.

Although the IMF formulated its findings with care, in the Netherlands there were strong reactions to the suggested 30 percent gap in house prices. The IMF responded by explaining that it is hard to predict bubbles and went on to emphasize that the results of its models do not exclude the possibility that price increases may be driven by factors other than economic fundamentals (NRC, 19 May 2008, p. 23). In contrast to the IMF study, Kranendonk & Verbruggen (2008) argued that Dutch house prices in 2007 can be fully explained by the underlying determinants. Their study functioned as a reply to the assumed house price bubble warning of the IMF. Their model (which was originally developed by Koning *et al.,* 2006) showed that the development of real house prices in the period 1980-2007 can be ascribed to fundamental demand and supply variables, such as real disposable wage income, the real interest rate, the real financial wealth of households other than stock, and the stock of dwellings. Furthermore, they concluded that the calculations of earlier models (Verbruggen *et al.*, 2005), showing that house prices had been overvalued by about 10 percent in 2003, were substantiated by the more recent calculations. After 2003 the overvaluation diminished, however, and disappeared entirely by 2007. This was due not to a downward house price correction but to the fact that between 2003 and 2007 the increase of actual house price lagged behind the increases of the long-term equilibrium price calculated in the model.

Kranendonk & Verbruggen (2008) explained that their results differed from the IMF's analysis because the IMF would not have taken national housing market specifics into account, such as the moderate increase in the supply of dwellings in the Netherlands which pushed up the equilibrium house price more than otherwise would be the case.

De Vries & Boelhouwer (2009) showed with their model that house prices had been out of equilibrium longer – from 2000 to the first half of 2007 to be precise – than Kranendonk & Verbruggen (2008) assert. This was caused particularly by decreasing interest rates and increasing income levels, both of which have more than likely supported the creation of the house price bubble. When interest rates began rising at the end of 2005 (3.75 percent), continuing to rise through the first half of 2008 (5.16 percent), and income growth began slowing down more than before, the affordability of home ownership worsened and house prices therefore began a gradual downward adjustment. De Vries and Boelhouwer (2009) conclude that in 2007, house prices can be determined by the fundamentals and as from 2008, the growth of real prices was predicted to be zero.

In summary, calculations based on two models for Dutch house prices counter the IMF's warning of a possible Dutch house price bubble in 2007.

Any bubble that may have existed before 2007 had vaporised by that year as a result of the period's moderate house price development.

7.4.2 Effect of credit crisis on house prices in 2008

The global financial crisis (that began in the US in the summer of 2007) had its source, after 2000, in the increase in loan incentives that caused declining lending standards (Haffner, 2008; Chomisengphet & Pennington-Cross, 2006; Zelman *et al.,* 2007). The long-run trend of rising house prices also caused financial institutions to engage in sub prime loans with a heightened risk of default. That same long-run trend also presumably encouraged households to assume riskier mortgage types in the belief that they would be able to refinance quickly at more favorable terms. As interest rates began to rise in 2006, the well-known consequences followed: refinancing became more difficult, more dwellings were seized and foreclosures increased dramatically when initial soft terms of mortgage loans expired. As house prices started falling in the US, the financial problems of the US housing market especially for securities based on sub prime and other risky mortgages, triggered the global crisis.

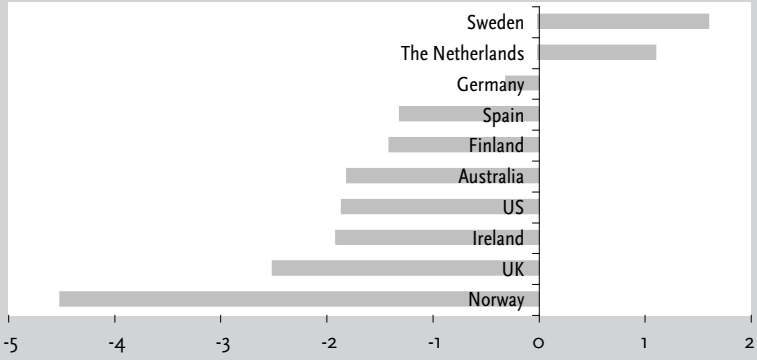
Will the global crisis trigger house price decreases in the Dutch housing market? The Dutch central bank (DNB, 2008) argued that the risk of a downward house price correction in the Netherlands as a result of the effects of the American credit crisis is much lower than in some other countries. This is supported by Figure 7.2, which compares nominal house price changes in the third quarter of 2008 compared to the third quarter of 2007 and demonstrates that house prices in the Netherlands (and Sweden) had not started falling.

DNB (2008) asserted that the reason for relatively less downward movement of house prices in the Netherlands than in some other countries is because of several features of the local housing market that differ from housing markets in other countries. These local features apply, although in general, underlying affordability of home ownership had begun to decline in the Netherlands due to interest rates rising from 3 to 4.3 percent in the period from 2005 to 2007. First, DNB identified the relatively low share of home ownership (54 percent) in the Netherlands, which means that fewer households are vulnerable to changes in mortgage interest rates.

Second, the Netherlands has a relatively low share of mortgage loans with a variable interest rate, or an interest rate fixed for a period of less than one year (only 15 percent). This contributes to what Case & Quigley (2008) refer to as 'downward stickiness' of house prices because changes in interest rates will take their toll on affordability less quickly.[3]

3 See also Peltzman (2000) who studied the phenomenon of downward stickiness of output prices as a response to an input price decrease.

Figure 7.2 Nominal house price development in a number of countries (percentage change in third quarter 2008 in relation to the third quarter of 2007



Source: Statistics Netherlands

Tsatsaronis & Zhu (2004) also show that house prices are more sensitive to short-term interest rates in countries where floating mortgage rates are used.

Third, as discussed further in Section 7.5, there is a significant tax effect in the Netherlands because of the relatively high share of mortgage interest that is deductible for income tax (maximum tax rate of 52 percent). As a result, increases in the mortgage interest rate are mitigated more than in most other countries where home mortgage interest deductions are more limited or do not exist (Haffner, 2002). Affordability of mortgage expenditure will thus be changed at a slower rate.

Fourth, DNB argued that in countries where house production and the number of building permits has been relatively high in the past decade, the drop in demand may hit harder, especially when house buys are fed by the speculative expectation that house prices will keep on rising (compare IMF, 2008). the Netherlands is not one of those countries, as house building has been decreasing for several years of this century and has not regained the higher levels of production that were achieved in the past century.[4]

According to DNB, overall, these factors contribute to a smaller risk of a downward house price correction in the Netherlands, even if mortgage credit becomes scarcer and economic growth perspectives are less optimistic than in the recent past.

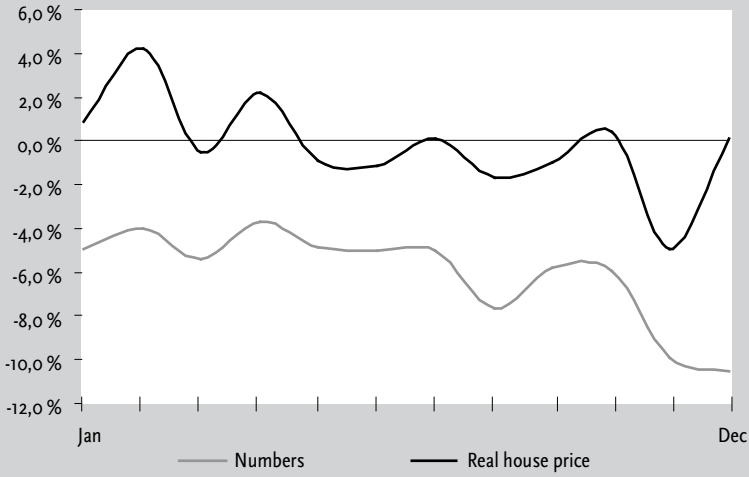
However, some more recent data may suggest otherwise. Although it is still too early to establish a statistical relationship between the global credit crunch and the Dutch housing market, Figure 7.3 illustrates that the number of sales of newly built dwellings fell sharply in the fourth quarter of 2008.[5]

The decline in number of transactions that started in the second half of

4 House production expressed as investment reached almost 6 percent of GDP in 2007 versus e.g., more than 8 percent respectively 10 percent in Spain and Ireland. The number of building permits reached 6 per 1,000 inhabitants in 2006 versus e.g., more than 19 in Spain and 6 also in Ireland, but for 2001.

5 The sales of newly built dwellings fell 50 percent in comparison to a year earlier according to the database *Monitor Nieuwe Woningen.*

Figure 7.3 Real house price and number of transactions, January-December 2008 (percentage-changes per month compared to 12 months earlier)



Source: Kadaster Nederland; OTB Research Institue (TU Delft) calculations

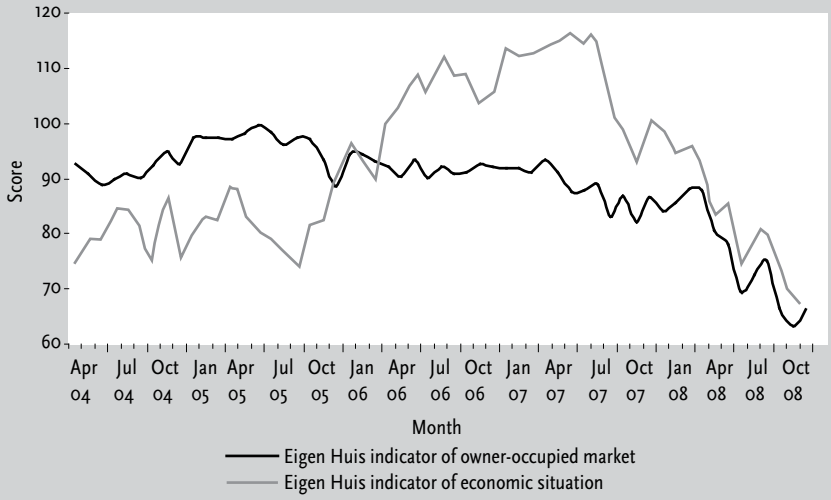
2006 (more than 195,000) intensified in 2008 (from less than 180,000 to less than 161,000). Figure 7.3 also shows that the real house price seems to have started decreasing at that time, but is volatile.

Statistics like these have not been seen for the Dutch housing market in decades; nor were they expected (De Vries *et al.,* 2008). It was assumed that in the period 2008-09, house prices would at least follow inflation because the fundamentals were expected to show a favorable development in both years. For 2009, both a decline in interest rate and an increase in disposable household income through tax measures were taken into account.

It seems that a negative short-run effect, possibly caused by the credit crunch, has 'infected' the housing market in the fourth quarter of 2008. This negative psychological effect determines some 50 percent of price developments in the Dutch housing market according to De Vries and Boelhouwer (2009). Figure 7.4 shows that psychology seems to have started playing a role in the owner-occupied market as early as the second quarter in 2007 when the news about the start of the problems on the financial markets became known, even before the Vereninging Eigen Huis (association for owner-occupiers) indicator for consumer confidence in the owner-occupied housing market started falling.

The question remains whether the presumably positive influence of economic fundamentals can neutralise the current negative sentiment in the housing market. If an economic downturn affects the fundamental drivers, especially the income situation of households, then house prices as well as the number of transactions may decrease further. This is not an unrealistic scenario, as De Jong *et al.* (2008) forecast a 0.75 percent shrinkage of the Dutch economy in 2009. Unemployment has also started rising for the first time in

Figure 7.4 Eigen Huis indicator for owner-occupied market and Eigen Huis indicator for the general economy, April 2004-December 2008 (average scores per month)



Source: Boumeester & Lamain, 2008

more than 3 years in the fourth quarter of 2008 (CBS, 2009).[6]

What may seem 'only' psychological effects for the moment may fall into line with changing fundamentals of house prices in the near future.

On the other hand, the continually lagging supply of new dwellings (illustrated in Figure 7.1) has brought about a situation of scarcity in dwellings on the housing market,[7] a situation which will counterbalance the threat of a price decrease. If the sharp decline in new construction and backlog orders continues,[8] another offset to house price decreases may be at work. In total, Van Hoek (2008) expects that the production of dwellings will decrease by 20 percent in 2009 and 2010.

7.5 Tax reform and house prices in the Netherlands

In this section, we discuss the potential impact on house prices of tax reform that would reduce the favourable tax treatment of home ownership in the Netherlands. In particular, we examine the potential impact of reduction or repeal of the Dutch home mortgage interest deduction.

6 Dutch newspapers also mention regularly that banks have tightened up their lending policy.

7 The policy aim is to reduce scarcity on the housing market by 2010 to 1.5 percent of housing stock (Ministerie van VROM, 2004-05).

8 The backlog of orders for new dwellings continued to fall from ten months to less than eight months in September 2008 (Van Hoek, 2008).

Table 7.2 Quantification of tax treatment of home ownership in Box 1 ranked according to income and age, using estimates for 2005

Joint aggregate income	Net tax deduction (€ M)	Home ownership (%)	% Home owners with mortgage loan	No. of households	Net advantage per household with mortgage interest relief (in euros)	Net advantage per household with mortgage interest relief as % of disposable income
Households < 65 years old						
Up to 30,000 euros	1,621	33	92	716,037	2,264	13
30,000 – 45,000	2,620	70	95	945,107	2,772	10
45,000 – 60,000	2,159	81	95	649,481	3,324	10
60,000 – 90,000	2,020	88	94	478,988	4,217	9
90,000 and above	1,219	89	92	187,115	6,515	7
Total < 65 years	9,639	59	94	3,012,201	3,200	
Households 65+						
Up to 20,000 euros	26	17	44	65,352	398	3
20,000 – 40,000	103	43	54	119,065	865	4
40,000 and above	167	69	54	80,103	2,085	4
Total 65+	295	32	51	261,354	1,129	
Total	9,934	53	88	3,280,070	3,029	

Sources: First four columns: Wijn (2005); final column: Kuipers *et al.* (2006)

7.5.1 Tax treatment of home ownership

As a matter of policy, in an 'ideal' income tax, two 'pure' options can be chosen for taxation of home ownership, or owner-occupied housing (Haffner, 2002).[9]

In the first option, the home is treated solely as a durable consumption good. Neither the imputed rent of the owner-occupied dwelling nor any capital gain is taxed and no income tax deductions are available for expenses associated with the home. In the second option, the home is treated as an asset or investment good. In this case, imputed rent and capital gain are taxed to the home owner as income and the costs incurred to produce that income are deductible.

Historically, the investment approach was taken when the Dutch income tax was first designed in 1914 (Bijvoet, 2001). That is, the owner-occupied home was treated like an investment good. This policy choice was not illogical if one considers the roots of income taxation in the aftermath of the Industrial Revolution. At that time, most dwellings were for rent. The treatment of owner-occupied dwellings probably was a simple adaptation of the way in which rental dwellings were taxed: the taxation of profit being the difference between rental income and maintenance and other costs (there was

9 From an economic point of view the choice for one of these options will be based on the policy aim that the marginal decision of the actors will not be influenced by income tax. Neutrality can either be established across tenures, across all investments or according to the primary structure of the tax system (Flood & Yates, 1989; Hancock & Munro, 1992).

no capital gains tax at that time). For the owner-occupied dwelling, rental income was imputed.

The net imputed rent from living in the dwelling is determined as a percentage of assessed market value of the dwelling. It is the imputed difference between gross income and a number of costs including local taxation and insurance. However, the interest expense of a mortgage to purchase the home and the leasehold costs of land may be deducted from taxable income as actual amounts instead of imputed amounts.

In due course, inconsistencies in treatment of owner-occupied dwellings, in comparison with the income tax treatment of other investment goods such as second homes, shares and bank savings accounts, crept into the system (Haffner, 2002). One of the more important inconsistencies was the result of a reform which meant that net imputed rent was no longer actually calculated or estimated for each dwelling, but was instead expressed as a percentage of 60 percent of taxable house value, while 100 percent of actual interest expense remained deductible (Ministerie van Financiën, 1989). The exclusion of 40 percent of value of the home was considered a political correction to the calculation of imputed rent, which was applied because of the mixed investment-consumption character of the owner-occupied dwelling. The investment character of the dwelling was considered weaker than that for a share, for instance, because a dwelling also was meant to provide shelter.

Another big inconsistency in comparison with the income tax treatment of other investment goods arose from the major Dutch income tax reform of 2001. In this reform, a type of dual income tax was introduced which separates income into two basic categories: income from capital (including gains from shares, property, bank savings accounts and so on) and income from other sources (most importantly income from work and active business (see further Cnossen and Bovenberg, 2001; Sørensen, 1994). Income from capital is generally taxed at a flat, proportional rate, while income from work and active business is taxed under a progressive tax schedule. In fact, in the Netherlands, three 'Boxes' of income were established. Box 1 included income from work and business at progressive marginal rates, with a maximum rate of 52 percent. The income from investment is taxed in two other boxes. Box 2 taxes actual income (dividends and gains) from shares at a flat rate of 30 percent for shareholders with a significant (more than 5 percent) interest in the company. Box 3 taxes the imputed return from capital (wealth) at a flat rate of 30 percent. In contrast to Box 2 (which taxes actual returns to shares), the net income from net wealth (wealth minus debt)is imputed at 4 percent so that, in effect, income tax on Box 3 capital assets is calculated as 1.2 percent (30 percent over 4 percent) of net wealth. The use of an imputed return to wealth is markedly different from income tax systems in most other countries.

From the standpoint of providing neutral treatment of individual owners of dwellings, one would expect to find the owner-occupied home in Box 3.

However, in fact, the net imputed income from the home, less actual interest expenses on mortgage debt to purchase the dwelling, is treated in the same way as income from work and taxed in the new Box 1 against a progressive rate with a maximum of 52 percent. This is inconsistent with the treatment of second home and landlord-owned dwellings, which are included in Box 3. This exceptional income tax position for owner-occupied housing results in a much more favorable treatment of owner-occupiers in comparison with landlords, as owner-occupiers can deduct home mortgage interest against employment income up to a maximum rate of 52 percent. This mortgage interest deduction does not stimulate households to save, but rather to borrow money.

The special position of the home owner could make the owner-occupied dwelling an easy victim for tax savings for the government. However, nothing could be further from the truth. The fundamentals of the income tax treatment of owner-occupied dwellings have not been changed since 2001 and various Dutch cabinets have promised not to interfere with the fiscal treatment of home ownership.

In spite of this, there have been some changes that will make mortgage interest deductibility less favourable over time. The tax reform of 2001 lowered the maximum progressive tax rate from 60 to 52 percent, which reduced the benefit of mortgage interest deductions for home owners facing the top marginal rate. At the same time, mortgage interest deductions were limited to 30 years and to the principal dwelling only. Subsequently, in 2004, for existing home owners who move to their next owner-occupied dwelling, the deductibility of mortgage interest was limited to interest on a loan sum being the difference between the price of the new dwelling and their accumulated equity in the previous dwelling. In 2005, net imputed rent would be limited to the amount of interest deducted, when the amount of interest deducted is lower than the net imputed rent. As a result of this reform, which was intended primarily as an encouragement to pay off the mortgage loan, no further income tax is levied on the principal dwelling once the mortgage loan is paid off. This means that the incomplete investment good approach that applies for as long as there is a debt on the owner-occupied dwelling, is changed to the consumption good approach to owner-occupied housing, once the mortgage is repaid.

Although these measures will in due course limit mortgage interest deductions, the estimated budgetary importance of the outstanding balance of the mortgage interest deduction and the imputed rent (indicated by the net tax deduction in Table 7.2) rose from 1.5 percent of GNP in 2000 to 2 percent of GNP in 2005. Table 7.2 also shows that the net tax deduction per home owner with mortgage loan rises with income. Expressed as a percentage of disposable income, these tax reductions go to those owner-occupiers with a mortgage who are in the lower income brackets.

7.5.2 Is reform of the Dutch home mortgage interest deduction likely?

There are a number of external factors that may influence the Dutch government to reform taxation of home ownership in future. However, the suggestion of some politicians thathome mortgage interest deductions in the Netherlands should be abolished because of the European Union (EU) influence is a misunderstanding. The EU is less concerned with national housing or income tax policy issues than with competition, focussing on modifying laws and regulations that are disruptive to competition in order to improve and ensure the free movement of persons, goods, services and capital across the EU (Elsinga *et al.,* 2006).

Dutch policy may nonetheless be influenced by outside forces. For example, the final two decades of the 20th century saw a general trend in OECD countries to reduce tax rates and abolish or reduce allowable deductions. The goal was to make labour less expensive and stimulate job opportunities and economic growth. According to the European Commission (2005), the revenue cost of interest deductions for home owners in the Netherlands is expected to increase and this will further erode the income tax base. This is undesirable because the effect will only arise in the middle and higher income brackets and this is inefficient since it keeps capital away from productive objectives. It may also disturb the housing market, not in the least through a possible undesired price rise effect, due partly to a minimal supply side elasticity, as shown in Figure 7.1 (see also Swank *et al.,* 2002; Vermeulen & Rouwendal, 2007). (We return to the price impact below).

As noted above, the mortgage interest deduction does not stimulate households to save, but to borrow money. In recent years, the national exposure to risk as a result of the large financial value represented by the dwelling in combination with a large mortgage debt has made the housing market increasingly sensitive to the economic climate (Van Ewijk & Ter Rele, 2008). Van den Noord (2005) developed a model in which the relatively large tax advantage in the Netherlands makes house price variability in response to changes in inflation relatively high. Van Ewijk *et al.* (2006) attribute welfare increases in housing and labor markets in their model to the abolition of fiscal advantage for the owner-occupied dwelling. Present annual welfare loss would amount to 800-2,000 million euros, between 0.15 and 0.4 percent of GNP, depending on the supply elasticity of dwellings. On the other hand, DNB (2008) ascribes a positive thus mitigating effect to the mortgage interest deduction when interest rates change. The mortgager then bears only part of the change.

Various national and international organisations, including the IMF (2005) and REA (2005) have called for changes to this unbalanced situation in the housing and labor markets. The OECD (2004) called for the phasing out of

tax subsidies for housing because of their contribution to reduced economic efficiency, such as supporting higher tax rates than necessary and drawing resources into home ownership that otherwise would not have gone there. Another influence coming from outside the Netherlands could result from the further integration of mortgage markets, from which the EU expects economic advantages (Doling, 2005; Neuteboom, 2006). On balance, it is not unthinkable to imagine that influences from outside the Netherlands might stimulate the Dutch government into setting limits on the income tax treatment of owner-occupied dwellings.

An expectation that was carried broadly throughout the last election campaign (and the subsequent negotiations between political parties to form a new Dutch government in 2007) was that a commission of experts would be appointed to come up with reforms for the housing market. However, much to everyone's surprise, the new coalition parties agreed to put a halt on reforms (Tweede Kamerfracties CDA, PvdA and Christen Unie, 2007; see also Boelhouwer & Hoekstra, 2008). As a result, politicians and government officials are not to prepare or study reforms of the housing market. In this compromise, the Christian Democrats won their point that the fiscal treatment of home owners should not be changed, the Social Democrats won their point that the annual rent increase (1.1 percent on July 1, 2007) for 95 percent of the rental market – the regulated rental market – should not exceed inflation. Thus, at present the tax position of Dutch home owners and lack of neutrality across investment goods (including types of dwellings) is being perpetuated.

7.5.3 What is the modelled impact of tax reform on house prices?

Despite the agreed policy standstill, it is not unrealistic to expect future changes in the tax treatment of home ownership. Countless in-depth arguments are forcing political parties and lobbyists to take stands on this issue (see above, VROM-raad, 2007). The VROM-raad, the council which advises the government and parliament on matters including housing, has issued an advisory paper that presents the results of modelled house price developments, based on the two models referred to in Section 7.4, if income tax concessions were gradually to be reduced (VROM-raad, 2007).

The aim of the reform would be to increase the economic stability of the housing market and to stimulate upwards mobility in the housing market. The main scenario dealt with an annual phasing out of 5 percent of the home mortgage interest deduction, leading ultimately to the abolition of the deduction for home owners in 20 years' time. Tax proceeds would be 'returned' to all households as a general tax advantage (a reduction in the tax rate). The nominal interest rate was assumed to be 4.5 percent throughout the 20 year period.

The basic assumptions in the De Vries and Boelhouwer's[10] macroeconomic model differ from those in the microeconomic model by Koning *et al.* (2006). De Vries and Boelhouwer's model assumes that in the long-term, housing expenses will develop in much the same way as income (same housing expenditure to income ratio) whereby an increase in housing expenditure through a change in tax treatment leads to a decrease in house price. This model is also based on the assumption of an extremely inelastic supply of dwellings. As a result, the change in tax treatment would return largely as a price effect.

The model by Koning *et al.* (2006) assumes that house buyers, in their role as investors, take into account a required market yield on the dwelling that should balance the costs and financial risks that accompany big investments. In addition, it includes the effect of a change in housing supply, emphasising gradual modification because such changes do take time. The starting position is a supply elasticity of 0.65, whereby the change in the tax treatment of the owner-occupied dwelling will return partly as a price reduction and partly as a decrease in supply. In this model, most of this effect is processed directly in the first year. The supply elasticity of 0.65 in the Konings model is, in particular, a point of discussion because most of the house price models are based on the assumption of an inelastic supply between 0.2 and 0.4 (see also Vermeulen & Rouwendal, 2007; Swank *et al.,* 2002).

Although the assumptions are different, one may conclude from both model calculations that any reduction of the tax advantage for home owners will have a negative effect on house prices. The speed at which this effect appears is not easy to model. Calculations based on the De Vries and Boelhouwer model (De Vries, 2007) result in a large total price effect (real and nominal) of in total 23 percent over the period of 20 years, compared to the no-change situation. Partly because this model assumes a housing supply elasticity of zero, this effect may to a certain extent be considered the maximum expected price effect (or worst case scenario).

Koning *et al.* (2006) also find a house price decline but expect a much smaller total price effect of a reduction in 4.4 percent in house prices over a period of 20 years, compared to the no-change situation, with about two-thirds of this price effect occurring in the first year. A volume effect of negative 3.5 percent will also occur because their calculations are based on a price elasticity of 0.65. However, if the model of Koning *et al.* (2006) were to incorporate De Vries & Boelhouwer's assumptions concerning inelasticity and, apart from interest costs, no capital expenditure, then the estimated decrease in the house price will be greater as well (an estimated negative 9.7 percent).

10 This was the model used by Boelhouwer *et al.* (2004) and updated by De Vries (2007) and De Vries & Boelhouwer (2009).

7.6 Conclusion

In this chapter, we examined whether house prices in the Dutch owner-occupied market may decline in the near future as a result, first,. of a price bubble that is ready to burst; second, in response to the global credit crisis; or, third, in response to potential tax reform that would reduce the home mortgage interest deduction in the Dutch income tax system. Each aspect was analysed on the basis of a literature study using Dutch house price models.

The IMF issued a cautious warning of the possible existence of a Dutch house price bubble in 2007. However, calculations based on two models of Dutch house prices counteract this warning. Any bubble that may have existed prior to 2007 had burst by that year as a result of the moderate house price developments in the years before 2007. In 2007 house prices were in accordance with fundamentals.

We conclude that a psychological effect, possibly resulting from the global credit crisis, is causing the downturn in 2008 in the number of housing transactions, construction orders and in house prices in 2008. The effect of possible credit restrictions applied by financial institutions is not clear, as there is no hard evidence. This 2008 downturn may be temporary, unless it is reinforced by a downturn in the real economy of which the first signs are being foreshadowed in terms of increasing unemployment and forecasted shrinkage of the economy.

Third, we addressed whether it is likely that house prices will fall as a result of changes to the tax treatment of home owners. As the Dutch form of taxation of owner-occupied dwellings is relatively unique, the expectation is that in due course the Dutch government will be unable to stand alone on this matter and so it is likely at some point to reduce the benefits of the home mortgage interest deduction. The Dutch models predict that house prices will decline if the income tax treatment of owner-occupiers is phased out over a 20 year period, even if the savings are returned to taxpayers as a general reduction in tax rates. The extent of the decline will depend on supply elasticity.

The outcomes of the models predicted that even without tax reform, prices in the Dutch housing market are expected to come under pressure in the sense that, contrary to the previous decades, the growth of real house prices is predicted to be zero. If tax reform were to be carried out that reduces the benefit of the mortgage interest deduction, this would make housing more expensive. The models indicate that this will decrease demand and that house prices will respond with a decrease of between ten and 25 percent over a period of twenty years. The effect of housing becoming more expensive will have been mitigated by the general tax relief provided and the scarcity of dwellings on the Dutch housing market. It is important to realize that these effects are first-order effects that will change as households adapt their

behavior to the new situation. Also, the housing market will never be in equilibrium but is always moving towards an equilibrium with many opportunities to react to new stimuli.

As house price growth in the Netherlands has already been slowing down since 2000 and has become negative since the fourth quarter of 2008 because of the effects of the global financial crisis, a tax reform that would have the effect of making owner-occupied housing more expensive at the current time may be unfortunate.

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8 How economic growth affects the price-quality relationship in housing

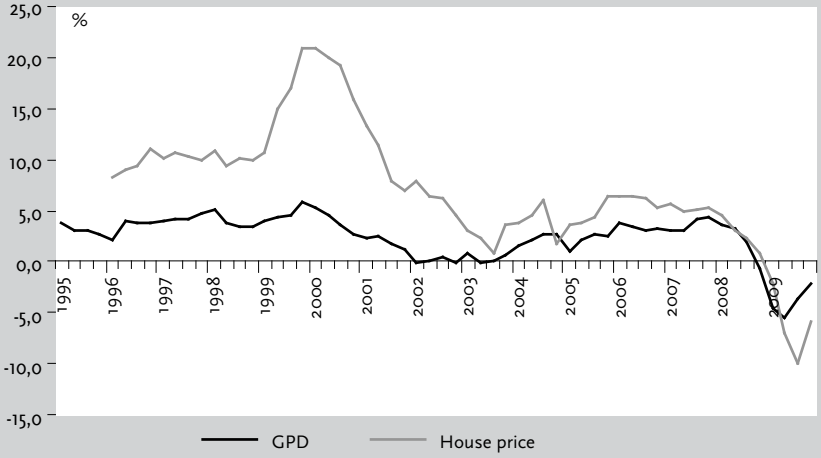
Paul de Vries & Peter Boelhouwer, submitted to Journal of Housing Economics

Abstract
The literature on housing markets suggests that periods of economic growth are characterized by growing demand for better housing quality and by rising prices. Affordability of higher-quality properties subsequently becomes a problem in a period of economic stagnation. This article outlines the mechanism of trade-offs made between quality and affordability against the background of the Dutch housing market, showing that the price-quality relationship changes with the level of economic growth. The analysis shows that in a high-growth economy households want better quality and are willing to pay for it. In a stagnant economy the demand for quality takes second place to the demand for affordable homes. The appreciation of quality shifts most evidently during the transition between periods of low and medium growth, whereas the trade-offs of price and quality barely change between the medium- and high-growth stages.

8.1 Introduction

The link between the demand for housing quality and the level of house prices is contingent on the times one is living in. Theory based on the permanent income hypothesis suggests that aggregate consumption for housing in any particular period is a stable function of the average income over the current cycle (Abraham & Hendershott, 1996; Malpezzi, 1999; Meen, 2002; Chen *et al.,* 2007; De Vries & Boelhouwer, 2009). Over a long period, economic growth will certainly push up incomes and house prices and increase the demand for better quality. As early as 1972, Fair drew attention to the significance of the long-run equilibrium between house prices and incomes. This equilibrium, as he states, stems directly from the premises of general price theory, which proposes that the demand for an object is a function of income and the price of the object or service in relation to other prices (Fair, 1972). However, the quality demanded is not a constant but is influenced by changes prompted by economic growth, which can cause short-run fluctuations in the demand for better-quality housing and the price people are willing to pay for it. There is evidence of a long-run development fed by the relationship between price and income and of a short-run development fed by economic growth. That evidence indicates that both short-run and long-run fundamentals have an impact on house prices. In the short term, significant upward or downward movements (shocks) occur due to speculative or psychological effects (see, for example, Reichert, 1990; Levin & Wright, 1997; Meen, 1998; Hort, 1998; De Vries & Boelhouwer, 2009). The term 'bubble builder', often used in this context, reflects the feeling that house prices are too high for their quality. The

Figure 8.1 GPD in the Netherlands, 1995-2009, %-change on corresponding period and %-change of house prices, 1996-2009



Source: Statistics Netherlands

short-run mechanism shows up in the way house buyers deal with the price-quality relationship. In a growing economy, such as in the 1990s, buyers seek better quality in housing and are willing to pay for it. In a stagnating economy, as in the early 21st century, the demand for better-quality housing is outstripped by the demand for affordable housing.

This paper considers how the relationship between the house price and the demand for quality changes with fluctuations in economic growth. Micro-level data are available for the period between 1995 and 2008, allowing us to demonstrate the connections between the preferred bundles of housing requirements, demand price and economic growth. The data come from the Dutch surveys of *Huizenkopers in profiel* (a profile update of house buyers – HBP), which were conducted in October-December for the years 1995, 1996, 1997, 1998 and 1999 and in January-March for 2002, 2004, 2006 and 2008. HBP was designed to chart the dynamics of house-buying demand among households with above-average incomes (66 percent of Dutch households). The survey is based on a random sample of around 1300 potential house buyers. As it was conducted during periods of low, medium and high economic growth, we can draw connections between the pattern of housing preferences and the business cycle. Using HBP for our research, we can answer two questions. First, what is the relationship between the preferred quality of housing and the stage of economic growth? And second, what is the relationship between the preferred quality of housing and the demand price?

The article is organized as follows. Section 8.2 analyzes the Dutch situation at the macro level over a long time span. It describes the context within which house prices are determined at a given stage of economic growth. This overview is restricted to the factors that influence housing demand and thereby house prices. Section 8.3 considers the situation at a micro level, using hedonic and multinomial logistic regression analysis to relate preferred quality, demand price and economic growth to each other. On that basis, we seek to establish whether the connection between the preferred quality, the

composition of the household and the demand price for housing has changed in the course of time and, if so, whether these changes are contingent on the level of economic growth. The article concludes with a summary (Section 8.4).

To our knowledge, nothing has previously been published about these relationships. Studies, often based on realized transactions, generally draw out the connections between housing characteristics and real house prices (e.g., Green & Hendershott, 1996), though Kiel and Zabel (2008) present a more extensive model that also includes owner characteristics.

8.2 Macro relationship between economic growth and the housing market

8.2.1 Economic growth

Gross Domestic Product (GDP) is often used as an indicator of economic growth. Figure 8.1 shows the evolution of GDP and house prices for the Netherlands.

As far back as 1939, Schumpeter (De Groot, 2006; Liebregts, 2008) distinguished four stages of economic growth: prosperity, recession, depression and recovery. Prosperity occurs from the midpoint of the cycle to the peak of the economic period. During this phase, expectations for economic development increase, debt rises, inflation is high, economic growth rates peak and interest rates reach a high point at the end of the phase. In a recession, from the economic peak back to the mid-point, psychological optimism in society continues to grow along with the level of debt. Rates of inflation and economic growth decline and housing prices peak. Interest rates drop , the level of sustained liquidity is very high and financial speculation is rife. During a depression, from the mid-point to the nadir of the economic cycle, the mood in society turns negative. There are periods of uncontrolled deflation and a consequent drop in prices; as share prices go down, economic growth is low or negative. House prices decline and interest rates bottom out. Recovery is characterized by new and growing optimism, low inflation, slow economic growth and a gradual increase in interest rates.

According to the Dutch central bank DNB, the most recent business cycle in the Netherlands started in March 2006, when its indicator rose above the long-term trend. In April 2008 prosperity ended and a recession began; economic growth declined, house prices peaked and consumer confidence remained buoyant. But the recession was brief, because only 14 months later the Netherlands landed in a depression. The economy is expected to show positive growth figures in 2010 and the Netherlands is again expected to reach prosperity.

The turning points of Schumpeter's four phases of the cycle can be pin-

Table 8.1 Economic patterns 1995-2008

Economic	Years	GDP	Inflation	Purchasing power	Interest rate	Nominal house price
Low	2002, 2003, 2009	1.2	1.9	-0.1	4.5	1.4
Middle	1995, 1996, 1997, 2001, 2004, 2005, 2006, 2008	2.8	2.3	2.0	5.6	5.0
High	1998, 1999, 2000, 2007	4.2	2.2	2.2	5.5	13.9

Sources: Statistics Netherlands, Kadaster Netherlands, Dutch central bank (DNB), CPB (calculations OTB Research Institute (TU Delft))

pointed to the month. However, the most relevant Dutch macro databases and databases containing buyers' preferred bundles of housing requirements are available on an annual basis from 1995. So to draw connections with the economic phase, we turn to Liebregts' (2008) refinement of the four cyclical phases as phases of low, medium and high economic growth. The values of the four key indicators per economic phase are presented in Table 8.1.

In the low-growth phase, GDP only grows by an average of 1.2 percent, while during high growth it rises by 4.2 percent on average. We see that purchasing power decline during low growth by an average of 0.1 percent per year, whereas incomes rise by 2.0 percent in years of middle growth. As Englund and Ioannides (1997) point out for 15 OECD countries, including the Netherlands, there seems to be a clear connection between the increase in house prices and economic phases. House prices increase by 1.3 percent in a low-growth phase and by as much as 13.9 percent per year in a high-growth phase. We see striking values for inflation, incomes and mortgage interest in the medium growth phase. These indicators reach the highest averages during periods of medium growth (i.e., between periods of high and low economic growth). The medium-growth phase that occurred in 1995 and 1996 developed into a boom, while 2001 marked the transition from a high-growth to a low-growth economy. Apparently this transition can take many different guises.

8.2.2 Market forces and the Dutch housing market

Home ownership in the Netherlands only matured at the end of the 20th century (De Vries 2009). In 1930, 15 percent of the population owned their own home, rising to 30 percent in 1970. Since 1977, more houses have been built for sale than for rent, and only in 1997 did the share of owner-occupied dwellings surpass 50 percent. In 2010, 58 percent of all homes in the Netherlands are owner-occupied. Historically, this growth may be deemed spectacular, with the market having to adapt continuously and seek a new equilibrium.

The growth in home ownership is closely connected with the social value of having a home of one's own and the associated introduction of market forces since the 1990s. In 1930 it was normal to rent rather than to buy a house (Bijvoet, 2001). And after the Second World War, Dutch housing policy was preoccupied with the quantitative shortage of homes. House building was strongly driven by the government and there was no question of mar-

ket forces. Only in 1990 was a cautious step taken toward the liberalization of Dutch housing policy. Increasingly, the government cites housing quality, choice, market forces and consumer sovereignty as core concepts, and in 2001 the government proclaimed that home ownership should be encouraged (Boelhouwer, 2002, 2005). Great emphasis is put on the facilitative power of the market, in which the price mechanism ensures that supply and demand balance out at the macro level.

Many studies place the conditions in which an efficiently operating market is created and the characteristics of the housing market side by side (see, among others, Cho, 1996; Barr, 1998; Priemus, 2000; Kiel & Zabel, 2008). The most commonly cited conditions for a perfect or efficiently operating market are as follows. The first is the possibility for the actors to make allowance in their deliberations for all the relevant information; they must therefore have access to perfect information, both now and in the future. The second condition is that the actors must have equal power. This is possible when there are many customers and many suppliers active in the market. The third is homogeneity. When the product is heterogeneous, such as in the housing market, the concept of 'market' is not sharply defined. Clearly, neither the housing market nor many other markets are efficient or perfect.

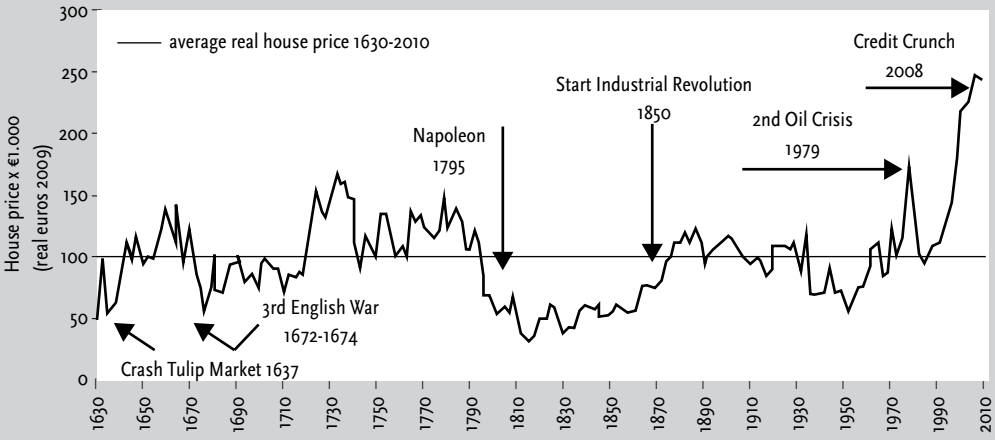
It has been investigated in many countries whether the housing market works efficiently (Cho, 1996). It appears that the housing market is imperfect, as the hypothesis of an efficiently operating market has been rejected time after time. This imperfection or inefficiency is due to the fact that the economic forces have not played out, thereby leading to changes from within, which in turn lead to imbalance in the housing market.

8.2.3 House price development

We have four long-term data sources for an analysis of the house price development in the whole of the Netherlands. The first refers to the *Herengracht* in Amsterdam over the period 1628-1973 (Eichholtz, 1997). The second is the CBS (Statistics Netherlands) (1965-1974), which overlaps with the Herengracht index. But the CBS gives a more representative view of the Dutch price development. Both the CBS and the Herengracht index stop in 1974. The third source is the NVM (Dutch association of brokers and real estate experts), which started publishing information on the housing market in 1975. The participating real estate agents have a fluctuating market share of around 70 percent. The fourth source is the database of the Dutch Land Registry Office, which has published the average house price per month from 1993 on, based on all house sales. These four data sources are combined in Figure 8.2.

The development of the real house price over the last four centuries (Figure 8.2) gives an impression of the socio-economic changes that took place in the Netherlands and Amsterdam; the horizontal line shows the average

Figure 8.2 Development of real house price in the Netherlands, 2009=100, 1630-2009



Sources: Eichholtz 1997, Statistics Netherlands, NVM, computation OTB Reserach Institute

real house price over the entire period (EUR 99,000). We present the development of the real house price in accordance with Shiller's hypothesis that the (US) house price correlates with inflation in the long term (Shiller, 2005). This gives some idea of when the house price is 'high' or 'low'. Clearly visible at the middle of the figure is the deep recession that the Netherlands experienced at the start of the nineteenth century. Only when industrialization got underway in the Netherlands did house prices reach their old level again: early evidence that house prices here are directly related to economic growth. In other Western economies, too, the relationship between economic growth and house price has been demonstrated. Adams and Fuss (2010) examine the impact of the macro economy on house prices using a panel of 15 countries over a period of more than 30 years to allow the robust estimation of long-term macroeconomic impact. They conclude that a 1 percent increase in economic activity raises the demand for houses and house prices over the long term by 0.6 percent.

The real house price in the Netherlands has been above the four-century average since 1984, when the basis was laid for market forces in the Dutch housing system. The period from then to 1990 was one of rapid recovery. Despite the economic growth, the inflation rate kept declining; between 1987 and 1989, it was even exceptionally low. We also see a recovery in incomes and a strong decrease in interest rates. The financial capacity of households on the housing market thus improved markedly. House prices show a more or less stable trend. From 1992 onward, market forces were cautiously introduced and nominal house prices developed annually with exceptions of over 10 percent in 1993 (10.5 percent), 1996 (10.1 percent), 1999 (18.1 percent) and 2000 (15.1 percent). The only deviation from this positive price development was in the first half of 1990, when prices increased by only 2.1 percent. This was the time of the Gulf War, and there was evidence of economic instability. After 2001, economic conditions in the Netherlands changed; economic growth was lower in 2001 and even declined in 2002 – a situation that had not

occurred since the beginning of the 1980s. Nominal house prices responded with decreasing growth percentages, reaching a trough in 2003 (1.7 percent). In that year, inflation (at 2.1 percent) was higher than the rise in house prices, meaning that house prices fell in real terms. Note that in the US the nominal house price rose annually between 2000 and 2005 by 8.9 percent or 6.5 percent per year in real terms (Goodman & Thibodeau, 2008). This nationwide increase in the US followed a decade in which house prices had remained roughly constant in real terms while prices in the Netherlands, by contrast, rose strongly. But from 2004 on, the Netherlands has seen an economic recovery, slowly rising interest rates and house price increases. This phase turned abruptly in the fourth quarter of 2008 into a recession in reaction to the bankruptcy of Lehman Brothers on 15 September 2008. The Dutch open economy appeared to be highly vulnerable to the worldwide credit crunch (Priemus, 2009). A year later, house prices had dropped by 5 percent.

8.2.4 Demand factors, economic growth and price trend

Recently, De Vries and Boelhouwer (2009), Van der Heijden *et al.* (2004), and Haffner and De Vries (2009) have again demonstrated that the Dutch housing market is an imperfect one in which supply has insufficient power. The inefficiency arises because demand is strongly stimulated by government policy and by the simultaneous increase in borrowing capacity through the introduction of the two-earner and interest-only mortgages and other products by the financial institutions. These demand impulses cause spectacular price increases. De Vries (2009) concluded that this has fundamentally changed the housing market, resulting in higher price levels. The price trend is thus mainly driven by developments in housing demand.

In the long term, there are other factors besides economic growth that influence demand on the housing market, notably demographic shifts, government fiscal policy and the policy of the financial institutions. (For an overview of the relevant literature see Goodman & Thibodeau, 2008). The force these factors exert on demand depends on the economic phase. Demographic developments appear to have a structural influence (Boelhouwer *et al.*, 2002; Green & Hendershott, 1996; Goodman & Thibodeau, 2008). An increase in population and/or households stimulates the demand for housing. However, researchers find that the demographic influence varies. Mankiw and Weil (1989) explain the house price trend in the US entirely in terms of demographics. Using hedonic regression techniques, they link the value of the house to the age of each household member. Based on their study, the authors predicted in 1989 that by 2007 real house prices would have declined by 47 percent because the demand for more expensive houses would flatten out. However, Poterba (1991) found no impact of the Mankiw-Weil demographic variable on metropolitan-level real house appreciation during the 1980s. Green

and Hendershott (1996) concluded that changes in demographic factors may have contributed significantly to real house price appreciation if attributable to education and household income.

In the Netherlands we see little connection between economic growth and age composition after the 1970s. This is partly because demographic developments have a delayed effect on the general economy and the housing market. However, from 2000 onward, the population aged 45 years and older increased sharply, and these are the very people who are most active on the housing market. The study by Markiw and Weil shows this group to be the one that can best afford to own homes. In addition, the increase in the proportion of single-person households since 1960 and the sharp rise after 2000 had a particularly strong influence on the demand for homes and their quality. In the long term, house-buying demand is driven by the composition of households.

Affordability in the housing market reflects a combination of the government's fiscal policy and the financial institutions' lending conditions. In the Netherlands, affordability is monitored every six months by calculating the maximum borrowing capacity of several household types, taking into account the interest rate, household income and lending standards. From 1982 to 1986, financing capacity increased after having been under pressure in the previous period. The house price trend, which also emerged from a deep trough, did not immediately respond to this increased capacity. Perhaps most people were still too aware of the deep recession. Up until the 1990s, house prices and financing capacity were reasonably in tune. Then prices increased sharply, but so did borrowing capacity. The causes of the increased borrowing capacity are the declining mortgage interest rates during the 1990s, the rising household incomes and the new mortgage products being offered. This also caused the demand for homes to increase from the mid-eighties onward.

The financial institutions in particular set their policy according to the economic conditions. A striking example of this is the recent market situation following the credit crunch of the third quarter of 2008. The economic circumstances before the credit crunch were good; incomes grew and income prospects were rosy, and mortgage interest rates dropped. Financial institutions had relaxed their lending conditions. This situation changed abruptly in November 2008 with a sharp drop in prices, which appears to have been a direct consequence of the downfall of Lehman Brothers on 15 September, when the credit crunch reached the Netherlands. Optimism about increasing incomes evaporated. Government and banking policy exacerbated this situation by tightening up lending conditions (Haffner & De Vries, 2009). At the end of 2009, the balance showed that prices had dropped by 5 percent and the number of sales by 35 percent (De Vries & Van der Wal, 2009).

8.3 Micro relationships between economic growth and housing market

For the period between 1995 and 2008 there are micro data available with which we can demonstrate connections between housing requirements, demand prices and economic growth. We use the surveys of *Huizenkopers in profiel* (HBP), which were conducted in October–December for the years 1995, 1996, 1997, 1998 and 1999 and in January–March for 2002, 2004, 2006 and 2008. HBP was specifically set up to survey the dynamics in house-buying demand among households with above-average incomes (66 percent of Dutch households). It is based on a random sample of around 1300 potential house buyers. As the survey was conducted during periods of low, medium and high economic growth, we can see connections between the pattern of housing requirements and the level of economic growth.

8.3.1 Influence of economic growth on demand determinants

Table 8.2 provides an overview of the most relevant differences between characteristics per economic phase. The analysis includes other characteristics such as having children and the desire for a bigger living space, but these appear to have no significant correlation with phases of economic growth. Table 8.2 shows that the spread of the demand determinants in the low-growth economic phase differs from that in the medium- and high-growth phases. The differences between the medium- and high-growth phases are considerably smaller. Looking at the socio-demographic characteristics, it is clear that the proportion of households with an income more than twice the average is greater in the medium-growth (36.0) and high-growth (34.3) phases than during a low-growth phase (30.7). What strikes one most is that only the proportion of the age group 30-40 differs per economic phase (low 39.6; middle 33.5; high 31.7). The other age groups are comparable, as though economic growth had no effect on their behaviour.

In a high-growth economy, it is to be expected that people will have more money to spend and thus want more rooms per dwelling. This is borne out by the fact that demand for smaller homes is manifestly greater at times of low growth than in the medium- and high-growth phases. It is also clear that the demand for apartments declines as soon as the economy starts to recover; at the same time the demand for types of homes that offer more in terms of amenities, such as detached houses, starts to increase. It is striking that in the low-growth phase, 73 percent of the people are determined to buy a home, while in the medium and high phases the percentage is more or less equal (80 percent).

The three economic phases differ unmistakably as regards the desired res-

Table 8.2 Preferred quality of house buyers per economic phase, 1995-2008, in %

		Economic phase		
		Low	Middle	High
Household income	Until 1,5x average income	40.1	34.0	34.1
	Between 1,5 and 2x average income	29.2	30.0	31.6
	From 2x average income	30.7	36.0	34.3
Age	18-30	13.8	14.9	14.6
	30-40	39.6	33.5	31.7
	40-55	31.2	37.4	37.4
	55 and older	15.3	14.2	16.3
Preferred architecture	Experimental	13.5	14.5	12.3
	Modern	15.9	15.9	15.7
	Traditional	70.6	69.6	71.9
Preferred kitchen	Open kitchen	33.4	23.9	20.4
	Separate from living room	36.5	43.3	45.0
	No preference	30.0	32.9	34.7
Preferred number of rooms	1, 2 or 3	15.2	12.4	11.3
	4 or 5	64.8	65.6	68.2
	6 or more	20.0	22.0	20.5
Preferred dwelling type	Row house or corner house	21.6	12.2	18.9
	Semi-detached house	27.9	31.1	29.7
	Detached house, no floors	18.2	21.6	20.6
	Detached house, 1 or 2 floors	18.2	20.8	20.4
	Apartment	14.0	14.3	10.4
Rent or owner-occupied	Certainly owner-occupied	73.5	79.5	80.9
	No preference	26.5	20.5	19.1
Preferred location	City centre	14.0	9.7	9.4
	City suburb	37.4	36.5	35.9
	In a small town	25.5	34.8	37.9
	Near a small town	17.1	15.3	14.3
	No preference	6.0	3.7	2.5
Want to move to	Less luxurious dwelling	8.2	8.4	6.4
	More luxurious dwelling	58.0	67.8	68.0
	Same quality	33.8	23.8	25.6
Look at advertisements	Yes	73.5	83.1	81.9
Say to friends I want to move	Yes	44.0	59.0	58.6
Watch windows real estate agents	Yes	48.4	62.9	61.3
Ask for information newly built dwellings	Yes	18.7	34.5	29.9
Inspected dwellings outside, consider to move	Yes	18.7	34.5	29.9
Inspected dwellings inside, consider to move	Yes	24.7	36.1	30.2
Talk with a real estate agent	Yes	15.9	23.3	17.7

Source: OTB Research Institute (TU Delft), HBP 1995-2008

idential environment. The likelihood of people seeking a home on the outskirts of town and in smaller municipality's increases noticeably as the economy recovers. It also appears that households are much more active on the housing market in a high-growth than a low-growth phase.

The categories in Table 8.2 are only two-dimensional. Using the chi-square test Table 8.3 shows that low, middle and high economic phase differ significantly in most of the characteristics. As assumed, most similarity is observable between the middle and high economic phase for income, age and pref-

Table 8.3 Multinominal logistic regression model

	Level of significance		
	Low-middle economic phase	Low-high economic phase	Middle-high economic phase
Household income	0,001 ***	0,001 ***	0,169
Age	0,001 ***	0,001 ***	0,355
Preferred architecture	0,588	0,479	0,008 **
Preferred kitchen	0,006 **	0,001 ***	0,001 ***
Preferred number of rooms	0,006 **	0,001 ***	0,024 **
Preferred dwelling type	0,001 ***	0,001 ***	0,001 ***
Rent or owner occupied	0,001 ***	0,001 ***	0,075 *
Preferred location	0,001 ***	0,001 ***	0,001 ***
Want to move to	0,001 ***	0,001 ***	0,001 ***
Look at advertisements	0,001 ***	0,001 ***	0,128
Say to fiends I want to move	0,001 ***	0,001 ***	0,689
Watch windows real estate agents	0,001 ***	0,001 ***	0,087 *
Inspected dwellings outside, consider to move	0,001 ***	0,001 ***	0,001 ***
Inspected dwellings inside, consider to move	0,001 ***	0,085 *	0,001 ***
Talk with a real estate agent	0,001 ***	0,001 ***	0,001 ***

Notes: Significance at the 1%, 5%, and 10% levels is denoted as ***, **, and *.

Sources: OTB Research Institute (TU Delft), HBP 1995-2008

erence for an owner-occupied dwelling. We conclude that house buyers adapt their preference to the economic phase. In a stagnant economy, the emphasis in demand is on affordability rather than better quality. Thus, the economic phase influences our housing requirements.

8.3.2 Relationship of preferred quality and demand price

The previous section shows that the preferred quality is contingent on the economic phase. This section considers whether the preferred quality in a given phase is valued differently – the question is, does the connection between the preferred quality and the demand price change when the economic conditions change? Again, we refer to the surveys of *Huizenkopers in profiel* (a profile update of house buyers) from 1995 and apply the hedonic regression method.

First of all we estimated, per economic phase, a hedonic model in which house price and income are annually standardized to create a data set in which the average house price and average income for each year is zero with a standard deviation of 1. Standardized coefficients are often interpreted as a reflection of the influence a predictor has within the model. However, the standardized regression coefficients are estimated without taking account of the mutual correlations. Pratt's measure of relative importance is an alternative statistic that does take account of these. The higher Pratt's importance, the more the variable contributes to the explained variance (R^2).

The standardized coefficients as well as Pratt's importance for the low-, medium- and high-growth phases are presented in Table 8.4. There appears to be no clear pattern in the values of the regression coefficients, but one does

Table 8.4 Coefficients hedonic regression and Pratt's importance

	Economic phase						Economic phase		
	Low		Middle		High		Low	Middle	High
R^2	0,41		0,46		0,50				
	Beta	Sign	Beta	Sign	Beta	Sign	Pratt's importance		
(constant)	-0.37		-0.18	*	-0.17				
Income	0.37	***	0.58	***	0.50	***	34%	70%	55%
Traditional architecture	0.05		-0.12	**	0.11	**	0%	0%	0%
Modern architecture	0.30	**	-0.12	**	0.08		2%	0%	0%
Experimental architecture	-0.04		-0.19	**	0.01		0%	0%	0%
Big living room	0.25	***	0.14	***	0.28	***	8%	4%	10%
4 or 5 rooms	0.28	***	0.22	***	0.14	**	3%	2%	1%
6 or more rooms	0.63	***	0.43	***	0.32	***	13%	7%	5%
Big sleeping room	0.04		0.06	***	0.04	**	1%	3%	2%
Two incomes	-0.04		-0.24	***	-0.25	***	1%	3%	2%
30 to 40 years	0.48	***	0.06		0.01		0%	0%	0%
40 to 55 years	0.49	***	-0.03		0.01		6%	0%	0%
55 years and older	0.68	***	-0.03		0.15	**	4%	0%	1%
No children	0.05		0.00		0.04		1%	0%	0%
Region North Netherlands	-0.43	***	-0.35	***	-0.55	***	3%	2%	5%
Outside built-up area	0.07		0.07	*	0.02		0%	0%	0%
Apartment	-0.48	**	-0.05		-0.27	**	1%	0%	1%
Row house	-0.74	***	-0.05		-0.40	***	15%	0%	8%
Semi-detached house	-0.51	**	-0.09		-0.22	**	1%	1%	2%
Detached house, no floors	-0.23		0.29	***	0.27	***	4%	6%	6%
Detached house, floors	-0.44	**	0.14	*	0.01		2%	1%	0%
Dreamers	-0.19	**	-0.02		-0.07	**	0%	0%	0%

Notes: Significance at the 1%, 5%, and 10% levels is denotes as ***, **, and *, respectively.
Estimation logarithm of the desired house price.

Source: OTB Research Institute (TU Delft), HBP 1995-2008

emerge when we look at Pratt's importance. The level of income in a low-growth economy is clearly less important (34 percent) to the formation of the demand price than in the medium-growth (70 percent) and high-growth phases (55 percent). It would seem that, in the low-growth phase, quality is the most important characteristic determining the price, which accords with expectations. People tend to be more critical in a low-growth economy, while they are motivated more by their spending power when growth is high.

We subsequently tested for variance in the standardized regression coefficients of the three models. First we determined the deviation between two regression coefficients; then, with the aid of the standard error[1] (*SE*), we determined the 95-percent reliability interval of the deviation (Table 8.5). Any deviations among the coefficients are apparent in Table 8.5, from which we conclude that income in the medium-growth phase determines the level of the house price more than it does in the low-growth phase. This table also shows that appreciation of quality in particular varies between the low-growth phase and the medium-growth phase. The price-quality relationship

1 The standard error (*SE*) of the deviation between two independent regression coefficients is a function of the estimator's standard errors $SEbx\text{-}by = \sqrt{(SEbx^2 + SEby^2)}$.

Table 8.5 Signification of the deviation

	Low and middle economic phase			Middle and high economic phase		
	Deviation	SE	Sig	Deviation	SE	Sig
(constant)	0.19	0.26	No	0.02	0.15	No
Income	0.21	0.03	Yes	-0.08	0.02	No
Traditional architecture	-0.17	0.10	No	0.23	0.07	Yes
Modern architecture	-0.42	0.11	No	0.20	0.08	Yes
Experimental architecture	-0.15	0.12	No	0.20	0.08	Yes
Big living room	-0.11	0.06	No	0.14	0.04	Yes
4 or 5 rooms	-0.06	0.09	No	-0.08	0.07	No
6 or more rooms	-0.20	0.11	No	-0.10	0.08	No
Big sleeping room	0.03	0.03	No	-0.02	0.02	No
Two incomes	-0.20	0.07	No	-0.01	0.04	No
30 to 40 years	-0.42	0.09	No	-0.05	0.06	No
40 to 55 years	-0.52	0.09	No	0.04	0.06	No
55 years and older	-0.71	0.12	No	0.19	0.09	Yes
No children	-0.05	0.07	No	0.04	0.04	No
Region North Netherlands	0.08	0.09	No	-0.20	0.06	No
Outside built-up area	0.00	0.07	No	-0.05	0.05	No
Apartment	0.43	0.23	No	-0.23	0.12	No
Row house	0.69	0.23	Yes	-0.34	0.12	No
Semi-detached house	0.43	0.22	No	-0.13	0.11	No
Detached house, no floors	0.52	0.23	Yes	-0.02	0.11	No
Detached house, floors	0.58	0.23	Yes	-0.13	0.11	No
Dreamers	0.17	0.06	Yes	-0.05	0.04	No

Source: OTB Research Institute (TU Delft), HBP 1995-2008

between the medium- and high-growth economies barely differs.

8.4 Summary

The long-term demand for houses is fed primarily by demographic developments such as population growth and change in the number of households. While population growth in the Netherlands was gradual from 1900 till the Second World War, in the 1960s this pattern started shifting due to the post-war baby boom and the sharp increase in the share of single-person households. The increased borrowing capacity, caused by rising wages and falling interest rates, spurred a demand for better-quality and owner-occupied housing. Since the 1990s, the Dutch housing system has pursued the implementation of market forces and freedom of choice. According to neoclassic economic theory, demand will increase as the economy recovers. Our analysis shows that the house buyer in a high-growth economy is looking for a better-quality property and is prepared to pay for it. In a stagnant economy, such as that prevailing in the early years of the 21st century, the demand for quality takes second place to the demand for affordable homes. Thus, there is apparently a mechanism that trades off quality against affordability. This increases the chance that households in a medium- and high-growth phase will demand more quality than in a low-growth phase. It also appears that appreciation of

quality varies, particularly between the low-growth phase and the medium-growth phase. The price-quality relationship barely varies between the medium-growth and high-growth phases.

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9 Conclusions

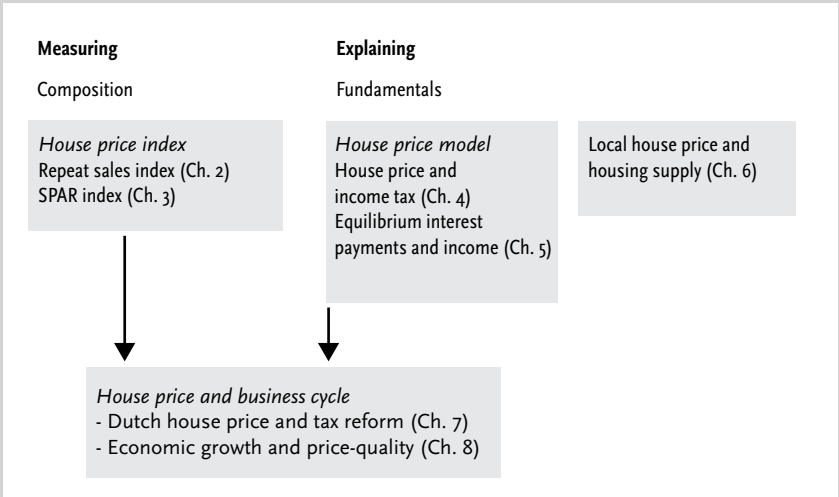
This dissertation discusses ways of calculating and explaining the development of house prices against the background of the Dutch housing market. The goal of the research underpinning this dissertation was to develop a methodological framework for studying the development of house prices, covering the period in which market forces were introduced in the market for owner-occupier dwellings in the Netherlands. The framework presented in this book relates, first, to correcting for changes in the composition of dwellings sold or in the stock and, second, to the fundamentals of the price development. Chapters 2 through 6 have already been published as articles in scientific journals; Chapter 7 has appeared as part of a scientific book, and Chapter 8 has been submitted for publication. The relationships between each of the chapters in this book are depicted in Figure 9.1.

The calculation of the house price development by means of a house price index is treated in Chapters 2 and 3. The weighted repeat sales method is discussed in Chapter 2, followed by the Sales Price Appraisal Ratio method (SPAR) in Chapter 3. The explanation of the development continues in the next chapters, particularly Chapters 4 and 5. Those two chapters present the house price model and its explanatory factors – the fundamentals – by which the model explains and predicts the development of house prices. One of these fundamentals is housing supply. It is not included in the house price model. That is the topic of Chapter 6, where it is argued that a relation between price and supply can be demonstrated at a low scale but not at the macro level. Some connections between the house price and the business cycle are drawn in Chapters 7 and 8. The current chapter presents the main conclusions and, in the final Section (9.3), advances several ideas for follow-up research.

9.1 Conclusions about calculating house price development

Chapters 2 and 3 deal extensively with calculating the house price development. Two methods to estimate a house price index are discussed. House price indexes for the Netherlands are estimated by these means and then in Chapter 3 they are compared. Chapter 2 deals with the weighted repeat sales method and Chapter 3 with the Sales Price Appraisal Ratio method (SPAR). The choice of a method for calculating an index depends on the characteristics of the available dataset (Abraham & Schauman, 1991) and the 'target' (Wang & Zorn, 1997). In both instances, the dataset of the Dutch Land Registry Office was used. This dataset is very large (more than two and a half million transactions, of which more than 700,000 repeated) but does not include property characteristics. The target is the statistic that users of an index need to know regardless of the method (Wang & Zorn, 1997). The target of

Figure 9.1 Relationships between the chapters of the book



the house price index in Chapter 2 differs from that in Chapter 3.

Chapter 2 deals with the weighted repeat sales method. Repeat sales models are based on the average difference in price between two sales dates for the same dwelling. Given the characteristics of the Dutch Land Registry Office dataset and the target of the index (current value of dwellings in the housing stock), an index based upon the weighted repeat sales method was the obvious choice. One major benefit of the repeat sales model is that, theoretically, it removes the quality differences between packages of homes sold in different periods (Bailey *et al.,* 1963). It thereby distinguishes differences in quality from differences in price (Abraham & Schauman, 1991). All the characteristics that could be included in a hedonic regression analysis or in a hybrid method are corrected, theoretically, by the repeat sales model (Abraham & Schauman, 1991). However, the index is only corrected for quality if properties retain the same physical attributes and if these attributes are accorded the same value by the market over time (Stephens *et al.,* 1995). It is highly plausible that the characteristics will be different on the two dates of sale. This would then undermine one of the assumptions that make for consistency in the repeat sales approach. On the one hand, houses may depreciate through time, either through physical decline or because of new tastes and fashions. On the other hand, they may have been modernized and upgraded, thereby gaining in value.

However, the Dutch house price index based upon the repeat sales model was formulated primarily to allow financial institutions in the Netherlands to estimate the risk of their mortgage portfolio. In line with that perspective, these institutions are only interested in the current value of the houses in their portfolio. According to Hwang and Quigley (2004), a change in quality is not an issue if an index is intended to measure the market value of dwellings transacted in a given time interval. Similarly, Wang and Zorn (1997) argue that researchers looking for an estimate of the change in the value of housing may prefer to include the impact of improvements and depreciation in their indexes. For this reason, this disadvantage of the repeat sales method seems

less relevant to the application of the repeat sales index that is presented in Chapter 2.

In 1987, Case and Shiller published an adapted version of the repeat sales model of Bailey *et al.* (1963), naming it the weighted repeat sales method. As Case and Shiller argued, the longer the time interval between transactions, the more variance there is in individual house price appreciation. Consequently, the variance of the residuals will increase with the length of the holding period. This condition, known as heteroskedasticity, undermines efficiency because the variance of the index values becomes too great (Wang & Zorn, 1997). To minimize the effect of heteroskedasticity, Case and Shiller (1987) proposed a three-step procedure. However, the results in Chapter 2 show that although heteroskedasticity does seem to be present, the amount of explained variance is less than one percent.

The main drawback of the repeat sales method is revision. Additional sales reverberate in the index values because the information that new pairs provide on shifts in house prices goes beyond the information obtained from the sample. However, the conclusion in Chapter 2 is that the revision volatility observed for the weighed repeat sales house price index for the Netherlands was reasonably small and acceptable. Whereas most of the revisions are directed downwards, even after removing the 'flips', it seems that excluding transactions with a holding period of less than 12 months (the flips) may not be sufficient. In a previous study, Hoesli *et al.* (1997) examined the effect of revisions on the index. Because they did not find statistically significant systematic deviations in the revisions, they concluded that each of the original indexes is unbiased and that the revised index is a more efficient estimator of the price level. Abraham and Schauman (1991) found similar results. They concluded that while there is a fair bit of volatility in the indexes, transaction bias (responsible for revision volatility) does not appear to be a problem, even down at the city level. In conclusion, given the characteristics of the available dataset and the target of the index, the weighted repeat sales model seems to be an adequate method for calculating a house price index for the Netherlands.

Chapter 3 reports on a project to develop a house price index for the owner-occupier sector based on the SPAR method. The reason to undertake the project was to address the problem of revision, which is the most serious shortcoming of the repeat sales method, whether for official statistics or as input for the HICP. Briefly, revision means that past values of the index are revised in light of presentday information. Bourassa *et al.* (2006), who discuss the problem of revision and other drawbacks, present the SPAR index as an alternative to hedonic or repeat sales indexes. Like the repeat sales method, the SPAR method is based on matched pairs. But unlike it, the SPAR method uses (nearly) all of the price data that is available for the period under observation. Since the majority of the dwellings sold during the observation peri-

od were not sold during the index reference or base period, there is a general shortage of transaction prices for the base period. The base period prices are therefore estimated using appraisals for the dwellings. In contrast to a repeat sales index, the SPAR index is not revised when data for new periods is added. The SPAR approach to constructing a house price index has been used in New Zealand since the early 1960s and is also applied in Sweden and Denmark. Since January 2008 the Dutch Land Registry Office and Statistics Netherlands have been jointly publishing house price index figures for the country as a whole but also for different types of dwellings and regions, all based on the SPAR method that was elaborated in Chapter 3.

Price indexes can be either value weighted or equally weighted. A value-weighted price index explicitly or implicitly weights the indexes of individual dwellings by their base period prices (values). The literature stresses that the choice between a value-weighted and an equally weighted index should depend on the aim of the index (see e.g., Wang & Zorn, 1997). The intention of the Dutch Land Registry Office and Statistics Netherlands is to produce an index that can measure price changes in the owner-occupier housing stock. To that end, the weighted arithmetic variant of the SPAR method would seem to be a suitable choice. Yet some users may want a price index for a 'mean dwelling'. In that case, a geometric mean repeat sales index might be more appropriate.

Two main conclusions may be drawn from Chapter 3. First, the quality of the official Dutch appraisal values, while subject to certain limitations, is sufficient for computing a SPAR index. Second, while the difference in trend between the (geometric) repeat sales index and the (value-weighted arithmetic) SPAR index for the Netherlands is small, this difference might not be negligible in the very long term. Furthermore, the SPAR index is less volatile (Figure 9.2) and more precise than the weighted repeat sales index, particularly in the shorter run, and SPAR index figures are not subject to revision. From a practitioner's point of view, the simplicity and transparency of the SPAR method would seem advantageous.

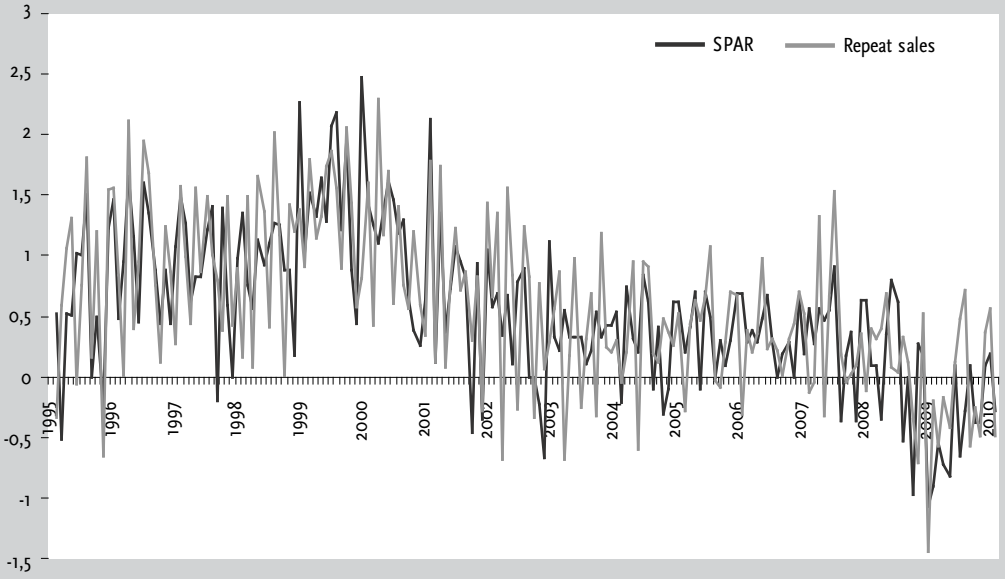
9.2 Conclusions on explaining house price development

In general

This dissertation goes into some depth on the explanation of house price development. House price fundamentals are dealt with in Chapters 4 and 5. The house price model presented there can be used to explain and predict changes in price. This is the first house price model for the Netherlands that has been published in scientific articles.

On the basis of neoclassical economic theory, it may be assumed that in a

Figure 9.2 Monthly % change in house price indexes for the Netherlands, January 1995-February 2010



well functioning housing market, the long-term price development of dwellings will be determined by the development of construction costs. When scarcity causes prices to rise in the short run, the supply of newly built houses will increase. An expanding supply puts pressure on the price level, which leads to a new equilibrium price on the housing market. However, it takes between one and three years to build a house; in the meantime, problems will arise in attuning the supply to the demand, so short-term price fluctuations will occur. Because it will take several years before the level of supply will be able to meet the increasing demand, prices will continue to rise for an extended period; the opposite will occur when demand declines. The literature casts the relation between the development of construction costs and that of house prices in a leading role in the development of house prices (for an overview of the literature, see Meen 1998, 2002). These studies show that house prices fluctuate much more than construction costs and that there is hardly any evidence of a direct statistical relation between the two variables. The most probable explanation for the absence of a relationship is that housing supply is inelastic because of spatial planning and thus reacts insufficiently to changes in the demand for owner-occupier dwellings. Another plausible explanation is that the development of house prices is primarily influenced by the equilibrium in the existing stock, while new construction has a minor effect.

The development of house prices has commonly been explained in terms of speculative or psychological effects (see, among others: Reichert, 1990; Abraham & Hendershott, 1996; Levin & Wright, 1997; Hort, 1998; Meen, 1998; Malpezzi, 1999). Along with the effects of the slow adjustment of the market for newly built homes, as mentioned in Chapter 6, the speculative or psychological effects explain why prices fluctuate in the short term. The underly-

ing idea is that the recent development of house prices also exerts an influence on future demand for owner-occupier dwellings. Obviously, when prices are rising, the consumer will want to act swiftly. Such calculating behavior on the part of homebuyers will have the opposite effect when the prices are lower; the consumer will postpone the decision to buy as long as possible to avoid incurring a capital loss. In order to model these effects, the lagged price development is usually incorporated into the model as an explanatory variable (as the bubble builder). In the long term, structural features should explain the price development. To ensure this, the model (the bubble buster) usually incorporates the deviation from the price equilibrium, generally based on the relation between price and income that has been determined for a stable period.

The second explanation for the development of house prices lies in the state of the economy (Chapters 7 and 8). Economic developments play a role in the short and middle range. For instance, real income, inflation, and mortgage interest rates (both real and nominal) are taken as explanatory variables in the development of house prices.

Third, the explanation may be grounded in demographic factors. It is acknowledged that most of their impact shows up in the long run, but opinions differ on the magnitude of their effects. This is illustrated by Meen's (1998) comments on the study by Mankiw and Weil (1989), who explain the development of house prices in the US entirely in demographic terms (see also Chapter 8). On the basis of their findings, these authors predicted that real housing prices in the US would have declined by 47 percent in 2007. Not surprisingly, that forecast caused quite a stir. Afterwards, a great deal of criticism was leveled at the operationalization of this model; investigations in other countries did not turn up similar relations. Despite this criticism, however, demographic factors remain important in any analysis of the development of house prices.

The fourth explanation is more structural in nature; it is sought in the policy of government and key institutions (see, among others: Muellbauer & Murphy, 1997; Abraham & Hendershott, 1996). For example, this type of explanation cites the important role that government plays by releasing sufficient amounts of building land (Winky & Ganesan, 1998) and in implementing spatial planning policy. Fiscal regulations play a significant part in government policy. The relationship between the development of house prices and personal income tax regulations is discussed in Chapters 4 and 7.

The model described in Chapters 4 and 5 explains and forecasts the percentage of change in the real house price of existing owner-occupier dwellings per half year. An effort was made to include all of the above-mentioned influences in the model. In comparison with other studies on house prices, this is a parsimonious number of explanatory variables. It proved that variables such as supply (Chapter 6), rent, demographic characteristics, and

Figure 9.3 Schematic diagram of the house price model

Effects		Describes
Housing market, speculative or psychological effets House price (t-1)	→	The reaction to the previous market situation for both buyer and seller. The assumption is that market conditions at time t-1 will affect the market at time t.
Long-term effect on the housing market Relation between interest payments and income	→	Income largely determines the housing costs. It is assumed that in the long run, housing costs will show the same development as income. The house prices vary around this long-term trend.
Seasonal effect on the housing market Season-correction variable	→	The price usually changes more in the first half of the year than in the second half.
Economic developments Income effect Change in income	→	A change in income means a similar change in price.
Economic developments Cost effect Change in mortgage interest rate	→	The chance of entry into the owner-occupancy market in terms of the cost of financing. An increase in financing costs (interest) causes the house price to decline.

Source: Model of house price for existing owner-occupied dwellings (OTB Research Institue)

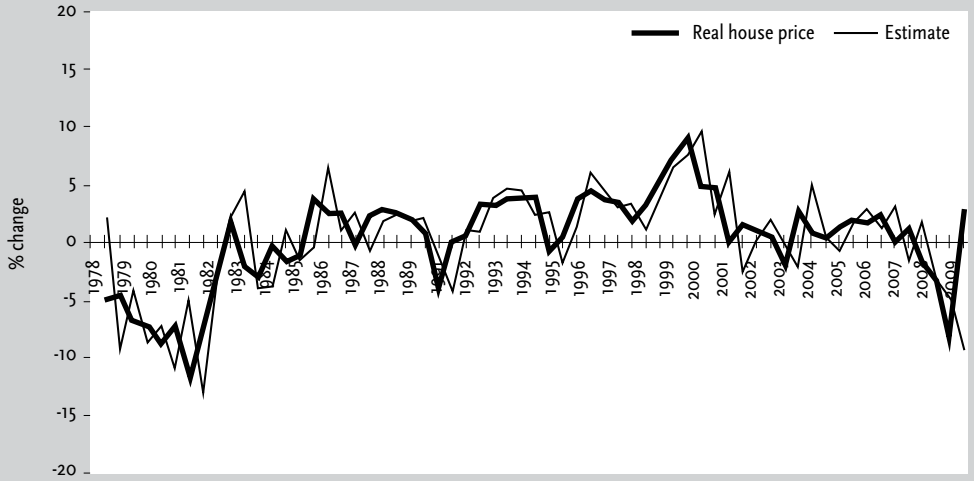
the unemployment rate did not add any extra explanatory value. Figure 9.3 depicts these steps schematically. In the short term, significant upward or downward movements (shocks) appear due to speculative or psychological effects. Recent price developments have been used to construct models of such short-run price fluctuations. In addition to short-run price effects, other more permanent factors play a role in the development of house prices. For the long-term effect on the housing market, a connection has been drawn between mortgage interest payments and income, and a dummy has been entered for the half-year effect. The economic factors serving as explanatory variables are income and mortgage interest. Figure 9.4 displays the real and estimated price development in schematic form.

In Chapter 6 special attention is drawn to the supply that plays a role at the national level but not as an explanatory factor. Chapters 7 and 8 set forth some relations with the business cycle, Chapter 7 with the house price development, and Chapter 8 with the sought-after quality.

In depth

Chapter 4 traces the relationship between two dynamics: the personal income tax position with respect to the treatment of the owner-occupied dwelling; and the development of house prices. That relationship is depicted in various ways. First, in a theoretical light, this chapter examines the variables influencing house prices. Like government policy, economic circumstances (for instance, household income and mortgage interest rates) play a role in both the short and the long term, whereas demographic changes have a structural effect. As a review of the literature suggests, the fear that a deterioration of the deductibility of mortgage interest payments will lead to sharp drops in house prices might well be exaggerated. Clearly, if the supply is not

Figure 9.4 Realized and estimated real house price changes in the Netherlands



Source: OTB Research Institute, House price model

entirely inelastic, no full capitalization of the tax deduction will be reflected in the house prices. If the deductibility is restricted, the converse will apply. Nonetheless, a fear of significant decreases in the top segment of the housing market would certainly be realistic if housing becomes more expensive and demand shifts toward cheaper housing.

Comparison of the consequences that tax reform would have on house prices in several European countries reveals that the means and timing of tax adjustments largely determine the effects on the development of house prices. Applying the econometric model to the Netherlands, it appears that moderate limitations on the tax concession would make the decline in nominal house prices less steep, 6 versus 25 percent, and that the period of decline would not last as long. In light of these findings, it seems that governments would be wise to implement any tax limitations they might envision in small steps and to keep an eye on the timing. From this perspective, it would be better to limit mortgage interest relief when the market for owner-occupier dwellings is overheated than it would be in hard times.

Chapter 5 also makes use of the house price model discussed in Chapter 4. Many housing market researchers have tried to shed light on the short- and long-run relationships between house prices and income. The basic principles of the theory are that short-run fluctuations (shocks) occur due to market imperfection, while over the long term, causality with such fundamentals as income or population growth will recover. One of the strongest indicators of these short-run shocks is the evidence that pricing on the current housing market correlates with prices in the past. Were the market functioning optimally, this relationship could not exist. In the practice of house-price modelling, this serial correlation is corrected by a variable that establishes long-run equilibrium between house price and income (price-to-income ratio). Although market imperfection may render this ratio artificially high or artificially low during certain periods, market corrections eventually take effect,

restoring the overall equilibrium between house price and income. This long-run equilibrium has been applied in many price models. The use of the relationship as (part of) an error-correction mechanism, however, is not without criticism. With regard to the situation in the Netherlands, Chapter 5 assumes a long-run relationship between net interest payments and income, whereby affordability becomes the key factor in long-run equilibrium. The output of the model, including the interest-to-income ratio instead of the price-to-income ratio, gives a good statistical result. Other authors, notably Kranenburg *et al.* (2008) and Francke *et al.* (2009), have also published on house price models for the Netherlands. For an overview, see Francke *et al.* (2009). While these models likewise ascribe no significant influence to the supply, they do find, as expected, a strong influence of the lagged house price and the long-term equilibrium.

Chapter 6 examines the relation between the house price and the supply. The supply serves neither as an explanatory nor a predictive variable in the house price model, even though price theory posits that the supply should indeed have an influence. Therefore, Chapter 6 differentiates the supply by spatial scale. At the scale of the street, the price is determined by negotiations between the seller and the buyer. Price models on this lowlevel scale are based largely on significant connections between the price and a multiplicity of qualitative features. Here, the national average house price serves as a benchmark. Though new housing supplies depend on many factors that cannot be easily registered in databases, the effect of new housing supplies on house prices can still be analyzed by housing market level. Each regional housing market functions more or less independently of the others. On the one hand, new construction can push up the value of the surrounding housing because it is associated with a qualitatively better housing stock; on the other hand, it can increase the supply of houses in the neighborhood and actually put pressure on the prices. The latter situation seems to apply in the Netherlands, where building has been concentrated in designated areas (around the large cities, i.e., Amsterdam, Rotterdam, The Hague, and Utrecht) since the 1990s. Though the research was hampered by a shortage of usable data, it appears that the large amount of newly built housing around the four main Dutch cities does influence the development of property prices. The relationship between price development and housing production is inverse, which means that an increase in supply triggers a fall in prices. In other areas the correlation coefficients are more or less than zero, which leads us to conclude that the expansion of the housing stock is market-compliant in these areas.

Chapter 7 examines whether house prices in the Dutch owner-occupier market might decline under various circumstances: first, after a price bubble that is ready to burst; second, in response to the credit crunch; or, third, in response to a potential tax reform that would reduce the home mortgage

interest deduction in the Dutch income tax system (see also Chapter 4). Each aspect is analyzed on the basis of a literature study using Dutch house price models. The IMF had issued a cautious warning that a Dutch house price bubble might exist in 2007. However, calculations based on the house price model, as presented in Chapters 4 and 5, and on the findings of Kranenburg *et al.* (2008) contravene this warning. Any bubble that might have existed prior to 2007 had already burst by then as a result of the moderate house price developments in the preceding years.

In 2007 house prices were in accord with the fundamentals. Chapter 7 concludes that a psychological effect, possibly resulting from the global credit crisis, was causing a downturn in 2008 in the number of housing transactions and construction orders as well as in house prices. The effect of possible credit restrictions applied by financial institutions is not clear, as there is no hard evidence. The 2008 downturn might have been a temporary one, unless it was reinforced by a downturn in the real economy, of which the first signs had already appeared – rising unemployment and (a forecast of) a shrinking economy. Third, it is likely that house prices will fall as a result of changes in the tax treatment of homeowners. The Dutch models predict that house prices will decline if the income tax treatment of owner-occupiers is phased out over a 20-year period, even if the savings are returned to taxpayers as a general reduction in tax rates. The outcomes of the models indicated that even without tax reform, prices in the Dutch housing market are expected to come under pressure in the sense that, contrary to the previous decades, the growth of real house prices is predicted to be zero. If a tax reform that reduces the benefit of the mortgage interest deduction were actually to be carried out, housing would become more expensive. The models indicate that this would decrease demand and that house prices would respond with a decrease of between 10 and 25 percent over a period of 20 years. It is important to realize that these are first-order effects that the housing and tax policy would change as households adapt their behavior to the new situation. Also, the housing market will never be in equilibrium; rather, it is always moving towards equilibrium, with many opportunities to react to new stimuli. The growth in house prices in the Netherlands has been slowing down since 2000 and has been negative since the fourth quarter of 2008 because of the effects of the global financial crisis. In that light, following Åsberg and Åsbrink (1994), a tax reform that would have the effect of making owner-occupier housing more expensive at present may be unfortunate. Åsberg and Åsbrink studied the price reaction in Sweden after the fiscal reform of 1991. In their analysis, they distinguished between a price reaction to expected versus unexpected changes in taxation, concluding that it is difficult for households to assess the consequences of a reform. For that reason, the expectation of fiscal reform will have hardly any effect on the price development, while the actual reform will have an effect.

While Chapter 7 is mainly concerned with the influence of the business cycle on the development of house prices, Chapter 8 turns to the influence that the business cycle exerts on the price-quality relationship. The analyses provide evidence that the homebuyer in a high-growth economy is looking for a better-quality property and is prepared to pay for it. In a stagnant economy, such as that prevailing in the early years of the 21st century, the demand for quality takes second place to the demand for affordable homes. Thus, there is apparently a mechanism that trades off quality against affordability. This increases the chance that households will demand more quality in a medium- and high-growth phase than they will in a low-growth phase. It also appears that appreciation of quality varies, particularly between the low-growth phase and the medium-growth phase. The price – quality relationship barely varies between the medium-growth and high-growth phases.

9.2 Follow-up research

There is great interest in explaining the development of house prices among scientists and members of civil society. This is not surprising, as the Dutch housing market appears to be on the brink of a major reform. Two compelling reasons for reform are the fiscal treatment of home ownership and the demographic decline of peripheral regions. Both issues warrant fundamental follow-up research.

Over the past few years, several important advisory reports have been drawn up. These documents cite a clear link between the inefficient way the Dutch housing market operates and how the Dutch tax code treats home ownership. The reforms proposed for the owner-occupier market are thus aimed mainly at abolishing the deductibility of mortgage interest payments. The Dutch Council for Housing, Spatial Planning and the Environment submitted its first advisory report on this topic in 2007 (VROM-raad). One implication of its pursuit of tenure-neutral government policy was that the deductibility of mortgage interest would be tapered off. As part of a wide-ranging re-evaluation of policies, the working party on housing investigated how the housing market might help reach the national austerity targets after 2010. A dysfunctional housing market was one of its findings. The working party identified three inefficiencies on the owner-occupier market, all of which relate to the tax treatment of home ownership. The third (and last) report appeared in April 2010, submitted by the Social and Economic Expert Committee (CSED), working independently under the auspices of the Social and Economic Council of the Netherlands (SER). Also this committee recommends reform of the tax regime for home ownership.

All of the proposed revisions concern the facets of the owner-occupier market that impact price-setting. The tax reform is intended to make the hous-

ing market more efficient, a market in which the households' choice between owning and renting will not be driven by price but by other factors.

Demographic shrinkage – primarily through a decline in the number of households – does not lead to changes in the market parameters but does have implications for local and regional housing market conditions. One positive outcome could be that the market slackens, conceivably leading to lower house prices and more choice for housing consumers. But that would not necessarily have to happen. As stock-flow models demonstrate, house price levels only generate new construction if in the long run the desired housing stock is different from the current stock. This could mean that an area without any population increase may have high prices with little or no new construction, while an area with a growing population and low prices can nevertheless have a flourishing new home-building market.

For adjusting the market parameters as well as for addressing the problem of shrinking regions, housing policy pays close attention to expectations for house price development. Obviously, the development of house prices has consequences for the assets of individual households as well as for society at large through its direct link to economic growth. At present, not enough fundamental research is conducted within the Dutch context on how households would take the effect of a reform of the owner-occupier market into account in their purchasing decision. It may be expected that households would find it difficult to assess the consequences of a reform, whereby an expected reform would have hardly any bearing on the current price development. That is also the assumption on which the models were calibrated in Chapters 4 and 8, though this is under discussion. It is proposed that research be carried out on the way in which households take the effect of a reform of the owner-occupier housing market into account in their decision to buy.

Further, it has been demonstrated – in this dissertation, among other documents – that a causal relation exists at the local level between the production of dwellings and the development of house prices. While local production influences the local price development, this relation cannot be demonstrated at the national level, however. So particularly for shrinking regions, the relation between new construction and house prices may be of great importance. Fundamental research in which shrinkage, production, and pricing are pivotal could yield results that are critical to a regional housing policy. Such research would also have to take the supply of second-hand dwellings into account.

Besides these two more or less socially desirable directions for follow-up studies, there is another research topic that warrants attention on scientific grounds, namely, the separate effect of mortgage interest on the house price. It is precisely in a demand-driven (stock) housing market that the supply does not lead to an equilibrium price, and therefore the direct effect of rising interest rates will be a drop in prices. Because the house price model (Chapter 4) is estimated anew every half year, it is evident that the effect of interest

payments on the price development changes in the course of time. There may be various reasons for this: for instance, the introduction of the savings mortgage, or a housing market that operates more and more efficiently.

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prijsontwikkeling
woningprijs
beide
niveau
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regime
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koopwoningmarkt
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revisie
januari
spar
methode
alle
periode
vraag
algemene
vanaf
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tijd
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marktwerking
proefschrift
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Samenvatting

Het meten en het verklaren van de ontwikkeling van de woningprijs

Paul de Vries

Dit onderzoek gaat over de woningprijs, specifiek over de ontwikkeling van de woningprijs. Daarbij zijn twee wegen ingeslagen. Ten eerste wordt onderzocht hoe de prijsontwikkeling gemeten kan worden. Ten tweede hoe de prijsontwikkeling verklaard kan worden.

Voor het meten van de prijsontwikkeling is het van belang om te corrigeren voor kwaliteitsverandering. Hiervoor is een woningprijsindex geschat; deze wordt maandelijks door het Kadaster en het CBS gepubliceerd. Een index geeft de prijsontwikkeling van de woning alsof de kwaliteit niet wijzigt in de tijd. Voor het verklaren van de prijsontwikkeling is een tijdreeksmodel geschat waarin relaties gelegd zijn tussen de woningprijsontwikkeling en haar belangrijkste *fundamentals* rente, inkomen en inflatie. Met behulp van deze *fundamentals* kan ook een voorspelling gegeven worden voor de prijsontwikkeling. De modeluitkomsten worden ieder half jaar gepubliceerd in de *NVB Thermometer Koopwoningmarkt*.

Zowel voor het meten als voor het verklaren van de woningprijsontwikkeling is de maatschappelijke en economische context van groot belang. Binnen deze context ontwikkelt de woningprijs zich.

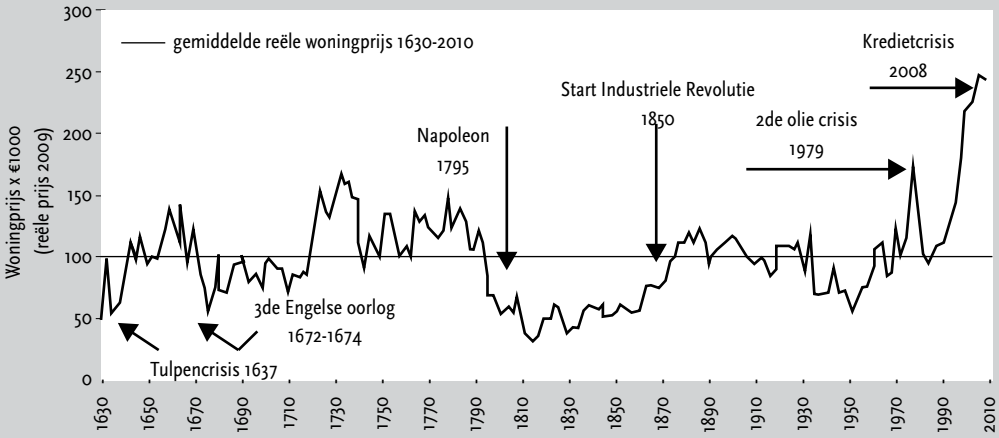
De context: aandacht voor de koopwoning

In 1970 is het aandeel koopwoningen slechts 30% van de woningvoorraad, maar stijgt in één decennium naar 48% en vervolgens naar 58% begin 2010. Historisch gezien een spectaculaire ontwikkeling die gevoed wordt door fases van hoogconjunctuur en de introductie van begrippen zoals 'zeggenschap' en 'keuzevrijheid' binnen de discussies over de woningmarkt. Staatssecretaris Remkes van VROM vond bijvoorbeeld dat zeggenschap over de woning en woonomgeving een belangrijke sociaal-culturele beleving is die past binnen de geëmancipeerde samenleving (Remkes, 2001).

Meten

Binnen die steeds wijzigende marktomstandigheden vindt prijsvorming plaats en ontstond er een groeiende wetenschappelijke belangstelling voor de woningprijs (De Vries, 2009). Toch verschijnt de eerste internationale publicatie over een woningprijsindex voor Nederland pas in 1997 (Eichholtz, 1997). Zijn Herengracht Index geeft het prijsverloop vanaf 1628 tot en met 1973 en toont aan dat de woningprijs een reflectie is van voor- en tegenspoed in de economie. Dit is te zien in Figuur 1 die, met behulp van de Herengrachtindex, de reële woningprijs weergeeft. Oorlogen en economische crises veroorzaken dalende prijzen; herstel van de economie doet de prijs toenemen. Nadat eerst begin deze eeuw twee andere wetenschappelijke publicaties zijn verschenen over schattingenmethodes voor woningprijsindices met behulp van Neder-

Figuur 1 Ontwikkeling van de reële woningprijs, in euro's 2009, 1630-2010



Bron: Eichholz 1997, CBS, NVM, Kadaster, bewerking Onderzoeksinstituut OTB (TU Delft)

landse data (Francke & De Vos, 2000; Francke & Vos, 2004) publiceren Jansen *et al*. (2008) uiteindelijk in 2008 een index voor Nederlandse woningmarkt. Deze index wordt geschat met behulp van de weighted repeat sales methode. Deze index wordt al snel opgevolgd door de index die berekend is met behulp van de SPAR-methode (De Vries *et al.,* 2009). Beide zijn onderdeel van dit proefschrift – de SPAR-index wordt maandelijks door zowel het Kadaster als het CBS gepubliceerd.

Verklaren

Het is nog maar 23 jaar geleden dat de eerste wetenschappelijk studie verschijnt waarin de Nederlandse woningprijs wordt verklaard (Spit & Needham, 1987). Kort daarna verschijnt het proefschrift van Jos Janssen (Janssen, 1992). Beide verklaren het niveau van de woningprijs en niet de prijsontwikkeling. Het eerste model van de ontwikkeling van de nationale woningprijs, verschijnt in 1996 (Boelhouwer *et al.,* 1996). Het model verklaart de prijsontwikkeling vanaf eind jaren zeventig en geeft een voorspelling voor de volgende twee jaar. Sindsdien evolueert dit model; elk halfjaar wordt het model opnieuw geschat en wordt een voorspelling voor de komende vier halfjaren gepubliceerd in de *NVB Thermometer Koopwoningmarkt*. Dit model wordt in deze dissertatie beschreven en toegepast, waarbij het gaat om het schatten van woningprijseffecten indien de fiscale regelgeving rondom de eigen woning wijzigt en om het duiden van de relatie tussen de woonlasten en het inkomen. Er zijn ook anderen die de prijsontwikkeling op de Nederlandse koopwoningmarkt hebben gemodelleerd (voor een overzicht zie: Francke *et al.,* 2009b).

Marktwerking

Vanaf de Tweede Wereldoorlog tot aan 1990 staat het volkshuisvestingsbeleid in het teken van het wegwerken van het kwantitatieve woningtekort. Over bijna de gehele periode bepaalt de overheid omvang, type en eigendomsverhouding van de productie, zodat van een echte wisselwerking tussen vraag

en aanbod geen sprake kon zijn, laat staan van een evenwichtsprijs. Daarin komt vanaf 1989 verandering. Corporaties worden verzelfstandigd, objectsubsidies worden afgeschaft of beperkt en het rijksbeleid richt zich op invoering van meer marktwerking (Heerma, 1989). Rond de eeuwwisseling wordt marktwerking nadrukkelijk gestimuleerd door de positie van de consument te verstevigen (Remkes, 2001), waarbij het uitgangspunt is dat efficiënte marktwerking een waarborg is voor een balans tussen vraag en aanbod op macroniveau (Boelhouwer, 2002, 2005). Vooral de vraag naar koopwoningen wordt gestimuleerd. Deze vraagimpulsen, gecombineerd met dalende renteniveaus, koopkrachttoename en de introductie van de tweeverdieners- en aflossingsvrije hypotheek, zorgen voor spectaculaire prijsstijgingen in de jaren negentig.

Niet efficiënte marktwerking

Een efficiënte markt leidt ertoe dat marktprocessen onmiddellijk doorwerken naar een evenwichtsprijs. Met andere woorden, als de prijs optimaal de vraag-aanbodverhouding weerspiegelt op de woningmarkt, dan kan worden aangenomen dat op de lange termijn de prijsontwikkeling door de bouwkostenontwikkeling wordt bepaald. Er is dan sprake van een efficiënt functionerende woningmarkt.

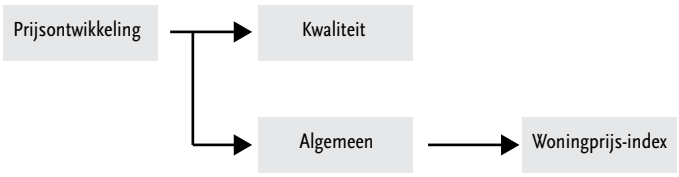
De drie meest genoemde voorwaarden voor efficiënte marktwerking zijn ten eerste de mogelijkheid voor de actoren om bij hun afwegingen rekening te houden met alle relevante informatie; zij dienen dus nu en in de toekomst te beschikken over perfecte informatie. Een tweede eis is de gelijke marktmacht van de actoren. Dit kan bereikt worden als er veel vragers en veel aanbieders op de markt actief zijn (Priemus, 2000). Een derde, veel genoemd criterium is de homogeniteit van het product. Wanneer het product heterogeen is, zoals bij de koopwoningmarkt, dan is het begrip markt niet meer scherp omlijnd. In veel studies worden deze voorwaarden en de kenmerken van de woningmarkt naast elkaar gezet (zie onder meer Barr, 1998; Cho, 1996; Boelhouwer & Haffner, 2002; Priemus, 2000) en onderzocht of de koopwoningmarkt een efficiënt werkende markt is. Deze hypothese is keer op keer verworpen, waarmee gezegd wordt dat de koopwoningmarkt een onvolmaakte markt is (Cho, 1996). Deze niet efficiëntie geeft een onstabiel marktevenwicht op de koopwoningmarkt waardoor de woningprijs vooral op korte termijn 'schokt' onder invloed van de verwachtingen ten aanzien van de prijs (Hort, 2000). Er is dus bijna nooit sprake van een stabiel prijsevenwicht op de koopwoningmarkt.

Ook in Nederland is er sprake van niet efficiënte marktwerking. Bij het meten en verklaren van de woningprijsontwikkeling zal hiermee rekening gehouden moeten worden.

Neoklassiek marktkader

Marktwerking, efficiënt of niet efficiënt, leidt naar prijsvorming en is afhan-

Figuur 2 Van prijsontwikkeling naar prijsindex



kelijk van de marktkaders. De koopwoningmarkt kent een neoklassiek kader, wat inhoudt dat de woningprijs het resultaat is van vraag en aanbod, waarin de vraag naar woondiensten een functie is van demografische factoren, inkomen, rente en woningvoorraad en het aanbod een functie is van grondkosten, bouwkosten en kredietvoorwaarden (Chen, 1998). Die factoren – de *fundamentals* – beïnvloeden de prijsontwikkeling op de korte, middellange en lange termijn.

De internationale literatuur onderscheidt binnen het neoklassieke kader twee stromingen wat betreft de impact vanuit het aanbod op de evenwichtsprijs. De eerste stroming is die waarin een grote betekenis wordt gegeven aan het aanbod, de aanbodsmarkt (Boelhouwer, 2005). De gedachte is dat, wanneer het woningaanbod elastisch reageert, op de lange termijn de prijzen van woningen de ontwikkeling van de bouwkosten zullen volgen, waardoor er een evenwichtsprijs bereikt wordt. Met andere woorden: de productiekosten bepalen op de lange termijn de woningprijs (zie voor een overzicht Meen, 1998; McAvinchey & Maclennan, 1982; Thorson, 1997; Shiller, 2007). De woningprijzen fluctueren echter veel sterker dan de bouwkosten en er blijkt nauwelijks sprake van een direct statistisch verband. De meest voor de hand liggende verklaring hiervoor is dat door het ruimtelijke ordeningsbeleid het woningaanbod onvoldoende reageert op veranderingen in de vraag naar koopwoningen. In theorie is de aanbodmarkt een efficiënt functionerende woningmarkt. In Nederland is er echter geen sprake van een aanbodmarkt en dus ook niet van een efficiënt functionerende markt.

De tweede stroming is de gedachte dat de koopwoningmarkt een voorraadmarkt is. Dit is het uitgangspunt in de meeste westerse economieën met een sterk gereguleerde bouwmarkt zoals Nederland (Boelhouwer, 2005). Prijsvorming vindt plaats op de markt van bestaande koopwoningen. De vraag-aanbodverhouding wordt immers zodanig verstoord door het ruimtelijke ordeningsbeleid en schaarste in concentratiegebieden, dat het door de markt gewenste aanbod onvoldoende gerealiseerd wordt. Hierdoor is de relatie tussen de bouwkosten en de woningprijs doorgesneden. In de wetenschappelijke literatuur wordt daarom telkens benadrukt dat de woningprijsontwikkeling vooral onder invloed staat van de ontwikkeling van het inkomen, de hypotheekrente en de woningprijs zelf (Abraham & Hendershott, 1996; Hort, 1998; Malpezzi, 1999). Ook de Nederlandse koopwoningmarkt is een voorraadmarkt en kenmerkt zich door een niet efficiënte marktwerking waarop vooral vraaggerelateerde factoren de woningprijsontwikkeling beïnvloeden. Het aanbod speelt nauwelijks een rol van betekenis bij prijsvorming.

Het meten van de prijsontwikkeling

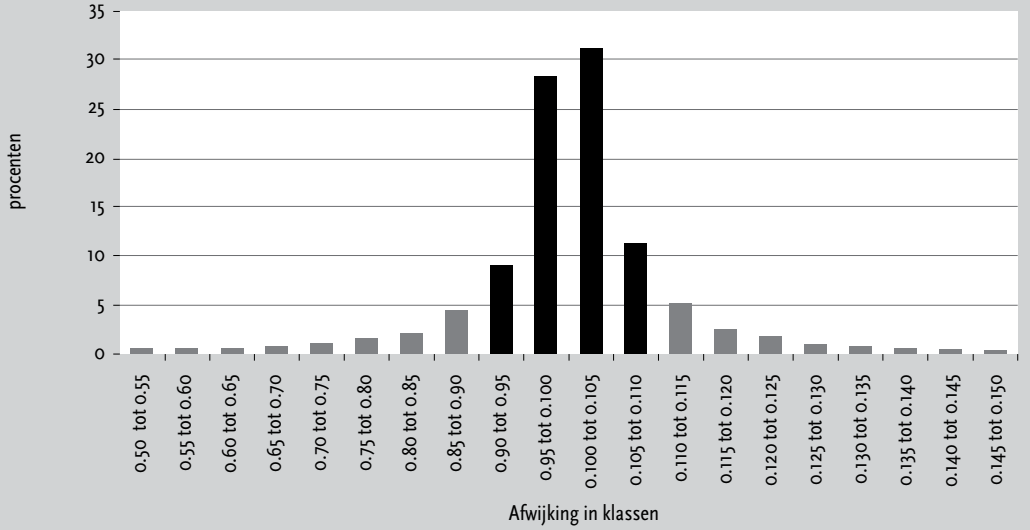
De prijsontwikkeling van woningen bestaat grofweg uit twee componenten (zie Figuur 2). Een deel van de prijsverandering wordt veroorzaakt door de verandering in de kwaliteit van de koopwoningen. De gemiddelde kwaliteit van koopwoningen is de afgelopen decennia toegenomen en die verandering heeft invloed op de gemiddelde woningprijs. Ook wisselt elke maand het pakket aan woningen dat verkocht wordt. Zo worden er bijvoorbeeld in de ene maand meer grondgebonden woningen verkocht dan in de andere maand. Die pakketverandering heeft invloed op de gemiddelde woningprijs. De andere component van de prijsontwikkeling is de algemene prijsontwikkeling van koopwoningen. Deze algemene of geschoonde prijsontwikkeling staat los van de kwaliteit. Een index volgt de algemene prijsontwikkeling.

In hoofdstuk 2 en 3 van dit proefschrift worden twee methoden beschreven waarmee voor de Nederlandse woningmarkt een index geschat kan worden. Het gaat om de weighted repeat sales methode (WRS) en de Sales Price Appraisal Ratio methode (SPAR). Beide methoden corrigeren voor kwaliteitsverandering met als schattingsresultaat een algemene prijsontwikkeling. De keuze van een methode is afhankelijk van de aanwezige databestanden (Abraham & Schauman, 1991) en van het doel (Wang & Zorn, 1997). Voor de WRS-index is gebruik gemaakt van Kadasterbestanden. Deze bestanden bevatten alle woningverkopen vanaf januari 1993 (2,5 miljoen transacties). Voor de SPAR-index is daarnaast gebruik gemaakt van de WOZ-bestanden (actuele taxatiewaarde van alle woningen).

Weighted repeat sales methode (WRS)

De basis voor de weighted repeat sales methode is het prijsverschil tussen twee transactiemomenten van dezelfde woning; de actuele verkoop (tweede verkoop) en de eerdere verkoop (eerste verkoop). Er is prijsinformatie beschikbaar van 700.000 paren vanaf januari 1993. De WRS-methode schat met behulp van deze paren de maandelijkse prijsontwikkeling vanaf januari 1993 tot en met de meest actuele maand. In theorie wordt gecorrigeerd voor kwaliteitsverschillen in de samenstelling van de verkochte woningen per periode (Bailey *et al.,* 1963). Omdat de individuele woning als basis is genomen, wordt de algemene prijsontwikkeling gemeten (Abraham & Schauman, 1991). Er is wel kritiek op deze aannamen. Immers, alleen als de woning op beide verkoopmomenten van dezelfde kwaliteit is én als die woonkwaliteit door de markt op dezelfde wijze wordt gewaardeerd, is er sprake van een juiste meting van de algemene prijsverandering (Stephens *et al.,* 1995). Het is zeer onwaarschijnlijk dat dit het geval is. Echter, de in dit proefschrift beschreven WRS-index is primair ontwikkeld voor risicomanagement bij financiële instellingen. Zij zijn geïnteresseerd in de actuele woningprijs van de woningen in hun hypothekenportefeuille. Als het doel van de index 'het meten van de marktwaarde op een bepaald moment in de tijd' is, dan is het juist te prefe-

Figuur 3 Verdeling van het procentuele verschil tussen de woningprijs en de WOZ-waarde in klassen, waardepeildatum januari 2003



reren om het effect van verbetering en veroudering mee te nemen in de index (Hwang & Quigley, 2004; Wang & Zorn, 1997). Verder wordt bij de berekening van de index rekening gehouden met de wisselende pakketsamenstelling van de verkochte woningen door iedere maand opnieuw het pakket zodanig te corrigeren dat het representatief is voor de verdeling in de koopwoningvoorraad.

Een belangrijk, vooral praktisch probleem, voor gebruikers van de index is de revisie. Doordat iedere maand nieuwe woningverkopen toegevoegd worden aan het databestand ontstaan nieuwe paren – de WRS methode koppelt immers actuele (tweede) verkopen aan eerste verkopen die ver in het verleden kunnen liggen. Het gevolg is dat nieuwe prijsinformatie beschikbaar komt over voorliggende jaren. De WRS-index schat, ook op basis van deze nieuwe informatie, de prijsontwikkeling over de gehele periode vanaf 1993. Het is logisch dat daardoor de indexreeks wijzigt. De revisie zorgt voor betere schattingsresultaten, maar gebruikers zien deze revisie als het belangrijkste nadeel van de WRS-methode. Zij worden telkens geconfronteerd met een gewijzigde indexreeks. In het proefschrift wordt aangetoond dat de revisie in de WRS-index voor Nederland klein en verwaarloosbaar is. Dit geldt niet voor regionale indexreeksen.

Verder is in het proefschrift aandacht voor de heteroskedasticiteit waarvoor de WRS-index corrigeert. De WRS-methode is een evolutie van de repeat sales methode (RS) van Bailey *et al.* (1963). In 1987 publiceerden Case & Shiller het WRS-model. Zij beargumenteren dat in de RS-methode de variantie in de residuen toeneemt als de periode tussen twee transacties toeneemt. Dit staat bekend als heteroskedasticiteit. De WRS-methode voorziet in een correctie hiervoor. Het resultaat is een lagere betrouwbaarheid van de indexwaarden (Wang & Zorn, 1997). Case en Shiller hebben dit empirisch niet kunnen toetsen. In dit proefschrift wordt empirisch aangetoond dat er nauwelijks sprake

is van een probleem; heteroskedasticiteit is aanwezig, maar de hoeveelheid onverklaarde variantie is niet meer dan 1%.

Sales price appraisal ratio methode (SPAR)
De sales price appraisal ratio methode (SPAR) maakt gebruik van de Kadasterbestanden maar ook van de WOZ-waarden van individuele woningen. Net als bij de WRS koppelt de SPAR-methode een actuele (tweede) verkoop aan eerdere waarde-indicatie. Bij de WRS-methode was dat een eerdere verkoop; bij de SPAR is dat de vastgestelde WOZ-waarde. Doordat van vrijwel alle vastgoedobjecten een WOZ-waarde bekend is, zijn voor nagenoeg alle nieuwe woningverkopen koppelingen te leggen met een eerste waarde-indicatie; er is nauwelijks sprake van dataverlies.

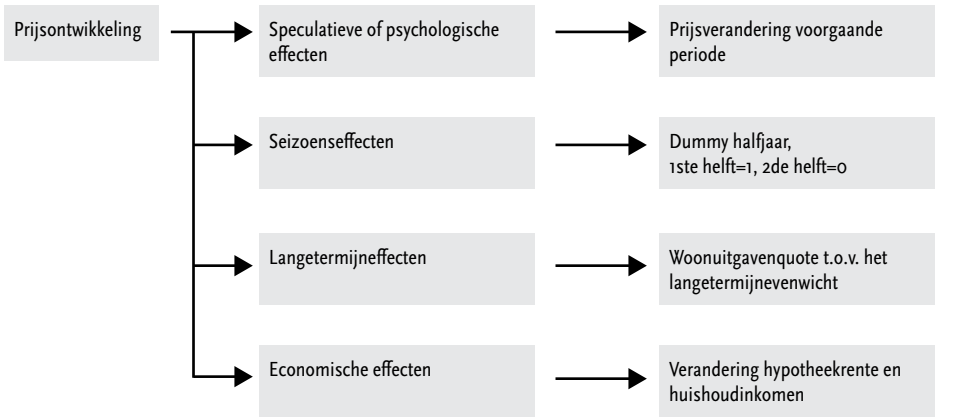
De aanleiding om een woningprijsindex te ontwikkelen op basis van de SPAR-methode was de revisie van de WRS-methode (Bourassa *et al.,* 2006). De SPAR-methode kent geen revisie. Verder wordt aan nog een belangrijk minpunt van de WRS-methode tegemoet gekomen, namelijk die van de verandering van waardering van woonkwaliteit door de tijd heen. Hiervoor corrigeert de WOZ-waarde impliciet. De WOZ-waarde is immers een schatting van de marktprijs op de WOZ-waardepeildatum. Het verschil tussen de WOZ-waarde en de actuele woningprijs is daardoor de algemene prijsverandering.

Het gebruik van de SPAR-methode hangt sterk af van de betrouwbaarheid van de WOZ-taxaties. Figuur 3 geeft de procentuele afwijking van de WOZ-waarde ten opzichte van de werkelijke woningprijs voor waardepeildatum januari 2003. Hieruit blijkt dat 79% van alle WOZ-waarden minder dan 10% afwijken van de marktprijs. In het proefschrift wordt deze verdeling ook gegeven voor de WOZ-peildata 1 januari 1995 en 1 januari 1999. Uit die vergelijking blijkt dat gemeenten steeds nauwkeuriger de WOZ-waarden schatten.

Een vergelijking tussen de WRS-methode en de SPAR-methode geeft aan dat de SPAR-methode de prijsontwikkeling meer precies in beeld brengt en minder volatiel is. Vanaf 2008 publiceren het Kadaster en het CBS de woningprijsindex gebaseerd op de SPAR-methode. Marc Francke *et al.* (2009a) vergeleken alle indexreeksen voor de Nederlandse woningmarkt.

Het verklaren van de woningprijsontwikkeling
Op verschillende manieren wordt in dit proefschrift naar een verklaring gezocht voor de ontwikkeling van de woningprijs. In belangrijke mate wordt hierbij gebruik gemaakt van het woningprijsmodel (hoofdstuk 4, 5 en deels 7). Specifiek wordt in hoofdstuk 4 en 7 gezocht naar de relatie met het fiscale regime en in hoofdstuk 5 naar de betaalbaarheid. Al eerder is opgemerkt dat het aanbod in een niet efficiënt functionerende markt slechts beperkt invloed heeft op de prijsontwikkeling. Hierover gaat hoofdstuk 6, waarin op lokaal niveau naar een causaliteit gezocht wordt. Verder verklaart de conjunctuur de prijsontwikkeling; die relatie komt in hoofdstuk 7 en 8 aan bod.

Figuur 4 Schematische weergave van het woningprijsmodel



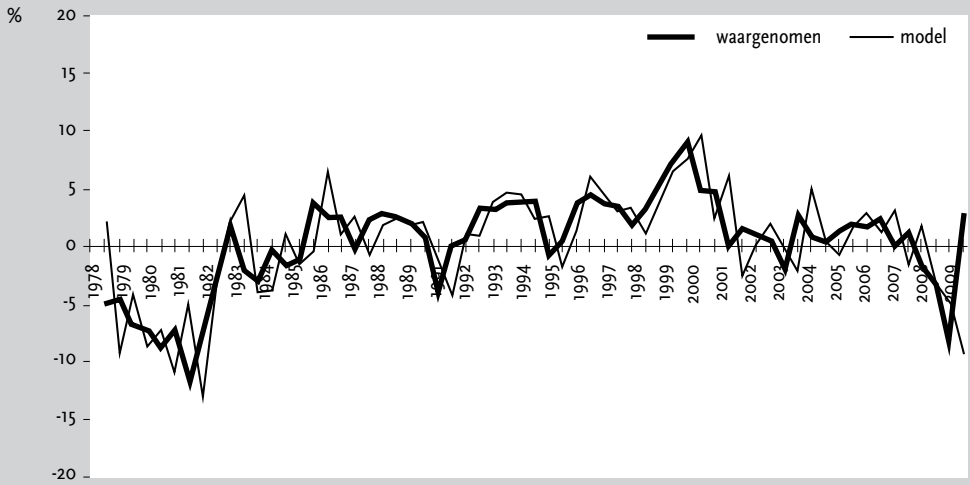
Het woningprijsmodel

Specifiek biedt het woningprijsmodel ruimte om uitspraken te doen over prijseffecten. Immers, in het model is vastgelegd hoe de verandering van de woningprijs tot stand komt. De veronderstelde verbanden tussen verklarende factoren en de prijsverandering zijn expliciet en consistent aangegeven en details zijn buiten beschouwing gelaten. Hierdoor kunnen overzichtelijke scenario's berekend worden; er is informatie beschikbaar van het aandeel van iedere factor in de woningprijsmutatie.

In de internationale literatuur zijn diverse modelstudies bekend waarin de koopprijsontwikkeling in het perspectief van de totale woningmarkt wordt geplaatst (Meen, 2002). Veelal onderscheidt men korte termijn en lange termijn prijseffecten. Korte termijn prijseffecten zijn zeer typerend voor de koopwoningmarkt. Dit is een direct gevolg van prijsverwachtingen en deze prijseffecten worden veelal aangeduid als speculatieve of psychologische effecten (o.a. Reichert, 1990; Abraham & Hendershott, 1996; Mapezzi, 1999; Hort, 2000) en van het niet efficiënt kunnen reageren van het aanbod (Boelhouwer, 2005).

Al eerder is genoemd dat de woningprijs zo goed als nooit een marktevenwicht bereikt maar altijd doorschiet. Om dit effect te modelleren wordt doorgaans een causale relatie opgenomen tussen de actuele prijsontwikkeling en die uit het verleden (Bubble-builder). In een markt met stijgende prijzen anticipeert de woonconsument op verdere prijsstijgingen, waardoor lucht in de woningprijs kan ontstaan (Shiller, 2007). Om er vervolgens voor te zorgen dat uiteindelijk op de lange termijn de prijsontwikkeling door haar fundamentals wordt verklaard, wordt als correctiefactor (Bubble-burster) een langetermijnevenwicht opgenomen in een woningprijsmodel. In het woningprijsmodel dat in dit proefschrift wordt gepresenteerd, is een langetermijnevenwicht opgenomen tussen de rentelasten en het inkomen (betaalbaarheid). Deze benadering wijkt af van de meer voorkomende assumptie dat er een langetermijnevenwicht is tussen de woningprijs en het inkomen (Case & Shiller, 1990;

Figuur 5 Gerealiseerde en geschatte reële prijsverandering, in procenten, 1978 -2010



Bron: woningprijsmodel Onderzoeksinstituut OTB (TU Delft)

Abraham & Hendershott, 1996; Malpezzi, 1999). Gallin concludeerde echter dat hiervoor geen bewijs is (Gallin, 2006). In hoofdstuk 5 wordt specifiek ingegaan op het langetermijnevenwicht. Naast rente, inkomen en inflatie zijn er ook andere factoren die tot de fundamentals behoren, zoals het aanbod, de bouwkosten en de demografische ontwikkelingen. In de Nederlandse context is de invloed van deze factoren echter statistisch niet significant. Ook andere onderzoekers vonden geen overtuigend bewijs dat aanbod invloed heeft op de prijsontwikkeling (voor een overzicht zie: Francke et al., 2009b). Op lokaal niveau lijkt er gedurende een korte periode een relatie te zijn tussen nieuwbouwaanbod en prijsvorming (hoofdstuk 6).

Uiteindelijk verklaart het gepresenteerde woningprijsmodel de procentuele verandering van de reële woningprijs met een aantal economische en woningmarkteffecten, namelijk het vertraagde prijseffect P_{t-1}, de verandering in de reële rente R_t, de verandering in het reële huishoudinkomen I_t en het langetermijneffect tussen de rentelasten en het inkomen E_{t-2} (see Figure 4). Vergelijking 1 geeft het model weer dat in juni 2010 is geschat (R^2 0,63, DW 2,00). De t-waarde staan tussen haakjes. Figuur 5 geeft de werkelijke en de geschatte prijsmutaties grafisch weer.

$$P_t = 6.87 + 0.37P_{t-1} - 0.32E_{t-2} - 1.67R_t + 0.79I_t \quad (1)$$
$$(+3.84)(+3.43) \quad (-3.95) \quad (-2.02) \quad (+2.21)$$

Effect van het aanbod op de woningprijsontwikkeling

De nieuwbouwsector heeft nagenoeg geen directe invloed op de woningprijs. Hiervan is sprake in landen, en zeker in Nederland, die een sterk gereguleerde woning(bouw)markt kennen en waar bouwgrond schaars is. Desalniettemin is het rijksbeleid gericht op efficiënte marktwerking. In een efficiënt werkende markt wordt op de lange termijn de ontwikkeling van de woningprijs verklaard door de factoren die de nieuwbouw bepalen. In hoofdstuk 6 is on-

derzocht of de neoklassieke economische theoretische relatie wel gevonden kan worden op lokaal niveau. De vraag naar nieuwbouw zal immers vooral afhangen van lokale factoren, zoals een kwantitatief of kwalitatief woningtekort. Het ligt daarom voor de hand dat het nieuwbouwaanbod juist op lokaal niveau meetbare impact heeft op de prijsontwikkeling. In Brits (Meen, 1996), Amerikaans (Goodman, 1998) en Zweeds onderzoek (Berg, 2002) wordt deze eigenwoningmarkt-dynamiek bewezen. In de Nederlandse context ligt het voor de hand dat in Vinex-gebieden de prijsontwikkeling door de grote hoeveelheden nieuwe woningen voor enige tijd getemperd zal worden. Hoofdstuk 6 bevestigt slechts ten dele deze hypothese. Wel lijkt het erop dat de toevoeging van grote aantallen nieuwbouwwoningen in een kort tijdbestek zichtbaar is in de prijs op lokaal niveau. In verschillende gebieden is waarneembaar dat een forse verruiming van het aanbod gelijktijdig optreedt met een negatief effect op de woningprijsontwikkeling. Het gaar hier om een kortstondig effect waarna het prijsniveau zich na enkele jaren weer herstelt.

Effect van een wijziging van het fiscaal regime op de woningprijsontwikkeling
De fiscale behandeling van de eigen woning is een onderwerp waarover volop wordt gediscussieerd in zowel wetenschappelijke als politieke kring. Terugkerende argumenten zijn dat het huidige systeem een efficiënte marktwerking in de weg staat, dat doorstroming wordt belemmerd, de overheid grote financiële risico's loopt bij rentestijging en dat het gevaar bestaat van een sterk toenemende hypotheekschuld in Nederland. Door die schuld is de woningmarkt gevoelig voor veranderingen in de conjunctuur. Met behulp van het woningprijsmodel is een aantal fiscale varianten doorgerekend voor het Ministerie van Financiën (2002), de NVM/NVB (2006), de VROM-raad (2007) en de NVB (2010).

Decennialang is het fiscale regime rondom de eigen woning niet gewijzigd. Dat betekent ook dat het effect van het fiscale regime min of meer constant is en niet als aparte verklarende variabele in het woningprijsmodel is opgenomen. Om toch veranderingen in de fiscale regelgeving te modelleren moet er eerst een vertaalslag gemaakt worden naar een variabele die wel in het model is opgenomen. Dit is de rentetoeslag. De gedachte achter de rentetoeslag is dat een fiscale verandering effect heeft op de woonuitgaven. Hoe ingrijpender de ingreep, hoe hoger de toeslag. De rentetoeslag verhoogt de rente in het model. Vervolgens zal het model een prijsdaling voorspellen. Verder is bij de berekening van de varianten aangenomen dat er door de beperking van de hypotheekrenteaftrek geen veranderingen in de bestaande voorraad en verhuisbewegingen optreden. In hoeverre deze veronderstelling strookt met de werkelijkheid is echter sterk afhankelijk van de wijze waarop en het tempo waarin deze beperkingen worden doorgevoerd. Ook kan verwacht worden dat de prijsmutaties in werkelijkheid zullen differentiëren tussen de diverse prijsklassen, waarbij het prijseffect voor dure koopwoningen vermoedelijk groter zal zijn dan voor middeldure en goedkope koopwoningen. Naast

de verandering van de rente bepaalt ook de woonquote de geschatte woningprijsontwikkeling in het woningprijsmodel. Als de werkelijke woonquote boven het langetermijnevenwicht ligt, zal de woningprijs dalen.

De uitkomsten zijn eenduidig. In de transitieperiode ligt de woonquote langdurig boven het langetermijnevenwicht en wordt daardoor de woningprijsontwikkeling gedrukt. Bij een afschaffing van de hypotheekrenteaftrek daalt de prijs ten opzichte van de ongewijzigde situatie rond de 20% in 20 jaar tijd (nominale euro's). In hoofdstuk 8 wordt aangetoond dat het juist in een periode van laagconjunctuur onverstandig is om het fiscale regime aan te passen.

Effect van de conjunctuur op de woningprijsontwikkeling

In een fase van hoogconjunctuur ontwikkelt de woningprijs zich sneller dan in een fase van laagconjunctuur. Woonconsumenten anticiperen op een toenemende woningprijs en zijn deels bereid om meer voor dezelfde kwaliteit te betalen dan in een fase van minder economische groei. Dit effect is impliciet via het psychologische of speculatieve effect in het woningprijsmodel gemodelleerd. De modeluitkomsten geven aan dat er in 2007 'lucht' zat in de woningprijs, maar dat die lucht al uit de woningprijs was ontsnapt voordat de kredietcrisis ons lang bereikte. Het CPB-model bevestigt dit beeld (Kranendonk & Verbruggen, 2008). Met behulp van beide modellen kan aangetoond worden dat de werkelijke woningprijs boven de geschatte woningprijs ligt, het verschil tussen beide wordt niet verklaard door de *fundamentals*.

Een onderliggende modelaanname hierbij is dat de relaties tussen de prijsontwikkeling en de verklarende factoren over de gehele schattingsperiode – dus ook in alle conjunctuurfases – gelijk zijn. Dat hoeft niet het geval te zijn. Zo blijkt uit hoofdstuk 8 dat de conjunctuur het gewenste pakket aan woonkwaliteit beïnvloedt. Hoewel de vraag naar kwaliteit in een periode van laagconjunctuur niet echt afneemt, verliest bij een stagnerende economie de vraag naar meer kwaliteit het van de vraag naar betaalbaar wonen. Verder is onderzocht of de relatie tussen de gewenste kwaliteit en de woningprijs per conjunctuurfase verschilt. Zo blijkt dat in een fase van midden- en hoogconjunctuur men daadwerkelijk meer bereid is te betalen voor dezelfde kwaliteit als in een laagconjunctuur.

Vervolgonderzoek

De wetenschappelijke en maatschappelijke belangstelling voor een verklaring van de woningprijsontwikkeling is groot. Directe redenen hiervoor zijn de invloed van de fiscale behandeling van de eigen woning en de regionale krimp op de woningprijsverandering. Beide geven aanleiding voor fundamenteel vervolgonderzoek.

Herziening van het fiscale regime hangt direct samen met de kaders van de woningmarkt waarbinnen prijsvorming plaatsvindt. Het beoogde effect van

een hervorming van het fiscale regime is een meer efficiënt werkende woningmarkt waarop huishoudens niet door de prijs gestuurd worden in hun keuze tussen een eigen woning of een huurwoning, maar door andere factoren.

Demografische krimp – vooral een daling van het aantal huishoudens – leidt niet tot wijzigingen van de marktkaders, maar heeft gevolgen voor de marktwerking op lokale en regionale woningmarkten. Een positief gevolg zou kunnen zijn dat de woningmarkt ontspant, wat zou kunnen leiden tot lagere woningprijzen en meer keuze voor woonconsumenten.

Bij zowel de hervorming van de marktkaders als bij de regionale krimp speelt de verwachting van de ontwikkeling van de woningprijs een grote rol in het woonbeleid. Immers, de woningprijsontwikkeling heeft voor individuele huishoudens vermogensgevolgen en voor de maatschappij is er een direct verband met de economische groei. Op dit moment is er nog onvoldoende fundamenteel onderzoek binnen de Nederlandse context naar de wijze waarop huishoudens het effect van een hervorming van de koopwoningmarkt in hun koopbeslissing meenemen. Huishoudens kunnen de consequenties van een herziening moeilijk overzien, waardoor een verwachte herziening nauwelijks doorwerkt in de actuele prijsontwikkeling. Dat is ook de aanname bij de modeldoorrekeningen uit de hoofdstukken 4 en 8.

Een onderzoek dat zich toespitst op de vraag hoe huishoudens het effect van een verwachte hervorming van de koopwoningmarkt meewegen in hun koopbeslissing lijkt waardevol.

Verder blijkt – onder andere uit deze dissertatie – dat op lokaal niveau een causaal verband bestaat tussen woningproductie en woningprijsontwikkeling. De lokale woningproductie heeft invloed op de lokale prijsontwikkeling. Op nationaal niveau geldt dat deze relatie moeilijk aantoonbaar is. Juist voor krimpregio's kan de relatie tussen nieuwbouw en woningprijs dus van groot belang zijn. Fundamenteel onderzoek waarin krimp, woningproductie en prijsvorming centraal staan kan belangrijke resultaten opleveren voor regionaal woonbeleid. In dat onderzoek moet ook het aanbod van tweedehandswoningen meegenomen worden.

Naast beide min of meer maatschappelijk gewenste vervolgonderzoeken ligt er nog een onderzoeksvraag vanuit wetenschappelijke interesse, namelijk wat het afzonderlijke effect is van de hypotheekrente op de woningprijs. Juist in een vraaggestuurde (voorraad)woningmarkt leidt het aanbod niet tot een prijsevenwicht en heeft een stijgende rente daardoor direct een prijsdaling tot gevolg. Doordat het woningprijsmodel (hoofdstuk 4) ieder halfjaar opnieuw geschat wordt, blijkt dat de invloed van de rente op de prijsontwikkeling wijzigt. Hier kunnen verschillende redenen voor zijn: bijvoorbeeld de invoering van de spaarhypotheek of een meer en meer efficiënt werkende woningmarkt.

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Curriculum vitae

I was born on 27 February 1958 in Amsterdam, which is also where I went to school. After my 18th my activities revolved mainly around the (International) Young Nature Friends (Nivon). I organized youth travel programs, was a member of the national youth board, was twice chairman of the international congress, and was involved in demonstrations against nuclear weapons. We also wrote and performed our own critical of the social structure plays, taking our theatre on the road in our VW van.

I tried my hand at all kinds of things and eventually, in May 1988, went to work three days a week at OTB Research Institute for the Built Environment/ Delft University of Technology. Three days suited me fine, as I had become a father and wanted to be involved in raising my two terrific daughters. During my first years at OTB I followed three courses of study given by the Netherlands Society for Statistics and Operations Research, earning professional qualification as a Statistical Analyst (1990) and completing programs in Linear Modeling (1992) and Sampling Techniques (1992). I finished these programs with academic qualifications. Since 1999 I have been engaged in research as a statistical analyst (see my Preface). In that framework, I followed the postdoctoral program on Housing, Urban and Mobility Studies (Delft University of Technology) and graduated in 2002 with a 9 for research skills.

In 2005 I started on my PhD track. Because my prior education did not meet the admissions requirement stipulated in Article 2.1, Subsection a, of the Doctorate Degree Regulations, on 22 November 2005 I submitted a request for exemption. The request was substantiated by diplomas from the educational programs mentioned above and was accompanied by a letter of recommendation from Professor Peter Boelhouwer. On 8 December 2005 the Board for the Conferral of Doctoral Degrees gave me permission to pursue my PhD.

At present, I am involved in both fundamental and contract research. The common denominator in my fundamental research is house price development. My contract research covers a much broader field of study, with sponsoring parties such as the national government, provinces and cities, umbrella organizations of builders and realtors, and individual housing corporations. I belong to the Working Group on Housing Economics of the European Network for Housing Research (ENHR); I am a member of the group of referees for Real Estate Research Quarterly; I regularly review submissions for diverse scientific journals; and I am on the supervisory board of the Rotterdam housing associations, PWS Rotterdam.

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This study discusses ways of measuring and explaining the development of house prices. The goal of the research underpinning this dissertation was to develop a methodological framework for studying these developments. This framework relates, first, to correcting for changes in the composition of dwellings and, second, to the fundamentals of the price development. Using the weighted repeat sales method and sale price appraisal ratio (SPAR) method house price indexes were developed for the Netherlands. Both the Dutch land registry office and Statistics Netherlands publish the SPAR based house price index monthly.
To explain and predict changes in prices a house price model is presented. As suggested in literature on western housing markets, the Dutch house price developments can be explained by demand-oriented short-run term variables and a long-run term variable. Using the house price model, this work identifies the fundamental factors in the development of house prices, a long-run equilibrium between interest payments and income, and the weak relationship on an aggregated level between house prices and newly built dwellings.

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