

# STUDIES

## 1. Unabridged translations

### What role do financial factors play in house price dynamics?

*House prices in industrialised countries have fluctuated significantly over the past decades. The recent strong growth in prices has raised concerns that a property bubble may be inflating, which could have a detrimental impact on financial stability and economic activity.*

*By using different methods to determine the equilibrium level of house prices, i.e. an asset-pricing approach and a structural model, it is possible to identify the factors common to all industrialised countries, which drove residential property prices at the end of the 1990s. Recent developments were particularly influenced by the decline in interest rates as of the second half of the 1990s, and the high levels of household income at the end of the 1990s. However, continued growth in house prices, at the rate observed since the start of the 2000s, does not seem to be sustainable in a number of countries.*

*The apparently predominant role, among the usual determinants of house prices, of short- and long-term interest rates calls for a more in-depth analysis of the impact of changes in the financial system in the 1980s and 1990s. This study highlights the close interaction between house prices, financial variables and lending conditions. While it appears that the bubble observed at the end of the 1980s may be related to the financial deregulation that preceded it, the situation seems more complex since the 1990s.*

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Since 1970, house price growth in industrialised countries has on average outstripped consumer price inflation.<sup>1</sup> Average house price growth has been particularly strong since the middle of the 1990s (see Table 1). In nominal terms, house prices more than doubled between 1995 and 2003 in half a dozen countries and rose by over 50% in a similar number of others. In real terms, *i.e.* adjusted for inflation, house prices increased by over 50% in ten or so countries. Growth of real house prices, which was already buoyant at the end of the 1990s, accelerated at the start of the 2000s, raising concerns as to levels reached in some countries, including France (see Moëc, 2004, for example).

The fact that housing constitutes a substantial proportion of household wealth and the recent level of existing mortgage debt in industrialised countries<sup>2</sup> make the situation on the housing market, and in particular price dynamics, of primary interest to central banks, both in terms of monetary and financial stability.

From the point of view of monetary stability, house price fluctuations have a sizeable impact on economic activity and in turn on prospects for price developments. A rise in house prices directly affects consumer price inflation *via* rent levels, which are a component of the consumer price index. House price growth also contributes to boosting economic activity *via* residential investment, as the increase in the value of property feeds through to the construction and renovation sector, and household consumption *via* wealth effects (see Case *et al.*, 2001, and, more recently, Catte *et al.*, 2004, and Odonnat and Rieu, 2003). The size of these wealth effects is nevertheless likely to vary across countries according, in particular, to home ownership rates.<sup>3</sup> From the point of view of financial stability, real estate assets are one of the main forms of collateral accepted by credit institutions. Therefore, if house prices fall together with a deterioration in household balance sheets, this could constitute a risk to the stability of the banking system with major macroeconomic consequences.<sup>4</sup>

Monetary policy decisions have an impact on house prices. Changes in key rates influence households' residential investment *via* the interest rate channel. Moreover, the transmission of monetary policy to the real economy may be amplified by "the balance sheet channel": an increase in the prices of houses – which, due to credit market imperfections, are frequently pledged as collateral against loans – reduces the "external financing premium" required by banks.<sup>5</sup> Monetary policy also affects households' balance sheets *via* an "income effect" that varies according to their net financial position and the terms and conditions of their loans and investments

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<sup>1</sup> This study focuses on Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, the Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, the United Kingdom, and the United States. These 19 industrialised countries account for half of world GDP. As the house price index was only available for Austria from 1987 to 2000, this country was not used for longer-run calculations. House price index series used for other countries were taken from a database kindly provided by Claudio Borio of the Bank for International Settlements (BIS).

<sup>2</sup> In 2003, household mortgage debt stood at 73% of households' annual disposable income in Canada, 77% in Germany, 84% in the United States and 102% in the United Kingdom. In comparison, in France, long-term debt, which also includes long-term loans for non-housing durable goods, only accounted for 60% of income (source: OECD, Economic Outlook).

<sup>3</sup> In the 15-member EU, this proportion varied, for example, from 53% in the Netherlands to 85% in Spain (ECB, 2003).

<sup>4</sup> See, for example, Bordo and Jeanne (2002). Past episodes of sharp rises in house prices were followed by periods of falling prices in 11 out of the 19 countries reviewed between 1970 and 2003.

<sup>5</sup> See Clerc (2001) and Clerc and Pfister (2002) for a presentation of the broad credit channel and the balance sheet channel and Aoki *et al.* (2001) for an application of the financial accelerator mechanism to the UK housing market.

(*i.e.* whether mortgages are at a fixed rate or variable rate, whether or not they can be renegotiated, etc.). Lastly, in a number of countries, households can easily take advantage of a rise in the price of their property (pledged as collateral) to obtain a larger mortgage and use mortgage equity withdrawal to boost spending.<sup>6</sup>

In this study, we will first identify a number of stylised facts concerning house price developments in industrialised countries over the past 30 years. We will then review the factors that appear to be behind the recent strength of property prices, focusing particularly on the impact of changes in the mortgage lending system. Lastly, we will present an econometric analysis using panel data of the determinants of house price growth in industrialised countries since the middle of the 1980s.

## 1. House prices have grown rapidly over the past decade

Since 1970, house prices in industrialised countries have risen, in real terms, by close to 2% on average. Growing trade and financial integration over the past decades has significantly contributed to increasing the correlation between national housing market cycles, by speeding up the transmission between countries of the shocks affecting economic activity, household income and interest rates, especially from the United States to other industrialised countries. The gradual reduction in the dispersion of real house prices across countries highlights this closer correlation: 5.7 percentage points on average between 2001 and 2003, compared with 9 percentage points in the 1970s.<sup>7</sup>

House prices in OECD industrialised countries have fluctuated significantly over the past three decades, four periods of expansion (1970-1974, 1977-1979, 1986-1989 and 1997-2003) were followed by three periods of contraction (1975, 1980-1984, and 1991-1996). Nevertheless, house price volatility has declined over the period, from 7.8% year-on-year in 1980 to 7.0% in 1990 and 4.7% in 2000.<sup>8</sup>

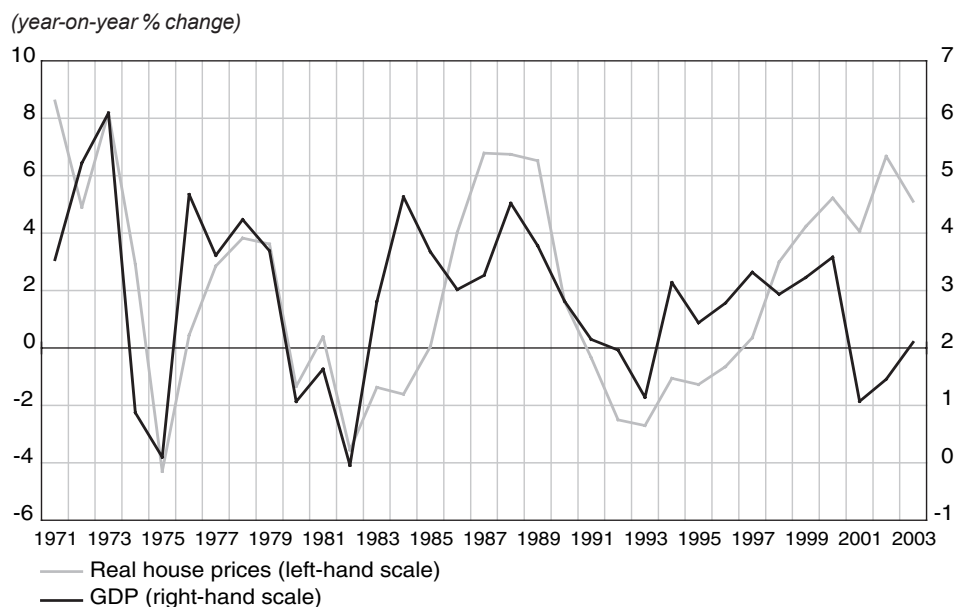
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<sup>6</sup> See Mésonnier (2004b) for a review of mortgage equity withdrawal issues.

<sup>7</sup> Using more sophisticated statistical techniques (*i.e.* an unobservable dynamic factor model) the International Monetary Fund (IMF) (2004) estimates that 40% of the total variation of house prices has been common to all industrialised countries over the last two decades.

<sup>8</sup> Average of the national volatilities of annual increases in prices, calculated with a ten-year moving window.

Chart 1  
Real GDP and house prices in industrialised countries



NB: Average of 19 OECD industrialised countries, weighted by GDP in purchasing power parity.  
Sources: OECD, BIS, World Bank, Banque de France calculations.

This period is exceptional in terms of its length of expansion at the aggregate level (six years in 2003) and due to the fact that house price growth accelerated as of 2001 while the world economy was slowing down whereas, until then, there had been a strong correlation between GDP growth and house price inflation (see Chart 1). The current boom in house prices is also unusual in terms of its geographical scale. By applying a statistical method that detects episodes of boom and bust, it can be seen that house prices experienced an exceptionally strong period of expansion between 1995 and 2003 in half of the countries in our sample (see Table in the Appendix). In real terms, the previous peaks were exceeded in ten or so countries, including Australia, Canada, Denmark, France, the Netherlands, Spain, the United Kingdom, and the United States.

The average increase in prices over the past few years nevertheless conceals diverging trends among countries,<sup>9</sup> which persist despite the tendency towards increased correlation. Over the most recent period, house price inflation has been particularly vigorous in the United Kingdom, Spain, Ireland, Australia and, up to 2000, in the Netherlands. It was also strong, albeit less so, in France and the United States. Conversely, in Germany and Japan real house prices declined, and those of the other countries in the sample were in an intermediate position (see Table 1).

<sup>9</sup> It should be noted that the heterogeneity of available price data renders comparisons between countries difficult. Such comparisons thus require care. Between countries, house price series may differ in terms of source (national statistics institute, federation of real estate agents, notaries, etc.), geographical coverage (national or main cities), types of property included (houses, flats, new and/or existing), measures (price per m<sup>2</sup> or index) and methodology (hedonic prices, repeated sales indices, median price of a sample of transactions, etc.). For a discussion about these issues in European countries, see ECB (2003).

Table 1

**Recent trends in house prices in industrialised countries**

	Average annual growth rate (real prices)		
	Average 1971-2003	Average 1995-2003	Average 1998-2003
Australia	2.8	5.9	8.8
Belgium	2.2	3.3	3.9
Canada	2.0	1.3	3.1
Denmark	1.0	4.7	3.3
Finland	0.9	4.0	3.7
France	1.8	3.9	7.5
Germany	0.1	-1.2	-0.8
Ireland	3.3	8.8	8.9
Italy	1.8	0.7	4.3
Japan	0.9	-2.4	-2.7
Netherlands	2.7	6.9	7.2
New Zealand	0.5	1.4	1.0
Norway	1.6	5.7	5.2
Spain	3.7	5.8	9.4
Sweden	0.3	4.6	6.6
Switzerland	0.1	-1.1	1.1
United Kingdom	3.8	7.3	10.4
United States	1.7	3.4	4.6

Sources: BIS, OECD, Banque de France calculations.

In mid-2004, in a number of countries including France, house prices were continuing to grow at a rate deemed unsustainable (see Moëc, 2004). While, since end-2001, house prices in the Netherlands have been declining sharply, in Australia a turnaround was observed in the first half of 2004 (see The Reserve Bank of Australia, 2004) and a similar turnaround cannot be ruled out in the United Kingdom, where transactions and certain price indices started to flag in autumn 2004.

## 2. The growing role of financial factors

In general, households purchase a property to occupy it and enjoy housing services, as well as for investment purposes: property thus fulfils two economic functions. Investors, households and companies also purchase property based on a comparison between the return on this asset and that on other assets. In view of these two roles, two theoretical approaches should be applied to assess the level of house prices in a given country: the asset-pricing approach, which focuses on the investment aspect considered purely in terms of arbitrage, and the use of “structural models”, which take account of both dimensions (*i.e.* the return on the residential investment and the utility of the property), focusing on the determinants of supply and demand for property (see Box below).

**The main house price valuation methods**

The sharp rise in house prices in industrialised countries in the past years raises the following question: are house prices currently in line with economic fundamentals or are they overshooting their equilibrium level? Two approaches are generally used to try and answer this question: a property can either be considered an asset that generates an income, in the same way as a share pays dividends, or a structural model can be constructed relating the supply of housing to the demand for housing services.

**Asset-pricing theory applied to house prices**

In the first approach, a comparison is made between a housing investment and a stock market investment (see, for example, Weeken, 2004). A property is therefore taken to be an investment whose value is the present value of its expected future pay-offs (i.e. rents, equivalent to dividends paid on a share), discounted at an interest rate that factors in the risk premium specific to that asset. If we assume that the risk premium  $k$  and the risk free rate  $r^f$  that make up the discount rate  $R$  are constant over the time the asset is held, the asset's equilibrium price  $Ph_t^*$  at time  $t$  as a function of income stream  $D_{t+j}$  can be expressed as follows:

$$Ph_t^* = \sum_{j=1}^{\infty} \frac{D_{t+j}}{(1+R)^j}$$

If, furthermore, the pay-offs are assumed to grow at a constant rate  $g$ , the previous equation can be simplified to:

$$Ph_t^* = \frac{D_t(1+g)}{(R-g)} = \frac{D_t(1+g)}{(r^f+k-g)}$$

In a study recently published by the Bank of England, Weeken (2004) regresses the P/E of UK house prices on the long-term interest rate, a proxy for the risk-free rate, and non-reinvested rental income flows. He concludes that the residual of the equation, which reflects changes in the unobservable housing risk premium, largely explains the rise in house prices in the UK in relation to rental prices, alongside the decline in real interest rates. However, the estimated level of the risk premium does not appear to be excessively low compared to that observed at the end of the 1980s during the previous house price bubble in the United Kingdom. In conclusion, while house price growth clearly appears to be unsustainable, the level of house prices at the start of 2004 may be closer to its equilibrium level than it was in the late 1980s before the last housing bubble burst in the United Kingdom. In the case of France, Moëc (2004) calculates the risk premium on property investment and concludes that it is relatively high compared with its highest level during the previous bubble of 1990-1991. The risk premium nevertheless seems to have declined since 2000.

This approach is appealing in its simplicity, but has a number of limitations (see Weeken, 2004, for a in-depth presentation). Aside from the practical problems of the comparability of available series of rental and housing prices and the unavailability of certain series in level form, there are a number of factors specific to the housing market such as limited arbitrage opportunities, the lumpiness of housing, the imperfect substitutability between owning and renting a property, which do not allow for a rapid convergence towards the equilibrium price  $Ph^*$ .

**Structural models**

Structural approaches determine house prices using either supply and demand equations for housing or as the solution to the problem of optimising the choice of consumption of housing services of a representative agent 1. In both approaches, a housing demand equation and a housing supply equation are traditionally formulated. The equations often represent the "long-term" equilibrium and may be supplemented, for the purpose of an empirical estimate, by short-run dynamics as part of the error-correction process (see, for example, McCarthy and Peach, 2004). Supply is generally described by households' gross fixed capital formation in dwellings, land prices and building costs, but it may also be influenced by the level of interest rates, given that construction requires borrowing.

House price equilibrium is therefore the price that allows demand for housing to adjust to the housing stock, taking account of the variables theoretically determining the demand for housing such as permanent household income and the housing user cost. The user cost is the sum of the after-tax opportunity cost of holding the capital asset, after-tax property taxes, and depreciation and repair, minus the expected capital gain of the asset. This arbitrage can be expressed as:

$$u_t = P_t[(1 - \tau_t^y)(i_t + \tau_t^h) + \delta_t - E(\pi_t^h)]$$

Where  $u_t$  represents the user cost and  $P_t$  the price of the property. The first term between brackets denotes the interest rate on the mortgage loan ( $i_t$ ), adjusted for the impact of the property tax rate ( $\tau_t^h$ ) and the income tax rate ( $\tau_t^y$ , if loan repayments are deductible), the second term denotes the depreciation rate of the capital asset ( $\delta_t$ ) and the third term denotes the expected capital gains from the housing asset ( $E(\pi_t^h)$ ).

In practice, the housing supply equation, which is considered to be relatively static in the short and medium term (or even in the longer term if the role of property tax is predominant), is often omitted and only a reduced-form equation for housing demand is used. The house price equation is then constructed by inverting the demand function. An equation is constructed with household income or other proxies for their permanent income, and variables describing the financial and/or tax conditions that buyers-borrowers face, the number of households, etc.

Given the historically low level of short- and long-term interest rates in the first half of this decade, among the standard determinants of structural models of house prices, the trend decline in interest rates provides one of the most relevant explanations for recent developments. The available empirical studies confirm this intuition (see Chart 2). McCarthy and Peach (2004) estimate, using a structural model incorporating long-term dynamics, that house prices in the United States are currently not overvalued, due to the decline in the housing user cost associated with the fall in interest rates. Ayuso and Restoy (2003) used an intertemporal asset pricing model where housing services and consumption are inseparable. They conclude that, while the model makes it possible to explain the first phase of price rises (1997-2000), real house prices in 2002 overshoot the estimated equilibrium by around 20% in Spain and the United Kingdom, compared with 7% in the United States.

<sup>1</sup> This approach was introduced by Poterba (1984).

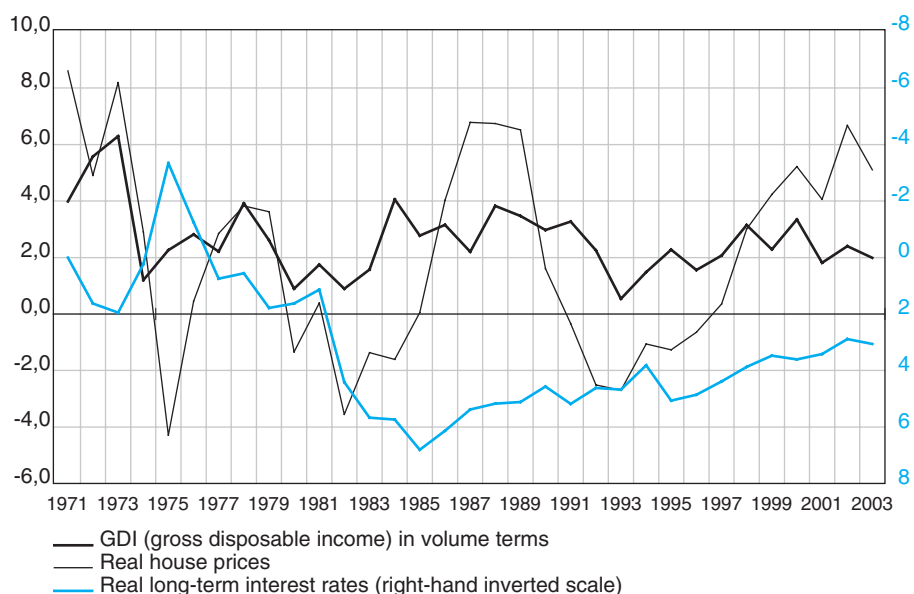
Housing supply and demand change over time in relation to a number of structural and cyclical factors. However, one of the features of housing supply is its inertia, associated with the lack of available space (in particular in the centre of cities), the need to obtain planning permission and the time it takes to build.<sup>10</sup> House prices therefore react strongly in the short term to changes in housing demand, which is less rigid than supply.

The close interaction between house prices and the volume of mortgages suggests that financial factors play an important role – credit constraints and interest rates – in the recent house price dynamics. The fact that banks' lending behaviour seems to have been significantly modified by changes in the regulation of the financial sector that marked the past two decades has further amplified the role of these factors. Moreover, an econometric estimate carried out on a panel of industrialised countries confirms the role of the trend decline in interest rates in the 1990s and supports the assumption of loan supply effects.

<sup>10</sup> The elasticity of housing supply to house prices is relatively weak, in particular in the United Kingdom, the Netherlands and Denmark (Catte, Girouard, Price and André, 2004).

Chart 2  
Households' gross disposable income in volume terms,  
long-term interest rates and real house prices

(year-on-year percentage change; interest rates in level form)



NB: Average of 19 OECD industrialised countries, weighted by GDP in purchasing power parity.  
Sources: OECD, BIS, World Bank, Banque de France calculations.

## 2.1. The interaction between house prices and mortgages

Most households have to borrow to acquire a property. Lending conditions, which depend on prevailing regulations (prudential regulation, consumer protection, etc.), monetary policy – for the level of interest rates – and the commercial policy of banks in a given economic and competition environment, intuitively play a decisive part in the demand for housing and, consequently, in house price dynamics.

From a theoretical point of view, the literature highlights the existence of nonlinearities associated with mortgage lending conditions. Exceeding or changing certain limits may destabilise house price dynamics. Ortalo-Magné and Rady (2001) developed a life-cycle model with heterogeneous agents, with wealth accumulation over the life cycle and credit constraints, which highlights the destabilising impact of a decline in down payment requirements or, equally, of a rise in the loan-to-value ratio. A lasting decline in banks' down payment requirements is equivalent to a rise in permanent income and generates, in the model, a change in the equilibrium following a transition period marked by an overshooting of prices. Young households that already own a first home see an improvement in their ability to move up the property ladder, leading to an acceleration in property transactions as house prices go up, which in turn raises their down payment for the second purchase.

The assumption that house prices overshoot as a result of income shocks where credit constraints are present appears to be borne out by a number of empirical studies, in particular that of Lamont and Stein (1997). This study, focusing on a sample of US metropolitan areas, also shows that the reaction of real house prices to income shocks is significantly greater in cities where households are more highly-leveraged – *i.e.* have high loan-to-value ratios. Lastly, Muellbauer and Murphy (1997) suggest that the transaction costs associated with buying a property, which may be partly linked to obtaining a mortgage, create a threshold effect. When the appreciation of current and expected future prices is sufficient, the future expected asset payoffs are such that this threshold is exceeded and that a growing number of households enter into property transactions.

In turn, house prices affect both the supply and demand for mortgages. On the demand side, if house prices rise faster than available resources, the size of the mortgage requirement mechanically increases. On the supply side, fluctuations in the prices of property, frequently used as collateral for mortgages, affect the availability of the latter: higher collateral values reduce moral hazard between lenders and borrowers and encourage banks to lend more. Moreover, expectations of an increase in the value of collateral may cause banks to underestimate their risk exposure and, possibly, to display disaster myopia behaviour, which becomes increasingly pronounced the longer the bubble inflates. Empirically, Hofmann (2001)<sup>11</sup> suggests that there is a positive long-run correlation between real credit to the private sector and house prices in most countries: impulse response analysis clearly shows a dynamic interaction between these two variables.<sup>12</sup>

## 2.2. The impact of regulations

In the 1980s and 1990s, a number of developments associated with changes in regulatory constraints appear to have shifted credit constraints and weighed on the external financing premium: heightened competition in the banking sector, the reduction in transaction costs and the easing of banks' lending conditions. These developments seem to have played a significant role in increasing house price inflation during certain housing booms over the past two decades in industrialised countries.

The deregulation of the financial system in industrialised countries, which took place in the 1980s, mainly consisted of a lifting of credit controls and constraints on the setting of lending rates, as well as a review of the possible specialisation of credit institutions (see Table 3 in the Appendix). The increased competition in the banking sector, resulting from this deregulation, put pressure on lending rates and fostered financial innovation. It also seems to have led to a race for market share, which was accompanied by an expansion of credit and an increase in bank's exposure to risk.

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<sup>11</sup> Based on a Vector Error Correction Model (VECM) applied to 16 countries.

<sup>12</sup> Similarly, a recent report by the ECB (2003) shows that, while house price fluctuations probably do not fully explain developments in household mortgage debt in EU countries, the positive correlation between house prices and mortgages appears to have contributed to simultaneous housing and mortgage booms in Denmark, the Netherlands and the United Kingdom at the end of the 1990s.

This, in turn, resulted in a temporary rise in lending rates to cover additional losses (Northcott, 2004). Indeed, empirical studies linking banking sector competition to the level of lending rates conclude that there is a positive correlation between bank concentration and retail interest rates (Corvoisier and Gropp, 2002, on European countries), which could be called into question if regulatory variables (barriers to entry) are introduced (Demirguç-Kunt, Laeven, Levine, 2003, on 72 countries).<sup>13</sup> This rise in lending rates may have weakened borrowers' balance sheets during certain housing booms, such as in Scandinavian countries in the second half of the 1980s.

In a number of countries, financial deregulation measures were often followed by credit booms and a sharp rise in real house price inflation (see Table 3 in the Appendix). The impact of financial deregulation on house price dynamics was particularly significant in North European countries, France and the United Kingdom at the end of the 1980s. The mortgage boom in these countries may be attributed to both the deregulation measures themselves and the build-up of excess demand for credit in the previous years, due to the substantial credit rationing by banks (see de Greef and de Haas, 2000).<sup>14</sup>

In the 1990s, prudential regulation evolved with the introduction of financial ratios. At the international level, the solvency ratio of regulatory capital to risk-weighted assets came into force in 1993. As regards mortgage lending, the *a priori* restrictive impact of this ratio on increasing assets was nevertheless offset by lowering the weighting of mortgage-backed housing loans (50%). In the second half of the 1990s, further changes to prudential regulation led banks to better assess and take account of their risk exposure.

Lastly, in the 1990s the development of new credit risk management techniques, in particular securitisation, also facilitated mortgage financing.

A number of empirical studies highlight the impact of the deregulation of the mortgage market and banks' lending behaviour on house prices. For the United Kingdom, Muellbauer and Murphy (1997) suggest, on the basis of breakpoint tests, that interest rates and income expectations became more important determinants of real house prices after the financial deregulation measures of the 1980s. A recent study by the BIS (Tsatsaronis and Zhu, 2004), conducted on 17 industrialised countries<sup>15</sup> between 1970 and 2003, shows the importance of banking practices (mortgages mainly granted at a fixed or a variable rate, down payment requirements, method of assessing the value of the pledged collateral) and the particular characteristics of the mortgage market (securitisations, the possibility of mortgage equity withdrawal) in the sensitivity of house prices to shocks on interest rates, GDP or the volume of bank loans. The impact of short-term interest rates – more directly steered by central banks – has therefore been greater in countries where most mortgages are at a fixed rate, as well as in those countries where banks' commercial practices have been more aggressive.

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<sup>13</sup> In the 1990s, as a result of banking sector concentration, the number of credit institutions declined: from 12,370 in 1990 to 8,130 in 2001 in the United States, from 1,981 to 1,067 in France and from 3,913 to 2,370 in Germany (source: OECD).

<sup>14</sup> Booms and busts in the housing market were naturally caused by a combination of a number of factors: a rise in households' income expectations, an increase in demographic pressure, (e.g. the United Kingdom), and a tax regime that allows interest on mortgage payments to be deducted from taxable income (e.g. Scandinavian countries).

<sup>15</sup> These countries are the same as those in Table 3, with the exception of Austria and New Zealand.

### 2.3. An econometric estimate

An econometric estimate based on a panel of 18 industrialised countries<sup>16</sup> illustrates the respective role of the different potential determinants of house prices.

Studies on panel data are frequent in literature on house prices. The panel regression technique, which exploits both the temporal dimension and the intraindividual dimension of a database containing a number of observed units, can be used to compensate for the lack of availability, in most countries, of house price data over a sufficiently long period and at an intra-annual frequency. By way of illustration, and notwithstanding the limitations inherent to an estimate based on a small number of observed units, several studies have recently used this technique to analyse fluctuations in residential (IMF, 2004) or commercial (Davis and Zhu, 2004) property prices in a restricted sample of countries (17 and 18, respectively).

Empirical literature points to the existence of a fairly strong persistence of house price fluctuations, and a tendency to revert to the mean: when the level of prices overshoots that dictated by fundamentals, in particular that compatible with disposable income of the average household, prices tend to return towards equilibrium (see Lamont and Stein, 1999, Abraham and Hendershott, 1994, Muellbauer and Murphy, 1997). Abraham and Hendershott find, for example, that these two factors explain around 40% of the variation in real house prices in thirty American cities in the period 1977-1992. From an econometric point of view, the persistence of house price inflation complicates the estimate. The estimator of the ordinary least squares is biased and non-convergent if the lagged dependent variable is used as the regressor. To resolve this, the equation could be estimated using the generalised method of moments (GMM), as applied to dynamic panel data by Arellano and Bond (1991). This method also has the advantage of dealing with the problems posed by the possible endogeneity of some of the explanatory variables used; the relation between the rate of growth of house prices and that of credit is not *a priori* unequivocal (see Hofmann, 2001).

In a given year, real house price growth can therefore be explained in our model by the rate of growth the previous year and the ratio of house prices to real disposable income *per capita*, which brings prices back towards equilibrium. Other explanatory variables are the “fundamentals” expected in theory, such as the rate of growth of household disposable income (*per capita*), which is supposed to represent fluctuations in permanent income, and the rate of population growth, which is supposed to capture the impact of demography on housing demand. Unlike in the study by the IMF (2004), we consider simultaneously the impact of the variations in the real short-term interest rate and the spread between short- and long-term rates (which is tantamount to introducing both the real short- and long-term rates), as variables determining the demand for housing loans *via* their impact on the user cost of capital. It is essential therefore to take account of short- and long-term interest rates, insofar as, in the sample, there are both countries where interest rates on housing loans are mainly based on short-term market rates – such as the

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<sup>16</sup> The countries reviewed are the same as those in footnote 2, with the exception of Austria.

United Kingdom, Ireland and Australia – and countries where long-term interest rates may better reflect the rate used to discount the housing service flow (Sutton, 2002). We also introduce the rate of growth of real credit to the private sector as a proxy for housing loans. Given the imperfections of the credit market, a variable representing the volume of loans could usefully supplement the interest rate variables to describe households' access to bank financing. The contemporaneous growth rate of real stock prices is introduced in order to capture, in a simple manner, the impact of fluctuations in households' financial wealth, while past growth rates are used to capture the empirical results showing a lag in the impact of stock price fluctuations on house prices in industrialised countries. This lag varies between one and three years according to the studies and countries in question (Borio and McGuire, 2004, Van den End and Kakes, 2002). Lastly, in the list of determinants, we include a variable that indicates the deregulation of mortgage lending, and is assigned a value of 1 after the date this measure was applied in each country (see Table 3 in the Appendix).

Some data are unavailable for certain countries and some years. In order to prevent the number of countries used in the regression from fluctuating too greatly over the estimation period, we only consider the period 1985-2002. Table 2 below shows the results of the estimate for a basic specification (column 1) and two alternatives (columns 2 and 3). The results are also compared with those of the IMF cited above.

The signs and values of coefficients are generally in line with expectations and comparable to those of the IMF's study, obtained over a longer estimation period. The terms that describe the return to equilibrium dynamics are very significant, as are the three financial variables: interest rates, the slope of the yield curve and the volume of bank loans.

The rate of growth of disposable income *per capita* and of the total population have the correct sign and an acceptable order of magnitude, but do not appear significant. This result may be explained, in that current income is a very imperfect measure of permanent income and that total population is probably not as relevant a measure of demographic effects as the number of households or the share of young households in the population. Moreover, from a theoretical point of view, it is possible that fluctuations in young first-time buyers' income, which are often more volatile than those of households as a whole, play a particular role (Ortalo-Magné and Rady, 2001). However, income is a statistically significant variable in our equation *via* the error correction term, which corresponds to the intuition whereby income is a structural rather than a temporary determinant of the level of house prices (see Tsatsaronis and Zhu, 2004).

Lastly, the impact of stock prices does not appear to be significant. This finding is in line with the results of Sutton (2004) and Tsatsaronis and Zhu (2004), who use VAR models with a limited number of countries, not exceeding that of our financial deregulation variable. This finding nevertheless appears to depend on the estimation period used, which, in a number of countries, was well after the deregulation measures (see Table 3). In conclusion, all these results highlight the sizeable role that monetary and financial developments have played in house price dynamics since the middle of the 1980s.

Table 2

**Determinants of house prices in industrialised countries  
(panel of 18 OECD countries)**

Dependant variable:	M1	M2	M3	FMI
Real house prices, growth rate	(1985-2002)	(1985-2002)	(1985-2002)	(1971-2003)
	1	2	3	4
Persistence:				
Real house prices, growth rate (lagged)	0.33 ***	0.39 ***	0.34 ***	0.52 ***
Error correction term (lagged price-to-income ratio <i>per capita</i> )	-0.15 ***	-0.17 ***	-0.14 ***	-0.14 ***
Income per head, growth rate	0.53	0.49	0.66	0.53 ***
Population, growth rate	7.04	1.04	6.00	1.75 ***
Real short-term interest rate	-1.30 ***	-1.42 ***	-1.48 ***	-0.51 ***
Term spread	-1.30 ***	-1.61 ***	-1.20 ***	–
Real credit, growth rate	0.52 ***	0.40 ***	0.43 ***	0.11 ***
Real stock prices, growth rate	–	0.01	–	–
Real stock prices, growth rate (lagged)	–	–	0.2	0.033 ***
Deregulation (proxy)	–	-0.11	-1.89	–
Bank crisis (proxy)	–	–	–	-2.43 ***
Number of observations	288	288	288	524
Sargan (p-value)	0.25	0.13	0.14	–
Arellano-Bond (p-value)	0.81	0.74	0.80	–

NB: The symbols \*\*\*, \*\*, \* denote a significance threshold of 1%, 5% and 10%, respectively.

The Sargan test for overidentifying restrictions is used to validate the choice of instrumental variables used in the GMM. The Arellano and Bond test (1991) verifies the absence of second-order autocorrelation of residuals. The estimation by GMM is carried out on the equation in differences and the variables are instrumented by their second and even third lagged values in level form, except for the proxy for deregulation that is instrumented by itself.

Sources: BIS for house prices, OECD for the other variables.

In conclusion, the analysis of recent developments, irrespective of the approaches used, points to the specific role of financial factors, in the broad sense, in house prices. In particular, an econometric analysis on a sample of 18 countries between 1985 and 2002 confirms the impact of short- and long-term interest rates and supports the assumption of loan supply effects, in the new environment that has gradually emerged as a result of financial deregulation measures.

Over the past ten years, and with varying consequences across countries, monetary policy easing associated with the completion of the disinflation process that started in the 1980s, financial system deregulation, possibly underway since the 1980s, and the resulting heightened competition in the banking sector, have contributed to increasing the impact of higher household income and demographic developments on the housing market. These developments may have fostered macro-financial imbalances, which in turn have fuelled the ongoing debate on the appropriateness of a reaction of monetary policy to fluctuations in asset prices in general, and more specifically in house prices.<sup>17</sup>

<sup>17</sup> On the relation between the financial stability and monetary stability objectives of central banks, see, for example, Mésonnier (2004a)

## Appendix

*Table 3*  
**Mortgage market deregulation measures  
and episodes of house price booms**

	Date	Type of measurement	Real housing price booms
Australia	1986	Deregulation of interest rates	1987-1990; 2000-2003
Austria	1980	Deregulation of interest rates	NA
Belgium	1977	Partial deregulation of financial markets	1975-1979
Canada	1967	Deregulation of interest rates; relaxation of limits on bank borrowing	1972-1975; 1986-1989
Denmark	1982	Deregulation of interest rates; deregulation of mortgage lending	1983-1986; 1996-1998
Finland	1986-1987	Deregulation of interest rates; lifting of quantitative credit control	1986-1989; 1995-1998
France	1987	Lifting of credit controls	1999-2003
Germany	1967	Deregulation of interest rates	–
Ireland	1985	Deregulation of interest rates	1977-1980; 1995-2001
Italy	1988	Permanent lifting of quantitative credit control	1972-1976; 1979-1981; 1987-1991
Japan	1994	Complete deregulation of interest rates	1971-1974; 1985-1990
Netherlands	1980	Deregulation of interest rates	1974-1978; 1996-2002
New Zealand	1984	Deregulation of interest rates and lifting of components of credit controls	1971-1975
Norway	1985	Deregulation of interest rates and lifting of credit controls (1984)	1984-1987; 1994-1996; 1999-2000
Spain	1987	Deregulation of interest rates	1985-1991
Sweden	1985	Deregulation of interest rates and relaxation of limits of quantitative credit controls	1987-1990; 1998-2001
Switzerland	1977	Very advanced deregulation of the financial sector	1971-1973; 1987-1989
United Kingdom	1986	Authorisation granted to building societies to extend their activity to mortgage loans, lifting of mortgage credit control	1971-1974; 1978-1980; 1985-1990; 1997-2003
United States	1984	Deregulation of interest rates; removal of Regulation Q	–

Columns 2 and 3: Debelle (2004), ECB (2003), Girouard and Blöndal (2001), Mehrez and Kaufmann (1999).

Column 4: episodes of real house price booms estimated by statistical method of Bordo and Jeanne (2002).

The identification of periods of booms is based on the distribution of real house price growth in 18 countries in the period 1971-2003. A boom is identified in years A – 2 to A if the average growth rate in these three years is in the upper two deciles of this distribution.

Sources: BIS for house prices, OECD for the other variables.

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