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The Role of the Housing Market in Monetary Transmission[*]

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Abstract

As part of the monetary transmission studies of the Magyar Nemzeti Bank, this paper attempts to analyse the role of the housing market in the monetary transmission mechanism of Hungary. The housing market can influence monetary transmission through three channels, namely, the nature of the interest burden of mortgage loans, asset (house) prices, and the credit channel. The study first summarises the experiences of developed countries, paying special attention to issues arising from the monetary union. It then examines the developments in the Hungarian housing and mortgage markets in the last 15 years, as well as the expected developments and changes attendant to the adoption of the euro. Using panel econometric techniques, the study investigates the link between macroeconomic variables and house prices in Hungary, and the effect of monetary policy on housing investment and consumption through the wealth effect and house equity withdrawal.

JEL classification: E52

Keywords: Housing, Monetary transmission, Mortgage market, Panel econometrics

I. Introduction

Housing may be considered mundane, an ordinary part of a household's everyday life. However, it can also be a rather complex economic phenomenon, as dwellings can have several functions. Apart from being the traditional 'roof over one's head', a house can serve as a source of wealth accumulation, a valuable item for bequest motives, or a form of investment. Another distinctive characteristic of housing is its sizeable share in household wealth, implying its importance in the household's decision-making process. As a result, shocks to the housing market can have a significant impact on household behaviour, and on the economy as a whole.

The housing market is more complex than the consumption goods market in a number of ways. Not only are the standard economic agents present; other institutions, such as mortgage markets and governmental subsidy/tax regimes, also play a role. Due to the complex interactions among these agents, it is important for policymakers to understand the mechanisms that drive housing market dynamics.

Taking note of the aforementioned distinctive role of dwellings, we attempt to analyse the role of the housing market in the Hungarian monetary transmission, as part of the monetary transmission studies of the Magyar Nemzeti Bank. Section II provides an overview of the theoretical background of transmission through the housing market. Section III provides stylised facts about the housing markets of developed countries and its implication for monetary policy. Section IV gives a brief description of the Hungarian housing market. Section V presents the empirical estimates, for Hungary, of the effect of interest rates on the behaviour of the household sector and discusses the expected effects of the single monetary policy of the eurozone on the Hungarian markets. Finally, Section VI presents the conclusions.

II. The theoretical foundations of transmission

This section discusses the three main theoretical channels through which the housing market and related economic forces influence the behaviour of households: (1) the interest rate channel; (2) the asset price and wealth effect; and (3) the credit channel. The interest rate channel is important in that the changing mortgage interest rate alters the amount of monthly repayment, thereby influencing households' disposable income. As regards the asset price and wealth effect, dwellings may be considered as an asset class; thus, their prices and investment volume can be determined like that of any other asset. Moreover, a rise in house prices implies increasing wealth, which makes higher consumption possible through the wealth effect. Finally, the credit channel has a fairly similar effect: a rise in house prices increases housing wealth and, consequently, the available collateral for the loan, which, in turn, induces higher consumption expenditure.

II. 1. Interest rate channel

Monetary policy can have a direct impact on the behaviour of households through the interest rates on mortgage loans, providing a significant channel of monetary transmission. There are three main characteristics of mortgage loans that are relevant for monetary transmission. The most important characteristic is the low risk of a mortgage loan, which is reflected in the low risk premium. The physical characteristics of the dwellings, serving as collaterals, explain the low level of risk: dwellings are immobile and have a very long lifetime. The second characteristic is related to the size of the loans. Usually the mortgage loan is the largest loan in the portfolio of a household, representing

a high ratio both compared to the value of the house and to disposable income. The third characteristic is long maturity which, on the one hand, is feasible due to the safety of the collateral but which, on the other hand, requires a long amortisation period due to the large volume of debt.

Despite the low level of risk, financial intermediaries have nevertheless set up prudential limits on mortgage loans. Due to the volatility of house prices and the costs related to liquidating the dwelling of non-servicing debtors, limits were introduced to maximise the loan-to-value ratios. For the monetary transmission, however, another limit is of greater interest: the one determining the ratio of monthly instalments to disposable income. As a general rule, monthly instalments should not exceed one-third of disposable monthly income.

The nominal interest rate on a mortgage loan can be broken down into three components: inflation compensation, risk-free real interest rate, and the risk premium of mortgage loans. For debtor households, the real interest rate prevailing in the economy and the risk premium are equally relevant; together they determine the real cost of a mortgage loan. Inflation compensation also has an impact on the behaviour of the households. In other words, for the households it is not simply the net present value of the cash flow that is important, but also the duration of the loan.

If the nominal interest rate is high due to high inflation, then the ratio of inflation compensation would be increasing within the monthly instalment and, ceteris paribus, the ratio of capital amortisation would be decreasing. This implies that, in case of higher inflation, higher nominal monthly instalments are required to serve a mortgage loan with the same net present value. Monetary policy has to take into consideration that, with the increase in nominal interest rates, more and more households would face a credit constraint due to the amortisation/income ratio.

Figure 1, taking the example of a 20-year loan with fixed nominal instalments and a 1/3 amortisation/income ratio, shows the maximum amount of loan, expressed in terms of monthly income, as a function of the nominal interest rate. In case of a 19% interest rate, the maximum loan is less than two years' income, roughly one third of what is available at a 3% nominal interest rate.

So far we have argued that the nominal interest rate is important due to its impact on credit constraints. However, the indexation of monthly instalments could also result in higher loan amounts, as it allows monthly instalments to grow nearly parallel with monthly income. While indexation can be useful in the financial markets as long as the inflation uncertainty is not too high, it can easily have a counter-effect on long-run inflation. The more widespread indexation is in an economy, the more permanent inflationary inertia can turn out to be, making disinflation more costly in the future.

In what follows, we group the different kinds of mortgage loans, according to the link between the key interest rate and mortgage rates. The long-maturity mortgage loans can be divided into two major sets based on whether mortgage rates are fixed or variable within the time horizon (2-3-years) relevant for monetary policy.

The shorter the interest rate period of a loan, the stronger the effect of the key interest rate on the mortgage rate. In case of variable rate mortgages, first, re-pricing occurs faster, and second, changes in the key interest rate have a stronger effect on short rates. Thus, variable rate mortgages provide a direct and efficient channel for monetary transmission.

If, on the other hand, rates are fixed for longer periods (for instance, 5 years), then changes in the key interest rate would have only an indirect effect, in two stages. The

first step involves the impact of changes in the key interest rate on the yield curve at maturities relevant for mortgage loans. It is important to note that, in general, the effect will be declining at longer maturities. The second step is related to the length of the period with a fixed rate. Market rates are relevant only at the beginning of a new interest rate period. Thus, while having an immediate impact on new loans, they exert only a gradual effect on the outstanding stock of existing loans.

Another feature that should be considered in the case of fixed loans is the possibility of early repayment. If debtors can refinance with low transaction costs (having callable loans), then the transmission mechanism becomes asymmetric. During periods of declining interest rates, debtors will take advantage of lower rates, reducing monthly instalments and/or increasing the amount of the loan. This is an immediate reaction to lower rates. Increasing rates, on the other hand, do not imply any changes in the behaviour of households, as debtors keep servicing their loans with the original fixed rates. Monetary tightening has no immediate effect on household behaviour; its impact can be discerned only at the beginning of the new interest rate period, as discussed above.

II. 2. Asset price and wealth effect

In theory the price of an asset is the net present value of future dividends (D) that it can earn, that is, $P_0 = \sum_{t=1}^{\infty} E[D_t]/(1+r)^t$. However, before we apply asset price theory to housing investment, we should re-examine the role of dwellings.

In the microeconomic sense, a house is not simply a 'roof over one's head'. Arrondel and Lefebvre (2001) define the dual aspect of the households' housing decision-making process: as a source of housing services and as an asset, i.e., housing is also taken into consideration in investment decisions. Xiao Di (2001) examines the role of dwellings in the USA, where housing investment is treated as a form of investment, at par with financial investment.

By and large, although housing investment has several special characteristics (e.g., a considerable amount of initial down-payment, large transaction costs, uncertainty about quality, uniqueness of every unit, relative illiquidity, long implementation time, etc.), it can be regarded as an investment form. The owner of a house can realise income from tenants and from changes in house prices. Increasing house prices can provide a higher return on real estate than does financial investment, and thus force households to reallocate their portfolios. In general, households are willing to buy or sell assets as long as they are profitable, irrespective of the type of the asset in question.

The determinants of house prices are examined in empirical literature as well (for instance, see Cho (1996), Mayer and Somerwille (1996)). Muellbauer and Murphy (1997) introduced the following equation for house prices:

$$P_t = g(H/POP, y, r, \Delta P/P, M, ...) \qquad (1)$$

where H, POP , y, r and M denote demand for housing, population, average real income, interest rate, and a proxy for credit/mortgage rationing, respectively. Two points are worthy of note. First, Muellbauer and Murphy (1997) show a fairly stable house price-to-income ratio. Second, recall that return on housing investment (R) equals $R = (E[D_{t+1}] + E[\Delta P_{t+1}])/P_t$ in asset price theory, which suggests that this return could

be related to returns from any other investment form. Chen and Patel (1998) made this explicit by using the form

$$p_t = \alpha + \beta y_t + \gamma E\left[r_{t+1} - \Delta p_{t+1}\right] + \delta DV_t \qquad (2)$$

where DV and the small letters denote demographic variables and the logarithm of the corresponding variables, respectively. It should be noted that equation (2) can be considered as the long-term component of the error correction model. The Bank of England (2000) (hereafter BoE) model uses a similar form in the long-run house price equation, restricting the long-run elasticity of income to one.

At first glance, it would appear that these empirical shortcuts have no connection with asset price theory. However, Vadas (2003) showed that if one considers housing as an asset, the theoretical price relation of the portfolio choice model can be captured by the error correction form. Based on the aforementioned considerations, we can examine the effect of the interest rate on house price by using the error correction form, keeping in mind the underlying asset price implications.

Obviously, changing house prices influence households' decisions, that is, those pertaining to housing investment and consumption. As far as dwelling investment is concerned, we can apply the portfolio choice approach described in Vadas (2003). This paper argues that the choice of investment between real and financial assets can be compared to the choice between two financial assets. Based on this, the ratio (τ) between dwelling investment and gross saving[1] can be explained by the excess return (ER) of holding real estate over holding a financial asset[2]:

$$\tau_t = \frac{1}{1 + \exp\left[-\left(\eta + \Phi(L)\tau_t + \Theta(L)ER_t\right)\right]} + \varepsilon_t \qquad (3)$$

Given τ, dwelling investment can be computed by multiplying τ by gross saving.

In the case of consumption, the BoE model (2000) uses the modified version of the error correction consumption equation originally suggested by Hendry and Ungern Sternberg (1981). In the BoE model, households' wealth consists not only of net financial but also housing wealth. When house prices rise, total housing wealth does so too, which implies a positive adjustment to consumption through the error correction mechanism. Case et al (2001) and Girouard and Blöndal (2001) also found an empirically significant positive relationship between housing wealth and household expenditure. Based on this, the consumption function can be formed the following way:

$$\Delta c_t = \alpha_0 + \alpha_1\left(c_{t-1} - \beta_1 y_{t-1} - \beta_2 w^f_{t-1} - \beta_2 w^h_{t-1}\right) + \alpha_2 \Delta c_{t-1} + \alpha_3 \Delta y_t + \varepsilon_t \qquad (4)$$

where c, w^f and w^h denote consumption expenditure, financial and housing wealth, respectively.

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[1] Gross saving equals households' disposable income minus consumption expenditure.

[2] Since the ratio of housing investment to gross savings must be between 0 and 1, the study suggests the logistic function, which fulfills this requirement.

II. 3. Credit channel

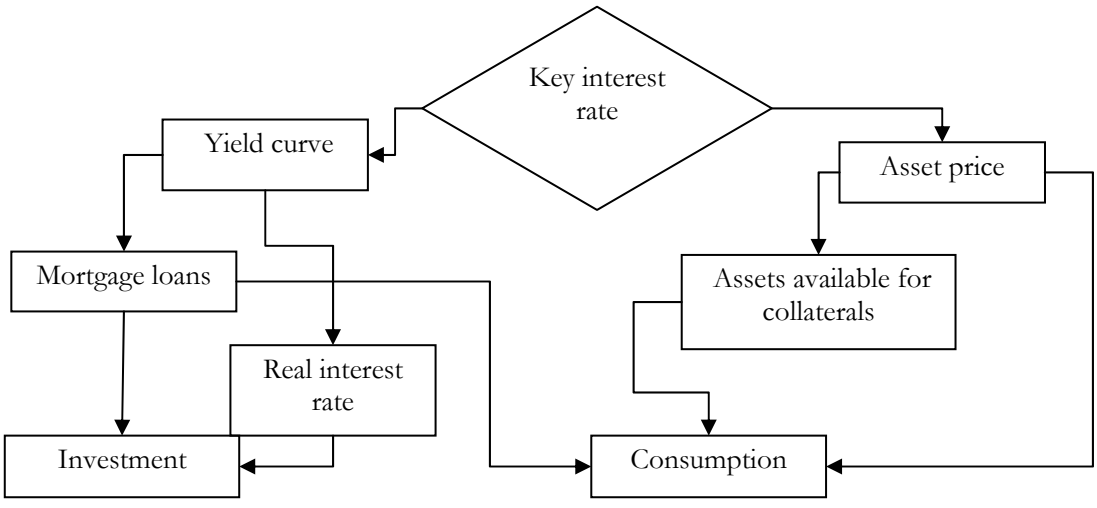
If mortgage repayment is tied to the value of the collateral, namely dwellings, changes in house prices alter the amount of monthly repayment by changing the risk premium. Increasing house prices reduce, while decreasing house prices increase, the risk premium. Thus, changes in house prices either increase or decrease the amount of monthly repayment, thereby influencing the ability to repay, and the possibility of default.

Several theoretical and empirical studies seek to incorporate these effects into their models. Westaway (1992) provides a comprehensive general equilibrium model, which incorporates the flow of housing services into the utility function. Aoki et al. (2002) go one step further and not only use housing services in the utility function, but also apply the financial accelerator model developed by Bernanke et al. (2000). The main point of the financial accelerator is that house prices influence housing wealth which households can use as collateral in borrowing. If house prices increase, housing wealth and available collateral do so as well. Consequently, households can borrow at a lower financial premium and/or increase their indebtedness.

The financial accelerator can be captured in two ways in empirical modelling. First, the financial premium on households' loans should be linked to housing wealth. Although this would be the better option, identifying the premium on the consumer loan can prove to be very difficult. The other method involves linking households' consumption to housing wealth directly. However, in this case, the wealth effect and the financial accelerator or credit channel cannot be separated. Even so, we employ this latter approach in empirical investigation due to the measurement difficulty of the first approach.

The following diagram summarizes the theoretical monetary transmission channels, discussed in this section.

Diagram 1. Housing and mortgage markets in monetary transmission



III. International experiences of mortgage and real estate markets

The first part of this section describes the main features of the housing and mortgage markets in a set of developed, mainly European, countries and then attempts to show the relevance of these structural factors in the monetary transmission mechanism. The second part deals with the assessment of housing related monetary transmission in the EU countries, focusing especially on the eurozone.

III. 1. Housing markets in developed countries

Mortgage regimes play an important role in determining the key indicators of housing markets in developed countries. All three theoretical types of mortgage regimes, described in Chapter II, can be found in developed countries. Most countries can be characterised by the dominance of a particular type that has, historically, become the most relevant. Grouping the countries according to mortgage regimes, the following table summarises the major characteristics of the housing and mortgage markets in a number of developed, mainly EU, countries.

Table 1. Key mortgage and housing indicators in developed countries (2001)

Countries	Dominant type of mortgage	Mortgage/GDP	Average LTV*	Owner occupation
Denmark	Fixed callable	67%	80%	59%
US		58%	78%	68%
Germany	Fixed non-callable	47%	70%	39%
Netherlands		74%	112%	53%
France		22%	60%	58%
Italy		10%	55%	69%
UK	Variable	60%	70%	68%
Ireland		30%	60-70%	78%
Portugal		47%	70-80%	64%
Spain		32%	80%	85%

* Loan-to-value
Source: ECB, OECD

The first observation that can be drawn from the table is that, despite their similarities in terms of recent macroeconomic framework (low inflation, co-ordinated and stability-oriented economic policy), sound and liberalised financial systems, and a high standard of living, developed countries exhibit a surprisingly wide range of key mortgage and housing indicators.

Analysing the countries individually, Denmark and the US belong to the first group, which can be labelled as *fixed callable* mortgage markets. These highly efficient and mature financial markets are able to provide mortgage loans that have fixed interest rates for up to 10-15 years and have the flexibility needed for the early repayment of long mortgage loans. It is not surprising that very few countries belong to this group. Both the US and Denmark have above-average owner-occupation rates, as well as very high mortgage/GDP ratios, indicating the significant role of mortgages in the economy.

The second group consists of countries where the majority of the mortgage loans have *fixed interest rates*, but early repayment is constrained by high fees. Most of the continental European countries belong to this category, which can be further split into two subsets. The first subset is represented by Germany and the Netherlands, with both countries having a high level of mortgage loans. The historical commitment of policymakers to price stability in these countries has created a favourable environment for high turnover at low and fixed long-term interest rates. In other aspects, however, the two countries have some extreme features: the ratio of owner occupation is the lowest in Germany among all the countries in our survey, while the Netherlands has surprisingly high loan-to-value (LTV) ratios, on average exceeding 100% in the case of new mortgages[3].

In the second subset of countries with long fixed interest rates, the mortgage loans do not play an equally significant role in the economy. France and Italy belong to this group, with traditionally low mortgage debt/GDP ratios of 22% and 10%, respectively.

The mortgage markets in the third set of countries are characterised by *variable interest rates*. The UK has been the most traditional example of variable-rate mortgages, with a high mortgage debt/GDP ratio (60%), close to those in the first group. Apart from the UK, the fast growing mortgage markets of Portugal and Spain are also dominated by variable rates. These eurozone members benefit from low interest rates, considering that, prior to the nominal convergence, the high interest rates generated credit constraints for the majority of households. In Portugal, the mortgage debt/GDP ratio was 47% in 2001, equal to that of Germany, whereas a decade earlier, it was comparable to that of Italy (12%).

We have argued earlier at theoretical level that mortgage loans should constitute a big portion of households' debt portfolio. This is indeed the case in most developed countries, as the ratio of mortgage debt/total household debt varies in the range of 0.4-0.8. Empirically there is a relatively strong correlation between mortgage/GDP and mortgage/total household debt ratios. (see Figure 2) The higher the role of mortgage loans in an economy (mortgage/GDP), the higher its share in total indebtedness of households. It indicates that mortgage loans are key determinants of the level of households' indebtedness in developed countries, while other loan types have less variability across countries.

Evolution of the main indicators

The financial deregulation of the 1980s may be considered as a good staring point in examining the dynamics of mortgage markets. In the overwhelming majority of the EU countries, the deregulation of the mortgage markets started in the '80s, proceeding at different speeds across countries. The major steps generally included the abolition of interest rate ceilings on mortgage contracts, as well as the elimination of credit controls and contractual restrictions. Further measures were taken with the aim of liberalising entry into mortgage markets and the securitisation of mortgage loans.

In the short run, however, the quite similar deregulation measures did not lead to similar mortgage markets, but rather widened the set of available choices for new contracts in most countries. The primary reason why mortgage markets could keep their national characteristics for long was the very long maturity of the typical mortgage loan. Apart

[3] The substantial incentives for mortgage payments in the tax regime provide an explanation for the extremely high LTV ratios in the Netherlands. (see further discussion of the impact of tax regimes)

from the fact that deregulation can take effect only gradually through new contracts, the slow changes may be attributed to other factors as well. One explanation may be that the significantly different histories of inflation, and thus nominal interest rates, still have an impact on household decisions.

In the following sections, we attempt to highlight the most relevant trends of mortgage markets in the last decades and to present the stylised facts illustrating the interplay of mortgage markets with other key macroeconomic variables.

The mortgage debt/GDP ratio has increased substantially during the last 20 years in most of the developed countries. Whereas in the early '80s, the mortgage debt/GDP ratio exceeded 50% in only a few of the countries with the most developed mortgage markets (such as Denmark and the UK), by 2001, nearly half of the countries in our sample recorded ratios around or above 50%. The average growth rates of mortgage debt/GDP ratios have varied through the different periods and also across countries. As already mentioned, the most dynamic growth in our sample was that of Portugal during the '90s, with an average growth of 15% per annum. During this period, Spain also recorded an annual growth rate above 10%. For the entire period of 1980-2001, the highest growth rate was slightly less, at 10%, also recorded in Portugal. On the other hand, there was basically no growth in the mortgage debt/GDP ratio of France during the entire period.

Analysing the dynamics of the mortgage debt/GDP ratios in a macroeconomic context, the changes can, to a large extent, be attributed to three major macroeconomic factors: changes in real house prices and interest rates, and the deregulation of the mortgage markets.

It is interesting to examine the interrelation between mortgage debt and house price growth in different countries (see Figure 3). The EU countries provide a wide set of combinations. In Portugal, for instance, the most dynamic growth of the mortgage debt/GDP ratio was not accompanied by any growth in real house prices in the '90s. By contrast, in Germany, where the mortgage debt/GDP ratio was already high in the '80s, real house prices were rather decreasing in the second half of the '90s, parallel with a mild increase in the mortgage debt/GDP ratio. Italy and the Netherlands show a third type of relationship: house prices and mortgages have been positively correlated. In Italy, house prices and the mortgage debt/GDP ratio showed a cyclical pattern following the economic cycle, the correlation having been broken by the yield convergence prior to the euro adoption which resulted in a pronounced growth of the mortgage debt/GDP ratio. In the Netherlands, the two indicators were growing basically parallel during the entire period, with a faster house price growth at the end of the period.

Changes in nominal mortgage rates had a clear effect on mortgage dynamics. The nominal interest rate of mortgage debt plays a crucial role in determining the credit constraint of households in EU countries, as loan indexation had never been popular, for historical reasons, in these countries. Mortgage interest rates declined during the '90s in all countries, reaching historically low levels in a number of countries. The decrease in the nominal rates could be attributed partly to cyclical effects, which generated very low real interest rates globally from 2002 and, more importantly for a number of countries, to a drop in inflation rates and risk premium. The latter was especially significant in the case of South European eurozone countries during the nominal convergence process (see Figure *4*).

The effect of the change in mortgage interest rates on credit constraints can be best illustrated by an example. Using the interest rates prevailing in 1995 and 2002 in different countries, given the example of a 20-year loan with fix nominal instalments, where 1/3 of

the disposable income is spent on amortisation, we calculated the maximum amount of loan a household could take out. The change in the credit constraint, which is the difference between the maximum loan amounts in 1995 and 2002, can be expressed in terms of monthly income. The following table shows that the easing of the credit constraint was significant in all countries, and it had the greatest effect in the case of Portugal, Spain and Italy, explaining to a large extent the growth in the mortgage debt/GDP ratio.

Table 2. Effects of decreasing yields between 1995 and 2002

Country	Change in the credit constraint (monthly income)
Portugal	20.6
Spain	20.2
Italy	19.6
Denmark	10.1
UK	9.8
Germany	6.8

Source: Own calculations

The relevance of the effect of the nominal interest rate on mortgage dynamics can also be seen in the debt service of mortgage loans compared to disposable income. As *Figure* 5 (ECB 2003) shows,[4] despite the more dynamic growth of mortgage debt/GDP ratios, the mortgage debt service/disposable income ratio has increased only modestly in most countries due to the substantial easing effect of the lower nominal interest rates. As regards the effect of decreasing nominal and real interest rates, a BIS study by Debelle (2004) came to a similar conclusion based on calculations of the ratio of debt service of total household debt to disposable income.

Thus far, we could, to a large extent, explain the dynamics of mortgage debt/GDP ratios in an economic context in recent decades. However, the marked differences in the level of mortgage indebtedness across countries suggest that institutional factors also play a role.

Mortgage regulations are basically not yet harmonised in the EU. There are still barriers to further integration, as identified by the Forum Group on Mortgage Credit (2004), and the level of cross-border activity is low compared to other segments of the financial sector. The regulatory and institutional differences appear to be due to differences in characteristics of mortgage regimes; rather surprisingly, these differences are less reflected in mortgage interest rates across regimes in the eurozone member countries. Due to yield convergence in the second half of the '90s (see Figure 6), the standard deviation of mortgage rates within the eurozone have dropped significantly and euro mortgage rates have recently been very similar across member countries.

It is worth noting the difference in household preferences between Portugal and Italy. While both countries had experienced significant credit constraints prior to eurozone membership, and now as euro area members face low and very similar interest rates and economic policy frameworks, households in these two countries responded entirely differently to the easing of credit constraints. In contrast to the situation in Portugal, families in Italy do not have a strong tendency to rely on the financial system to solve

[4] This is only an estimate of the debt-servicing-to-income ratio, particularly as it applies the mortgage interest rate of new contracts to the whole stock of mortgage debt

housing problems, as indicated by the country's permanently low mortgage debt/GDP ratio.

House Equity Withdrawal

House equity withdrawal has become relevant for monetary transmission in a number of developed countries in the past decades, parallel with the liberalisation of the mortgage markets. There are very different patterns in housing equity withdrawal, both significantly positive and negative values can be found in the EU. This might look less than straightforward given that housing as an asset has a relatively stable ratio to total household wealth in the four biggest EU countries[5]. On the one hand, house equity withdrawal was equal to 3% of disposable income in the UK during the '80s and the '90s. According to the OECD (2004), house equity withdrawal was also positive in the Netherlands and was around zero in Denmark in the '90s. On the other hand, in Germany, Italy and France during the '90s, households increased housing wealth on average by 6% of disposable income, implying that house equity withdrawal was significantly negative.

The experience of the UK shows that house equity withdrawal became significant after the beginning of the liberalisation of the mortgage markets in the early 1980s, rising during the entire decade to reach 8% of disposable income by 1989. Apart from the liberalisation of the mortgage markets, the UK experience also supports the concept that the number of transactions also plays an important role in house equity withdrawal. In the UK, the ratio of transactions to owner-occupied housing is about twice as high as the EU average. It is also above average in the Netherlands and Denmark.

During the cyclical downturn in the past years, house equity withdrawal became an important macroeconomic issue in a number of economies. In the US, which can be considered as one of the best examples for house equity withdrawal, equity extracted from owner-occupied housing reached $700bn, or around 9% of disposable income, in 2002. A large part of this extraction, almost $200bn, was related to the refinancing of existing callable loans. Low and decreasing mortgage rates undoubtedly motivated refinancing, particularly given the low cost prepayment options in the US mortgage market. An even greater part of house equity withdrawal, $350bn, was related to the transactions of existing homes. It is not surprising, then, that a record number of existing home sales, strongly encouraged by the low mortgage rates, was behind the very high level of transaction-related house equity withdrawals. According to Fed estimates (Greenspan 2003), mortgage originations for existing home purchases reached $600bn, after subtracting repayment of home sellers, resulting in a net increase of $350bn in mortgage debt, of which a considerable part was spent on goods and services. By and large, evidence from the US in the last years illustrate that, provided a sufficiently developed and efficient mortgage market exists in the economy, monetary policy through housing equity withdrawal can have a greater impact on household behaviour, and thus on economic activity, than previously thought.

[5] The ratio, according to HM Treasury (2003), is between 0,31 (in Italy) and 0,4 (in France), with Germany (0,32) and the UK (0,34) in between. In assessing these ratios, it should be kept in mind that the definition of households' total asset cannot be compared strictly across countries due to, for instance, differences in pension schemes and, therefore, the size of pension funds.

Transaction costs, tax regimes

Considering that dwellings answer a basic human need, housing is also an important area for economic policy. Governments in most countries take measures to influence the housing market, to pursue social goals, such as improving the housing conditions for low-income households. Government intervention also has implications for the monetary transmission. In the following discussion, which is based on the ECB (2003) survey, we focus on the interaction between government policies and monetary transmission.

Government policies pertaining to housing include, on the one hand, subsidies (such as provision of tax exemptions for housing-related expenses and direct subsidies to certain households) and transaction-related taxes, on the other. Theoretically, government measures have an impact on the housing market at three levels of household decision-making: first, on the choice between investment in housing and moveable assets; second, the choice between owner-occupied and rented housing; and finally, the choice between new and existing housing.

Most EU countries have traditionally supported home ownership through direct subsidies and the granting of tax exemptions for mortgage interest payments, and by not taxing imputed rents. Measures favouring owner occupation can have an adverse effect on the single monetary policy, as they decrease labour mobility within the eurozone, an important adjustment mechanism in the monetary union. The total amount of public expenditures on housing policies in the EU countries has not changed significantly since 1980, averaging 0.6-1.3% of GDP[6]. While public expenditures remained generally stable, there were important changes in the structure of housing policy measures in most EU countries. A number of countries have moved towards a more neutral stance in terms of influencing investment decisions between housing and movable assets. At the same time, some countries have increased the incentives towards owner-occupied housing.

Transaction costs do not only generate income for the government in the form of stamp and registration duties and inheritance taxes; they also provide a means for containing speculative price movements. However, higher transaction costs can also have adverse effects. Higher transaction costs tend to decrease the number of transactions in the housing market, as shown by EU data. Belgium, which has the highest stamp duties, reaching 10-12%, has one of the lowest transaction figures, while the UK with very low stamp duties (1-4%) has the highest transaction figures. Relating housing transactions to house equity withdrawal, it can be concluded that government policies can constrain monetary transmission if these rely heavily on transaction-related incomes.

III. 2. Housing in the monetary transmission of the EU countries

Prior to accession to the eurozone, it is important for the conduct of Hungarian monetary policy to understand in detail the transmission mechanism in the eurozone. Focusing on eurozone experiences is particularly important in trying to analyse a channel that is relatively new to the Hungarian economy, such as the interaction between monetary policy and the housing and mortgage markets. Given the nominal convergence process of Hungary, the experiences of the less developed eurozone countries can serve as useful benchmarks for expected future dynamics, both during the last years of the convergence process and for the expected effects in the early years in the eurozone.

[6] These figures are not strictly comparable across countries, as some countries include forgone revenues in public expenditures, while others do not.

Furthermore, understanding the main features of the transmission mechanism in these countries could help policymakers to facilitate the convergence of the Hungarian housing and mortgage markets to structures prevailing in the eurozone.

The first characteristic of the transmission mechanism in the eurozone is related to the dominance of long-term, non-callable bonds in the mortgage markets of the biggest member countries. As discussed previously, the dominance of long non-callable bonds results in a rather weak link between the key interest rate and interest burden of the mortgage debt in the eurozone, and leads to a slow convergence of the main parameters of the existing mortgage stock across the different countries.

The heterogeneity of the structural factors, along with the differences in house price and mortgage dynamics, has important implications for the monetary transmission in the eurozone. Prior to the launch of the single currency, some economists had serious concerns about the risks stemming from the differences in the transmission mechanism between interest rates and housing markets, given the heterogeneity of institutional and market characteristics. Maclennan, Muellbaurer and Stephens (1999) argue that, apart from initial heterogeneity, there could be considerable blockages to the convergence of the mortgage and housing markets in the unified financial markets even in the longer run. These could slow down the process, and probably eliminate the prospect of convergence entirely in some countries.

It is interesting to note in this regard that an assessment of the structural factors in the EU housing markets based on the four-year experience of the monetary union (ECB 2003) highlighted the fact that, due to the liberalisation of the markets, the heterogeneity prevailing in the mortgage markets of the eurozone countries had moved from the country level to the household level. This implies that the transmission through the mortgage and housing markets in the eurozone will retain its heterogeneity in the long run. However, in contrast to the situation before the adoption of the euro, it will change from household to household, as households can have access to a wider range of mortgage products in choosing what fits their preferences the best.

The ECB conducted a comprehensive analysis of the monetary transmission mechanism in the eurozone (Angeloni et al. 2002), summarising the experiences of the first years of the single currency. The analysis took into account the difficulties related to the short time series since the implementation of the euro, as well as the structural changes that might have happened due to the change in the monetary regimes of the member countries. Having these caveats in mind, the study found that the interest rate channel is a very important channel of monetary transmission, although it is not exclusive in many countries. The bank lending channel was found to be significant in Italy and Germany, countries with more rigid mortgage markets, although at the eurozone level, the results were contrary to the presumption of a widespread and strong bank lending channel.

The study also found that the overall effect of monetary policy on the real economy is comparable between the US and the eurozone. However, the components of GDP most sensitive to monetary policy are different. It is investment that drives output changes in the eurozone, whereas in the US, much of the output adjustment seems to stem from changes in consumption. These qualitative findings are consistent with the assumption that flexible mortgage markets, such as those in the UK and the US, can strengthen the monetary transmission mechanism operating through households' consumption behaviour.

Among the most developed EU mortgage markets, the UK and Denmark are not part of the eurozone, as both countries have an opt-out from becoming a full member of the EMU. However, both countries have thorough analyses of how their transmission

mechanism through the housing and mortgage markets would be affected by the adoption of the euro. What makes the comparison of the two countries even more interesting is the fact that they are basically at the opposite ends of the spectrum in terms of mortgage regimes.

In the UK, HM Treasury (2003) prepared a study on the implications of the housing market for the transmission mechanism as part of the very comprehensive assessment of the five economic tests for determining whether adoption of the euro would be in the interest of the economy. The study concluded that, due to the structural differences between the UK and the eurozone housing and mortgage markets, the interest-rate sensitivity of households in the UK is greater than in the eurozone. Thus, the optimal monetary policy for the enlarged eurozone might not be optimal for the UK. The study identifies four main structural differences: housing supply elasticity, level of mortgage debt combined with the dominance of variable rate mortgages, owner-occupation rate and the level of competition and liberalisation of mortgage markets. The last point is the main reason behind the difference in house equity withdrawal, which has probably the most important macroeconomic effect for the difference between the consumption behaviour of UK and eurozone households.

Denmark has a rather different view of the possible effects of adopting the euro. Despite the structural differences between the housing and mortgage markets of Denmark and the eurozone countries, there are no serious concerns about the possible effects of adopting the euro. One reason for this is the set-up of the current monetary policy framework: the Danish crown is pegged to the euro with a narrow band in the ERM II regime, and the interest rate policy of the ECB is rather closely followed by the Danish National Bank. Due to the monetary regime, the adoption of the euro would mean only slightly lower interest rates, given the 20-30 bps spread of Danish yields above euro benchmark levels. Based on the fixed exchange rate regime market, participants can hedge prepayment risk in the euro market without needing to hedge currency risk, although, the single currency could make hedging even easier in the Danish market.

Another reason behind the pro-euro stance is the limited difference between the transmission effects of the long callable Danish bonds and the non-callable eurozone bonds in empirical terms. As discussed earlier, an asymmetry arises between callable and non-callable types when the long rates are decreasing, making the re-mortgaging of callable bonds profitable. This happens usually when the economy is below the potential growth rate and the monetary policy stance is accommodative. In these cases the asymmetry would lead to faster recovery through the higher consumption generated by the more favourable terms of re-mortgaging. However, it would not lead to overheating as there are basically no differences between the two mortgage types in times of increasing yields, leading to tighter monetary conditions.

While it is important to pay attention to the national characteristics influencing monetary transmission even in a monetary union, global forces should also be kept in mind. An IMF study (IMF 2004) argues that house prices are globally synchronised to a large extent, despite the extreme non-tradable nature of dwellings. The study, which used the dynamic factor model, has found that in a set of 13 developed countries, global factors explained, on average, 40% of house price movements between 1980 and 2004. One theoretical explanation for the important role of global factors in determining house prices is that, apart from housing assets, a significant part of household wealth consists of internationally traded assets, causing rates of return to move in a coordinated fashion globally. Another reason, confirmed by the econometric results of the IMF (2004), is that interest rates and mortgage debt/GDP ratios are correlated with the global housing

factor, which captures common shocks affecting house prices in all countries of the sample. These results highlight the importance of monetary policy and the mortgage market in the housing markets of developed countries, strengthening the transmission mechanism of the single monetary policy in the eurozone.

By and large, there is a sizeable outstanding stock of mortgage loans and the mortgage debt/GDP ratio has been growing steadily in the eurozone, not least due to the effects of the convergence of nominal yields. However, the transmission effect of residential mortgage loans is rather limited, as the bulk of the loans in the biggest countries are made up of long, non-callable loans. Mortgage markets are liberalised, as reflected in the growing heterogeneity of the new contracts across countries. However, on an aggregate level, the competitiveness of the eurozone mortgage market is well behind that of the UK market, where households have a better opportunity for housing equity withdrawal and can thus significantly ease credit constraints to smooth consumption.

IV. Short history of the Hungarian housing market

The Hungarian housing market experienced a number of shocks in the last two decades. In the late '80s and the early '90s, Hungarian households, wary of an economic breakdown, turned to real estate as the most important form of saving. This resulted in rising house prices. A few years into the transition, concerns regarding economic stability began to subside, paving the way for the restoration of portfolio balance between real and financial saving. This led to the so-called financial savings' miracle in Hungary in the mid-'90s[7].

At the beginning of the transition in the early 1990s, there was no mortgage market to speak of in Hungary. Although there was a considerable amount of outstanding subsidised housing loans during the socialist regime, the government decided to abolish the subsidy on account of the rising budget deficit, which attended the collapse of the centrally planned economy. Following the legal disputes over the termination of the subsidy for existing, long-maturity loans, the subsidised housing loans were converted into market-rate loans, significantly increasing the debt-servicing obligations of households. However, debtors were given the option to repay the debt fully at highly advantageous discounted rates. Since many households chose the prepayment option, the outstanding amount of housing loans dropped to less than HUF 150 bn by 1991, equivalent to 6% of GDP. It dropped further in nominal terms, becoming insignificant, from a macroeconomic point of view, for almost a decade (see Figure 7).

There were basically no new housing loans during the years when inflation was high and volatile. In 1991, the inflation rate peaked at 35%, remaining above 15% until 1998. In light of this, and considering the 1/3 prudential limit on debt service/disposable income, households could thus not raise loans exceeding their two-year income[8], even with nominal interest rates close to 15%. High and volatile rates of inflation in the first half of the '90s also led to the shortening of business contracts. Economic agents did not want to get tied down to long nominal contracts. This was particularly true in the financial markets. Even the Hungarian government could not issue long-term forint bonds: the 5-

[7] For a more detailed description of this period see Zsoldos (1997).

[8] Due to the effect of high interest rates on the credit constraint of a household, assuming a 20-year maturity and that 1/3 of disposable income is spent on the loan amortisation.

year government bond appeared in the market only in 1996. Considering that mortgage loans cannot have maturities longer than benchmark government bonds, the short yield curve also significantly constrained the potential growth of the mortgage market. In short, a confluence of factors hampered the growth of the mortgage market in the first years of the transition: high and volatile inflation, as well as low household demand for mortgages owing to declining real wages and rising unemployment.

The next period of development in the Hungarian housing market may be considered to have started in the late '90s[9]. Economic consolidation began in the mid '90s. This was accompanied by increasing credibility in the stability oriented economic policy. As a result, long yields and the inflation rate declined continuously from 1997, parallel with the gradual extension of the benchmark government yield curve to longer maturities of 10 and 15 years in 1999 and 2001, respectively. These developments created the necessary financial background for the functioning of a mortgage market in Hungary.

Alongside these developments was the establishment of the legal framework for the Hungarian mortgage market. In 1997, the Parliament passed the Act on Mortgage Institutions. In line with this, new regulations in related areas, such as loan origination, foreclosure and prudential limits, were harmonized with the EU legal framework. However, despite improving macroeconomic and financial conditions and the institution of a legal and regulatory framework, the mortgage market remained stagnant until 2000 when the government introduced mortgage-related subsidies.

In 2000, more than 10 years after the loan subsidies were abandoned in the last years of the socialist regime, the government introduced interest subsidies to long mortgage loans for new housing constructions. The main rationale for instituting the new housing policy measures was the fact that the number of new housing constructions had been declining throughout the '90s. This decline was, to a large extent, due to the lack of house financing: households could rely only on their savings to finance housing investment.

Early governmental measures promoting only new housing constructions facilitated the development of a mortgage regime similar to many EU countries, with the dominance of fixed non-callable mortgage loans. Although these measures did not have a major macroeconomic impact, they gave an impetus to the previously inert mortgage market. In 2000, the households' mortgage debt/GDP ratio started to post some growth. To further foster this growth, although to a smaller extent, the government extended the subsidy to buying existing dwellings as well. Meanwhile, macroeconomic conditions had also become favourable: the inflation rate dropped below the 7% target at end-2001, while the yield curve showed a steep negative slope, reflecting investors' confidence in the profitability of the convergence play strategy in the Hungarian government bond market. The new government measures, along with the favourable macroeconomic conditions, resulted in a gradual increase in mortgage loans, with a monthly average of HUF 15 bn of new loans granted in 2001. However, the outstanding stock by the end of the year still did not exceed 2% of GDP.

The year 2002 brought dramatic changes to the mortgage market. Government subsidies directly targeting households were increased significantly at the beginning of the year. Moreover, through subsidies linked to funding costs, bank margins climbed to 8%. Meanwhile, the subsidy scheme was exhibiting a rather unusual feature: the interest burden of households was not sensitive to market rates; all interest rate risk was with the central budget. The most general mortgage type was a 15-20 year loan, with the interest

[9] The early stage of this period is discussed in Valkovszky (2000).

rate fixed for 5 years and a cap on interest paid by households at 6% for existing dwellings and even lower for new constructions. These rates were even significantly lower than benchmark government yields at that time.

The subsidy scheme was clearly not going to be sustainable. Under the scheme, even households that would otherwise not have considered taking out a mortgage loan in the near future, were applying for loans simply to take advantage of the favourable conditions. This resulted in such a sudden and significant rise in mortgage loans that, by the middle of 2002, the mortgage market had started to post exponential growth. In the second half of the year, the volume of new loans originated in 2 months exceeded the total volume originated in the previous year. However, the government was slow to respond. It decided to cut the subsidies substantially only in December 2003, amidst serious concerns about the external and internal stability of the Hungarian economy.

The tightening measures primarily attempted to cut the budget expenditures on interest rate subsidies. Given the lower subsidies for the new loans, banks' profit margins declined, parallel with the significant increase in the interest burden of households. Furthermore, the changes to the subsidy scheme gave rise to two new features: mortgage rates became partly linked to market rates, and the difference between subsidies for new and existing housing widened from 1 to around 3 percentage points. (See Figure 8)

From the transmission point of view, the most relevant change was the establishment of the link between the mortgage rate faced by households and the market rate. The immediate and strong impact of the tightening measures on the demand for new loans may be attributed not only to the fact that subsidies were cut significantly but also to unfavourable market developments. As concerns about the external and internal equilibrium of the Hungarian economy increased in 2003, the long segment of the yield curve started to increase significantly, putting an end to the yield convergence that characterised long yields in the previous years.

Loan origination dropped significantly in 2004 as a natural consequence of the tightening measures and the high long rates. At the same time, a new product appeared in the market: foreign exchange-denominated (FX) mortgage. Faced with the high forint (HUF) mortgage rate, a growing number of households opted for mortgages with a lower nominal rate, notwithstanding the imminent exchange rate risk.

V. Hungarian housing market in monetary transmission

In this section, we apply econometric techniques to estimate the role of housing and mortgage markets in monetary transmission in Hungary. Apart from the standard transmission channels (namely, the interest rate channel and, the joint wealth effect-credit channel), we identified two other effects which influence the role of the Hungarian housing market in monetary transmission. Looking ahead, the expected effects of the single monetary policy of the eurozone on the Hungarian markets are also discussed.

V. 1. Interest rate channel

We expect mortgage loans to have a weak direct impact on households' disposable income in Hungary, for two reasons. First, despite dynamic growth in recent years, the outstanding stock of mortgage loans is still low compared to that in developed countries. Second, the key interest rate affecting the yield curve has had only a minor impact on the interest burden of mortgage loans due to the features of the government subsidies effective until 2003**.** Apart from the government subsidies, the fixed non-callable

mortgages dominating the Hungarian market result in a delayed effect of interest rate changes, similar to many eurozone countries.

Based on the evolution of the mortgage market and the government subsidy scheme discussed in Section II, the following table summarises the direct effect of interest expenditure on disposable income and the effect of a change in the market interest rate.

Table 3. Sensitivity of disposable income to changes in the mortgage interest rate

Year	Households' disposable income (bn HUF)	Mortgage interest expenditure (bn HUF)	Interest payments/ Disposable income (%)	Sensitivity of interest expenditures to change (+100 bps) of the market rate (bn HUF)
2001	8913	18.4	0.21%	0.8
2002	9742	53.4	0.55%	2.2
2003	10863	95.4	0.88%	3.9
2004*	11950	132.2	1.11%	5.5

* *Estimate.*

Source: Own calculations

As is apparent from Table 3, a one-percentage-point change in the market rate induces a negligible change in the disposable income of the household sector and, thus, in aggregate consumption expenditure.

V. 2. Wealth effect and credit channel

In order to determine the wealth effect of monetary policy on housing investment and private consumption, we first have to estimate the relationship between the interest rate and house prices. Using the resulting price elasticity coefficient, we can then simulate the following: (1) the effect of interest rates on house prices, and thus on dwelling investment, and (2) the effect of altered housing wealth on consumption.

As previously discussed, house prices can be modelled within an error correction framework. Previous studies used simple time-series techniques. However, due to the short sample period, this is not feasible for Hungary. Instead of using aggregated time series we apply panel data where the cross-sectional variance comes from the geographic separation[10]. The economic rationale for using national cross-sectional data lies in the fact that the mobility of Hungarian households between regions is very low. Thus, regional time series are not explanatory variables for each other.

A further adjustment to equation (2) is the exclusion of demographic variables. Demographic variables are certainly essential to explaining house prices when significant demographic fluctuations can be observed. However, our sample is too short (quarterly observations for the period of 1997-2002) to demonstrate such effects. Moreover, we also know that there has been no considerable movement in Hungarian demography in the past few years. As a result, we can proceed with our estimation process using the following equation:

[10] For details about the data set, see VIII. 1, Data set section.

$$p_{i,t} = \mu_i + \gamma_1 p_{i,t-1} + \gamma_2 p_{i,t-2} + \beta_0 y_{i,t} + \beta_1 y_{i,t-1} + \alpha_0 r_t + \alpha_1 r_{t-1} + \alpha_2 d_{00} r_t + \alpha_3 d_{00} r_{t-1} + \varepsilon_{i,t} \quad (5)$$

where i represents the capital and the 19 counties of Hungary, while p, y, r and d_{00} denote house prices, GDP per capita, the interest rate of housing loan, and a dummy variable which equals 0 before 2000 and 1 otherwise, respectively. The dummy variable is supposed to test whether government measures easing access to mortgage loan has an effect on monetary transmission[11]. Equation (5) can be rewritten in the following form, which is a frequently used form of the ECM:

$$\Delta p_{i,t} = \mu_i + \theta_0 \left[p_{i,t-1} - \theta_1 y_{i,t-1} - \theta_2 r_{i,t-1} - \theta_3 d_{00} r_{i,t-1} \right] - \gamma_2 \Delta p_{t,t-1} + \beta_0 \Delta y_{i,t} + \alpha_0 \Delta r_t + \alpha_2 \Delta d_{00} r_t + \varepsilon_{i,t} \quad (6)$$

where $\theta_0 = \gamma_1 + \gamma_2 - 1$, $\theta_1 = -(\beta_0 + \beta_1)/(\gamma_1 + \gamma_2 - 1)$, $\theta_2 = -(\alpha_0 + \alpha_1)/(\gamma_1 + \gamma_2 - 1)$ and $\theta_3 = -(\alpha_2 + \alpha_3)/(\gamma_1 + \gamma_2 - 1)$. This specification allows us to test numerous assumptions, among them: that the ratio of house price to income is constant (θ_1=1); that the interest rate has a significant effect on house prices ($\theta_2 \neq 0$); that government measures altered the transmission ($\theta_3 \neq 0$); that house price growth has been sluggish ($\gamma_2 \neq 0$), etc. In order to avoid the estimation bias that may arise from using a single estimator, we apply three different approaches.

Firstly, since our sample has a cross-sectional dimension, we apply panel estimators. We apply a fixed-effect estimator as a starting point since the lagged dependent variable is correlated with the error term, making the estimation biased. To handle this problem, we apply the IV (instrumental variables) of the Arellano and Bond (1991) dynamic panel estimator.

Secondly, panel estimators can have two weaknesses in our case. On the one hand, they are appropriate when $N \to \infty$, so they are not fully suitable to our sample. On the other hand, they assume all parameters to be homogeneous in a cross-sectional dimension. However, if this assumption does not hold, the following would be the more appropriate equation:

$$\Delta p_{i,t} = \mu_i + \theta_0 \left[p_{i,t-1} - \theta_1 y_{i,t-1} - \theta_2 r_{i,t-1} - \theta_3 d_{00} r_{i,t-1} \right] - \gamma_{i,2} \Delta p_{t,t-1} + \beta_{i,0} \Delta y_{i,t} + \alpha_{i,0} \Delta r_t + \alpha_{i,2} \Delta d_{00} r_t + \varepsilon_{i,t} \quad (7)$$

Time-series estimators, such as 3SLS, can handle the second problem. However, they are appropriate only when $T \to \infty$.

In order to handle these weaknesses, we consider a 'mid-solution' when the cross-sectional and time dimensions are roughly equal and allow heterogeneous parameters. Pesaran at al. (1999) suggest an estimator for this special case, which is called the pooled mean group estimator (PMGE). To ease comparison, we also apply the simple mean group estimator (MGE). Finally, for the sake of completeness, we also employ three-

[11] Since government actions take place in stages, no single date can be pinpointed. As we argued earlier, 2000 was the first year when subsidy measures were introduced. It was thus only after that when households' mortgage debt/GDP ratio started growing.

stage least squares (3SLS), which is frequently used in time-series studies, keeping in mind its aforementioned weakness.

In order to understand the estimation results, one has to recall the significant discrepancy between estimators. While panel estimators use equation (5) and assume all parameters - namely, that all α, β and γ are equal across counties - the pooled mean group estimator uses equation (7) and restricts only long-run parameters (θs) to be equal, allowing different short-run dynamics, i.e., α_0, α_2, β_0 and γ_2. Since the latter assumption is more acceptable, we design the 3SLS estimation in the same way. The estimated parameters using the various estimation methods are shown in Table 4 below.

Table 4 Estimation results

	Fixed effect		Arellano-Bond			MGE		PMGE		3SLS	
	Coef.	t stat	Coef.	Z stat		Coef.	χ^2 stat	Coef.	t stat	Coef.	P(θ_i=0)
γ_1	1.330	34.3	0.820	4.02	θ_0	-0.255	203.2	-0.068	-1.06	-0.153	0.00
γ_2	-0.502	-14.3	-0.293	-2.47	θ_1	0.977	102.2	0.972	10.06	1.065	0.00
β_0	0.441	2.7	0.860	3.85	θ_2	-0.031	71.6	-0.028	-9.38	-0.031	0.00
β_1	-0.323	-2.1	-0.403	-1.76	θ_3	0.013	190.4	0.010	6.73	0.004	1.00
α_0	-0.002	-0.9	-0.003	-1.07							
α_1	-0.005	-2.3	-0.007	-2.71							
α_2	0.006	9.2	0.006	7.12							
α_3	-0.004	-5.8	-0.002	-1.56							
	Long-run income elasticity										
θ_1	0.69		0.966			0.977		0.972		1.065	
P(θ_1) = 1	0.165		0.787			0.263		0.775		0.317	
	Long-run interest rate elasticity:										
before 2000	-0.037		-0.020			-0.031		-0.028		-0.031	
after 2000	-0.027		-0.012			-0.019		-0.018		-0.027	

In the case of Arellano-Bond, the Hansen J statistic is $\chi^2(4)$= 4.41, P = 0.353, while AR(2) test is z = 1.37, P = 0.171. Exogenous instrument variables are $p_{i,t-3}$, $p_{i,t-4}$, $y_{i,t-2}$, $sh_{i,t-1}$, $sh_{i,t-2}$ and $fh_{i,t-2}$ where *sh* and *fh* denote new house stars and finished house constructions. In the case of 3SLS, we applied the Monte Carlo method to obtain proper distribution.

According to the estimation results, the long-run relationship between house price, income and interest rate seems to be an acceptable assumption[12]. Every estimator indicates unit elasticity between house price and income, i.e., the ratio of house price to income is constant. The only discrepancy between the panel estimator and the other two estimators is the speed of adjustment. While it is reasonable in the case of 3SLS and Pesaran-Shin-Smith, the Arellano and Bond estimator indicates too rapid an adjustment (θ_0 = -0.473).

The interest rate elasticities before 2000 seem to be reasonable and are also close to each other. More worthy of note, however, are the results from the dummy variable estimations. Contrary to our expectations, the increasing interest rate elasticity after the introduction of government subsidies is not supported by the estimation results. Each of the methods implies a declining interest rate parameter, although its magnitude is fairly

[12] Figure 10 displays the ratio of price per square meter to monthly per captia GDP in the individual counties.

small. On the other hand, it is not significant in every estimator, e.g. 3SLS strongly rejects the change in the interest rate parameter.

There could be several reasons for obtaining such a result. Firstly, government subsidies were gradually increasing. They can thus be considered as being a series of measures rather than one single measure. Due to the relatively short sample period, we did not want to extend the number of dummy variables, as this would have distorted the estimation results. Instead, we chose the approximate start of the effect of government actions (see footnote *11*). Secondly, the drop in the mortgage loan rate occurred at the end of the sample. Obviously, the adjustment of house prices takes longer, likely continuing through the ensuing years. Since the full effect of the sharp decrease in interest rate cannot be detected in the sample, the estimations cannot capture its effect properly. Finally, and most importantly, the changing variables do not imply different deep parameters. Note that the lower interest rates do not alter household behaviour by themselves. They simply increase the demand for credit. By and large, we believe that the whole sample should be considered, although greater attention should be paid to the more significant parameters.

Based on the estimation results, we are able to simulate the effect of the interest rate on relevant household variables, such as housing investment and consumption expenditure. We use, for the simulation, the Hungarian Quarterly Projection Model (MNB (2004a)) in which the consumption function contains housing wealth, and the housing investment function is based on the aforementioned portfolio choice approach, and we extended the model with our new house price equations. In order to obtain a complete interval, we use the lowest (Arellano-Bond) and the highest (3SLS) estimation results. It should be recalled, however, that the most probable outcome is likely to be within this interval, as the more appropriate Pesaran-Shin-Smith estimator suggests.

Table 5 Transmission through the wealth and credit channel

	House prices		Housing investment		Consumption	
long-run interest rate elasticity of house price	-0.012	-0.031	-0.012	-0.031	-0.012	-0.031
	min	max	min	max	min	max
1st year average	-0.60	-1.14	0.00	0.00	0.00	-0.01
2nd year average	-1.22	-2.89	-0.39	-0.56	-0.05	-0.11
3rd year average	-1.19	-3.07	-0.70	-1.13	-0.11	-0.26
4th year average	-1.19	-3.05	-0.70	-1.02	-0.14	-0.34
5th year average	-1.19	-3.05	-0.69	-0.88	-0.13	-0.35

* 1 percentage-point permanent increase in mortgage loan rate. Results are displayed as the percentage differences from baseline.

Table *5* shows the simulation results of a one percentage-point permanent increase in the mortgage loan rate. Evidently, house prices decrease by 1.2 and 3.1 percentage points. Declining house prices are only one source of decreasing housing wealth. Higher interest rates and lower house prices also discourage housing investment. According to the simulation, this effect could be around 1 percent. Lower house prices and dwelling investment alter the real wealth position of households, which should influence consumption decisions. Since a consumer loan secured by dwellings is not very common

in Hungary, it is not surprising that declining housing wealth has a rather moderate effect on consumption. It should be noted that the changes in consumption expenditure shown above stem merely from the housing market; we ignore any other relationship between interest rate and consumption.

V. 3. Country specific features

Institutional arbitrage – a form of house equity withdrawal

In recent years, house equity withdrawal has become an important macroeconomic feature, despite the unsophisticated mortgage products offered in the Hungarian market. The main reason for this was the combination of the previously binding credit constraint on households and the generous subsidies made available for existing dwellings.

The existence of the housing equity withdrawal involving housing transactions can be illustrated with an example. Households who would like to purchase a more expensive apartment sell their old one and take out a mortgage loan with the highly advantageous interest rates. On the aggregate level, if the transaction involves only existing dwellings, there is no change in the net financial position of the household sector, as the mortgage loan equals the increase in the savings of the seller. However, due to the low interest rate, the household taking up the mortgage might consider taking out a bigger loan to finance consumption, for instance, to furnish the new apartment. If LTV and debt service/income ratios are at manageable levels, households could significantly ease the credit constraint. Our previous calculations (MNB Inflation report 2004 February, MNB(2004b)) showed that 15-30% of mortgage loans raised for existing housing could finance consumption during 2001-2003. The estimation was based on the unexplained consumption growth by standard factors such as income, financial and housing wealth, and the consumer confidence index[13].

However, the 15-30% ratio of extra consumption expenditure to housing loan was plausible in extraordinary years, such as 2002-2003, it is definitely too large in a normal housing market after the tightening of the subsidies. In order to test the impact of the institutional arbitrage we apply a simple VAR analysis using Δln of consumption, personal disposable income, financial asset, consumption loan and housing loan. According to the estimation results the housing loan had a significant influence on consumption expenditure after 2002 (see Figure 9). After reaching its peak, this effect basically decreased gradually. The econometric results are also consistent with the fact that during 2002-2003 the growth rate of consumption loans was subdued temporarily, while consumption expenditures remained robust.

Based on these results, the institutional arbitrage was a significant phenomenon in the last years, however, due to the tightening of the government subsidy, its importance will decrease in the coming years.

FX mortgages

Another distinctive feature of the Hungarian mortgage market is the growing importance of FX loans, as discussed in detail in Bethlendi at. al. (2005). Due to the high domestic interest rates, FX mortgages are becoming more popular, creating a new and rather unique channel for monetary transmission. First, in this case, monetary tightening occurs

[13] Widely used empirical consumption functions, such as equation (4), are not capable of handling the changing expectation of households. Several studies suggest the incorporation of consumer confidence index into the consumption function, as a possible way to tackle the problem of unobserved factor. See Carroll at al (1994), Carnazza and Parigi (2001) and Vadas (2001).

when the exchange rate is depreciating, as household income after mortgage payments falls; the converse is true when the exchange rate is appreciating. Another very important feature of this channel of monetary transmission is the speed of adjustment: monthly instalments are immediately affected by changes in the exchange rate regardless of the interest conditions (variable or fixed) of the mortgage loan.

V. 4. Rental market

The rental market can have important implications for monetary transmission. Rental costs are usually included in the consumer basket. The housing market therefore has a direct effect on inflation. The Hungarian situation is rather special in this regard since there are hardly any apartments rented at market price, as reflected in the very high level (92%) of owner occupation. One reason behind the very high level of owner occupation is the fact that the majority of state-owned apartments were sold to tenants in the early '90s for a symbolic amount. Another possible reason why official statistics register a very small renting market is tax evasion. Landlords are obliged to pay a 20% tax after rental income. According to anecdotal evidence, however, rental income hardly ever appears in the tax reports.

The non-existence of a statistically observable renting market has led to a situation where rental costs are substituted with different items in the Hungarian consumer basket. Market rents are substituted with a regulated price, the rents charged by local municipalities on dominantly social housing. The imputed rents of owner-occupied housing are approximated by a weighted average of goods and services related to house repair and maintenance. From a monetary policy point of view this substitution is rather controversial, as largely different macroeconomic factors determine regulated prices, housing repair and maintenance goods and services on the one hand, and house-price-linked rental costs on the other. Thus, the full effect of transmission cannot yet be captured by recent statistics. A switch to actual rental costs in the consumer basket is therefore necessary to reflect the real transmission effects.

Another important point to consider is the difference between the weight of rents in the Hungarian and the HICP baskets: while the weight of housing rents is around 6% in the HICP excluding imputed rents, in Hungary, the regulated rent and the imputed rent account for 0.1% and 5.5%, respectively, of the consumer basket.

V. 5. On the way to the eurozone

In light of the international experiences discussed in section III, it is important to consider the possible dynamics coming into play in the Hungarian housing and mortgage market in the coming years and decades. In the following section, we focus mainly on the mortgage market for two reasons. First, the most rapid change in the structural factors is related to the mortgage market. Second, the adoption of the euro will certainly exert the most direct impact through mortgage loans.

As we look forward to the adoption of the euro, it is logical to assess the future of the Hungarian mortgage market in light of the experiences of current eurozone members. We have seen earlier that Portugal and Italy are the two extremes in terms of mortgage market developments. Portugal is the typical example of a credit-constrained market where demand for mortgage loans grew extremely fast, alongside interest rate convergence. In Italy, on the other hand, there was a rather moderate increase in demand during the years of convergence.

However, apart from the foregoing, another factor should be considered in studying a small open economy using its national currency, such as Hungary. Since a significant part of the transmission mechanism through the housing market is related to the indebtedness of the household sector, the net financing position of the household sector also needs to be taken into account. In other words, apart from structural features, the sustainability of the net position of the domestic sectors, as reflected in the current account, can also influence the speed of adjustment in the run-up to euro adoption.

If there were only forint loans available in the mortgage market, the dynamics of the new loan provision would depend primarily on long-yield convergence. Given the loan conditions after the tightening of the subsidy scheme, the benchmark rates should drop some 300-400 basis points, so as to be comparable with the levels during the heavily subsidised period of 2002-2003. This would also imply that, due to the gradual process of yield convergence, the growth in the mortgage market would be rather limited in the coming years, contrary to the exponential dynamics in 2003. In this scenario, the Hungarian mortgage market would become similar through time to those in most continental EU countries. Given the dominance of long fixed loans in these countries, monetary policy has had only a weak impact on the disposable income of households, although there is still a substantial growth in the mortgage debt/GDP ratio.

The response of the household sector to the tightening of the subsidies points, however, to a somewhat different path. As earlier mentioned, FX loans became increasingly popular in 2004 among households facing the higher forint mortgage rates. The strong mortgage demand suggests that Hungarian households were willing to pay a high price, namely the imminent exchange risk, to loosen credit constraint. The growing popularity of FX mortgage loans provides an additional transmission channel on the one hand, as high domestic rates rather shift mortgage demand to FX loans, and leads to the build up of the non-hedged FX position of households, raising stability-related concerns, on the other.

Looking from a longer perspective, however, the increased importance of FX loans in the mortgage market is only temporary. As earlier noted, the rationale for the FX loans from a household's perspective, lies mainly in the high domestic rates at long maturities, which are directly related to macroeconomic fundamentals. Given the still existing government subsidies for housing loans, the mechanism by which a credible convergence path can decrease the popularity of FX loans is clear: improving fundamentals are reflected in decreasing risk premium, leading to lower domestic yields, thus giving less incentive for FX loans. At the same time, it is less than straightforward to determine the level to which the stock of FX loans will rise before domestic yields become once again more favourable to households. It will depend partly on domestic economic policy, when it can commit itself to a credible convergence path and also on international market conditions, which, due to the historically low short interest rates and rather steep yield curve, recently make variable rate FX mortgages highly attractive for credit-constrained households.

Short term simulation

In light of recent dynamics, it is a relevant question for monetary policy to see what could potentially be the size and composition of mortgage loans at the time of eurozone accession. To answer this question we performed a simple simulation until 2010, the official target date for Hungary's eurozone accession.

The calculations were based on the assumption that mortgage/GDP ratio will be growing by 1 percentage point every year until 2010, a rate similar to the dynamics observed in 2004[14]. We considered two scenarios for the currency composition of new loan origination: in the first case (A), the ratio, of HUF and FX mortgages will be constant at 50:50 per cent until 2010, while in the second case (B), due to the fast convergence of long HUF yields, the ratio of FX mortgages is decreasing gradually. The following table contains the results.

Tabel 8: Currency composition of mortgage loans as a percentage of GDP

	HUF	FX	Total
Transaction in 2004	app. 0.4	0.6	app. 1.0
Stock in 2004	8.8	0.7	9.5
Stock in 2010 A	11.8	3.7	15.5
Stock in 2010 B	13.3	2.2	

The results indicate that the weight of FX loans in total mortgages could be between 15-25% in 2010, while the level of mortgage indebtedness, in this simplified simulation, is not influenced by the currency substitution. It is important to note that the currency composition of the loan portfolio also has a significant implication for the ratio of fixed and variable interest rates. Contrary to the negative slope of the HUF yield curve, explained by the convergence process, both euro and Swiss franc yield curves have a positive slope. Credit constrained households, to optimise in this environment, choose between short FX interest rates and long HUF rates, therefore the HUF rates are fixed for a longer period (1-5 years), while the FX mortgages can be considered as variable rate loans. This implies that the Hungarian mortgage market will also become more heterogeneous, with an increasing share of variable mortgage products, while the clear dominance of fixed non-callable loans will remain.

Long term outlook

Although it is still quite early, just a few years after the start of mortgage lending, to forecast the mortgage/GDP level which could be considered as the long-run equilibrium for Hungary after euro adoption, the popularity of FX loans points toward high equilibrium mortgage levels. Considering that Hungarian households have gotten so easily used to the wide range of mortgage products, encouraging them to take on significant exchange rate risk to improve access to mortgage loans, Hungary will likely not follow the moderate path observed in Italy. Rather, mortgage developments in Hungary will, more likely, mirror the dynamics observed in Portugal, where mortgage loans rose to almost 50% of GDP in the last ten years from a low level comparable to Italy.

[14] The full year growth in 2004 was significantly influenced by the tightening measures at end-2003. The majority of the loans that households applied for in the last weeks of the heavily subsidises were technically granted in 2004, thus the first quarter growth reflected dominantly 2003 processes.

VI. Conclusions

Based on the international experiences and the evolution of the Hungarian mortgage and housing markets, the following conclusions can be drawn regarding the monetary transmission mechanism.

- The transmission through the interest rate channel is negligible at the macroeconomic level, for two major reasons. First, notwithstanding its exponential growth in the last years, the ratio of mortgage indebtedness to GDP in Hungary (10%) is still low compared to those in developed countries (40-60%). Second, the Hungarian mortgage market is dominated by long, non-callable loans, which creates a weak and delayed link between key policy interest rate and mortgage rates.
- The wealth and credit channel could be discerned in the Hungarian data, with theoretically consistent parameters, although transmission effects on house prices, housing investment and consumption are rather limited.
- A further transmission channel related to house equity withdrawal, the institutional arbitrage, due to the very generous subsidy scheme, has had a significant impact on household consumption in recent years.

There are various factors determining the future dynamics of mortgage markets until and after the adoption of the euro. During the convergence process, the sustainability of the net saving position of the domestic sectors can constrain the growth of household indebtedness. Recent experience shows that high domestic mortgage rates shift demand towards FX loans, rather than decrease the overall demand for mortgages.

It could take decades after euro adoption to reach the equilibrium mortgage debt/GDP level. Given the fast growing loan demand of households, particularly the popularity of FX loans at times when domestic rates are high, the possible dynamics in the Hungarian market on the longer run, fuelled by the rate convergence and euro adoption, might mirror those of Portugal. In Portugal during the last years of the run-up to the eurozone and after the euro adoption, in a period of less than 10 years the mortgage debt/GDP ratio increased from 10% to almost 50%.

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VIII. Appendix

VIII. 1. Data set

House prices: Data on house prices constitute the most problematic data set. The Hungarian Central Statistical Office (CSO) publishes house prices based on contracts submitted to the Land Registry Office. On one hand, this implies great cross-sectional detail. However, CSO data are available only on a yearly basis. In order to increase the information content, we thus generated a quarterly database based on the raw monthly database of the Hungarian CSO (2003). During the generation process, we applied the following data-check filters:

- the total area of dwellings should be between 20 and 600 m^2 square meter
- the price per square meter of dwellings should be between € 200 and 4000.

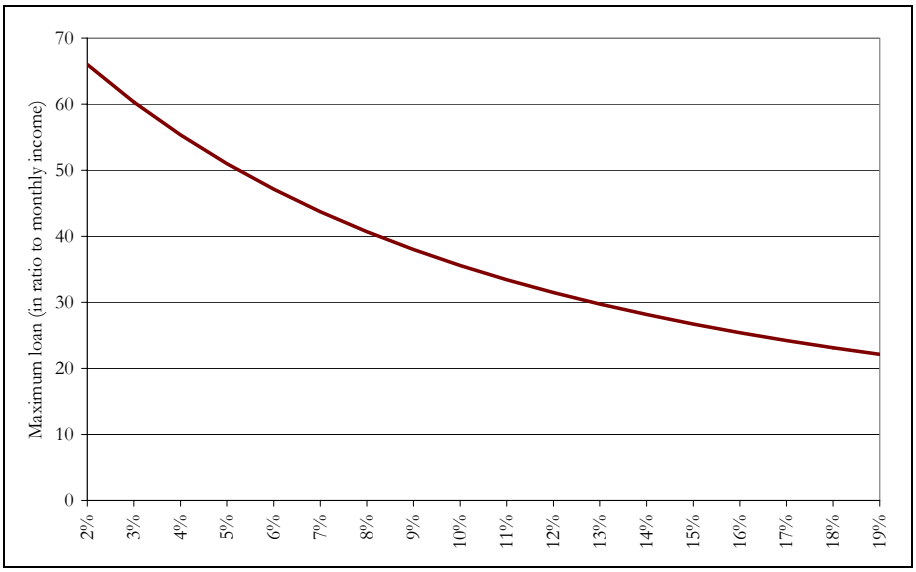
Income. Theoretically, the appropriate income variable should be the disposable income of households, which would consist of average net wages. However, average net wages available at the county level have two problems. First, average wages are only roughly half of households' disposable income. Second, the wage data are published in terms of headquarters rather than the actual working site. This means that part of the income reported under a certain county may not really be attributable to that county, as it may lodge merely the headquarters and not the actual place of work of the employee concerned. However, considering that GDP figures are also published in terms of headquarters, the available data may still serve as a proxy for the entire amount of households' incomes. It is thus reasonable to use data on GDP per capita instead of average wages.

Interest rate: We use a composite mortgage interest rate of subsidised loans, market loans and FX loans, weighted by their respective shares in loan origination. Since official interest rate statistics incorporate data on government subsidies in the time series, we therefore used the maximum APRC set by government regulations in case of subsidised loans.

New house starts and finished house constructions: We use new house starts and finished house construction by county as exogenous instruments. The first one denotes the number of house building permits issued by local governments. The latter shows the number of permits to reside that are granted to newly built houses.

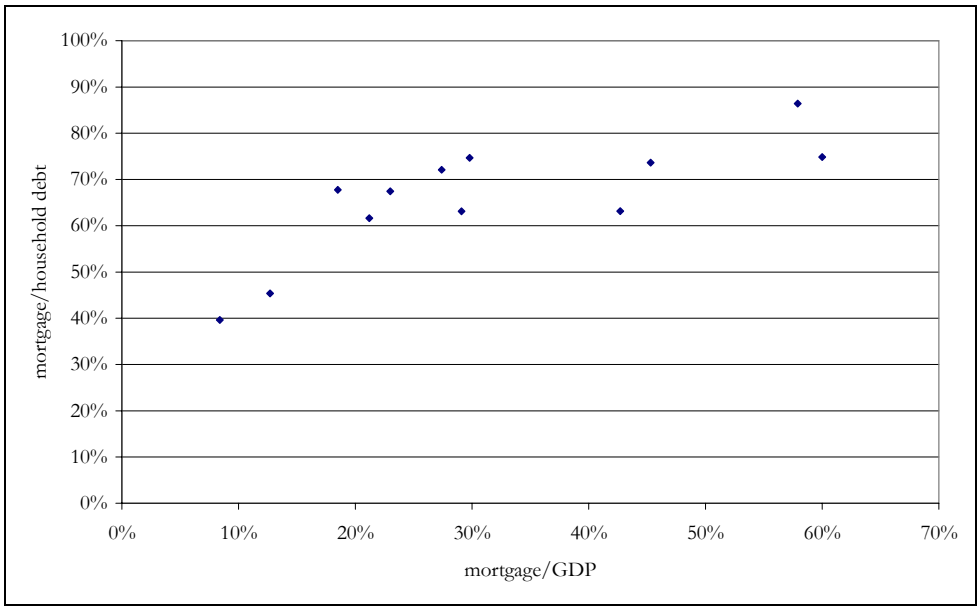
VIII. 2. Figures

Figure 1. Credit constraint and nominal interest rate



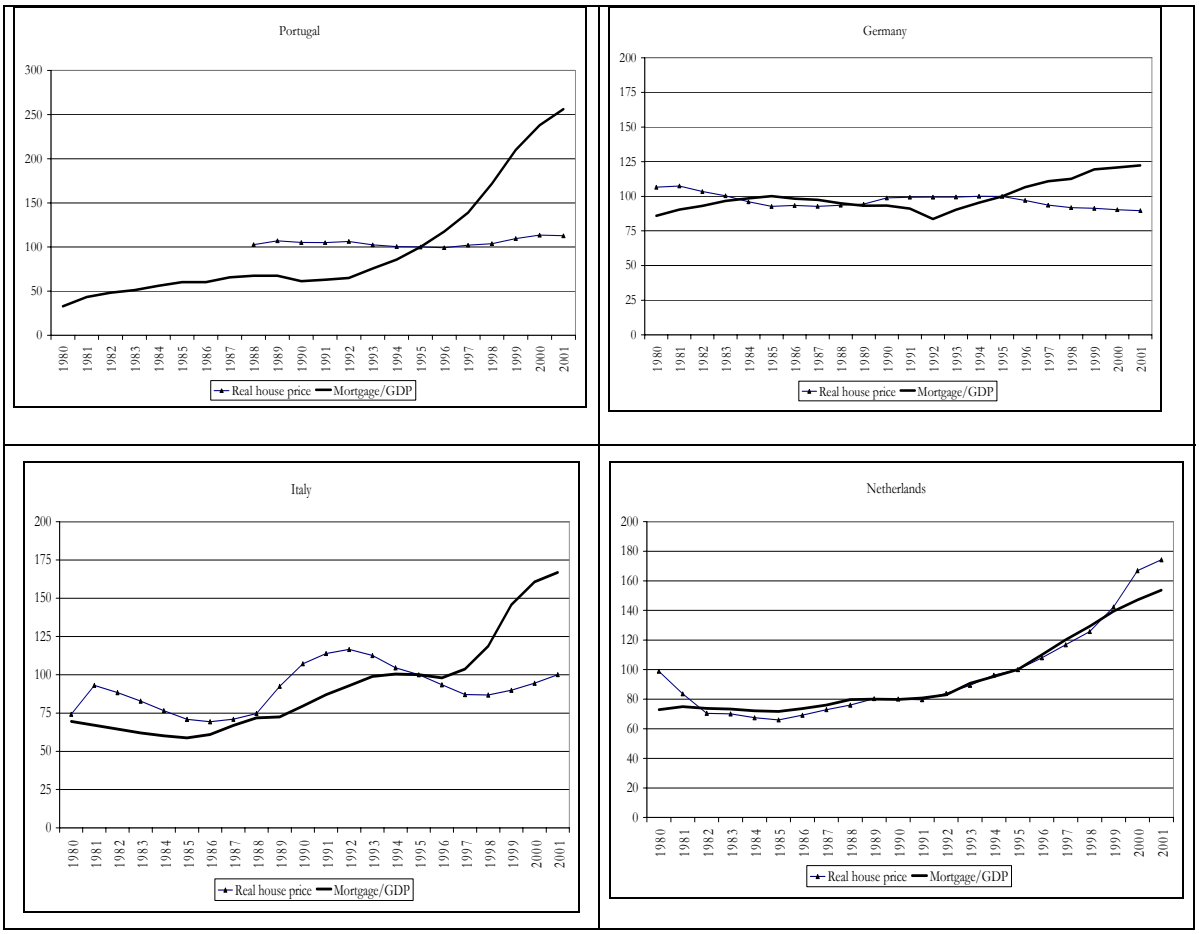
Source: Own calculations

Figure 2. Role of mortgages in indebtedness



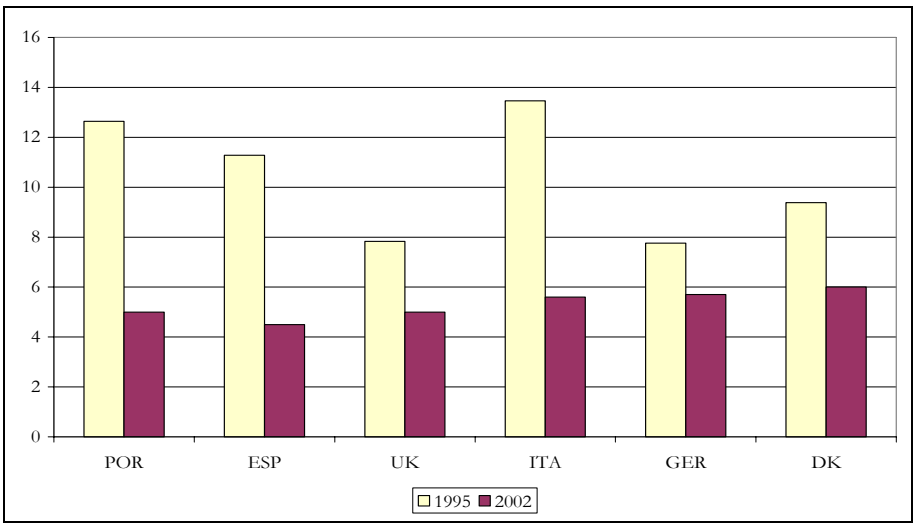
Source: ECB, BIS

Figure 3. Real house prices and mortgage/GDP growth in selected eurozone countries (1995=100)



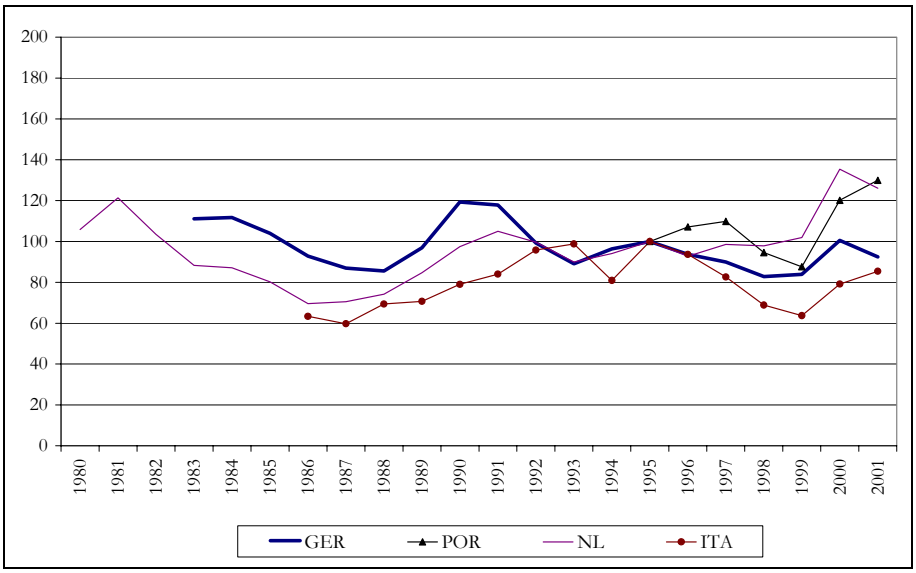
Source: ECB

Figure 4. Convergence of mortgage interest rates (%)



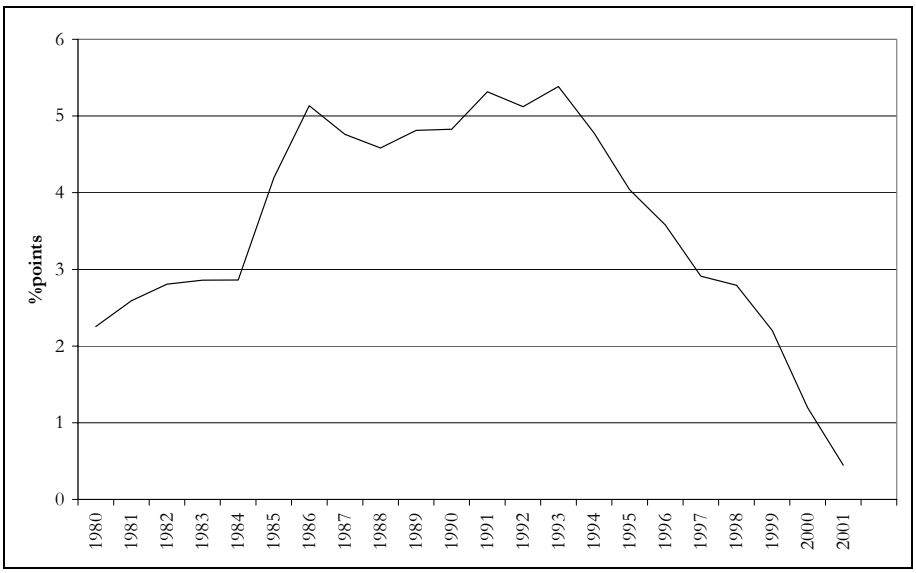
Source: ECB, HM Treasury

Figure 5. Debt servicing to disposable income (1995=100)



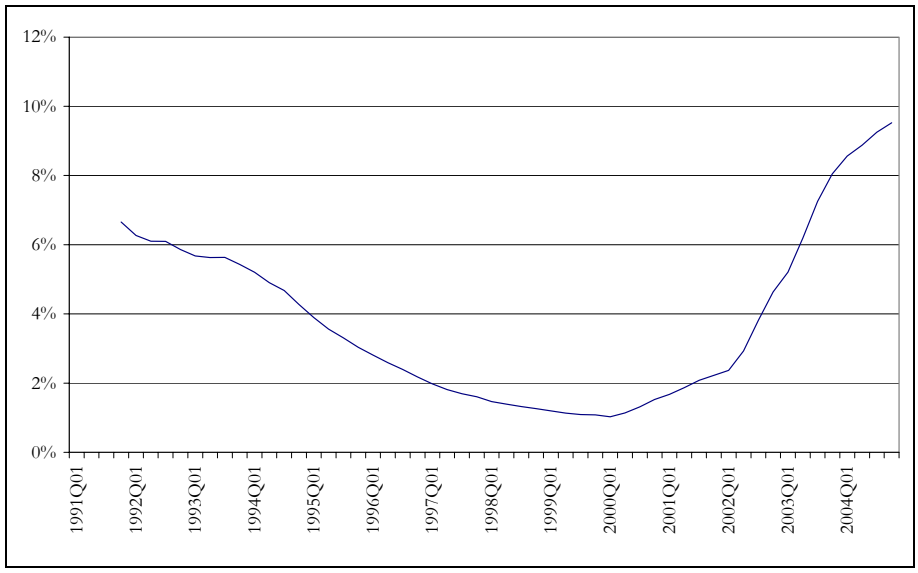
Source: ECB

Figure 6. Standard deviation of mortgage rates in eurozone member states



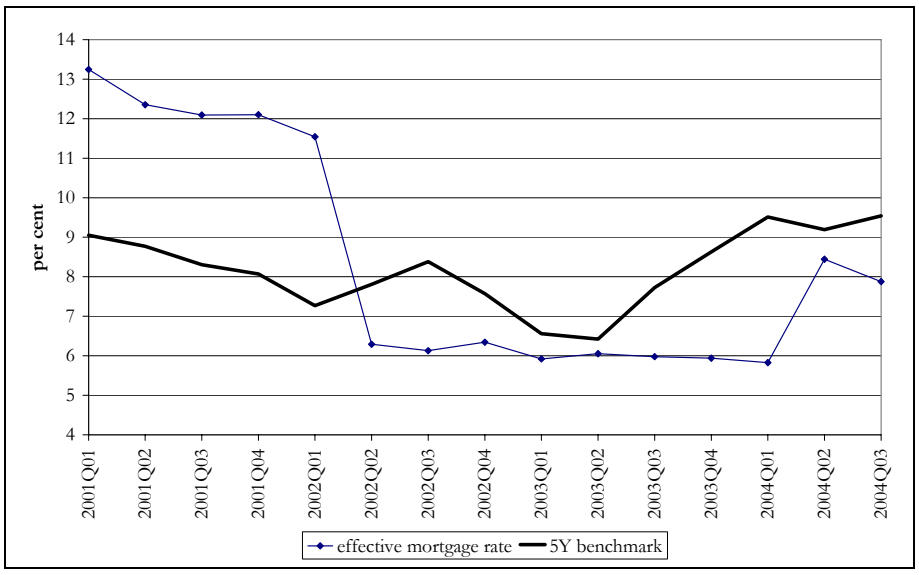
Source: ECB

Figure 7. Mortgage/GDP in Hungary



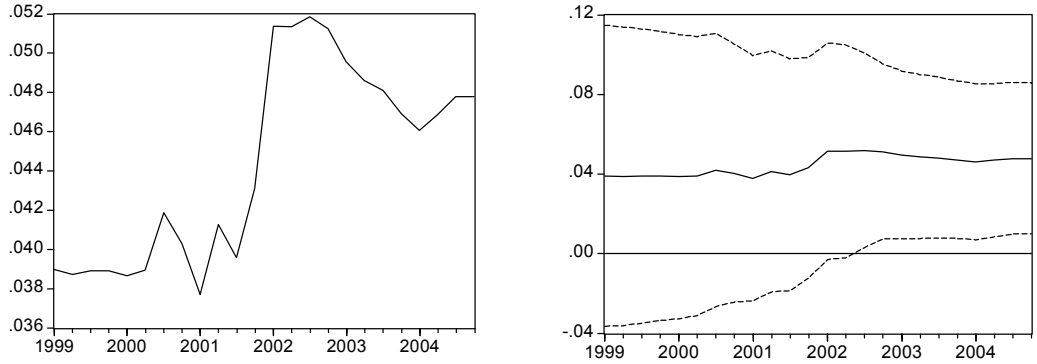
Source: MNB

Figure 8. Effective mortgage interest rate in Hungary



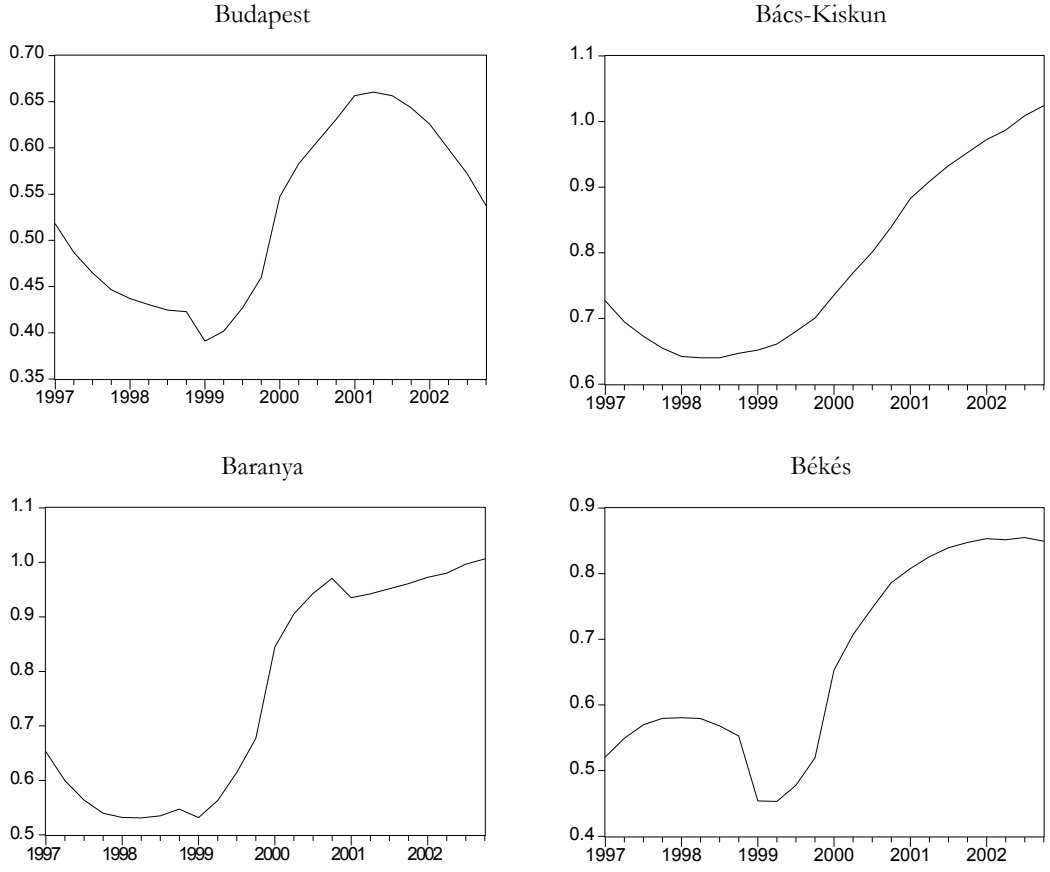
Source: Own calculations

Figure 9 Parameter of housing loan in VAR model



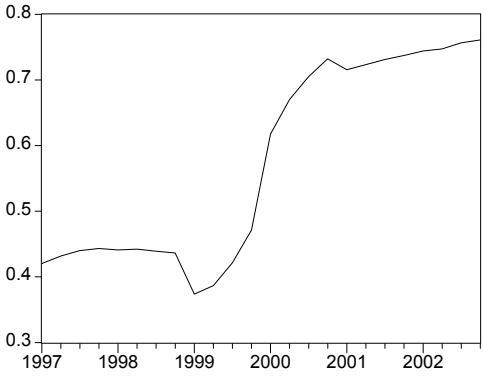
The estimated model is $\Delta \mathbf{X}_t = \mathbf{B}0 + \mathbf{B}_1 \Delta \mathbf{X}_{t-1} + \boldsymbol{\Omega}_t$ where **X** contains consumption, income, financial asset, consumer loan and housing loan. Left panel shows the rolling-window parameter estimation of housing loan in consumption equation. The right panel displays the same parameter with ± two standard errors.

Figure 10 The ratio of price per square meter to monthly GDP per captia[15]



[15] Since both house prices and per capita income could vary county by county the ratio of house price to per capita income indicates only the relative price of dwellings.

Borsod-Abaúj-Zemplén



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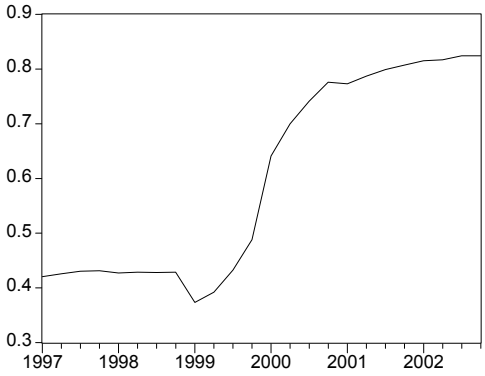

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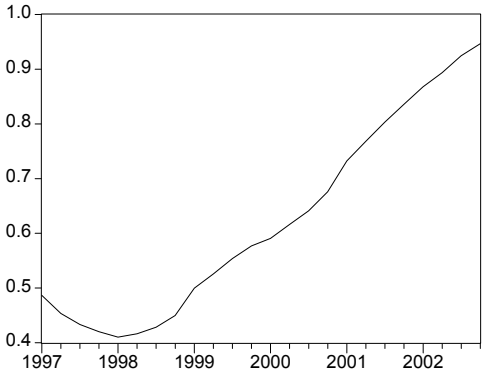

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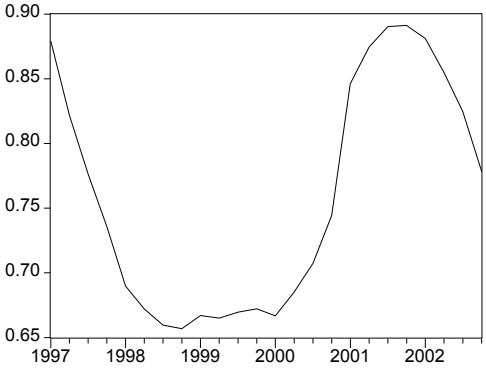

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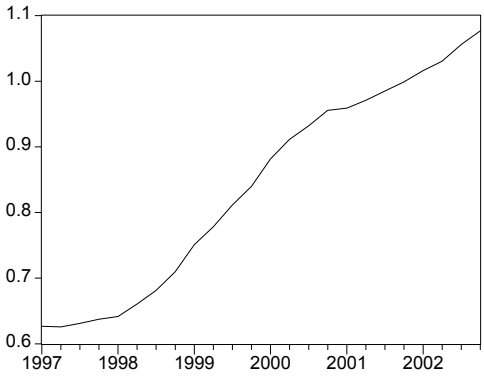
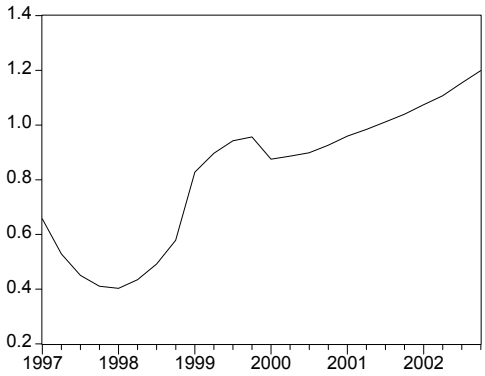
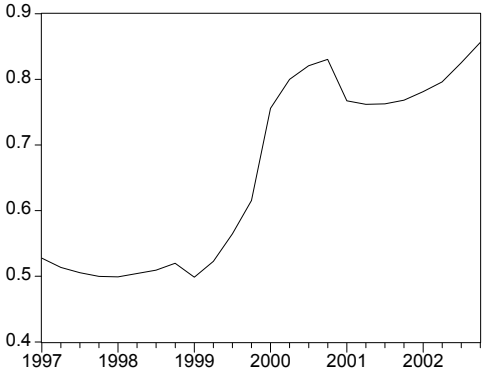


Heves



Jász-Nagykun-Szolnok



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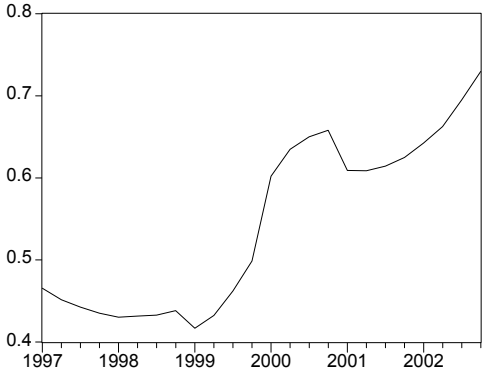

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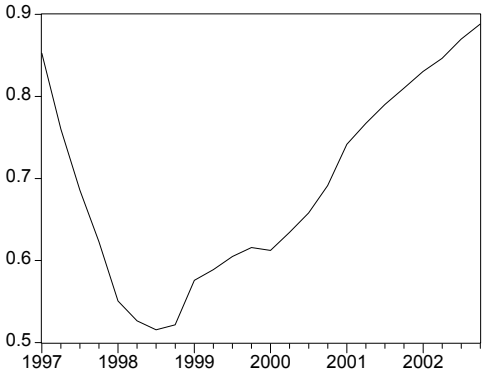

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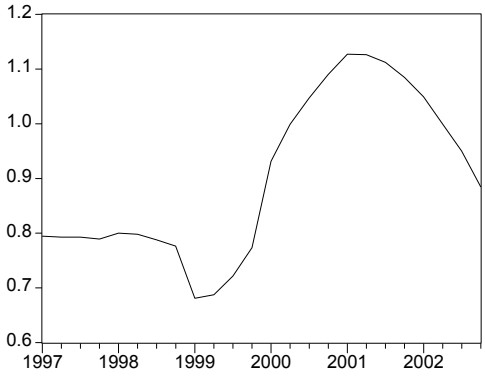

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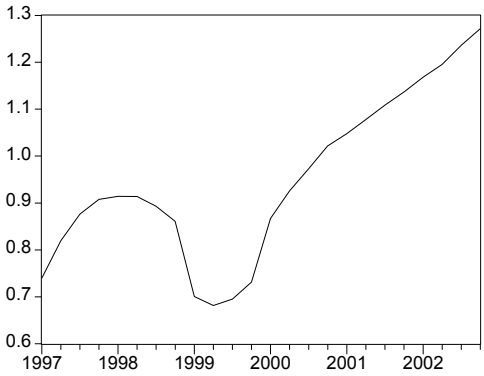

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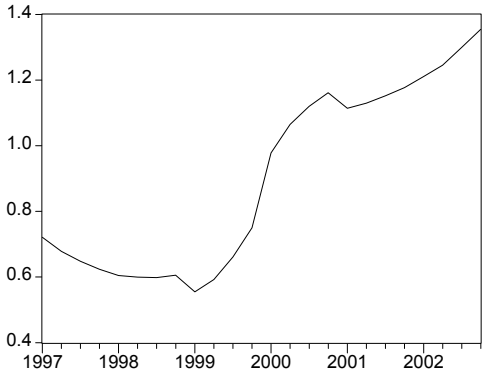

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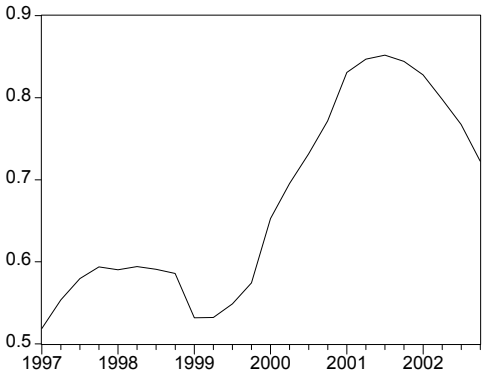
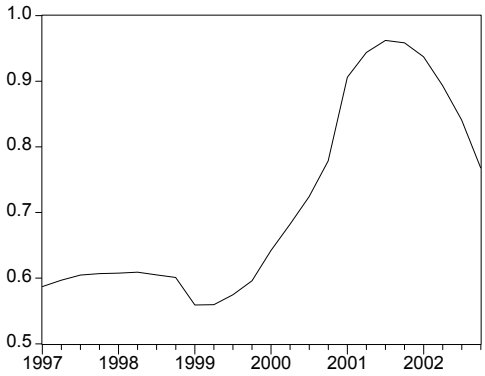
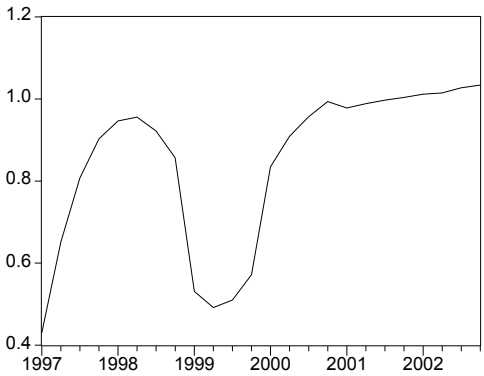


Vas



Veszprém



Zala