

Economic sustainability considerations in a local housing market with post-bubble hindsight

Tom Kauko, Department of Geography, NTNU, Trondheim and OTB Research Institute, Delft University of Technology, Delft.

Abstract

Given the pivotal role of the housing bubble in the subsequent credit crunch, the following question may be raised: could the global *financial crisis* have been moderated if prudent property valuations had been made at the time of issuing bank loans, and if governments and institutions had been concerned about raising the quality of market information? Indeed 'we still lack the good knowledge even about how to measure house prices and what would be the best methods to map the markets' (as stated in the Call for papers for this event). As a corollary, are *automatic valuation methods/models* (AVMs) useful in handling mortgage lending problems? This paper addresses the abovementioned issues in two ways: on one hand, it presents an empirical modelling application for mortgage valuation; on the other hand, it examines more qualitative, rhetorical arguments for the use of AVMs in this field. After an overview of the problems involved the paper proposes a novel framework based on the concept of *economic sustainability* that is argued to connect with the financial crisis, credit crunch and housing bubble discourse – it is to note that, traditionally, housing market modelling and sustainable development paradigms are treated as incompatible. Defining a sustainable housing market depends on long-term processes and often partial criteria. The empirical part of the paper concerns the development of house prices in relation to incomes in Trondheim, Norway, in the period 1993-2007.

Keywords: automatic valuation methods (AVMs), economic sustainability, financial crisis.

I think it's over now, I think it's ending
I think it's over now, I think it's beginning

Over! Over! by The Fall (2007, from the CD *Reformation Post TLC*; emphasis added)

Introduction

The magnitude and pace of the recent financial ‘meltdown’ in the world economy has taken us by surprise. At the end of the summer 2008 it was mainly about crisis in the US and then UK, but two months later it had already reached global proportions. Here in Norway – the richest country in the world – the currency was/is devalued 10% and, while in this country the financial institutions are not in serious troubles, many Norwegian municipalities have lost the total worth of their investments. In other countries outside the Euro-zone the problems are more serious, and the tone of government policymakers is a hopeless one. On the other hand, speaking about the US, the leader of the world economy, a recent homeowner confidence survey by *Zillow* found out that 62% of American homeowners believe the value of their house has increased or stayed the same during a year when in reality 77% of U.S. homes actually declined in value (AVM News, 2008a)! Apparently consumers still tend to overvalue their assets with it-happens-to-others-but-not-to-me mentality. It is reasonable to believe that similar attitudes prevail on this side of ‘the pond’ too.

But is it really ‘over’ or is it just a new ‘beginning’? Is the development of value and market modelling tools an endeavour worth embarking on, or are there unforeseeable risk factors – ‘storms’ or ‘pirates’ – in sight? Has room now, thanks to the economic downturn, been created for merging the ‘sustainable development’ and ‘market modelling’ paradigms? According to an old Finnish proverbial ‘there is nothing that bad that there cannot be something good in it’. Perhaps the new, more difficult situation, forces us to sharpen our tools and see what can be made as efficiently as possible. While the issue of financial crisis arguably is ‘a walk in the park’ in comparison with the risks associated with the global climate change, it is furthermore acknowledged that it might be possible to cease this unique opportunity of market calmness to ‘take stock’ and learn from the financial crisis. In other words, we have now all the right reasons to look at long-term growth patterns and evaluate how sustainable these are – and to begin speaking the same language as those engaged in sustainability research. The financial crisis is not a reason to give up in this field – not even the climate change is such a reason! This forward looking amidst general awareness of mistakes made is copied from the discourse of the practitioners rather than that of the real estate and housing market research community, as the latter, due to academic inertia, can be considered a laggard in this respect (see Kauko, 2004c; Kauko & d’Amato, 2008a).

Citing the call for papers for the ‘ENHR 2009’ workshops in Prague, indeed ‘we still lack the good knowledge even about how to measure house prices and what would be the best methods to map the markets’. This concerns, on the one hand, the price setting process in relation to the development of affordability, and on the other hand, the price setting process in relation to more static price factors tied to fundamental quality variables including location specific amenities such as the physical and social environment or transport infrastructure. While this topic is important in general socio-economic terms, as witnessed through the established urban housing market research tradition (see e.g. Ball & Kirwan, 1978; Maclennan 1978; Maclennan & Tu, 1996; Watkins, 2001; see also Meen & Meen 2003, for a somewhat alternative approach) we may also now speculate about a more particular issue:

given the pivotal role of the housing bubble in the subsequent credit crunch, could the global financial crisis have been moderated or even avoided if prudent property valuations had been made at the time of issuing bank loans, and if governments and other institutions were concerned about raising the quality of property market information? Do *automatic valuation models/methods* (AVMs, automated, often computerised procedures for carrying out the task of valuing one or more properties) help us in mortgage lending problems? And if we don't believe they do, what are the valid grounds for criticism? Here we may select between two different lines of analysis: we may, based on empirical evidence, argue for or against a direct empirical modelling application for mortgage valuation; alternatively, we may look at a more qualitative, rhetorical way of convincing either for or against the general use of AVM in this research area. The aim of the present study then is to show 'how' (or 'why not' if one is a sceptic) an AVM approach to residential property valuation and housing market analysis is feasible (or unfeasible), given the situation where the market and the whole economy is distorted and (at best) recovering from the financial crises that began in the autumn 2007. While still documenting work in process, this paper will do both: discuss aspects of general feasibility and present an empirical application. However, before beginning the discussion on valuation methodology, a discussion on the housing market is necessary.

The need for a sustainable housing market

In the evolution of the functioning of neighbourhoods, the importance of local housing markets is crucial, as shown in UK by Bramley et al. (2008). On the other hand these authors maintain the importance of house prices having a high responsiveness to income and supply, and indirectly being influenced by various planning measures. These factors are partly static and partly time-varying. Thus both macro and micro level factors influence urban housing markets. This turbulence can be for better or for worse depending on the economic and institutional starting conditions. Concerns about financial stability implications of developments in the housing market when house price dynamics become disconnected from developments in underlying fundamentals of housing demand and supply are particularly serious in the central eastern European (CEE) country context, given the strong role of interest rate fluctuations, demographic and labour market movements, development of wages, and establishment of new market and financial institutions (See Égert & Mihaljek, 2008).

Within the framework of a typical Keynesian critique of monetarism, Baker (2008) presents how the financial market is both cause and effect of the housing bubble in USA. He rightly notes that 'the expectation that prices would continue to rise led homebuyers to pay far more for homes than they would have otherwise'. He cites Robert Shiller, who showed that prior to 1995 in USA real house prices were unchanged for 100 years, but by 2002 a ca. 30 per cent overpriced *speculative bubble* completely detached from the *fundamentals of the housing market* was evident. Subsequently, however, the bubble burst – by the end of 2007 real house prices had fallen by over 15% from their peak, which according to Baker amounts to almost 50% of GDP. Baker blames, above all, the appraisers, who had a strong incentive to, instead of valuing an honest appraisal, adopt 'a high-side bias in their appraisals'. Among the reasons he notes the complex web of finance that concealed the risk that was building in the financial structure'; a large supply of housing being placed for sale; and a dampened demand as a result of the stress in financial markets. He finally notes that financial bubbles in principle could be contained (but accuses Alan Greenspan for not doing his job).

Sapir (2008), however, adds the institutional dimension to the criticism in the sense that, if a country is to a sufficient extent detached from the global financial system, it is capable of dampening the effects of crises, and thereby remains unaffected by the credit crunch. The emerging economies on one hand and the continued social-democratic welfare states on the other are such countries. To be able to design better policies than the current ones, we cannot rely on neoclassical economic (NCE) theory, but we need to study more realist and heterodox economic theory (see also Keen, 2009; Söderbaum, 2009). Elsewhere, Aalbers (2008) sets up the following argumentation that much resonates with those of Baker and Sapir above:

- *Financialization* occurs when profit-making occurs in different parts of the economy (including real estate) through financial channels rather than through trade and commodity production.
- Risks in any finance-led regime become risks for all actors involved in any specific industry; hence mortgage loans fuel house prices.
- Mortgage markets are today not only ‘a means to an end’, but ‘an end in itself’.
- Today the real estate markets are more than ever dependent on the financial markets.
- *Vice versa*, the development of financial markets is also dependent on the development of the real estate and housing markets.
- Most homeowners depend on mortgage markets and these fuel the economy both directly and indirectly.
- This crisis is not limited to USA: many other mortgage markets (e.g the Netherlands) are increasingly financialised. In fact, a ripple effect to Europe was anticipated.
- The importance of the secondary mortgage market (i.e. investors can buy mortgage portfolios from lenders) has increased over the last ten years.
- The high risk and exploitative character of the mortgage loans.
- Some borrowers should never have received a mortgage loan.
- Not only is ‘global’ tied to ‘local’ through of financialization of the mortgage market, but also the financial and the built environment have become tied together through this mechanism.

As Aalbers shows, the analysis of individuals is used as a basis for credit scoring and risk-based pricing. The key to the crisis is still in understanding the credit scoring of lenders. However, it is not clear why such a criterion could not be based on the product itself – the real estate instead of the personal traits of the lender (see RICS, 2007). In such a case, the role of appraisals is important.

When evaluating inflationary effects against sustainability criteria, an additional qualification has to be noted. While in countries where the overall demand has risen strongly in recent decades due to increased incomes (e.g. Norway, the Netherlands) the negative impact on a sustainable market is total. Indeed it is true that when house price inflation is higher than the normal index (as measured through incomes and consumption index), the situation is categorized as unsustainable – at least economically – using the definitions of the present study. However, after a lag of few years the new stock will be adjusted upwards in terms of quantity and quality, which then moves the situation towards sustainability again, albeit at functionally and spatially varying rates.

When examining the extent to which the price development of a local housing market shows a healthy and stable trend, one of the issues to decide is whether the focus of the research ought to be on the location or the built structures? Which one of the two elements is more important then for the investor behaviour? At a more global scale a reasonable aggregate would be 50% for each, but this balance in particular is context dependent. For example, in urban housing

market ‘hotspots’ the location is much more appreciated than the structures, but in derelict Brownfield areas as well as for rural property it is the other way around: land being of a minuscule value compared to the structures. Traditionally sustainability analysis is biased towards the latter case, but that is for a different reason: the focus is on the built structures because data on the quantitative and qualitative characteristics of the buildings often already exists readily in registers or in any case is relatively simple to collect, whereas corresponding data on the location does not exist and tends to be more difficult to collect. In an attempt to correct this deficit this study therefore look at the location more than research hitherto when comparing its value share against that of the building.

A conceptual model

The comments in the previous section suggest that the way we understand and explain property value might be undergoing a paradigm change. However, several issues mark this (plausible) change, and to dwell on all of them is beyond the scope of this contribution. The way ‘value’ and ‘market’ are understood from an epistemological or ontological point of view must nevertheless be of concern here, given our ambition of improving the methodological basis for valuation. In the old paradigm the separation of the various dimensions (economic, physical, social, cultural etc) was acceptable, because being able to use equilibrium economic models such as the hedonic model, which would not have been possible otherwise, was considered the goal. In the new paradigm the methodology might be pragmatic instead of formal, but that is not the point; the point is to avoid a totally artificial separation of dimensions as is the case with the models and methods of the old paradigm. In doing so, it puts a further emphasis on the behavioural and institutional elements, as well as on a communicative purpose in disseminating the results (rather than the instrumental purpose). In other words, the motive is holism rather than reductionism. In doing so, the view propagated here purports that in the new paradigm an approach to valuation methodology ought to comprise the following five main elements: (1) sufficient detail in the analysis; (2) the goal in the long term situation; (3) the recognition that a long term diversification and dynamics equals sustainability; (4) the use for market sustainability data; and (5) the flexibility to allow for an uneven change towards sustainable markets.

Detailed analysis

If the aim of the study is detailed analysis of the market for property products and locations, it is always important to incorporate *a diversified process/dynamics view* for the demand side: i.e. diversified and changing preferences of buyers and renters as well as intermediaries need to be recognised. Otherwise we only manage to capture an average type of market behaviour at best, and a miscalculation at worst.

The long term situation

If the topic of analysis is the long-term situation it is similarly important to incorporate a diversified process view for the supply side analysis (sellers, investors, builders, developers, planners etc.); otherwise we fail to see the effect of factors such as additions/reductions in the stock, outcomes of planning, demographic change, increased/decreased mortgage availability and new consumption patterns. For shorter terms, however, merely a *diversified static* view (i.e. a collage of snapshots at a given point in time) suffices.

Long term diversification and dynamics equals sustainability

As long as the market analysis concerns the long term market situation, economic sustainability becomes a natural issue. This is not an attempt to attack the economists' defensive mantra of 'in the long run we are all dead', but more constructively, to realise the added value of looking ahead – not necessarily more than to the next generation (or two) of housing consumers. By the time these people enter the markets most of the housing stock and housing environments will be the same as we see today. It is to observe that, due to the context dependent normative element (i.e. regulations vary and change) here it is particularly important to look at diversification and dynamics, even beyond what currently seems the standard housing market products.

Data on market sustainability

The arguments above all suggest that to analyse the market and sustainability poses huge challenges for the production and evaluation of datasets. Even more so if non economic dimensions, that is to say ecological, environmental, social or cultural values and benefits that we can identify but not necessarily quantify, are included. Not only data on prices, rents, yields etc. financial-economic variables are needed, but also on physical, aesthetic, health etc elements of the stock and environment, even though we in many cases have to accept the subjective and hypothetical nature of this data. Optimistically market actors are expected to generate such data and to make it available for analysts in times to come.

The change towards sustainable markets is uneven

Due to the previous point: the need to collect relevant data, it can now be argued that the analysis always needs to begin from context and then select the methods based on the available data, rather than the other way around: screen the data based on assumptions as is the case with NCE. In other words, one should proceed bottom up and employ the richness of empirical material instead of trying to fit all circumstances into the same model or methodology of appraisal/valuation. This is even more the case for sustainability evaluation, which, as already argued, necessitates adding dimensions and taking the longer term perspective. Or, we cannot treat industrialised and developing countries the same way; neither can we do it with urban and rural areas', or with market and public housing; and so forth. To illustrate this logic with an example, as shown in figure 1, the asking prices for row houses in the western and central regions of the Netherlands are too high compared to modal income in year 2006; if we take a long-term view the evaluation is that the housing market is unsustainable for that segment and part of the country – but not in the country as a whole.

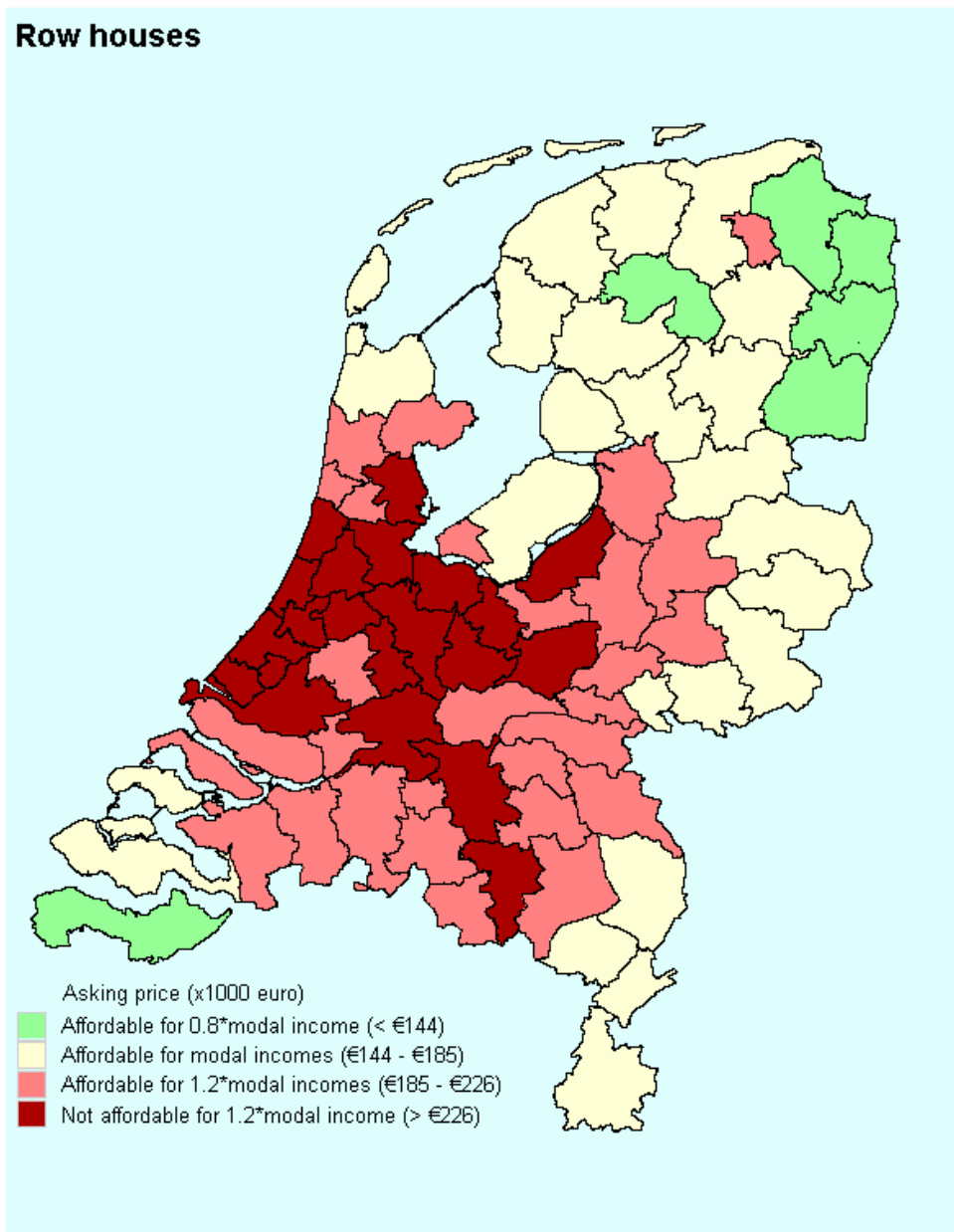


Figure 1. The affordability of standard row houses for three income levels (modal income, 20% below and 20% above modal income) in the last quarter of 2006. (Source: Op't Veld et al., 2008)

Current AVM practice

Given the often doubted relevance of AVMs for valuation and market analysis, the next question is whether the current recession has had an impact on research and development (R&D) activity on AVM. To find out a good starting point is the recent literature survey by Downie & Robson (2007). From their comprehensive literature review on automated valuation models Downie & Robson find that traditional valuation approaches are being increasingly replaced by the cheaper and quicker AVMs, and that this development goes together with the need to control loan decisions. They identify, however, potential problems due to inaccuracy and the fact that AVMs have not yet been fully tested in a housing market

slump, although some evidence from USA indicate that circumstances of market downturn do not cause invalidity. Furthermore, in a more established market best practice guidance is being developed about *when* and *how* AVMs are to be used. Finally, Downie & Robson argue that human valuers will not become obsolete even if many valuations are carried out electronically, as the US experience shows. They conclude that standardisation of AVM procedures and features is the crucial issue that determines the direction of R&D in this respect, and that there is potential for proving the benefit of AVMs for stakeholders in less established markets.

To get some insight into the discourses being recreated within the realm of ‘valuation competence amidst crisis’, the following brief review of currently available American and British commercial AVM options is informative. A variety of notes, columns and adds written ‘with post-bubble hindsight’, i.e. since the summer 2008, in the recently established e-newsletter *AVM News* (2008a,b,c,d, 2009) are used as a source. While this documentation is largely opinion-based, the first fact to note is that the Obama Administration already has included appraisal and valuation components in its guidelines for the Home Affordable Refinance program, and a number of federal agencies have jointly issued the following comment:

‘Volatility within certain real estate markets and associated credit risk underscore the importance of independent and reliable collateral valuations.’

Elsewhere, it is clarified that lenders are apparently more interested in the capability of the potential borrower to repay the loan than on the current market value of the property. The AVM development framework furthermore seems to be a local rather than national issue according to some experts; this is after all understandable given that ‘housing markets are granular and localized. Anthony Garritano, Editor of Mortgage Technology Magazine points out that it is ultimately the investor who determines the value, and that technology cannot work alone without the control of lenders and servicers because the risk in relinquishing the collateral values to a model or third party is too high. He states that, while there is a role for predictive models, the role for solutions that provide transparency and data management capabilities is even greater, and that ‘the real need is for accurate analytically based valuations combined with solutions that allow users to understand the different value opinions’. It is furthermore noted that several different tools or methods should be used for valuing the same property or to support a particular lending activity, and that an institution should not select simply the one that provides the highest value, but instead establish criteria where property type, location and the nature of transaction all is taken into consideration. Finally, it is speculated that the future of valuation lies in a blend of ‘traditional human evaluations’ and ‘automated products’.

In the US several technology and database companies have taken the AVM technology on board. *Zaio* provides an instant predicted market value as well as an estimated value based on the assessed value of the property using digital photographs of the property. This can be used as a tool to check property values. They maintain a database of 140 million properties. Their goal is photographing every home in major cities and metropolitan areas. The recent alliance between *FNC* and *IntelliReal* gives a sophisticated option for AVMs as this product utilizes multiple listings data from 77 million property records nationwide. *Visre* is a company active in imaging for country government tax reassessment projects in Louisiana and Georgia. Their vehicle mounted camera arrays that enable imaging 4,000 parcels a day offer a service for reducing the risk levels of the valuation. *Realtor.com* offer yet another tool that utilises

multiple listing services. *Lender Processing Services (LPS)* is a particularly interesting option as they have announced a launch of a system for value forecasting at the neighbourhood level, including delinquency and inventory trends for the immediate neighbourhood surrounding a specified property. *LPS* thereby has a solution for understanding not only the property's current value but also its likely direction in the near future, given that individual property values are substantially influenced by neighbourhood characteristics. Other appraisal systems worth mentioning here are 'the three leading home valuation sites': *Zillow.com*, *Cyberhomes.com*, and *Trulia.com*; the San Diego-based *MDA DataQuick*; *Boxwood Means*; *Patriot*; *Integrated Asset Services (IAS)*; and – this seems somewhat obscure even within the esoteric AVM community – a cooperation between the firm *Smithfield & Wainwrights* and an anonymous 'Florida State University alumnus'.

AVM has become increasingly common also in the UK residential mortgage markets due to a rise in demand for mortgage products for which lenders require a more time-efficient and cost-efficient valuation approach than the physical inspection undertaken by surveyors which hitherto has been the standard practice (cf. Op't Veld et al., 2008, on the corresponding situation in the Netherlands). *UK Valuation*, the UK's pioneering provider of AVMs, reports that its AVM solution is performing robustly despite the continuing decline in UK house prices: their largest observed undervaluation of test portfolios during an over two and a half year period was just 0.5%; their parent company *First American* recoded an overvaluation of 1.7% in region of falling house prices during a half year period. Moreover, their market-leading AVM solution *Mortgage Brain* has launched a systems' integration where users get instant access to its AVM using innovative data modelling techniques to enable provision of residential property valuations in service characterised as highly accurate, fast, efficient, complete, simple, and easy to use. *Moody's* modelling approach also quantifies the risk associated with the use of different AVMs in Residential Mortgage-Backed Securities (RMBS) transactions. *Hometrack*, which claims to have 95% of the AVM market in UK, is claiming to reach acceptable levels of accuracy irrespective of whether the market is rising or falling. Based on this documentation of the practitioners' state-of-the-art – sometimes referred to as 'the dark side' by academic researchers – there seems no end in sight in the drive to establish innovative solutions for AVM, and if anything, the crisis has only accelerated this development. Such aspirations align with the aim of this paper, designing an empirical approach to determine the degree of housing market sustainability.

Designing an empirical modelling method

A similar ingenuity as the practitioners have is yet to be seen on the academic side. Within the residential sector two different broad scientific approaches or perspectives to valuation and market analysis exist: one, hedonic, which has been extended in recent years; two, the alternative or non market perspective which is yet in a testing stage. The approach propagated in the current paper falls in between those two but is closer to the latter. Drawing on prior contributions by the same author (see d'Amato & Kauko, 2008; Kauko, 2001, 2004a,b, 2008a,b, 2009), the point here is that context is an important precondition to take into account when selecting/designing valuation methodology in relation to specific changes in the market environment. Furthermore, we need to examine two different groups of procedures: group (1) concerns *direct* comparison of known cases (i.e. the standard comparable sales approach); group (2) concerns hedonic regression or other type of *indirect* valuation methods and techniques that, based on specified and estimated models, inform about coefficients and adjustments for the former group. Note that the latter group is rather reductionist and thereby

rather problematic for the argument insofar as we wish to take distance from a hedonic regression approach.

In latter day methodological perspectives to house price analysis/modelling the market is considered idiosyncratic with respect to one or more of its fundamentals, in which case the differences across locations and housing bundles are more qualitative than quantitative by nature. This way, the urban location is possible to analyse either using a simple equilibrium or a more context-specific model, based on multiple equilibria. There are, however, no clear guidelines for when to apply what kind of model/method. The questions to answer are how physical, socio-demographic, financial and administrative factors shape the housing choices of individual households, and this way the urban form. If we want to perform empirical tests on these issues, we need simplifications.

The selection of modelling approach is the key to success when the criterion is ‘realisticness’ as opposed to formal elegance. This principle is not difficult to grasp: what kind of market – that kind of method (see d’Amato & Kauko, 2008). *The self-organising map (SOM, Kohonen Map*, see fig. 2) is one example of a promising approach within this realm of realistic but less elegant modelling techniques (there are several others comparable techniques, for example genetic algorithms and case-based reasoning, see Kauko & d’Amato, 2008). Using machine learning and adaptive computation jargon, the SOM is a type of *unsupervised neural network with competitive network architecture*. The neural network is a sophisticated statistical method that captures nonlinear, but regular associations (i.e. patterns) within a data set without a pre-defined model. The SOM is best defined as a mapping from a high-dimensional data space onto, a (usually) two-dimensional lattice of points. This way disordered information is profiled into visual patterns, forming a landscape of the phenomenon described by the data set.

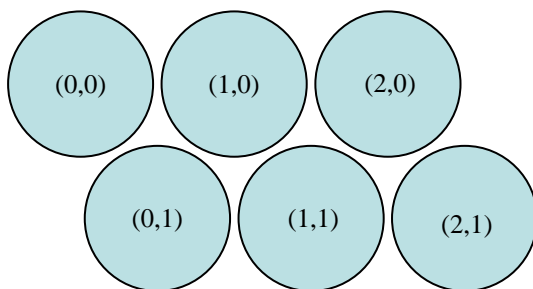


Figure 2. The situation of the nodes in a three-by-two (3x2) map.

The overall principle of the learning process in the SOM is to ‘train’ the output lattice (map surface, feature map) based on the input data and some externally manipulated parameters in such a way that each original observation is matched with a unit (node, neuron) on the map surface where the numerical values measured in the dimensions of the observation are as close to those of the input observation as possible (see Fig. 3). When this matching proceeds iteratively, we eventually obtain a projection of the input data. In this projection the topology between items is preserved rather well from the original data. The result is when the SOM, after a predefined amount of iterations, has then produced a feature map of nodes, each of

which represents a characteristic combination of attribute levels. In the training procedure of the algorithm the matching is usually determined by the smallest Euclidean distance between observation and response. The results are strongly dependent on the data – all necessary guidance to the analyses is obtained from the sample we feed the network and from the compulsory network parameters.

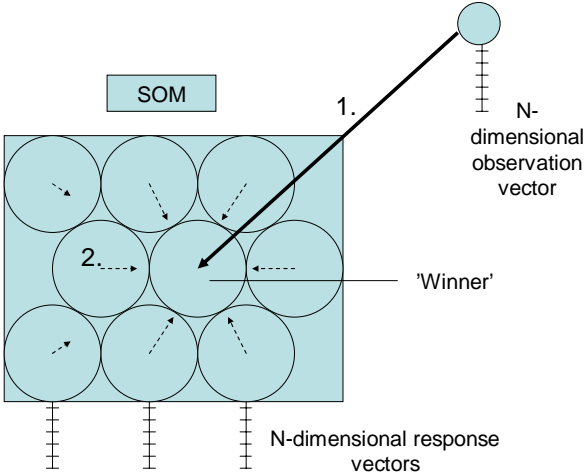


Figure 3. Illustration of the learning process of the SOM in two steps: in the step 1 the winner determined and its numerical value subsequently adjusted towards the observation vector; in step 2 the numerical values of the other nodes are adjusted towards this winner, and the further they are situated on the map surface, the lesser this adjustment is.

As the figures 2 and 3 show, the SOM only performs cross-sectional analysis – of price or any other variable or combination of variables. However, the apart from the question of ‘where?’, the other interesting question to answer here is ‘when?’. Thus the answer cannot be provided merely by results of a model. Because the objective of the present study is price movement, as opposed to cross sectional price analysis, the SOM has to be used in a repetitive way. Carlsson’s (1998) *method of fixed time-windows* is suited for this purpose. It is a quasi dynamic modelling device which can illustrate changes in the modelling outcome or in one particular variable such as price without using the time of sale as a variable. This is illustrated in fig. 4 (see also Kauko, 2009).

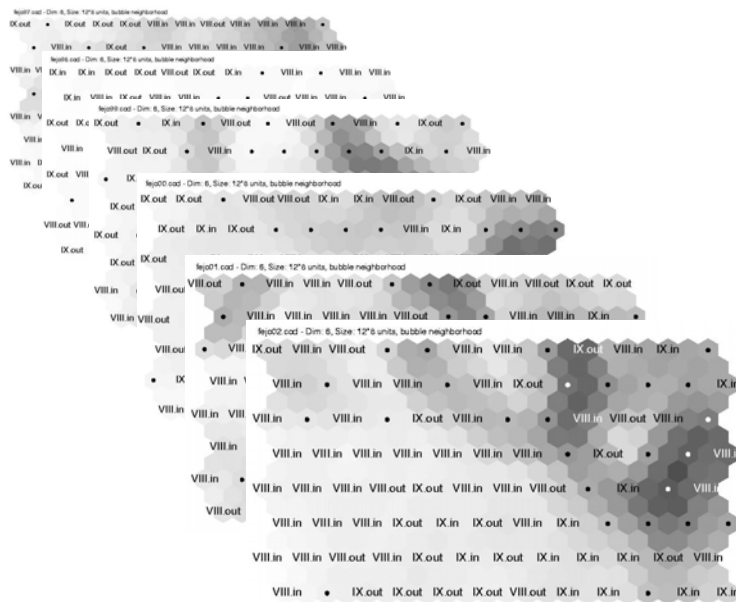


Figure 4. The method of fixed time-windows.

The results from a prior study serve to illustrate the possibilities (cf. prior analyses on Budapest housing markets by the same author, see fig.4). Here the SOM output showed two kinds of dynamics, concerning two inner city urban renewal areas in Budapest, Hungary: (1) the change in dominant house type, (2) change in price level. However, there is a difference to this study: the variable of interest is economic sustainability of real estate price development approximated through the affordability indicator: transaction prices divided by income. How is data on the long-term development of prices and affordability indicators related to each other? This is a yet untried approach, although in another prior study the aim was to classify the citywide residential property market to *sustainable or unsustainable* based on price in relation to the quality of the dwelling and environment; that study used a dataset from Amsterdam 1986-2002, with sales prices and a number of attributes including subjective environmental and housing quality as input variables (see Kauko, 2009).

The particular aim of this project is to compare house prices with an affordability indicator. The variables comprise property transactions price, dwelling format (i.e. house type), dwelling size and other building features, and location (street and ward). Relevant information for the study is assembled from the Norwegian property registry on one hand; and on the income statistics on the other hand (the income variable comprises median gross income for the municipality based on the taxation of resident over 17 year old persons). The administrative city area of Trondheim is isolated from the data which results in 54,479 sales transactions for the years 1993-2007, after removing suspicious cases: prices lower than 100 000 kr (ca. 12000 EUR) or (other) clear errata. It is to note, as a curiosity, that approximately half of these sales are for a house type ‘other’ – i.e. a miscellaneous fifth category on top of the four types shown in fig. 5. These are the years we obtained aggregate income data for too.

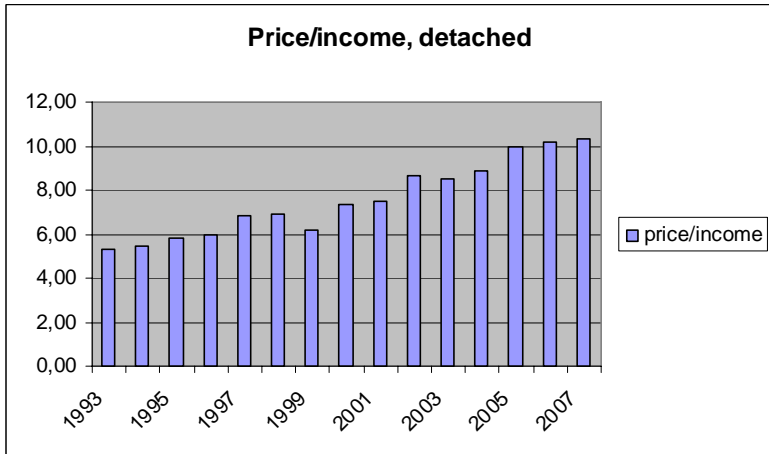
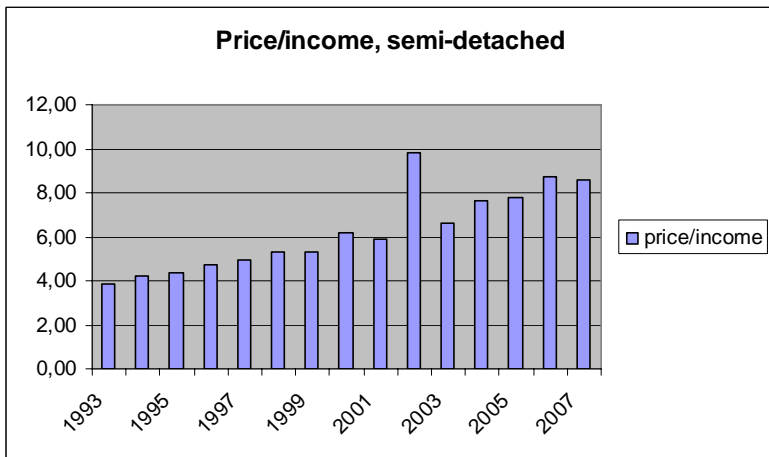
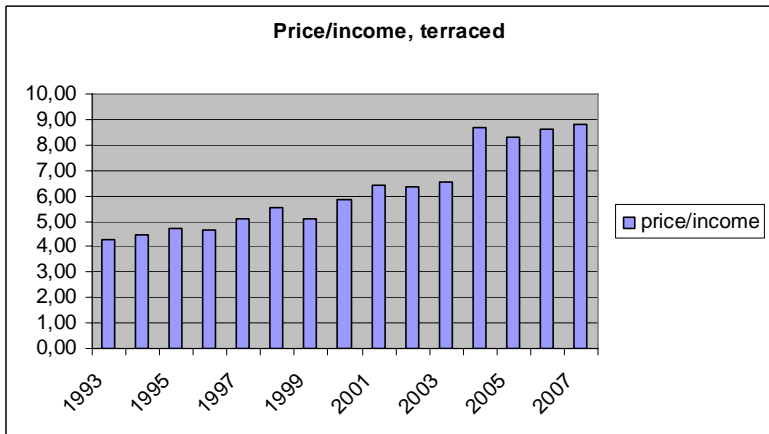
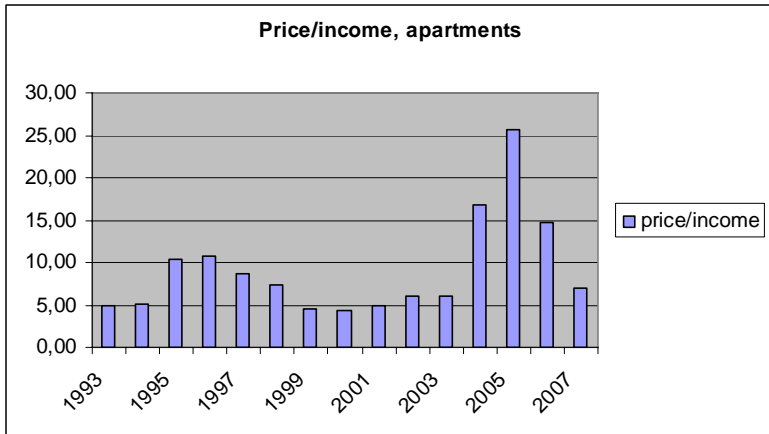


Figure 5. Development of prices in relation to incomes in Trondheim for four house types.

The first stage of the analysis is to show the descriptive trend of price in relation to income (as an affordability proxy as shown in fig. 5) for different house types: apartments, row houses, semi-detached and detached homes. It is interesting to see how a slight dip in the indicator occurs from 1998 to 1999 for all four trends, even though they otherwise are of very different shapes. One can furthermore note a couple of curiosities in these diagrams: only for apartments a sharp decrease in the indicator, i.e. a sharp increase in affordability, from year 2005 onwards; only for semi-detached homes the year 2002 is an anomaly with very high indicator value. The trend for the detached and terraced homes is relatively smooth, with a steady increase in the indicator for most of the period.

The second stage is to analyse this development using the SOM, more particularly the method of fixed time windows innovated by Carlsson (1998). By examining successive feature maps of cross sections from 1993 to 2007 the price-to-income signals are seen as a trend. This way it can be established which cases have become the most expensive ones in relative terms, using location, house type and other property descriptors as identification.

When such a piece of analysis is carried out on a year-by-year cross-sectional basis it can be seen which house types and locations are more and which less sustainable in terms of the upwards (i.e. increased sustainability) and downwards (i.e. decreased sustainability) signals when measured through the price/income indicator identifiable from the yearly SOM outputs.. This is a pragmatic approach in the sense that we look for a locally adequate viable solution for a problem without need for general laws. (Note that the debate of selecting a suitable philosophy of science between pragmatism and positivism is a different topic and goes beyond the scope of this paper.)

Using data on property sales in the city of Trondheim, central Norway 1993-2007 together with a time series on income aggregated on a city level from the same time-period, the idea is twofold: first, look at a descriptive trend of price related to income to see how the citywide sustainability develops; second, to apply the SOM and Carlsson's method of time-windows. The output will here too indicate price/income. Here a caveat is to be noted, originally the idea was to accommodate district-wise aggregated income data of Trondheim. However, consistent income data aggregated on a detailed spatial level was not possible to get on a yearly basis, and therefore the method has to do with using the same income denominator for the whole dataset for each year. In other words, whereas the price variable is varying in time, space, and house specific attributes, the income variable is only varying in time due to the abovementioned limits of this application. The layer of examination shows the variation in price/income in a way that enables seeing the development of differences across locations and combinations of property attributes.

Last remarks

The paper has documented a number of key points that require attention when designing a methodology for evaluating local market sustainability. Given the backdrop of the current financial crisis worldwide and housing market downturn in most western countries, regions and cities, the list of practical AVM applications launched for valuation is astonishing. Throughout the community of leading commercial AVM developers various innovative solutions are being tested 'as we speak' – it is all about going forwards in this problem field regardless of any doom-and-gloom scenarios put forward from above. This really is an unexpected finding. The present paper, while yet work in progress, has attempted to catch

some of this attitude and take distance from the current conservatism of the academia in this research area. That the frontier of valuation research is moving forwards so rapidly is an embarrassing finding for us academic housing market and real estate analysts. This brings to mind the conclusion by Söderbaum (2009), who argues that we academics cannot escape the blame for causing the economic downturn, because one of the roles of the science and university is to inform actors and governments about the right decisions to make? In particular, NCE has contributed to legitimate neo-liberal policies and, as these policies have failed, so has the teachings of the economics departments. While the hardest criticism can be levied on the general economists, to a lesser extent the same applies within the applied fields of real estate and housing economists.

However, we need to be constructive: if market sustainability is a goal, what kind of methods and models should we then aim at? The desired level of empirical model performance depends on the context, but also on the preferred balance in trade-off between conceptual soundness and accuracy. This is why the sufficiently accurate linear hedonic regression modelling of the housing market has proven reasonably successful. On the other hand, alternative approaches allow researchers to capture the complex nature of the housing market relationships. In this body of literature the *methods in relation to data* are categorized onto the following typology:

- Statistics in a parametric distributional sense, which then validates the hedonic model.
- Other statistics and related approaches (e.g. the SOM).
- Other data, that is judgemental and possibly more qualitative approaches:
 - When we for one reason or another need different information, and therefore need to collect data for new variables.
 - When we don't have info even of the standard variables (Kauko & d'Amato, 2008).

In this study quasi dynamic 'models' are created using Trondheim housing market data and Carlson's time window approach to using the SOM. Any results are highly speculative. Nevertheless, due to its pragmatic and nonlinear nature the SOM time windows approach to quasi dynamic market modelling seems promising in this respect. The findings also have policy implications: using innovative empirical housing market modelling as an analytic tool enables planning for sustainable land use and governance on an urban and regional scale. The other side of the coin is that, for some academics this approach might seem too different than an economic mainstream approach. However, as Einstein once said, a problem cannot be solved based on the body of knowledge that created the problem (see Lorenz et al., 2008).

Acknowledgements

The building of this argument has benefited from various informal sources, notably following the panel sessions in the *EXPO Real Munich* (October 2008); discussions with Dr. David Lorenz, Lorenz Property Advisors and University of Karlsruhe (October 2008); and Dr. Fotis Mouzakis, Cass Business School (April, 2009). The data was generously supplied by the Department of Geography at NTNU and the project *VULCLIM*.

References

- Aalbers, M., B. (2008) The Financialization of Home and the Mortgage Market Crisis. *Competition & Change*, 12(2), June, pp. 148-166.
- AVM News (2008a) e-newsletter, issue July, August
- AVM News (2008b) e-newsletter, issue September, October
- AVM News (2008c) e-newsletter, issue November, December
- AVM News (2009) e-newsletter, issue January, February
- Baker, D. (2008) The housing bubble and the financial crisis. *Real-world economics review*, issue no. 46, 20 May 2008, pp. 73-81.
<http://www.paecon.net/PAERReview/issue46/Baker46.pdf>
- Ball M.J. and Kirwan R.M. (1977) Accessibility and Supply Constraints in the Urban Housing Market. *Urban Studies* 14, pp. 11-32.
- Ěgert, B. & Mihaljek, D. (2008) Determinants of house prices in Central and Eastern Europe. Czech National Bank working paper, available at: www.eukn.org
- Bramley G., Leishman, C. and Watkins, D. (2008) Understanding Neighbourhood Housing Markets: Regional Context, Disequilibrium, Sub-markets and Supply. *Housing Studies*, 23(2), pp. 179-212.
- Carlson, E. (1998) Real Estate Investment Appraisal of Land Properties using SOM. In: Deboeck G. and Kohonen T. (eds): *Visual Explorations in Finance with Self-Organizing Maps*. New York: Springer, pp. 117-127.
- d'Amato, M. & Kauko, T. (2008) Property Market Classification and Mass Appraisal Methodology, in Kauko, T. & d'Amato, M. (eds): *Mass appraisal methods – an international perspective for property valuers. RICS Series, Blackwells*, Oxford, pp. 280-303.
- Downie, M. L. and Robson, G. (2007) Automated Valuation Models: an international perspective. The Council of Mortgage Lenders (CML), London, October.
- Kauko, T. (2001) Combining theoretical approaches: the case of urban land value and housing market dynamics, review article, *Housing, Theory and Society*, 18(3/4), pp. 167-173.
- Kauko, T. (2004a) Sign value, topophilia and house prices, *Environment and Planning A*, 36(5), pp. 859-878.
- Kauko, T. (2004b) Infusing 'institution' and 'agency' into house price analysis, *Urban Studies*, 41(8), pp. 1507-1519.
- Kauko, T. (2004c) Towards the 4th generation – An essay on innovations in residential property value modelling expertise *Journal of Property Research*, 21(1), pp. 75-97.
- Kauko, T. (2008a) From *modelling tools* towards *the market itself* – an opportunity for sustainability assessment? *International Journal of Strategic Property Management*, 12, pp. 95-107.
- Kauko, T. (2008b) AVMs, Empirical Modelling of Value, and Systems for Market Analysis, in Kauko, T. & d'Amato, M. (eds): *Mass appraisal methods – an international perspective for property valuers. RICS Series, Blackwells*, Oxford, pp. 307-319.
- Kauko, T. (2009) Creating a sustainable local housing market – part II: some diagnostic issues, RSA Cconference, Leuven, Belgium, 6-8 April. Copy available at <http://www.regional-studies-assoc.ac.uk/events/060409papers.asp>
- Kauko, T. & d'Amato, M. (2008): Introduction: Suitability Issues in Mass Appraisal Methodology, in Kauko, T. & d'Amato, M. (eds): *Mass appraisal methods – an international perspective for property valuers. RICS Series, Blackwells*, Oxford, pp. 1-19.
- Keen, S. (2009) Mad, bad, and dangerous to know. *Real-world economics review*, issue no. 49, 12 March 2009, pp. 2-7. <http://www.paecon.net/PAERReview/issue49/Keen49.pdf>
- Lorenz, D., d'Amato, M., Des Rosiers, F., Elder, B., van Genne, F., Hartenberger, U., Hill, S., Jones, K., Kauko, T., Kimmitt, Ph., Lorch, R., Lutzkendorf, Th. & Percy, J. (2008) Sustainable Property Investment & Management – Key Issues & Major Challenges, *RICS*,

2008. (Accessible via Internet:

http://www.rics.org/Newsroom/Keyissues/Sustainability/SPIM_r_230908.html).

Maclennan, D. (1977) Some Thoughts on the Nature and Purpose of House Price Studies. *Urban Studies*, 14, pp. 59-71.

Maclennan, D. and Tu, Y. (1996) Economic Perspectives on the Structure of Local Housing Systems. *Housing Studies*, 11(3), pp. 387-406.

Meen, D. and Meen, G. (2003) Social Behaviour as a Basis for Modelling the Urban Housing Market: A Review. *Urban Studies*, 40(5-6), pp. 917-935.

Op 't Veld, D., Bijlsma, E. and van de Hoef, P. (2008) Automated Valuation in the Dutch Housing Market: The web-application 'MarktPositie' used by NVM-realtors, In: Kauko, T. and d'Amato, M. (Eds.), *Advances in Mass Appraisal Methods*. Blackwell, Oxford, pp. 70-90.

RICS (2007) Financing and valuing sustainable property: we need to talk. Findings in Built and Rural Environments (FiBRE), RICS Research, April, available at www.rics.org.

Sapir, J. (2008) Global finance in crisis: A provisional account of the "subprime" crisis and how we got into it. *Real-world economics review*, issue no. 46, 20 May 2008, pp. 82-101. <http://www.paecon.net/PAERreview/issue46/Sapir46.pdf>

Söderbaum, P. (2009) A financial crisis on top of the ecological crisis: Ending the monopoly of neoclassical economics. *Real-world economics review*, issue no. 49, 12 March 2009, pp. 8-19. <http://www.paecon.net/PAERreview/issue49/Soderbaum49.pdf>

Watkins, C. A. (2001) The definition and identification of housing submarkets. *Environment and Planning A* 33, pp. 2235-2253.

Woon Amsterdam (2007) Dienst Belastingen Gemeente Amsterdam & Makelaarsvereniging Amsterdam.