

A Hedonic Price Index on Bank Data and the Impact of the Economic Crisis on House Prices in the Czech Republic

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Abstract: In the first section, this paper describes the methods employed to calculate the first ever hedonic price index created in the Czech Republic using data from the country's biggest mortgage lenders. This section also presents the wider context of the creation of this index and its practical application. In the second section, hedonic price index data are used to demonstrate the impact of the global economic crisis on housing prices in the Czech Republic. The impact of the economic crisis on housing and mortgage markets is then analysed using methods from both neoclassic and institutional economics. The findings show that institutional factors relating to the housing system may have an important influence on the scope and character of the impact of the economic crisis on housing and mortgage markets in the Czech Republic.

Introduction

This paper briefly describes, in the first section, the background and the methodology for calculating the hedonic house price index based on data from Czech mortgage lenders. This price index can be used, among other things, to observe the current trends in house prices. Consequently, unlike other price indexes available in the Czech Republic, it is also suitable for measuring the current impact of the economic crisis on house prices. In the second section, the paper focuses on the actual effects of the global economic crisis on the housing and mortgage markets in the Czech Republic. The impact of the economic crisis on housing and mortgage markets is then analysed using methods from both neoclassic and institutional economics. The findings show that institutional factors relating to the housing system may have an important influence on the scope and character of the impact of the economic crisis on housing and mortgage markets in the Czech Republic.

The hedonic house price index

Several price indices on residential real estate have emerged in the Czech Republic since the late 1990s. Leaving aside the amateur attempts of some real estate agencies, which use simple averages of offer prices, there are three indexes that from a methodological perspective can be regarded as relevant. The first is the index published by the Czech Statistical Office (CSO) each year in the publication *The Prices of Monitored Types of Real Estate*, which is based on transaction prices ascertained by financial offices and recorded by the Ministry of Finance for the purpose of stamp duty collection. The second is the index created by the Institute of Regional Information (IRI), which is based on offer (advertised) prices. The third index – the price index of the Czech Technical University (CTU) – is saturated using a similar method (taking offer prices from adverts).

All of the above-cited indexes grapple with methodological problems, relating either to the indexing method and sample selection (IRI, CTU) or to the scope and quality of the data (CSO). In the data file for the CSO index the sample of executed transactions is incomplete, only a small number of housing attributes are collected, and above all the index itself is released with a substantial delay (by as much as two years). The approaches used by the IRI and the CTU are based on advertised (offer) prices; data on real estate attributes depends on

how truthful and exhaustive the information in the adverts is. Moreover, for the purpose of the index only ‘standard’ flats are used; the hedonic approach is not applied.

The hedonic approach and its applications in the Czech Republic

The hedonic approach to measuring changes in house prices views the price of a real estate unit as the sum of the implicit (‘concealed’) prices of that real estate’s attributes (for example, the size of the flat, its age, the attractiveness of its location, and other attributes) and in this way it offers the best examination of residential real estate as a complex economic good. The following equation articulates the hedonic price model in its most general form:

$Y = B_1S + B_2L + B_3R + \varepsilon$, where:

| | |
|---------------|--|
| Y | - price of the real estate unit; |
| S | - attributes of the given real estate unit (flat size, number of rooms, etc.); |
| L | - location-specific attributes (the socioeconomic features of the location, accessibility to the workplace, etc.); |
| R | - region-specific attributes (the level of the region’s economic development, employment rate, etc.); |
| ε | - model error component (residuals). |

The hedonic approach involves identifying the relationship between price-determining factors (the real estate’s attributes) and price. This relationship is first tested for each component separately, that is, the relationship between the dependent variable and each explanatory variable, and only then are the multi-dimensional models capturing the interactive effect of all the explanatory variables on the dependent variable tested. If the relationships between the dependent and the explanatory variables are non-linear, a mathematical transformation is employed. Many explanatory variables enter the model, for instance, in quadratic, cubic, or logarithmic form or after a so-called gamma transformation, and even the functional form of the entire model is changed, usually by means of a semi-logarithmic transformation, where the dependent variable of ‘house price’ is replaced with the ‘natural log of the housing price’.

The advantage of using hedonic models to construct a house price index is that they are relatively best able to identify the net price change and control for the changes in the quality and structure of transactions occurring during the period to which the index pertains. Almost all the data on transactions can be used; this can be contrasted with the repeat sales index, which uses information on around just 20% of transactions on houses repeatedly sold. The main disadvantage of the hedonic index is the volume of observed data on individual real estate units that has to be monitored. The more thoroughly price changes are to be cleaned of changes in the quality and structure of units sold, the more detailed the information on the attributes of real estate units that has to be monitored.

A good way of obtaining reliable and comprehensive data records on real estate units and their close surrounding is to employ independent real estate appraisers, who make assessment of real estate for mortgage applications. Real estate appraisers are in a relatively independent position; their remuneration is not tied to the client’s interests. Unlike the information on the attributes of a real estate unit provided by real estate agencies, which have a stake in the transaction, the information recorded by an appraiser can be regarded as more reliable; often this information is verified by an internal auditing system of mortgage lender. The standardised, electronic form of records they use ensures that the records are complete - all

the important fields in the appraisal form must be filled in, otherwise the appraiser cannot electronically submit the appraisal for processing. In real estate adverts it is common for there to be missing information on the various attributes of the real estate unit.

For this reason, the source of data selected to construct the first hedonic price index in the Czech Republic was the database of residential real estate pledged to mortgage lenders operating in the Czech Republic. The objective of the project to construct this index was to create a dataset shared and saturated by all or a large portion of mortgage lenders in the Czech Republic. Bank data-sharing results in statistical models of much greater reliability, leads to more detailed monitoring of price trends in different market segments, eliminates the deviation caused by differences in the transaction portfolios of different banks, and generates lower unit costs.

However, to achieve this objective, it was first necessary to establish a uniform format for electronic data collection that will be applied by all mortgage lenders, and this proved to be a very time-demanding process. In cooperation with Česká spořitelna, a.s., the second-largest mortgage lender in the Czech Republic (part of ERSTE financial group), in 2005 a new format for data collection was devised, and, at no small expense to the bank, which had to change its internal IT system, it began to apply this data collection form in 2007. After testing the hedonic models on data collected in 2007 and 2008, the number of relevant attributes in the data collection form was reduced to the 78 most significant attributes.

In the spring of 2008 this form was also adopted by representatives of Hypoteční banka, a.s., the largest mortgage lender in the Czech Republic (part of KBC financial group). These two banks together hold approximately 60% of the total outstanding mortgage balance in the Czech Republic. In 2010 the price index was calculated for the first time using the shared data of these two biggest mortgage lenders in the Czech Republic. In 2013 two additional mortgage lenders entered the project: UniCredit Bank and Wüstenrot. The coverage of market by data used for index on the shared data increased to approximately 70% of outstanding mortgage balance.

Other mortgage lenders are being invited into (or being informed about) the project on an ongoing basis through a working group set up within the Czech Banking Association. Despite our repeated requests the project received no financial support from the Czech National Bank, even though both it and the Ministry of Finance voiced their support for the project.¹

Given that real estate appraisers do not have at their disposal all the information on a given location or its accessibility, to calculate the hedonic models the data provided by appraisers and collected by mortgage lenders are supplemented with additional and regularly updated data on location and region specific attributes. The following data were supplemented to construct the hedonic models: selected data from the Population and Housing Census for each cadastre district based on sources from the Czech Statistical Office (percentage of the population with different levels of education; age structure of the population; the share of the housing stock built using panel technology); data on the average unemployment rate for each municipality (based on sources from the Ministry of Labour and Social Affairs); data on the

¹ The costs incurred in connection with the establishing a uniform data collection format are mainly motivated by the need to revalue pledged real estate at regular intervals – and better and more reliable revaluations can be attained by sharing data. The resulting dataset is thus not used just for the price index, but also, and by the mortgage lenders especially, for automatic revaluations of pledged real estate.

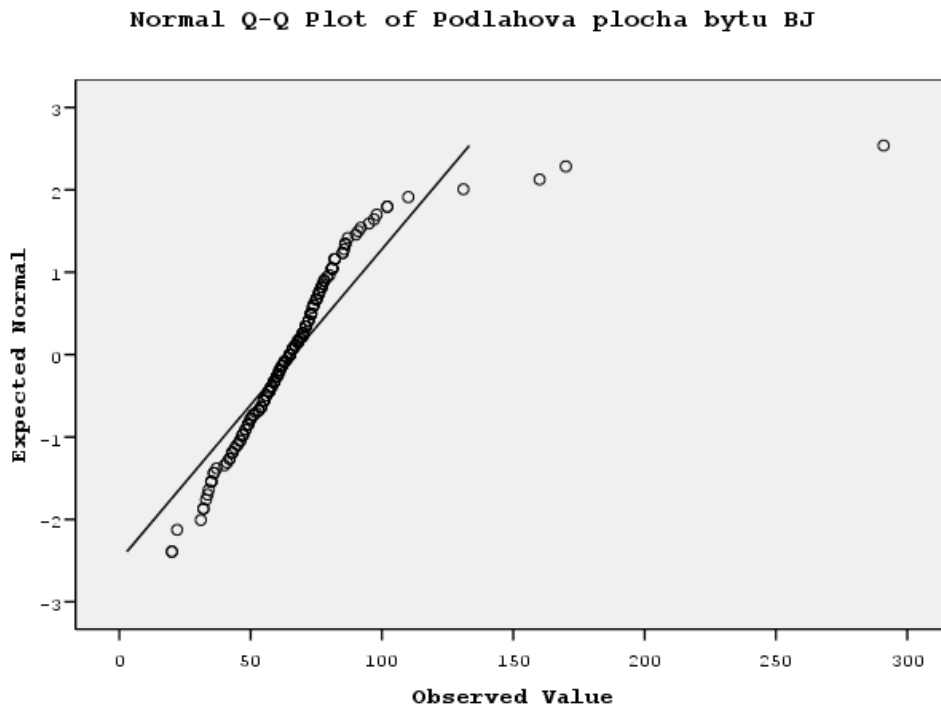
average monthly number of recipients of means-tested social benefits (specifically recipients of the housing allowance and the child allowance) for each municipality (based on sources from the Ministry of Labour and Social Affairs); data on the population size for each municipality (based on sources of the Czech Statistical Office); data on the services and facilities available in municipalities based on the database of Statistics on Towns and Municipalities maintained by the Czech Statistical Office for each municipality (net migration, utilities the municipality is connected to, the range of cultural, educational, health and sporting facilities, the scope of housing development); and data on the number of self-employed for each municipality (based on sources from the Czech Statistical Office's Register of Economic Entities).

Using an ID number (the code of the cadaster or the code of the municipality) these external data are 'automatically' assorted into a data file on the prices and attributes of real estate units. Also included in the data file are the commuting distances from the municipality in which the real estate unit is located to regional capitals and to 'centres of employment' – the fastest commuting route (in kilometres) and the fastest commuting time (in minutes) to the closest 'centre of employment' and the closest regional capital. 'Centres of employment' are defined as municipalities with more than 15,000 inhabitants. Technically the above-mentioned commuting distances were obtained from publicly accessible map websites using a script generating departure and destination points.

In order to prevent the systematic deviation of the results of hedonic regression models due to the inclusion of cases with extremely high or extremely low values (so-called 'outliers'), a group of key variables is identified for each of the individual segments of residential real estate (flats, family homes, land) and also for the individual regions of the Czech Republic, and using these variables real estate units with extreme values are mechanically excluded from dataset. For flats the key variables are usually the size of the flat (floor area in m²), unit price (price per m² of floor area), and total flat price.

Figure 1 provides a clear illustration of the approach used to establish the limits for excluding extreme values and at the same time ensuring that one of the basic assumptions of regression modelling is met: that exogenous variables have normal distributions. The observed values of the relevant indicator (in this case the floor area of the flat) are plotted in relation to the axis of the ideal normal distribution. Figure 1 shows that flats with a floor area greater than approximately 140 m² are much further from the size of floor area of the other flats in this segment, so in this case a floor area of 140 m² was selected as the maximum floor area for flats included in the regression model.

Figure 1: Mechanical filtering – the Central Bohemia Region, flats, municipalities with a population of up to 4,999 inhabitants



After excluding real estate units with extreme or irregular values, supplementary use is made of a statistical filtering method. Statistical filtering is based on an analysis of residuals, i.e. the differences between the observed values of the dependent variable (estimated prices or their logarithm) and values predicted by the model. The regression model is calculated with the aim of identifying outlying observations, and these observations are not entered into the calculation of the regression model in its final form in the second step. Whether the observations are outliers is determined on the basis of the size of the deviation of the real price of the flat and the price predicted by the model. This is a standardised residual (*Studentized residual*), which is determined as the absolute value of the difference between the estimated price and the price predicted by the model divided by the estimated standard deviation of the residual for the given flat. In order to identify extreme and outlying observations, a maximum ‘cut-off’ level for the absolute value of the residual has to be established. No general recommendations exist on how to establish this cut-off level, so it is determined empirically in reference to the number of excluded real estate units (the cut-off rate must not be too high) and in reference to the results of the model (the explanatory and predictive power must be satisfactory).

The hedonic price index is constructed with data that have been cleaned from outliers and supplemented as described above. The hedonic price model is computed for the Czech Republic as a whole (the regions are represented just in the form of input dummy variables) and it is maintained in terms of the structure throughout all time periods; only parameters are regularly recalculated. Depending on the length of the period under observation, a price index can be monthly, quarterly, semi-annually, and so on; for the time being, a quarterly index was applied on mortgage lenders data in the Czech Republic.

There are basically three ways in which the factor of time can be incorporated into hedonic price models and the price index can be built. The easiest way, but also the one most criticised, is to use the so-called pooled time-dummy method. The principle of this method involves calculating a single regression equation from the shared data file for multiple observed periods. Here, alongside the individual attributes of real estate units and attributes of location, time is included in the equation in the form of dummy variable. This approach, however, implicitly assumes that the change in prices over time is manifested in equal proportions across all the real estate attributes in the equation and thus that there is no change in the implicit prices of individual attributes over time.

The second approach is the so-called adjacent-period time-dummy method. The principle of this method involves calculating the regression equation from the shared data file for just two successive periods. The implicit prices of individual real estate attributes would be different for each of the equations, i.e. there would be some relaxation of the rigid assumption that the implicit prices of individual attributes experience no change. That rigidity, however, is only relaxed to some degree. The third and by far most flexible approach is the so-called hedonic imputations method. Using this method, as many regression models as there are periods for which a price change is to be determined are calculated. In this case there is no dummy variable representing time in the regression equations and the restriction on changes to the implicit prices of the individual real estate attributes is entirely eliminated. The equation coefficients, that is to say, the implicit prices of individual attributes, can differ over time.

Generally it could be said that the advantage of the first two methods using a time dummy variable derives mainly from the fact that the regression models are calculated from shared data files, i.e. from the largest sample of real estate units, and this helps make the parameters of the estimated models more robust. The disadvantages have already been discussed: the main disadvantage remains the rigidity attached to determining the implicit prices of individual attributes, and the lack of adaptability to structural changes in supply and demand in the residential real estate market that could occur in the future.

For the reasons cited above, the hedonic imputations method was used to create a hedonic price index based on the data from mortgage lenders in the Czech Republic. However, in such a case it is necessary to ensure that potential changes in the structure of observed real estate units between periods are adequately controlled for and this is done with the help of weighting (mix adjustment). In other words, before finally comparing average real estate prices, it is first necessary to weight house prices for each combination of real estate attributes. Usually these weights are calculated from the moving averages of the total number of transactions in different segments over the past several years. These can be derived either from the data of the mortgage lenders or from the data of the cadaster offices. If no such aggregated data exist – which was the case in the Czech Republic – it is possible to use census data. The disadvantage of using the census is generally that it is impossible to adjust the weights continuously to the changing structure of the housing stock over time. However, because no other option was available, data from the 2001 census were firstly used to create the weights. In 2013, i.e. after three years of operating the index on the shared data, transaction weights were computed on sample of all transactions monitored between 2010 and 2012 and the transaction weights are going to substitute census-based weights in the last quarter of 2013. Transaction weights will be recomputed each year in the form of a three years moving average.

Compared to the Czech Statistical Office price index, the hedonic price index based on data from mortgage lenders offers:

- *Up-to-date information* – the index is calculated quarterly and the results of the calculation are usually released within three weeks of the end of the given quarter. The CSO index can never attain this standard. The CSO transaction price index has more than a one-year delay, and even after that it is substantially adjusted owing to later additions to the dataset;
- *A vast dataset with which to create the index* – the index is created on detailed data on the individual attributes of real estate that are obtained directly from independent appraisers based on their viewing of the real estate. The dataset itself contains large number of real estate attributes, which makes it possible to reliably apply the hedonic approach. The CSO index contains very few attributes and the application of the hedonic approach is limited;
- *A high quality of data, and an index based on appraised (real) and not offer prices* – the dataset relates to real transactions and is created by independent appraisers; it does not relate to offer prices or information from developers or real estate agencies;
- *Sustainability of the index methodology* – the data collection is done using methods that should basically remain unchanged in the future (the principles of mortgage lending, real estate appraisals). On the other hand, the stamp duty could be eliminated in the future for political reasons – then the dataset required to create the CSO index would no longer exist.

The trend in house prices in the Czech Republic based on the hedonic price index

Figure 1 shows the price index on the shared data (data of all mortgage lenders participating in the project) for different residential market segments: apartments (flats), detached houses and building plots. The figure clearly shows the price drop for apartments, price stagnation for detached houses and price increase for building plots during preceding three years. However, given that the second mortgage lender (Hypoteční banka) did not join the project until 2010, the results of the hedonic price index for apartments based only on the data of Česká spořitelna are also presented (Figure 2). With this time series it is possible to analyse the impact of the global economic crisis on prices of apartments in the Czech Republic because the co-operation with Česká spořitelna, the second largest mortgage lender, has started already in 2007.

Table 1 presents the fit of the hedonic regression price models used for computation of Česká spořitelna index: the adjusted R-squared and average deviation between real and estimated price for all the hedonic models since the start of price observations (Q4 2007). The index results show the decrease in prices of flats between Q3 2008 (the index value of 110) and Q3 2013 (the index value of 90). Compared to the situation in many other countries the decrease in apartment prices is not particularly dramatic. Furthermore, the prices of detached houses did not change and prices of building plots actually increased during this period.

Figure 1: Hedonic price index on the shared data (Q1 2010 - Q3 2013)

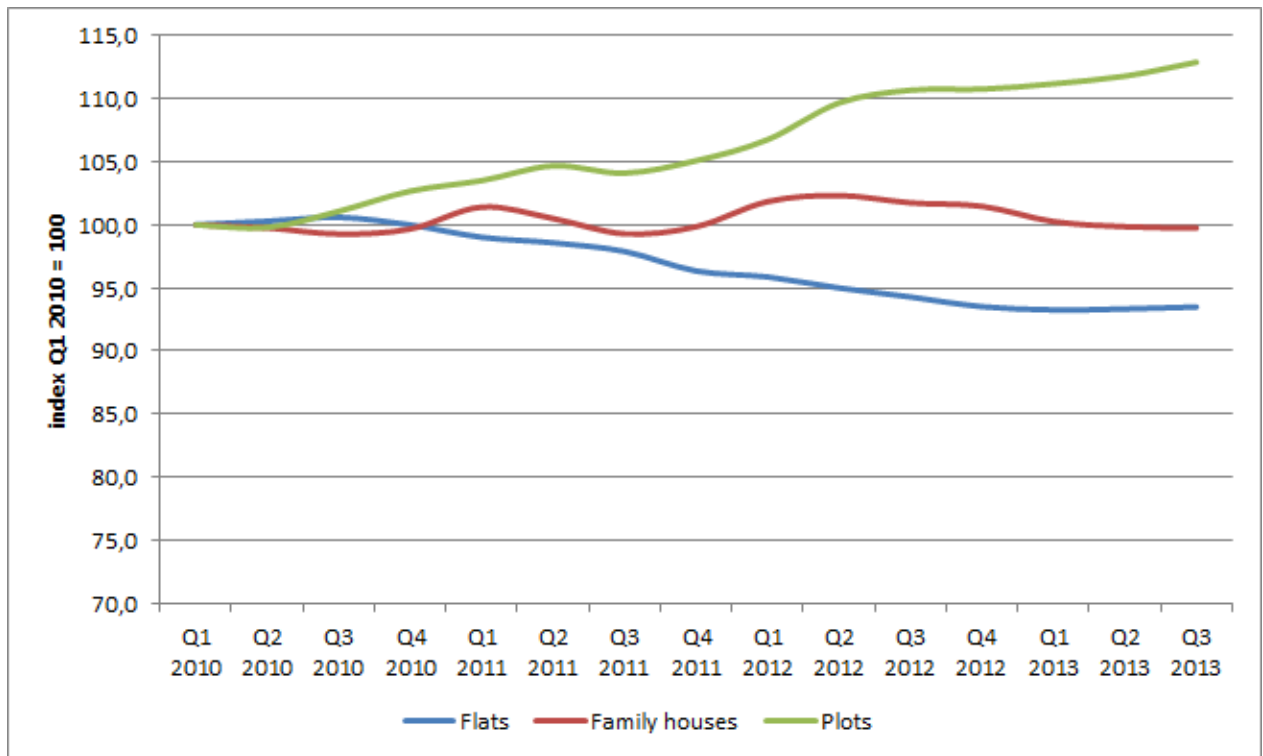


Figure 2: Hedonic price index for apartments, Česká spořitelna index (Q4 2007 – Q3 2013)

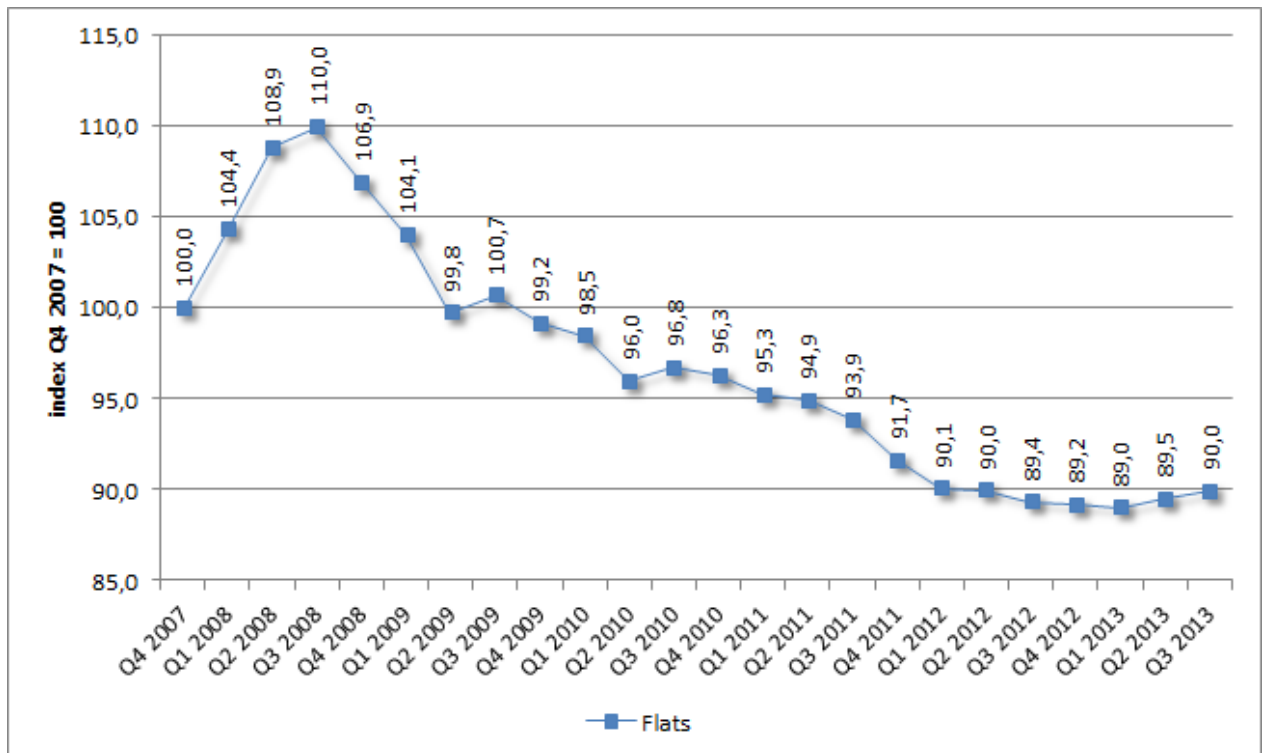


Table 1: The fit of the hedonic price models, apartments, Česká spořitelna index (Q4 2007 – Q3 2013)

| <i>Quarter</i> | <i>Adj. R2</i> | <i>n</i> | <i>Average observed price (CZK)</i> | <i>Average modelled price (CZK)</i> | <i>Deviation (%)</i> |
|----------------|----------------|----------|-------------------------------------|-------------------------------------|----------------------|
| Q4 2007 | 88,8 | 2 268 | 1 715 626 | 1 695 689 | 12,5 |
| Q1 2008 | 90,1 | 1 614 | 1 711 309 | 1 692 898 | 11,8 |
| Q2 2008 | 89,5 | 882 | 1 690 219 | 1 673 041 | 11,7 |
| Q3 2008 | 89,9 | 1 307 | 1 810 187 | 1 788 805 | 12,0 |
| Q4 2008 | 89,3 | 1 261 | 1 784 715 | 1 761 999 | 12,2 |
| Q1 2009 | 87,4 | 997 | 1 609 215 | 1 590 785 | 12,1 |
| Q2 2009 | 90,0 | 881 | 1 811 959 | 1 790 642 | 12,0 |
| Q3 2009 | 89,5 | 828 | 1 832 040 | 1 811 547 | 12,1 |
| Q4 2009 | 90,7 | 1 040 | 1 760 508 | 1 740 880 | 11,9 |
| Q1 2010 | 89,7 | 559 | 1 614 830 | 1 598 687 | 11,2 |
| Q2 2010 | 90,1 | 656 | 1 653 021 | 1 631 317 | 12,3 |
| Q3 2010 | 90,6 | 709 | 1 617 695 | 1 601 554 | 11,6 |
| Q4 2010 | 90,2 | 908 | 1 588 139 | 1 573 503 | 11,4 |
| Q1 2011 | 88,3 | 1 187 | 1 615 619 | 1 594 119 | 12,7 |
| Q2 2011 | 88,0 | 1 226 | 1 545 357 | 1 526 362 | 12,1 |
| Q3 2011 | 89,9 | 777 | 1 598 479 | 1 580 330 | 12,1 |
| Q4 2011 | 89,5 | 1 069 | 1 622 377 | 1 604 591 | 12,4 |
| Q1 2012 | 90,4 | 894 | 1 699 474 | 1 678 740 | 12,5 |
| Q2 2012 | 90,4 | 722 | 1 585 081 | 1 565 876 | 12,4 |
| Q3 2012 | 89,4 | 773 | 1 551 002 | 1 524 399 | 12,4 |
| Q4 2012 | 88,7 | 1 245 | 1 633 510 | 1 608 137 | 12,7 |
| Q1 2013 | 88,5 | 875 | 1 583 343 | 1 557 149 | 14,2 |
| Q2 2013 | 89,0 | 1 364 | 1 637 167 | 1 609 651 | 14,5 |
| Q3 2013 | 90,4 | 1 270 | 1 672 950 | 1 650 150 | 13,8 |

Analysis of the impact of the economic crisis on housing and mortgage markets

The second goal of this paper is to answer the central question: what factors explain the impact of the global economic crisis on mortgage and housing markets in the Czech Republic?

An analysis of markets and their reactions to external economic shocks may be framed in the terms of both neoclassical and institutional economic theory. Neoclassical economics applies the concepts of market efficiency and market equilibrium. Ideally, markets provide an optimal allocation of resources on the basis of consumer sovereignty. Differences in the performance of housing markets can be explained by differences in the size of the markets, the macroeconomic environment (such as inflation, the interest rate, unemployment), the existence of specific constraints (such as land or credit availability), market inefficiencies (such as monopolistic competition), and market regulations (such as the given legal framework). Consequently, the impact of the global economic crisis on mortgage and housing markets should be examined through an analysis of these ‘universal’ aspects of the economy and markets.

In contrast, institutional economists emphasise the importance of a specific institutional context, that is to say, the behaviour of organizational and individual actors embedded in specific cultural and social norms. Such norms are seen to be the product of decades of social interaction oriented towards solving the social, economic and political problems of a particular society (North 1991, Hodgson 2006). One of the key concepts of this theoretical

approach is institutional equilibrium, which occurs when there is of no advantage to any market participants to take on the costs connected with altering existing contracts. Institutional equilibrium does not represent only ‘universal’ free market equilibrium. This is because in different historical and cultural contexts diverse institutional equilibriums will emerge. This is also the reason why the same global (exogenous) change will affect any pair of countries in different ways. In other words, the economic life of markets is territorially embedded in social and cultural relations. Consequently, the observed impact of the recent global economic crisis on housing and mortgage markets should be explored through an analysis of the wider institutional and cultural context of Czech society.

Both neoclassical and institutional economics can enhance our understanding of market reactions and performance. Consequently, we can formulate two hypotheses that reflect the main causal mechanisms postulated by each of these economic theories, i.e. neoclassical and institutional economics, respectively.

H1 The impact of the global economic crisis on the mortgage and housing markets in the Czech Republic is explained by the macroeconomic environment, that is, for instance, by inflation, and the features of market regulations, such as the existence of regulations that expand or constrain the supply of mortgage credit.

H2 The impact of the global economic crisis on the mortgage and housing markets in the Czech Republic is explained by the wider institutional factors that influence the behaviour of market actors. Here the focus is on the institutional development of a housing system and housing tenure choice.

The impact of the economic crisis on the mortgage and housing markets itself will be measured by examining changes in house prices and the default rate among mortgage borrowers that emerged during the crisis period, i.e. between 2008 and 2012.

Findings

The Czech Republic’s macroeconomic performance was generally very good before the economic crisis (2008). This is demonstrated by the fact that the Czech Republic maintained a high GDP growth with a relatively low public budget deficit and public debt. The Czech Republic also had a low inflation rate, low inflation volatility and a high household savings rate (Table 2). Inflation and the savings rate have important macroeconomic consequences on interest rates, including the rates charged on mortgage loans. In the Czech Republic the real (after-inflation) interest rate on local currency deposits was negative between 2004 and 2008. This fact, together with the low inflation rate, allowed Czech mortgage lenders to offer low interest rates on local currency (CZK) mortgage loans. From 2005 to 2008, the average nominal rate on local currency loans was around 4-5% p.a.; for loans in the local currency for a five-year to ten-year fix period the average rate was around 5% p.a.

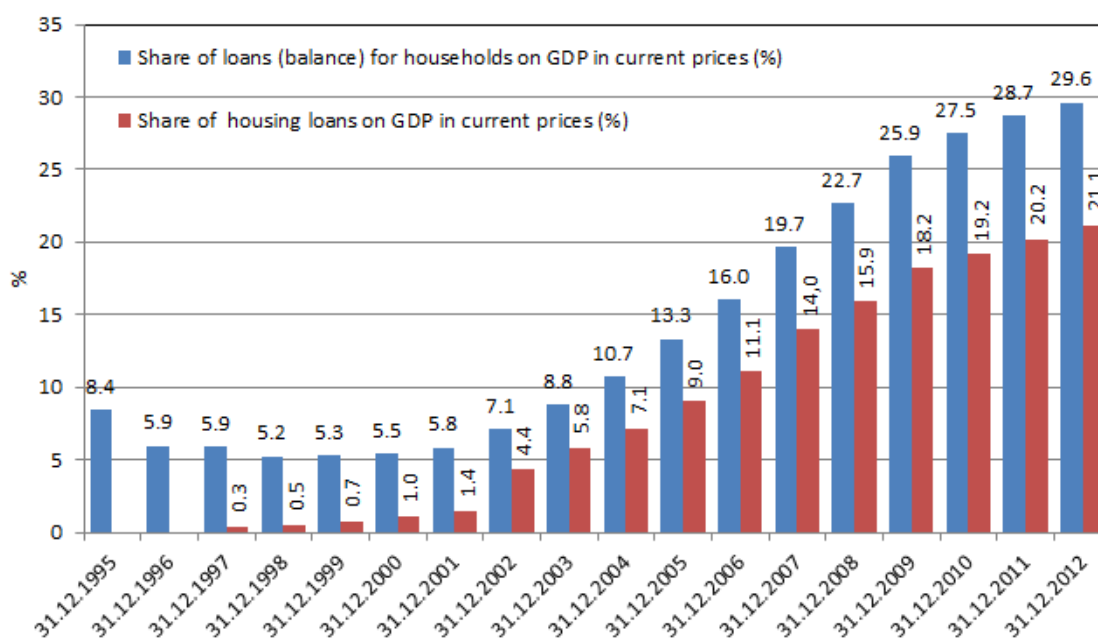
Table 2: Contextual information, selected indicators (2005 – 2008)

| Socio-economic indicators | Years | | | |
|--|--------|--------|--------|--------|
| | 2005 | 2006 | 2007 | 2008 |
| <i>Economic indicators</i> | | | | |
| GDP per capita in PPS (EU-27 average =100) | 75.9 | 77.0 | 80.1 | 80.4 |
| Growth of real GDP (% , y/y, real) | 6.3 | 6.8 | 6.1 | 2.5 |
| Household consumption (% , y/y, real) | 2.5 | 5.0 | 4.8 | 3.6 |
| Inflation rate (CPI, %, annual) | 1.9 | 2.5 | 2.8 | 6.3 |
| Unemployment rate (ILO, %, average) | 7.9 | 7.1 | 5.3 | 4.4 |
| Gross household saving rate | 8.2 | 9.6 | 10.9 | 10.4 |
| Total of housing savings (billions EUR) | 11.1 | 12.7 | 13.9 | 16.1 |
| Monetary base M0 (% , y/y) | 11.4 | 11.9 | 10.0 | 12.8 |
| M1 (% , y/y) | 13.4 | 14.7 | 15.7 | 9.7 |
| M3 (% , y/y) | 11.1 | 13.8 | 16.7 | 13.1 |
| General government deficit (surplus) / GDP (%) | -3.6 | -2.6 | -0.7 | -2.7 |
| General government debt as a % of GDP | 29.7 | 29.4 | 29.0 | 30.0 |
| <i>Income distribution, poverty rate</i> | | | | |
| Income distribution: Gini | 26.0 | 25.3 | 25.3 | 24.7 |
| At-risk-of-poverty rate (%) | 10.4 | 9.8 | 9.5 | 9.1 |
| <i>Demography</i> | | | | |
| Population (millions) | 10.202 | 10.207 | 10.234 | 10.267 |
| Proportion of population aged 25-49 years (%) | 36.9 | 36.9 | 37.0 | 37.1 |
| Proportion of population aged 65 and over (%) | 14.2 | 14.4 | 14.6 | 14.9 |
| Live births per 1,000 inhabitants | 10.0 | 10.3 | 11.1 | 11.5 |
| Natural growth per 1,000 inhabitants | -0.6 | 0.1 | 1.0 | 1.4 |
| Total fertility rate | 1.28 | 1.33 | 1.44 | 1.50 |

Note y/y denotes year-on-year change generally expressed in percentage points.

Source: Czech Statistical Office, Hungarian Central Statistical Office, Czech National Bank, National Bank of Hungary, Ministry of Finance of the Czech Republic, Eurostat

Figure 3: Share of total loans and share of housing loans out of GDP in current prices (1995-2012)



Source: Czech National Bank, Czech Statistical Office, own calculations.

Owing to low inflation combined with low local currency deposit/loan rates, the Czech mortgage loan portfolio contained a high share of fixed-rate mortgages (43% of all mortgages granted in 2008) and a marginal share of foreign currency loans (0.06% of all mortgages granted in 2008). The outstanding mortgage balance as a share of total GDP increased very steadily until 2001, but due to interest rate drops and deregulation of mortgage market (2004) it grew sharply between 2001 and 2008 and continued to grow until today (Figure 3).

Owing to high house price appreciation during the boom period (between 2000 and 2008 house prices increased by 123% according to the Czech Statistical Office price index) the attractiveness of the main substitute for owner-occupied housing, namely private rental housing with market rents, grew in the eyes of potential tenants. This is because market rents did not follow the same path of appreciation as house prices: the rent-to-price ratio in fact dropped substantially from 9 in 2000 to 5 in 2008. Private rental housing thus became more affordable and began to be characterized by more competition and a more broadly segmented supply (Lux and Sunega 2010).

In addition, the stock of public housing did not become marginalized: owner-occupied housing represented ‘only’ 61% of the housing stock (77% with housing cooperatives) and rental housing 23% of the housing stock in 2008 (13% private and 10.2% public rental housing).² In general, tenure choice was not as constrained as in other post-socialist states with ‘super-homeownership’ housing systems, and rental housing stock offered an adequate alternative of housing for those on lower or unstable incomes.

After Lehman Brothers filed for bankruptcy protection in the US on September 15, 2008, the ensuing uncertainty generated in the global financial markets and the simultaneous credit crunch had an immediate effect on financial markets in Central and Eastern Europe (CEE). In the Czech Republic, in late September and October 2008, there was a substantial drop in activity in the interbank money market, an increase in the volatility of exchange rates, with the Czech Crown (CZK) depreciating continuously as a result of reduced investor confidence in the whole CEE region until the second quarter of 2009, and a slump in the stock market. The Czech National Bank (CNB) reacted by lowering basic rates. For example, the rate for advances on collateral decreased cumulatively from August 2008 to December 2009 by 2.75 percentage points. However, these steps had only a limited effect on interbank money market rates and consequently on interest rates for mortgage loans. The monetary policy mechanism linking national bank rates to commercial rates was disrupted and risk premiums increased substantially.

Instead, banks tightened their loan conditions. In practice this meant that the loan financing of new housing development projects de facto stopped, and mortgage loans for households were tightened with the addition of a maximum loan-to-value ratio or by imposing a minimum income requirement on all new loan requests. The ‘innovative’ mortgage products of the boom period (see Sunega and Lux 2007) quickly disappeared from the market, although formally banks continued to offer these products to customers. Owing to liquidity constraints there was a real danger of a run on Czech banks. This spurred the Czech government to

² There are several factors that explain this more balanced tenure structure, such as: (1) the non-existence of a central right-to-buy policy (mass, quick and centrally directed privatization of public housing to the ownership of sitting tenants), and (2) strong public support for the restitution of housing stock in the Czech Republic during the early phases of the post-communist transition process. Support for public rental housing construction after 1990 is also of some relevance in this respect.

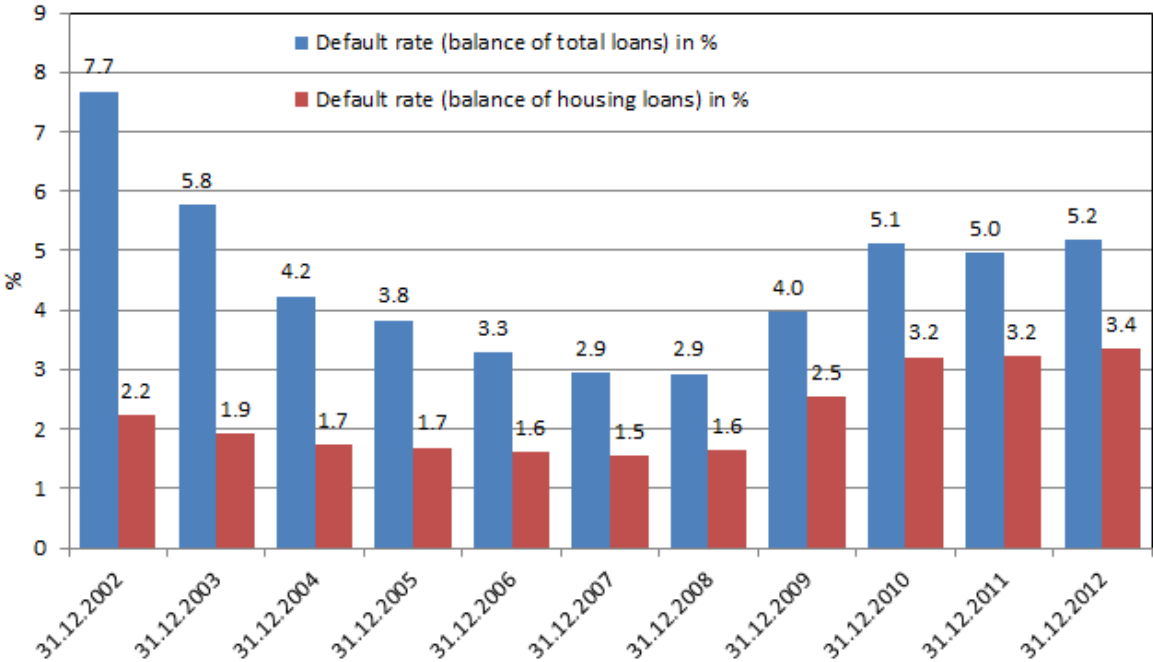
increase state guarantees for deposits from EUR 25,000 to 50,000 in October 2008. In February 2010 the government doubled this state guarantee for deposits to EUR 100,000.

In 2008 the year-to-year GDP increase was only 2.5% (after 6-7% annual GDP growth between 2005 and 2007) and the economic recession, which started during the final quarter of 2008, led to an annual decline in GDP of 4.5% in 2009. In 2010, GDP increased by 3.1%, in 2011 by 1.8% but in 2012 it dropped again by 1%. However, the overall macroeconomic situation remained relatively stable in the Czech Republic. In 2009 annual inflation dropped to 1% (remained at the 1.5% level in 2010, 1.9% in 2011 and increased only in 2012 to 3.3%) and registered unemployment increased from 6% in 2008 to 9.2% in 2009 (and remained almost at the same level in 2010, slightly decreased to 8.6% in 2011 and increased to 9.4% in 2012).

In 2009 it became evident that the financial sector was in a healthy state, and despite the credit crunch Czech banks remained profitable. No Czech bank was taken over or went bankrupt during 2008-2010. It should be noted in this respect that the Czech Republic is one of the few new EU member states whose banking sector is independent of external financing, despite the fact that almost all the banks are owned by foreign capital (CNB 2009). The main reason for this situation is the high ratio of deposits to loans resulting from the comparatively high savings ratio of Czech households.

Figure 4 shows the trend in the default rate for all loans and housing loans (Bausparkasse and mortgage) separately. The default rate decreased between 2002 and 2008, increased in 2009 and 2010 and remained more or less stable in 2011 and 2012. During the global financial crisis and the economic recession in the Czech Republic, the default rate on housing loans increased from 1.6% in 2008 to 2.5% in 2009 and to 3.4% in 2012. The acceptable increase was partly due to the relatively conservative lending conditions applied by Czech mortgage lenders until 2006, but more likely stemmed from the high share of fixed rate mortgages and the marginal share of foreign currency mortgages.

Figure 4: The default rate for the balance of total loans and the default rate for the balance of housing loans (2002-2012)



Source: Czech National Bank

Tighter loan conditions, decreasing household demand, falling exports, general economic recession and growing uncertainty in the labour market resulted in a drop in apartment prices (by 17% between 2008 and 2012 in nominal values according to the Česká spořitelna price index). However, prices of detached houses practically did not change and prices of plots increased by 10% in the same period.

The Czech government’s response to the economic crisis in the financial sector, beyond the above-mentioned higher state guarantees for deposits, was limited. There were no mortgage rescue schemes, no special income support for highly leveraged borrowers, no new regulation of the banking sector, and nor moratorium on repossessions either. The only government measures implemented were the postponement of rent deregulation in a number of larger Czech cities (the target date for full rent deregulation in 2010 was postponed to 2012), and the introduction of state guarantees for loans to housing developers building rental housing (however, there are very few rental housing development projects). Several employment policy measures such as tax incentives for employers with low-wage employees and measures designed to cut the public budget deficit were also introduced, but they did not directly or significantly influence the situation in the housing market.

Conclusion

We described the background and the methodology for calculating the hedonic house price index based on data from Czech mortgage lenders, which is being gradually established since 2005. The price index built on data from mortgage lenders uses independent appraisals and supplement this database with information on region and location specific attributes (including commuting distances and times); it applies hedonic imputation method and both mechanic and statistical filtering to exclude outliers from the dataset. The price data are finally weighted for each combination of main characteristics; weights were derived from the

census until 2013 and will be derived from transactions themselves since the last quarter of 2013. Since 2010, the dataset for price index is saturated by two leading Czech mortgage lenders and since 2013 by additional two smaller mortgage lenders, with about 70% total share on outstanding mortgage balance. The Česká spořitelna price index is suitable for measuring the current impact of the economic crisis on house prices. The impact of global economic crisis on mortgage and housing markets has been measured by trends in house prices and mortgage default rate. We showed that the impact of crisis on housing and mortgage markets in the Czech Republic was relatively mild up to now.

Our first hypothesis postulated that the impact the global economic crisis had on the mortgage and housing markets is explained by the macroeconomic environment and market regulations. This hypothesis, which is based on neoclassical economic theory, is confirmed by the empirical evidence presented in the preceding section. The Czech economy went through an economic crisis before in 1997-1998 and made significant fiscal and structural adjustments during the 2000 to 2002 period. In 2008, the Czech Republic had a high household savings ratio, low inflation and low inflation volatility. Czech mortgage lenders were consequently not dependent on external financing and could accumulate resources with relatively low deposit rates. The supply of credit consisted almost exclusively of local currency denominated mortgage loans and high share of fixed-rate mortgages; the interest rates for local currency mortgage loans remained low (between 4-5% p.a.).

Consequently, the economic factors that helped Czech mortgage market and banking system to remain in healthy conditions are following: (a) very short period of intensive mortgage boom before the crisis; (b) sufficient finance sources from deposits and mortgage bonds (also thanks to traditionally high household savings rate); (c) the rather low total indebtedness of Czech households; and (d) the fact that mortgage loans were denominated in local currencies and were mostly with fixed interest rates (thus well protecting borrowers from interest and exchange rate risks).

Our second hypothesis outlined above contends that the impact of the global economic crisis on the mortgage and housing markets is explained by wider institutional factors that influence the behaviour of market actors. Here emphasis is given to how the national housing system emerged and evolved. The evidence showed that in the Czech Republic the housing tenure structure remained balanced with relatively high shares of both public and private rental housing (while in many other post-socialist states public housing was marginalized and private rental housing now forms a small and high-priced sector). The yields (rent-to-price ratio) from residential rental investments dropped substantially and quickly, making rental housing a real alternative to owner-occupied housing. Housing subsidies in the Czech Republic, though also biased towards owner-occupied housing, have in the past also included support for public rental housing. This meant that new households on low or unstable income were not forced to become home-owners and had other tenure alternatives from which to choose permanent housing – the default rate thus remained relatively low even during the crisis period. From a comparison with Hungary (Hegedüs et al. 2011) it seems that this factor can explain an important part of the differences in the impact of the global economic crisis on the default rate and house prices between these two states.

In sum, the evidence presented above suggests that the second hypothesis can be accepted, with two caveats: the methodology used in this paper restricted the generality of the institutional mechanisms identified, and it was impossible to take full account of other competing explanations. With these caveats in mind, there are still strong grounds to conclude

that there are factors originating in the broader institutional frameworks (i.e. housing tenure policies and the development of housing systems) that explain the impact of the global economic crisis on the housing and mortgage markets in post-socialist states. In short, a full understanding of the impact of the global crisis requires a neoclassical explanation supplemented with an institutional account for otherwise puzzling features.

References

- CNB, 2009. *Zpráva o finanční stabilitě* (Report on financial stability). Prague: Czech National Bank.
- Hegedüs, J., Lux, M., Sunega, P. 2011. Decline and Depression: The Impact of Global Economic Crisis on Housing Markets in Two Post-Socialist States, *Journal of Housing and the Built Environment* 26 (3): 315-333.
- Hodgson, G. 1998. The Approach of Institutional Economics, *Journal of Economic Literature* 36: 166-192.
- Lux, M., P. Sunega 2010. Private rental housing in the Czech Republic: Growth and...?. *Sociologický časopis/Czech Sociological Review* 46 (3): 349-373.
- North, D. 1991. Institutions, *Journal of Economic Perspectives* 5: 97–112.
- Sunega, P, Lux, M. 2007. Market-based housing finance efficiency in the Czech Republic, *European Journal of Housing Policy* 7: 241–273.