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EDITORIAL

The Czech National Bank's (CNB) Economic Research Department was established in 2000 and was fully up and running by 2001. It has been ten years since we published our first working paper, and in the intervening ten years we have published 125 Working Papers, Research and Policy Notes and Research Bulletins. To commemorate this tenth anniversary, we have decided to devote this issue to four papers that were among the most influential in the economic policy debate. The first one formed the basis for the current CNB forecasting framework. The second one significantly shaped the discussions about the implications of the CNB's losses. The third one established which methodologies and which data can be used to identify bubbles in the Czech housing market. The fourth introduced Beveridge curve estimates into the CNB's policy documents. There are, of course, other papers that have influenced the CNB's policy thinking. Some of them were featured in previous Bulletins and some are still work-in-progress. It is our hope that the CNB's economic research will continue contributing to policy debates in the next ten years.

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IN THIS ISSUE

CNB CZECH NATIONAL BANK

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Implementing the New Structural Model of the Czech National Bank

Michal Andrle, Tibor Hlédik, Ondra Kameník and Jan Vlček[1]

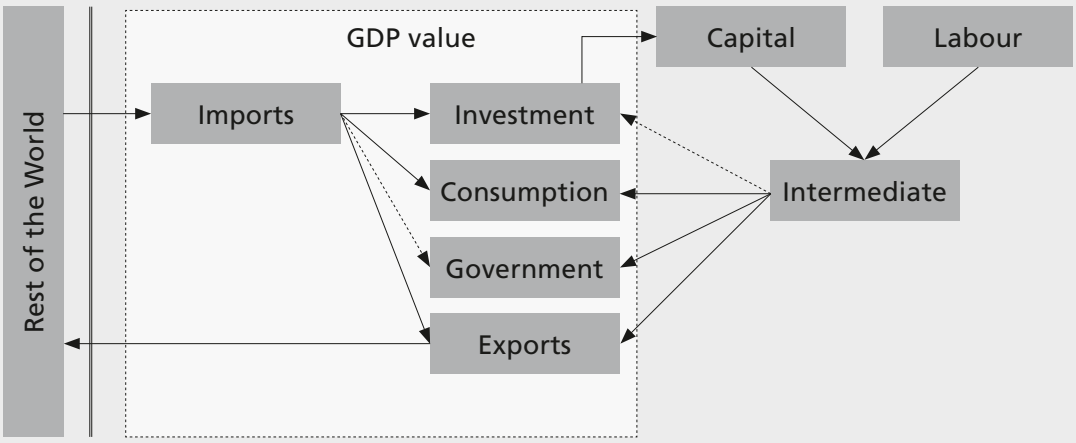
MODEL FOUNDATIONS

The structure of the "g3" model and the built-in behaviour of the model economy were carefully considered along two guiding lines. First, the model is aimed to be a *parsimonious representation* of the Czech economy that is able to describe the data well and capture the key channels of the transmission mechanism. To put it differently, any relationship that can be excluded from the model without jeopardising its forecasting properties or story-telling value considered to be important, should be dropped. Second, "g3" was built with special attention to capturing some of the *specific features* of the Czech economy, many of them related to the transition process. Trends in sector-specific relative prices, the evolution of nominal expenditure shares, the multiple stages of exchange rate pass-through, a high import intensity of exports and increasing trade openness rank among the most important ones (see Hummels at al., 1999 and Ghironi and Melitz, 2005).

The model is built following the New-Keynesian tradition, consistent with a real business cycle core, enriched with important real and nominal frictions. In order to provide policymakers with the required national accounts breakdown, the factors used for production include both labour and capital. The model's dynamics are a result of a complex interaction among households, firms and domestic and foreign fiscal and monetary authorities. Domestic firms produce consumption, government-consumption, investment and exported goods by inputting technology and domestically produced intermediate and imported goods (see Figure 1). Besides rigidities in wage and price-setting behaviour (Calvo-type) there are imperfect exchange rate pass-through, habit formation and investment adjustment costs incorporated into the model. In addition, the price structure of "g3" (see Figure 2) quantifies the effects of indirect taxes and administered prices on headline CPI. Importantly, the model is consistent with full stock-flow equilibrium.

FIGURE 1

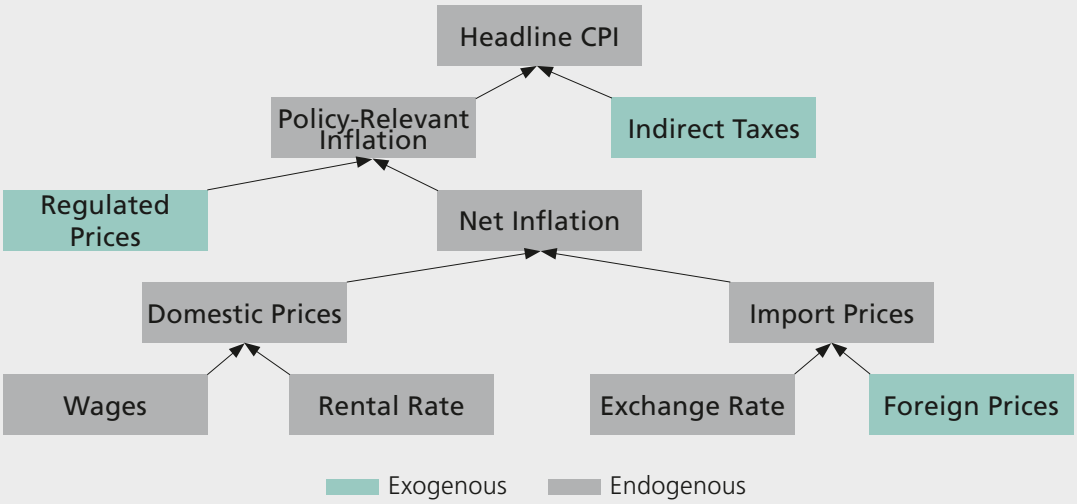
Flow of goods & services in the model



1 This article is based on Andrle et al. (2009).

FIGURE 2

Headline CPI components ("price tree")



MODEL EVALUATION AND ANALYSIS

The model is *calibrated* with special attention to *its story-telling potential and population properties*.[2] It has been tested along many dimensions, using, for instance, model-consistent identification of structural shocks and shock decomposition of historical data, time and frequency domain analysis of the model's second moments and recursive filtering with forecasts. We shall subsequently describe the shock decomposition and recursive forecast evaluation methodologies in more detail.

Model-consistent identification of structural shocks and the decomposition of historical data into structural shocks is one of the most important steps in terms of both interpreting data and verifying the model's story-telling properties. This analysis goes beyond impulse-response analysis, though well-designed impulse response analysis is a necessary prerequisite. In order to reflect varying data quality and to avoid replicating every bit of "noise" in the data, non-zero *measurement errors* were chosen for those variables that – based on expert judgement – were considered to be sensitive to revisions and methodological changes, or are simply very noisy indicators of the business cycle. This way a sensible design of the model frequency transfer function is obtained. Figures 3 and 4 are examples of variables with non-zero or zero measurement errors reflecting expert judgement with respect to their reliability.

2 We follow the minimal econometric approach to DSGE models advocated by Geweke (2006).

FIGURE 3
Government deflator, quarterly changes

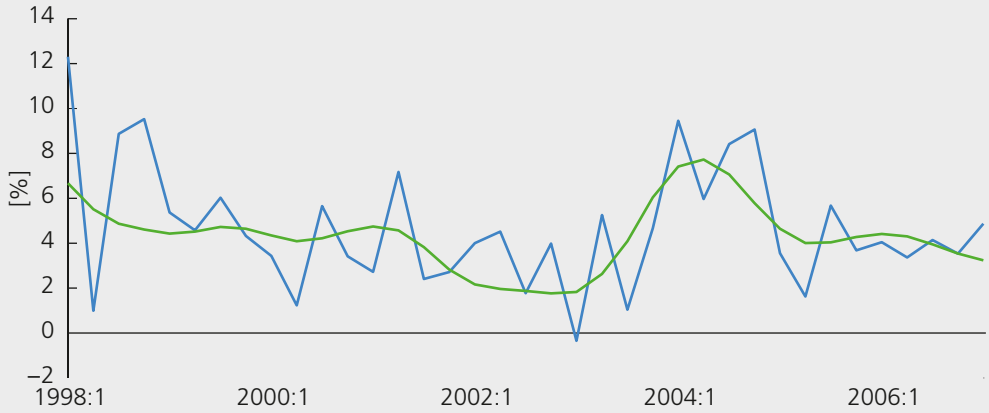
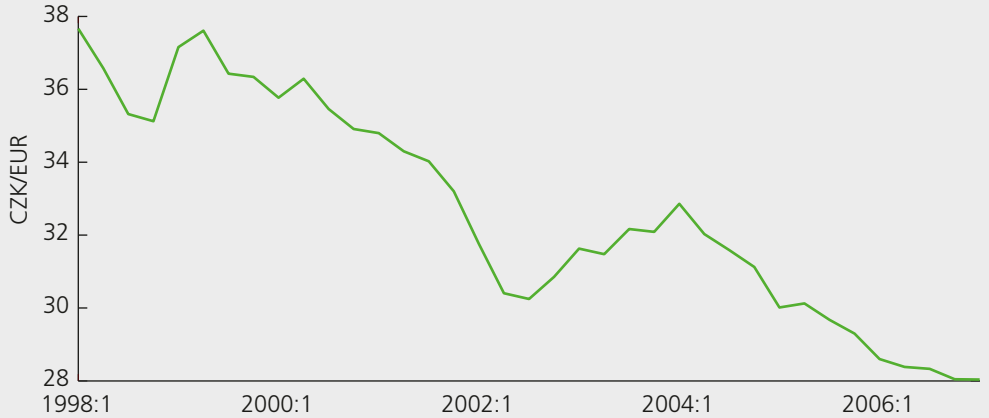


FIGURE 4
CZK/EUR exchange rate



In this case, the change in the government consumption deflator is considered to be a less reliable indicator by the CNB's forecasting team than, for instance, the measurement of the nominal CZK/EUR nominal exchange rate. This judgement is reflected in the use of a non-zero measurement error for the government consumption deflator and a zero measurement error for the exchange rate. As a result, the model will not be forced to replicate the deflator polluted by high-frequency noise and the government deflator might be smoothed using the model's forecasts. The exchange rate is replicated by the model exactly, since here the highly volatile movements are a key input for monetary policy analysis and inflation forecasting.[3]

After the size of the measurement errors for the observables has been decided, *the shock decomposition of historical data* serves two goals. First, it is an important calibration tool.

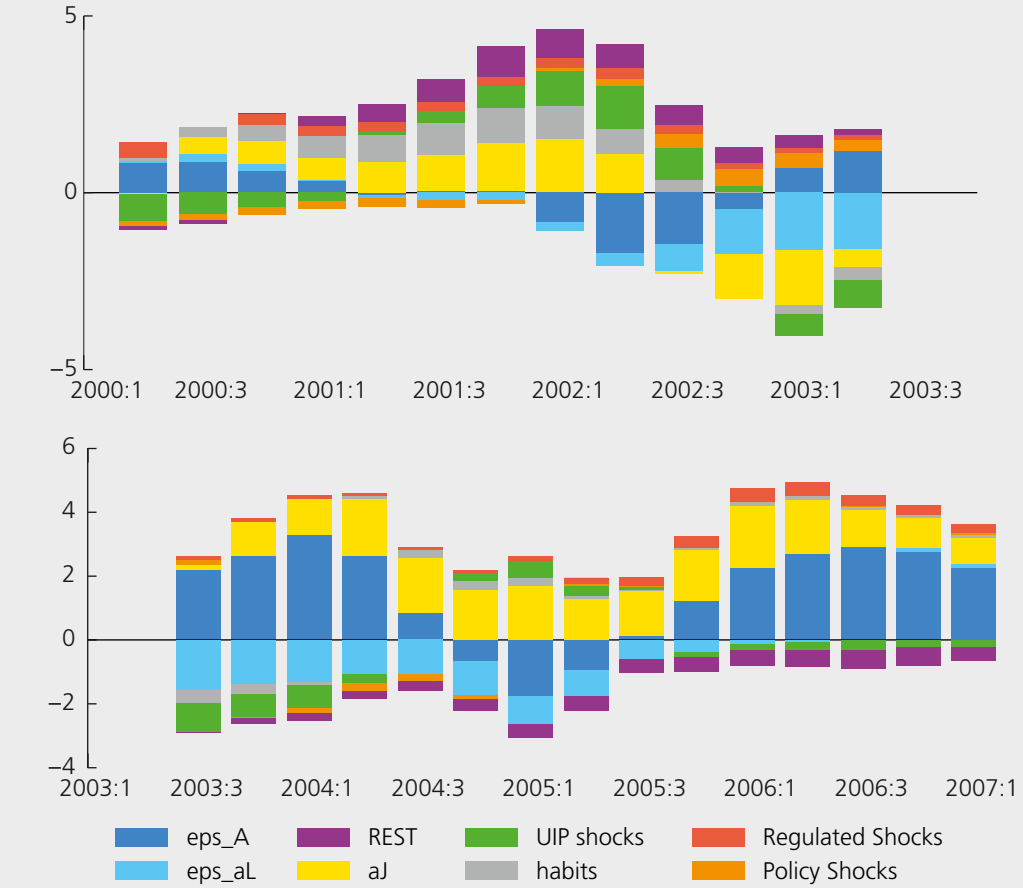
3 A more detailed discussion is provided by Andrle et al. (2009).

4 By "filtering" we mean the Kalman smoother, i.e. a multivariate linear two-sided filter.

The magnitude and occurrence of historical shocks, identified through the filtering process, are aimed to be consistent with economic intuition linked to particular episodes of Czech economic history. Second, the identification of historical shocks is of key importance for explaining the initial conditions of the forecast to policymakers, with a special focus on the overall economic story. Figure 5 captures the structural shock decomposition of investment growth. Besides the dominant role of labour-augmented technology (*eps_A*) and investment-specific technology (*eps_J*), exchange rate shocks and habit formation shocks boosted investment growth throughout 2002. The timing and magnitude of exchange rate shocks as well as shocks to consumption of households are very much in line with the unexpected weakening of the exchange rate and high consumption growth during this period.

FIGURE 5

Decomposition of observed data into structural shocks



Note: eps_A – labour-augmenting technology shock, eps_aL – labour force shock, aJ – investment-specific technology, habits – habit formation shock, UIP shocks – white-noise and debt-elastic UIP shocks, Regulated Shocks – shocks to regulated prices.

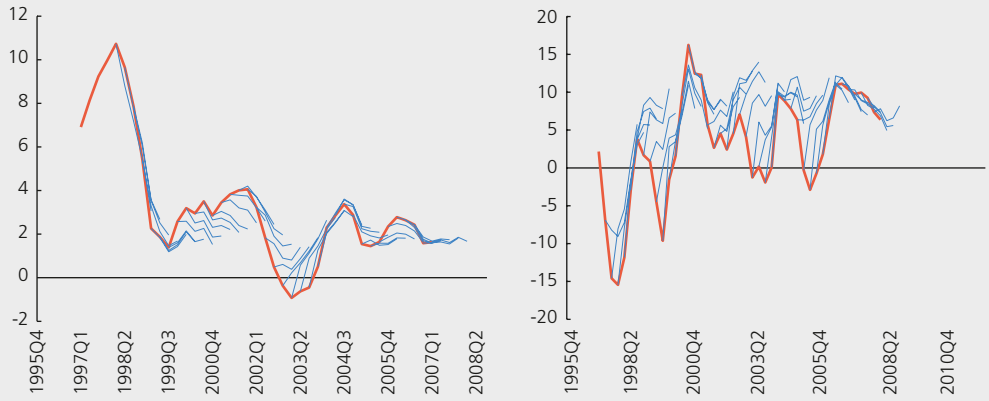
The model's forecasting properties are evaluated using regular fully-fledged forecasts since January 2007. As it is worthwhile to know the model's forecasting properties faced with historical shock episodes, *recursive filtering and forecasting* exercises are carried out ex post using historical data. In principle, the extended data is filtered each time, the initial conditions are obtained and a new forecast is simulated, without imposing any judgement, conditioned on the data available in particular phases.

The results indicate that the forecasting performance of the model is good enough to be used in the process of forecasting inflation and policy analysis.[5] Its forecasting properties are comparable with the previous forecasting model of the CNB.[6] Figure 6 presents an example of recursive filtering and forecasts of year-to-year CPI inflation and real investment.[7]

As the observed dynamics of economic variables reflect expected and unexpected future outcomes it is important to accommodate both of these shocks over the forecasting horizon. Methods have been adopted allowing for mixing of unanticipated and some fully anticipated shock trajectories. Using both anticipated and unanticipated shocks together allows for a perfectly anticipated trajectory of the foreign interest rate path, for example, while retaining the possibility of expectation shocks regarding technology processes and other variables

FIGURE 6

Recursive forecasts – CPI inflation and real investment (year-to-year)



FORECASTING

The *forecasting process* using the model is carefully designed and divided into several phases, including (i) identification of basic issues and new information, (ii) analysis of the impact of new information on the assessment of the state of the economy and the forecast, (iii) conditioning on exogenous macroeconomic variables (the world economy) and the imposition of expert judgement in a model-consistent way. Importantly, the CNB interest rate "forecast" is unconditional, hence the model is used for the analysis of monetary policy needed to support the official inflation target.

All ingredients of the forecast – initial state estimate, exogenous variables and judgement – are explicitly quantified and interpreted. The regular forecasting

5 When comparing the outcomes of recursive filtering and forecasting with the observed data the conditionality of the forecast on the interest-rate setting has to be taken into account.

6 For a more detailed description of the CNB's forecasting system based on the QPM model see Coats et al. (2003).

7 The mechanical structure and the absence of conditioning on foreign exogenous assumptions make the forecast different from the CNB's official forecasts.

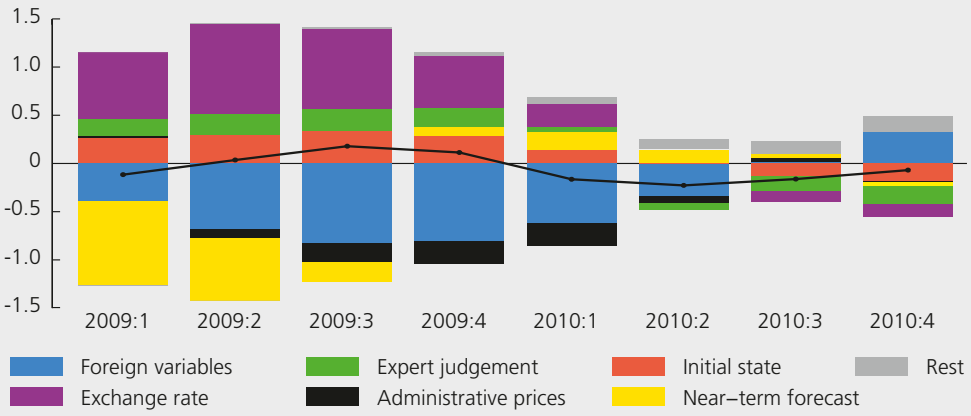
exercises require tools for detailed and flexible analysis of alternative scenarios and differences between successive forecasts. These analytical tools help in understanding complex simulations and avoid use of the model as a black box.

Figure 7 illustrates the decomposition of changes between two forecasts for the trajectory of short-term interest rates. Based on the information set, it is possible to decompose these differences between the two interest rate trajectories. The illustration of Figure 7 identifies disinflationary pressures stemming from the new outlook for foreign variables, from the near-term forecast, and from the administrative price forecast. The near-term forecast represents the sectoral specialist's assumption regarding price developments in the very first quarter of the forecast. In the presented example the disinflationary pressures are offset by inflation pressures stemming from the exchange rate assumption (the very first quarter reflects already available observed data and expert views), from the initial state and from expert judgement.

The CNB comments in detail on these decompositions and the effects of individual factors on the interest rate path in a special box of the situation report. The presented forecast is thus very transparent in terms of assumptions, results and details of the analysis.[8] Importantly, the story behind the forecast can always be articulated without explicit reference to the particular model used and therefore we can focus on the economic intuition behind the forecast, supported by a consistent and flexible analytical tool.

FIGURE 7

Successive forecast difference decomposition (policy rate)



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8 The forecast decomposition of short-term interest rates has also been depicted by some leading global investment banks when discussing the Czech monetary policy outlook.

Central Bank Losses and Economic Convergence

Martin Cincibuch, Tomáš Holub and Jaromír Hurník[1]

Central banks have traditionally been perceived as a "money machine" which is bound to generate profits due to their monopoly on issuing currency and thus their ability to generate seigniorage (monetary income). However, numerous central banks around the world have experienced losses in recent years, in some cases deep enough to push them into negative overall equity. Examples include the Czech Republic, Slovakia, Israel, Chile and Thailand, which are all low-inflation catching-up economies.

The economic literature has discussed the issue of central bank losses for a relatively long time. In the 1990s, the focus was mainly on quasi-fiscal origins of the losses. A classical work in this respect is Fry (1993). Quasi-fiscal operations were also explored in Mackenzie and Stella (1996) and Stella (1997).

Recently, however, the literature has started to focus on the losses related to the high and growing foreign exchange (FX) reserves in many countries. Holub (2001a) decomposed central banks' profits/losses into seigniorage, the costs of holding net FX assets, quasi-fiscal operations and operating costs. Hawkins (2003) mentioned sterilised FX interventions as a special case of quasi-fiscal activities by central banks that could lead to losses. Higgins and Klitgaard (2004) discussed the costs and risks of accumulating reserves, focusing mainly on Asian central banks. Exchange rate losses were also discussed in Stella and Lönnberg (2008).

Taking the CNB as an example, the actual experience has been largely in line with the above-mentioned shift in the focus of academic research. In the second half of the 1990s, the CNB's financial losses were to a large extent associated with quasi-fiscal operations related to bank reform, whereas since 2001 the dominant factor has been revaluation losses on FX reserves due to a nominal appreciation trend of the Czech koruna (see Table 1). In the last two years the CNB has achieved positive profits due to the effects of the economic crisis in terms of a depreciated exchange rate and low domestic interest rates (and thus low sterilisation costs), but it still has a huge accumulated loss in its balance sheet. Its negative equity reached more than CZK 135 billion at the end of 2009, equivalent to 35% of currency in circulation.

TABLE. 1

CNB profits/losses from selected operations (in CZK billion)

Year	FX revaluation profits/losses	Monetary policy and FX reserves management profits/losses	Quasi fiscal operations profits/losses etc.	Total profits/losses
1993–99	32.90	1.21	-65.60	-17.47
2000	-3.52	8.35	1.89	2.52
2001	-40.12	12.70	1.62	-28.63
2002	-26.15	11.38	0.98	-9.47
2003	-29.77	12.84	0.76	-18.17
2004	-61.14	8.16	0.88	-53.72
2005	8.73	10.91	1.19	19.96
2006	-66.99	10.12	1.34	-56.39
2007	-47.67	13.97	0.02	-37.50
2008	20.21	10.74	0.06	29.13
2009	-17.56	37.71	0.14	18.45

Source: CNB

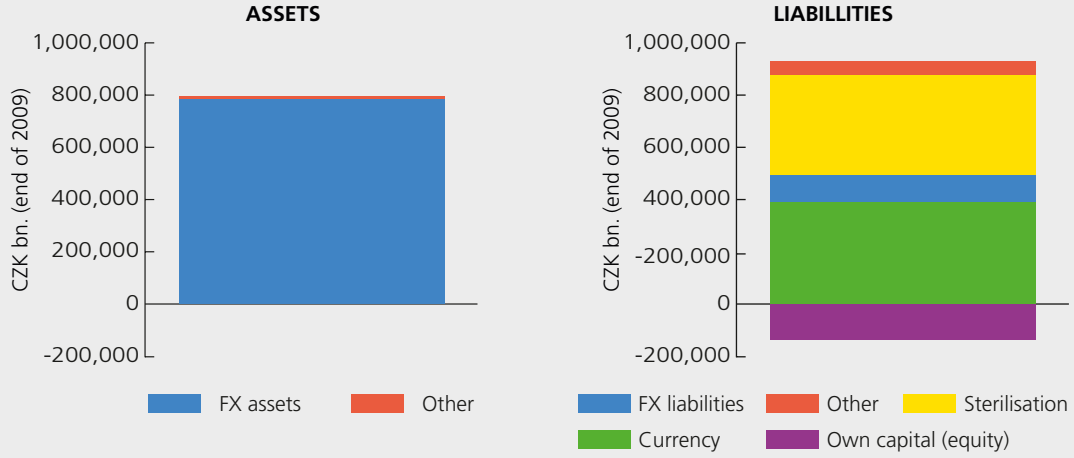
1 The article is based on Cincibuch, et al. (2008, 2009).

The revaluation losses on FX reserves are closely associated with the CNB's balance-sheet structure (see Figure 1). Its asset side is dominated by FX reserves, the volume of which is double that of currency in circulation. Roughly one half of the FX reserves were accumulated before May 1997 under a fixed exchange rate regime. The other half reflects FX market interventions under the managed floating regime as well as FX purchases from the Czech government. On the liability side, the large stock of FX reserves is mirrored by sterilisation of excess liquidity issued against FX purchases, i.e. interest-bearing liabilities in CZK to the domestic banking sector. A similar balance-sheet structure can be observed for many other central banks in catching-up small open economies. In such a situation, and provided that the FX reserves are marked to the market, any nominal exchange rate appreciation may lead to substantial accounting losses. Similarly, a central bank may face losses if the interest it has to pay on the sterilised liquidity exceeds its earnings on FX reserves.

For a central bank, negative equity may not imply any direct problem, as it can always honour its financial obligations in the domestic currency. Nevertheless, under some circumstances the negative equity could impact on its ability to achieve its policy goals. Stella (1997) discussed the need for positive central bank capital and articulated the possibility of inflation control being abandoned in reaction to the worsening of a central bank's balance sheet. Stella and Lönnberg (2008) used the term "policy insolvency" to describe situations in which a central bank's policy decisions are affected by its financial condition.

FIGURE 1

Structure of the CNB's balance sheet (end of 2009)



Source: CNB.

To discuss these issues more rigorously, one needs to develop a formalised, coherent framework for assessing the ability of a central bank to keep its balance sheet sustainable without having to default on its policy objectives or to resort to government support. The earlier contributions in this direction include Holub (2001b), Bindseil, Manzanares and Weill (2004) and Ize (2005). Cincibuch, Holub and Hurník (2008, 2009) – "CHH" henceforth – extend these earlier papers in such a way that allows the consequences of economic convergence for the evolution of a central bank's balance sheet to be discussed in more detail.

Economic convergence typically includes some combination of GDP catch-up from an initially low level, real exchange rate appreciation, a high – but gradually decreasing – risk premium on domestic assets, progress with disinflation and relatively fast growth of currency in circulation. All these factors have important implications for the central bank's financial performance. In the theoretical parts of the paper, CHH demonstrate that in equilibrium the following macroeconomic variables play a decisive role:

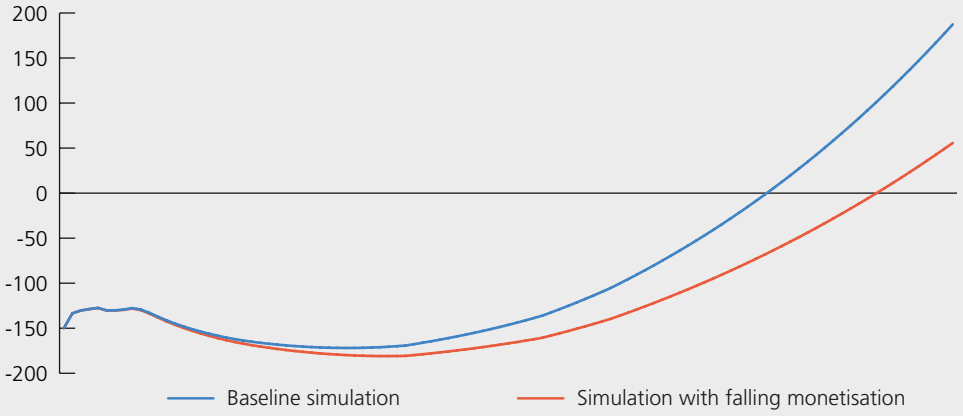
– higher domestic inflation increases central bank profits due to higher seigniorage;
– a real exchange rate appreciation trend lowers central bank profits by lowering domestic equilibrium real interest rates, implying lower seigniorage;
– if net FX reserves exceed currency in circulation plus central bank equity, i.e. if the central bank has to sterilise a liquidity surplus, a positive risk premium in the foreign exchange market can lead to central bank losses;
– it is important whether the growth rate of currency in circulation exceeds the domestic nominal interest rate or not. Fast growth of currency in circulation helps to restructure the central bank's balance sheet and prevent unsustainable dynamics of equity (as a ratio to currency) even if "core profits" (see Ize, 2005) are negative.

This general analysis is applied to the CNB's case. The CNB currently finds itself in a situation with a low inflation target (2% since 2010), high net FX reserves (1.75 times currency in circulation), fast real exchange rate appreciation (around 3.2% on average in 1998–2009), a still relatively high risk premium in the FX market (estimated at around 2.2% p.a.), and fast currency growth (about 8% on average). With such parameters, the ratio of its negative equity to currency in circulation would converge to about 35% (i.e. close to the current value), implying that in absolute terms the accumulated loss would go on growing. However, CHH argue that such a scenario is not the most likely outcome for at least two reasons. First, if the CNB carries out no more massive purchases of FX reserves in the future, the ratio of its net FX reserves to currency in circulation is going to decline. At the same time, the volume of sterilisation will be falling due to the growing volume of issued currency. This structural change in the CNB's balance sheet will improve its financial results. Second, both the risk premium and the real exchange rate appreciation should be falling over time as the convergence process progresses further.

In order to reflect these dynamic factors, CHH complement the comparative-static analysis with dynamic simulations of central banks' balance sheets. They derive the laws of motion for the key balance-sheet items and apply this tool to the CNB's balance sheet. An updated version of the simulations is presented in Figure 2. The simulations take the CNB's balance sheet from mid-March 2010 as a starting point, and use long-term projections consistent with the forecast published in the CNB's Inflation Report I/2010 (for Czech nominal GDP, the CNB's two-week repo rate, the short term EURIBOR and the CZK/EUR exchange rate).

FIGURE 2

Simulation of the CNB's own capital (equity) into the future



Source: CNB.

It is evident from Figure 2 that the CNB's period of losses is probably not over yet and its own capital will become initially even more negative, bottoming at around CZK -170 billion in about 8–10 years. By that time, the growth of currency in circulation will have eliminated the surplus liquidity. Together with an assumed slowdown in real exchange rate appreciation and a decline in the risk premium, this will push the CNB back to profits. It will then take roughly ten more years to cover the accumulated loss. The CNB thus remains able to fully cover the losses by the stream of future profits in about 20 years from now. This conclusion is of course conditional on the assumed macroeconomic scenario. Figure 2 presents a sensitivity analysis with a falling ratio of currency in circulation to GDP, showing that this would delay the repayment of the loss by about 3–4 years. The elimination of the loss could be also delayed by accumulation of further FX reserves due to the inflow of EU funds.

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Housing Price Bubbles and their Determinants in the Czech Republic and its Regions

Michal Hlaváček and Luboš Komárek[1]

Housing prices proved to be a very important factor during the recent financial crisis. Their explosive growth and busts in combination with the mispricing of subprime mortgage loans are usually mentioned among the most important factors of this crisis (see, for example, Calomiris et al., 2008). Therefore, an understanding of housing price determinants is of crucial importance for central banks. Housing price busts might negatively influence the balance sheets of the banking sector. They might also negatively influence private consumption via the wealth channel; a change in the situation on the housing market might influence the mobility of the labour force and thus the flexibility of the supply side.

This study, based on three empirical approaches, discusses supply and demand factors affecting property prices and tries to identify periods of misalignment of housing prices. It also sheds more light on different sources of real estate data for the Czech Republic in order to choose an appropriate index for the description of housing market developments. The situation on the Czech housing market is also discussed from the international perspective.

Supply on the housing market is generally driven primarily by the profitability of the construction business and is regarded as sticky in the short run (see Poterba, 1984). The housing market is often divided into two segments: the segment of existing housing with inelastic supply, where the price is already fixed, and the segment of new housing construction, where the price determines the amount of new construction. The supply factors also include the majority of cost factors, such as building plot prices, average apartment acquisition amounts and building construction costs. These factors often pass through to property prices with a long lag, due to the long time it takes to prepare and actually implement a construction project.

Demand for property is determined primarily by households' disposable income, the main component of which is wages and salaries. They affect both the accumulation of savings and wealth by households and the availability and riskiness of housing loans. Other labour market factors that can influence property prices include the unemployment rate, the economic activity rate of the population and the number of vacancies. With the exception of unemployment, growth in labour market factors should lead to growth in apartment prices.

Housing prices can also be affected by various demographic factors: linked with the aforementioned labour market factors is population growth due to migration, where higher inward migration should lead to housing price growth; natural population growth should act in the same direction. Property price growth should also be fostered by a higher divorce rate, as most divorces turn one household into two, thus giving rise to a need for a new dwelling. The marriage rate can act in the same direction, as a wedding often establishes a completely new household. Demand for housing can also be affected by the age structure of the population.

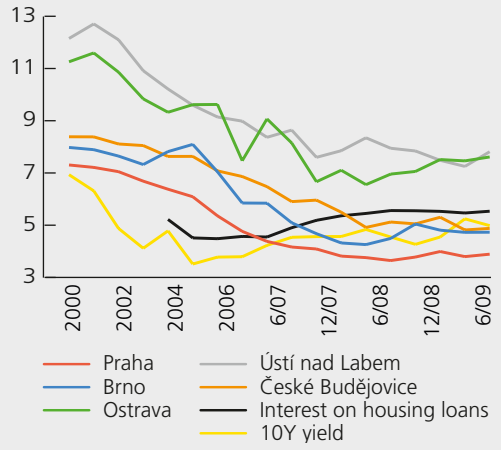
The major factors of property price growth have recently also included the development of the financial market. This is being reflected primarily in growth in housing loans and is reducing the liquidity constraints on households when acquiring their own housing and should therefore be pushing property prices upwards. The mortgage interest rate acts in the opposite direction, as growth in the mortgage rate makes loan financing of property purchases less attractive and increases households' repayments of existing loans. Demand from abroad can affect demand for housing quite strongly. Demand for housing prices can also be affected by market rents, growth of which tends to lead to rising apartment prices.

1 This article is based on Hlaváček and Komárek (2009).

The empirical analysis tries to identify periods of housing price misalignment by three approaches using: (i) simple ratios related to house prices (price-to-income and price-to-rent), (ii) time series analysis for the Czech Republic as a whole, and (iii) panel regression for the Czech regions. Our estimations were conducted on a narrower set of explanatory variables owing to the possible existence of endogeneity of some explanatory variables. Due to the low number of observations we were not able to capture this endogeneity analytically other than by removing variables suspected of endogeneity from the regression.

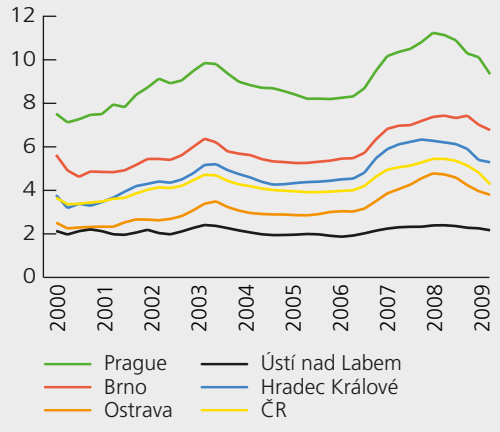
The first approach quickly visualised the excessiveness of housing prices using simple price-to-income or rental return ratios (see Figure 1).[2] Both ratios show that for the majority of the Czech regions the rental return ratio was constantly worsening between 2000 and 2008 H1. Until 2005 this worsening was in line with the drop in interest rates, but starting from 2006 the rental return declined further despite rising government bond yields and housing loan interest rates. Thus, the growth in prices in 2006–2008 might have some bubble component according the rental return indicator. A drop in prices in 2009 resulted in an improvement of the rental return indicator for the majority of regions, but for the majority of them it remains below the relevant interest rates. Similarly, the price-to-income ratio (see Figure 2) indicates two potential apartment price bubble periods, namely the start of 2003 and late 2007/early 2008. These periods are those with high price growth. For the period 2004–2006 one can see that the housing price bubble might ease relatively easily from the point of view of the price-to-income ratio. During this period, apartment prices were more or less stable and the improvement in the price-to-income ratio was due to wage growth. However, a question arises as to whether this can be repeated in the generally less favourable macroeconomic conditions of the world financial crisis. The improvement in the price-to-income ratio in 2009 was mainly due to apartment price drops. The ratio remains at relatively high levels. From both the price-to-income and rental return ratios one can also work out which regions are "more risky" from the point of view of these indicators. Looking at the cross-regional dimension of those indicators it is evident that the worst values are reported for regions with relatively high absolute prices (Prague) and the most favourable values for regions with relatively low absolute prices (northern Bohemia – Ústí nad Labem and northern Moravia – Ostrava).

FIGURE 1
Structure of the CNB's balance sheet (end of 2009)



Note: Averages for period in %; comparison with yields on 10Y government bond and housing purchase loan rates.
Source: IRI, CNB, data for 2009 preliminary.

FIGURE 2
Price-to-income ratios



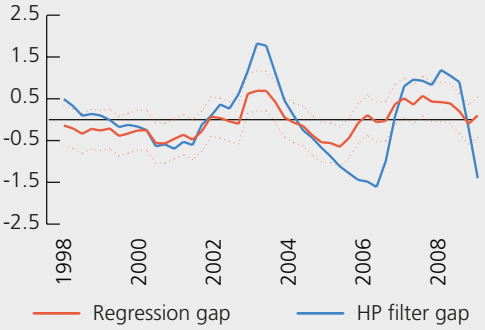
Note: Ratio of price of 68 m² apartment to wage for last 4 quarters.
Source: CZSO transfer prices, CNB calculation; data for 2009 preliminary or calculated from supply prices.

2 The rental return ratio is the inverse of the alternatively used price-to-rent ratio. Its advantage is that it can be compared directly with interest rates in the economy.

The second approach (the time series analysis) was conducted for the Czech Republic and Prague on quarterly data for the period January 1998–June 2009. The explained variable was apartment price growth in real terms. These results for Prague and the Czech Republic as a whole show that the apartment price growth can be explained mainly by rising prices of building plots, rising vacancies/labour force, rising average monthly real wages and rising monthly real rents. These estimates were then compared with the "naive" equilibrium estimate obtained by applying the Hodrick-Prescott (HP) filter (see Figure 3). Both analyses identify two possible periods of property price overvaluation (bubbles), namely the start of 2003 and late 2007/early 2008. One difference between these two periods might be that the growth in prices in 2002/2003 was driven mainly by speculation linked with the Czech Republic's accession to the EU, whereas the recent surge in 2007/2008 is due primarily to improved fundamentals (wage growth, higher population growth, lower unemployment, etc.). Analogously, the results of the HP filter for the recent period, which identify strong undervaluation of current property prices in the Czech Republic, is not credible from our point of view.[3]

FIGURE 3

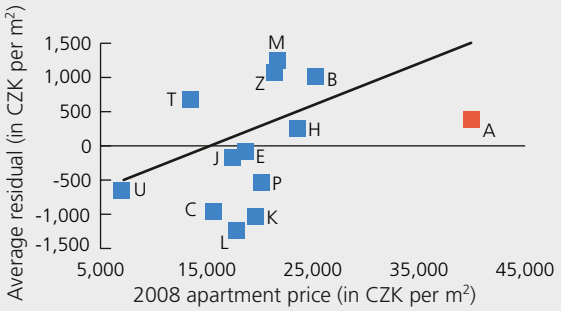
Gap in prices in the Czech Republic (time series analysis for the Czech Republic)



Note: Deviation of actual prices from estimate in CZK thousands per m²; positive values mean overvaluation, negative values undervaluation. Dashed lines indicate 10% confidence interval.
Source: CZSO, CNB calculation.

FIGURE 4

Apartment price misalignment (panel regression from Czech regions)



Note: Values show average residual for time period 1998–2008. A – Prague, S – Central Bohemian Region, C – South Bohemian Region, P – Plzeň Region, K – Karlovy Vary Region, U – Ústí nad Labem Region, L – Liberec Region, H – Hradec Králové Region, E – Pardubice Region, M – Olomouc Region, T – Moravian-Silesian Region, B - South Moravian Region, Z – Zlín Region, J – Vysočina Region.
Source: CZSO, IRI, CNB, CNB calculation.

3 This is due to the end-point-bias problem of the HP filter. The HP filter also does not account for the strong worsening of the macroeconomic situation in the Czech Republic at the end of 2009 linked to the world financial crisis.

The third approach (the panel regression) was conducted across the Czech regions including and excluding Prague on annual data for 1998–2008. The explained variable was the apartment price level in real terms. One result is that the level of overvaluation of apartment prices in individual regions is positively related to the apartment price level (in regions where apartment prices are higher, they are also more likely to be overvalued). Apartment prices in Prague are the exception to this rule, as the level of overvaluation is one of the lowest despite the fact that Prague has the highest absolute prices. This is probably due to the properties of the estimation technique, as the conclusion that apartment prices in Prague are relatively undervalued may be based on explanatory variables which are not necessarily equilibrium variables themselves. This outcome is therefore not wholly consistent with the earlier simple analyses, which see Prague as the most risky region as far as housing price bubbles are concerned. It may be due to the properties of the estimation technique and may thus not be entirely robust. However, it confirms that the property market in Prague is specific in nature compared to the other Czech regions (see Figure 4).

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Structural and Cyclical Unemployment: What Can We Derive from the Matching Function?

Kamil Galuščák and Daniel Münich[1]

A popular way to summarise changes in the economy is to plot the Beveridge curve describing the negative empirical relationship between unemployment and vacancies (Figure 1). While periods of increasing aggregate demand are characterised by increasing vacancies and decreasing unemployment, the opposite is true for recessions. On the other hand, simultaneous increases or decreases of both unemployment and vacancies are due to increased frictions or rising mismatch between labour demand and supply, but observably the same outcome can also be due to higher labour market turnover.

While the Beveridge curve is described in terms of labour-market stocks, the underlying changes are driven by net flow variables: inflow into and outflow from unemployment. The deterministic relationship linking outflows from unemployment with stocks of unemployment and posted vacancies is the matching function – a simplifying concept similar to the notion of the production function. Understanding regularities in flow variables is important for identifying the origins of shifts in the Beveridge curve. These shifts are associated with parameter changes in the matching function. In other words, estimates of the matching function may help to distinguish cyclical and structural changes in the unemployment rate. Distinguishing cyclical and structural components in the unemployment rate and its changes is crucial for proper assessment of inflationary pressures in the economy.

Relying primarily on Berman (1997), Jackman et al. (1990) and Petrongolo and Pissarides (2001), we interpret developments in the Czech economy based on shifts in and movements along the Beveridge curve and as reflected in parameter changes in the matching function. We consider specific forms of the matching function and examine parameter changes in the matching function during the business cycle.

We use monthly data on unemployment and vacancy stocks and gross flows from the registers of district labour offices in the Czech Republic. From the policy perspective, the registry data do not suffer from the drawbacks of the commonly used aggregate economic indicators, particularly productivity measures. In particular, registry data are comprehensive, published a few days after collection, and are not subject to revisions. We show that unemployment flows closely coincide with turning points in the cyclical component of gross domestic product at constant prices. Unemployment flows may be thus used as coincidence indicators of turning points in the business cycle. This is because the figures on productivity measures are published with a substantial delay of several months, while the information on net unemployment flows is available within a few days after the end of each month.

However, the registry data on unemployment and vacancies suffer from some limitations. For example, the unemployment data are likely to underestimate the actual number of the unemployed, as some people do not register with a labour office when changing job. Similarly, the vacancy data are also underreported, as some vacancies may not be posted at labour offices. The underreporting of unemployment and vacancies is likely to be uneven across districts and higher in urban areas, where other channels of job and worker search are used. On the other hand, the registry unemployment may be overreported, since some people register with a labour office in order to be eligible for social security benefits while engaging in some kind of undeclared work. Assuming that the differences in under- or over-reporting across districts are time-invariant, these effects are removed by the differences which we use in the estimation.

1 This article is based on Galuščák and Münich (2005, 2007).

Existing empirical studies rely on simplified versions of the matching function due to data limitations. These simplifications are necessary to keep the estimation tractable, but introduce potential biases. While we face similar empirical obstacles, we find expressions for possible biases and take these biases into account when interpreting our empirical findings. In particular, we inspect possible biases in the coefficient estimates of the matching function during the business cycle due to the omission of employed job seekers and the discouraged unemployed, proceeding from Petrongolo and Pissarides (2001).

The coefficients of the matching function capture the marginal effects of job search and the search for workers and thus reflect the effects of the business cycle. On the other hand, the additive constant term aggregates all other effects that are not captured by the marginal effects. The additive term indicates changes in the structural component of unemployment or, in other words, in the mismatch. Given that the unemployment inflow rate is constant, changes in the additive term of the matching function may be associated with shifts in the Beveridge curve. Conversely, changing unemployment inflows may also explain movements in the Beveridge curve, but they cannot affect our interpretation of parameter changes in the matching function.

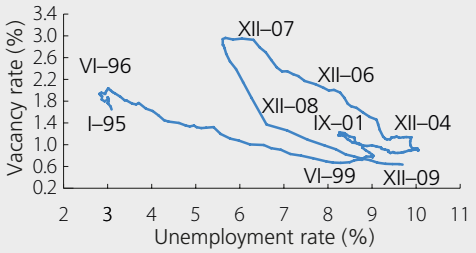
We estimate the matching function on a panel of 74 Czech districts in moving windows, i.e. over a particular fixed time span that moves period by period, between January 2000 and December 2004. With coefficient estimates at hand, we calculate the district-specific fixed effects and then aggregate these effects into an economy-wide parameter.

The aggregated fixed effects capture the average rate of matching and reflect mismatches. Increasing aggregated fixed effects signal an improvement in matching (falling frictions), while a deterioration in matching (rising frictions) is indicated by decreasing aggregated fixed effects. Parameter changes in the matching function have direct consequences allowing us to distinguish cyclical and structural changes in the unemployment rate given that the inflow rate into unemployment does not change. Given that the unemployment inflow rate is constant, changes in the aggregate fixed effects may be associated with shifts in the Beveridge curve.

In accordance with our expectations, we find some cyclical pattern in the unemployment inflow coefficient. The parameter of the aggregated fixed effects was constant until 2001, but dropped in late 2001 and in 2002, indicating a rise in labour market mismatch during that period. This corresponds to the outward shift in the Beveridge curve in that period. While the Beveridge curve shifts owing to changes in

FIGURE 1

The Czech Beveridge curve (1995–2009)



Note: Seasonally adjusted monthly data.
Source: Ministry of Labour and Social Affairs.

stock variables, primarily due to the long-term component of the unemployment rate, the rising frictions as indicated in the aggregated fixed effects concern flow variables. This implies that the matching function parameters may signal changes in mismatch and, in advance, changes in stock variables as observed in the Beveridge curve.

Provided that the measurement errors have a minor impact on the estimates, our results indicate a deterioration in the functioning of the Czech labour market until 2004. Our findings support the view that outward shifts in the Beveridge curve are due to increasing mismatches. The Czech economy suffers from the hysteresis (path dependency) in the labour market that is common in many other European economies.

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The CNB Economic Research and Financial Stability Department announced the regular Call for Research Projects 2011, direct link:
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CNB Research Open Day

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Programme

Tuesday, 25 May 2010
The Czech National Bank's Commodity Exchange (Plodinová Burza) building,
Senovážné nám. 30, Praha 1

8.30 Registration & Morning Coffee

9.00 Introduction and ERFSD Award 2010, Kateřina Šmídková, Executive Director, ERFSD

9.10 Ten Years of Economic Research in the CNB, Kateřina Šmídková

9.20 "Housing Prices Bubbles and Their Determinants in the Czech Republic and its Regions", by Michal Hlaváček and Luboš Komárek

9.45 Discussion: Aaron Mehrotra, Bank of Finland

10.10 Q&A

10.15 Coffee
Chair: Michal Hlaváček, CNB

10.40 "Implementing the New Structural Model of the Czech National Bank", by Michal Andrle, Tibor Hlédik, Ondra Kameník and Jan Vlček

11.05 Discussion: Gunter Coenen, ECB

11.30 Q&A

11.35 "Heterogeneity in Bank Pricing Policies: The Czech Evidence", by Roman Horváth and Anca Maria Podpiera

12.00 Discussion: Laurent Weill, University of Strasbourg

12.25 Q&A

12.30 Lunch

14.00 Information Meeting for Prospective Authors of CNB Research Projects