Poland on the road to the euro: How serious is the risk of boom-bust cycles after the euro adoption? An empirical analysis

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Abstract: The goal of this paper is, firstly, to determine which structural characteristics of an economy make it more (or less) prone to macroeconomic booms and busts and, secondly, to empirically assess the risk of a boom-bust cycle in Poland after the euro adoption. We start from identifying booms and busts in private consumption and investment in fourteen "old" EU member states and then we seek to explain the identified boom and bust series using panel probit and pooled probit models. We then use the estimated equations to assess the probability of booms and busts in Poland over the period 2004 to 2009. Our results suggest that credit developments have been the most important driving force of booms and busts in EU-14. The relevance of international capital flows as a boom-bust transmission channel and of the cyclical heterogeneity of countries which undergo a process of monetary integration is also confirmed. We also find evidence that the fiscal channel boils down to a crowding-out effect: a reduction in the general government expenditure "makes room" for a boom in the private expenditure, and the reverse holds for busts. In turn, our results for Poland are inconclusive, which probably means that the models estimated for EU-14 are not adequate to predict the probabilities of booms and busts in this country.

JEL Classification: E32, E42, E63, C23

Keywords: Booms and busts, Poland, EMU enlargement, panel data analysis, probit models

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Non-technical summary

Ever since the Economic and Monetary Union came into effect, a lot of ink has been spilt on the question of how soon the new EU member states should join the euro area. Until recently, the dominant view seemed to be that a small converging economy can benefit a lot from joining a monetary union with more advanced economies. It was pointed out that the related decrease in the country's risk premium leads to a drop in the nominal and, *ceteris paribus*, also the real interest rates. This, along with the microeconomic efficiency gains resulting from the elimination of exchange rate risk, should boost domestic investment and bring about a faster economic growth in the longer term. It was also argued that the costs of monetary integration, arising from the loss of independent monetary policy and the exchange rate instrument, should be low for most new member states. Arguably, these costs are negligible or non-existent for those counties, such as the Baltic states, which already form an "asymmetric monetary union" with the euro area via a currency board or another hard peg against the euro.

However, the recent experience of several countries at the euro area's periphery as well as the Baltic states has shown that the drop in interest rates resulting from monetary integration can be a mixed blessing. Specifically, if the natural (neutral) real interest rate in a converging economy is significantly higher than the monetary union's average, the post-accession expansion in that economy can easily turn into a boom-bust cycle, i.e. very rapid growth followed by a steep decline in the economic activity. Such cycles are detrimental to the macroeconomic and financial stability and thus to the country's long-term growth. Therefore, we argue that the risk of a boom-bust cycle is an important potential cost that a converging economy envisages when joining a monetary union with more advanced economies.

The goal of this paper is, firstly, to determine which structural characteristics of an economy make it more (or less) prone to macroeconomic booms and busts and, secondly, to empirically assess the risk of a boom-bust cycle in Poland after the euro adoption. Our analysis proceeds in three steps. In the first step, we identify booms and busts in private consumption and private investment in fourteen "old" EU member states, i.e. those countries which were members of the EU prior to its enlargement of 2004, except for Luxembourg. The identification of booms and busts is based on three different methods which were employed in previous empirical studies focusing on boom-bust cycles in credit and asset price markets. The sample covers the period 1970 to 2009 and thus it ends before the entire impact of the global financial crisis on consumption and investment in the EU became manifest. In the second step, we seek to explain the identified boom and bust series using panel probit models with random effects and pooled probit models. In the third step, we use the equations estimated for the "old" EU to assess the probability of booms and busts in Poland in the years 2004 to 2009. We repeat this exercise for two different sets of assumptions: firstly, that

Poland joined the ERM II immediately upon EU accession in 2004 and adopted the euro in 2007, and secondly, that it did not join either the ERM II or the euro area until at least 2009. The results of both scenarios – respectively the quick euro adoption and the real scenario – are compared to assess whether a rapid euro adoption would have increased the probability of a boom when the global economic activity was high, and the probability of a bust when the global financial crisis hit.

The contribution of this paper is, correspondingly, threefold. Firstly, to the best of our knowledge, this is the first paper to identify booms and busts in macroeconomic aggregates such as private consumption and investment; previous studies were only concerned with booms and busts in asset prices or credit developments. Secondly, we are among the first to empirically analyse the specific mechanisms contributing to the emergence of macroeconomic booms and busts in the "old" EU. Thirdly, we make a small contribution to the debate concerning the costs and benefits of a relatively early euro adoption in Poland.

Our results suggest that credit developments have clearly been the most important driving force of booms and busts in EU-14, which points to the crucial role of the financial accelerator mechanism. The relevance of international capital flows as a transmission channel is also confirmed, albeit mainly for busts rather than booms. Interestingly, a higher degree of financial openness is coupled with a lower, not higher, probability of a consumption boom. Variables that capture the cyclical heterogeneity of countries which undergo a process of monetary integration are also significant. Strikingly, converging economies in our sample have been less, not more, prone to consumption booms, and it appears that participation in the EC or EU lowers the probability of a boom for both converging and non-converging economies but more strongly for the former. Finally, we find evidence that the working of the fiscal channel is contrary to our expectations and boils down to a crowding-out effect: a reduction in the general government expenditure "makes room" for a boom in the private expenditure, and the reverse holds for busts.

As regards the forecast for Poland, our results are rather inconclusive, which means that either the models estimated for EU-14 are not adequate for Poland, or – which is a less probable outcome – that a rapid euro adoption would not have significantly affected the probability of a boom-bust cycle in Poland. In any case, there are certain lessons to be drawn from the experience of EU-14, most notably that preventing an excessive credit expansion should be the main policy objective if Poland is to avoid the vicious cycle of macroeconomic booms and busts both in the euro area and before accession. A better cyclical alignment with the euro area's core countries, such as Germany, should also contribute to a lower probability of booms and busts.

1 Introduction

Ever since the Economic and Monetary Union came into effect, a lot of ink has been spilt on the question of how soon the new EU member states should join the euro area. Until recently, the dominant view seemed to be that a small converging economy can benefit a lot from joining a monetary union with more advanced economies. It was pointed out that the related decrease in the country's risk premium leads to a drop in the nominal and, *ceteris paribus*, also the real interest rates. This, along with the microeconomic efficiency gains resulting from the elimination of exchange rate risk, should boost domestic investment and bring about a faster economic growth in the longer term. It was also argued that the costs of monetary integration, arising from the loss of independent monetary policy and the exchange rate instrument, should be low for most new member states. Arguably, these costs are negligible or non-existent for those counties, such as the Baltic states, which already form an "asymmetric monetary union" with the euro area via a currency board or another hard peg against the euro.

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The remainder of this paper is structured as follows. The next section provides a brief overview of the relevant literature concerned with boom-bust cycles on the one hand and the macroeconomic effects of the euro adoption in converging economies on the other hand. Section 3 reviews the major transmission channels or mechanisms conducive to boom-busts cycles. Section 4 describes the three methods used to identify booms and busts in private consumption and investment in the "old" EU member states and concisely summarises the results of the identification exercise. Section 5 presents the empirical methodology employed to explain the previously identified booms and busts as well as the explanatory variables, and it further discusses the results of the analysis regarding both the "old" EU and Poland. The last section addresses some important caveats, most notably those related to the Lucas critique, summarises the main results and concludes.

2 Overview of the literature

This paper builds upon two strands of literature: studies that analyse booms and busts on the one hand and those concerned with the macroeconomic consequences of the euro adoption in Poland on the other hand.

As regards the first group of studies, several of them start from the empirical identification of boom and bust episodes in a panel of countries. There is no single and generally accepted definition of a boom or bust; they can be defined respectively as a period of exceptionally fast growth in a given (macro)economic variable and a period of exceptionally strong fall in (the growth rate of) that variable. How to understand the term "exceptionally strong" is a matter of interpretation and so these papers try to make the above definitions operational by setting quantitative thresholds above/below which the growth/decline becomes a boom/bust. The

focus so far has been either on credit developments (Gourinchas et al. 2001; IMF 2004; Cottarelli et al. 2005; Mendoza and Terrones 2008) or on asset prices, including housing prices (Bordo and Jeanne 2002; Kakes and Ullersma 2003; Jaeger and Schuknecht 2007; Agnello and Schuknecht 2009; IMF 2009). Some of these papers also analyse the "anatomy" of booms and busts using event study techniques, i.e. they look at the behaviour of various macroeconomic aggregates before, during and after booms and busts. The identification of boom and bust episodes is also the point of departure of our empirical analysis but, in contrast to the previous studies, we focus on private consumption and private investment.

Further, many papers in this strand of literature look at the transmission channels or mechanisms contributing to the emergence of boom-bust cycles. On the empirical side, Bakker and Gulde (2010) offer a very comprehensive analysis of the recent credit booms and the subsequent busts in the new EU member states. They argue that the severe boom-bust cycles in these countries were, to a large extent, the result of "bad luck" rather than bad policies: the boom was largely driven by high global liquidity and strong foreign capital inflows, and the bust was brought about by the global financial crisis. Similar conclusions are reached by Brixiova et al. (2010) who examine the shocks, institutions and policies which made the Estonian boom-bust cycle so severe. The authors point out that the currency board arrangement, financial liberalisation and "credit democratisation" along with benign global conditions were conducive to massive capital inflows, fuelling an unsustainable credit expansion. Kuodis and Ramanauskas (2009), in turn, apart from stressing the role of the same factors in fuelling the boom-bust cycle in Lithuania, make a point that ill-devised economic legislation and pro-cyclical fiscal policy aggravated the vicious cycle of credit acceleration.

On the theoretical side, the analysis of macroeconomic boom-bust cycles within a general equilibrium framework put forward by Fagan and Gaspar (2007) is an important reference. They focus on the case of a small open economy which, upon accession to a monetary union, is faced with a reduction in the exogenous risk premium and easier access to external financing. Their model is able to replicate the stylised facts regarding the effects of interest rate convergence in the euro area's peripheral economies (Spain, Ireland, Italy and Portugal), notably an increase in aggregate expenditure and a fall in savings, significant current account deficits, real exchange rate appreciation, and the accumulation of household debt and of a negative net foreign asset position. A very recent paper in this vain is that of Landmann (2011) who presents a stylised theoretical model aiming to explain non-synchronised output and inflation movements in a monetary union.

To our knowledge, only two papers – Brzoza-Brzezina et al. (2010) and Torój (2011) – deal with the issue of boom-bust cycles upon the euro adoption within general equilibrium models calibrated for Poland. These papers thus combine the two strands of literature which our study touches upon. In the former paper, the euro adoption shock is modelled as a permanent decrease in the target level of net foreign assets, reflecting the related credibility shift. The

resulting boom-bust cycle can be smoothed by adequately designed policies; simulations show that a revaluation of the central parity against the euro prior to accession is the most effective one. The second paper jointly analyses the competitiveness and the real interest rate channels as the equilibrating and disequilibrating forces in a monetary union. Having compared Poland and Slovakia based on simulations, the author concludes that the latter country is more capable of handling asymmetric shocks under a common monetary policy.

As regards the second group of studies, the literature concerning the macroeconomic effects of the euro adoption in the new EU member states is vast. For the case of Poland, this issue is discussed in depth e.g. in the two reports prepared by the National Bank of Poland (NBP 2004; NBP 2009). The references provided therein cover the most important aspects of the European monetary integration.

Several studies deserve special attention as they deal explicitly with the possibility of boom-bust cycles developing after the euro adoption. Apart from the above-cited paper of Brzoza-Brzezina et al. (2010) and our analysis, however, virtually all studies concentrate on credit market developments rather than booms and busts in macroeconomic aggregates such as consumption and investment. For instance, Schadler et al. (2005) offer an early but comprehensive overview of the different aspects of the euro adoption, including the probable credit market developments, in five Central European countries, among them Poland. Their simulations suggest that the convergence towards the euro area should bring about very rapid credit expansion[1]. Brzoza-Brzezina (2005) conducts a similar exercise concentrating on the expected loan developments in the Czech Republic, Hungary and Poland during the euro accession process against the background of the euro area periphery: Greece, Ireland and Portugal. He concludes that, even though relatively strong credit growth could be expected for the three new EU member states, the potential for credit boom-bust cycles is lower than it used to be for the euro area periphery. The main reason for this conclusion is that, as of 2004, the new member states were more advanced in terms of nominal convergence against the euro area than was the latter group of countries five years before they acceded to the EMU. Eichengreen and Steiner (2008), in turn, concentrate on the case of Poland and analyse the potential for boom-bust cycles in the years to come. Their conclusions are mixed: on the one hand, at the time of their writing Poland remained an outlier compared with other Central and Eastern European countries due to the relatively slow credit growth, which increased the danger of a boom (assuming mean reversion). On the other hand, as the nominal interest rates had already come closer to the euro area levels, the euro accession as such should not fuel a severe boom. Inevitably, the conclusions from different studies may vary and so it appears

[1] Cottarelli et al. (2005) scrutinise the credit market conditions in Central Europe and the Balkans and also attempt to model the future loan developments. They conclude that the credit to GDP ratios are (or were at the time of their writing) substantially undersized relative to their equilibrium values and thus rapid credit growth in those countries should be expected in the years to come. However, the authors do not point to the euro area accession as the main reason behind the expected credit acceleration.

insightful to contribute to the debate by empirically analysing the potential for booms and busts in consumption and investment based on the results obtained for the "old" EU.

3 Boom-bust cycles: major transmission channels

In theory, several mechanisms can contribute to the emergence of boom-bust cycles, most notably: (1) the financial accelerator, (2) international capital flows, (3) the real interest rate channel in a heterogeneous monetary union, (4) the fiscal channel. In the following, we will regard each of these in turn (see also the discussion in Martin et al. 2007).

Macroeconomic booms and busts are often associated with cyclical upturns and downturns in asset prices. The link between the macroeconomy and asset markets can be explained by the **financial accelerator mechanism** (Bernanke and Gertler 1995; Kiyotaki and Moore 1997; Bernanke et al. 1999) whose working results from credit market imperfections, such as information asymmetry or institutional shortcomings. Due to those imperfections, agents may face borrowing constraints which can be relaxed or tightened depending on the value of the collateral that can be brought up. Under such conditions, asset price shocks are magnified by balance sheet effects, and they affect the real economy.

Specifically, a positive shock to asset prices, by increasing the collateral value of assets, relaxes agents' borrowing constraints, leading to a rise in the volume of credit in the economy. The resulting increase in the demand for assets leads to further increases in asset prices, further relaxation of the borrowing constraint and further credit expansion, and so on. As a consequence of the larger credit volume and the rise in Tobin's q, investment expenditure of firms rises, and in the presence of wealth effects, consumption expenditure of households also increases. GDP growth thus accelerates, raising total income and boosting expectations about the future, which again tends to inflate asset prices and aggregate spending. In this way, the boom in asset prices is passed on to the real economy and then magnified by feedback effects. Overinvestment in some sectors, above all building and construction, is often the result, along with an acceleration of wages in those sectors. At some point, asset prices must stop rising and eventually collapse, which adversely affects both asset markets and the real economy via the same mechanisms as those already described. The resulting macroeconomic bust can be severe, depending on the magnitude of the imbalances that accumulated during the boom phase. In is worth noting that the financial accelerator may work best in advanced economies due to the depth of their credit and asset markets, but its importance was also confirmed for several emerging market economies (Gertler et al. 2007; Brei and Buzaushina 2009).

International capital flows, in turn, have been a common factor behind many booms and busts in emerging market economies (IMF 2004[2]; Williamson 2005; Bakker and Gulde 2010), which are more dependent on foreign capital import due to the relatively low level of domestic saving. However, this channel can also play a significant role in fuelling advanced countries' booms and busts[3]. International capital flows affect the real economy through the credit market and tend to reinforce the financial accelerator channel.

Specifically, in a fixed exchange rate regime the inflow of foreign capital contributes to lower interest rates and possibly – when it leads to (unsterilised) central bank intervention – to a rise in base money, which has the usual expansionary effect on the economic activity. Moreover, if the flows are mainly channelled to the domestic banking system, they often lead to the expansion of credit to the non-financial sector, which again boosts the aggregate expenditure and GDP growth. In turn, when the exchange rate is floating, capital inflows favour its appreciation. This in itself should have a demand-switching effect, i.e. lead to a decline in net exports and thus lower GDP growth. However, the fact that exchange rate appreciation is conducive to lower inflation means that the policy interest rate can be lower than it would otherwise be, which is conducive to stronger economic activity. If capital inflows and the resulting appreciation are exceptionally strong, the central bank might want to discourage an overshooting of the domestic currency and thus delay interest rate hikes even when expected inflation in the monetary policy transmission horizon is relatively high. Furthermore, as in the fixed exchange rate regime, if capital mainly flows into the domestic banking system, the credit volume expands, bringing about increased spending and higher GDP growth. In addition, a sustained appreciation often leads to a belief that foreign exchange denominated loans, especially mortgage loans whose repayment constitutes a large burden for households, are considerably cheaper than those denominated in the domestic currency. To the extent that banks are able and willing to meet the rising demand for foreign currency denominated loans, the volume of those loans increases – often to a large extent, given that banks may be inclined to take larger risks when they experience a continuing inflow of capital from abroad. Finally, if the foreign capital is flowing into the sovereign debt market, under both exchange rate regimes the government may increase its expenditure, additionally fuelling domestic demand, and its debt (especially the part that is denominated in foreign currencies) expands. These developments are often accompanied by rapidly increasing asset prices, and the financial accelerator mechanism discussed above sets in as well. All these factors are conducive to a credit-financed boom and a build-up of macroeconomic imbalances.

[2] IMF (2004) looks at credit market developments in 28 emerging market economies over 1970–2002 and shows that large capital inflows preceded over half of episodes identified as credit booms.

[3] For instance, the empirical analysis of Sá and Wieladek (2010) shows that in the first half of the 2000s, capital inflows to the United States played a bigger role in generating the U.S. house price boom than the Federal Reserve's monetary policy loosening.

Under such circumstances, a reversal of capital flows (sudden stop) inevitably generates downward pressure on the domestic currency. In a fixed exchange rate regime, the central bank needs to raise interest rates significantly in order to defend the peg. This, apart from the usual contractionary effect on the domestic economic activity, increases the burden of debt repayment for all agents involved. Under floating, there may be no interest rate hikes if the central bank allows the domestic currency to give in to the depreciate pressure, but if this pressure is large enough, the interest rates may be kept above the level that is consistent with the price stability objective. As a result, the burden of debt repayment – especially of foreign-currency denominated debt – increases markedly, similarly as in the fixed exchange rate regime. Moreover, regardless of the exchange rate regime, a sudden stop is usually followed by a reversal in asset prices and thus a decline in their collateral value. Both factors (higher debt repayment burden and lower collateral value of assets) negatively affect agents' balance sheets, leading to a worsening of banks' portfolio and tensions in the domestic banking system and causing banks to curb the credit supply. If sovereign debt is also affected by the interest rate increases or domestic currency depreciation, the government may need to tighten fiscal policy. As a consequence of all these developments, aggregate demand and GDP growth collapse and the boom turns to a bust. In the worst case scenario, a sudden stop may lead to a fully-fledged financial crisis: a banking, currency or debt crisis.

The **real interest rate channel in a heterogeneous monetary union** offers another explanation for the emergence of boom-bust cycles (Brzoza-Brzezina et al. 2010; Torój 2009; Landmann 2011). Walters (1994) was among the first to point out that common monetary policy in the prospective Economic and Monetary Union can prove to be procyclical in the case of individual economies ("Walters critique"). This generally results from some sort of heterogeneity of the economies making up the monetary union; this heterogeneity can be manifested in asymmetric (i.e. country specific) shocks, low synchronisation of economic cycles within the union, or different levels of the natural real interest rate.

Accordingly, a boom specific to one member state of a monetary union is initially caused by a positive relative output gap, which can be generated by an aggregate demand shock, a more favourable cyclical position compared to the rest of the union, or the accession to the monetary union and the related drop in the nominal and real interest rates below the equilibrium level[4]. The resulting increase in the domestic inflation above the union's average leads to a drop in the *ex post* real interest rates, and under adaptive inflation expectations (or under rational expectations in the presence of price rigidities) the same holds for the *ex ante* real interest rates. This leads to another increase in the aggregate demand and output gap, which further fuels domestic inflation and lowers the real interest rates. As a consequence,

[4] Importantly, the accession can produce a boom even if the natural real interest rate in the acceding country is equal to that in the rest of the union if domestic agents have overly optimistic expectations as to its impact on future incomes (Calmfors et al. 2007). This factor arguably played a role in the accession booms of some euro area countries, most notably Portugal.

nominal wages accelerate, contributing to higher unit labour costs and real exchange rate appreciation. The resulting decline in the trade balance brings about a gradual worsening of the situation in the export sector, while the domestic demand continues to expand. At some point employment in the export sector starts declining, which contributes to a lowering of the domestic demand and the unwinding of the imbalances that have accumulated. Because such country-specific macroeconomic booms are often accompanied by rapidly rising domestic asset prices and capital inflows from abroad, the economic slowdown may turn to a severe bust when it is accompanied by collapsing asset prices and a reversal of foreign capital flows. In other words, in a heterogeneous monetary union the real interest rate channel plays the role of an "automatic destabiliser"; the "rotating slumps under the euro" (a term coined by Blanchard 2007b) are a good empirical example.

Finally, the mechanisms just described can be set in motion whenever the macroeconomic policy mix is inadequate to the cyclical position of an economy and the level of the natural real interest rate – in a monetary union and under independent monetary policy alike. In this respect, overly expansionary fiscal policy is often the culprit and so the literature explicitly points to the **fiscal channel** as a separate channel generating booms and busts. All in all, it is worth stressing that regardless of which specific mechanisms initially led to a boom, inflation inertia play an important role in fuelling boom-bust cycles (Blanchard 2007a; Landmann 2011).

4 Identification of booms and busts

As a first step of our empirical analysis, we identify periods of booms and busts in the time series of private consumption and private investment in the "old" EU member states. In other words, we decide whether the values of the underlying series in any given year represent "normal" developments or booms/busts. We do that in line with the existing literature where three methods seem to dominate: (1) a method concentrating on deviations of the series from their trend, (2) an approach based on moving averages of detrended series, (3) the so-called triangular approach taking into account both the magnitude and the duration of expansionary/ recessionary episodes.

Method (1) was adopted to analyse credit booms by, among others, Gourinchas et al. (2001), Cottarelli et al. (2005), IMF (2004), and Mendoza and Terrones (2008). In line with this approach, a boom/bust is identified if the value of the analysed time series deviates from trend by more than k standard deviations (e.g. $k = 1.5$) or by more than m percent (e.g. $m = 10$). Empirical studies focusing on credit or asset markets often adopt the threshold of $k = 1.75$ as it has a useful interpretation: if the deviations from trend were normally distributed, there would be an approx. 5 percent probability of observing extreme values (i.e. values falling outside the interval defined by trend ± 1.75 standard deviations). We use a lower threshold of

$k = 1.3$ which, under the normality assumption, points to an expected fraction of boom/bust episodes of almost 10 percent. For reasons explained below, and in contrast to several studies, we compute the threshold using country-specific standard deviations and not those computed based on the entire dataset. As in many other papers, the trend is approximated by means of the Hodrick-Prescott filter with the smoothing parameter set at 1000, i.e. higher than typical for annual data, separately for each country.

Method (2), in turn, was employed by Bordo and Jeanne (2002), Kakes and Ullersma (2003), and IMF (2009) to analyse booms and busts in asset markets. It compares moving averages of the growth rates of the analysed series with their historical first and second moments. Specifically, there is a boom in the underlying series in country i in year t if the following inequality holds:

$$\frac{1}{n}\sum_{i=1}^{n}\left(g_{i,t-(n-1)}+\ldots+g_{i,t-1}+g_{it}\right) > \bar{g}_i + ks_i, \quad (1)$$

where g_{it} is the growth rate of the given variable in country i in year t, $\bar{g}_i$ is the average growth rate of that variable in country i, s_i is the standard deviation of the growth rates in that country, and k is a constant. A bust, in turn, is identified if:

$$\frac{1}{n}\sum_{i=1}^{n}\left(g_{i,t-(n-1)}+\ldots+g_{i,t-1}+g_{it}\right) < \bar{g}_i - ks_i. \quad (2)$$

It is again worth noting that in other studies the first and second moments are not country-specific but they are computed for the entire sample. In line with Bordo and Jeanne (2002), we use three-year moving averages and – consistently with method (1) – a threshold of $k = 1.3$. We approximate the growth rates with the first differences of log indexes[5].

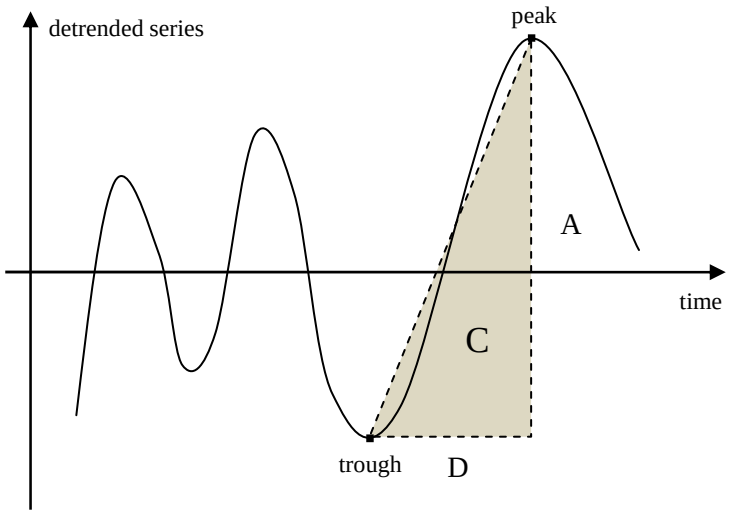
Finally, **method (3)** was proposed by Harding and Pagan (2002) as a method of analysing the business cycle in terms of the turning points, and subsequently used by Jaeger and Schuknecht (2007) and by Agnello and Schuknecht (2009) to study booms and busts in asset and housing prices. The identification of booms and busts consists of the following steps (see Figure 1 below):

(i) detrend the underlying time series;
(ii) identify the turning points (peaks and troughs) in the detrended series;
(iii) compute the duration (D) of each phase of increase or expansion (from trough to peak) and decline or contraction (from peak to trough) in the detrended series;
(iv) compute the total change or amplitude (A) of the detrended series for each phase of expansion/contraction;
(v) compute the cumulated increase/decline in the detrended series during each phase by means of a triangular approximation (hence the name of the method): $0.5 \times A \times D$;

[5] Admittedly, this may lead to a flattening of the growth rates but is generally consistent with the empirical literature.

(vi) identify booms and busts as the episodes with the largest cumulated increase/decline in the sample period in the given country (or, as in other studies, in the entire dataset). Specifically, we assume that the boom/bust years are the two to six years with the distinctly largest cumulated increase/decline in a country's sample history.

Figure 1: An illustration of the triangular approach



Source: based on Agnello and Schuknecht (2009), p. 13.

To sum up, both the first and the second method identify a boom/bust if – respectively – the detrended value of a series or a moving average of the growth rates falls outside an interval defined as the average plus/minus *k* standard deviations. Advocates of approach (1) argue that it allows to formally discriminate between changes in economic variables which reflect economic growth (i.e. trend), "normal" cyclical upturns and downturns (i.e. detrended values falling inside the defined interval), and periods of excessive growth or larger than usual decline (i.e. booms or busts). The downside is that the results are generally sensitive to the choice of the detrending procedure. Approach (2) has the following advantages: „[it] is objective, easily reproducible, and can be applied consistently across countries" (IMF 2009, p. 94). The results, however, may also depend upon the time horizon over which the moving averages are calculated. A disadvantage of both methods is that they are sensitive to outliers: one exceptionally strong boom/bust may bias the standard deviation upwards and as a result, some booms/busts might not be identified as such.

As regards the triangular approach, it is worth stressing that it attaches a relatively large importance to the duration, not only the magnitude, of an expansion/contraction episode. The rationale behind this is the proposition that long-lasting changes of the cyclical component of a series are more probable to alter agents' behaviour patterns than changes of the same total magnitude which last for a shorter period of time. A criticism to think of is that a period of "great moderation" characterised by insignificant annual increases in the cyclical component

persisting for, say, two decades could be identified as a boom and thus treated on a par with a much shorter period of very steep increase; this may appear contrary to the economic intuition. However, such a situation seems to be a hypothetical rather than a real problem: if a cyclical component of a series increases year after year for two decades, it is very probable that at least a part of those increases represents the trend, i.e. that the trend itself, and thus the cyclical component, were not identified properly in the first place. In any case, no "great moderation" was found in our dataset. Another shortcoming of this method is that it might not identify a boom/bust properly if a long-lasting expansion/contraction is interrupted by a very short period of decline/increase in the detrended series – rather, the two expansion/contraction periods are treated as two separate phases of a cycle. To circumvent this shortcoming, one can apply an additional ad-hoc identification rule, e.g. one stating that two episodes of expansion/contraction interrupted by a phase of contraction/expansion lasting for only one period should be treated as one episode[6].

We applied the three methods discussed above to the time series for private consumption and private investment in fourteen "old" EU member states, i.e. those countries which were members of the EU prior to its enlargement of 2004, except for Luxembourg. We will henceforth refer to those countries as EU-14. The reasons for which we did not include Luxembourg were mainly related to the availability of data[7], but the country's very small size and some related characteristics also played a role. The data are annual, cover the period from 1970 to 2009 and were taken from the AMECO database (see the discussion in Section 5.2 regarding the choice of the sample period as well as Table 1 in that section).

As already mentioned, an important point to underline is that we identify booms and busts separately for each country: in methods (1) and (2), we use country-specific means and standard deviations, and in method (3) we look for the episodes with the largest positive or negative amplitudes in a given country's history. This stands in contrast to many other studies which use means and standard deviations computed for all countries together, and search for the largest cumulated increases or decreases in the entire set of countries. We adopted this country-specific approach because it is more in line with the goal of our empirical analysis, which is to identify the factors explaining those expansions or contractions that are unusually large *for a given country*. The dominant approach, in turn, would be better suited to address the question as to what makes a country unusually volatile in terms of economic activity.

The booms and busts identified with the help of all three methods are presented in Table A.1 in the Appendix. As Bordo and Jeanne (2002, p. 8) note, "A good criterion should be simple, objective and yield plausible results. In particular, it should select the notorious boom-bust

[6] We only used such a rule in the case of one series, namely the consumption series for Austria, which included several one-year-long expansions and contractions.

[7] Among other things, only private consumption but not private investment data were available, and many time series representing the explanatory variables (see Section 5.2) were shorter than for the other countries.

episodes (…) without producing (too many) spurious episodes." As can be seen from the table, our methods generally pass this test: they correctly identify the German reunification boom, the booms in EU periphery around the turn of centuries, the strong expansions in many countries at the beginning of the sample, and on the other hand, the severe busts in the Nordic countries following the collapse of the Soviet Union and the recent busts following from the global financial crisis. Nevertheless, there are still noticeable differences across methods so we believe that it can be insightful to run our panel regressions separately on each of the differently computed boom/bust series.

5 Empirical analysis

5.1 Econometric methodology

In the second step of our analysis, we aim at identifying those factors which significantly contributed to the emergence of booms and busts in EU-14. This can be achieved by means of panel binary choice models defined as follows:

$$y_{it}^* = X_{it}'\beta + \alpha_i + \varepsilon_{it}, \tag{3}$$

$$y_{it} = \begin{cases} 1 & if \;\; y_{it}^* > 0 \\ 0 & if \;\; y_{it}^* \leq 0. \end{cases} \tag{4}$$

In the above equations, y_{it}^* is an unobservable dependent variable (e.g. the propensity of a country to have an investment boom), y_{it} the observed binary outcome (e.g. taking on the value 1 when there was an investment boom in country i in time period t and 0 otherwise), X_{it} is a vector of explanatory variables which can be time-varying or time-invariant (see below), β is a vector of coefficients, α_i is an unobserved individual-specific effect, and ε_{it} is a random error. $i = 1, 2, \dots, N$ denote the cross-sectional individuals or units (countries in our case) and $t = 1, 2, \dots, T$ denote the time periods over which those units were observed.

The two most commonly used binary choice frameworks are the logit and probit models (Greene 2003). They are based on different assumptions regarding the distribution of the error term ε_{it}: in the logit model, ε_{it} has the logistic distribution, whereas it is normally distributed in the probit model. In the context of panel data, another important difference is that the **probit model** can only be estimated assuming **random individual-specific effects**, which means that α_i are not fixed but have a distribution whose parameters can be estimated. Equation (3) can then be rewritten as follows:

$$y_{it}^* = X_{it}'\beta + \vartheta_{it}, \tag{5}$$

where ϑ_{it} is a new "composite" error term:

$$\vartheta_{it} = \alpha_i + \varepsilon_{it}. \tag{6}$$

The probit model is based on a relatively strict assumption that the individual effects α_i are independent from the explanatory variables X_{it} – in other words, the unobserved (α_i) and the observed or structural (X_{it}) sources of individual heterogeneity are independent. By contrast, the **logit model** usually assumes **fixed individual effects**, i.e. α_i are treated as estimable parameters (individual-specific constants). In turn, when α_i are equal for all individuals ($\alpha_i = \alpha$ holds for all i and thus there is no unobserved individual heterogeneity), we obtain the so-called **pooled** or **population-averaged model**, which treats the sample as one large cross-section.

The advantage of the logit over the probit approach is that no assumptions need to be made regarding the distribution of the individual effects or their independence from the explanatory variables. However, the logit model does not allow to use all the information contained in the data: those explanatory variables which are time-invariant (in the sense of having a constant value throughout the entire sample period) for a given individual cannot be used in the estimation[8], and the same holds for the individuals in whose case the dependent variable y_i has the same value (0 or 1) throughout the sample period[9].

Moreover, and more importantly, a consistently estimated logit model would not allow us to compute the expected probability of a boom or bust happening in country i in time period t. This becomes apparent when we note the following:

$$P(y_{it} = 1) = P(y_{it}^* > 0) = P(\varepsilon_{it} > -X'_{it}\beta - \alpha_i) = 1 - F(-X'_{it}\beta - \alpha_i) = F(X'_{it}\beta + \alpha_i), \quad (7)$$

where P stands for probability and F is the cumulative distribution function of the error term ε_{it}; the last equality makes use of the fact that F is symmetrical in the case of both the logistic and the normal distribution. Evidently, in order to calculate the expected probability of the variable y_{it} taking on the value 1, we need to compute the estimated (theoretical) value of α_i. In the case of the logit model, this is not feasible because the individual effects cancel out in the estimation – they are removed by the "within" transformation necessary to obtain consistent maximum likelihood estimates. By contrast, in the probit model the individual effects α_i are part of the error term ϑ_{it} with zero expected value, so we can assume that $\hat{\alpha}_i = 0$ and compute the probability of interest. This is an important advantage of the probit approach given that, in the third step of our analysis, we want to compute the probabilities of a boom or bust in Poland based on the models estimated for EU-14. For all the above-stated reasons, our estimations in Section 5.3 will be based on the probit rather than the logit model, provided that specification tests confirm that this is indeed the correct approach.

[8] This restriction means that if we used the fixed effects logit approach, most of the explanatory dummy variables that we have come up with (see Table 1 in Section 5.2) could not be employed as almost all of them take on a constant value for at least one country in the sample.

[9] At first glance, it seems that there is only one such case in our dataset: no consumption boom was identified for Finland with the help of method (2) (see Table A.1 in the Appendix). Our panel is unbalanced, however, and it happens that several specifications do not take account of the time periods in which some countries experienced all their booms or busts. Those countries would have to be dropped from the panel if we were to estimate the fixed effects logit model.

5.2 Explanatory variables

Based on the boom and bust series identified in Section 4, we construct twelve different binary variables which are to be explained by our panel probit regressions: three representing booms in private consumption (**boom_c1**, **boom_c2**, **boom_c3**), three representing booms in private investment (**boom_i1**, **boom_i2**, **boom_i3**), three standing for busts in consumption (**bust_c1**, **bust_c2**, **bust_c3**), and three standing for busts in investment (**bust_i1**, **bust_i2**, **bust_i3**). The indices 1, 2, 3 denote the method used to identify booms and busts.

While choosing the variables to be used in our panel regressions explaining boom and bust episodes in EU-14, we had the following considerations in mind. Firstly, the explanatory variables should have a theoretical foundation, i.e. correspond to the boom-bust transmission channels discussed in Section 3. Secondly, because consumption and investment are flow variables, the same should also hold for the regressors. Thirdly, the explanatory variables should be stationary. Fourthly, endogeneity of the regressors may be an issue. Last but not least, the time series representing the explanatory variables should be available for all EU-14 countries for a considerably long period of time (optimally they should cover several economic cycles); on the other hand, the sample period should ideally not include very serious regime shifts. The data availability criterion became the most serious constraint of our analysis, and even though we tried to find time series covering the entire sample period, it was not always possible and so our panel is unbalanced.

After a careful consideration we chose the years 1970 to 2009 as our sample period. Because quarterly data are unavailable for several variables and countries, we use annual data which have the advantage of not being susceptible to seasonal variation; unavoidably, however, this comes at the cost of a lower number of observations. We believe to have resolved the issue of regressor endogeneity by taking lagged values of all variables except for the dummies and the variable gdp_corr (see below). To determine whether the time series are stationary, we ran panel unit root tests of Hadri (2000) and Breitung (2000) on those series that are strongly balanced. For the unbalanced series, we used the Im, Pesaran and Shin (2003) panel unit root test as well as Fisher-type panel unit root tests proposed by Maddala and Wu (1999) and by Choi (2001). Below we only present those variables for which none of the tests pointed to unit roots[10].

As a result, we came up with the set of potential regressors presented in Table 1 at the end of this section. In the following, we will briefly discuss the rationale behind the use of the specific variables and, in cases where it does not follow directly from the theoretical analysis in Section 3, the expected sign of the regression coefficient (shown in the last column of the table). We start with those variables which correspond to the financial accelerator mechanism:

[10] The results of those tests are not reported here to save space but, as any other results, they are available from the author upon request.

- Because this mechanism is set in motion by changes in financial asset or property prices, variables capturing those prices could be very useful. However, we could not find suitable time series of sufficient length; e.g. the property price statistics published by the Bank for International Settlements start in the 1990s for most EU countries, and it is hard to find comparable financial market indices on a country level which reach back to the 1970s.
- Because the financial accelerator works through the credit market, variables representing credit developments are potentially important. The variables **real_credit** and **credit_gdp** are two alternative proxies which are often used in empirical studies of (credit) boom-bust cycles[11]. The former variable has the advantage that, unlike the latter, it allows for the possibility that credit and output might have different trends (Mendoza and Terrones 2008) and thus it should not underestimate the scale of credit expansion or contraction during macroeconomic booms or busts.
- The variable **w_build** is also relevant because boom-bust cycles generated through this channel often involve an acceleration of wages in the building and construction sector over and above the pace prevailing in the tradable goods sector.

Regarding the channel of international capital flows, we consider the following regressors:

- The variables **portf_inv** and **fdi** are the ones that capture the most relevant types of capital inflows. "Other investment", a residual category on the financial account of the balance of payments, could also be useful given that it includes loans from abroad (e.g. from parent companies or foreign banks). Alternatively, we could use the net inflows on the entire financial account, taking into consideration that specific types of capital flows were subject to different classification rules throughout our sample period. However, we were unable to find suitable time series reaching back to the 1970s.
- As this channel might have become a significant driving force of boom-bust cycles only after the liberalisation of the capital account in a given country, variables capturing this process should also be introduced. One potentially relevant regressor is **kaopen**, the financial openness index of Chinn and Ito (2008), which is based on countries' classifications published by the IMF in its *Annual Report on Exchange Arrangements and Exchange Restrictions* (AREAER). Another is the dummy variable **lib** representing the capital account liberalisation process in each of the EU-14 countries. We constructed this variable based on the information contained in Bakker and Chapple (2002) and – in the case of Greece – in various volumes of the AREAER. We use this dummy both individually and in interaction with (i.e. multiplied by) the variables portf_inv and fdi.
- Because foreign capital inflows into the banking system are an important driving force of boom-bust cycles, the variables **for_liab** and **for_liab_nb** also seem relevant.

[11] Strictly speaking, the available credit data in nominal terms are not flow but stock variables, but – in line e.g. with Gourinchas et al. (2001) or Cottarelli et al. (2005) – we circumvent this problem by taking geometric means of end-of-year stocks.

- The variable **forex_loans** can be useful because foreign capital inflows fuelling boom-bust cycles often contribute to the expansion of foreign currency denominated bank loans.

With regard to the real interest rate channel in a heterogeneous monetary union, the following regressors come into question:

- As boom-bust cycles in a monetary union often result from country specific shocks or low synchronisation of economic cycles, we need variables which capture this sort of heterogeneity. The variables **gdp_corr** and **u_gap** are considered as candidates because they proxy the cyclical position of a country relative to, respectively, EU-15 (i.e. EU-14 along with Luxembourg) and Germany. In addition, they can be regarded as proxies for the shock symmetry, too, because stochastic shocks, which are unobserved variables, can only be identified based on their impact on observable variables. We refrain from using regressors which directly measure the degree of shock synchronisation since any such measures are heavily sensitive to the methodology used to identify the shocks themselves.
- Because boom-bust cycles in a monetary union can result from differing levels of the natural real interest rate in individual economies, we should ideally use this variable as a regressor. However, estimates of the natural rate for the countries in our sample can differ substantially across authors and methods, and we could not find any suitable time series covering our sample period. As an imperfect substitute, we take the dummy variables **conv** and **rich**, defined so as to single out, respectively, converging and rich economies[12]; the former tend to be characterised by a higher and the latter by a lower level of the natural real interest rate. We believe that converging economies should be more prone to both booms and busts and so the coefficient should be positive in both cases. The variable **i_spread** can be regarded as another measure of this sort of heterogeneity as it proxies the credibility of a country's macroeconomic policy mix in comparison with Germany (which arguably had the most credible policy mix in the EC/EU throughout most of our sample period)[13]. We expect that less credible countries should be more susceptible to boom-bust cycles and so the coefficient should be negative in boom and bust regressions alike.
- As booms in a monetary union are often associated with a worsening of an economy's competitiveness relative to other members and real exchange rate appreciation (and the reverse holds for busts), the variable **reer_ulc** may also be relevant.
- We also use the following dummy variables: (i) **ec1/ec2**, (ii) **erm1/erm2**, (iii) **eur1/eur2**, representing the participation in/the accession to (i) the European Communities (EC) or the EU, (ii) the Exchange Rate Mechanism (ERM) of the European Monetary System or the ERM II, and (iii) the euro area. The dummies are introduced both as stand-alone

[12] It is worth noting that, due to data availability, the GDP per capita is measured relative to EU-15 and not EU-14. For the same reason EU-15 is also the reference point in the case of the variable reer_ulc (see Table 1).
[13] Unavoidably, this variable also depends on the degree of an economy's synchronisation with Germany in terms of economic cycles and asymmetric shocks, but we were not able to come up with a variable which would only measure the policy credibility.

variables and in interaction terms, i.e. multiplied by other explanatory variables. Using interaction terms should help us determine whether any of the explanatory variables had a different impact on the probability of a boom/bust under different regimes. We do not formulate *a priori* hypotheses regarding the coefficient sign of the dummies when these are used individually but rather, we would like to know whether the monetary integration as such affected the probability of booms and busts.

Further, we consider one regressor representing the fiscal channel:

- The variable **gov_exp** is based on the *cyclically adjusted* total expenditure of the general government and we believe that its significant positive/negative impact on the probability of booms/busts would point to the relevance of this channel.

Finally, we include some additional variables:

- As domestic demand booms often concentrate in the non-tradable goods sector, i.e. (apart from building and construction) in the services sector, the variable **w_serv** can also be considered.
- The dummy variables **crisis** and **erm_crisis** may prove significant because banking or currency crises should lower the probability of a boom and increase that of a bust. The opposite holds for the dummy variable **reunif**, representing Germany's reunification.
- It might also be insightful to analyse whether the degree of exchange rate stability or of monetary policy independence, as measured by the indices of Aizenmann, Chinn and Ito (2008) (the variables **ers** and **mi**), exert any significant impact on the probability of booms and busts. Similarly as in the case of the dummies representing monetary integration, we do not hypothesise the sign of the respective coefficients.

Obviously, we cannot use all the above-discussed variables together in one regression because this would cause rather serious multicollinearity problems. In the case of several regressor couples (e.g. real_credit and credit_gdp, or for_liab and for_liab_nb), their collinearity can be expected from the outset – we propose them as alternative proxies of a given phenomenon or economic aggregate. The high pair-wise correlation coefficients confirm those expectations and so only one variable from each of such couples can be used in any of the regressions. For some other pairs of variables, the correlation is also relatively strong so we need to be careful when specifying the regression equations. In most cases, though, the correlation coefficients are insignificantly different from zero. We now turn to the results of our estimations, which will be presented in the next subsection.

Table 1: Variables used in the panel regressions

Code of the variable	Short description	Data source*	Sign**
Dependent variables			
boom_c1, boom_i1, bust_c1, bust_i1	Binary variables representing booms and busts in private consumption and private investment, constructed with the help of method (1) detailed in Section 4 (the series are presented in Table A1 in the Appendix)	AMECO, author's calculations	
boom_c2, boom_i2, bust_c2, bust_i2	Binary variables representing booms and busts in private consumption and private investment, constructed with the help of method (2) detailed in Section 4 (the series are presented in Table A1 in the Appendix)	AMECO, author's calculations	
boom_c3, boom_i3, bust_c3, bust_i3	Binary variables representing booms and busts in private consumption and private investment, constructed with the help of method (3) detailed in Section 4 (the series are presented in Table A1 in the Appendix)	AMECO, author's calculations	
Explanatory variables representing the financial accelerator mechanism			
real_credit	The rate of change*** in domestic credit (claims on private sector) in constant prices, deflated with GDP deflator; credit data are geometric means of end-of-year stocks	IMF IFS (credit data), NBP, AMECO (GDP deflator)	+
credit_gdp	The change in the ratio of domestic credit (claims on private sector) to GDP in current prices; credit data are geometric means of end-of-year stocks	IMF IFS (credit data), AMECO (GDP)	+
w_build	The rate of change in nominal unit wage costs in the building and construction sector relative to nominal unit wage costs in the manufacturing industry	AMECO	+
Explanatory variables representing the channel of international capital flows			
portf_inv	The change in the ratio of portfolio equity investment (net inflows) to GDP in current prices	World Bank WDI	+
fdi	The change in the ratio of foreign direct investment (net inflows) to GDP in current prices	World Bank WDI	+
kaopen	The Chinn-Ito financial openness index (an increase in the index means an increase in the degree of *de iure* financial openness)	Chinn and Ito (2008), http://web.pdx.edu/~ito/Chinn-Ito_website.htm	+
lib	Dummy variable representing the liberalisation of financial account transactions, taking on the value 1 starting from the year in which significant progress in this respect was made by the country in question (details are available from the author upon request)	Information in Bakker and Chapple (2002); for Greece: various volumes of the IMF's AREAER	+
for_liab	The change in the ratio of BIS reporting banks' external liabilities vis-á-vis all sectors of a given country to that country's GDP	BIS Locational Statistics (banking data), World Bank WDI (GDP)	+
for_liab_nb	The change in the ratio of BIS reporting banks' external liabilities vis-á-vis the non-bank sector of a given country to that country's GDP	BIS Locational Statistics (banking data), World Bank WDI (GDP)	+
forex_loans	The change in the ratio of banks' local assets in foreign currency vis-á-vis the non-bank sector to GDP in current prices	BIS Locational Statistics (banking data), World Bank WDI (GDP)	+
Explanatory variables representing the real interest rate channel in a heterogeneous monetary union			
gdp_corr	Correlation coefficients of GDP growth rates in a given country with GDP growth rates in the rest of EU-15 (rolling window, years $t-10$ to $t-1$)	AMECO	– (when multiplied by erm1 or eur1)

Table 1 continued

Code of the variable	Short description	Data source*	Sign**
u_gap	Deviation of the unemployment rate from NAWRU minus the respective deviation for Germany	AMECO	– (when multiplied by erm1 or eur1)
conv	Dummy variable "converging economy" taking on the value 1 if a country's average nominal GDP per head of population in the previous five years was not higher than 85 percent of that in EU-15 (EU-14 plus Luxembourg), and 0 otherwise	AMECO (per capita GDP), author's calculations	+ (for booms and busts)
rich	Dummy variable "rich economy" taking on the value 1 if a country's average nominal GDP per head of population in the previous five years was not lower than 115 percent of that in EU-15 (EU-14 plus Luxembourg), and 0 otherwise	AMECO (per capita GDP), author's calculations	– (for booms and busts)
i_spread	Spread between nominal long- and short-term interest rate minus the respective spread for Germany	AMECO	– (for booms and busts)
reer_ulc	The rate of change in the real effective exchange rate based on unit labour costs; positive value means appreciation (performance relative to the rest of the EU-15, i.e. EU-14 plus Luxembourg)	AMECO	+
ec1, erm1, eur1	Dummy variables "EC/EU membership", "ERM/ERM II membership" and "euro area membership" (1 if the country is a member and 0 otherwise****)	Author's compilation	?
ec2, erm2, eur2	Dummy variable "EC/EU accession", "ERM/ERM II accession" and "euro area accession" (1 in the year in which the country accedes and 0 otherwise****)	Author's compilation	?
Explanatory variables representing the fiscal channel			
gov_exp	The change in the ratio of cyclically adjusted total expenditure of general government to GDP in current prices	AMECO	+
Other explanatory variables			
w_serv	The rate of change in nominal unit wage costs in the services sector relative to nominal unit wage costs in the manufacturing industry	AMECO	+
crisis	Dummy variable "banking crisis" (1 if a country experienced a banking crisis in a given year and 0 otherwise)	Database in Laeven and Valencia (2010)	–
erm_crisis	Dummy variable "ERM crisis" (1 in the years 1992 and 1993 and 0 otherwise)	Author's compilation	–
reunif	Dummy variable "reunification of Germany" (1 in 1991, 0 otherwise)	Author's compilation	+
ers, mi	The Aizenmann-Chinn-Ito exchange rate stability and monetary independence indices; an increase in the index means an increase in the degree of exchange rate stability/monetary independence	Aizenmann et al. (2008), http://web.pdx.edu/~ito/trilemma_indexes.htm	?

* AMECO = the annual macro-economic database of the European Commission; AREAER = Annual Report on Exchange Arrangements and Exchange Restrictions; IFS = International Financial Statistics; WDI = World Development Indicators.

** The expected sign of the variable's coefficient in a regression explaining the probability of a consumption or investment boom; the opposite sign is expected for busts.

*** The rates of change are approximated with the first differences of log indexes.

**** It is assumed that EC/EU accession took place in the year in which a country signed a treaty of accession, and that the country joined the ERM/the euro area in the year in which green light was given to its participation.

5.3 Results for EU-14

We estimate separate models for each of the binary variables representing booms and busts in private consumption and investment identified with the help of three different methods, i.e. twelve panel probit models for twelve dependent variables (see the first rows of Table 1 above). Because our explanatory variables are in many cases highly correlated and thus have to be used interchangeably, for each dependent variable we have come up with several subsets of regressors which are statistically significant, both individually (at the 10 percent level) and jointly (at least at the 2.5 percent level and in most cases at the 1% level), as confirmed by t tests and likelihood ratio tests[14]. The coefficients generally have the expected sign, with some exceptions which we will explicitly address below. We believe that the relatively large number of specifications, similarly as the identification of booms and busts with the help of three different methods, serve the purpose of a sensitivity check of our results. The specifications, estimated by the maximum likelihood method, along with the associated p-values are presented in Tables A.2 to A.5 in the Appendix and will be discussed shortly.

As mentioned at the end of Section 5.1, for each specification we need to test whether the probit model – which is based on the strong assumption that the individual effects α_i and the explanatory variables X_{it} are independent – is indeed the correct specification. To this end, we run two tests: the Hausman (1978) test which should allow us to choose between the probit and the logit model, and a likelihood ratio test aimed at comparing the random effects probit model with a pooled specification. The Hausman test is based on the null hypothesis that both the random effects probit and the fixed effects logit models are consistent but the probit model is efficient (because it makes use of all available information, see Section 5.1). The alternative hypothesis states that the logit model is consistent whereas the probit model is not, perhaps because α_i and X_{it} are dependent or because of another misspecification. The test did not reject the null hypothesis for any of the specifications presented in Tables A.2 to A.5, so we assume that the probit model is indeed the correct one.

The null hypothesis of the second test, a likelihood ratio test, assumes that:

$$\rho \equiv \frac{\sigma_\alpha^2}{\sigma_\varepsilon^2+\sigma_\alpha^2} = 0, \tag{8}$$

where σ_ε^2 and σ_α^2 are the respective variances of the error term ε_{it} and the individual effect α_i in a probit model with random effects. Obviously, ρ can only equal zero when σ_α^2 also equals zero, i.e. when there is no unobserved heterogeneity. If this is the case, the random effects model can be replaced by its pooled (population-averaged) version. The alternative hypothesis states that ρ is larger than zero and so the random effects need to be included in the model. The null hypotheses was only rejected for the models explaining booms in consumption identified by means of methods (1) and (2) (the series boom_c1 and boom_c2, see Table A.2),

[14] In some cases the constant term was not significant but we kept it nevertheless.

one specification explaining busts in consumption (the series bust_c1, see Table A.4), and four specifications explaining busts in investment (the series bust i2, see Table A.5). Therefore, those were the only cases for which we employed the random effects specification, and all the other models were specified as pooled probit models.

Turning to the estimation results, Tables A.2 to A.5 confirm that the financial accelerator mechanism is an important driving force of boom-bust cycles in EU-14. The credit variables are significant in all of our models, and in most cases no interaction terms (i.e. no products of the credit variables with the dummy variables ec1, erm1 and eur1 representing the monetary integration process) were necessary. It is worth noting that we only introduced interactions of variables with those dummies if a given variable was not significant by itself. Thus, the fact that the credit variables do not need interaction terms means that these variables are significant throughout the entire sample and not only in the EC or EU/under the ERM or ERM II regime/in the euro area. Interestingly, it is the variable real_credit (the rate of change in the domestic credit in real terms) rather than the variable credit_gdp (the change in the domestic credit relative to GDP) that turned out to be significant in most specifications, especially those explaining booms and busts in investment. This reinforces the argument of Mendoza and Terrones (2008) that the former variable is a better proxy of credit booms because, in contrast to the latter, it allows for the possibility that credit and output might have different trends. Apparently, our results suggest that this argument is more relevant in the case of booms or busts in investment than those in consumption.

Furthermore, the variable w_build (the rate of change in the wages in the building and construction sector relative to the manufacturing sector) turns out to be significant in several specifications, both by itself (above all in the models referring to consumption) and when interacted with the dummy eur1 standing for the participation in the euro area (especially in the models referring to investment). Thus, increases/decreases in the nominal wages in the building and construction sector relative to the manufacturing sector were followed by booms/busts in consumption throughout the entire sample period, and in the euro area they mainly fuelled investment booms/busts.

As far as the channel of international capital flows is concerned, several interesting results stand out. Firstly, the variable portf_inv, capturing the inflows of portfolio investment relative to GDP, is significant only in about one sixth of our specifications (and in a few cases the coefficients are wrongly signed) but the variable fdi, capturing the inflows of foreign direct investment relative to GDP, shows up in more than one fourth of the specifications. More often than not, the two variables are only significant when interacted with the monetary integration dummies, usually erm1 or eur1. This means that the inflow of portfolio capital or foreign direct investment can regarded as one of the driving forces of boom-bust cycles in EU-14, but hardly a very important one. However, this relatively weak link may also be the result of the specific data that we could come up with: as argued in Section 5.2, foreign

capital flows were subject to different classification rules throughout our sample period. A related result is that the inflow of foreign capital into the domestic banking system relative to GDP (the variable for_liab) is only significant in the case of busts in consumption as well as – when interacted with ec1 – in one specification explaining busts in investment[15]. A sudden stop, it seems, generally contributes to busts in consumption, but otherwise hardly any impact could be detected.

Secondly, the change in banks' foreign exchange denominated local assets relative to GDP (the variable forex_loans) shows up in more than half of our specifications, and only in about one third of all cases an interaction term – usually erm1, standing for the participation in the ERM or ERM II – was necessary. The developments of the foreign exchange denominated loans to GDP ratio were mainly relevant in the specifications explaining busts in investment (throughout the entire sample period) and booms in investment (under the ERM or ERM II regime), though in the latter case the coefficient is wrongly signed. Thus, it appears that expansions of foreign exchange denominated bank loans significantly lower the probability of busts in investment but, inexplicably, they also lower the probability of booms in investment. In the case of booms and busts in consumption, the sign of the coefficient is always in line with our expectations, but the variable forex_loans shows up in relatively few specifications.

Thirdly, the Chinn-Ito financial openness index (the variable kaopen) is highly significant in most of the models explaining booms in consumption, but contrary to our expectations, the increase of the degree of financial openness results in a lower, not higher, probability of a boom. By contrast, the dummy variable lib, representing the capital account liberalisation, was never significant – either alone or when interacted with the variables portf_inv and fdi. All in all, our results confirm the relevance of international capital flows as a driving force of boom-bust cycles, though the results are not as clear-cut as in the case of the financial accelerator channel.

Turning to the real interest rate channel in a monetary union, the variables capturing the cyclical heterogeneity of countries – the correlation of GDP growth with the rest of EU-15 (gdp_corr) as well as the deviation of the unemployment rate from NAWRU minus the same deviation for Germany (u_gap) – appear respectively in about one fifth and about one third of all specifications. The regressor u_gap is correctly signed in all cases and it is significant without any interaction terms only in the regressions explaining busts; when interacted with the monetary integration dummies, it becomes significant in boom and bust regressions alike. Thus, throughout the entire sample period a deterioration in a country's cyclical position relative to Germany was coupled with a higher probability of a bust and, as monetary

[15] The results remain unchanged when we use the variable for_liab_nb instead of for_liab. This is due to the very high correlation (the correlation coefficient amounting to 0.96) of the change in BIS reporting banks' external liabilities vis-á-vis all sectors and the liabilities vis-á-vis the non-bank sector.

integration was advancing, also with a lower probability of a boom. The variable gdp_corr, in turn, has the wrong coefficient sign in half of the cases so its explanatory power is rather low.

A look at the variables capturing the structural heterogeneity of countries which undergo the process of monetary integration reveals further interesting results. Firstly, the dummy variable conv denoting the converging economies is significant by itself only in a small number of regressions explaining consumption booms[16]. In all cases its coefficient sign is contrary to our expectations: being a converging economy makes a country less, not more, prone to a consumption boom. Secondly, the interaction of the variable conv with the dummy ec1 appears in a small number of regressions explaining booms in both consumption and investment, and it seems that participation in the EC or EU lowers the probability of a boom for both converging and non-converging economies but more strongly for the former – a result which also differs from what we expected. Thirdly, the variable i_spread (the spread between nominal long- and short-term interest rate minus the respective spread for Germany) is significant in about a third of all models explaining both booms and busts in consumption and investment, and in most cases no interaction terms are needed. However, we included this variable as a proxy of a country's credibility compared with Germany and, therefore, we believed that its coefficient should be negative for both booms and busts because less credible countries (i.e. those with a higher spread) should be more prone to both booms and busts. Nevertheless, the coefficient is negative in the boom regressions and positive in the bust regressions, which could suggest that the variable i_spread is a good measure of a country's cyclical position relative to Germany, but not necessarily a good proxy of its policy credibility (see footnote 13). Fourthly, the dummies ec1/ec2, erm1/erm2, eur1/eur2 used as stand-alone variables are significant only in a very small number of specifications and their signs do not show any clear pattern. We thus believe that our data do not point to a significant shift in the probability of booms and busts resulting from the monetary integration *per se*. Similar remarks hold for the variable reer_ulc (the rate of change in the real effective exchange rate based on unit labour costs), which is seldom significant and often has the wrong coefficient sign.

Turning to the fiscal channel, the change in the cyclically adjusted expenditure of the general government relative to GDP (the variable gov_exp) appears in more than half of the specifications, albeit often multiplied with the dummies erm1 or eur1. Strikingly, this is another variable whose coefficient sign is consequently opposite to what we expected: an increase in the cyclically adjusted government expenditure lowers the probability of a boom and increases that of a bust (especially an investment bust). The former regularity is in line with the results of Brzoza-Brzezina et al. (2010) who show that a fiscal contraction adds to the consumption boom. In other words, our results mean that the fiscal channel is at work but

[16] By contrast, the variable rich, standing for the economies whose GDP per head of population is at least equal to 115 percent of that in EU-15, is never significant.

it boils down to a crowding-out effect: a reduction in the general government expenditure "makes room" for a boom in the private expenditure, and the reverse holds for busts.

As regards the remaining regressors, the dummy variable reunif standing for the reunification of Germany (lagged or non-lagged) is significant and positively signed in several regressions explaining booms in consumption, but not booms in investment. In turn, the dummy representing banking crises (the variable crisis) appears with a positive sign in a small number of specifications explaining consumption busts and in most of those explaining investment busts. The dummy erm_crisis standing for the ERM crisis of 1992 to 1993, by contrast, is never significant. The variable w_serv (the rate of change in the wages in the services sector relative to the manufacturing sector) appears in about a third of all specifications, mainly those explaining busts, and interestingly, it is negatively signed in all cases except for one. In other words, an acceleration of the nominal wages in the services sector relative to the manufacturing sector lowers the probability of both a boom and a bust – a result which is rather difficult to explain. Finally, the Aizenmann-Chinn-Ito indices of exchange rate stability and monetary independence (the variables ers and mi) show up only in a small number of specifications. It appears that an increase in the degree of monetary independence raises the probability of an investment boom, whereas a higher degree of exchange rate stability is coupled with a lower probability of a consumption bust.

Overall, a comparison of all the specifications reveals that our results are relatively insensitive to the choice of the boom/bust identification method, especially in the case of the bust regressions. Further, the regressions referring to consumption booms or busts generally use a similar set of explanatory variables as those referring to booms or busts in investment.

5.4 Results for Poland

The third goal of our analysis is to assess the probability of booms and busts in Poland in the years 2004 to 2009 based on the above-discussed models estimated for EU-14. The choice of the time period over which we run our forecast is restricted by the availability of the Polish data. We use the same data sources as in the case of EU-14, with the exceptions of the credit variables and the data on foreign exchange denominated loans for which we take the time series provided by the National Bank of Poland[17]. In order to assess the impact of a rapid euro adoption on the probability of booms and busts in Poland, we compare the forecasts generated based on two different sets of assumptions. The first is the following counterfactual (the **quick euro adoption scenario**): we assume that Poland joined the ERM II immediately upon EU accession in 2004 and adopted the euro in 2007. The second is the **real scenario** in which

[17] The reason is that the IMF credit data for 2009 are missing, and the BIS data on foreign exchange loans are unavailable for Poland.
By contrast, the variable rich, standing for the economies whose GDP per head of population is at least equal to 115 percent of that in EU-15, is never significant.

Poland joined the EU in 2004 but did not join either the ERM II or the euro area until at least 2009.

The computation of the probabilities is straightforward for the pooled probit models; for the probit models with random effects, we assume that the individual effect is always equal to zero (see Section 5.1). The predicted probabilities for both scenarios as well as the differences in probabilities between the rapid euro adoption and the real scenario are presented in Tables A.6 and A.7 in the Appendix. At first glance, our results do not follow any pattern whatsoever – they vary rather strongly across the different specifications, even those using the same dependent variable.

A closer look at the tables reveals some minor regularities, notably an increase in the probability of an investment boom in 2005 and a decrease in the probability of a consumption boom in the same year under the rapid euro adoption scenario compared with the real one. Another visible difference is a lower probability of an investment boom in 2009 in the former scenario. If we forecasted the value of the binary dependent variables rather than the probabilities of a boom or bust (i.e. $\hat{y}_{it}$ instead of $P(y_{it}) = 1$), these three regularities would translate to differential values of the forecasted dependent variables: an investment boom instead of a consumption boom would be forecasted for 2005, and no investment boom would be forecasted for 2009 under the rapid euro adoption scenario compared with the real one[18]. Moreover, there is a certain increase in the probabilities of both a consumption and an investment bust in 2009 under the rapid euro adoption scenario, but it is so small that they can be disregarded. Thus, according to our forecast the probability of a macroeconomic bust when the global crisis hit would not be higher if Poland participated in the euro area.

The above-discussed results are the only ones that hold regardless of the specification used and so we conclude that either the models estimated for EU-14 are not adequate for Poland, or – which is a less probable outcome – that a rapid euro adoption would not have significantly affected the probability of a boom-bust cycle in Poland.

6 Summary, conclusions, and some related caveats

The goal of this paper has been to determine which structural characteristics of an economy make it more (or less) prone to macroeconomic boom-bust cycles, and to empirically assess the risk of such cycles in Poland after the euro adoption. In a first step, we identified booms and busts in private consumption and private investment in fourteen "old" EU member states based on three different methods. In a second step, we applied panel probit models with random effects as well as pooled probit models to explain the identified boom and bust series.

[18] In line with the common rule, a boom/bust is forecasted for country *i* and year *t* if the predicted probability of a boom/bust is larger than the share of booms/busts in the sample, i.e. approx. 10 percent in out case.

In a third step, we used the models estimated for the "old" EU to assess the probability of booms and busts in Poland in the years 2004 to 2009 under two different scenarios: the quick euro adoption and the real scenario.

Before we summarise our results and conclude, several caveats are worth addressing. The most important one is related to the Lucas critique, i.e. the question to what extent the experience of "old" EU countries during the years 1970 to 2009 is relevant for Poland once it joins the euro area. Similar questions always arise when it comes to formulating policy recommendations based on empirical analyses which, inevitably, draw on past data. However, in the case of this study the Lucas critique is of utmost importance due to a major structural break which occurred at the end of the sample: the global financial and economic crisis which originated in the US subprime mortgage market in 2007. The severity of the crisis led governments and central banks around the world to try to design policies aimed at avoiding such crises in the future. Similarly, the Greek debt crisis of 2009 has forced the EU authorities to change the rules governing the institutional setup of the euro area, and this will affect the functioning of individual member states within the common currency area. Without any doubt, the world will be very different at the time of Poland's euro adoption than it was during the four decades covered by our analysis.

At first glance, the above seems to render our results a rather useless foundation for policy recommendations. Nevertheless, we believe that the conclusions formulated above can at least shed some light on the question as to which factors tend to increase the probability of booms or busts. It is worth stressing that the future changes of the institutional setup might "switch off" some of those factors. For instance, until recently countries with relatively high natural real interest rates experienced a substantial decline of nominal interest rates in the run-up to the euro adoption. As our analysis shows, the interest rate spread against Germany has been one of the factors contributing to booms and busts alike. After the recent crisis, however, the reduction in interest rates accompanying the euro adoption process will most probably not be as strong as it used to be; rather, financial market participants will concentrate more on a country's fundamentals instead of assuming that the euro area gives its members full protection against policy failures – or default, for that matter. Only time will show how exactly the recent crisis changed the structure of the global economy, but this need not mean that empirical researchers should wait for years before they start to analyse the past and try to formulate cautious policy recommendations based on the outcome of their analyses.

Also worth addressing is the question whether booms and busts of the past four decades have enough in common to be analysed all together within a panel framework. As a comparison, suffice it to say that currency crises which happened in many parts of the world during our

sample period[19] were often triggered by different sets of factors – and they were often accompanied or followed by consumption and investment busts so they are to some extent related with our research question. Obviously, not all booms or busts are alike, and often their dynamics depend on unobservable factors such as agents' differing expectations regarding long-term developments of important variables (see Burnside et al. 2011). Nevertheless, we believe that there are several factors which, under normal circumstances and in countries that are structurally alike at least in some ways, significantly affect the probability of booms or busts. Our analysis was aimed at identifying such factors, and in our opinion this aim has been achieved.

Given these considerations, our results suggest that credit developments have clearly been the most important driving force of booms and busts in EU-14, which points to the crucial role of the financial accelerator mechanism. The relevance of international capital flows as a transmission channel is also confirmed, albeit mainly for busts rather than booms. Interestingly, a higher degree of financial openness is coupled with a lower, not higher, probability of a consumption boom. Variables that capture the cyclical heterogeneity of countries which undergo a process of monetary integration are also significant. Strikingly, converging economies in our sample have been less, not more, prone to consumption booms, and it appears that participation in the EC or EU lowers the probability of a boom for both converging and non-converging economies but more strongly for the former. Finally, we find evidence that the working of the fiscal channel is contrary to our expectations and boils down to a crowding-out effect: a reduction in the general government expenditure "makes room" for a boom in the private expenditure, and the reverse holds for busts.

As regards the forecast for Poland, our results are rather inconclusive, which means that either the models estimated for EU-14 are not adequate for Poland, or – which is a less probable outcome – that a rapid euro adoption would not have significantly affected the probability of a boom-bust cycle in Poland. In any case, there are certain lessons to be drawn from the experience of EU-14, most notably that preventing an excessive credit expansion should be the main policy objective if Poland is to avoid the vicious cycle of macroeconomic booms and busts both in the euro area and before accession. A better cyclical alignment with the euro area's core countries, such as Germany, should also contribute to a lower probability of booms and busts.

[19] Most notably, the "first generation" currency crises in Latin America of the 1970s and 1980s, the "second generation" crisis of the European Monetary System of 1992-93, and the "third generation" Asian crisis of 1997-98, as well as the sharp depreciation of many currencies caused by the global financial meltdown of 2008.

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Appendix

Table A.1: Boom and bust episodes identified with the help of different methods

Country*	Method (1)	Method (2)	Method (3)	Method (1)	Method (2)	Method (3)
	Booms in private consumption			Busts in private consumption		
	Series boom_c1	Series boom_c2	Series boom_c3	Series bust_c1	Series bust_c2	Series bust_c3
AT	1977, 1992	1973–4, 1977	1972–3, 1977, 1991–2	1970–1	1986, 2009	1982, 1985–6, 2009
BE	1979–80	1973–5	1973, 1991, 2000	1970–1, 2009	2009	1983–4, 2009
DE	1978–80, 1992, 2001	1973, 1977–8, 1991–2	1979, 1990–2	1970, 1983–5, 2009	1982–3, 2004–5, 2009	1983–5, 2005
DK	1976–9, 1986, 2007	1977, 1986, 2006	1986, 2006–7	1982, 2009	1981–2, 1989–90, 2009	1981–2, 1989–90, 2002–3
ES	1976–7	1973–4	1973–4, 1989–91, 2001	1970–1, 1984–6, 2009	1982–4, 2009	1982–5, 1996
FI	1988–90	none	1988–9, 1999	1993–5	1992–4	1978, 1992–3
FR	1978–9, 1990	1973–4, 1978	1973–4, 1989–90, 2001–2	1970–1, 1996–7	1993–5	1985, 1994–7
GR	1978–80	1973, 1977–9	1978–9, 1991, 2006–7	1970, 1974, 1986–7	1986–7	1981, 1985–6
IE	1978–81, 2000–1	1998–2001	1979, 1999–2000	1995, 2009	1982–4, 2009	1982–4, 1994–5, 2009
IT	1980–1, 1989–92	1973, 1980–1	1988–9, 2000	1996, 2009	1994–5, 2009	1983, 1994–6, 2009
NL	1977–80, 2000–1	1978, 1999–2000	1976–8, 1999–2000	2009	1981–3	1983–5, 2007–9
PT	1974, 1991–2	1973, 1980, 1988–91	1974, 1990–1	1984–6, 2009	1977, 1985	1977, 1984–5, 1995–6
SE	1976, 1987–9	1987–8, 2000	1975–6, 1987–8, 2000	1983–4, 1993–6	1983, 1993–4	1983, 1992–3
UK	1973, 1988–90	1987–9	1973, 1988–9, 2000–2	1982, 1984, 2009	1976–7, 1982, 1992, 2009	1977, 1992–5, 2009
	Booms in private investment			Busts in private investment		
	Series boom_i1	Series boom_i2	Series boom_i3	Series bust_i1	Series bust_i2	Series bust_i3
AT	1972, 1977, 1991, 2000	1973, 1989–91	1972, 1990–1	1970, 1983–6, 2009	1975, 1982–4, 2009	1983–4, 2009
BE	1989–90	1988–90	1988–90, 2008	1981–6	1981–3	1982–3, 1993–4
DE	1972–3, 1991–2, 2000	1990–2	1979–80, 1990–2	1975, 1987	1974–6, 2002–3	1975, 2003–5
DK	1970, 1986–7	1984–7	1985–6, 1998	1981–3, 1993, 2009	1975, 1981, 2009	1981, 1991–3
ES	1974	1974, 1988–9	1974, 1988–90, 1999–2000	1984–5, 2009	1993–4, 2009	1981–4, 2009
FI	1988–90	1997	1975, 1998–2000	1992–5	1978, 1992–4	1978, 1992–4
FR	1973–4, 1989–90	1973, 1989–90, 2000	1973–4, 1989–90, 2000	1970, 1984–5, 1996–7	1983–4, 1993–4	1983–5, 1993–4
GR	1973, 1978–9, 2003	1973, 1999–2000, 2003	1973, 1979, 2001–3	1970, 1984, 1994–5, 2009	1975–6, 1981–4, 2009	1982–4, 1995
IE	1979, 2005–6	1997–8	1979, 1997–9	1993, 2009	1985, 2008–9	1985–7, 2009
IT	1974, 1980, 1990, 2002	1989, 2002	1974, 1980, 1989–90, 2001–2	1993–4, 2009	1983, 1993–4, 2009	1976, 1982–3, 1993, 2009
NL	1998–2000	1986, 1997–9	1986, 1998–9	1981–4, 2009	1976, 1981–3, 2003–4, 2009	1994, 2002–4
PT	1973–4, 1999–2000	1973–4, 1988–9, 1999	1973–4, 1988, 1999–2000	1970, 1984–6, 2009	1976	1976, 1985, 1995, 2003–5
SE	1988–90	none	1987–9, 2007	1993–5	1992–4	1992–3, 2009
UK	1988–9	1988–9, 1998	1988–9, 1997–8	1981, 1993–4, 2009	1981, 1992–3, 2009	1992–3, 2009

* AT = Austria, BE = Belgium, DE = Germany, DK = Denmark, ES = Spain, FI = Finland, FR = France, GR = Greece, IE = Ireland, IT = Italy, NL = Netherlands, PT = Portugal, SE = Sweden, UK = United Kingdom

Table A.2: Estimation results: booms in consumption

	boom_c1					boom_c2					boom_c3				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
real_credit	3.8057	3.4223				2.3168	2.3025	3.5166	2.6401	2.8447	2.4922	3.0356	2.8500	2.1253	2.9596
	[0.001]	[0.002]				[0.039]	[0.072]	[0.018]	[0.045]	[0.032]	[0.002]	[0.000]	[0.000]	[0.022]	[0.000]
credit_gdp			2.5640	2.7604	2.4995										
			[0.028]	[0.025]	[0.027]										
w_build			5.7415			5.1887									
			[0.040]			[0.049]									
eur1*w_build	9.3834			9.3197											
	[0.038]			[0.030]											
portf_inv							0.0473								
							[0.073]								
eur1*portf_inv											0.0425				
											[0.059]				
fdi								0.0387	0.0443	0.0458					
								[0.099]	[0.052]	[0.062]					
ec1*fdi												0.0463	0.0528	0.0426	
												[0.001]	[0.002]	[0.014]	
eur1*fdi															0.0400
															[0.020]
kaopen	–0.6376	–0.5936	–0.5378	–0.6036	–0.5936		–0.2876	–0.3327	–0.2902	–0.3012	–0.1121	–0.1752			–0.1697
	[0.000]	[0.000]	[0.001]	[0.000]	[0.000]		[0.022]	[0.022]	[0.026]	[0.042]	[0.076]	[0.010]			[0.012]
forex_loans	14.4889														
	[0.032]														
erm1*forex_loans			34.7986	39.4233											
			[0.057]	[0.037]											
eur1*gdp_corr													–0.6728	–0.7725	
													[0.016]	[0.017]	
erm1*u_gap							–76.1890	–116.2546	–80.3302						
							[0.008]	[0.010]	[0.009]						
conv#ec1: 0, 1	–1.0057		–0.8189	–0.9366											
	[0.068]		[0.093]	[0.071]											
1, 0	(empty		(empty	(empty											
	group)		group)	group)											
1, 1	–1.3901		–1.1797	–1.3503											
	[0.042]		[0.063]	[0.041]											

Table A.2 continued

	boom_c1					boom_c2					boom_c3				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
conv		–0.9006 [0.036]			–0.8734 [0.038]							–0.3676 [0.062]			–0.3637 [0.063]
i_spread		–13.8462 [0.085]			–14.3152 [0.067]										
eur1*i_spread										–52.2037 [0.053]					
reer_ulc												3.5330 [0.038]			3.3091 [0.049]
ec1*reer_ulc													3.3649 [0.064]		
erm1								–1.0562 [0.010]		–1.0531 [0.003]			–0.3476 [0.050]	–0.4208 [0.043]	
erm2	1.9473 [0.001]	1.5802 [0.004]	1.6904 [0.002]	1.8105 [0.001]	1.5342 [0.004]										
gov_exp						–18.3471 [0.076]	–18.4308 [0.039]	–22.5272 [0.017]	–18.2170 [0.042]	–20.7613 [0.026]					
eur1*gov_exp		–37.0815 [0.021]			–37.0537 [0.019]									–25.4402 [0.056]	
reunif							1.2032 [0.037]	1.6889 [0.012]	1.2061 [0.042]	1.3333 [0.025]	1.0411 [0.003]	1.0820 [0.002]	1.1053 [0.002]	1.1571 [0.003]	1.0762 [0.002]
L.reunif	1.3102 [0.011]	1.2068 [0.007]	0.9515 [0.052]	0.8634 [0.074]	1.1275 [0.009]										
constant	–0.2417 [0.608]	–0.9096 [0.001]	–0.3116 [0.485]	–0.0233 [0.959]	–0.7987 [0.003]	–2.3758 [0.000]	–1.5913 [0.000]	–1.6515 [0.000]	–1.7420 [0.000]	–1.6575 [0.000]	–1.2817 [0.000]	–1.1811 [0.000]	–1.2857 [0.000]	–1.2432 [0.000]	–1.1713 [0.000]
RE or pooled?*	RE	RE	RE	RE	RE	RE	RE	RE	RE	RE	pooled	pooled	pooled	pooled	pooled
No. of observations	339	373	339	339	373	368	368	377	370	370	461	500	500	378	500
LR test of all coeff.*	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
LR test of rho = 0*	0.013	0.048	0.037	0.027	0.048	0.010	0.011	0.000	0.003	0.000	1.000	1.000	1.000	1.000	1.000
Hausman test*	0.255	0.160	0.530	0.431	0.160	0.573	0.596	0.425	0.338	0.341	0.1825	0.188	0.162	0.244	0.214

Note: Different specifications in columns (1) – (5); p-values corresponding to the t statistics of the individual coefficients in square brackets.

* p-values corresponding to the respective test statistics; the Hausman test refers to the logit (null hypothesis) versus the probit (alternative hypothesis) specification; RE = random effects.

Table A.3: Estimation results: booms in investment

	boom_i1					boom_i2					boom_i3				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
real_credit	2.7221 [0.002]	2.6470 [0.002]				2.0604 [0.031]	2.2188 [0.029]	2.0655 [0.030]	2.2550 [0.027]	2.2073 [0.019]	2.3604 [0.015]	2.6412 [0.006]	2.1398 [0.024]	2.1632 [0.026]	
ec1*real_credit			1.9008 [0.017]	2.2432 [0.014]											
credit_gdp					1.8380 [0.045]										1.8905 [0.062]
eur1*w_build											6.5654 [0.019]	4.3635 [0.070]			4.7652 [0.047]
eur1*portf_inv													0.0374 [0.097]		
erm1*forex_loans						–19.3254 [0.069]	–23.2819 [0.039]	–20.4694 [0.053]	–23.2376 [0.040]	–18.9325 [0.065]	–24.6487 [0.077]		–19.2807 [0.086]	–20.1694 [0.085]	
gdp_corr						–0.6253 [0.025]	–0.6508 [0.048]								
ec1*gdp_corr			–0.5070 [0.021]					–0.4481 [0.094]	–0.5402 [0.088]						
eur1*gdp_corr												0.6972 [0.042]			0.6696 [0.048]
ec1*u_gap														–20.4294 [0.046]	
conv#ec1: 0, 1	–0.4285 [0.089]			–0.5537 [0.034]											
1, 0	(empty group)			(empty group)											
1, 1	–0.4955 [0.125]			–0.6234 [0.058]											
i_spread						–21.9846 [0.018]		–19.6258 [0.032]		–22.3647 [0.012]					
erm1*reer_ulc						–7.9866 [0.061]									
eur1*reer_ulc			12.6518 [0.095]												

Table A.3 continued

	boom_i1					boom_i2					boom_i3				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
erm1										0.3838 [0.062]					
erm1*gov_exp							–30.4587 [0.004]		–30.8103 [0.004]		–33.5255 [0.005]	–31.4313 [0.010]	–23.4932 [0.017]	–21.4144 [0.035]	–32.9340 [0.006]
w_serv	–6.6356 [0.004]			–6.4993 [0.004]	–5.6104 [0.066]										
ec1*w_serv		–8.2654 [0.013]													
mi							1.4722 [0.011]		1.5093 [0.009]		1.9537 [0.000]	2.2055 [0.000]	1.3975 [0.004]	1.6671 [0.001]	2.1480 [0.000]
constant	–1.1541 [0.000]	–1.5331 [0.000]	–1.3605 [0.000]	–0.9854 [0.000]	–1.4214 [0.000]	–1.4155 [0.000]	–1.6917 [0.000]	–1.4821 [0.000]	–1.7761 [0.000]	–1.8841 [0.000]	–1.9766 [0.000]	–2.2747 [0.000]	–1.7552 [0.000]	–1.7863 [0.000]	–2.1407 [0.000]
RE or pooled?*	pooled	pooled	pooled	pooled	pooled	pooled	pooled	pooled	pooled	pooled	pooled	pooled	pooled	pooled	pooled
No. of observations	410	417	517	410	417	359	315	359	315	359	299	339	310	310	299
LR test of all coeff.*	0.004	0.001	0.006	0.016	0.024	0.000	0.000	0.002	0.000	0.001	0.000	0.000	0.000	0.000	0.000
LR test of rho = 0*	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Hausman test*	0.388	0.140	0.302	0.492	0.323	0.262	0.182	0.216	0.196	0.224	0.206	0.156	0.356	0.248	0.184

Note: Different specifications in columns (1) – (5); p-values corresponding to the t statistics of the individual coefficients in square brackets.

* p-values corresponding to the respective test statistics; the Hausman test refers to the logit (null hypothesis) versus the probit (alternative hypothesis) specification; RE = random effects.

Table A.4: Estimation results: busts in consumption

	bust_c1					bust_c2					bust_c3				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
real_credit		–4.3403	–5.1677			–6.2634	–6.1856	–4.3262			–5.5235	–5.5327	–1.9843	–1.8987	–5.2226
		[0.050]	[0.022]			[0.001]	[0.001]	[0.033]			[0.001]	[0.001]	[0.039]	[0.046]	[0.001]
credit_gdp	–3.9729			–3.8753	–5.7588				–2.8829	–2.8475					
	[0.052]			[0.061]	[0.002]				[0.090]	[0.090]					
w_build	–9.2271	–5.4208	–4.5445	–4.8968	–4.0902				–3.9073		–5.7290	–4.8684			
	[0.001]	[0.041]	[0.043]	[0.028]	[0.062]				[0.066]		[0.009]	[0.035]			
eur1*w_build						–5.9321									
						[0.096]									
portf_inv													–0.0332	–0.0407	
													[0.097]	[0.048]	
eur1*portf_inv											–0.0544				–0.0426
											[0.040]				[0.068]
ec1*fdi													–0.0234		
													[0.097]		
erm1*fdi						–0.2264	–0.2211				–0.3375	–0.3579			–0.3447
						[0.075]	[0.082]				[0.000]	[0.000]			[0.000]
for_liab	–4.1754	–3.6765	–2.9084	–2.9657	–4.8670	–2.8119	–2.7467	–2.5041	–2.5808	–2.3786	–2.2198	–1.6202	–2.0329	–2.2265	–2.2357
	[0.002]	[0.042]	[0.031]	[0.032]	[0.004]	[0.006]	[0.008]	[0.012]	[0.008]	[0.014]	[0.020]	[0.048]	[0.012]	[0.005]	[0.009]
forex_loans						–11.8577	–11.0886	–12.5153	–11.1350	–11.5883	–14.1447				
						[0.022]	[0.033]	[0.014]	[0.021]	[0.015]	[0.010]				
u_gap		20.3039		22.9870									14.1467	12.7166	
		[0.087]		[0.044]									[0.057]	[0.089]	
ec1*u_gap	32.6081		19.6782					19.5974							
	[0.005]		[0.093]					[0.079]							
i_spread						26.9842	26.1400	26.3957	34.3496	32.3163					
						[0.009]	[0.011]	[0.008]	[0.001]	[0.001]					
eur1*i_spread		307.8939			280.0423										
		[0.013]			[0.027]										
reer_ulc			–4.9690	–4.2876	–4.8981	–5.9546	–6.1868				–4.6074	–5.5120	–3.6759	–3.9619	–5.8857
			[0.052]	[0.091]	[0.027]	[0.013]	[0.010]				[0.026]	[0.017]	[0.020]	[0.014]	[0.002]
eur1*reer_ulc	37.0418														
	[0.010]														

Table A.4 continued

	bust_c1					bust_c2					bust_c3				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
erm1														0.3088	0.3730
														[0.062]	[0.059]
eur1											–0.4781				
											[0.058]				
gov_exp												19.8840			14.0916
												[0.006]			[0.021]
w_serv	8.7982														
	[0.054]														
eur1*w_serv			–19.7722	–19.0621	–19.8370		–14.8729	–12.6771		–13.9406					
			[0.013]	[0.015]	[0.023]		[0.048]	[0.098]		[0.040]					
crisis		1.2512	1.1932	1.2495											
		[0.001]	[0.001]	[0.000]											
ers		–2.3943			–2.2605										
		[0.001]			[0.001]										
constant	–1.8569	–0.4353	–1.5046	–1.6770	–0.2646	–1.1866	–1.1598	–1.2869	–1.2639	–1.2664	–0.7935	–0.9566	–1.0995	–1.2247	–1.2097
	[0.000]	[0.220]	[0.000]	[0.000]	[0.394]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
RE or pooled?*	RE	pooled	pooled	pooled	pooled	pooled	pooled	pooled	pooled	pooled	pooled	pooled	pooled	pooled	pooled
No. of observations	358	354	358	358	354	335	335	335	335	335	333	315	415	415	351
LR test of all coeff.*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
LR test of rho = 0*	0.096	1.000	0.499	0.499	1.000	1.000	1.000	1.000	1.000	1.000	0.341	0.324	1.000	1.000	1.000
Hausman test*	0.120	0.142	0.139	0.131	0.108	0.172	0.151	0.130	0.197	0.174	0.211	0.166	0.284	0.254	0.213

Note: Different specifications in columns (1) – (5); p-values corresponding to the t statistics of the individual coefficients in square brackets.

* p-values corresponding to the respective test statistics; the Hausman test refers to the logit (null hypothesis) versus the probit (alternative hypothesis) specification; RE = random effects.

Table A.5: Estimation results: busts in investment

	bust_i1					bust_i2					bust_i3				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
real_credit	–5.0185	–5.4280	–7.2818			–4.5639	–5.5687	–7.7507	–4.9389	–0.2054	–3.0979	–2.6831	–3.1647	–2.4005	
	[0.020]	[0.024]	[0.001]			[0.037]	[0.023]	[0.006]	[0.014]	[0.097]	[0.042]	[0.062]	[0.030]	[0.079]	
credit_gdp				–4.4531	–4.8218										
				[0.023]	[0.017]										
eur1*credit_gdp															–13.5443
															[0.026]
w_build										–3.8791	–4.0907				
										[0.069]	[0.067]				
eur1*w_build				–5.5087											
				[0.082]											
erm1*portf_inv											0.1184	0.1165	0.1179		
											[0.060]	[0.057]	[0.060]		
erm1*fdi						–0.2134	–0.2441	–0.3529	–0.2054						
						[0.095]	[0.081]	[0.025]	[0.097]						
ec1*for_liab	–1.4712														
	[0.083]														
forex_loans	–9.4409	–13.6681	–12.3629	–12.2967	–11.7645	–19.3127	–21.9000	–21.2777			–12.0385	–10.6988	–10.4565	–10.6722	–10.3232
	[0.084]	[0.040]	[0.034]	[0.028]	[0.040]	[0.004]	[0.003]	[0.008]			[0.018]	[0.024]	[0.027]	[0.020]	[0.041]
ec1*forex_loans									–16.6261						
									[0.012]						
eur1*gdp_corr						–0.6778			–0.6486	–0.6549					
						[0.090]			[0.095]	[0.065]					
u_gap	23.1459	21.3063													19.7711
	[0.040]	[0.073]													[0.042]
erm1*u_gap												26.5982			
												[0.038]			
eur1*u_gap							70.1278	78.9423		48.3155				39.4474	
							[0.060]	[0.050]		[0.081]				[0.090]	
i_spread	32.9161		33.8732	38.2202	35.7550	23.2770	21.8187								
	[0.002]		[0.003]	[0.001]	[0.002]	[0.021]	[0.033]								
ec1*i_spread										14.4220					
										[0.052]					

Table A.5 continued

	bust_i1					bust_i2					bust_i3				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
reer_ulc			–5.7285	–5.0841	–5.6305			–8.7486							
			[0.043]	[0.061]	[0.040]			[0.007]							
eur1*reer_ulc											26.5406		21.9078	24.2534	45.0205
											[0.007]		[0.017]	[0.007]	[0.002]
eur1		–0.9668													
		[0.040]													
erm1*gov_exp											36.1514		35.2339	34.4987	31.4772
											[0.005]		[0.005]	[0.003]	[0.007]
eur1*gov_exp	30.6895	52.3353	34.0005	35.5302	33.5995	76.2854	64.7231	78.9791	73.2942	54.1343		31.4480			
	[0.060]	[0.088]	[0.073]	[0.032]	[0.070]	[0.001]	[0.004]	[0.001]	[0.001]	[0.006]		[0.032]			
eur1*w_serv		–19.2540	–25.9381		–24.7976		–23.6298	–25.6790							
		[0.077]	[0.002]		[0.002]		[0.016]	[0.013]							
crisis		1.4815				1.1619	0.9143	0.9420	1.1765	0.9613		0.5368	0.4944		0.6334
		[0.000]				[0.002]	[0.025]	[0.034]	[0.001]	[0.001]		[0.072]	[0.094]		[0.051]
constant	–1.1898	–1.1044	–[0.9770	–1.2015	–1.1542	–1.4127	–1.3638	–1.3385	–1.3168	–1.0417	–1.1506	–1.2683	–1.2471	–1.1647	–1.3647
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
RE or pooled?*	pooled	pooled	pooled	pooled	pooled	RE	RE	RE	RE	pooled	pooled	pooled	pooled	pooled	pooled
No. of observations	315	299	299	299	299	315	299	299	315	336	294	310	310	315	315
LR test of all coeff.*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
LR test of rho = 0*	1.000	0.259	0.330	0.499	0.444	0.039	0.046	0.029	0.075	0.156	1.000	1.000	1.000	1.000	1.000
Hausman test*	0.121	0.310	0.103	0.161	0.108	0.126	0.336	0.367	0.113	0.331	0.180	0.264	0.182	0.160	0.185

Note: Different specifications in columns (1) – (5); p-values corresponding to the t statistics of the individual coefficients in square brackets.

* p-values corresponding to the respective test statistics; the Hausman test refers to the logit (null hypothesis) versus the probit (alternative hypothesis) specification; RE = random effects.

Table A.6: Probabilities (in percent) of booms in consumption and investment in Poland over 2004–2009 under different scenarios

	Probabilities of a boom in consumption (series boom_c1)															Probabilities of a boom in investment (series boom_i1)														
	(A) Rapid euro adoption					(B) Real scenario					Difference (A) – (B)					(A) Rapid euro adoption					(B) Real scenario					Difference (A) – (B)				
year	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
2004	74.4	53.5	69.9	83.0	52.1	9.8	6.8	4.1	6.7	6.9	64.6	46.7	65.8	76.3	45.2	1.6	1.5	7.6	1.8	2.7	1.6	1.5	7.6	1.8	2.7	0.0	0.0	0.0	0.0	0.0
2005	3.0	4.7	3.9	1.3	4.8	3.0	4.7	10.5	5.0	4.8	0.0	0.0	–6.6	–3.7	0.0	2.5	2.7	5.7	2.8	3.7	2.5	2.7	5.7	2.8	3.7	0.0	0.0	0.0	0.0	0.0
2006	10.3	3.5	14.8	17.5	3.6	9.5	6.5	7.1	7.2	6.6	0.7	–3.0	7.8	10.3	–3.0	4.8	5.6	48.6	5.0	6.4	4.8	5.6	8.7	5.0	6.4	0.0	0.0	40.0	0.0	0.0
2007	39.7	6.0	39.3	52.9	4.3	21.4	8.6	16.8	10.8	6.3	18.3	–2.6	22.5	42.1	–2.1	2.7	2.2	15.4	2.5	3.2	2.7	2.2	12.3	2.5	3.2	0.0	0.0	3.2	0.0	0.0
2008	52.2	24.8	40.8	57.1	18.4	24.2	10.2	23.6	13.1	6.8	28.0	14.6	17.2	44.0	11.6	8.7	9.1	24.9	7.8	8.1	8.7	9.1	12.6	7.8	8.1	0.0	0.0	12.3	0.0	0.0
2009	83.2	8.6	97.6	99.5	5.5	66.2	15.8	25.6	18.0	10.8	17.0	–7.2	72.0	81.5	–5.3	16.4	18.5	73.9	14.3	14.2	16.4	18.5	18.7	14.3	14.2	0.0	0.0	55.2	0.0	0.0
	Probabilities of a boom in consumption (series boom_c2)															Probabilities of a boom in investment (series boom_i2)														
	(A) Rapid euro adoption					(B) Real scenario					Difference (A) – (B)					(A) Rapid euro adoption					(B) Real scenario					Difference (A) – (B)				
year	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
2004	0.6	0.0	0.0	0.0	0.3	0.6	5.3	5.1	4.1	4.8	0.0	–5.3	–5.1	–4.1	–4.5	42.9	1.5	6.2	1.4	9.0	12.4	5.1	11.4	4.7	7.9	30.5	–3.6	–5.2	–3.3	1.2
2005	5.2	1.0	0.0	0.7	1.4	5.2	11.5	13.3	10.2	12.9	0.0	–10.5	–13.3	–9.5	–11.4	23.6	27.7	12.9	27.2	17.7	7.8	6.4	7.6	6.1	5.6	15.8	21.3	5.3	21.0	12.1
2006	0.9	6.6	0.5	4.6	1.4	0.9	4.9	4.2	3.3	3.8	0.0	1.7	–3.7	1.3	–2.4	1.3	7.9	7.0	7.4	9.1	12.2	19.0	11.1	18.0	6.9	–11.0	–11.0	–4.1	–10.6	2.2
2007	3.6	5.4	0.6	6.0	0.7	3.6	8.2	12.8	9.2	11.1	0.0	–2.8	–12.2	–3.2	–10.4	3.9	10.3	4.3	9.7	5.6	9.8	26.0	9.5	24.9	5.5	–6.0	–15.6	–5.2	–15.2	0.1
2008	12.0	39.5	20.9	36.1	1.2	12.0	20.5	27.4	17.3	21.9	0.0	19.0	–6.5	18.8	–20.7	2.5	21.5	4.9	21.1	7.0	8.3	17.2	8.6	16.6	5.5	–5.7	4.3	–3.7	4.4	1.5
2009	5.2	69.9	67.8	66.4	0.6	5.2	12.1	14.3	8.7	10.5	0.0	57.8	53.4	57.7	–9.9	0.0	0.1	0.5	0.1	0.8	16.1	16.4	15.1	15.0	8.6	–16.1	–16.3	–14.6	–14.9	–7.8
	Probabilities of a boom in consumption (series boom_c3)															Probabilities of a boom in investment (series boom_i3)														
	(A) Rapid euro adoption					(B) Real scenario					Difference (A) – (B)					(A) Rapid euro adoption					(B) Real scenario					Difference (A) – (B)				
year	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
2004	11.9	2.3	2.1	5.9	2.5	11.9	2.3	4.5	12.7	2.5	0.0	0.0	–2.5	–6.8	0.0	1.3	1.9	2.7	0.5	2.0	4.9	2.8	6.6	1.6	2.9	–3.6	–0.9	–4.0	–1.1	–0.9
2005	10.2	5.6	5.2	6.4	4.5	10.2	5.6	10.0	13.6	4.5	0.0	0.0	–4.9	–7.2	0.0	36.4	16.7	28.4	19.8	17.7	8.8	5.8	9.6	6.0	5.9	27.7	10.9	18.8	13.8	11.8
2006	12.3	13.6	8.9	2.4	13.5	12.5	13.6	19.7	11.7	15.0	–0.2	0.0	–10.8	–9.3	–1.5	9.9	16.7	10.0	13.4	16.1	22.8	18.8	19.8	24.6	18.6	–12.9	–2.1	–9.8	–11.2	–2.5
2007	17.6	17.9	12.5	6.5	17.5	18.8	17.9	25.8	21.5	15.1	–1.2	0.0	–13.3	–15.0	2.4	21.8	36.1	12.3	14.5	31.4	31.3	27.5	26.9	29.1	23.1	–9.5	8.6	–14.6	–14.7	8.3
2008	22.8	20.9	12.1	13.4	20.7	22.1	20.9	28.3	21.0	21.0	0.7	0.0	–16.2	–7.6	–0.3	47.0	56.5	24.5	29.5	51.6	21.4	17.3	20.8	27.6	13.3	25.6	39.2	3.7	2.0	38.3
2009	27.1	32.7	25.6	6.4	32.2	26.8	32.7	40.0	21.6	36.2	0.3	0.0	–14.5	–15.2	–4.0	0.2	9.6	0.4	1.1	7.1	13.3	9.6	15.5	28.9	7.0	–13.1	0.0	–15.1	–27.8	0.1

Note: Different specifications in columns (1) – (5) (see Tables A.2 and A.3).

Table A.7: Probabilities (in percent) of busts in consumption and investment in Poland over 2004–2009 under different scenarios

	Probabilities of a bust in consumption (series bust_c1)															Probabilities of a bust in investment (series bust_i1)														
	(A) Rapid euro adoption					(B) Real scenario					Difference (A) – (B)					(A) Rapid euro adoption					(B) Real scenario					Difference (A) – (B)				
year	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
2004	57.2	28.7	41.2	42.7	45.8	57.2	28.7	41.2	42.7	45.8	0.0	0.0	0.0	0.0	0.0	7.7	17.9	12.5	10.6	14.4	7.7	17.9	12.5	10.6	14.4	0.0	0.0	0.0	0.0	0.0
2005	5.6	7.5	7.4	7.8	17.3	5.6	7.5	7.4	7.8	17.3	0.0	0.0	0.0	0.0	0.0	11.1	26.1	16.3	15.0	17.8	11.1	26.1	16.3	15.0	17.8	0.0	0.0	0.0	0.0	0.0
2006	98.6	0.0	0.3	0.4	0.0	4.5	10.8	1.1	1.4	8.9	94.0	–10.8	–0.8	–1.1	–8.9	4.0	0.4	0.2	1.4	0.3	2.3	5.2	0.5	0.7	0.7	1.7	–4.8	–0.4	0.7	–0.5
2007	9.1	12.7	0.0	0.0	0.1	3.9	1.4	0.4	0.9	2.9	5.1	11.3	–0.4	–0.9	–2.8	3.0	0.0	0.0	2.5	0.0	2.1	1.4	0.9	3.3	3.3	0.9	–1.4	–0.9	–0.8	–3.3
2008	4.6	35.5	0.0	0.0	13.9	0.1	0.2	0.0	0.1	0.7	4.5	35.3	0.0	–0.1	13.2	0.3	0.0	0.0	0.2	0.0	1.1	0.5	0.4	2.8	2.6	–0.8	–0.5	–0.4	–2.7	–2.6
2009	79.1	6.6	0.0	0.0	4.5	0.0	0.4	0.0	0.0	0.6	79.1	6.2	0.0	0.0	3.9	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Probabilities of a bust in consumption (series bust_c2)															Probabilities of a bust in investment (series bust_i2)														
	(A) Rapid euro adoption					(B) Real scenario					Difference (A) – (B)					(A) Rapid euro adoption					(B) Real scenario					Difference (A) – (B)				
year	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
2004	11.3	13.3	5.9	2.6	2.0	11.5	13.4	5.9	2.6	2.0	–0.1	–0.2	0.0	0.0	0.0	1.0	0.9	26.0	3.4	10.3	1.0	1.0	26.3	3.4	10.3	0.0	0.0	–0.4	–0.1	0.0
2005	3.1	3.5	10.0	3.7	7.1	11.3	12.1	10.0	3.7	7.1	–8.2	–8.6	0.0	0.0	0.0	1.9	1.9	4.7	4.3	6.4	7.2	8.6	25.9	13.1	6.4	–5.4	–6.7	–21.2	–8.9	0.0
2006	1.3	0.5	1.1	3.4	1.6	0.5	0.6	2.4	3.4	3.7	0.8	0.0	–1.4	0.0	–2.1	8.3	2.0	0.5	15.3	11.7	1.4	1.3	0.2	3.5	8.2	6.9	0.7	0.4	11.8	3.5
2007	0.0	0.0	0.0	2.8	0.1	0.7	0.8	1.7	2.8	4.5	–0.7	–0.8	–1.7	0.0	–4.4	0.3	0.0	0.0	0.3	8.2	0.7	0.4	0.1	0.7	4.9	–0.4	–0.4	–0.1	–0.4	3.3
2008	0.1	0.1	0.2	2.9	1.4	0.4	0.4	1.0	2.9	5.5	–0.3	–0.3	–0.8	0.0	–4.1	0.0	0.0	0.0	0.0	0.1	0.7	0.4	0.0	0.5	3.5	–0.7	–0.4	0.0	–0.5	–3.4
2009	0.0	0.0	0.0	0.4	0.4	0.0	0.0	0.0	0.4	0.6	0.0	0.0	0.0	0.0	–0.2	0.3	0.0	0.0	0.4	0.5	0.0	0.0	0.0	0.0	2.6	0.3	0.0	0.0	0.4	–2.0
	Probabilities of a bust in consumption (series bust_c3)															Probabilities of a bust in investment (series bust_i3)														
	(A) Rapid euro adoption					(B) Real scenario					Difference (A) – (B)					(A) Rapid euro adoption					(B) Real scenario					Difference (A) – (B)				
year	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
2004	35.1	46.3	42.4	49.8	45.6	35.5	46.7	42.4	37.7	31.8	–0.4	–0.5	0.0	12.1	13.8	11.9	22.4	8.0	10.0	22.2	8.9	5.8	5.9	7.3	17.9	2.9	16.6	2.1	2.7	4.3
2005	3.0	0.5	18.3	25.0	2.6	18.4	6.4	18.3	16.3	9.4	–15.4	–5.9	0.0	8.7	–6.8	3.1	26.7	4.7	4.5	6.3	9.7	12.8	13.1	15.1	17.9	–6.7	13.9	–8.4	–10.6	–11.5
2006	5.1	14.0	6.5	8.3	15.9	4.2	4.8	6.5	4.5	2.6	0.8	9.2	0.0	3.8	13.3	94.0	8.4	84.0	90.5	99.9	6.7	6.0	5.9	7.6	6.3	87.2	2.4	78.1	82.9	93.6
2007	0.0	0.1	7.2	11.3	0.6	0.9	1.7	7.2	6.5	1.9	–0.9	–1.6	0.0	4.9	–1.3	3.9	3.5	4.8	11.4	1.2	1.7	2.7	2.4	3.8	6.5	2.2	0.8	2.3	7.6	–5.3
2008	0.1	0.2	3.8	5.6	1.0	0.3	0.1	3.8	2.9	0.3	–0.2	0.0	0.0	2.7	0.7	3.3	0.4	4.0	3.9	0.7	1.1	2.4	2.0	3.4	4.9	2.3	–1.9	2.1	0.5	–4.2
2009	0.0	1.7	1.3	1.9	3.9	0.0	0.1	1.3	0.9	0.1	0.0	1.6	0.0	1.0	3.8	67.5	0.1	55.0	41.0	56.9	0.1	0.3	0.2	0.4	0.5	67.4	–0.1	54.8	40.6	56.4

Note: Different specifications in columns (1) – (5) (see Tables A.4 and A.5).