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**Monetary Policy Transmission Through Housing**

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# Monetary Policy Transmission Through Housing

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## Abstract

This paper provides empirical evidence for the role of house prices and residential investment in the monetary policy transmission to consumption for a broad sample of European countries. We find that the housing market is important in both, non-euro area, Nordic countries with flexible mortgage markets and large securitization activity and in some euro area countries with less developed mortgage markets. The difference between both is that instead through variations in house prices, transmission in the euro area takes places through changes in housing investment. The similarity is the high loan-to-value (LTV) ratios observed across all of them. The degree of mortgage market development can be in so far informative about the strength of the transmission through housing, as it signals the degree of leverage in the economy.

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# 1 Motivation

The housing market plays an important role in the transmission of monetary policy shocks to economic activity. Unlike other investment assets, housing is spread more evenly across the population. It comprises more than half of household total net worth in Europe, which makes consumption decisions vulnerable to changes in house prices and residential investment. The use of housing property as collateral in the credit market amplifies the impact of the housing market in the monetary transmission mechanism by changing the value of the balance-sheet position of borrowers. The importance of housing as collateral became obvious in the wake of the global financial crisis of 2007-09 when the credit-risk position of subprime borrowers deteriorated following a fall in house prices. The role of house prices in the monetary transmission mechanism has been largely studied in the past decade, which was characterized by the emergence of unprecedented housing bubbles in many industrial countries. And yet, it is still not clear, whether the housing markets in countries with more flexible mortgage markets were more strongly involved in the monetary policy transmission mechanism than in countries with less developed credit markets.

The majority of the empirical studies, which assess the role of housing in the monetary policy transmission mechanism, analyzes the effect of monetary policy and housing shocks by looking at impulse response functions. In order to disentangle the ‘housing effect’ stemming from an unexpected monetary policy shock, we conduct a counterfactual experiment ‘turning off’ the effect of the housing market on consumption expenditure. The difference between the estimated and the counterfactual impulse responses is called the ‘housing effect’. Previous studies by Ludvigson et al. (2002), Giuliadori (2005) and Elbourne (2008) use a similar approach to account for the role of wealth (Ludvigson et al. (2002)) or house prices (Giuliadori (2005)) in the monetary policy transmission mechanism. However, the findings are mixed. While Giuliadori (2005) argues that house prices play an important role in the monetary policy transmission to output in countries with well-developed mortgage markets (e.g. the Netherlands, Spain, Sweden, UK), the other two studies do not find that wealth or house prices are of major importance in the USA or UK, countries with highly flexible mortgage markets. Calza et al. (2011) assess empirically the role of the housing finance structure for the monetary policy transmission to consumption by comparing impulse response functions from two type of countries, classified according to their degree of mortgage market development or prevailing type of mortgage rate contract. They find that consumption does not necessarily respond stronger to monetary policy shocks in countries more flexible mortgage markets. Indeed, it is significantly more responsive only in countries, in which mortgage equity withdrawal (MEW) is available or in which variable mortgage rate contracts are more common, but not in countries with high mortgage debt or high leverage.

The heterogeneity of the mortgage markets within the euro area may then has as a consequence that the monetary policy of the European Central Bank has different effects on consumption associated with

the housing market in these countries. This paper therefore tries to contribute to the existing literature by quantifying the differences in the monetary policy transmission to consumption, stemming from the housing markets, across euro area member states. Furthermore, we provide new evidence of the role of the housing market in the monetary transmission mechanism by comparing housing effects across European countries with more and less flexible mortgage markets. The paper, which is at closest to our study, is that of Giuliadori (2005). However, our research differs from the one by Giuliadori (2005) in several aspects. First, the estimation sample is extended to include the period since the introduction of the euro, as we want to analyze the differences in the monetary transmission mechanism, which are attributed to the housing market, across the euro area member countries. Second, we analyze the role of the housing market not only by looking at variations in house prices or wealth but also at changes in residential investment. Indeed, in many European countries the construction sector has undergone substantial growth and has accounted for e.g. one-tenth of the total gross domestic product (GDP) in Ireland and Spain. The transmission of monetary policy innovations through variations in residential investment in the euro area may, therefore, be important and contribute more strongly to changes in consumption than through variations in house prices. Third, we account for housing effects on consumption and not on total output, as a large housing effect on output may be associated with variations in (residential) investment and not necessarily in consumption. And fourth, we come to partially different results.

We find significant housing effects stemming from variations in house prices in non-euro area, Nordic countries (Denmark, Norway, Sweden), whose flexible mortgage markets are characterized by large securitization activity. However, large housing effects have also been observed in three euro area countries (Ireland, Finland, France), which instead have a low index of mortgage market development. Thus, although monetary policy in the euro area affects consumption through the housing market only in three out of ten countries, its impact is large. The difference in the role of the housing market in the monetary transmission mechanism between the euro area and non-euro area is that, instead through variations in house prices, transmission in the euro area takes place rather through changes in housing investment. Therefore, our results are only partially consistent with previous studies, who argue that housing plays an important role in the monetary policy transmission mechanism in countries with well-developed mortgage markets. The availability of securitization, MEW and variable mortgage rate contracts can enhance the housing collateral effects. However, there are countries with a large share of variable rate mortgages (e.g. Italy, Portugal, Spain, UK), countries, in which MEW is also available (e.g. UK) and countries, in which securitization is also commonly used (Spain, UK), in which no housing effects are observed. Moreover, strong housing effects are also observed in countries with a low mortgage market index of development (e.g. Finland, France, Ireland). The existence of housing effects may thus rather depend only on specific institutional features of mortgage markets, which differ across countries. Instead, common for all countries, in which housing effects have been observed, are the high LTV ratios. This

finding shows the importance of households' leverage in the monetary policy transmission through housing and suggests that housing effects may be then observed, when institutional factors, such as MEW and securitization, abet the built-up in households' and financial market leverage. However, even if households are leveraged, their consumption expenditure can be less affected if the changes in their collateral and the cost of credit are balanced by expenditure stimuli such by e.g. fiscal policies. Accounting for additional variables may be therefore important in order to explain, why in countries with flexible mortgage markets and high LTV ratios, such as the UK, no housing effects are observed.

The paper is structured as follows. Section 2 assesses the channels of monetary policy transmission through housing and examines institutional differences of mortgage markets across 14 European countries. Section 3 presents the empirical estimation including data, methodology, model specification and identification. Impulse response functions and variance decomposition are analyzed in Section 4. The results of the counterfactual simulations are presented in Section 5 and differences in the housing effects across countries are discussed. Finally, Section 6 concludes.

## 2 Housing channels in the monetary transmission mechanism

This section addresses the theory associated with the role of the housing market in the monetary policy transmission mechanism to consumption. The transmission through housing can be attributed to wealth or collateral effects. While the wealth effect assumes a change in permanent income and does not explicitly account for information asymmetries on financial markets, the collateral effect accounts for credit market imperfections and does not imply an increase in overall wealth.

### 2.1 Wealth effects

The wealth effect is based on the permanent-income/life-cycle hypothesis of consumption of Ando and Modigliani (1963), according to whom an increase in overall wealth has a positive effect on household consumption. This effect operates at an individual level and on the basis that income expected over the entire lifetime determines current consumption spending. Changes in the wealth position of households should have a strong impact on consumption taking into account that more than a half of household wealth in the countries of our sample is housing. The wealth channel associated with changes in housing worth is well documented in the literature (see e.g. Iacoviello (2004), Benjamin et al. (2004), Case et al. (2005), Chen (2006), Chen et al. (2010)). An easing in monetary policy can increase the net present value of the housing wealth and foster household consumption spending.

However, the strength of the wealth effect on consumption is uncertain and subject to distributional effects, depending on who is benefitting from the increase in house prices (see Mishkin (2007)). Real estate is not only an investment asset yielding high returns when interest rates are low, but also a

consumption good providing housing services, whose price is the rent for tenants or the *imputed* rent for homeowners. An increase in the house price is associated with an increase in the price for ‘consuming’ housing services (see Iacoviello (2000) and ECB (2009b)). Higher opportunity costs can thus offset the wealth effects even though mortgage payments do not change. For homeowners who plan to spend their entire lives in the same house, a higher opportunity cost may offset the increase in wealth (Mishkin (2007)) or even lead to *negative* wealth effects. Furthermore, households that treat changes in housing wealth as permanent, may change their consumption expenditure to a greater extent than households that treat their wealth increase as temporary.<sup>1</sup> The strength of the wealth effect can also depend on the age and the financial position of the households. Souleles (1999) shows that wealthier homeowners are less likely to increase their consumption when interest rates decrease than young and less wealthy first-time home-buyers.<sup>2</sup> The housing wealth effect is likely to be stronger for younger households, because the younger the households, the longer the time horizon that remains for them to work (Attanasio et al. (2005)). Accordingly, if there is a change in their future earnings expectations (e.g. higher expected productivity, lower expected taxes) or a reduction in uncertainty, the net present value of total earnings over their entire lifetime changes.

Table 1: Institutional factors of mortgage markets across European countries

Country	RMBS / resid. lending	Covered bonds/ resid. lending	Resid. mrtg. debt/ GDP	Mrtg. rate type (a)	Share of variable mrtg. rate	Typical mrtg. maturity (in years)	Average typical LTV ratio	MEW	Index of mrtg. market flexib.
	2007	2010	2010	2010	2007	2007	2008	2007	2008
Belgium	13	n.a.	46	fix (10)	10	20	80	no	34
Denmark	n.a.	100	101	var.	50	30	80	yes	82
Finland	n.a.	13	42	var.	96	20-25	72	yes	49
France	1	25	41	fix (12)	15	19	91	no	23
Germany	0	19	47	fix (5)	15	25-30	74	no	28
Ireland	1	21	87	var.	67	31-35	83	ltd	39
Italy	8	8	22	var.	47	22	65	no	26
Netherlands	7	7	107	fix (5)	18	30	80	yes	71
Norway	n.a.	32	70	var.	n.a.	17	70	yes	59
Portugal	5	24	66	var.	99	30-40	56	n.a.	n.a.
Slovenia	n.a.	n.a.	14	var.	80	20	52	n.a.	n.a.
Spain	9	50	64	var.	91	30	60	ltd	40
Sweden	1	67	81	var.	50	40	80	yes	66
UK	13	14	85	var.	72	25	76	yes	58

Sources: EMF (2006), Cardarelli et al. (2008), ECB (2008), ECB (2009a), Calza et al. (2011), EMF (2010)

Note: All values in percent, unless otherwise indicated. RMBS stands for residential mortgage backed securities, resid. for residential, mrtg. for mortgage, var. for variable, LTV for loan-to-value, MEW for mortgage equity withdrawal, ltd. for limited, flexib. for flexibility; (a) this is the prevailing type of mortgage rate contracts; values in parentheses indicate the typical mortgage rate fixation period in years. Countries with variable mortgage rate contracts fix the mortgage rate typically for 6 months or one year. For example, in Portugal and Spain rates are typically fixed to Eurobor for 1 year; in Denmark to Cibor for 6 months. Denmark has a share of variable mortgage rate loans of nearly 50% on the national definition, but only 30% on the definition by the European Mortgage Federation (EMF). Variable rate mortgage contracts in Denmark were introduced in 1997.

## 2.2 Collateral effects

Due to the theoretical considerations, mentioned in the previous subsection, that housing wealth might have only small net effects on overall consumption, differences in the strength of the housing effect among

<sup>1</sup>Zhu (2005) argues that households treat changes in house prices as permanent, and changes in stock prices as temporary. This explains differences in the wealth effect stemming from the housing as opposed to the stock market; see also Case et al. (2005).

<sup>2</sup>See also Mian and Sufi (2011) for a discussion of the effect of house price increases on younger homeowners.

countries could be, instead, explained by the collateral effect. The collateral effect, in contrast to the wealth effect, does not imply a change in lifetime consumption, but in the timing of consumption, because an increase in collateral value does not increase overall household wealth (Bernanke and Gertler (1995), Benito et al. (2006)). In frictionless credit markets, a change in the collateral value does not affect bank and investment decisions. However, due to information asymmetries in credit markets, households can borrow more against the collateral value of their homes when house prices increase.

On the one side, the collateral effects can stem from the credit channel of monetary policy. According to the ‘financial accelerator’ approach proposed by Bernanke and Gertler (1989) (see also Aoki et al. (2004)), higher collateral values reduce the gap between risk-free and effective interest rates. The lower the risk premium, the cheaper it is for households to borrow, thus boosting consumption and residential investment (see Kuttner and Mosser (2002) and Mishkin (2007)).

On the other side, the collateral effect can also be associated with an easing of credit constraints resulting from the risk taking channel of monetary policy, presented by Borio and Zhu (2008). They define the risk-taking channel as “the impact of changes in policy rates on either risk perceptions or risk-tolerance and hence on the degree of risk in the portfolios, on the pricing of assets, and on the price and non-price terms of the extension of funding”. The observation that measures of risk, such as default probabilities, volatilities and correlations, behave procyclical, manifests the influence of interest rates on risk perceptions and risk-taking incentives of banks. One set of effects through which this channel operates is closest in spirit to the financial accelerator mentioned above and “may be thought of as a way of strengthening its impact” (Borio and Zhu (2008)). The idea is that risk tolerance increases with the increase in wealth. Lower interest rates can boost the collateral values for households and equity values of banks, which in turn can increase risk tolerance. Recent research (see Gambacorta (2009), Ioannidou et al. (2009), Altunbas et al. (2010), Dell’Ariccia et al. (2010), Buch et al. (2011), Delis and Kouretas (2011), Maddaloni and Peydro (2011)) provide theoretical and empirical evidence for the existence of the risk-taking channel in both the USA and the euro area. Ioannidou et al. (2009) find that following an ease in monetary policy, banks are more likely to grant loans to subprime or riskier borrowers. Maddaloni and Peydro (2011) show that low short-term interest rates in the euro area and the USA soften credit standards and this effect is further amplified by securitization activity and weak supervision for bank capital.

As a consequence, financial intermediaries and households can increase their leverage. Banks would increase credit supply by lowering credit standards and providing loans also to subprime borrowers. The collateral effect may have stronger impact on consumption of borrowers with low credit scores than of unconstrained individuals because the former may have stronger preference for current consumption than for future consumption. Indeed, Tobin (1980) argues that highly indebted households have a higher long-run marginal propensity to consume than other households. Iacoviello (2005) and Song (2011)

show that when allowing for collateral effects, a dynamic stochastic general equilibrium (DSGE) model matches better the results from VAR estimations. The authors find that credit-constrained households are substantially more responsive to monetary policy and housing shocks than unconstrained individuals. Furthermore, Ortalo-Magne and Rady (2006) find that in a life-cycle model with housing a decrease in the down-payment ratio for young households can cause house prices to overshoot.

Indeed, variations in residential investment may also be associated with collateral effects. When interest rates are low, the construction industry has also easier access to credit and construction firms can increase their leverage. An increase in investment increases also overall employment during a housing boom and can be associated with an increase in household income. During a bust, in turn, salaries and unemployment contract. In countries, in which the increase in construction is accompanied by an increase in employment, the housing effects may also be associated with collateral effects because this employment growth is often financed via the boom-cycle by increasing leverage.

### **2.3 Factors of mortgage market flexibility**

Higher mortgage indebtedness in some economies could, therefore, be indicative of looser credit conditions and the existence of collateral effects. Such countries include Denmark, the Netherlands, Ireland and the UK, in which mortgage debt represents between 80% and 100% of the GDP (see Table 1). At the other end are Italy, Belgium and France with a share of one-fifth to one-third of the GDP. It has therefore been widely argued, that in countries with flexible mortgage markets, the housing market would play a more prominent role in the monetary policy transmission mechanism. Among the European countries with the highest mortgage market development are Denmark, the Netherlands, Norway, Sweden and UK, according to an index constructed by Cardarelli et al. (2008) (see Table 1). The reason is that institutional features of mortgage markets, such as the availability of MEW, securitization, high LTV ratios, variable mortgage rate contracts, etc. can contribute to an increase in mortgage debt and households' leverage.

Several studies (see Greenspan and Kennedy (2005), Cardarelli et al. (2008)) emphasize the role of MEW in consumption because it allows households to tap into their housing wealth and extract housing equity when house prices rise. Households in countries in which MEW is available, such as the Nordic countries (Denmark, Finland, Norway, Sweden) and the Anglo-Saxon countries (Ireland, Netherlands, the UK), could therefore react more strongly to changes in house prices (see Table 1). Instead, in the majority of the euro area members, MEW is not available due to legal protection of collateral and long legal procedures for repossessions (Hoeller and Rae (2007)). Some studies (see Benito et al. (2006) and Mishkin (2007)), however, argue that households who withdraw equity are more likely to use the funds to pay off debt rather than feed them back into consumption. Moreover, homeowners who undergo a substantial appreciation of their homes are most likely less or even not credit constrained, so MEW



should be “the last step on the way to higher consumer spending” according to Mishkin (2007).

Two key indicators of mortgage market’s ability to provide end-borrowers access to financing are LTV ratios and mortgage loan maturity. High LTV ratios and long maturities make households more vulnerable to changes in house price and can strengthen the collateral effect on consumption. LTV ratios ranging between 80% and 100% are typical in Belgium, Denmark, France, Ireland, the Netherlands and Sweden (see Table 1). The lowest LTV ratios of about 60% are observed in the Mediterranean countries and can be explained by the existence of asymmetric information between borrowers and lenders, weak legal enforcement of repurchases or considerable variations across the individual country’s regions (see Hoeller and Rae (2007)).

Consumption in countries, in which variable rate mortgage contracts are available, can be more responsive to changes in interest rates due to the direct effect on debt service costs. Indeed, Table 1 shows that variable rate mortgage contracts are available in the majority of the countries, excluding Belgium, France, Germany and the Netherlands. The type of interest rate contract can be either supply or demand in character and can be explained by legislative incentives for banks, as in Spain, unfamiliarity with long-term fixed-rate products, as in the UK, or shifts in the term structure of interest rates, as in Italy.

Funding via the capital markets through securitization enables banks to set free reserves and provide more credit to households, thereby contributing to an increase in the stock of household mortgage debt. Residential mortgage backed securities (RMBSs) are common mainly in the UK, where they accounted for about 13% of total residential lending in 2007 (see Table 1). In the majority of the European countries, however, the funding of banks through credit markets is carried out by issuing covered bonds.<sup>3</sup> Covered bonds finance 100% of total residential lending in Denmark due to the existing legislative framework, 67% of that in Sweden and 50% in Spain.

### 3 Empirical analysis

Due to the mixed results about the role of the housing market in the monetary policy transmission and the strong heterogeneity on the mortgage markets in Europe, we conduct a counterfactual simulation within a VAR framework in order to disentangle the effects, which are attributed to the housing market. The empirical analysis is thus conducted in two steps. First, a VAR has been estimated for each country. Impulse responses and the variance decomposition have been then analyzed. Second, for each country a counterfactual experiment is conducted and the differences in the housing effects have been discussed.

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<sup>3</sup>Covered bonds come from the German concept of *Pfandbrief*. The difference between covered bonds and RMBSs is that, unlike RMBSs, in the event of a default of a covered bond, “the investors’ claim is not limited only to the mortgage pool of the special purpose vehicle, but to the issuer as well” (Ahearne et al. (2005)).

### 3.1 Data

The empirical analysis is conducted for 14 European countries: ten euro area member states – Belgium, Finland, France, Germany, Ireland, Italy, Netherlands, Portugal, Slovenia and Spain – and four non-euro area countries – Denmark, Norway, Sweden and UK. Given the risk of omitting important information by using a small model, we attempt to find a trade-off between constructing a good economic model and saving degrees of freedom. Therefore, the VAR is limited to the five most important variables, which are involved in the monetary transmission mechanism through the housing market. Each country model consists of the following variables: a consumer price index (CPI) ( $p$ ), real private consumption expenditure ( $c$ ), real residential gross fixed capital formation in housing ( $hi$ ), real house prices ( $hp$ ) and a short-term money market rate ( $r$ ). Moreover, the oil price index has been included as an exogenous variable in order to account for inflation expectations. The majority of the time series except house prices are taken from the International Financial Statistics (IFS) of the International Monetary Fund (IMF). Where IFS data was not available, data from the OECD or national sources was acquired. For the majority of the countries, house prices were available from the OECD, which constructs the indices using national sources. House price indices for Belgium and Portugal were obtained from the Bank for International Settlements (BIS). House prices for Slovenia are taken from the Slovenian statistical office and Slonep. All data except interest rates are seasonally adjusted and converted into natural logarithms.

### 3.2 Estimation period

We estimate the model with data starting in the early 1990s up to 2008.<sup>4</sup> The exact estimation period for each country is documented in Table 2. As we are interested in monetary policy shocks, the sample period excludes the global financial crisis, due to the change in the monetary policy instruments and the minor role played by the interest rate as such. The estimation starts in the early 1990s for two reasons. First, in the late 1980s, structural reforms on the financial and mortgage markets in Europe took place. Second, the euro convergence criteria related to the monetary union were established by the Maastricht Treaty in February 1992. This may have led to structural changes in the conduct of policies in the euro area countries due to the fulfillment of the Maastricht criteria. Indeed, Chow tests do not show any significant break points in the model of each country.

### 3.3 Methodology

The reduced-form VAR is given by

$$Y_t = C_1 Y_{t-1} + \dots + C_p Y_{t-p} + u_t \quad (1)$$

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<sup>4</sup>Estimation for Portugal, Slovenia and Spain starts in 1995 due to the lack of either housing investment or house price data prior to that.

where  $Y_t$  represents a  $5 \times 1$  vector of endogenous variables at time  $t$ , depending on  $p$  lagged vectors of the endogenous variables, with  $p$  the number of the lags.  $C_1$  to  $C_p$  are  $5 \times 5$  coefficient matrices. The vector of the forecast errors,  $u_t$ , does not correspond to a particular fundamental economic shock, therefore, a structural VAR model has been estimated in the form

$$AY_t = AC_1Y_{t-1} + \dots + AC_pY_{t-p} + \varepsilon_t \quad (2)$$

with  $Au_t = \varepsilon_t \Leftrightarrow u_t = A^{-1}\varepsilon_t$ . The  $\varepsilon_t$  is a  $5 \times 1$  vector of fundamental economic shocks. Equation (2) can be rewritten as

$$AY_t = AC_1LY_t + \dots + AC_pL^pY_t + \varepsilon_t \quad (3)$$

with  $L^pY_t = Y_{t-p}$ . For the means of the calculation of the impulse responses and later for the counterfactual simulation, we express the vector of the dependent variables  $Y_t$  only in terms of the structural shocks  $\varepsilon_t$

$$Y_t = (I - C_1L - \dots - C_pL^p)^{-1}A^{-1}\varepsilon_t. \quad (4)$$

which can be rewritten as

$$Y_t = \Psi_0\varepsilon_t + \Psi_1\varepsilon_{t-1} + \Psi_2\varepsilon_{t-2} + \dots \quad (5)$$

with  $\Psi$ , the matrices of the response coefficients to a one standard deviation (SD) shock in  $\varepsilon_t$ . Indeed, for the computation of the baseline and counterfactual impulse response functions from (5), the matrices  $A$ ,  $C_1, \dots, C_p$  should be first estimated. The lagged coefficient matrices  $C$  are estimated via an OLS regression of the reduced-form VAR given in (1). The  $A$  matrix stems from the structural VAR in Equation (2), which is estimated via maximum likelihood. Once  $A$ ,  $C_1, \dots, C_p$  are estimated, the counterfactual simulation is conducted. The counterfactual impulse responses are calculated from (4), setting to zero the contemporaneous and lagged coefficients in front of the housing variables in the consumption equation. ‘Shutting off’ the effects on consumption, which stem from the housing market, will however have little impact if consumption is largely predictable by its lagged values and not much by means of other variables.

### 3.4 Tests and specification

The VAR is estimated in levels due to the short-term character of the monetary policy shock. In order to account for the non-stationarity of the variables, the model can be alternatively estimated in first differences, however, important information contained in the levels is then lost and could lead to a misspecified or over-differentiated model. On the other side, the VAR can be estimated in its error-correcting form thus imposing long-run restrictions. Because such restrictions should be based on economic theory, they are often controversial and unreliable and can lead to potential inconsistency when incorrectly identified. Unit root Augmented Dickey Fuller (ADF) and Kwiatkowski Phillips Schmidt Shin (KPSS)

tests show that the variables are stationary either in first differences or in levels (see Table 2). Although it is often argued that estimating a VAR with non-stationary variables would produce inefficient estimates because existing stochastic trends arising from the long-run dynamics are not considered, Sims et al. (1990) show that VARs with some unit roots can be estimated consistently in levels when the variables are cointegrated. According to Trace and maximum eigenvalue (ME) tests, the variables are integrated of rank order between 1 and 3 (see Table 2). Therefore, the models can be consistently estimated in levels. The number of the lagged endogenous variables included in each model is determined following the Akaike (AIC), Schwarz (SC) or Hannan-Quinn (HQ) information criterion. If remaining residual autocorrelation is detected by a LM test, the lag length has been gradually increased. The lag order for the countries in the sample ranges between 1 and 3 (see Table 2).

Table 2: Estimation period, lag length, unit root tests, and cointegration tests

Country	Estimation period	Lag length	$p$	Unit root tests (a)				Cointegration (b)	
				$c$	$hp$	$hi$	$r$	Trace	ME
Belgium	1990:1-2007:4	3	I(1)	I(1)	I(1)	I(1)	I(1)	2	2
Denmark	1990:1-2008:1	2	I(1)	I(1)	I(1)	I(1)	I(1)	2	2
Finland	1990:1-2008:2	1	I(0)	I(1)	I(1)	I(1)	I(1)	2	2
France	1992:1-2008:1	2	I(1)	I(1)	I(1)	I(1)	I(1)	2	2
Germany	1992:1-2007:4	2	I(1)	I(1)	I(1)	I(1)	I(0)	2	1
Ireland	1990:1-2008:1	3	I(1)	I(1)	I(1)	I(1)	I(1)	2	3
Italy	1990:1-2008:2	2	I(0)	I(1)	I(1)	I(1)	I(1)	3	3
Netherlands	1990:1-2008:1	2	I(1)	I(1)	I(1)	I(1)	I(1)	2	2
Norway	1990:1-2008:2	1	I(1)	I(1)	I(1)	I(1)	I(1)	1	1
Portugal	1995:1-2008:2	1	I(1)	I(1)	I(1)	I(1)	I(1)	2	2
Slovenia	1995:1-2008:2	2	I(1)	I(1)	I(1)	I(1)	I(0)	3	2
Spain	1995:1-2008:1	1	I(1)	I(1)	I(0)	I(1)	I(1)	1	1
Sweden	1993:1-2008:2	3	I(1)	I(1)	I(1)	I(1)	I(1)	3	1
UK	1991:1-2008:2	1	I(1)	I(1)	I(1)	I(1)	I(1)	3	2

Note:  $p$  stands for CPI,  $c$  for consumption,  $hp$  for house prices,  $hi$  for housing investment,  $r$  for short-term money market rates. I(1) stands for integrated of order one; I(0) for a stationary variable. (a) Results from ADF and KPSS tests with intercept in the first difference. The results are based on the AIC, SC or HQ information criterion and are significant at the 95% confidence level. (b) Results for the number of cointegration relationships in the VAR, according to a Trace or a maximum eigenvalue (ME) test. The estimation is conducted with an intercept in the cointegration equation and a linear deterministic trend in the data. Rank is significant at 95% confidence level.

### 3.5 Identification

The fundamental shocks in each country are identified by a Choleski decomposition of the estimated covariance matrix of the reduced-form residuals from Equation (1). Assuming a recursive structure of the true economic model is plausible mainly for two reasons. First, imposing the same ordering of the variables, and thus the same restrictions, enables the comparison of the effects from monetary policy and housing shocks across the countries. If a specific non-recursive structural identification based on economic considerations is imposed, then it might be plausible for some countries but not for others. Second, as we are interested mainly in the identification of the monetary policy shock, a recursive identification structure should not be problematic and should correctly identify the shock.

The vector of endogenous variables is given in the order  $Y_t = (p_t, c_t, hp_t, hi_t, r_t)$ . The short-term interest rate is ordered last thus allowing it to respond contemporaneously to variations in all other variables in the model. This identification follows the considerations in Bernanke and Blinder (1992), who

assume that monetary authorities are concerned about the dynamics of macroeconomic variables such as inflation, consumption, investment and house prices. Similar identification is applied by Ludvigson et al. (2002) and Giuliadori (2005), who also model the monetary policy transmission including wealth or house prices respectively. The oil price has been included as an exogenous variable in the VARs and is used as a proxy for forward-looking inflation expectations. The results from the impulse response functions show that monetary policy shocks are correctly identified, as no significant price puzzles are observed in the majority of the countries.<sup>5</sup>

Concerning the identification of the housing shocks, it is assumed that house prices are influenced contemporaneously by the price level and consumption but not by residential investment. We order housing investment after house prices because we argue that building companies and residential investors can observe variations in housing demand in the same quarter. Instead, home-buyers observe the supply of housing only with a lag. This identification implies that construction firms are better off than households in acquiring housing-related information, which is often the case, especially in less flexible housing and mortgage markets. The assumption that house prices and residential investment do not depend on the current interest rate level is plausible even in countries, in which the prevailing mortgage contracts have variable rates. This is due to the fact that variable mortgage rates are often adjusted only once in an year.

## 4 Impulse response analysis

Before we analyze the role of the housing market in the monetary policy transmission to consumption by disentangling the housing effect in each country, we conduct a two-step impulse response analysis of the transmission through housing. In the first step, the effects of a monetary policy shock to house prices and residential investment have been compared across countries. In the second step, the effects on consumption, stemming from a shock to the housing market, have been analyzed.

### 4.1 Monetary policy shock

A monetary policy shock, which increases interest rates by one standard deviation, has negative effects on house prices and residential investment in all countries (see Figures 1 and 2).<sup>6</sup> House prices decrease significantly after the shock in about two-thirds of the countries. The majority of the significant responses is observed in the Nordic countries (Denmark, Finland, Norway and Sweden) and in the Anglo-Saxon countries (Ireland, Netherlands, UK), as well as in France and Italy. Only in half of the euro area countries (Finland, France, Ireland, Italy, Netherlands/Spain) the reaction of the housing market – either house

<sup>5</sup>A price puzzle is observed in Germany even if the oil price is included as endogenous in the VAR model. The oil price index is included as endogenous and ordered first in the VAR for Slovenia due to a better model performance.

<sup>6</sup>The positive response of housing investment in Sweden is the only exception. Varying the estimation period or the lag length does not change the direction of the response, however, the effect turns insignificant.

prices or housing investment – is significant. Indeed, monetary policy shocks have insignificant effects on house prices only in countries belonging to the euro area. The transmission of interest rate shocks to the housing markets of these countries does not, however, necessarily depend on the type of mortgage rate contract, as the half of these countries have fixed mortgage rates. Moreover, with France and Italy, there are two countries with fixed rate contracts and low mortgage market flexibility, which nonetheless have significant housing responses. This result differs therefore from previous findings (see Calza et al. (2011)), who argue that the transmission of monetary policy shocks to residential investment and house prices is significantly stronger in those countries with larger mortgage market flexibility. We confirm their results only partially, as the majority of the countries, in which significant house price responses are observed, have rather more developed mortgage markets (e.g. Denmark, Netherlands, Norway, Sweden, UK). However, it seems that the strength of the housing market's reaction does not always depend on the extent to which the mortgage markets are developed or the type of mortgage contract. Especially on the supply side of the housing market there are no significant effects in countries with flexible mortgage markets or not belonging to the euro area, such as the Netherlands, Sweden and the UK. It seems that monetary policy shocks in these countries affect the demand side stronger than the supply side. Instead, if significant, the adjustment on the housing market in the euro area takes place by variations in both, supply and demand of housing.

Figure 1: Impulse responses of house prices to a one SD monetary policy shock

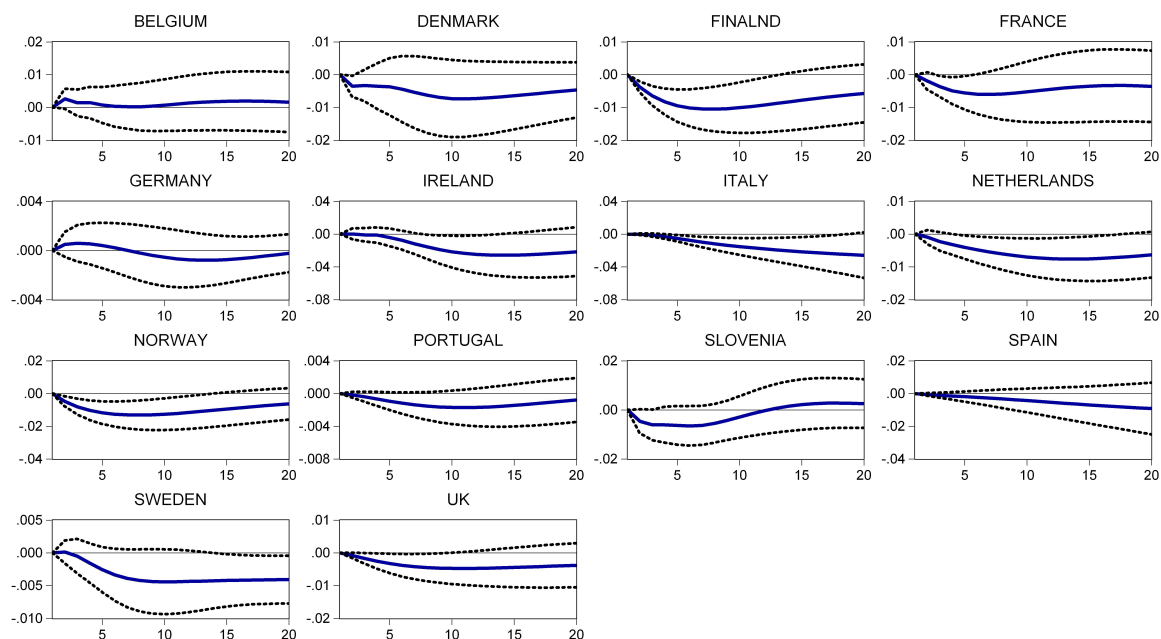
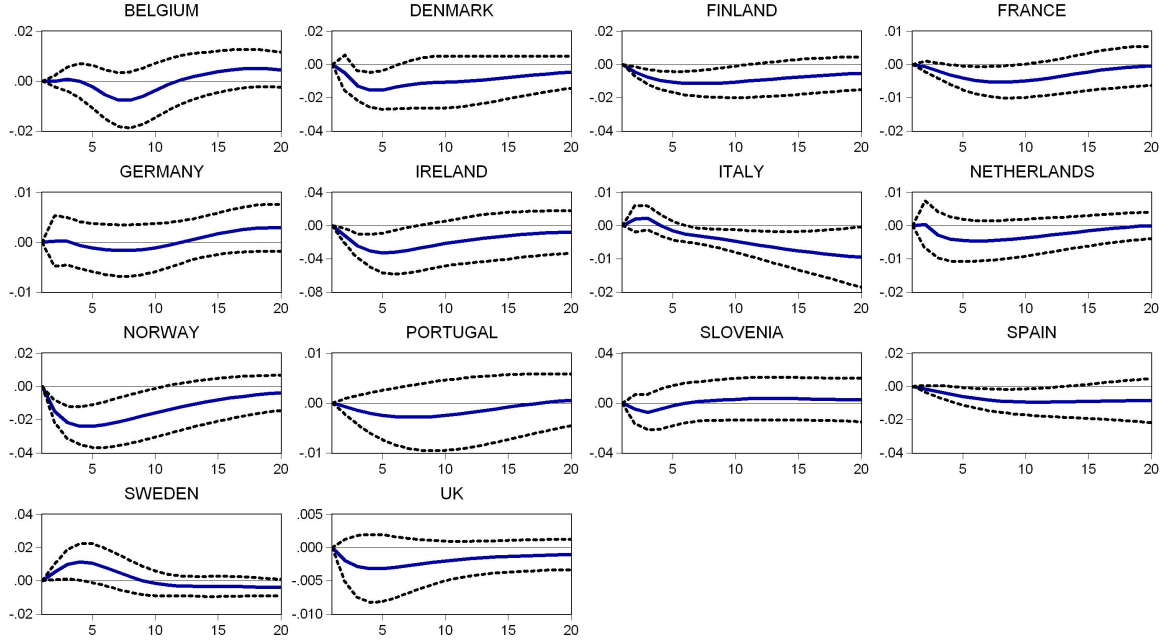


Figure 2: Impulse responses of residential investment to a one SD monetary policy shock



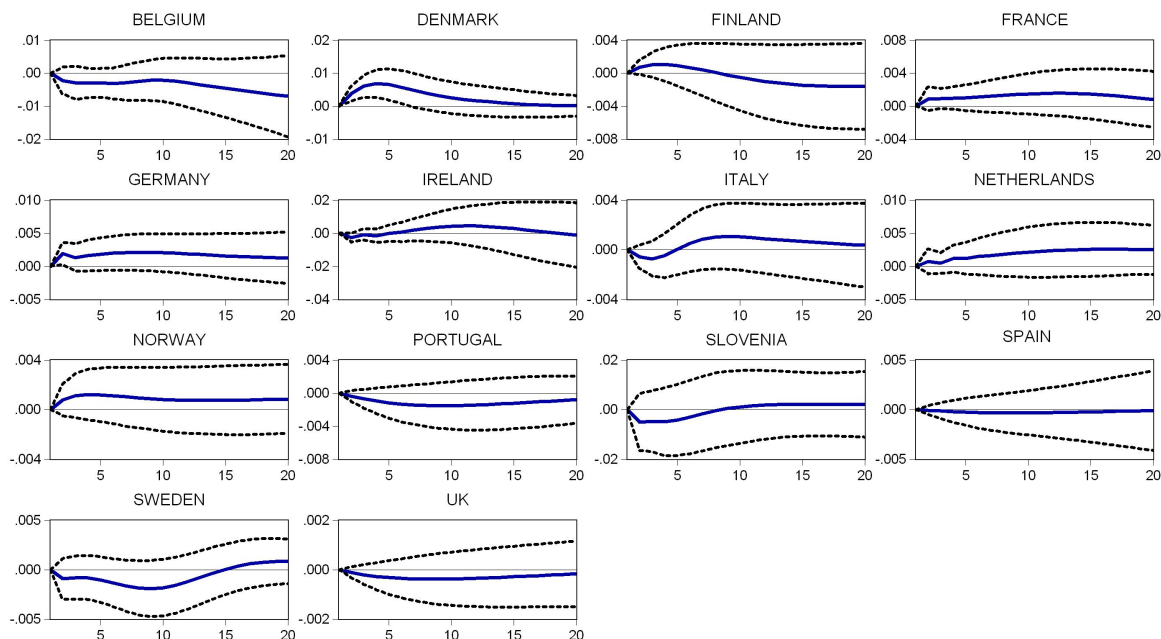
## 4.2 Housing shocks

The effect of a shock to residential investment on consumption differs from the effect stemming from house price shocks (see Figures 3 and 4). While an unexpected rise in residential investment has positive effects on consumption in the majority of countries, an increase in house prices does not always lead to higher consumption expenditure. Although the negative effect on consumption in Belgium, Portugal, Slovenia, Sweden and the UK might be associated with negative wealth effects, the impulse responses are insignificant and do not need any further interpretation. While a positive house price shock has significant effects only in Denmark, housing investment seems to be more important for consumption in the euro area countries. Anyway, three out of ten euro area countries (Ireland, Netherlands, Portugal) respond significantly positive to the shock in residential investment. Regarding the non-euro area countries, significant higher consumption following the shock is observed in Denmark and Sweden. Other countries with flexible mortgage markets, such as Norway and the UK, do not respond significantly to none of the housing shocks. The few significant impulse responses could mean that exogenous increases in the activity on the housing markets will not lead necessarily to higher consumption expenditure, but there might be rather factors on the credit markets which could contribute to an endogenous rise in housing demand and supply and so foster consumption. If exogenous housing shocks have though any direct effect on consumption, then it is due rather to a change in residential investment than in house prices.

Combining the results from both type of shocks – monetary policy and housing – suggests that the

housing market alone does not contribute much to variations in consumption neither in the euro area nor in the non-euro area countries. However, monetary policy has significant effects on the housing market in two-thirds of the countries. A counterfactual analysis conducted in the next section will thus enable to disentangle the part of the consumption response following a shock in monetary policy, which is explained by the housing market.

Figure 3: Impulse responses of consumption to a one SD shock in house prices



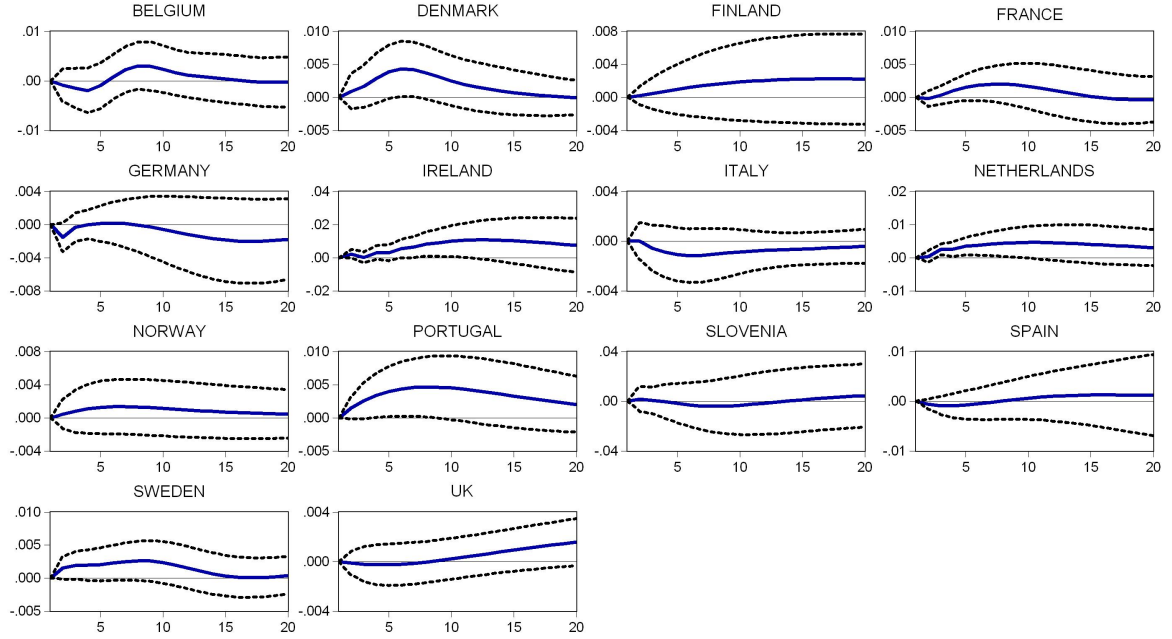
### 4.3 Variance decomposition

The results from the variance decomposition are in line with the significance of the impulse response functions from the previous two subsections. The strongest effect from a monetary policy shock is observed in Norway, with the shock explaining on average over 20 quarters 38% of the variation in residential investment and 30% of that in house prices (see Table 3). The shock also contributes strongly, by 12% to 15%, to the variation in housing investment in Denmark, France, Ireland and Italy. Instead, monetary policy shocks seem to be more important for house prices in Finland, Italy, the Netherlands and Sweden, explaining between 10% and 19% of their variation. To note is that monetary policy contributes to a similar extent to variations in the housing market in both, euro area and non-euro area countries, with the highest shares observed in about one-fourth to one-third of the countries from each economic area. Among them are, however, countries with less developed mortgage markets.

In the sense that the housing market channels the monetary policy shocks to economic activity, the contribution of housing shocks to consumption is also important. Housing markets in Denmark,



Figure 4: Impulse responses of consumption to a one SD shock in housing investment



the Netherlands and Sweden are strongly influenced by monetary policy, on the one side, but also explain a large share of the variations in consumption, on the other side. Therefore, they could be an important channel in the monetary transmission mechanism in these countries. A house price shock has the strongest effect in Denmark explaining on average over 20 quarters about one-fourth of the variance in consumption. A shock to residential investment contributes between 9% and 30% to variations in consumption in Denmark, Ireland, the Netherlands, Portugal and Sweden. Indeed, the highest shares of the variance explained by the shock are observed in two euro area countries, Portugal (30%) and the Netherlands (20%), what provides further evidence for the importance of residential investment for consumption in the euro area.

Table 3: Variance decomposition of impulse responses

Country	$hp$ to $c$	$hi$ to $c$	$r$ to $hp$	$r$ to $hi$
Belgium	9	3	1	5
Denmark	25	9	5	12
Finland	1	3	13	9
France	5	6	7	13
Germany	9	3	1	1
Ireland	3	11	7	15
Italy	2	3	19	13
Netherlands	4	20	10	3
Norway	1	1	30	38
Portugal	3	30	3	1
Slovenia	1	1	4	1
Spain	1	3	2	7
Sweden	4	14	12	1
UK	1	1	5	2

Note:  $hp$  stands for house prices,  $c$  for consumption,  $hi$  for housing investment,  $r$  for short-term money market rates. The values in the table are in percent and present the average share of the variable variance over 20 quarters explained by the corresponding shock (shock to interest rates, to house prices and to residential investment).

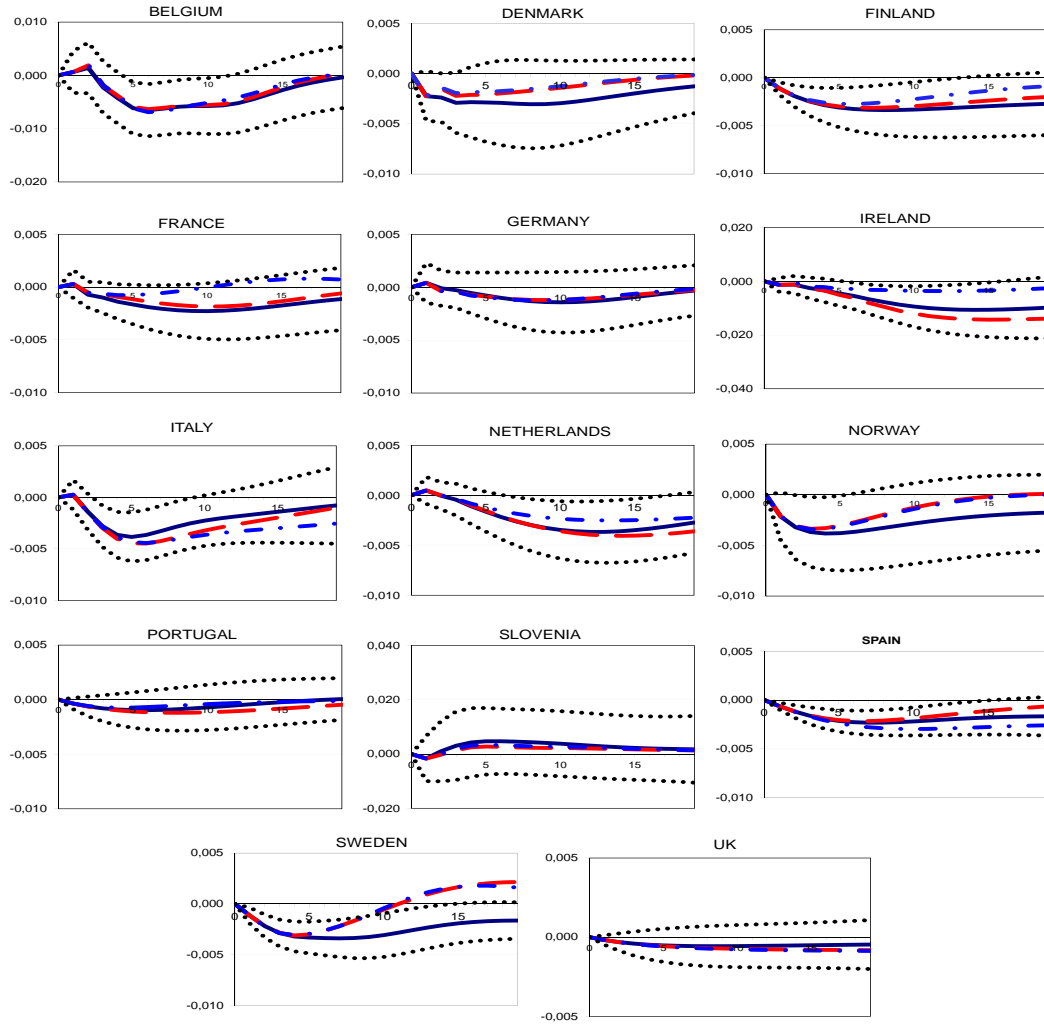
## 5 Counterfactual analysis

The role of the housing market in the monetary policy transmission mechanism to consumption is assessed through a counterfactual experiment. The effect stemming from the housing market is disentangled by comparing the impulse responses from the baseline VAR estimation from Section 4 against impulse responses, calculated under a counterfactual scenario, in which the effect of the housing market – house prices and residential investment – on consumption is set to zero. By conducting a counterfactual analysis, we address the question of how would consumption respond to monetary policy shocks if the housing market did not play any role for consumption decisions.

Figure 5 shows the baseline and counterfactual impulse responses of consumption following a monetary policy shock in each country. The dark blue (continuous) line is the impulse response from the baseline model. The red (dashed) line is the counterfactual response when the effect of house prices on consumption is set to zero. The blue (dash-dotted) line is the counterfactual consumption response when the effects of house prices and residential investment are turned off. Figure 5 shows that in the majority of the countries, counterfactual consumption responds to a less extent to the monetary policy shock than the baseline one. This means that without variations from the housing market, monetary policy tightening would have smaller impact on consumption. This result is in line with the theoretical considerations that the housing market can amplify the effect from interest rate shocks on consumption through wealth and collateral effects.

Nevertheless, the difference between both impulse responses in the majority of the countries is very small (see Figure 5). There are mainly the euro area countries, in which the housing effect is small, which is indicative of the minor role played by the housing market in the monetary policy transmission. In fact, monetary policy transmission through house prices is not observed in the euro area. Instead, house prices in the non-euro area countries Sweden, Norway and Denmark serve as an important transmission channel of monetary policy shocks to consumption. Noteworthy housing effects could also be observed for the Netherlands, however, the significance of the counterfactual impulse response function depends on the estimation period and the lag length. When the sample is estimated with one lag, as indicated by the Schwartz criterion, the difference between both responses is big. When the model is estimated with 2 lags instead, thereby accounting for some remaining residual autocorrelation, the housing effect disappears. The strongest housing effect is observed in Sweden. Under the counterfactual scenario, consumption would recover from the monetary policy shock by the 12th quarter, while under the baseline scenario it takes more than 20 quarters. Similarly, counterfactual consumption in Norway and Denmark fully recovers after 14, respectively 18 quarters. While the difference in both scenarios in Sweden arises after 1.5 years, in Norway it takes only one year and in Denmark, the house price effect appears almost immediately, after one quarter. Common for the 3 countries is that under the counterfactual scenario, the consumption response would have been only the half of the baseline impulse response. These results

Figure 5: Baseline and counterfactual impulse responses of consumption to a one SD monetary policy shock



Note: Dark blue (continuous) line – baseline model; red (dashed) line – counterfactual scenario with the effect of house prices on consumption set to zero; blue (dash-dotted) line – counterfactual scenario with the effect of house prices and residential investment on consumption set to zero; black (dotted) line – two standard deviations analytical confidence bands.

remain stable even if the lag order is changed or the estimation period extended or reduced by a few years.

Indeed, Sweden, Norway and Denmark are among the countries with the greatest index of mortgage market flexibility, constructed by Cardarelli et al. (2008) (see Table 1). Mortgage markets in these countries are characterized by the availability of MEW, securitization and high LTV ratios. The finding that house prices serve as a monetary policy transmission channel in above countries can be due to the fact that credit markets are the main funding source for mortgage lenders. In Denmark, residential lending is financed to 100% by the issuance of covered bonds, while in Sweden and Norway it is respectively 65% and 32% (see Table 1). According to data from the European Mortgage Federation (EMF), the size of the Danish covered bond market amounted to EUR 332 billion in 2010 and that in Sweden to EUR 198 billion in September 2011. Moreover, mortgage contracts in these countries are financed predominantly

by a variable mortgage rate and borrowers can withdraw additional mortgage out of the increase in their equity. The mortgage market flexibility regarding above funding source for mortgage lenders in these Nordic countries enables them to be less dependent on saving deposits. Indeed, Altunbas et al. (2009) and Gambacorta and Marques-Ibanez (2011) find that securitization is a source of capital relief and additional funding that can be used by banks to grant additional loans. When financial conditions are good and equity values increase, financial intermediaries can extend their balance sheets and increase credit supply. Therefore, under a limited number of eligible mortgage borrowers, the combination of securitization and variable mortgage rate contracts can lead in a low interest rate environment to the provision of mortgage loans also to individuals with lower credit scores. Such credit-constrained borrowers may respond stronger to changes in house prices because they are more leveraged than unconstrained households and, therefore, be more strongly affected by variations in the cost of credit. In turn, when monetary policy becomes more restrictive, as studied in this paper, leveraged borrowers with variable mortgage contracts can decrease consumption more strongly due to higher credit costs. This effect is amplified by the falling house prices, which lead to a decrease in the collateral values of households and financial intermediaries. As a consequence, both type of agents face problems with refinancing and credit stock and consumption fall. Therefore, the house price effects observed in Sweden, Norway and Denmark can be associated with collateral effects and can be a result from a loosening of credit standards, which enables the provision of credit to borrowers with less sound balance sheets.

In turn, in the majority of the euro area countries, no housing effects are observed, which could be due to low securitization and limited access to financing. However, Figure 5 shows that in two/three out of the ten euro area countries, the housing market also has a large impact on the transmission of monetary policy shocks to consumption. In these countries – France and Ireland (and in Finland but to a less extent) – the transmission takes place almost entirely through variations in residential investment and not in house prices. The counterfactual consumption response function, in which both – house prices and residential investment – are set to zero, deviates strongly from the baseline response, lying close to the zero-line. Instead, the counterfactual in which only the house price variable is ‘turned off’ does not differ much from the baseline function. The transmission through residential investment can take place through procyclical variations in employment. An increase in investment also drives up overall employment during a housing boom and can be associated with an increase in household income. The reverse is true during a bust. According to Cardarelli et al. (2008), in countries with more labor-intensive construction sectors, changes in housing demand can be followed by stronger supply reaction and have larger effects on economic activity. According to their data, Ireland’s labor intensity of construction is approximately 15% higher than the average; France and Finland have an average sector intensity. In such countries, the housing effects may also be associated with collateral effects because the increase in employment can be associated with an increase in income and affect consumption through the credit

and the risk-taking channels. Therefore, although monetary policy in the euro area affects consumption through the housing market only in one-third of the euro area countries, the impact on consumption is strong. The difference between the role of the housing market in the monetary transmission mechanism in the euro area and non-euro area is that, instead through variations in house prices, transmission in the euro area takes place rather through changes in housing investment.

The results from the counterfactual experiment are only partially consistent with some previous studies, which argue that housing plays an important role in the monetary policy transmission mechanism in well-developed mortgage markets. In half of the countries, in which house price effects exist, mortgage markets are characterized by above institutional features. However, we do not find that the housing market in other countries with a large index of mortgage market flexibility has necessarily an impact in the monetary policy transmission mechanism to consumption. The availability of securitization, MEW, high LTV ratios and variable mortgage rate contracts can enhance the housing collateral effects. However, there are countries with a large share of variable rate mortgages (e.g. Italy, Portugal, Spain, UK), countries, in which MEW is also available and LTV are high (e.g. UK) and countries, in which securitization is commonly used (Spain, UK), in which no housing effects are observed. Moreover as shown above, strong housing effects, stemming from variations in residential investment, are also observed in countries with a low mortgage market index of development (e.g. Finland, France, Ireland).

The existence of housing effects may thus depend only on specific institutional features of mortgage markets, which differ in each country. For example, even though France and Ireland have low mortgage market flexibility, they have the highest LTV ratios from all the countries in the sample, 83% and 91% respectively. Actually, LTV ratios take the highest values in the countries, in which housing effects have been observed, ranging between 70% and 91%. This finding underlines the importance of households' leverage in the monetary policy transmission through housing and suggests that housing effects may be then observed, when institutional factors of mortgage markets abet the built-up in households' and financial market leverage. The reason is that for economies with highly leveraged households or banks, an increase in the cost of credit is associated with an increase in the risk premia and a deterioration of collateral and can lead to lower credit stock. As the housing market is highly credit-intensive and housing stock serves as a collateral, it can play a more important role in the monetary policy transmission to consumption in more leveraged economies. However, even if households are leveraged, their consumption expenditure can be less affected if the changes in their collateral and the cost of credit are balanced by other policy stimuli. Accounting for additional variables may be therefore important in order to explain, why in countries with flexible mortgage markets and high LTV ratios, such as the UK, no housing effects are observed.

## 6 Summary

The purpose of this paper is to empirically explore the role of the housing market in the monetary policy transmission to consumption for a large set of European countries. Previous empirical studies come to mixed results. On the one hand, it has been argued that the housing market in one country is then important, when its mortgage market is well developed. However, studies for the USA and UK find only a small and insignificant housing channel. On the other hand, euro area member states have a single monetary policy but heterogenous housing and mortgage markets, which may lead to different policy effects on economic activity. While mortgage markets in the majority of the euro area countries have less flexible mortgage markets, mainly due to low securitization and limited access to financing, in Nordic countries (Denmark, Norway, Sweden) and the UK MEW and securitization is often used.

In order to assess the role of the housing market in the monetary transmission mechanism in Europe and explore whether euro area members show different patterns in the transmission process, we, firstly, estimate identical VAR models for 14 European countries. Secondly, a counterfactual simulation is conducted, in which the monetary-policy-induced effect of the housing market on consumption is disentangled. The results show large housing effects stemming from variations in house prices in the Nordic countries (Denmark, Norway, Sweden), which have flexible mortgage markets characterized by strong securitization activity. Large housing effects have also been observed in three euro area countries (Ireland, Finland, France), which instead have a low index of mortgage market development. The difference in the role of the housing market in the monetary transmission mechanism between the euro area and the non-euro area is that, instead through variations in house prices, transmission in the euro area takes place rather through changes in housing investment. Our results are only partially consistent with previous studies, which argue that housing plays an important role in the monetary policy transmission mechanism in countries with well-developed mortgage markets. The existence of housing effects may rather depend only on specific institutional features of mortgage markets, which differ in each country. Instead, common for all countries, in which housing effects have been observed, are the high LTV ratios. This finding shows the importance of households' leverage in the monetary policy transmission through housing and suggests that housing effects may be then observed, when institutional factors, such as MEW and securitization, abet the built-up in households' and financial market leverage. However, even if households are leveraged, their consumption expenditure can be less affected if the changes in their collateral and the cost of credit are balanced by e.g. fiscal policies. Accounting for additional variables may be therefore important in order to explain, why in countries with flexible mortgage markets and high LTV ratios, such as the UK, no housing effects are observed.

## References

- Ahearne, A., Ammer, J., Doyle, B., Kole, L., Martin, R., 2005. House Prices and Monetary Policy: A Cross-Country Study. International Finance Discussion Papers 841. Board of Governors of the Federal Reserve System.
- Altunbas, Y., Gambacorta, L., Marques-Ibanez, D., 2009. Securitisation and the bank lending channel. *European Economic Review* 53, 996–1009.
- Altunbas, Y., Gambacorta, L., Marques-Ibaez, D., 2010. Does Monetary Policy Affect Bank Risk Taking? Working Paper Series 1166. European Central Bank.
- Ando, A., Modigliani, F., 1963. The life cycle hypothesis of saving: Aggregate implications and tests. *American Economic Review* 53, 55–84.
- Aoki, K., Proudman, J., Vlieghe, G., 2004. House prices, consumption, and monetary policy: A financial acceleration approach. *Journal of Financial Intermediation* 13, 414–435.
- Attanasio, O., Blow, L., Hamilton, R., Leicester, A., 2005. Consumption, House Prices and Expectations. Working Papers 271. Bank of England.
- Benito, A., Thompson, J., Waldron, M., Wood, R., 2006. House Prices and Consumer Spending. Quarterly Bulletin Summer. Bank of England.
- Benjamin, J.D., Chinloy, P., Jud, G.D., 2004. Real estate versus financial wealth in consumption. *The Journal of Real Estate Finance and Economics* 29, 341–354.
- Bernanke, B., Blinder, A., 1992. The federal funds rate and the channels of monetary transmission. *American Economic Review* 82, 901–921.
- Bernanke, B., Gertler, M., 1989. Agency costs, net worth, and business fluctuations. *American Economic Review* 79, 12–31.
- Bernanke, B., Gertler, M., 1995. Inside the black box: The credit channel of monetary policy transmission. *The Journal of Economic Perspectives* 9, 27–48.
- Borio, C., Zhu, H., 2008. Capital Regulation, Risk-Taking and Monetary Policy: A Missing Link in the Transmission Mechanism? Working Papers 268. Bank for International Settlements.
- Buch, C.M., Eickmeier, S., Prieto, E., 2011. In Search for Yield? Survey-Based Evidence on Bank Risk Taking. Discussion Paper 10. Deutsche Bundesbank.
- Calza, A., Monacelli, T., Stracca, L., 2011. Housing finance and monetary policy. *Journal of the European Economic Association* forthcoming.

- Cardarelli, R., Igan, D., Rebucci, A., 2008. The Changing Housing Cycle and Its Implications for Monetary Policy. World Economic Outlook April. International Monetary Fund.
- Case, K., Quigley, J., Shiller, R., 2005. Comparing wealth effects: The stock market versus the housing market. *Advances in Macroeconomics* 5, 1–32.
- Chen, J., 2006. Re-evaluating the association between housing wealth and aggregate consumption: New evidence from sweden. *Journal of Housing Economics* 15, 321–348.
- Chen, N.K., Chen, S.S., Chou, Y.H., 2010. House prices, collateral constraint, and the asymmetric effect on consumption. *Journal of Housing Economics* 19, 26–37.
- Delis, M.D., Kouretas, G.P., 2011. Interest rates and bank risk-taking. *Journal of Banking & Finance* 35, 840–855.
- Dell’Ariccia, G., Laeven, L., Marquez, R., 2010. Monetary Policy, Leverage, and Bank Risk-Taking. Working Paper 276. International Monetary Fund.
- ECB, 2008. Financial Integration in Europe. Monthly Bulletin April. European Central Bank.
- ECB, 2009a. Housing Finance in the Euro Area. Occasional Paper Series 101. European Central Bank.
- ECB, 2009b. Housing Wealth and Private Consumption in the Euro Area. Monthly Bulletin January. European Central Bank.
- Elbourne, A., 2008. The uk housing market and the monetary policy transmission mechanism: An svar approach. *Journal of Housing Economics* 17, 65–87.
- EMF, 2006. Study on Interest Rate Variability in Europe. Technical Report. European Mortgage Federation (EMF).
- EMF, 2010. Hypostat 2010. Technical Report. European Mortgage Federation (EMF).
- Gambacorta, L., 2009. Monetary Policy and the Risk-Taking Channel. Quarterly Review December. BIS.
- Gambacorta, L., Marques-Ibanez, D., 2011. The Bank Lending Channel: Lessons from the Crisis. Working Paper Series 1335. European Central Bank.
- Giuliodori, M., 2005. The role of house prices in the monetary transmission mechanism across european countries. *Scottish Journal of Political Economy* 52, 519–543.
- Greenspan, A., Kennedy, J., 2005. Estimates of Home Mortgage Originations, Repayments, and Debt on One-to-Four-Family Residences. Finance and Economics Discussion Series 41. Board of Governors of the Federal Reserve System.



- Hoeller, P., Rae, D., 2007. Housing Markets and Adjustment in Monetary Union. Economics Department Working Papers 550. OECD.
- Iacoviello, M., 2000. House Prices and the Macroeconomy in Europe: Results from a Structural VAR Analysis. Working Paper Series 18. European Central Bank.
- Iacoviello, M., 2004. Consumption, house prices, and collateral constraints: A structural econometric analysis. *Journal of Housing Economics* 13, 304–320.
- Iacoviello, M., 2005. House prices, borrowing constraints, and monetary policy in the business cycle. *American Economic Review* 95, 739–764.
- Ioannidou, V., Ongena, S., Peydro, J.L., 2009. Monetary Policy, Risk-Taking and Pricing: Evidence from a Quasi-Natural Experiment. Discussion Paper 31S. CentER.
- Kuttner, K., Mosser, P., 2002. The monetary transmission mechanism in the united states: Some answers and further questions. *Economic Policy Review* 8, 433–443.
- Ludvigson, S., Steindel, C., Lettau, M., 2002. Monetary policy transmission through the consumption-wealth channel. *Economic Policy Review* 8, 117–133.
- Maddaloni, A., Peydro, J.L., 2011. Bank risk-taking, securitization, supervision, and low interest rates: Evidence from the euro-area and the u.s. lending standards. *Review of Financial Studies* 24, 2121–2165.
- Mian, A., Sufi, A., 2011. House prices, home equity-based borrowing, and the us household leverage crisis. *American Economic Review* 101, 2132–2156.
- Mishkin, F., 2007. Housing and the Monetary Transmission Mechanism. NBER Working Papers 13518. National Bureau of Economic Research, Inc.
- Ortalo-Magne, F., Rady, S., 2006. Housing market dynamics: On the contribution of income shocks and credit constraints. *Review of Economic Studies* 73, 459–485.
- Sims, C., Stock, J., Watson, M., 1990. Inference in linear time series models with some unit roots. *Econometrica* 58, 113–44.
- Song, I.H., 2011. House Prices and Consumption. mimeo. Korea Development Institute.
- Souleles, N., 1999. The response of household consumption to income tax refunds. *American Economic Review* 89, 947–958.
- Tobin, J., 1980. *Asset Accumulation and Economic Activity: Reflections on Contemporary Macroeconomic Theory*. Basil Blackwell, Oxford.

Zhu, H., 2005. The importance of property markets for monetary policy and financial stability, in: Real Estate Indicators and Financial Stability. Bank for International Settlements. volume 21 of *BIS Papers Chapters*, pp. 9–29.