# Determinants of House Price Dynamics in Central and Eastern Europe

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*This paper examines the determinants of house price dynamics in Central and Eastern European (CEE) transition economies. While we emphasize the role of conventional fundamental factors, we also highlight the importance of transition-specific factors in house price dynamics in the region. We take a comparative approach by looking at various panels composed of eight CEE transition economies (Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Lithuania, Poland and Slovenia) and 19 industrialized non-CEE OECD countries. The use of these panels provides insights into the common determinants of house prices for the two groups of countries and, at the same time, allows us to identify the reasons for important differences in house price dynamics across countries. Overall, this paper shows that the growth in house prices in Central and Eastern Europe can be explained fairly well by the development of conventional underlying fundamentals and transition-specific factors.*

## 1 Introduction

As an essential good, housing accounts for a large share of household expenditure and assets as well as for a significant part of economic activity. By affecting households' net wealth and their capacity to borrow and spend as well as profitability and employment in construction, real estate services and financial service industries, developments in house prices have major economic implications.

Since the early 1990s, house prices in many industrialized countries have been rising rapidly. According to OECD data, real house prices have increased by an annual average of 11% since 1993 in Ireland, by over 7% per year in Spain, much of Scandinavia and the United Kingdom and by about 4% per annum in the United States. These growth rates are high both by historical standards for housing markets and compared to the long-term growth rates of other asset prices. Against this background, a large number of studies have sought to explain the determinants of changes in house prices in non-CEE OECD countries.

In recent years, housing markets have also revived in many Central and Eastern European countries (CEECs). Although house prices in this region remain, on average, well below the levels observed in Western Europe, they have been catching up rapidly, with sustained real annual increases in the double-digit range not uncommon. Unlike the determinants of changes in house prices in industrialized countries, however, those in Central and Eastern Europe (CEE) have not yet been systematically investigated. This void in the literature provides a rationale for the present paper.

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To our knowledge, this is the first paper that quantitatively analyzes the driving forces behind house price changes in transition economies.[4] We take a comparative approach and study the determinants of house price changes for various panels composed of transition economies and developed OECD countries. The use of these panels provides insights into the common determinants of house price changes for the two groups of countries and, at the same time, allows us to identify some important differences.

We emphasize the role of conventional fundamental determinants of changes in house prices, such as changes in disposable income, interest rates, credit growth and demographic factors. However, we also highlight the importance of transition-specific factors such as major improvements in the quality of newly constructed housing, the profound transformation of housing market institutions and housing finance, growing external demand for housing in CEE and sustained real wage growth stemming from the catching-up process.

This paper is structured as follows. Section 2 provides an overview of house price dynamics in eight CEECs (Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Lithuania, Poland and Slovenia) and in 19 developed OECD countries (Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Japan, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, the United Kingdom, the United States) since the mid-1990s. Section 3 briefly reviews the empirical literature on house price determinants and illustrates the evolution of conventional fundamentals and transition-specific house price determinants in CEE. Section 4 presents our empirical model and describes the data set and estimation techniques. Section 5 presents the estimation results and section 6 concludes with a discussion of empirical results.

## 2 House Prices in Transition Economies: Hares and Tortoises

In principle, one would expect house prices to grow faster in CEE than in advanced industrialized countries because the initial level of house prices is lower in CEE (see box 1 in the appendix) and because the transition economies are growing much faster. At first glance, however, house prices in CEE do not seem to have grown systematically faster in the period under observation: They remained more or less flat in Poland over the past five years and increased at about the same pace as in the majority of industrialized countries in Croatia, the Czech Republic, Hungary and Slovenia (table 1).[5] The main exceptions to this trend were Bulgaria, Estonia and Lithuania, where house prices surged by an average of 22% to 36% per year since 2002, much faster than in any other industrialized country. Only Spain has seen house prices grow by more than 15% per annum on average over the past five years.

The heterogeneous nature of housing imposes severe limitations on the comparison of different measures of house prices. Data obtained from national

[4] *OECD (2002 and 2005) and Palacin and Shelburne (2005) provide detailed descriptions of housing markets and housing finance in CEE.*

[5] *Note that in the Czech Republic and Hungary, house prices surged particularly strongly during the late 1990s.*

Table 1

**Average Growth Rates of House Prices**

Four-quarter percentage changes, in national currency units; period averages

| Industrial countries | | | Central and Eastern Europe | | |
|---|---|---|---|---|---|
| | 1995–2001 | 2002–2006 | | 1990s–2001[1] | 2002–2006 |
| Germany | −0.4 | 0.1 | Poland (2000) | 5.4 | 1.6 |
| Japan | −2.0 | 0.3 | Croatia – Zagreb (1998) | 0.7 | 8.2 |
| Portugal | 4.7 | 1.3 | Croatia (1997) | 2.7 | 8.7 |
| Austria | −1.1 | 1.5 | Slovenia – Ljubljana (1996) | 6.3 | 8.9 |
| Norway | 9.9 | 6.2 | Czech Republic (2000) | 15.4 | 10.9 |
| Finland | 6.9 | 6.5 | Czech Republic – Prague (2000) | 13.8 | 13.4 |
| United States | 4.2 | 7.2 | Hungary (1998) | 2.9 | 13.4 |
| France | 1.5 | 7.5 | Bulgaria (2001) | | 21.7 |
| Sweden | 6.5 | 7.6 | Lithuania (2000) | −4.1 | 25.1 |
| Denmark | 8.5 | 7.8 | Estonia (1995) | 12.5 | 35.7 |
| Greece | 8.6 | 9.2 | | | |
| Canada | 1 | 9.3 | | | |
| Belgium | 6.4 | 9.8 | | | |
| Ireland | 13.6 | 10.4 | | | |
| Australia | 5 | 11.3 | | | |
| Netherlands | 1.5 | 12.6 | | | |
| New Zealand | 4.8 | 13.4 | | | |
| United Kingdom | 7.3 | 14.6 | | | |
| Spain | 6.4 | 18.5 | | | |

*Source: Authors' calculations using data described in the data section.*

[1] *The year in which country data were first compiled is shown in parentheses.*

sources refer to different types of residential property (new versus existing) or to their weighted averages, so it is not unusual that growth rates of house prices differ widely for the same city, region or country. These differences are even greater when data from commercial sources (e.g. real estate companies) are considered, which is often necessary, given the lack or inadequate coverage of official data in CEE.

## 3 Determinants of House Prices

### 3.1 Empirical Literature

The empirical literature on the determinants of house prices is vast. A sample of recent studies for the euro area, for various groups of industrialized countries and for small European economies is summarized in table A1 in the appendix.

Estimated elasticities of real house prices with respect to economic fundamentals – disposable income, interest rates, credit growth, demographic factors, housing supply as well as other demand and supply factors – differ widely depending on the sample of countries, the period examined and the methodology used. Nevertheless, two common patterns seem to emerge. First, key elasticities are higher for smaller countries (such as Ireland and the Netherlands) and catching-up economies (e.g. Ireland and Spain) than for the samples that include large industrialized countries. Second, the following factors also play a role in house price dynamics in addition to real income and real interest rates: credit growth, demographics and supply-side factors. These results are also broadly confirmed in empirical studies on housing markets in industrialized countries such as Denmark, Finland and Norway (see Girouard et al., 2006), which are not reported in table A1 in the appendix.

### 3.2 Fundamentals in Central and Eastern Europe

Just how important the conventional fundamental determinants of house prices are can be seen from their recent evolution in CEE. As shown in chart 1, over the past ten years *real GDP* increased by about 50% on average in Central European countries (the Czech Republic, Hungary, Poland and Slovenia), by about 40% in Southeastern Europe (Bulgaria and Croatia) and by over 100% in Estonia and Lithuania. Most of the acceleration in real growth has taken place since 2000. This development has coincided with the implementation of EU accession-related institutional reforms that were a precondition for the development of housing markets (see below).

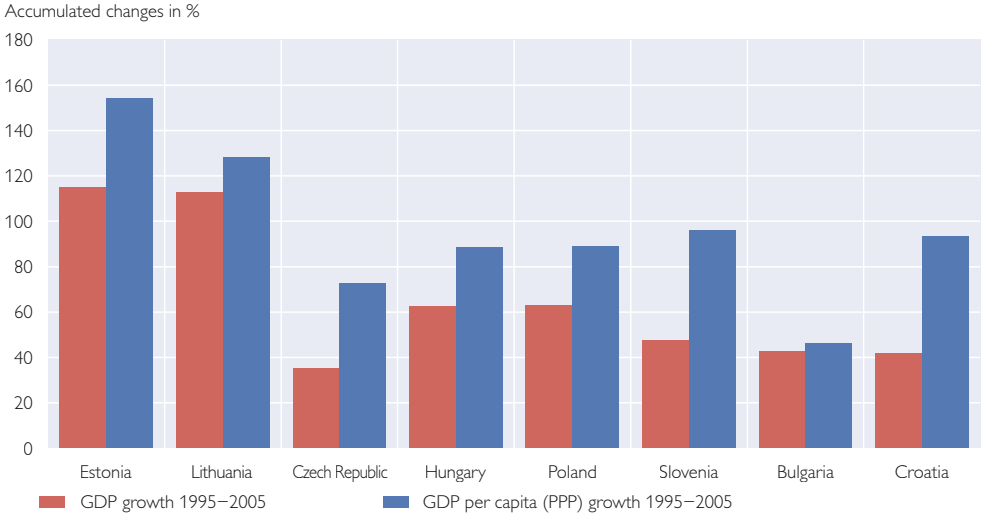
*Nominal interest* rates on long-term bank loans to households in the CEECs declined from over 30% on average in 1995 to about 13% in 2000 and to slightly over 6% in 2005 (chart 2). This means that the cost of borrowing for households declined significantly over the past ten years, making access to housing loans much easier than in the past.

*Bank credit* to households in CEE expanded by an annual 37% on average between 2000 and 2006, while housing loans went up by 59% per annum – much faster than total private sector credit, which posted a growth rate of 21% on average (see table 2). Housing loans were a factor in the credit dynamics recently observed in CEE, contributing an average of 35% to total private sector credit growth in 2005 and 2006.

In recent years, a large proportion of credit to households (especially housing loans) in CEE – with the exception of the Czech Republic – has been extended in foreign currencies (up to 80% in Croatia and Estonia in 2006, see table 2). Such loans are usually denominated in euro (in the Baltic countries, Bulgaria and Croatia) but increasingly also in Swiss francs (in Hungary, Poland and recently also Croatia). The main motivation for taking on foreign currency loans is lower interest rates: In 2006, the average interest rate differential between long-term household loans in foreign and domestic currencies was

Chart 1

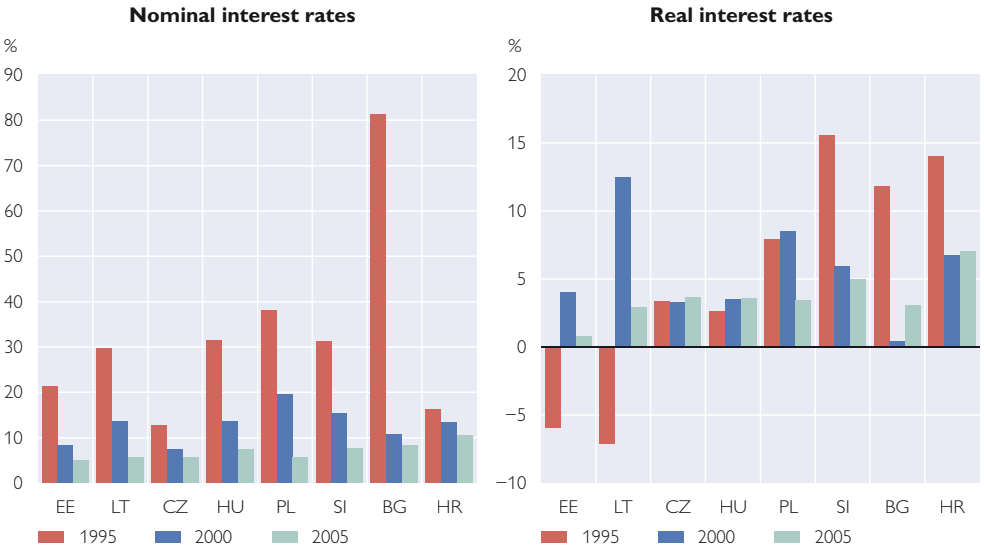
**Growth of Real GDP and GDP per Capita**




*Source: National data, AMECO.*

Chart 2

**Nominal and Real Interest Rates**




*Source: National data, BIS.*

*Note: Weighted average of long-term interest rates on domestic and foreign currency loans to households; nominal interest rates deflated by average annual CPI.*

about 2¾ percentage points, ranging from 0.2 percentage point in Lithuania to 6½ percentage points in Estonia. Moreover, many currencies in the region have been appreciating in nominal terms against the euro owing to strong capital inflows. This suggests that *exchange rate developments* have been another important determinant of house price dynamics in CEE.

Table 2

**Commercial Bank Lending to Households, 2000 to 2006[1]**

| Country | Household credit | | | | | | Total private sector credit growth |
|---|---|---|---|---|---|---|---|
| | Total | Housing | Consumer | Share of foreign exchange loans[2] | Contribution to credit growth[3] | Share in private sector credit | |
| | % per annum | % per annum | % per annum | % | | % | % per annum |
| Bulgaria | 50.4 | 71.5 | 39.9 | 17 | 50 | 37 | 37 |
| Croatia | 26.6 | 24.9 | 27.9 | 80 | 63 | 56 | 17.8 |
| Czech Republic | 33 | 69.8 | 13.9 | 0 | 89 | 38 | 0.8 |
| Estonia | 45.3 | 45.6 | 35.9 | 78 | 55 | 50 | 31.9 |
| Hungary | 45.5 | 68.7 | 47.1 | 40 | 59 | 34 | 25.3 |
| Lithuania[4] | 58.7 | 81.6 | 83.2 | 49 | 41 | 38 | 30.7 |
| Poland | 24 | 48.8 | 15.3 | 39 | 49 | 40 | 8 |
| Slovenia | 14.2 | .. | .. | 42 | 22 | 28 | 17.9 |
| Average | 37.2 | 58.7 | 37.6 | 43 | 54 | 40 | 21.2 |

*Source: IMF, central banks, authors' estimates.*

[1] *Average annual growth rates in %, except for shares and contribution of household credit (in % of total). Growth rates of household credit based on monthly data. In most cases, the latest observation for 2006 is for August.*

[2] *Share of foreign currency loans in total household loans in 2006 (for Croatia, including foreign currency-linked loans).*

[3] *Contribution of household credit growth to total private sector credit growth in % (average for the period from 2003 to 2005).*

[4] *Housing and consumer credit for the period from 2005 to 2006.*

In addition to strong income growth, declining interest rates, rapid credit growth and exchange rate developments, *demographic factors* have also played a role in housing demand and house prices. Overall population figures in CEE are stagnating or declining. However, many CEECs experienced small baby booms in the 1970s and early 1980s. As these cohorts are gradually nearing their prime earning age, they are entering the housing market, thus providing a strong boost to demand, especially for higher-quality housing.

### 3.3 Transition-Specific Fundamentals

In the countries undergoing transformation from a planned to a market economy, house price dynamics are also influenced by several transition-specific factors. These include the poor quality of initial housing stock, a weak institutional infrastructure for the functioning of housing markets, the initial absence and subsequent rapid development of housing finance, and external demand for housing. Except for housing finance innovations and, in cases such as Spain, external demand, these factors no longer have any major impact on the dynamics of house prices in mature market economies.

#### 3.3.1 The Poor Quality of Initial Housing Stock

It is a well-known fact that the quality of housing in socialist countries was low. As recently as 2002, the CEECs scored much lower than most industrialized countries with regard to measures of housing quality such as access to piped water, a fixed bath or a flush toilet (chart 3).[6] Other indicators of housing quality – the average size of dwellings and floor space per occupant – were also markedly lower in CEE.

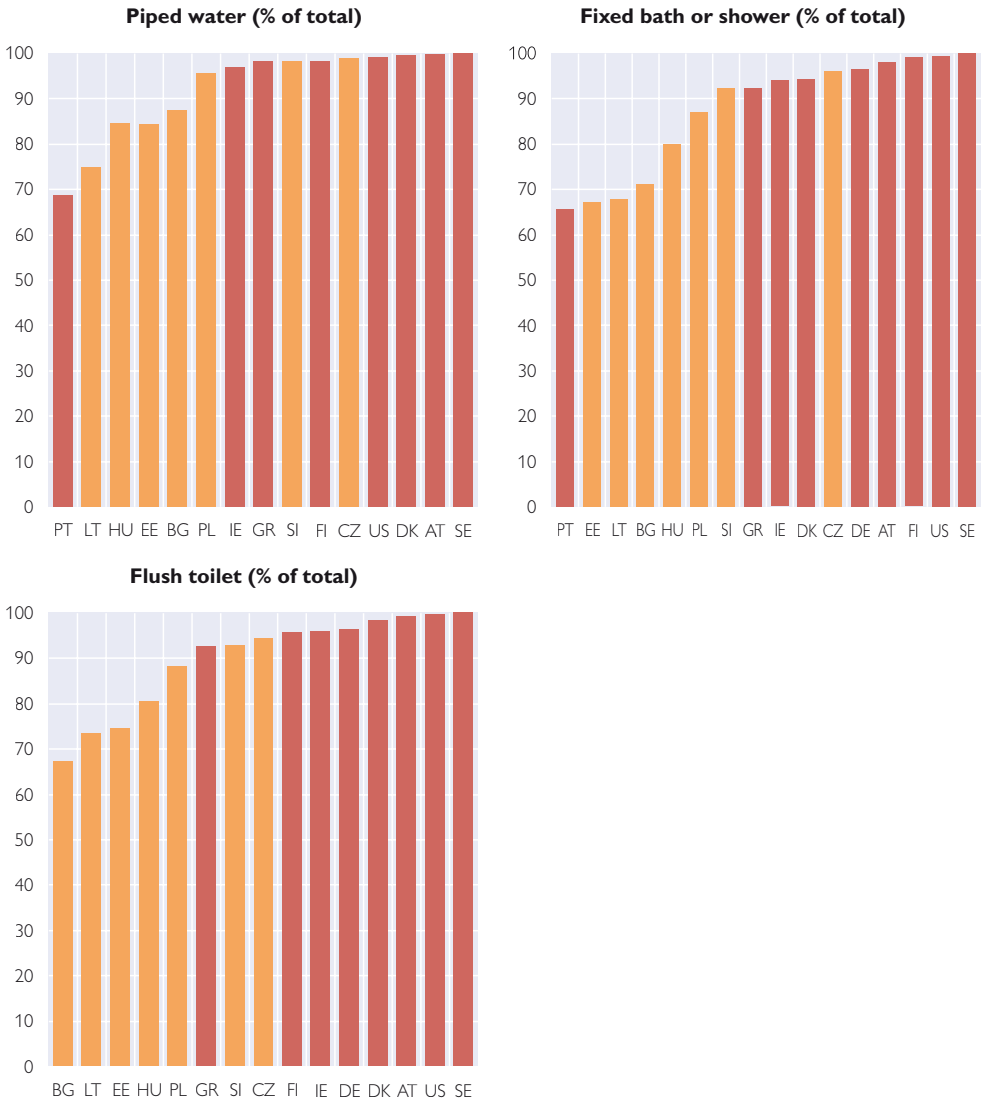
One would therefore expect that, once better-quality housing became available on the market, house prices in CEE would grow faster on average than in countries with a higher quality of the initial housing stock.[7] The rapid increase in house prices in CEE may thus simply reflect improvements in housing quality. Because quality adjustments are likely to persist for as long as the transition economies keep on catching up with the standard of living in the EU-15 countries, house prices in CEE can be expected to grow faster than in Western Europe in the foreseeable future.

The impact of improved housing quality on house prices can be assessed only indirectly, because statistical offices in CEE (like in many Western European countries) do not compile quality-adjusted house price indicators (although consumer price indices are usually partially adjusted for such quality changes). The real value of residential construction per square meter of newly constructed dwellings can provide a rough indication of changes in housing quality. This indicator is obtained as the value of residential construction per average area of new dwellings (excluding land prices and adjusted for changes in average area) deflated by the construction cost index. While the time span under observation is rather short, chart 4 suggests that housing quality went

[6] *The CEECs performance has certainly improved since, but the wide gap is unlikely to have closed by now.*
[7] *This phenomenon is basically a composition effect, where more weight is given to higher-quality and higher-priced housing.*

Chart 3

**Indicators of Housing Quality, 2002**




*Source: OECD, OEC.*

*Note: Piped water: data for Hungary from 1997 and for Denmark from 1993. Fixed bath or shower/Flush toilet: data for Hungary from 1997 and for Germany from 1993. Orange bars denote CEECs, red bars EU-15 countries.*

up in most, though not all, CEE economies between 2000 and 2004.[8] As indicated in chart 4, changes in real house prices during the period from 2000 to 2004 were generally closely correlated with the construction cost index. Exceptions were Croatia, Hungary, Estonia, Lithuania and Spain, where real construction costs climbed considerably faster than real house prices, probably because of capacity constraints in the construction industry and, in particular, the labor market.

[8] *We assume that the construction cost index reflects quality changes, while the value of residential construction per average area of new dwellings does not. The measure of changes shown in chart 4 is thus imperfect.*

Chart 4

**Increase in House Prices and the Real Value of Newly Constructed Housing, 2000 to 2004**


*Source: National statistical offices; authors' calculations.*

*Note: Increase in value of residential construction per average area (in m²) of new dwellings, deflated by construction cost index (2000=100); increase in average house prices, deflated by the CPI (2000 = 100).*

### 3.3.2 Limited Supply of Housing

Another transition-specific factor that has affected the dynamics of house prices in CEE is the limited supply of new homes. For many decades, the public sector had been the dominant supplier of new housing in CEE, especially in cities. During the 1990s, however, the public sector largely withdrew from housing construction owing to public expenditure retrenchments. Private construction companies and property developers only gradually began to fill the resulting void. Even where the capacity to build new private homes existed, spatial planning was often inadequate, which means that long construction delays were common. This situation resulted in a shortage of new, better-quality housing, which may explain why house prices went up so fast in some countries.

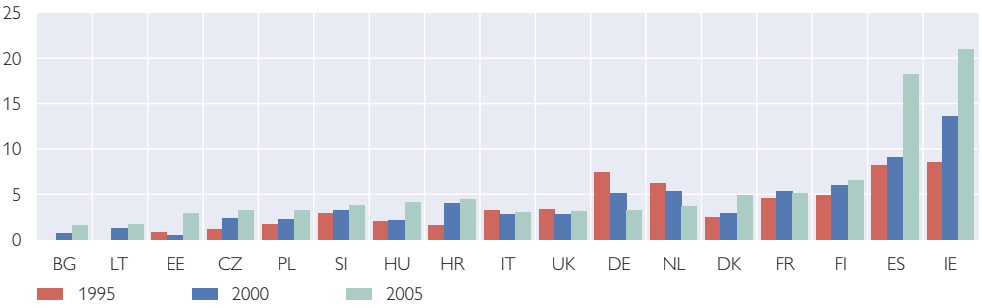
As shown in chart 5, in 1995 less than 2 new dwellings were completed on average per 1,000 inhabitants in CEE, compared with 3 to 8 dwellings in Western Europe. By 2000, the supply of new homes had increased only marginally (except in Croatia and Slovenia). Even in 2005, the supply of new housing in countries such as Bulgaria, Estonia and Lithuania – which, as noted above, recorded the fastest growth of house prices – was far below the supply in Western European countries with strong housing markets, such as Denmark, Finland and France, not to mention Ireland and Spain. Against this background of constrained supply, the rapid increase in house prices in some CEECs should not come as a surprise.

### 3.3.3 Institutional Factors and Housing Finance

In an environment of weak housing market institutions and nonexistent housing finance prevailing in most CEECs until the early 2000s, housing markets generally languished and, with few exceptions (see footnote 2), changes in

Chart 5

**Newly Completed Dwellings per 1,000 Inhabitants**




*Source: National statistical offices, UNECE.*

house prices were anemic. Improvements in the regulatory and institutional framework, which were necessary for the development of the property market, largely occurred in the past four to five years as a result of the EU accession process. In particular, reforms in legislation and judiciary practices that make it easier for creditors to seize real estate collateral removed a key obstacle to the buying and selling of property.[9]

Together with banking sector restructuring and the acquisition of local banks by strategic foreign investors with strong retail expertise, these reforms have spurred the development of housing markets and housing finance in CEE. Many banks started to provide longer-term housing loans, the loan-to-value ratios increased, and interest rates started to decline (chart 2).[10] Despite the fact that the housing market in CEE is a relatively young market – as reflected, among other things, by high fees – housing finance is highly competitive, with margins beginning to approach Western European levels in some countries. However, relative to the EU-15, mortgage penetration in CEE remains much lower and access to mortgage loans is still limited to higher-income households.

One can expect the development of housing market institutions and the lifting of credit constraints to be positively correlated with the growth of house prices on both theoretical and empirical grounds. Asset prices, including house prices, tend to rise toward equilibrium levels when markets are deregulated. Empirically, this development has been observed in many countries in Western Europe in the late 1980s and early 1990s. The United Kingdom, for instance, experienced a major housing boom in the late 1980s during a period of financial liberalization (see Attanasio and Weber, 1994; Ortalo-Magné and Rady, 1999).

[9] *Housing finance was generally unknown in socialist countries. Most urban housing was provided to workers free of charge by their employers or local authorities. The rare financial transactions that took place between private persons were normally settled in cash (often foreign exchange).*

[10] *Mortgage lending currently comes in two main forms: standard mortgage loans, which are usually provided by banks, and "building savings" based on the German building society model. For a comprehensive review of housing finance in transition economies, see OECD (2002 and 2005) and Palacin and Shelburne (2005).*

### 3.3.4 Wage Costs

Wages are an important component of construction costs. While changes in wage costs affect house prices everywhere, they play a more pronounced role in the rapidly catching-up economies, where continuous wage increases resulting from advances in real convergence are an important cost push factor for house prices. Rising wages lead to a systematic rise in construction costs, unless counterbalanced by productivity gains in the construction sector.

### 3.3.5 External Demand for Housing

In recent years, a new factor adding to housing demand in CEE has been – this is somewhat unusual for the property market – increased *external* demand (see Mihaljek, 2005).[11] Housing is usually thought of as a nontraded good *par excellence*, but the removal of restrictions to property ownership and labor mobility within the European Union are increasingly giving housing the characteristics of a traded good. The external demand for housing in CEE has three components: the demand for second homes by residents of EU-15 countries, the demand by CEE citizens who temporarily work abroad, and investment demand.

The demand for second homes by residents of EU-15 countries partly reflects demographic factors and partly the low interest rate environment of the past few years. As baby boomers from Northern Europe approach retirement age, they are increasingly looking for second homes in coastal areas in Southern Europe, where they could spend part of the year during retirement. Second homes in countries such as France, Italy and Spain have become fairly expensive in recent years.[12] Many retiring baby boomers have therefore turned their attention to properties in Bulgaria, Croatia, Montenegro and Romania. Even in the Czech Republic, the Baltic countries and Poland, the demand for second homes by nonresidents has gone up.

The demand for housing by CEE citizens working abroad is a consequence of the stronger migration from Eastern to Western Europe following EU enlargement in 2004. Even with restrictions on labor mobility in place in most EU-15 countries (with the exception of Ireland, Sweden and the U.K.), hundreds of thousands of workers from the Baltic countries and Poland, in particular, have started to work in EU-15 countries, sending remittances to their home countries. These remittances are partly used to finance residential construction, pushing up house prices in the process.[13]

Investment demand has so far concentrated on commercial real estate (mainly shopping malls and office space in major cities). But with property investment markets in CEE performing well, investors who three years ago

[11] *While external demand could potentially affect all economies, we regard it as a transition-specific factor because it is generated by economic integration, which is, in turn, triggered by economic transformation and restructuring.*

[12] *Moreover, overbuilding and the destruction of the coastal environment have become an important issue in some countries, in particular Spain.*

[13] *For instance, remittances have accounted for 3% to 5% of household expenditure in the Baltic states and Poland since 2004 (World Bank). Unlike past economic migrations, the most recent east-west flows of workers by and large represent temporary, cross-border commuting facilitated by cheap transportation. According to opinion surveys, most migrant workers plan to return once they have saved enough to build a house or start a business in their home countries.*

would have only considered offices are now reportedly open to the industrial, hotel and residential sectors (CB Richard Ellis, 2005).

Anecdotal evidence indicates that external demand for housing in CEE is still relatively small compared, for instance, with Spain. Nonetheless, external demand plays an important role in house price dynamics because it affects sellers' expectations. If the supply of land for construction is limited owing to the slow adjustment of zoning regulations, external demand will cause land prices to rise. This increase can spill over to house prices for local residents, as landowners are unwilling to sell land at lower prices for local housing projects if they can obtain a higher price from foreign buyers.

### 3.4 House Price Misalignments

Like prices of other assets, house prices can occasionally be disconnected from underlying fundamentals. In the case of the CEECs, one reason for house price misalignment could be the highly distorted relative prices at the beginning of transition, i.e. *initial undershooting*. The price of housing relative to other consumer durables (or the level of rents relative to the price of other consumer services) had been severely distorted under socialism. This distortion has not yet been corrected because the bulk of housing stock was privatized at nonmarket clearing prices. Typically, local governments sold residential property to long-time "renters" at a fraction of the market price prevailing at the beginning of transition in the 1990s. This has led to a very low turnover in the property market, given the very high proportion of privately-owned and owner-occupied housing.[14] In addition, because of the relative homogeneity of existing housing stock (most of which was built in apartment blocks after the Second World War), there was not much opportunity for moving up the "housing ladder," as is common in Western European countries.

As housing privatization was completed and institutional, regulatory and housing finance reforms were implemented, the initially distorted relative house prices started to move toward equilibrium. One piece of anecdotal evidence of the magnitude of this change – and, hence, the extent of initial undershooting – is provided by the change in the price of an apartment in a typical block of CEE flats built in the 1970s relative to the price of a middle-class passenger car produced in Western Europe, such as a Volkswagen Golf (equivalent to the VW rabbit). In the early 1990s, this relative price was roughly 1:1. By 2006, the same – nonrenovated – apartment was roughly four times more expensive than the VW Golf. In other words, even without any commensurate change in underlying fundamentals, the fourfold increase in the relative price of housing over the past 15 years would have been consistent with the correction of initial undershooting.

House prices might also be disconnected from economic fundamentals because of *overly optimistic expectations* of future growth in the underlying fundamentals. During the upturn of the business cycle, economic agents

[14] *In Western Europe, the share of housing owned by private individuals ranges from about 60% in Austria and Sweden to 90% to 95% in Belgium, Greece, Spain and Portugal, while the share of owner-occupied housing ranges from 38% in Germany to 80% in Ireland (OECD, 2002). In CEE, private individuals on average own 80% to 95% of the housing stock, while the ratio of owner-occupied housing in many countries (e.g. Bulgaria, Estonia, Hungary, Slovenia and Romania) exceeds 90% (ibid.).*

typically become optimistic about the future outlook for the economy in general and the property market in particular. For instance, EU accession and the prospect of euro adoption might have rendered economic agents in CEE excessively optimistic about future prospects – a phenomenon/development which may push up house prices.

House price bubbles could also be triggered by a *credit boom*, which could in turn result from positive shocks to wealth, financial market liberalization and/or financial innovations that lead to low interest rates (Gourinchas, Valdes and Landerretche, 2001). A greater availability of housing loans, for instance, may spur the growth of house prices, especially in areas where housing supply is lagging behind the demand. At the same time, rising house prices may make it necessary for households to take on larger mortgages and may induce some individuals to invest in property for speculative purposes. This may lead to a self-reinforcing cycle of credit expansion and increases in house prices.

Finally, *capital inflows* associated with the external demand for housing (and foreign investment in real estate in CEE in general) can also lead to house price increases that are unrelated to underlying fundamentals. For instance, the demand of foreigners for vacation homes on the Croatian coast has raised local house prices at a rate that is not in line with general housing market trends or with trends in underlying domestic fundamentals. Global real estate companies with deep pockets can easily buy up whole city blocks for redevelopment in CEE and thus significantly affect market sentiment and sellers' expectations.

## 4 Economic and Econometric Approach

### 4.1 The Empirical Model

As suggested earlier, our data set does not (fully) allow us to empirically investigate all the economically interesting issues related to house price developments in CEE. In particular, we are not in a position to assess the possible degree of house price misalignments and we have only a small number of rough proxies to analyze transition-specific factors.

Against this background, our model of house price determinants draws on the standard variables used in the empirical literature discussed above and also takes account of some transition-specific factors. In our analysis, we face two major constraints. First, given that we cover a large number of countries in an attempt to compare the determinants of house prices in developed and catching-up economies, it is very difficult to obtain a comprehensive and comparable data set for some of these variables. Second, given the low number of observations for transition economies, our model can include only a limited set of variables in a dynamic panel context.

Our baseline specification tries to explain house prices with GDP per capita (capita) and real interest rates (rir). In this simple specification, higher GDP per capita and lower real interest rates are associated with higher house prices.

$$p^{house} = f(\overset{+}{capita}, \overset{-}{rir}) \tag{1a}$$

The house price model is estimated using real house prices (nominal prices deflated by the CPI), GDP per capita converted to euro using PPP rates (alternatively, GDP per capita at constant prices and cumulated real GDP

growth), and real ex-post interest rates using annualized inflation rates ($I_t / (P_t - P_{t-4})$. We also use nominal interest rates because Sutton (2002) and Tsatsaronis and Zhou (2004) show that nominal interest rates perform better than real interest rates in explaining house prices, given that banks typically base their decision to grant a housing loan on the ratio of debt servicing costs to income. This ratio depends on the nominal and not the real interest rate. In this formulation, nominal interest rates (nir) might also serve as a proxy for loan availability.[15]

$$p^{house} = f(\overset{+}{capita}, \overset{-}{nir}) \tag{1b}$$

We check the robustness of the results for this basic specification in three steps. First, the interest rate in equation (1a) initially includes the lending rate for domestic currency loans. In CEE, however, an important share of domestic lending is denominated in foreign currencies, in particular in euro. Therefore, as the second approximation we use a weighted average of interest rates on domestic and foreign currency (euro) loans (equation (1c)). Finally, as a more precise measure of the cost of housing loans we use interest series charged on housing loans proper (equation (1d)) rather than bank loans to households in general (which also include loans for purposes other than housing):

$$p^{house} = f(\overset{+}{capita}, \overset{-}{rir}^{FX\&NCU}) \tag{1c}$$

$$p^{house} = f(\overset{+}{capita}, \overset{-}{rir}^{FX\&NCU\_hsg\_loans}) \tag{1d}$$

To this baseline specification we add, one by one, six complementary control variables: housing credit as a percentage of GDP ($c^{house}$), and, because of a possible multicollinearity between GDP per capita and housing loans, we also estimate an equation including only housing loans; the stock market index (sm), to capture the influence of equity prices on house prices via wealth effects induced by changes in equity prices, or as an investment alternative to real estate; and three variables relating to the labor market and demographic factors – the unemployment rate (u), the share of working-age population in total population (pop), and the share of the labor force in total population (lf).

$$p^{house} = f(\overset{+}{capita}, \overset{-}{rir}, \overset{+}{c^{house}}) \tag{2a}$$

$$p^{house} = f(\overset{-}{rir}, \overset{+}{c^{house}}) \tag{2b}$$

$$p^{house} = f(\overset{+}{capita}, \overset{-}{rir}, \overset{+}{sm}) \tag{3}$$

$$p^{house} = f(\overset{+}{capita}, \overset{-}{rir}, \overset{-}{u}) \tag{4}$$

$$p^{house} = f(\overset{+}{capita}, \overset{-}{rir}, \overset{+}{pop}) \tag{5}$$

$$p^{house} = f(\overset{+}{capita}, \overset{-}{rir}, \overset{+}{lf}) \tag{6}$$

The defining and collecting of data that would capture the transition-specific factors described in section 3 presents obvious problems. Regarding housing quality data, the main shortcomings are low frequency, the short time

[15] *We thank an anonymous referee for drawing our attention to this issue.*

span covered and the incomplete geographical coverage of underlying data used to calculate the real value of newly constructed housing shown in chart 4. Instead of this variable we use nominal construction costs (cc) as a proxy for changes in housing quality. A major component of these costs – wages in the construction sector – partly reflects the catching-up process resulting from differential productivity growth in tradable and nontradable sectors (the Balassa-Samuelson effect). In this interpretation, rising construction costs are a manifestation of the same catching-up phenomenon in CEE that instigates improvements in housing quality.

$$p^{house} = f(\overset{+}{capita}, \overset{-}{rir}, \overset{+}{cc}) \tag{7}$$

Another variable that might capture the impact of improved quality on house prices is the growth of per capita GDP, given that households normally demand better quality housing as their income rises.

We also include real wages in another specification:

$$p^{house} = f(\overset{+}{capita}, \overset{-}{rir}, \overset{+}{rwage}) \tag{8}$$

The proxy that we use to capture the effects of external demand on changes in house prices in CEE is monetary aggregates (monag). Sales of housing to foreign residents are typically settled in cash and should therefore be reflected in an increase in bank deposits. Clearly, this is an imperfect measure because movements in bank deposits contain a lot of "noise" from transactions unrelated to property sales to nonresidents.

$$p^{house} = f(\overset{+}{capita}, \overset{-}{rir}, \overset{+}{monag}) \tag{9}$$

Finally, the European Bank for Reconstruction and Development (EBRD) compiles a number of transition indicators that are potentially relevant for measuring the pace of development of housing markets and housing finance: (1) banking reform, and (2) security markets and nonbank financial institutions:

$$p^{house} = f(\overset{+}{capita}, \overset{-}{rir}, \overset{+}{reform}) \tag{10}$$

In addition, we use different credit growth series to partly capture these institutional effects, given that the evolution of housing loans clearly reflects the restructuring of the housing market and housing finance in CEE.

Despite its obvious importance, this paper will not address the issue of equilibrium or potentially excessive growth of house prices in CEE. First, using model estimates (including estimates for the transition economies in our case) to assess price misalignments would have a number of methodological drawbacks in the presence of initial undershooting (see e.g. Maeso-Fernandez, Osbat and Schnatz, 2005). Second, the out-of-sample panel approach, i.e. using the estimation results obtained for the OECD countries to derive misalignments for the CEECs, is not really feasible. Such an exercise would require a full data set on house price levels throughout the sample period, which is not available for a number of countries considered. For example, Australia, Austria, Belgium, Canada, Denmark, Germany, Greece, the Netherlands, Portugal and Sweden only publish time series for house price indices, but not any data on *levels* of house prices (in euro per square meter) at

a quarterly or monthly frequency. In fact, among small OECD countries, which could be taken as a natural long-term benchmark for CEE, only two countries (Finland and Ireland) publish such data.

Nonetheless, by looking at coefficient estimates on GDP per capita we can shed some light on the adjustment away from initial undershooting and the extent of possible overshooting. Said estimates would be higher if these phenomena were present. If house price developments were completely disconnected from fundamentals as a result of a correction of an initial undershooting or a bubble, it would not be surprising if we established the absence of any statistical relationship between house prices and GDP per capita.

### 4.2 Data and Country Sample Issues

Our data set comprises quarterly data covering 27 countries and grouped into two main panels: developed OECD countries and CEE transition economies. The (non-CEE) OECD panel is further split into three subpanels: large OECD countries (large OECD),[16] small OECD countries (small OECD)[17] and the four catching-up OECD countries Greece, Ireland, Portugal and Spain (catching-up 4). The CEE panel consists of eight transition economies. We further split this sample into two subgroups: countries with low or moderate increases in house prices (Croatia, the Czech Republic, Hungary and Poland) and countries where the rise in house prices has been more substantial (Bulgaria, Estonia and Lithuania) or sustained over a long period (Slovenia, since 1996).

Data on *house prices* expressed in domestic currency terms for non-CEE OECD countries are mostly obtained from the BIS Data Bank and Datastream; data for the transition economies stem from the respective national central banks and statistical offices.

Data on GDP *per capita* in purchasing power standards, at current euro exchange rates and at constant prices in domestic currency terms, are obtained from the European Commission's yearly database AMECO.

*Interest rates* relate to nominal lending rates and are obtained from the IMF's International Financial Statistics (IFS). Data on interest rates for the transition economies represent weighted averages of lending rates on domestic and foreign currency loans. Given that complete data series on interest rates on foreign currency loans are not available, these data are proxied by the three-month euro area money market rate (obtained from Eurostat's NewCronos). The weights used represent the respective shares of domestic and foreign currency loans in total housing loans. For most of the countries, lending rates refer to the whole economy. For the transition economies (but not for the EU-15), Eurostat also provides data on lending rates on new housing loans.

*Inflation rates* for the calculation of real interest rates stem from the IFS. CPI data for calculating real house prices and real interest rates are obtained

[16] *France, Germany, Japan, U.K., U.S.A.*
[17] *Austria, Belgium, Finland, Greece, Ireland, the Netherlands, Portugal and Spain from the euro area plus Denmark, Norway, Sweden, Australia, Canada and New Zealand.*

from the wiiw's monthly database for CEE (except Estonia and Lithuania) and from the IMF's IFS for the rest of the sample.

*Housing loans* in OECD countries are approximated by total private loans as a share of GDP, using IFS data. For Bulgaria, Croatia, the Czech Republic, Estonia, Hungary and Poland we were able to collect data on housing loans from central bank websites. However, the data series only start in 1999 for Croatia and in 2000 for Hungary, respectively. For these two countries, we extended the housing loan series to match the span of the house price series using data on loans to households for Croatia and on private credit for Hungary. For Lithuania and Slovenia, central banks only provide data on lending to households but not on housing loans.

The *stock market indices* are drawn from Datastream. The series of *nominal exchange rates* against the euro for the transition economies are obtained from the wiiw's monthly database.

*Labor market* data come from the IFS (unemployment rates) and the AMECO database (share of population aged between 16 and 64, and share of labor force in total population; both data series are annual and are interpolated linearly from yearly to quarterly frequencies).

*Construction costs* are obtained from Eurostat's NewCronos database. The country coverage is not complete (data are missing for six OECD and two CEE countries). As a result, we use this variable only for the OECD and CEE samples, but not for country subgroups.

*Real wages* are based on nominal wages for the whole economy, obtained from the BIS and the IMF's IFS, deflated by CPI.

*Monetary aggregates* used are M2 for the CEECs (M3 for Croatia), harmonized M3 for the euro area, and M2 or M3 (depending on availability) for other OECD countries. These data were retrieved from the wiiw's monthly database (for CEE), national sources (for the euro area) and Datastream (for other OECD countries).

*EBRD structural indicators were* obtained from the EBRD and are interpolated linearly from annual to quarterly frequency. The indicator on banking sector reform does not change for Hungary from 1997 on. The same applies to the indicator related to the development of security markets and nonbank financial institutions for Slovenia after 1997. As there is no variation in the series, we cannot include those countries when using the considered variable.

The data set is unbalanced, as the length of the individual data series largely depends on data availability. The sample begins between 1975 and 1994 for the non-CEE OECD countries, and between 1993 and 1998 for the transition economies; it ends in 2005. All data are transformed into logs with the exception of real interest rates.

### 4.3 Estimation Techniques

It is important to check whether the series under observation are stationary in levels. For this purpose, we employ four panel unit root tests: the Levin, Lin and Chu (2002) (LLC), the Breitung (2000), the Hadri (2000) and the Im-Pesaran-Shin (2003) (IPS) tests. The first three assume common unit roots across panel members, whereas the IPS test allows for cross-country heterogeneity. The Hadri test considers the null of no unit root against the

alternative hypothesis of a unit root, whereas the remaining tests take the null of a unit root against the alternative hypothesis of no unit root.

The panel unit root tests[18] are carried out for level, first-differenced and second-differenced data. While in general, all panel unit root tests usually come to the conclusion that the series are I(1) processes, some of the tests show that a few series are I(0) or I(2). But given that there is no overwhelming evidence that they are really stationary in levels or in second differences, we assume that the series under study are stationary in first differences.

Against this background, the coefficients of the long-term relationships are obtained using panel-dynamic OLS (ordinary least squares) estimations that allow for cross-country heterogeneity both in the short-run dynamic coefficients and in the long-run coefficients. The mean group panel-dynamic OLS estimator accounts for the endogeneity of the regressors. This is a very useful feature, as some of the explanatory variables such as housing loans may be endogenous (see e.g. Hofmann, 2001). It also corrects for serial correlation in the residuals in the simple OLS setting by incorporating leads and lags of the regressors in first differences. The panel DOLS (dynamic ordinary least squares) can be written for panel member $i$ as follows:

$$Y_{i,t} = \alpha_i + \sum_{h=1}^{n} \beta_{i,h} X_{i,t} + \sum_{h=1}^{n} \sum_{j=-k_{i,1}}^{k_{i,2}} \gamma_{i,j} \Delta X_{i,t-j} + \varepsilon_{i,t} \qquad (9)$$

where ki,1 and ki,2 denote leads and lags, respectively, and the cointegrating vector $\beta'$ contains the long-term coefficients of the explanatory variables (with $h = 1,...,n$) for each panel member $i$. The Schwarz information criterion is used to determine the optimal lag structure.

We use the mean group error correction term obtained from the error-correction specification as a test for cointegration. A negative and statistically significant error correction term is taken as evidence for the presence of cointegration:

$$\Delta Y_{i,t} = \alpha_i + \rho_i (Y_{i,t-1} + \sum_{h=1}^{n} \beta_{i,h} X_{i,t-1}) + \sum_{h=1}^{n} \gamma_{i,h} \Delta X_{i,h,t} + \varepsilon_{i,t} \qquad (10)$$

where $\rho$ is the error correction term.

## 5 Estimation Results

Owing to space constraints, table 3 shows only the results for the two large panels. Where relevant, results for the subpanels are discussed in the text. The existence of long-term relationships that connect house prices to a set of fundamentals is checked by using the error correction terms derived from the estimated error correction model. As explained earlier, one can establish a cointegrating vector in the event that the error correction term is statistically significant and has a negative sign. Indeed, all error correction terms reported in table 3 fulfill this double criterion. This suggests that house prices and the selected explanatory variables stand in a long-term relationship.

A striking feature of the results is the large difference in the size of the error correction terms for the non-CEE OECD countries on the one hand and

[18] *Not reported here because of space constraints.*

CEECs on the other. While the error correction terms range from –0.01 to –0.15 for the non-CEE OECD countries, depending on which subgroup is considered, they amount to between –0.3 and –0.7 for the CEECs. This indicates a much higher speed of adjustment to equilibrium in the case of the transition economies than for the non-CEE OECD countries.

The estimated long-run coefficients of explanatory variables displayed in table 5 point to several interesting conclusions. First, GDP per capita is highly significant and has the expected positive sign. However, there its size differs widely across countries, with estimates for the transition economies generally being higher than those for non-CEE OECD countries.

In particular, transition countries with low or moderate house price increases have coefficient estimates comparable to those for small non-CEE OECD countries. CEECs with high house price inflation record much higher estimates of the GDP coefficient, which are well above unity. The four catching-up countries of the "old" EU-15 (Greece, Portugal, Spain and Ireland) are somewhere between the two groups of transition economies.

Regarding the impact of real interest rates on house prices, the results are fairly robust. The estimated coefficients almost always have the expected negative sign. Coefficients tend to be quantitatively higher in CEE but are not always significant. For CEECs with low house price growth, a negative sign appears only if we use interest rates on housing loans, weighted by the shares of domestic and foreign currency housing loans (rir mix 2). Interestingly, the sign of coefficient on nominal interest rates is either positive or not significant.

Credit to the private sector bears a strong positive relationship to house prices in the non-CEE OECD countries. In transition economies, an increase in private sector credit is associated with higher house prices only in countries experiencing high house price inflation. In countries with low house price inflation the relationship between credit growth and house prices is negative. However, as in the case of real interest rates, when we use a more precise measure of credit, namely housing loans proper, the coefficient on housing loans becomes highly significant, with a positive sign even for the group of countries with low house price inflation.

One should also note that the inclusion of housing loans in the estimated equation significantly reduces the size of the coefficient on GDP per capita or even reverses its sign. Also, if the credit variable is included separately in the equation, the size of the estimated coefficient usually increases. This indicates possible multicollinearity between these two variables. Multicollinearity is also a serious issue when real wages and the EBRD structural indicators are used in the equations. This suggests that one should not include GDP per capita and the considered variables in the same equation.[19]

Coefficient estimates for population, labor force and unemployment variables are all significant and have the right sign for the non-CEE OECD countries, confirming the findings of earlier empirical research. In the CEECs,

[19] *Note that the inclusion of other control variables does not produce the typical signs of multicollinearity, i.e., one variable becoming insignificant and switching the sign.*

Table 3

## Estimation Results – Long-Term Relationships

Dependent variable: real house prices

All non-CEE OECD countries

| | Eq1a | Eq1a | Eq1a | Eq1c | Eq1d | Eq1b | Eq2a | Eq2b | Eq2a | Eq2b | Eq3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| capita (PPP) | 0.434** | | | | | 0.606** | 0.360** | | | | 0.590** |
| capita (constant prices) | | 0.947** | | | | | | | | | |
| GDP (real) | | | 0.640** | | | | | | | | |
| rir | −0.003** | 0.000** | −0.002** | | | | −0.001** | −0.015** | | | −0.005** |
| nir | | | | | | 0.016** | | | | | |
| credit | | | | | | | 0.294** | 0.617** | | | |
| sm | | | | | | | | | | | −0.023** |
| unemployment | | | | | | | | | | | |
| pop | | | | | | | | | | | |
| lf | | | | | | | | | | | |
| cc | | | | | | | | | | | |
| rwage | | | | | | | | | | | |
| monag | | | | | | | | | | | |
| ECT | −0.073** | −0.082** | −0.084** | | | −0.071** | −0.085** | −0.046** | | | −0.077** |
| R2 | 0,68 | 0,73 | 0,68 | | | 0,71 | 0,75 | 0,69 | | | 0,76 |
| All CEE economies | | | | | | | | | | | |
| capita (PPP) | 0.926** | | | 1.172** | 0.976** | 1.140** | 0.614** | | −0.309** | | 0.673** |
| capita (constant prices) | | 1.381** | | | | | | | | | |
| GDP (real) | | | 1.181** | | | | | | | | |
| rir | −0.012** | −0.016** | 0.002 | | | | | | | | |
| rir mix1 | | | | −0.009 | | | | | | | |
| rir mix2 | | | | | −0.013** | | −0.023** | −0.012** | −0.008** | −0.015** | −0.013** |
| nir mix2 | | | | | | 0.011** | | | | | |
| credit | | | | | | | −0.352 | 0.352** | | | |
| loan | | | | | | | | | 0.308** | 0.243** | |
| sm | | | | | | | | | | | −0.051 |
| unemployment | | | | | | | | | | | |
| pop | | | | | | | | | | | |
| lf | | | | | | | | | | | |
| cc | | | | | | | | | | | |
| rwage | | | | | | | | | | | |
| monag | | | | | | | | | | | |
| banking sector | | | | | | | | | | | |
| financial sector | | | | | | | | | | | |
| ECT | −0.262** | −0.270** | −0.319** | −0.252** | −0.241** | −0.237** | −0.328** | −0.268** | −0.341** | −0.284** | −0.284** |
| R2 | 0,75 | 0,76 | 0,79 | 0,75 | 0,74 | 0,77 | 0,80 | 0,75 | 0,85 | 0,77 | 0,81 |

*Source: Authors' calculations.*

*Note: * and ** indicate statistical significance at the 10% and 5% significance levels, respectively. Abbreviations: see section 4.1. ECT = error correction term.*

Table 3

## Estimation Results – Long-Term Relationships (continued)

Dependent variable: real house prices

| | Eq4 | Eq5 | Eq6 | Eq7 | Eq8 | Eq8' | Eq9 | 10 | 10 | 10 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| All non-CEE OECD countries | | | | | | | | | | | |
| capita (PPP) | 0.467** | 0.507** | 0.459** | 0.486** | 0.768** | | 0.359** | | | | |
| capita (constant prices) | | | | | | | | | | | |
| GDP (real) | | | | | | | | | | | |
| rir | 0,01 | −0.005** | −0.003** | 0.004** | −0,01 | −0.002** | 0,01 | | | | |
| nir | | | | | | | | | | | |
| credit | | | | | | | | | | | |
| sm | | | | | | | | | | | |
| unemployment | −0.197** | | | | | | | | | | |
| pop | | 4.456** | | | | | | | | | |
| lf | | | 1.065** | | | | | | | | |
| cc | | | | 0.130** | | | | | | | |
| rwage | | | | | −0.002** | 0.009** | | | | | |
| monag | | | | | | | 0.010** | | | | |
| ECT | −0.106** | −0.099** | −0.084** | −0.131** | −0.091** | −0.057** | −0.120** | | | | |
| R2 | 0,80 | 0,80 | 0,75 | 0,94 | 0,84 | 0,78 | 0,83 | | | | |
| All CEE economies | | | | | | | | | | | |
| capita (PPP) | 0.658** | 1.104** | 1.084** | 0.097 | 8.343** | | −1.002** | 13.568** | | 1.876** | |
| capita (constant prices) | | | | | | | | | | | |
| GDP (real) | | | | | | | | | | | |
| rir | | | | | | | | | | | |
| rir mix1 | | | | | | | | | | | |
| rir mix2 | −0.017** | −0.001 | −0.010** | −0.012** | −0.031** | −0.046** | −0.011** | 0.039 | −0.037** | −0.028** | −0.041** |
| nir mix2 | | | | | | | | | | | |
| credit | | | | | | | | | | | |
| loan | | | | | | | | | | | |
| sm | | | | | | | | | | | |
| unemployment | −0.186 | | | | | | | | | | |
| pop | | 12.496** | | | | | | | | | |
| lf | | | −1.211 | | | | | | | | |
| cc | | | | 1.280** | | | | | | | |
| rwage | | | | | −0.084** | 0.015** | | | | | |
| monag | | | | | | | 0.000** | | | | |
| banking sector | | | | | | | | −15.910** | 1.211** | | |
| financial sector | | | | | | | | | | −2.685** | 1.807** |
| ECT | −0.327** | −0.361** | −0.327** | −0.613** | −0.285** | −0.167** | −0.359** | −0.291** | −0.147** | −0.350** | −0.146** |
| R2 | 0,88 | 0,90 | 0,88 | 0,86 | 0,82 | 0,72 | 0,82 | 0,82 | 0,70 | 0,76 | 0,65 |

*Source: Authors' calculations.*

*Note: * and ** indicate statistical significance at the 10% and 5% significance levels, respectively. Abbreviations: see section 4.1. ECT = error correction term.*

however, it is not possible to establish a clear and robust relationship between these demographic and labor market variables and house prices.

House prices in non-CEE OECD countries are also positively correlated with stock prices. In CEE, house prices are positively correlated with stock prices only in countries with high house price inflation. Elsewhere, the sign of the stock market variable is often negative, which could indicate a substitution effect rather than a wealth effect of equity prices on house prices. However, it is more likely that the lack of relationship between equity prices and house prices reflects the low share of equities in total financial wealth in CEE and the relatively important role of foreign investors in CEE stock markets.

Construction costs are positively correlated with house prices in both OECD and CEE economies. Their impact is quantitatively more important in CEE (coefficient = 0.489) than in the non-CEE OECD countries (coefficient = 0.109).

Regarding the potential impact of external demand on house prices, the long-run relationship between house prices and monetary aggregates used as a proxy for this demand is highly significant. While this could in principle show foreign demand to be at play, the result needs to be interpreted with caution, given that the coefficient estimates tend to be considerably higher in non-CEE OECD countries than in CEE.

## 6 Concluding Remarks

This paper studies the determinants of house price dynamics in the CEE transition economies and in non-CEE OECD countries. In addition to analyzing the role of traditional fundamentals like GDP per capita, interest rates and demographic factors, we underline the importance of a number of transition-specific factors. In particular, we argue that improvements in the quality of newly constructed housing, the transformation of housing market institutions and housing finance, and growing external demand for housing are key to understanding developments in house prices in the region.

We test these hypotheses on a sample of eight transition economies (Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Lithuania, Poland and Slovenia), drawing on different panels composed of non-CEE OECD and transition economies. We obtain very high coefficient estimates on GDP per capita in those CEECs that have experienced a rapid or more sustained growth of house prices (Bulgaria, Estonia, Lithuania and Slovenia). We argue that this result might reflect a correction of the initial undervaluation of house prices or of subsequent overshooting.

We establish a robust relationship between real interest rates and house prices. This required the use of a precise measure of interest rates (weighted average of interest rates on domestic and foreign currency housing loans). Our results also show that the growth of housing loans plays an important role in house price dynamics, both in transition and OECD economies. Again, this result is obtained when the correct measure of housing loans is used.

Our results indicate that so far, house prices in transition economies have been less influenced by developments in equity prices, demographic factors and labor market developments than in non-CEE OECD economies.

Yet within our data set it was not possible to fully assess the effects of quality improvements, which seem to have played an important role in the growth of house prices in CEE. Quality effects may be captured by the higher coefficients of the GDP-per-capita variable.

The long-run relationship between house prices and monetary aggregates used as a proxy for external demand for housing in CEE is highly significant. However, this result might also reflect a number of factors unrelated to sales of property to nonresidents that are captured by changes in monetary aggregates.

In summary, the analysis presented in this paper suggests that the growth in house prices in Central and Eastern Europe can be explained fairly well by the development of conventional underlying fundamentals and transition-specific factors.

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# Appendix

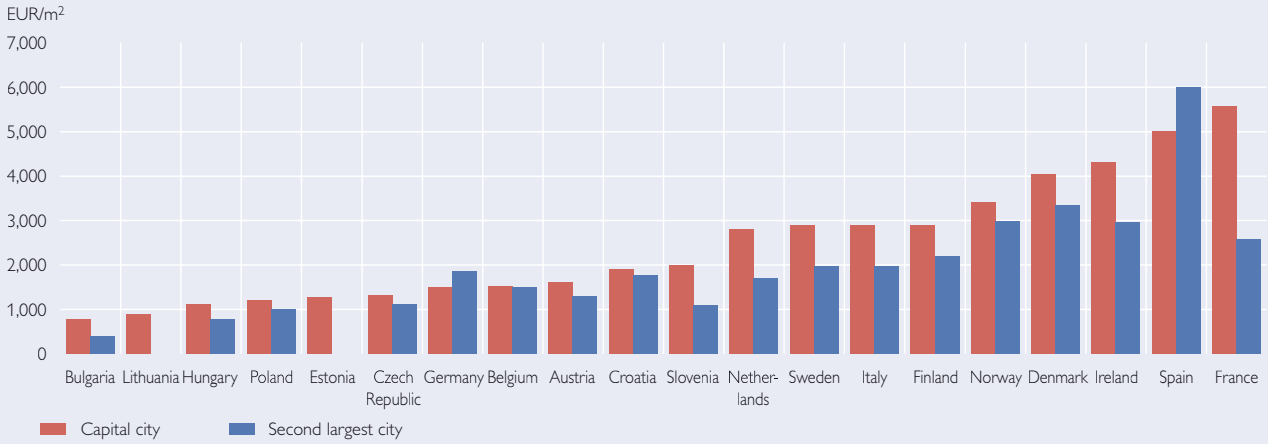
Box 1

## House Prices in Transition and Non-CEE OECD Economies

*House prices in euro per square meter are considerably lower in Central and Eastern Europe than in Western Europe. In 2005, average house prices in Bulgaria, Estonia and Lithuania were about four times lower than those in Italy, Finland, the Netherlands and Sweden and six to seven times lower than those in Spain and France (Chart A1). These orders of magnitude are broadly in line with the discrepancies in per capita GDP levels (expressed in purchasing power standards) between the "new" and "old" EU Member States, which reflects the lower level of economic development in CEE.*

Chart A1

### Average House Prices (2005)




*Source: National data, national central banks, Datastream, real estate companies.*

*Nevertheless, when house prices are compared across some of the capital cities under review, these differences narrow significantly and sometimes even disappear. In 2005, one square meter of housing in Budapest, Prague or Warsaw cost just 20% to 30% less than in Berlin, Brussels or Vienna; in Ljubljana and in Zagreb, average house prices were the same or higher than in the latter three Western capitals (chart A1). This phenomenon results from the increasing concentration of economic activity, especially the booming service industries, in urban areas in the CEECs. Urban land prices – and, by extension, urban house prices – thus often increase much faster than house prices in nonurban areas.*

Table A1

## Selected Recent Empirical Studies on the Determinants of House Prices

| Country and authors | Elasticity of real house prices | | | Methodology, comments |
|---|---|---|---|---|
| | Real disposable income | Real interest rate | Other factors | |
| **Euro area**<br>Annett (2005) | 0.1 to 1.4 short-run impact | −0.01 to −0.03 short-run impact | Real credit 0.1 to 0.2<br>Real money 0.4 to 0.6 | Panel regressions for subgroups of countries based on common institutional characteristics, short- to medium-run equations.<br>Institutional factors help explain the relationship between credit and house prices.<br>VaR model, from the 1970s to the first quarter of 2002. |
| **Six industrial countries**<br>Sutton (2002) | GNP 1 to 4 after 3 years | −0.5 to −1.5, weaker for longer rates | Equity prices 1 to 5 after 3 years | |
| **17 countries** (grouped on mortgage finance structures)<br>Tsatsaronis and Zhou (2004) | Accounts for < 5% of total variation in house prices after 5 years | Accounts for < 11% of total variation in house prices after 5 years | Inflation accounts for 50%; bank credit and term spread each account for >10% of total variation in house prices after 5 years | VaR model, 1970–2003.<br>Mortgage market structures have an impact on the sensitivity of inflation to interest rates and the strength of the bank credit channel. |
| **18 countries**<br>Terrones and Otrok (2004) | 0.5 to 1.1 | −0.5 to −1.0<br>Short-term rate | Housing affordability (t−1) −0.1<br>House price (t−1) 0.5<br>Real credit 0.1<br>Population growth 1.8<br>Bank crisis −2.4 | Dynamic factor model, from 1980 to the first quarter of 2004.<br>Real house prices show high persistence, long-run reversion to fundamentals and dependence on economic fundamentals.<br>Real house prices are strongly procyclical; average correlation with output (consumption) declined since the mid-1990s.<br>House prices in industrial countries tend to move in line and have become more synchronized in the 1990s. |
| **Ireland**<br>Rae and van den Noord (2006) | 1.8 | −1.9 | Housing stock supply −2.0 (new) to −0.007 (existing) | ECM, from 1977 to 2004 for new and existing houses.<br>The sharp increase in the price of existing houses relative to that of new houses since the mid-1990s partly reflects supply constraints. Short-run income elasticities are high. |
| **Netherlands**<br>OECD (2004) | 1.9 | −7.1 | Housing stock supply −0.5 | High growth in real house prices mainly attributable to weak supply response. |
| **Spain**<br>Ayuso et al. (2003), Banco de España (2004) | 2.8 | −4.5 (in nominal terms) | Equity market return −0.3 | ECM, 1989–2003.<br>Estimated overvaluation increases over time. |

*Source: Adapted from Girouard et al. (2006, pp. 11–15).*