ESSAYS ON IMPLICATIONS OF FINANCIAL AND GOODS MARKET IMPERFECTIONS IN OPEN ECONOMIES

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Introduction

The main motivation of this dissertations stems from my interest in the Central and Eastern European (CEE) economies. This part of Europe is currently in a fast expansion stage and I believe that this successful stage will continue for substantial periods of time. The questions I have asked in the three essays of my dissertation reflect some features of the Central and Eastern European development pattern. In studying these issues, however, I have not limited myself to the experience of CEE countries only.

The CEE region was part of a centrally planned economic system barely two decades ago. At the beginning of the 90s, however, intensive reforms to introduce market forces and incentives were started and economies responded to these changes by a rapid restructuring. Thereafter substantial socio-economic progress has been made and the remarkable growth performance of the region is indicating fast convergence towards Western European standards. Another impetus that has propelled economic expansion was the membership in the European Union (EU), the benefits of which the CEE countries started to enjoy in the early years of this decade. Currently the CEE economies are still in transition to a new steady state(s).

Orderly functioning of markets does not follow immediately after the introduction of market mechanisms. The implementation of market reforms is time-consuming and changes take effect over a period of many years. The economic structure of Eastern European transition countries has gradually become more similar to the old member states of the EU but one can still observe significant differences. The essays in this dissertation are based on differences either in the level or in the behavior of several macro variables that describe the state or functioning of the financial and goods markets of the CEE countries.

The performance of the CEE economies often depends on foreign capital inflows -- their net foreign asset positions are significantly negative. The central concern in my first essay is to what extent shocks to domestic output are transmitted to national output -- the difference between the two being the income balance of the current account. This depends on how foreign assets complement domestic assets in country portfolios. Therefore I measure the diversification *of the average unit and of the marginal unit of portfolio.* I find that the returns from domestic and foreign assets are highly correlated: thus the overall level of risk sharing is low in the world economy as a whole. However, countries perform better in allocating the marginal unit of their portfolio. I provide evidence that capital ownership gives creditor countries an advantage in building up their portfolios. The CEE countries have obtained relatively little foreign assets in their portfolios and these assets provide almost no insurance.

I start my second essay from the observation that due to lower price levels it is natural to observe higher inflation in the CEE countries as compared to Western Europe. However, if a CEE country wants to join the euro area, it has to meet the Maastricht inflation criterion -- that is an inflation differential not exceeding the margin of 1.5%. I infer from my empirical findings that for a candidate country to meet this criterion, its price level must reach approximately 85% of the EU-27 average price level (currently the average in the CEE countries is ca. 60%) given that other inflation determinants are very similar. Based on these findings, my claim is that the Maastricht inflation criterion should be adapted to allow for differences in price levels in order to allow countries with a lower price level but otherwise sound economies to join the monetary union.

My third essay stems from the observation that credit growth has been extremely fast in recent years in CEE countries, especially under a fixed exchange rate regime. In this essay I investigate whether exchange rate flexibility makes it easier for lending booms to develop. I start with the traditional conjecture that rigid exchange rate regimes provide a more fertile soil for credit booms but my findings run against this conjecture. The implications of my findings suggest that during a non-boom period the exchange rate flexibility measure is not able to explain credit performance. On the contrary, in boom periods credit is growing faster in those countries which have a more flexible exchange rate regime. I also claim that more flexible exchange rate regimes are characterized by faster credit growth in the build-up and peak stages of the boom, while this cannot be concluded for the ending stage of a boom.

I would like to express my deepest gratitude to my supervisor, Prof. Francesco Giavazzi, for numerous encouraging discussions, patient guidance and advice throughout this work. I owe many great suggestions and ideas to him which helped me further while writing the thesis. I appreciate flexibility and freedom that Prof. Francesco Giavazzi afforded me in combining my studies and full-time employment. I am also grateful to my second supervisor, Prof. Antonella Trigari, who agreed to supervise my work, despite a late asking date. The feedback from her provided me plentiful new insights and directions to explore. I would additionally like to acknowledge the contribution from the other members of my oral examination committee -- Prof. Laura Bottazzi and Prof. Giorgio Basevi -- whose comments have substantially improved my work.

Chapter 1

Country Portfolios: The Winners and Losers

1.1 Introduction

The idea of this paper stems from the inflow of foreign capital into the Eastern European emerging economies that has occurred in various forms. This region has lower per capita income but it is growing faster than the rest of Europe and therefore it is a net borrower as the neoclassical paradigm predicts. As a result, the net foreign asset positions in this region have substantially deteriorated over the course of last ten years, which has fostered financial and trade based integration. The intriguing question is whether capital flows diversify the portfolios of creditor or debtor countries or both. Often the answers to these questions are positive but such a conclusion is reached without looking at the data carefully enough.

Theory suggests that larger cross border ownership per se should give more opportunities to diversify country portfolios. The complementary nature of international consumption smoothing channels and domestic consumption smoothing channels becomes more apparent in the case of country specific shocks. It is natural to expect that foreign assets are selected in a way which helps diversify the risks stemming from domestic production. Consider an abstract two-country world where stochastic processes drive output, and the agents can hold cross border assets and share their risks. Full risk sharing is achieved if the agents in both countries hold identical portfolios and their incomes move hand in hand despite production turbulences.

How globalization affects the linkage between domestic and national output is a complex empirical question. One implication of real globalization is that production processes in different geographical locations become more interlinked but observed increase of cross-country correlations in GDP could be quite independent of portfolio diversification or financial globalization. Data also confirm substantial increases in the

stock of outstanding assets and liabilities in recent decades resulting in higher revenue flows. As the number of host countries represented in the stock of countries' foreign assets has also risen, the difference between domestic and national output is driven by a higher number of stochastic processes. Despite cross border ownership of real and financial assets has been substantially growing it is still puzzling how far are the observed levels from optimal levels given the goods and financial market imperfections. Furthermore, the question is not merely about the level of foreign asset and liability positions but also about their composition. For diversification both the level and the composition matter. If investors take advantage of globalization, the anticipated result is increase in gross national income correlations. Empirical evidence suggests that the variance in GNP growth rates is not necessarily smaller than variance of GDP growth rates in many OECD countries. Countries do not seem to pick the benefits that internationalization provides. This raises an uneasy question whether this implication is a matter either of low level or poor composition of gross external positions or both.

The central concern in this paper is the role of factor income channel in protecting national income against fluctuations in domestic output. The paper argues that one should not look only at gross asset positions but also at the revenues they produce because high asset and liability positions per se do not tell whether diversification has been achieved. There are two ways to look at the revenues: looking at the diversification of the average unit and of the marginal unit of portfolio. In other words, and simplifying a bit, this paper considers $\rho(rW,Y)$ while substantial literature on the factor income channel has been mostly about $\rho(d(rW),dY)$, where r, W, and Y denote the rate of return, external wealth, and domestic production respectively. These two approaches are both taken to data to measure whether cross border ownership provides any protection against domestic production shocks.

The paper addresses the issue of country portfolio diversification and the operational question is how returns from foreign asset holdings complement returns from domestic asset holdings. In a well-diversified portfolio they should be negatively correlated. Correlation is exactly what the both 'average unit' and 'marginal unit' approaches measure. The empirical exercise is fairly simple because these returns can both be found in national accounts. In order to provide a comparison of the results, I have also applied a widely used approach (stemming from Asdrubali et al (1996)) relying on the variance decomposition methodology to measure the level of risk-sharing through the factor income channel. This approach measures diversification from marginal portfolio holding. The main aspect in which the application of the variance decomposition methodology in this paper differs from the existing literature is that it uses a wider pool of countries including a number of emerging and low-income economies. It is anticipated that this dimension of heterogeneity reveals some information about the distribution of globalization gains across countries. Another aspect is that risk sharing is measured separately in creditor and debtor countries. This is done because of the hypothesis that capital ownership may give an advantage. While this assumption can theoretically be applied to both physical and human capital ownership, the former is used in this paper. A general shortage that my empirical estimates suffer from is that the gains from capital appreciation are neglected, which is in contrast to reality because international capital flows may sometimes seek return in the form of capital gains.

I find that the returns from domestic and foreign assets are relatively highly correlated and therefore the overall level of risk sharing is low in the world economy as a whole. However, countries perform better in allocating the marginal unit of their portfolio. The variance decomposition methodology delivers that there is even dis-smoothing of gross national income at the world level. Financial and real integration do not provide equal risk-sharing opportunities to all countries. The results indicate that, firstly, the portfolios of developed countries are more diversified and thus their incomes are more protected against fluctuations stemming from gross domestic product. Secondly,

the returns from domestic and foreign assets are less correlated for positive as compared to negative net foreign asset (NFA) position countries, i.e., capital ownership gives creditor countries an advantage. I have found also that portfolio investment provide more diversification opportunities than the other components of the income account. Another interesting observation is that worker's remittances are a good insurance against domestic income shocks, especially in the developed countries.

The extent of diversification that two countries can achieve in crossholding of assets depends on how similar is the structure of economic sectors in these countries and the costs that are related to holding foreign assets. Similar structure may lead to correlated technology, monetary, government consumption and preference shocks and, as a result, such environment provides fewer opportunities for diversification. It is highly unlikely that all economic sectors of a foreign country provide identical diversification opportunities for domestic production. Foreign capital flows from country A can be invested into an index containing assets from many economic sectors of country B. However, it has likely different diversification effect when country A invests in sector B1 of country B than investing in B2. One may think whether copper oriented Chilean economy wants to invest into copper mines and factories in abroad. Investigating these issues purely from the financial portfolio perspectives and looking at data on cross border factor income flows at the level of economic activities is left for future work.

The paper is organized as follows. In the next section a simple accounting approach to measure diversification in country portfolios is built; the framework that is frequently applied since Asdrubali et al. (1996) is also briefly described. Both these approaches consider how foreign assets complement domestic assets in country portfolios but from a slightly different perspective. The third section is devoted to an overview of data issues. The fourth focuses on the empirical findings from the two approaches and on their consistency. Section five relates empirical findings to gross external asset and liability positions. Directions for future work are in the concluding section.

1.2 Theory

The desire to be protected against fluctuations in consumption is in the nature of a risk averse agent. The institutional organization of modern economies provides consumption smoothing opportunities via various channels but the empirical evidence does not confirm that people effectively exploit these opportunities. The finding is that fluctuations in wider national accounts aggregates, like income or output, still significantly determine consumption profiles. People may hold various types of real and financial assets of domestic origin but international capital mobility has opened even more chances that allow enriching the portfolio. Achieving full-fledged risk sharing, when consumption profiles are independent of wider aggregates, is nevertheless clearly rejected in empirics. It cannot be said that the theory has so far quite satisfactorily coped with the empirical finding that cross-country consumption correlations are lower than output correlations.

Another way to highlight the issue that this paper raises is to draw a parallel with the widely discussed example of Chile's dependence on the world copper market. A substantial part of the Chilean economy depends on mining, production and exports of copper-related raw materials and products. Therefore the economic success of Chile depends on whether world copper market is at highs or at lows. However, if one believes in theoretical foundations, Chile could achieve welfare gains by holding foreign assets whose returns are uncorrelated with commodity prices reducing fluctuations stemming from the volatile copper market. The question whether Chile takes advantage of this, is an empirical one.

The institutional organization of modern economies provide consumption smoothing opportunities via various channels. Economic agents receive their income from holding

various forms of capital including numerous real and financial assets but also human capital. One of the first things that agents can do for consumption smoothing after having been hit by a shock is adjusting the level of savings. By doing this agents may affect the sequence of their consumption allocations over time. Credit and capital market institutions are involved in consumption smoothing and therefore the functional soundness of this part of the economy is crucial. Credit and capital market institutions not only intermediate savings but also transfer and pool risks and diversify portfolios. Governments are also involved in income and consumption smoothing. Governments redistribute income over various time spans and over households. In addition, numerous policy measures affect saving-consumption incentives and asset allocation decisions. It is not that there are only domestic instruments in the risk-sharing toolkit. In an open economy agents may use various balance of payment transactions to insure against domestic risks. All these channels are present in most of the economies but they are used with different intensities.

Higher international capital mobility opens more opportunities to complement domestic assets with foreign assets in countries portfolios. Declining restrictions on international capital movements have fostered financial globalization. Lower transportation and information-obtaining costs together with harmonization of institutional frameworks have contributed to declining transaction costs. These trends have given additional stimulus to acquire foreign assets and as the result has been the substantial increase in gross asset and liability positions witnessed in the recent decades. Literature claims that there is nevertheless a strong bias towards holding domestic assets in portfolios and that full benefits from cross-border ownership are not exploited. This literature starts from French and Poterba (1991) who conclude that the returns from holding domestic equity must be several hundred basis points higher in order to explain why the share of domestic equity is so high in wealth. This is an implication of the equity home bias puzzle, which claims that country portfolios are biased towards domestic assets[1]. Existing literature has not been able to provide one compelling explanation to the puzzle. Equity home bias puzzle is in turn related to consumption correlation puzzle. The latter claims that observed consumption growth correlations are lower than they should be. If there is lack of international risk sharing, consumption profiles across countries do not necessarily co-move. But the consumption correlation puzzle cannot be automatically inferred from the equity home bias puzzle because consumption can be smoothed via domestic channels as well in certain circumstances. (See for example Lewis 1999).

Incomplete international risk sharing is one reflection of equity home bias puzzle. The studies that consider international risk sharing usually take a look at output or consumption correlations or bridge demand components and variables that describe financial market development. The comparison of output and consumption correlations came to the forefront with the work of Backus, Kehoe and Kydland (1993) whose international business cycle framework highlighted a counterfactual finding: consumption correlations are lower than output correlations[2]. Literature has tried to overcome the inconsistency between theory and empirical evidence with the inclusion of a wide range of goods and financial markets imperfections in open economy models. These imperfections are for example incomplete substitutability between goods, trade costs, non-traded goods, information asymmetries of different type and etc. There is still no clear consensus on which combination of imperfections does the best job in explaining the puzzles.

A widely-referred study of Obstfeld and Rogoff (2000) is concerned mostly about the goods market imperfections as they believe that controlling for this source provides a

[1] This fact has been documented recently, among others, by Lütje and Menkhoff (2004), Strong and Xu (2003).

[2] Output and consumption correlations are documented for example in Lewis (1999), Pakko (2003) and others

unified understanding of puzzles. They show how the interplay of trade costs with the elasticity of substitution between domestic and imported goods can deliver realistic levels of equity home bias. However, they recognize that information asymmetries and legal restrictions have to be incorporated as well in order to improve the performance of the models. The supplement to this paper is Engel (2000) who is also convinced that the inclusion of trade frictions only does not explain the puzzles of international economics well but it moves things in right direction. He claims, however, that Obstfeld and Rogoff (2000) concentrate on special models where full portfolio diversification does bring complete risk sharing but this is not true in general.

Based on the importance that Obstfeld and Rogoff (2000) have given to transaction costs, one would anticipate that decline in these costs would have fostered international tradability of both financial and real assets substantially and helped creating an environment where investors hold portfolios that are potentially more identical across countries. However, taking into account these costs does not seem very powerful in explaining the home equity bias puzzle. The argument of low importance of trading costs in Tesar and Werner (1992) is built on the observation that the volumes of cross-border capital flows and the turnover rate on foreign equity investment relative to domestic equity markets are high as compared to domestic equity market. Therefore in this study the home bias of equity cannot be explained with transaction costs associated with trading and incomplete information. However, the panel in this study consists only of five OECD countries, where transactions costs are expectedly lower than in other economies and may not provide sufficient heterogeneity. Therefore this study has given raise to a number of studies. Warnock (2001) uses data from a comprehensive survey on 41 countries and rejects the argument that the turnover of international equity transactions is high. Turnover is overestimated in Tesar and Werner (1992) because cross-border equity positions are underestimated. The results nevertheless confirm that transaction costs do not help directly explaining the home bias puzzle but this does not exclude an indirect relationship. Rowland (1999) employs an intertemporal portfolio-choice model and obtains that the rate of portfolio diversification decreases if proportional transaction costs increase. The claim is that international turnover rate is higher because average holdings are small. If the fraction of international assets in portfolios increases it is natural to expect higher international asset turnover. Portes and Rey (2000) conduct an empirical analysis and find that market size, openness, efficiency of transactions, and distance can explain a significant part of cross-border equity flows. Several other authors have also recently documented the importance of information frictions[3]. Even if transaction costs associated with trading do not explain much of the puzzle, there is no reason to underemphasize the importance of transaction costs in a broader sense. Sorensen et al (2005) build an empirical connection between risk sharing and equity home bias. They relate the measure of risk sharing to the measure of equity home bias and obtain that those countries where home bias is smaller do better in terms of risk sharing.

One can look at the issue of portfolio diversification in a wider perspective. This is done in Baxter and Jermann (1995) who do not consider only financial wealth but also non-traded human wealth. That is why they include human capital in their two-country, one-good model. As returns to human capital are highly correlated with the returns to domestic marketable assets, we should see country portfolios that contain drastically more foreign assets than observed. As labour income risk is non-diversifiable, the portfolios should be short in domestic assets. Therefore the home equity bias puzzle is worse than has been thought. Equity home bias is also documented in Bottazzi et al (1996), where the presence of human capital has been given central importance. It is empirically tested in a continued-time VAR model of international portfolio choice and the average bias towards domestic assets is between 30…35% of the portfolio. This paper

[3] Li et al (2004), Daude & Fratzscher (2006), Berkel (2004) and others

also recognizes that including non-traded assets makes the discrepancy between theory and empirical findings worse. Heathcote and Perri (2004) employ a two-country, two-goods model with non-diversifiable labour and investment. The key difference as compared to Baxter and Jermann (1995) is that imperfect substitutability between traded goods is allowed. The equilibrium portfolio composition in this setting depends on the relative preference in consumption for domestically produced versus imported goods and on capital's share in production. Their main finding is that terms of trade movements provide insurance against country specific shocks and labour income risk, which can explain the low level of international diversification. In other words the existence of a terms of trade channel substantially lowers the need to diversify portfolios with the help of foreign assets. Therefore, contrary to previous findings, the international diversification puzzle would be less acute.

Looking at the share of foreign assets in country portfolios that numerous studies have done is obviously important. However, this is not sufficient to answer the question about diversification. The composition of foreign assets and in particular the revenues that these assets produce rather than the level itself may provide extra insight into the level of diversification. That is why this paper takes a closer look at the asset returns. The issue of changing asset returns has been included together with investment risk in the small open economy model of Kraay and Ventura (2002). The transitory income shock may have multiple implications at the level and the share of foreign assets in country portfolios in this framework. I will discuss these implications in more details towards the end of this section.

When it comes to empirical results in general, perhaps two main conclusions in the literature can be stressed. The first one is that the vision of full risk sharing is clearly not shared and the consensus view is that the overall level of risk sharing is relatively low. My findings confirm this conclusion. The second one is that home bias in bond and equity holdings has declined and risk sharing increased over time.[4]

In the remaining of this section I introduce a simple analytical approach to measure how the factor income channel functions. This approach allows considering how both the average unit and the marginal unit of the portfolio are diversified. In addition I describe the approach of Asdrubali et al (1996), which measures risk-sharing through a number of channels. A crucial difference between these two approaches is that factor inflows are separated from outflows in my approach but Asdrubali et al (1996) is based on net flows. The reason why I say it is crucial is explained with the help of Kraay and Ventura (2002) in the ending part of this section.

1.2.1 Measuring portfolio diversification: from total ("average") and marginal portfolio holdings

The net foreign asset position (*NFA*) of country *X* can be defined as a difference between capital (*K*) of country *X* owned by residents in the rest of the world and capital from the rest of the world owned by country *X*:

$$NFA_X = K_X^{ROW} - K_{ROW}^X \quad (1)$$

The net factor income (*NFI*), a component of the current account, links domestic and national output and for the sake of simplicity as capital gains and losses are neglected let the difference between return from capital of country *X* abroad and return of capital from the rest of the world in country *X* be defined:

[4] See for example Mann and Meade (2002), Kho at al (2006), Lieven et al (2007), Foad (2006) and others

$$NFI_X = r_{ROW} K_X^{ROW} - r_X K_{ROW}^X \tag{2}$$

Let the part of gross domestic product that is produced by domestic assets be defined:

$$Y_X = r_X * K_X^X + w_X L_X^X \tag{3}$$

Gross domestic product (*GDP*) can accordingly be divided into domestically and foreign owned product:

$$GDP_X = Y_X + r_X K_{ROW}^X \tag{4}$$

Gross national product (*GNP*) can also be divided in the same way into home and foreign produced product:

$$GNP_X = Y_X + r_{ROW} K_X^{ROW} \tag{5}$$

The well-known identity that bridges gross domestic product and gross national product of a country *X* is therefore the following:

$$GNP_X = GDP_X + NFI_X \tag{6}$$

Empirical application of this framework relies on correlation analysis to find out how the two components of the gross national product in equation (5) are complementing each other. The desirable situation is to achieve as low a covariance as possible between the two components of gross domestic product, those produced by domestic and foreign assets:

$$\text{var}(GNP_X) = \text{var}(Y_X) + \text{var}(r_{ROW} K_X^{ROW}) + 2\,\text{cov}(Y_X, r_{ROW} K_X^{ROW}) \tag{7}$$

The sign of correlation of the last term of equation (7) is estimated in the empirical part. Substituting domestic production with equation (3) allows decomposing the gross national product even further:

$$\begin{aligned} \text{var}(GNP_X) = \quad & \text{var}(r_X * K_X^X) + \text{var}(w_X L_X^X) + \text{var}(r_{ROW} K_X^{ROW}) + \\ & + 2\,\text{cov}(r_X * K_X^X, r_{ROW} K_X^{ROW}) + 2\,\text{cov}(w_X L_X^X, r_{ROW} K_X^{ROW}) \end{aligned}$$

According to this equation, the covariance structure between domestic capital income and foreign capital income on one hand and between domestic labour income and foreign capital income on the other hand is what matters. The covariance terms are potentially able to undo high variances of domestic production and capital income inflow from abroad.

The net factor income line in the balance of payments statistics, however, covers also cross border labour income movements:

$$GNP_X = Y_X + w_{ROW} L_{ROW}^X + r_{ROW} K_X^{ROW} \tag{8}$$

$w_{ROW} L_{ROW}^X$ denotes labour income that is earned abroad but repatriated thereafter. In this case the covariance structure not only between capital income inflow and domestic production but also between labour income inflow and domestic production matters:

$$\begin{aligned}\text{var}(GNP_X) = \quad & \text{var}(Y_X) + \text{var}(r_{ROW} K_X^{ROW}) + \text{var}(w_{ROW} L_{ROW}^X) + \\ & + 2\,\text{cov}(Y_X, r_{ROW} K_X^{ROW}) + 2\,\text{cov}(Y_X, w_{ROW} L_{ROW}^X)\end{aligned} \tag{9}$$

When I talk about measuring portfolio diversification of a country from average portfolio holding, I mean correlations for the two last terms in equation (9). I have estimated a number of correlation coefficients for various income account components in the empirical section of the paper.

Equation (8) can be rewritten also in changes and after applying the variance operator, the following is obtained:

$$\begin{aligned}\text{var}(\Delta GNP_X) = \quad & \text{var}(\Delta Y_X) + \text{var}(\Delta(r_{ROW} K_X^{ROW})) + \text{var}(\Delta(w_{ROW} L_{ROW}^X)) + \\ & + 2\,\text{cov}(\Delta Y_X, \Delta(r_{ROW} K_X^{ROW})) + 2\,\text{cov}(\Delta Y_X, \Delta(w_{ROW} L_{ROW}^X))\end{aligned} \tag{10}$$

When I talk about measuring portfolio diversification of a country from marginal portfolio holding, I mean correlations for the two last terms in equation (10). In the empirical section I provide correlation coefficients for these terms as well. In the remaining of this paper I refer to the equations (9) and (10) as the first approach. In the next subsection I review the approach proposed by Asdrubali et al. (1996), which can be interpreted as measuring diversification also from marginal portfolio holdings. It measures risk-sharing that various channels provide in protecting consumption from shocks to production and income. I call it hereafter the second approach.

1.2.2 Measuring risk-sharing from marginal portfolio holding

The analytical accounting framework that I review below is introduced in Asdrubali et al. (1996). It allows quantifying the amount of risk-sharing through a number of channels and providing estimates which percentage of shocks is smoothed by each channel. The reason why it can be considered as measuring diversification form marginal portfolio holding is that it relies on percentage changes in GDP and net factor income, similarly to equation (10), which relies on absolute changes. The construction of this framework starts from the following identity:

$$GDP_X = \frac{GDP_X}{GNP_X}\frac{GNP_X}{DI_X}\frac{DI_X}{C_X}C_X \tag{11}$$

DI_X and C_X are disposable income and consumption of country X respectively. After taking logs, differences, multiplying both sides by $\Delta \log GDP_X$ and applying the expectations operator, one obtains

$$\begin{aligned}\text{var}(\Delta \log GDP_X) = \quad & \text{cov}(\Delta \log GDP_X, \Delta \log GDP_X - \Delta \log GNP_X) + \\ & + \text{cov}(\Delta \log GDP_X, \Delta \log GNP_X - \Delta \log DI_X) + \\ & + \text{cov}(\Delta \log GDP_X, \Delta \log DI_X - \Delta \log C_X) + \\ & + \text{cov}(\Delta \log GDP_X, \Delta \log C_X)\end{aligned} \tag{12}$$

By dividing both sides by $\text{var}(\Delta \log GDP_X)$, one obtains the ordinary least squares slope estimates, which sum up to unity. These slope estimates can be interpreted as the incremental percentage amount of smoothing achieved through various channels and the last one refers to the proportion that is left unsmoothed.

The central concern in this paper is the extent to what the *NFI* channel cushions gross national product against fluctuations in gross domestic product. In the framework of Asdrubali et al (1996) this is described by the size of β_2 in the following equation:

$$\Delta \log GDP_X - \Delta \log GNP_X = \beta_1 + \beta_2 \Delta \log GDP_X + \varepsilon_X \tag{13}$$

The empirical part estimates equation (13). This equation can be rewritten as:

$$\Delta \log NFI_X \frac{NFI_X}{GDP_X} = \beta_1 + \beta_2 \Delta \log GDP_X + \varepsilon_X$$

where levels are measured at period *t* while difference operator denotes change from *t* to *t+1*. The slope estimate β_2 measures the diversification that the NFI channel provides. β_2 close to zero means that there is no co-movement between gross domestic product growth and change in net factor income. Therefore all shocks to GDP are fully transferred to gross national product. Positive β_2 means that the net factor income channel absorbs some of the variation in GDP. Negative β_2 is the worst case: shocks to GDP are amplified and the variance of GNP is higher.

1.2.3 Extensions of the 'risk-sharing' approach

The discussion of risk sharing and income smoothing was taken to the data by Sala-i-Martin and Sachs (1991) whose central question was the extent of insurance by federal government against regional income shocks in the U.S. member states. They estimate the elasticity of taxes and transfers with respect to disposable income and find that a one dollar reduction in a region's per capita personal income triggers a decrease in federal taxes about 34 cents and an increase in federal transfers of about 6 cents.

In this subsection the empirical studies that stem from Sala-i-Martin and Sachs (1992) (also from von Hagen (1991)) are reviewed into two broad categories: frameworks that consider either static or dynamic risk sharing. The papers in the first category can also be spitted into two groups: those that contain either one or several smoothing channels. My focus will be mostly on the net factor income channel. One commonality that all the papers in both categories share is that they are all applied on developed countries. That is the reason why the pool of countries in this paper is enlarged to include emerging and low-income countries as well.

The first category contains those studies in which risk-sharing is static, i.e. mostly contemporaneous relationship is in the centre of interest. Perhaps the two most referred sources are Asdrubali et al. (1996) that was introduced above and Sørensen & Yosha (1998) in which the measurement framework of Sala-i-Martin and Sachs (1992) is extended to allow the presence of several consumption smoothing channels. The estimates have been conducted either at the international or intranational level - Asdrubali et al. (1996) consider the U.S. states, Sørensen & Yosha (1998) the OECD and 8 European Union countries, Lane (2001) 21 developed economies, Becker and Hoffmann (2003) the U.S. member states, Kalemli-Ozcan et al. (2000) European Union countries.

The discussion in Asdrubali et al. (1996) and its successors classifies the NFI channel usually as the capital market income smoothing channel (or insurance channel), which is used for ex ante risk sharing. The credit market smoothing channel, as opposed to capital market channel, is used for ex post risk sharing. Following such a distinction, I would like to see the net foreign asset and liabilities positions to be decomposed so that the role of credit instruments contributing to net factor income becomes more visible. However, this is not done in any of these studies likely due to difficulties in data availability.

The results in Asdrubali et al. (1996) show that income smoothing across US States is mostly done with the help of capital markets rather than via transfers from the Federal government as suggested by Sala-i-Martin and Sachs (1991). Sørensen & Yosha (1998) show that in European countries it is vice versa, i.e., mostly savings are used to smooth consumption. Furthermore, the part that is left unsmoothed in Europe is substantially higher than in the U.S. The main conclusion growing out of this literature is nevertheless that consumption is not well protected against fluctuations in GDP. Among the other channels, the net income flow channel works poorly as well, and shocks to output are transferred to a large extent to income. The income smoothing via net factor income channel is negligible when panels consist of different countries. Only those panels, which consist of the U.S. states, find a significant role for this channel. The cases when results refer even to dis-smoothing are not rare.

Lane (2001) concentrates only on one channel – income-smoothing via international investment income. His empirical conclusion does not differ from the preceding results – net income flow channel provides almost no protection. Mélitz and Zumer (2001) evaluate the role of regional redistribution and stabilization, i.e. two channels that are present in Asdrubali et al. (1996) are in focus. They show that correcting for the autonomous (intraregional) smoothing of idiosyncratic regional shocks leads to underestimation of the credit channel as compared to the insurance channel. There are also other extensions to the methodology of Asdrubali et al. (1996). Obstfeld and Peri (1999) consider -- in the discussion of feasibility of European Monetary Union -- the stabilization and redistributive role of fiscal transfers. They apply a bivariate VAR in which endogenous variables are defined as regional data relative to national data in order to distinguish long-run redistribution and stabilization.

The dynamic counterpart to Asdrubali et al (1996), where different risk-sharing channels work with different time lags, is developed in Asdrubali & Kim (2004). The dynamic framework allows investigating the substitutability and/or complementarity of different channels. Estimations at quarterly frequency of a structural VAR model show that domestic channels together with trade balance channels play an important role in consumption smoothing. In Asdrubali & Kim (2004) domestic channels mean fixed investments, inventories, and government expenses. The dynamic framework delivers that the trade channel is the main smoothing channel in the short run but not in the long run. It is also concluded that risk sharing increases over time. Asdrubali & Kim (2005) have investigated dynamic smoothing effects in open economies via three channels: gross fixed investment, inventories, and trade balance. The results again question the results of static analysis because the trade balance channel appears to be substantially more important than previously thought.

1.2.4 Other extensions

Things are more complicated in reality than the net foreign asset formula (1) shows and there are shortcomings that both approaches are suffering from. One of the shortcomings is related to capital gains, which are neglected in both frameworks. In the terminology of Lane (2001), only ‘passive income smoothing’, i.e. only the yield as one part of overall rate of return, is considered and capital gains/losses are excluded. International capital flows, however, may not seek revenue only in the form of income but in the form of capital gains as well.

From the theoretical perspective things are always simpler if one assumes capital stock to be fixed. But it is not in reality and all four variables on the right hand side of the net foreign asset identity (2) may simultaneously change. A country can choose directly only one variable in the NFI channel – domestic capital, K_X^{ROW}, that is invested

abroad. The next paragraph sheds some light on how ample in implications the adjustment in this capital stock might be.

Agents can always make adjustments in the level of foreign asset holdings in order to soften the impact of any shock. This paragraph discusses among other things a special case when both approaches to measure portfolio diversification deliver the same result, i.e., the average unit of portfolio and marginal unit of portfolio are invested in the same way. The adjustment is not a trivial problem since Kraay and Ventura (2002) who consider the case of a transitory income shock and show that the spectrum of current account implications varies depending on the level of investment risk and the extent of diminishing returns. A traditional understanding outgrowing from traditional intertemporal current account models is that the incremental unit of wealth is invested in foreign assets. Ventura and Kraay (2002) call it a traditional rule and claim that this view is not necessarily a correct one. In their model such a response is a special case referring to the situation where diminishing returns are strong and investment risk is low. Investors prefer foreign assets if domestic assets face strong diminishing returns and foreign investment risk is not high. However, if diminishing returns are not an issue, why not invest at least a part of positive income shock domestically? Furthermore, if investment risk is high then investors will not want to shift their portfolios towards any single asset and will prefer the same composition of foreign and domestic assets as in current portfolios. This assumption generates a new rule according to which investors allocate one fraction of the income shock abroad and the remaining fraction at home so that the composition of the portfolio does not change. As a result, the post-shock dynamics of current account (net foreign asset position) may differ for debtor and creditor countries if diminishing returns are weak and investment risk is high. This is because in negative NFA countries capital exceeds wealth. If one wants to keep the composition of foreign and domestic assets in the country portfolio fixed, a unit increase in wealth results in a greater increase of foreign borrowing and the NFA position deteriorates even further. The mechanism works exactly the other way around for positive NFA countries. Kraay and Ventura (2002) test the new rule empirically and find that investors indeed seem to allocate income in the same proportion as the average unit of wealth. The main implication of Kraay and Ventura (2002) to my exercise is that if the preconditions of the new rule are met the marginal unit and the average unit of portfolio are invested in the same way. In other words, I should obtain the same results of measuring portfolio diversification from average and marginal portfolio holding. But I do not.

In the environment where transitory income shocks are dominant, the preceding has another implication to the approach, which is based on net factor income flows – due to asymmetries in the response of NFI the creditor and debtor countries must be considered separately. According to Kraay and Ventura (2002), if a creditor and a debtor country both experience a transitory income shock, the former will experience deterioration in the NFI while the latter an improvement, although both countries choose the composition of assets that is optimal to them. In this case risk-sharing measured from NFI would predict that the creditor country dis-smoothes its income while the debtor country, on contrary, smoothes it.

1.3 The data

The empirical part relies on data that are mostly taken from the IMF International Financial Statistics (IFS) and Balance of Payments (BOP) databases. For some countries the data are also collected from their statistical offices and in case of several developed economies Eurostat databases are used for obtaining national account estimates. In addition, the estimates of net foreign asset positions are taken from the EWNII database referred in Lane & Milesi-Ferretti (2006). There are some differences between the IFS

international investment position data and EWNII net foreign asset position estimates which are minor in the majority of cases but as the EWNII is more complete the data from the latter are used. The sample period covers years from 1995 to 2004 and there are altogether 95 countries included (See table 19). Countries are divided into five subgroups: African, Central and Eastern European (CEEC), Former Soviet Union (FSU), Non-Japan Asian (NJA) and developed countries. There is some overlap between these groups because, for example, some Central and Eastern European countries are also former Soviet Union countries. In order to make incomes of various countries comparable, all values are converted into current US dollars and are expressed in per capita terms.

An additional breakdown is made between countries with positive and negative international investment position. The reason of doing so has been discussed above. The majority of countries in the sample have negative net foreign asset positions. Hong-Kong has had the highest net foreign asset position among countries exceeding GDP almost twice (2.61) in 2004 while Angola has had the lowest net foreign asset position (-1.74 GDPs) in 1998. (See table 1). As expected, there are more high-income than low-income countries among positive net foreign asset countries. This refers to the direction of saving flows and is consistent with neoclassical theory. Countries nevertheless switch sometimes the sign of their net foreign asset position during the sample period. For example, Ireland is a negative net foreign asset country from 1995 to 1996 and from 2000 to 2004 but a positive net foreign asset country between these periods. In this case observations are split.

The comparison of net asset stock and factor income flow variables by country groups provides some insight into the extent of real and financial integration (see tables 1 to 3). Developed countries have the highest average net foreign asset position while African countries have the lowest. Consequently developed countries outperform other country groups when it comes to returns as a ratio of GDP for assets and liabilities. For all country groups the average return from liabilities exceeds surprisingly the average return from assets. The CEE and FSU countries have one of the lowest relative returns amounting to a few percentage points of GDP.

However, NFI is the sum of factor outflow and inflow and it is usually a tiny fraction of GDP (less than a half percentage point of GDP on average, see table 8) and therefore GDP and GNP are highly correlated (0.999, see table 9). Therefore it is more appropriate to look at outflow and inflow separately (see tables 4-7). Both outflow and inflow form a substantially larger part of GDP – more than 5%.

1.4 Empirical evidence

The question about winners and losers in the process of financial and trade integration is purely an empirical issue. Both accounting approaches described in the previous section are thus taken to the data. The empirical part estimates correlation coefficients for the last terms in equation (9) and (10) in the first approach but I provide also the results for the second approach of Asdrubali et al (1996) described by equation (13). The two ways to measure portfolio holding -- total and marginal -- are complementary and the results do not strictly contradict although the first approach provides a somewhat clearer set of conclusions and allows making preliminary conjectures on winners and losers given the level of integration.

In the empirical exercise creditor and debtor countries are considered separately. There is a theoretical but also an empirical reason for that. The theoretical reason was discussed in details before and stems from Kraay & Ventura (2002), who claim that investors allocate the savings from favourable income shock depending on the extent of diminishing returns and risk level. Another argument, which requires the separation of creditor and debtor countries in both approaches stems from empirical considerations that

positive NFA countries may use the advantage of being capital owners and invest abroad, thus diversifying their own portfolios but not necessarily the portfolios of debtor countries. Empirical evidence provides some support for this hypothesis and it will be discussed below. The argument that ownership may give an advantage while making allocation decisions can theoretically be applied also to the human capital but there will be difficulties when one has to measure the foreign asset and liability positions. A more pragmatic way to think about this idea is whether employees are free to choose between working at home and host country. There are substantial restrictions on international labour movement as compared to international capital movement. It is also likely that geographical and cultural distances matter substantially more as compared to financial capital markets. Therefore motivating cross-border employee movements based purely on portfolio returns is more dubious.

In the first approach the exposure to shocks depends on how domestic and foreign components of gross national product complement each other. Negative correlation is preferable for diversification and it is achieved if a shock to one component is compensated by the other component in a way that reduces aggregate income fluctuations. In accounting terms correlation between incomes from domestic assets, i.e. gross domestic product minus factor outflow, and foreign assets, i.e. factor inflow, is considered. (See table 9.) My empirical strategy is to estimate firstly pooled correlation coefficients between returns from domestic and foreign assets for both debtor and creditor countries, also for country groups, and secondly to condition these coefficients on the change in net factor inflow. The aim of the second step is to test whether countries are better protected against positive or negative net factor inflow shocks. It is always assumed that gross domestic production is homogenous, which means full correlation between $r_X * K^X_{ROW}$ and the rest of domestic production Y_X. This is a strong assumption, which will be discussed later. All empirical results are collected in tables 10-12. [5]

1.4.1 Results

Findings from the first approach: total portfolio holding

1. The first framework delivers the conclusion that engaging in cross-border ownership of financial and real assets is useful for countries as it diversifies their portfolios. However, the correlation coefficient for returns from domestic and foreign assets is 0.536 suggesting that countries could do much better. Diversification at the world level is still achieved due to industrial economies, whose correlation coefficient drives the correlation coefficient for the world economy downward. This could be due to the differences in the level of financial integration and the structure of portfolio or in the nature of shocks.
2. Splitting the sample into creditor and debtor countries gives correlations that are substantially different: 0.623 and 0.293 for negative and positive net foreign asset countries respectively. In other words, in those countries where foreign liabilities exceed foreign assets, returns from foreign asset holdings are more correlated with domestic output. Positive net foreign asset countries, on the other hand, have used the net factor inflow channel more efficiently achieving income flows that are better diversified. This is an indication that creditor countries are taking the advantage of being capital owners and consequently capital flies into those

[5] The first framework suffers from an outlier in the group of the developed countries that has a substantial effect on the results even at the world level. Namely, Luxemburg has returns from foreign liabilities that highly exceed GDP and drive correlation coefficients to the negative side. The extent of this impact is documented in table 16. As a result, the calculations in the first framework exclude Luxemburg while I include it in the second approach. Excluding Luxemburg in the second approach has negligible effect on the results.

countries, which diversify the portfolios of creditor countries. This is efficient from the creditor country perspective but not necessarily from the global perspective. A question about more far-reaching effects is whether these symptoms refer to an obstacle in income level convergence in the long-term.

3. Disaggregating by country groups is more promising as it brings about more heterogeneity. Expectedly the group of developed economies uses the *NFI* channel more effectively than the remaining country groups. Furthermore, the developed economies with a positive net foreign asset position outperform the developed negative net foreign asset position economies in terms of correlation coefficients, which are 0,130 and 0,285 respectively. Including Luxemburg, the same estimates are –0,958 and 0,285 respectively. (See table 17.) The conclusion that creditor countries hold portfolios that are better insured against income fluctuations holds. Given the fact that developed economies have more advanced financial systems, higher level of trade integration, increasing vertical and horizontal in- and outsourcing, higher level of asset diversification is a natural consequence. It is likely that many developed economies have been relatively open for quite a long time and this has provided more opportunities to engage in income smoothing via international markets.
4. Many developing economies, on the other hand, perform like the Chilean model economy with almost no insurance. Leaving the group of developed countries aside, the rest of the country groups consist mostly of developing countries where returns from foreign assets are substantially lower in terms of ratio to GDP and rather highly correlated to returns from domestic assets. The CEE countries have the highest correlation coefficient 0.876. This region is dependent on foreign capital and has experienced intensive capital inflows and therefore foreign liabilities have increased throughout the sample period. This tendency can be explained with the transition of the CEE countries from undercapitalized planned economy to a full-fledged market economy. At the same time the level of foreign assets has been growing slowly. Therefore the number of observations with positive net foreign asset position is fairly small for this region. African countries are also mostly negative net foreign asset position countries and have achieved very little benefits from international insurance opportunities. The correlation between returns from domestic and foreign assets is 0.777 and 0.816 for negative and positive net foreign asset countries respectively. For the latter, the number of observations is smaller and therefore the estimate is likely less reliable. There is also an outlier – South Africa – that substantially increases the correlation for negative net foreign asset position countries with its higher income level. Without South Africa the correlation coefficient is surprisingly low – only 0.347. African countries, in general, are less diverse economies and many of them depend on extractive industries, mineral and oil exports. Such dependence may provide insurance opportunities, which vary over the world business cycle that determines demand for commodities. Low correlation coefficients could potentially mean that the domestic part of the economy is rather closed. The FSU region is in the same way underinsured like the other low-income or developing countries with high correlation coefficients. The Non-Japan Asian countries group is more heterogeneous – it includes relatively high-income countries like Korea, middle-income countries like Malaysia, Thailand and low-income countries like Bangladesh, India and Cambodia among the negative net foreign asset position countries. For this group the correlation coefficient is high – 0,719 (without Korea 0,791). There are only two countries – Singapore and Hong-Kong – among the positive net foreign asset position countries and therefore their negative correlation coefficient is not reliable but it is nevertheless reported.

5. Separating various flows of the credit entry of the factor income account does not provide further significant insights: compensation of employees, revenues from FDI or portfolio assets provide similar income smoothing opportunities: correlation coefficients range between 0.425 and 0.522. Positive NFA countries have diversified their income sources more effectively, which becomes especially apparent in case of portfolio investment. However, repeating the same exercise with workers' remittances of the transfers account delivers that remittances provide a better insurance against domestic production shocks: correlation coefficient is -0.075 for the whole world and -0.281 for the positive NFA countries. This infers that either migration or the amount of remittance depend on the state of the business cycle. Similar finding is documented in Hadzi-Vaskov (2006).

Findings from the first approach: marginal portfolio holding

1. Estimating diversification from marginal portfolio holding shows that countries are performing better in diversifying the marginal unit than the average unit of their portfolios: the correlation coefficient for the whole world is 0, for the negative NFA countries it is 0.201 and for the positive NFA countries -0.16. See table 10.b. Developing countries again clearly outperform the other country groups.
2. Disaggregating the income account into components shows that countries succeed in allocating their marginal units of portfolio in the most efficient way in case of portfolio investment for which the correlation coefficient is the lowest: -0.071. (See table 10.d.) Positive NFA countries are more successful in doing this as compared to negative NFA countries: the correlation coefficients are -0.236 versus 0.107 respectively. A regional insight into these results shows that the portfolio investment of the Non-Japan Asian countries are smoothing their income flows even better than in the developed countries. On the other hand, the marginal profit receipts from FDI investment are also providing protection against fluctuations in marginal income: the correlation coefficients are close to 0.

Findings from the second approach: marginal portfolio holding

1. Overall, the results from the second approach are less conclusive than from the first one.
2. The main empirical finding from the second approach is unexpectedly that countries invest the marginal unit of their portfolios so that national income becomes more volatile than domestic output. It means that factor income channel does not provide insurance and no benefits arise from risk sharing. The empirical strategy is to use the same panel of countries as in the previous approach to estimate equation (13). Cross-section weights are used to correct the error structure of the generalized least squares. The left hand side of formula (13) is the growth rate of NFI from period t to $t+1$ weighted by the share of NFI in GDP at period t, i.e. the contribution of NFI growth to GDP growth. It is regressed on the growth rate of GDP. The coefficient describes the incremental percentage amount of smoothing achieved at each level but it says nothing about percentage amount of smoothing achieved at each level on average. The point estimate of $ß_2$ is -0.024 and it is statistically highly significant (t-statistic -5.1). (See table 11.a.) This result raises a question why countries engage in cross-border ownership at all. The stationarity tests for the endogenous variable clearly rejecting the presence of the unit root are reported in table 18.
3. One explanation to the previous finding is that risk sharing takes place within a longer time horizon than one year that is implicitly assumed in the framework.

Therefore I have estimated the lagged version of equation (13) as well. (See table 11.b and 11.c) It is indeed the case that more risk-sharing is obtained (except or developed countries, which are involved in contemporaneous portfolio diversification) when changes in factor income are compared against changes in GDP of the previous year. However, according to table 11.c. it is unlikely that it takes three years to compose portfolios that allow gross-national income smoothing.

4. Disaggregating into debtor and creditor countries does not find empirical justification in the variance decomposition framework, which is in contrast to the first approach. Both country groups perform badly having negative point estimates, which refers to dis-smoothing. The point estimate is more negative for creditor countries but it is surrounded by wider confidence bounds. This result is somewhat surprising given the conclusion from the correlation analysis in the first approach that creditor countries should have an advantage. On the other hand, table 11.a. showed that creditor countries have fewer opportunities for risk sharing than debtor countries and therefore protection against common shocks cannot be achieved.
5. Disaggregating by country groups delivers similar results to the first framework. Although industrial countries do not achieve substantial smoothing (the point estimate is close to 0), they do better in diversifying the marginal unit of their portfolios than other countries. African countries, especially positive NFA countries, experience considerable dis-smoothing, which is not entirely consistent with the results from correlation analysis. The parameter estimates (with t-statistic) are -0.020 (-11.1) and -0.023 (-2.1) for negative and positive NFA countries respectively. The other country groups containing emerging and low-income economies, except for CEE countries, are also not able to smooth shocks via international capital market channel. That is why their returns from foreign assets are highly correlated to returns from domestic assets as the first approach evidenced.

Economies are faced with various types of shocks and respond to them differently. This paragraph presents the results from the analysis where observations when NFI has been falling are separated from observations when NFI has been growing. This is done, analogously to the previous analysis, for both positive and negative NFA countries. Tables 12 and 12.a. present the results for both approaches. Surprisingly the number of yearly observations when NFI has been falling is twice higher for the first framework and even four times higher for the second framework. One could interpret that for negative (positive) NFA countries decrease (increase) in NFI refers to a good state that has realized and increase (decrease) to a bad state. Another finding is that correlation coefficients are smaller for those observations for which net factor inflow has been falling irrespective of whether the country is a creditor or a debtor. In other words the correlation between returns from foreign assets and domestic assets is stronger in those years when net factor inflows increase. The second approach points also to higher (and statistically significant) dis-smoothing in those years when NFI is increasing. This effect is more substantial for positive NFA countries, which is perhaps an indication of a common shock that cannot be diversified.

1.4.2. Interpreting the findings: the structure of asset and liability positions

The aim of this subsection is to compare the stock of outstanding assets and liabilities and its structure across the same country groups as in the preceding section and to look for explanations to the features that the current paper highlights, i.e., to draw some conclusions for the ability to smooth shocks and diversify portfolios. The main question

that this part tackles is: what are the differences in the stock of outstanding assets/liabilities and in its structure between developed countries, which proved to be more successful in their portfolio management, and the rest of country groups. The separation between positive and negative NFA countries is also maintained. While both currency structure and instrument structure of foreign assets and liabilities have implications on the returns, I have considered only the latter. The results are collected in tables 13 to 15.

From the risk-sharing point of view the question is not only why capital flows into low-income countries have been modest but also why low-income countries have not invested sufficiently abroad. There is no unique answer to the question what stops low-income and emerging economies from enriching their domestic assets with investments into foreign assets. Poorer countries have fewer opportunities to invest abroad because their savings are often insufficient to cover even domestic investment needs and there are also fewer incentives because domestic returns are likely higher. Low-income countries have also been often constrained by limited access to foreign savings because lacking key social, political, and economic infrastructure, a traditional argument in the literature of economic growth, and restrictions on cross-border capital flows. Insufficient institutional capabilities may have substantially stronger impact on the functioning of the financial markets and on the formation of country portfolios than country-specific production shocks. Therefore the ability to compose diversified portfolios has likely to be explained also with the tools of growth and development economics.

What drives the level of foreign assets and liabilities? Lane and Milesi-Ferretti (2001) have found that a small number of fundamentals including shifts in relative output levels, the stock of public debt and demographic factors can explain a substantial part of the evolution of net foreign asset positions. They claim also that another difference between industrial countries and emerging economies is in the currency structure of liabilities, which are denominated in its own currency in industrial countries, whereas a typical emerging market economy exhibits significant liability dollarization. Portes & Rey (1999) provide evidence that gross asset flows depend on market size in both source and destination country and trading costs.

There is no doubt about that given the differences in incomes, higher level of capital flows should have been observed. The level of international financial integration varies significantly across countries according to table 13. It shows that total assets of positive NFA countries exceed GDP almost by three (2.882) times while liabilities exceed GDP by two and half times (2.348). The same ratios for negative NFA countries are 0.6 and 1.067 respectively. The panel of 95 countries is on average a net borrower whose total assets amount almost to the size of one (0.985) GDP while liabilities exceed GDP by more than a quarter (1.277). The group of developed countries outstands clearly among the other country groups in terms of international financial integration and, as the previous section showed, they clearly outperform developing countries in terms of diversification between returns from domestic and foreign assets and in terms of protecting income from shocks to output. One can conclude that those countries, which are financially more integrated with the rest of the world, have acquired more diversified portfolios and they are also more efficient in protecting their income against output shocks.

When it comes to the structure of foreign assets and liabilities, more than 60% of the external position is debt on both the liability and asset side[6] for the whole sample. (See table 14.) The percentage structure of assets does not differ substantially for debtor and creditor countries. The same can be said about the liability side. The portfolio equity assets (liabilities) form around a tenth of total assets (liabilities). Slightly less than 15%

[6] The dominance of debt instruments in the external position poses a question why net factor income channel (also called as capital market channel) is often opposed to credit market channel in the variance decomposition literature.

of total assets are FDI assets and around a quarter of liabilities are FDI liabilities. Financial derivatives have minor importance. Therefore in relative terms the structure of assets and liabilities is rather similar. When it comes to (negative) net external position in absolute terms (or relative to GDP), the main contributors are debt instruments and foreign direct investment. (See table 13.) Why positive NFA countries are able to diversify their portfolios better? It is likely related to the fact that creditor countries have ca. 5 times more both FDI and portfolio equity assets and ca. 6 times more debt assets than debtor countries. On the liability side they have only twice more FDI, portfolio equity and debt liabilities than debtor countries. The ability to design well-diversified portfolios is more evident in case of developed creditor countries where correlation between returns from domestic and foreign assets is 0.13. (See table 11.) These economies have significantly higher portfolio equity, FDI and debt assets while the proportion of liabilities is almost similar to debtor industrial countries. The share of debt assets in creditor industrial countries is even twice higher than in debtor countries.

Overall, although debt is a dominant instrument of foreign financing it is nevertheless difficult to relate the ability to smooth national income flow to this financing instrument in the external position. Another aspect is the term structure of debt because revenue rates of short- and long-term debt need not be necessarily the same. It is likely that low-income and emerging countries have relatively more short-term debt than industrial countries. Therefore a close look to the time structure issue is warranted. It is also likely that some financial instruments give better access to technology transfer, which determines growth performance in the longer run. For example FDI flows may contain more technology than debt flows but it is unlikely that FDI flows are used for ex post income smoothing. Debt flows, on contrary, work more efficiently to do ex post income smoothing.

This subsection can be concluded that the extent of countries' external financial integration is potentially an explanatory variable to the ability to diversify country portfolios and insure income against output shocks. Those economies, which are internationally more integrated, are clearly better positioned in terms of shock-smoothing. The composition of gross external positions, on the other hand, implies that countries' ability to diversify their portfolios is higher the higher is the share of FDI and portfolio assets.

1.5 Conclusions

This paper considers international risk sharing in country portfolios. The paper argues that one should not look only at asset positions but also at the revenues that the assets produce because neither gross nor net positions per se tell whether diversification has been achieved. Therefore the role of international investment revenues in income smoothing is in the centre of interest in this paper. There are two ways to investigate the problem: looking at the diversification of the average (total) unit and of the marginal unit of country portfolio. In addition, I present the results for the framework of Asdrubali et al (1996) to make the comparison between the results.

An overall conclusion from the empirical exercise is that domestic and foreign returns are relatively highly correlated and the level of risk sharing is rather low in the world economy. Measuring diversification from the total portfolio holding shows that domestic and foreign component of the national product are highly correlated in those countries where NFA position is negative. Industrial countries and positive NFA countries have acquired portfolios that are more diversified but even for these countries returns from foreign and domestic assets still move together. Developed countries have higher ratios of foreign assets and liabilities to GDP and that is likely the reason why they do better in international risk sharing. Measuring diversification from the marginal portfolio holding shows that countries perform better in diversifying the marginal unit than the average unit

of portfolio. Disaggregating the income account into components shows that countries succeed in allocating their portfolios in the most efficient way in case of portfolio investment and FDI.

The second approach -- the variance decomposition methodology of Asdrubali et al (1996) -- that relies on the marginal unit of portfolio delivers the conclusion that shocks to GDP are transmitted to a large extent to GNP and sometimes factor income flows even amplify these shocks. The differences between country groups are not substantial. This approach does not confirm firmly that dividing economies into debtor and creditor countries has some empirical relevance.

There are two directions that are left for future work. The first one is to abandon the homogeneity assumption of domestic production. It is natural that various sectors in an economy are not perfectly collinear: some economic sectors grow faster than the others and provide different diversification opportunities. Therefore cross border factor flows by sectors may provide extra insights. This, however, is not done because sectoral data on factor flows is not available for most of the countries. In principle one could ask whether there are sectors, which diversify country portfolios more than other sectors. This gives rise to the role of economic policy, which may give incentives to favour investing in particular sectors. Principally it is possible that Chile can design a mix of economic policy that attracts capital into sectors, which are not related to copper.

Another interesting question is whether advanced countries have diversified their portfolios at the expense of developing countries. The result that negative NFA countries perform worse than positive NFA countries is a necessary but not sufficient indication for that. Answering this question requires information on the structure of returns by country, which is also unfortunately not available.

Table 1. International investment positions across different country groups

	IIP>0	Developed	CEEC	Africa	Non-Japan Asia	FSU	IIP<0
Min	0,00	-1,65	-1,01	-1,74	-1,35	-1,32	-1,74
Max	2,61	1,29	0,13	1,06	2,61	0,12	0,00
Average	0,54	-0,11	-0,31	-0,53	-0,07	-0,48	-0,47
Observations	155	225	108	175	109	102	750

Table 2. Return from foreign assets as a ratio of GDP

	IIP>0	Developed	CEEC	Africa	Non-Japan Asia	FSU	IIP<0
Min	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Max	5,86	5,86	0,03	0,16	0,05	0,04	0,60
Average	0,28	0,24	0,01	0,01	0,01	0,01	0,01
Observations	143	221	108	157	104	104	726

Table 3. Return from foreign liabilities as a ratio of GDP[7]

	IIP>0	Developed	CEEC	Africa	Non-Japan Asia	FSU	IIP<0
Min	-2,67	-2,67	-0,10	-0,20	-0,32	-0,10	-0,43
Max	-0,01	-0,01	-0,01	0,00	0,00	0,00	0,01
Average	-0,20	-0,17	-0,04	-0,04	-0,06	-0,04	-0,05
Observations	143	221	108	157	104	104	726

Table 4. GDP less factor outflow as a ratio to GDP

	World	Developed	CEEC	Africa	Non-Japan Asia	FSU
Min	0,18	0,56	0,90	0,80	0,68	0,90
Max	1,01	0,99	0,99	1,00	1,00	1,00
Average	0,94	0,93	0,96	0,96	0,94	0,96
Median	0,96	0,95	0,97	0,97	0,96	0,97
Observations	878	211	108	157	104	104

Table 5. GDP less factor outflow as a ratio to GDP (Luxemburg included)

	World	Developed	CEEC	Africa	Non-Japan Asia	FSU
Min	-1,67	-1,67	0,90	0,80	0,68	0,90
Max	1,01	0,99	0,99	1,00	1,00	1,00
Average	0,91	0,83	0,96	0,96	0,94	0,96
Median	0,96	0,94	0,97	0,97	0,96	0,97
Observations	888	221	108	157	104	104

[7] Cyprus is the country which has the odd-looking maximum value among the IIP<0 countries.

Table 6. Factor inflow as a ratio to GDP

	World	Developed	CEEC	Africa	Non-Japan Asia	FSU
Min	0,00	0,01	0,00	0,00	0,00	0,00
Max	4,46	0,51	0,04	0,16	0,49	0,20
Average	0,06	0,07	0,02	0,02	0,06	0,03
Median	0,02	0,04	0,02	0,01	0,01	0,01
Observations	878	211	108	157	104	104

Table 7. Factor inflow as a ratio to GDP (Luxemburg included)

	World	Developed	CEEC	Africa	Non-Japan Asia	FSU
Min	-2,17	-2,17	0,00	0,00	0,00	0,00
Max	4,46	0,51	0,04	0,16	0,49	0,20
Average	0,04	-0,02	0,02	0,02	0,06	0,03
Median	0,02	0,04	0,02	0,01	0,01	0,01
Observations	888	221	108	157	104	104

Table 8. Net factor inflow as a ratio to GDP (Luxemburg included)

	World	Developed	CEEC	Africa	Non-Japan Asia	FSU
Min	-0,68	-0,24	-0,05	-0,08	-0,01	-0,05
Max	0,19	0,19	0,00	0,10	0,01	0,03
Average	-0,01	-0,01	0,00	0,00	0,00	0,00
Median	0,00	0,00	0,00	0,00	0,00	0,00
Observations	888	221	108	157	104	104

Table 9. Correlation matrix of various national accounts and their components

	GDP	GDP-outflow	GNP	Inflow	Outflow	Net flow
GDP	1	-	-	-	-	-
GDP-outflow	0,992	1	-	-	-	-
GNP	0,999	0,994	1	-	-	-
Inflow	0,441	0,536	0,627	1	-	-
Outflow	0,444	0,499	0,583	0,998	1	-
Net flow	-0,219	-0,077	-0,083	-0,285	-0,231	1

Table 10.a. Diversification of the average unit of portfolio: regional view

Country	World	Developed	CEEC	Africa	Non-Japan Asia	FSU
All						
ρ	0,536	0,313	0,876	0,662	0,807	0,799
t-stat	(18,8)	(4,8)	(18,7)	(11,0)	(13,8)	(13,4)
observations	878	211	108	157	104	104
NFA<0						
ρ	0,623	0,285	0,874	0,777	0,719	0,803
t-stat	(21,4)	(3,7)	(17,9)	(13,8)	(9,5)	(13,2)
observations	723	155	101	127	87	97
NFA>0						
ρ	0,293	0,130	-	-	-	-
t-stat	(3,6)	(1,0)	-	-	-	-
observations	138	56	-	-	-	-

Note: ρ is the cross-country correlation (between $GDP - r_X * K^X_{ROW}$ and factor inflow) coefficient for the period 1995-2004, source: Lane & Milesi-Ferretti (2006), IMF IFS). The results for less than 40 observations are not reported but are available upon request from the author.

Table 10.b. Diversification of the marginal unit of portfolio: regional view

Country	World	Developed	CEEC	Africa	Non-Japan Asia	FSU
All						
ρ	-0,002	0,026	0,502	0,461	-0,031	0,561
t-stat	(0,1)	(0,4)	(5,6)	(6,1)	(0,3)	(6,5)
observations	782	188	96	138	93	93
NFA<0						
ρ	0,201	0,158	0,505	0,384	0,473	0,612
t-stat	(5,2)	(1,8)	(5,5)	(4,4)	(4,7)	(7,0)
observations	634	133	89	112	78	84
NFA>0						
ρ	-0,160	-0,083	-	-	-	-
t-stat	(1,7)	(0,6)	-	-	-	-
observations	109	46	-	-	-	-

Note: ρ is the cross-country correlation (between $GDP - r_X * K^X_{ROW}$ and factor inflow) coefficient for the period 1995-2004, source: Lane & Milesi-Ferretti (2006), IMF IFS). The results for less than 40 observations are not reported but are available upon request from the author.

Table 10.c. Diversification of the average unit of portfolio: factor income components (labour income and profit receipts) and remittances

Country	World	NFA<0	NFA>0
Compensation of employees			
ρ	0,522	0,570	0,392
t-stat	(17,3)	(17,7)	(5,0)
observations	802	651	138
FDI1			
ρ	0,425	0,558	0,244
t-stat	(13,1)	(16,8)	(2,9)
observations	774	626	136
Portfolio investment			
ρ	0,447	0,517	0,167
t-stat	(14,5)	(16,1)	(1,8)
observations	842	715	118
FDI2			
ρ	0,468	0,574	0,334
t-stat	(14,0)	(16,5)	(4,1)
observations	697	553	134
Workers' remittances			
ρ	-0,075	-0,064	-0,281
t-stat	(-2.1)	(-1.6)	(-3.1)
observations	773	647	117

Note: ρ is the cross-country correlation (between $GDP - r_X * K^X_{ROW}$ and factor inflow) coefficient for the period 1995-2004, FDI2 denotes reinvested earnings while FDI1 the remaining profit receipts on the credit entry of foreign direct investment in the BOP. Data source: Lane & Milesi-Ferretti (2006), IMF IFS, IMF BOP).

Table 10.d. Diversification of the marginal unit of portfolio: factor income (labour income and profit receipts) components and remittances

Country	World	NFA<0	NFA>0
Compensation of employees			
ρ	0,334	0,318	0,367
t-stat	(9,4)	(7,9)	(4,1)
observations	703	558	109
FDI1			
ρ	-0,013	0,054	-0,050
t-stat	(-0.3)	(1,2)	(-0.5)
observations	673	534	107
Portfolio investment			
ρ	-0,071	0,107	-0,236
t-stat	(-1.9)	(2,7)	(-2.3)
observations	746	625	92
FDI2			
ρ	0,189	0,228	0,144
t-stat	(4,7)	(5,0)	(1,5)
observations	598	462	106
Workers' remittances			
ρ	-0,009	0,013	-0,026
t-stat	(-0.2)	(0,3)	(-0.3)
observations	678	560	93

Note: ρ is the cross-country correlation (between $GDP - r_X * K^X_{ROW}$ and factor inflow) coefficient for the period 1995-2004, FDI2 denotes reinvested earnings while FDI1 the remaining profit receipts on the credit entry of foreign direct investment in the BOP. Data source: Lane & Milesi-Ferretti (2006), IMF IFS, IMF BOP).

Table 10.e. Diversification of the average unit of portfolio: regional view by various factor income components and remittances

Country	World	Developed	CEEC	Africa	Non-Japan Asia	FSU
Compensation of employees						
ρ	0,522	0,336	0,665	0,185	-0,092	0,278
t-stat	(17,3)	(-5.1)	(9,0)	(2,2)	(-0.8)	(2,8)
observations	802	210	105	135	85	96
FDI1						
ρ	0,425	0,355	0,331	0,645	0,448	0,609
t-stat	(13,1)	(5,4)	(3,5)	(9,8)	(4,6)	(6,1)
observations	774	205	104	136	86	66
Portfolio investment						
ρ	0,447	0,217	0,743	0,690	0,770	0,873
t-stat	(14,5)	(3,2)	(11,4)	(11,7)	(11,2)	(18,0)
observations	842	211	108	154	89	103
FDI2						
ρ	0,468	0,323	0,233	0,201	0,458	0,564
t-stat	(14,0)	(4,6)	(2,2)	(2,0)	(4,6)	(5,9)
observations	697	180	85	100	83	76
Workers' remittances						
ρ	-0,075	-0,558	0,101	0,117	-0,304	-0,063
t-stat	(-2.1)	(-9.5)	(1,0)	(1,3)	(-3.2)	(-0.6)
observations	773	202	100	124	104	80

Note: ρ is the cross-country correlation (between $GDP - r_X * K_{ROW}^X$ and factor inflow) coefficient for the period 1995-2004, FDI2 denotes reinvested earnings while FDI1 the remaining profit receipts on the credit entry of foreign direct investment in the BOP. Data source: Lane & Milesi-Ferretti (2006), IMF IFS, IMF BOP).

Table 10.f. Diversification of the marginal unit of portfolio: regional view by various factor income components and remittances

Country	World	Developed	CEEC	Africa	Non-Japan Asia	FSU
Compensation of employees						
ρ	0,334	0,397	0,428	0,275	0,087	0,408
t-stat	(9,4)	(5,9)	(4,5)	(3,0)	(0,7)	(4,1)
observations	703	186	93	115	74	85
FDI1						
ρ	-0,013	-0,030	0,325	0,355	-0,003	0,504
t-stat	(-0.3)	(-0.4)	(3,3)	(4,1)	(-0.0)	(4,2)
observations	673	181	92	116	75	53
Portfolio investment						
ρ	-0,071	-0,033	0,228	0,324	-0,106	0,318
t-stat	(-1.9)	(-0.5)	(2,3)	(4,0)	(-0.9)	(3,2)
observations	746	188	96	136	78	92
FDI2						
ρ	0,189	0,188	0,390	0,328	-0,030	0,327
t-stat	(4,7)	(2,4)	(3,5)	(3,0)	(-0.2)	(2,7)
observations	598	158	71	78	72	65
Workers' remittances						
ρ	-0,009	0,168	0,130	0,065	0,021	0,147
t-stat	(-0.2)	(2,3)	(1,2)	(0,7)	(0,2)	(1,2)
observations	678	179	89	103	93	69

Note: ρ is the cross-country correlation (between $GDP - r_X * K^X_{ROW}$ and factor inflow) coefficient for the period 1995-2004, FDI2 denotes reinvested earnings while FDI1 the remaining profit receipts on the credit entry of foreign direct investment in the BOP. Data source: Lane & Milesi-Ferretti (2006), IMF IFS, IMF BOP).

Table 11.a. Income smoothing via net factor income channel (ß2 of equation 13): contemporaneous GDP growth

Country	World	Developed	CEEC	Africa	Non-Japan Asia	FSU
All						
β2	-0,024	0,007	0,006	-0,028	-0,024	-0,011
t-stat	(-5.1)	(2,2)	(1,1)	(-4.8)	(-5.6)	(-2.5)
observations	782	188	96	138	93	93
NFA<0						
β2	-0,020	0,004	0,008	-0,020	-0,026	-0,006
t-stat	(-11.1)	(1,0)	(1,4)	(-3.8)	(-5.8)	(-1.7)
observations	634	133	89	112	78	84
NFA>0						
β2	-0,023	0,009	-	-	-	-
t-stat	(-2.1)	(2,5)	-	-	-	-
observations	109	46	-	-	-	-

Note: the results for less than 40 observations are not reported but are available upon request from the author.

Table 11.b. Income smoothing via net factor income channel (ß2 of equation 13): GDP growth over 2 years

Country	World	Developed	CEEC	Africa	Non-Japan Asia	FSU
All						
β2	-0,004	0,001	0,006	-0,006	-0,011	-0,004
t-stat	(3,9)	(0,8)	(1,7)	(-2.5)	(-3.0)	(1,2)
observations	692	167	85	121	83	82

Note: the results for the modified equation 11 in which GDP growth over 2 years is used as an explanatory variable.

Table 11.c. Income smoothing via net factor income channel (ß2 of equation 11): GDP growth over 3 years

Country	World	Developed	CEEC	Africa	Non-Japan Asia	FSU
All						
β2	0,003	0,000	0,004	-0,007	-0,009	0,000
t-stat	(-3.1)	(-0.1)	(1,3)	(-2.7)	(-2.1)	(0.3)
observations	602	146	74	104	73	71

Note: the results for the modified equation 11 in which GDP growth over 3 years is used as an explanatory variable.

Table 12. Income smoothing via NFI channel: separating positive/negative NFA countries and increasing/decreasing NFI observations

	NFA<0		NFA>0	
	NFI ↓	NFI ↑	NFI ↓	NFI ↑
ρ	0.594	0.774	0.242	0.337
t-stat	(15.6)	(17.2)	(2.2)	(2.3)
observations	455	201	78	44

Note: World (1995:2004 average). Data source: Lane & Milesi-Ferretti (2006), IMF IFS)

Table 12.a. Income smoothing via NFI channel: separating positive/negative NFA countries and increasing/decreasing NFI observations

	NFA<0		NFA>0	
	NFI↓	NFI↑	NFI↓	NFI↑
ß2	-0.025	-0.035	-0.003	-
t-stat	(-9.9)	(-10.6)	(-0.3)	-
observations	258	61	42	-

Note: estimating ß2 of equation 13. World (1995:2004 average). Data source: Lane & Milesi-Ferretti (2006), IMF IFS); the results for less than 40 observations are not reported but are available upon request from the author.

Table 13. The structure of net foreign asset position by country groups: relative to GDP

	World	Developed	CEEC	Africa	Non-Japan Asia	FSU
Portfolio equity assets						
- average	0,10	0,26	0,01	0,02	0,15	0,00
- IIP>0	0,29	0,33	0,01	0,05	0,79	0,00
- IIP<0	0,06	0,23	0,02	0,02	0,01	0,00
Portfolio equity liabilities						
- average	0,11	0,32	0,03	0,02	0,14	0,02
- IIP>0	0,22	0,34	0,03	0,03	0,44	0,08
- IIP<0	0,09	0,32	0,02	0,02	0,07	0,01
FDI assets						
- average	0,14	0,33	0,02	0,04	0,27	0,03
- IIP>0	0,40	0,44	0,02	0,08	1,28	0,12
- IIP<0	0,08	0,28	0,01	0,03	0,04	0,03
FDI liabilities						
- average	0,30	0,32	0,25	0,23	0,46	0,27
- IIP>0	0,54	0,34	0,26	0,31	1,72	0,15
- IIP<0	0,26	0,31	0,08	0,24	0,17	0,28
Debt assets (portfolio debt + other investment)						
- average	0,60	0,94	0,22	0,21	0,62	0,20
- IIP>0	1,91	1,34	0,22	0,54	2,84	0,48
- IIP<0	0,34	0,78	0,25	0,15	0,13	0,18
Debt liabilities (portfolio debt + other investment)						
- average	0,85	1,08	0,46	0,66	0,79	0,54
- IIP>0	1,58	1,14	0,47	0,22	2,00	0,44
- IIP<0	0,71	1,06	0,28	0,76	0,52	0,54
Financial derivatives (assets)						
- average	0,01	0,02	0,00	0,00	0,01	0,00
- IIP>0	0,01	0,01	0,00	0,00	0,07	0,00
- IIP<0	0,01	0,03	0,00	0,00	0,00	0,00
Financial derivatives (liabilities)						
- average	0,01	0,02	0,00	0,00	0,01	0,00
- IIP>0	0,01	0,01	0,00	0,00	0,07	0,00
- IIP<0	0,01	0,03	0,00	0,00	0,00	0,00
Total reserves minus gold						
- average	0,14	0,06	0,18	0,15	0,26	0,12
- IIP>0	0,27	0,08	0,18	0,36	0,75	0,11
- IIP<0	0,11	0,06	0,14	0,10	0,15	0,12
Total assets						
- average	0,99	1,61	0,44	0,42	1,32	0,35
- IIP>0	2,88	2,20	0,44	1,02	5,73	0,72
- IIP<0	0,60	1,38	0,42	0,30	0,33	0,33
Total liabilities						
- average	1,28	1,74	0,74	0,91	1,39	0,83
- IIP>0	2,35	1,84	0,76	0,56	4,23	0,67
- IIP<0	1,07	1,71	0,38	1,02	0,76	0,84
NFA						
- average	-0,29	-0,13	-0,31	-0,49	-0,07	-0,48
- IIP>0	0,53	0,37	-0,32	0,47	1,50	0,05
- IIP<0	-0,47	-0,33	0,04	-0,72	-0,42	-0,51

Note: 1995-2004 average, source: Lane & Milesi-Ferretti (2006)

Table 14. The structure of net foreign asset position by country groups: relative to total assets (liabilities) if asset (liability)

	World	Developed	CEEC	Africa	Non-Japan Asia	FSU
Portfolio equity assets						
- average	0,10	0,16	0,02	0,06	0,12	0,01
- IIP>0	0,10	0,15	0,02	0,05	0,14	0,00
- IIP<0	0,10	0,17	0,05	0,06	0,03	0,01
Portfolio equity liabilities						
- average	0,09	0,19	0,04	0,02	0,10	0,02
- IIP>0	0,09	0,19	0,04	0,05	0,10	0,11
- IIP<0	0,09	0,19	0,06	0,02	0,09	0,02
FDI assets						
- average	0,14	0,20	0,05	0,09	0,20	0,09
- IIP>0	0,14	0,20	0,06	0,07	0,22	0,17
- IIP<0	0,14	0,20	0,02	0,09	0,12	0,08
FDI liabilities						
- average	0,24	0,18	0,34	0,25	0,33	0,33
- IIP>0	0,23	0,19	0,34	0,55	0,41	0,23
- IIP<0	0,24	0,18	0,21	0,23	0,23	0,34
Debt assets (portfolio debt + other investment)						
- average	0,61	0,58	0,52	0,50	0,47	0,57
- IIP>0	0,66	0,61	0,51	0,53	0,50	0,67
- IIP<0	0,56	0,57	0,59	0,50	0,38	0,56
Debt liabilities (portfolio debt + other investment)						
- average	0,67	0,62	0,62	0,72	0,57	0,65
- IIP>0	0,67	0,62	0,61	0,40	0,47	0,66
- IIP<0	0,66	0,62	0,74	0,75	0,68	0,65
Financial derivatives (assets)						
- average	0,01	0,01	0,00	0,00	0,01	0,00
- IIP>0	0,00	0,01	0,00	0,00	0,01	0,00
- IIP<0	0,01	0,02	0,00	0,00	0,00	0,00
Financial derivatives (liabilities)						
- average	0,01	0,01	0,00	0,00	0,01	0,00
- IIP>0	0,00	0,01	0,00	0,00	0,02	0,00
- IIP<0	0,01	0,01	0,00	0,00	0,00	0,00
Total reserves minus gold						
- average	0,14	0,04	0,40	0,35	0,20	0,33
- IIP>0	0,09	0,04	0,41	0,35	0,13	0,16
- IIP<0	0,19	0,04	0,34	0,35	0,47	0,35
Total assets						
- average	1,00	1,00	1,00	1,00	1,00	1,00
- IIP>0	1,00	1,00	1,00	1,00	1,00	1,00
- IIP<0	1,00	1,00	1,00	1,00	1,00	1,00
Total liabilities						
- average	1,00	1,00	1,00	1,00	1,00	1,00
- IIP>0	1,00	1,00	1,00	1,00	1,00	1,00
- IIP<0	1,00	1,00	1,00	1,00	1,00	1,00

Note: 1995-2004 average, source: Lane & Milesi-Ferretti (2006)

Table 15. The structure of net foreign asset position by country groups: relative to the group of developed countries

	World	Developed	CEEC	Africa	Non-Japan Asia	FSU
Portfolio equity assets						
- average	0,38	1,00	0,04	0,09	0,59	0,01
- IIP>0	0,88	1,00	0,04	0,15	2,42	0,00
- IIP<0	0,26	1,00	0,06	0,07	0,04	0,01
Portfolio equity liabilities						
- average	0,35	1,00	0,09	0,07	0,42	0,05
- IIP>0	0,63	1,00	0,09	0,08	1,30	0,22
- IIP<0	0,29	1,00	0,06	0,06	0,21	0,04
FDI assets						
- average	0,42	1,00	0,07	0,11	0,82	0,09
- IIP>0	0,91	1,00	0,09	0,17	2,91	0,28
- IIP<0	0,29	1,00	0,02	0,10	0,15	0,09
FDI liabilities						
- average	0,96	1,00	0,80	0,73	1,44	0,87
- IIP>0	1,58	1,00	0,85	0,90	5,07	0,45
- IIP<0	0,85	1,00	0,23	0,78	0,56	0,92
Debt assets (portfolio debt + other investment)						
- average	0,64	1,00	0,24	0,23	0,66	0,21
- IIP>0	1,42	1,00	0,29	0,40	2,12	0,36
- IIP<0	0,43	1,00	0,18	0,19	0,16	0,24
Debt liabilities (portfolio debt + other investment)						
- average	0,79	1,00	0,42	0,61	0,73	0,50
- IIP>0	1,39	1,00	0,44	0,20	1,75	0,39
- IIP<0	0,67	1,00	0,25	0,72	0,49	0,51
Financial derivatives (assets)						
- average	0,33	1,00	0,09	0,00	0,46	0,04
- IIP>0	0,85	1,00	0,08	0,01	4,87	0,00
- IIP<0	0,25	1,00	0,00	0,00	0,03	0,04
Financial derivatives (liabilities)						
- average	0,31	1,00	0,09	0,00	0,46	0,04
- IIP>0	0,80	1,00	0,08	0,01	4,87	0,00
- IIP<0	0,24	1,00	0,00	0,00	0,03	0,04
Total reserves minus gold						
- average	2,19	1,00	2,74	2,34	4,11	1,80
- IIP>0	3,40	1,00	3,07	4,49	9,39	1,41
- IIP<0	1,96	1,00	1,80	1,78	2,67	2,00
Total assets						
- average	0,61	1,00	0,27	0,26	0,82	0,22
- IIP>0	1,31	1,00	0,32	0,46	2,60	0,33
- IIP<0	0,44	1,00	0,19	0,21	0,24	0,24
Total liabilities						
- average	0,73	1,00	0,43	0,52	0,80	0,48
- IIP>0	1,28	1,00	0,45	0,30	2,30	0,36
- IIP<0	0,63	1,00	0,21	0,60	0,44	0,49
NFA						
- average	2,23	1,00	2,34	3,75	0,54	3,68
- IIP>0	1,46	1,00	0,98	1,27	4,10	0,14
- IIP<0	1,41	1,00	0,11	2,19	1,29	1,54

Note: 1995-2004 average, source: Lane & Milesi-Ferretti (2006)

Table 17. Correlation coefficients with and without Luxemburg (1995:2004 average, source: Lane & Milesi-Ferretti (2006))

	with Luxembourg	w/o Luxembourg
NFA>0	-0,727	0,293
NFI ?	-0,789	0,242
NFI ?	-0,647	0,337
NFA<0	0,624	0,624
NFI ?	0,594	0,594
NFI ?	0,774	0,774
Developed		
NFA>0	-0,958	0,130
NFA<0	0,285	0,285
CEEC		
NFA>0	0,982	0,982
NFA<0	0,874	0,874
Africa		
NFA>0	0,816	0,816
NFA<0	0,777	0,777
Non-Japan Asia		
NFA>0	-0,530	-0,530
NFA<0	0,719	0,719
FSU		
NFA>0	0,799	0,799
NFA<0	0,803	0,803

Table 18: Panel unit root test summary: endogenous variable of equation (13), 1995-2004

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-27,4272	0.0000	91	685
Breitung t-stat	-15,9387	0.0000	91	589
Null: Unit root (assumes individual unit root process)				
ADF - Fisher Chi-square	820.421	0.0000	91	685
PP - Fisher Chi-square	852.058	0.0000	91	685

Note: ** Probabilities for Fisher tests are computed using an asympotic Chi-square distribution. All other tests assume asymptotic normality.

Table 19. The list of countries

Angola	Estonia	Panama
Argentina	Finland	Paraguay
Armenia	France	Peru
Aruba	Germany	Philippines
Australia	Greece	Poland
Austria	Guinea-Bissau	Portugal
Azerbaijan, Rep. of	Hungary	Romania
Bahrain, Kingdom of	Iceland	Russia
Bangladesh	India	Rwanda
Belarus	Indonesia	Senegal
Belgium	Ireland	Singapore
Benin	Israel	Slovak Republic
Bolivia	Italy	Slovenia
Botswana	Japan	South Africa
Brazil	Kazakhstan	Spain
Bulgaria	Korea	Swaziland
Burkina Faso	Kyrgyz Republic	Sweden
Burundi	Latvia	Switzerland
Cambodia	Lithuania	Tanzania
Canada	Luxembourg	Thailand
Chile	Malaysia	Togo
China,P.R.:Hong Kong	Mali	Tunisia
Colombia	Malta	Turkey
Costa Rica	Mexico	Uganda
Cōte d'Ivoire	Moldova	Ukraine
Croatia	Morocco	United Kingdom
Cyprus	Namibia	United States
Czech Republic	Netherlands	Uruguay
Denmark	New Zealand	Vanuatu
Dominican Republic	Niger	Venezuela, Rep. Bol.
Ecuador	Norway	Yemen, Republic of
El Salvador	Pakistan	

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Chapter 2

Inflation Differentials between Eastern and Western Europe: Should the Maastricht Inflation Criterion Be Adapted?

2.1 Introduction

Price level differences across countries are easily observed but not so easily understood. The PPP debate has a long history. It is not only that price levels differ but inflation rates differ as well. Even in countries that are fairly close to each other in terms of economic profile and the level of development, not talking about countries that are far away in terms of geography or economic performance. There is plenty of empirical evidence on price level convergence and divergence available but what have we learned from these episodes? The literature has identified many causes, which are recognized as sources of heterogeneity in price levels and inflation. I show in this paper that a substantial part of the inflation performance in the Eastern European countries can be ascribed to lower price levels. Being more precise, a 10% lower price level refers to 0.5-0.7% higher inflation, i.e. we see Eastern Europe converging and this is what is expected. Policy-making in Frankfurt and Brussels, however, ignores undeservedly this structural feature when applying and interpreting the Maastricht inflation criterion.

The price level in the old EU member states (OMS) ranges from 80% to 126% while in the new EU member states (NMS) from 35% to 87% of the 2005 EU15 average. (See figures 1 and 2.) Inflation ranged from 0.8% to 3.8% in the OMS while from 1.6% to 9% in the NMS at the same time. (See figure 3.) Convergence Reports prepared by the European Central Bank (ECB) and the European Commission evaluate price convergence only within the framework based on the Maastricht Treaty provisions, which are applied

by the ECB. The Maastricht inflation criterion, as required in article 121(1) of the Maastricht Treaty and its protocol, states that inflation in an acceding country cannot exceed the inflation in three best performing (EU) Member States by a margin higher than 1.5%. This rule has proven not to be flexible enough to allow catching-up countries with sound market economies to join the euro club. In order for their price level to converge, inflation in the NMS has to diverge from inflation in the OMS for some time.

Perhaps the most investigated determinants of cross-country variability in price levels are income and productivity levels: variability in inflation rates is explained by income and productivity growth respectively. This relationship is well established in the Balassa-Samuelson (BS) effect, which says that either price level or income level have to be included in order to explain inflation performance. The entrance rule to join the European Monetary Union does not recognize the BS type of relationship between productivity growth and inflation. In the BS world the economy is divided into two sectors – tradable and non-tradable sectors, which are open and not open respectively to foreign competition. It is the tradable sector that leads productivity growth, which will be channeled through the labor market into non-tradable inflation. Although there is relatively little written on the structure of productivity catch-up in the Eastern part of Europe, there is a substantial amount of literature confirming the presence of the BS effect, which implicitly assumes the presence of certain type of productivity catch-up. Very recent papers, however, show that the BS relationship is weaker than previously thought. The main aim of the empirical exercise, presented in this paper, is to investigate the strength of the relationship between price level and inflation but not in the traditional BS framework. The framework that this paper is using has been applied earlier as well (see Lane and Honohan (2003), Lane (2004), Rogers (2002) and etc) but not in the context of the NMS. This framework decomposes inflation differentials into three components – exchange rates, business cycle and catch-up factors. The latter contains the BS effect. My empirical results suggest that the convergence component substantially exceeds the BS effect estimates.

It is not that only supply factors determine the price level. Because of price rigidities, demand factors have to be included as well to cope with inflation variability at least at business cycle frequency. Therefore the cyclical position of the economy is included in the empirical exercise of this paper. The fiscal stance is included to control additionally for price pressures stemming from a particular domestic source. There are other sources of inflation differences, which are not captured in the empirical exercise but are nevertheless discussed. One example is inflation measurement, which is due to quality improvements more upward biased in the transition economies as compared to advanced economies. Fast-growing purchasing power allows people to switch consumption towards higher quality goods and services, which also mean moving toward the expensive side of price spectrum. This and other sources of inflation measurement biases are discussed in the report of the Boskin Commission. Central banks should definitely not be concerned about this inflation component.

The paper is organized as follows. The next section considers at first the BS effect as the reason for cross-country inflation differentials. Then it turns to other factors that potentially explain inflation differences and introduces the framework that is applied in the empirical section. The third section reviews data sources and discusses a few aspects related to inflation performance in recent years. In the last section I present my empirical findings and draw conclusions for the Maastricht inflation criterion. There is also a shorter way this paper can be read – the literature review section except for the subsection 2.3 can be skipped.

2.2 Literature review

This section reviews a number of reasons why inflation differs across countries. It is not that all these reasons can be related to lower price level and it is neither that these reasons call for more flexible interpretation of the Maastricht inflation criterion.

When one talks about real convergence then usually the catch-up of purchasing power, per capita income, or productivity is meant. When one talks about nominal convergence, the catch-up of price level, production factor prices, narrowing of interest gap or inflation rate differential is meant. Real and nominal convergence, however, are different sides of the same coin, which is well established in the empirical relationship between price level and purchasing power parity adjusted income level. See figures 4 and 5. It is a relationship, which holds more strongly across countries and over longer periods. Perhaps the most widely used way to bridge nominal and real convergence is the BS effect but recent empirical evidence suggests that it is probably not the whole story. There is also a number of alternative explanations but these haven't (yet?) shown their viability as compared to the success of the BS effect. There is not very clear understanding to what extent real and nominal convergence must move hand in hand in the short run, how persistent the departures are and what, if any, are the implications of the departures.

Therefore this section starts from reviewing the literature on productivity convergence investigating what could be the lessons for the BS effect literature. Thereafter the focus is turned to the BS effect literature before examining several other explanations to cross-country inflation differentials. Among other issues, sources of potential upward biases in inflation measurement are surveyed.

2.2.1 Explaining inflation differentials: the BS effect

According to the BS effect the unavoidable precondition of price convergence is productivity convergence in the tradable sector. The issue of productivity convergence in the neoclassical world stems from diminishing returns to whichever type of capital. Sometimes diminishing returns are undone by various factors and there is no convergence. The empirical evidence on convergence is evident when one looks at aggregate PPP adjusted productivity in the NMS. In Obstfeld & Rogoff (1996) the BS effect is formulated in the following way:

$$\hat{P} - \hat{P}^* = (1-\gamma)(\hat{p} - \hat{p}^*) = (1-\gamma)\left[\frac{\mu_{LN}}{\mu_{LT}}\left(\hat{A}_T - \hat{A}_T^*\right) - \left(\hat{A}_N - \hat{A}_N^*\right)\right] \quad (1)$$

where P denotes price level, γ the weight of tradables in the consumer basket, μ the share of labor income in GDP, and A always denotes productivity. The subscripts T and LT refer to tradable and non-tradable sector respectively, and the superscript "*" denotes foreign country. For the price convergence based on the BS effect to occur, two preconditions have to be met. First, productivity convergence must be observed and second, the structure of productivity convergence must be appropriate: productivity growth differential has to be higher in the tradable sector than in the non-tradable sector. The gap between productivity growth in the tradable and non-tradable sectors leads to changes in relative prices: anticipated non-tradable inflation and therefore appreciation of the real exchange rate. The validity of both these preconditions can be questioned, especially when developed countries are considered. For developing countries the case is likely less severe.

Productivity in the tradable sector is a weighted sum of productivities in all sectors that are open to foreign competition. But the BS effect measures productivity at rather aggregate level.

$$prod_{LT} = \sum_i \alpha_i prod_i^{LT} \quad (2)$$

This might have implications on the appropriate way of imposing the test of the BS effect. What if there is regional convergence and productivity in one part of the tradable sector converges to the productivity of respective part of the tradable sector in country A but productivity in the remaining part of the tradable sector converges to respective part of the productivity of country B. Should the price level converge to country A, country B or a combination of both countries' price level? What if productivity in one part of the tradable sector does not converge at all? Should it be included in the weighted productivity measure at all, especially if it destroys convergence for the tradable sector as a whole? Given that there is only a limited number of converging sectors, which price measure would be appropriate to use in measuring the BS effect. Empirical literature on the BS effect has neglected these issues but this aspect might have potentially important. This issue is discussed later.

The amount of empirical literature on the BS effect is remarkable. The tests have been carried out with various specifications, which differ usually in restrictions on wage homogeneity condition and PPP in tradable sector. The most commonly used productivity measures are labor productivity and total factor productivity. However, there is less disagreement which activities belong to tradable sector. This discussion on this issue can be found in Egert et al (2002) and Mihaljek and Klau (2003). The list of earlier BS effect estimates for the NMS can be found in Mihaljek and Klau (2003), which includes Cipriani (2001), DeBroek & Slǿk (2001), Fisher (2001), Coriccelli & Jazbec (2001), Halpern & Wyplosz (2001), where the BS effect is estimated to be no more than 3,5%. This list can be extended with estimate of 2% by Lojshová (2003), which also has been obtained using a standard model for four Central European countries over the period 1995-2002. When the assumption of PPP in the tradable sector is relaxed, like in Wagner (2005,a), the BS effect almost disappears. Égert & Lommatzsch (2004) believe that the tradable prices have also appreciated due to improvement in supply capacities and in the quality and reputation of domestically produced goods. The estimations of Mihaljek and Klau (2003) refer to smaller BS effect than in previous studies as well. This study also tests the extent to what the BS effect explains inflation difference vis-à-vis the euro area. This estimate remains between 0.2-2.0%, which is considerably less than actual inflation difference because their sample covers relatively high inflation period. The BS effect is surprisingly the highest for Slovenia, which is the most price level converged economy. The reason why Mihaljek and Klau (2003) believe their estimate of the BS effect estimate to be smaller is that many studies have neglected high productivity growth in non-tradable sector. They conclude that factors other than differential productivity growth are responsible for higher inflation in Central European countries.

The methodological updates that have been employed in a very recent literature somewhat undermine the strength of the previous panel estimates of the BS effect. Namely, a number of papers in the BS effect literature have been using the first generation of panel cointegration techniques, which are not appropriate when the condition of cross-sectional independence is violated. It is violated in the BS tests because the prices of tradable goods co-move across countries as economies are subject to worldwide shocks. The misuse of the earlier cointegration tests in PPP applications is discussed in Wagner (2005,a). Wagner & Hlouskova (2004) have corrected this bias and found the BS effect to be only 0,5% per year. The sample period covers the years since 1993 to 2001 and includes eight NMS. However, when demand variables and inter-

sectoral wage differentials are added in the specification, the observed inflation is described more accurately. This refers to the necessity to incorporate price rigidities in order to explain inflation differentials. Wagner (2005,b) provides a comparison of the BS effect estimates for both the Central and Eastern European countries on one hand and the Western European countries on the other hand. If appropriate cointegration techniques are used, the BS effect explains a relatively small proportion of inflation differentials with developed countries. A surprising result, which somewhat undermines these findings is that in some developed European countries the BS effect is even stronger than in developing European countries. Wagner (2005,b) concludes that modest size of the BS effect in the new member states implies that there will be no obstacle for common monetary policy.

The conventional findings of the BS effect that were discussed above are somewhat undermined also by a number of other findings. As it will be seen in the next paragraph, there are reasons to believe that convergence should be observed activity by activity. One successful attempt to consider the real exchange rate at the single activity level has been made by MacDonald & Ricci (2001), who investigate the role of the distribution sector in the BS effect. It turns out that an increase in the productivity and competitiveness of the distributive sector gives surprisingly raise to appreciation of the real exchange rate similarly like an increase in the productivity of the tradable sector. This result strictly conflicts with most of the literature on the BS effect, where the distribution sector a priori belongs to the non-tradable sector. This result is validated with the reasoning that arbitrage in the goods market does not occur at the consumer level but at the producer level. If the distribution sector has outlets with different productivities in two countries, it will charge different prices for the distribution service: it is lower where productivity is higher and higher where productivity is lower. Another finding, which does not strictly invalidate the BS effect but says that its preconditions may not be met, is presented in Mijajima (2005). It is shown that the BS effect does not apply to episodes of strong economic growth because the necessary gap in total factor productivity between the tradable and non-tradable sector is not systematically present. This might be due to the fact that economic booms sometimes arise from credit booms when credit access of the non-tradable sector improves and fast economic expansion in the result. Furthermore, Alessandria & Kaboski (2004) claim that in the international business cycle literature, in particular in Engel (1993, 1999), Asea and Mendoza (1994), and Chari, Kehoe and McGrattan (2002), the BS effect cannot account for fluctuations in real exchange rates at business-cycle frequency.

This chapter presents findings where the structure of productivity convergence in the developed economies is not what one would expect based on the BS effect. Another feature that is discussed is that more convergence can be found at aggregate rather than at disaggregate level. Although there is almost no literature, it is possible that the NMS are also vulnerable to the same issues. The finding of Doyle and O'Leary (1999) is that aggregate productivity converged at a rate of 0.9% per annum, services converged at a rate of 0.6% per annum while agriculture and manufacturing both diverged. Pascual and Westermann (2002) support the view that disaggregated data have to be used when analyzing productivity convergence. The reasoning is that if technological spillovers are the major source of productivity convergence, then one needs to compare similar industries which employ similar technologies. In aggregate data, where converging and non-converging technologies are together the convergence may be incorrectly rejected. The main result in Gouyette and Perelman (1997) is that productivity grows slowly in the services sector but it still converges across countries while productivity in the manufacturing sector does not. They find also that convergence in the services sector has been favored by large deregulations but also due to development of communication and information technologies. Boussemart et al. (2006) allow that other countries besides the US can also be the technology leaders. It is obtained that both tradable and non-tradable

sectors experience catching-up and technology transfer. The catching-up rates and behavior are not substantially different in tradable as compared to non-tradable sector. Mulder and Groot (2004) also find support to the view that disaggregated rather than aggregated approach should be used for productivity analysis. They conclude that services sector shows strong evidence of convergence; agriculture shows weak convergence while manufacturing does not show convergence in labor productivity.

There are several conclusions arising from this subsection. Firstly, the estimated size of the BS effect explains a relatively small proportion of inflation differential between NMS and the developed European economies. Secondly, the BS effect can be naturally small, but this result may also stem from either incorrect aggregation or incorrect assumption about productivity convergence structure. As the BS type of inflation is purely supply-driven adjustment in relative prices, it does not pose any threat to common monetary policy.

2.2.2 Explaining inflation differentials: factors besides the BS effect

The conclusion from the previous subsection leads to the search for other sources of inflation differentials. The list of potential sources is heterogeneous or even eclectic because it is impossible to estimate the contribution of each source in a single framework.

One reason why the estimates of the BS effect could be biased is the failure of PPP. Maier (2004) conducts a simple accounting exercise for price convergence and finds that tradable inflation in the NMS can account for inflation that is 1.5-3.5% higher than in the euro area. Price gaps in the tradable sector are explained with market segmentation stemming from cultural and cyclical factors but also from transportation costs and inflation expectations. Alessandria & Kaboski (2004) document empirical evidence that international price discrimination is based on wages and not income per capita. They use a detailed micro database, which avoids the problem arising from differences in transportation costs, tariffs, and non-tradable component. In their theoretical framework with search frictions pricing to market accounts for 62% of the relationship between national price levels and income and 100% of the deviation from the law of one price. The remaining 38% of the relationship between national price levels and income can be ascribed to the BS effect. This list can still be extended. An important explanatory variable of price level for some items in the consumer basket of the NMS is the level of direct taxes. Variability in the tobacco, fuel and alcohol prices stems mostly from the excise component. Regulated prices, especially of those goods and services, which do not have market determined price (natural monopolies for example), can be considered in the same category with excise taxes. The importance of regulated prices is documented in Égert et al (2005). Yet another source of variability is the market size, which may have substantial effect on market integration and may affect achieving economies of scale.

Cyclical position of the economy is one of the major factors that drives inflation gaps in the currency union at the business cycle frequency - difference is the highest if one economy is boosting while the other is booming. This issue is discussed in Blanchard (2001) where the question about equilibrium inflation rates in the euro area is raised. It is said that inflation is a lubricant through which the adjustment process works when the economy is overheating. When domestic demand is the source of overheating, the adjustment should come through restrictive fiscal policy. When external demand is the source of overheating, it is better for the economy if adjustment takes place through higher inflation. However, inflation can be inertial which may make the adjustment costly. Opposite to Blanchard (2001) is shown in MacDonald & Wojcik (2006) – divergent inflation patterns in a currency union do not necessarily have to be an equilibrium phenomenon. Common monetary policy can create divergence of inflation rates if countries differ in size and productivity growth. If a small open catching-up economy has trend-productivity growth that is substantially higher than in the rest of

monetary union, it may potentially lead to unsustainable credit booms in the catching-up economy. The reasoning is that if interest rate is below appropriate, households borrow in the credit market to smooth consumption and actual output exceeds potential, employment and wages rise and the actual mark-up is below profit-maximizing mark-up. Adjusting the mark-up causes additional inflation, which makes the real interest rate to fall and stimulates borrowing even more. This is not an equilibrium adjustment of relative prices as prescribed by the BS effect but a realization of demand pressures. The conventional BS effect even amplifies this process - a productivity shock may give stimulus to excessive demand pressures. There is also another study, an extended version of the BS effect model, where demand channel is present. Coto-Martinez & Reboredo (2003) introduce imperfect competition in the Balassa-Samuelson economy. As a result, the markup component is added to the marginal cost component in the price setting equation. Therefore changes in demand will be transmitted into markup and may affect relative prices in the same way as the change in productivity. In this case, similarly to MacDonald & Wojcik (2006), the amplified BS effect can be the consequence. If mark-ups are correlated to productivity growth, the true BS effect is overestimated. These are potential explanations why demand factors are sometimes found to be statistically important in the BS effect equations. Another piece of literature is a two-region two-sector (tradable and non-tradable) micro founded model of Altissimo et al. (2005). In this model capital is not mobile and labor mobility across sectors is imperfect as well. As a result, wage differential across sectors appears and introduces amplifying effect in relative price movements in response to shocks in economic activities. Therefore variability in the non-tradable sector productivity is what matters while productivity shocks to the traded sector are absorbed by terms of trade shocks. This model is able to replicate the feature that major source of inflation persistence is the services sector. The conclusion in Altissimo et al. (2005) is that the BS effect has limited empirical relevance.

Exchange rate system can also be an explanatory variable of price levels and therefore inflation. Broda (2006) has found that developing countries with fixed exchange rate regimes have national price levels that are 20% higher than those with flexible regimes. Broda argues that exchange rate overshooting in floating exchange rate systems; inflation inertia in pegs and expansionary policies can explain only about 5 percentage points of the observed 20% difference. This empirical observation can be complemented with the theoretical findings of Devereux (2005) who has endogenized price flexibility in a small open economy model. It is shown that in unilaterally pegged exchange rate systems such as currency boards price flexibility is higher but in bilateral exchange rate pegs such as monetary union price flexibility is less than in freely floating exchange rate systems.

This subsection reviewed factors other than the BS effect. It is clear that all of them are not innocent from the monetary policy perspectives – higher inflation may not be always an equilibrium process. If income gap is too large, a small open economy may not want to join the monetary union because inappropriate monetary policy stance may amplify inflation cycles beyond equilibrium levels.

2.2.3 Estimating the role of lower price levels on inflation

The BS effect prescribes a specific channel through which price level gap or inflation can be bridged to productivity gap. The preceding subsection discussed the reasons besides the BS effect why lower price (income) level can be related to higher inflation. This subsection presents a framework, which asks the question what is the contribution of lower price level to inflation without specifying a specific channel. This framework can be found in use by Rogers (2002), Honohan and Lane (2003), Lane (2004) and others. Lane (2004) starts from a fairly general specification:

$$\pi_{it} - \pi_t^E = \beta\left(z_{it} - z_t^E\right) - \delta\left(\left[P_{it-1} - P_{it-1}^*\right] - \left[P_{t-1}^E - P_{t-1}^{E^*}\right]\right) + \varepsilon_t \quad (3)$$

where inflation difference between country *i* and euro area is on the left hand side. On the right hand side vector z includes variables that control inflation dynamics over shorter horizon while the second term describes difference between the gap of actual end expected price level in country *i* and euro area respectively. The "*" in the superscript always denotes long-run equilibrium price levels in country *i* and euro area respectively. Given that price levels converge and long run equilibrium price levels coincide, the formula can be simplified. Furthermore, if the euro area variables are combined into a time dummy, the following can be written

$$\pi_{it} = \phi_t + \beta z_{it} - \delta P_{it-1} + \varepsilon_t \quad (4)$$

Lane (2004) has included three variables in the z vector: change in the nominal effective exchange rate (lagged by one period), the impulse in the cyclically adjusted fiscal surplus and the output gap, which gives the following equation:

$$\pi_{it} = \phi_t + \beta_1 \Delta NEER_{it-1} + \beta_2 GAP_{it} + \beta_3 FISC_{it} - \delta P_{it-1} + \varepsilon_t \quad (5)$$

Equation (5) is used in the empirical section of this paper as well and the coefficient of the price level variable is in the centre of interest. This term can be interpreted as capturing various price level catch-up factors. Although Lane (2003) has used the euro area inflation as a reference, this paper uses average inflation of the EU 27 countries instead.

Lane (2004) conducts the estimations on a number of euro area countries and obtains the estimate of the price level coefficient to range between -0.03 and -0.05 depending on the HICP measure. In other words it means that a 10% lower price level explains inflation that is up to 0.5% higher. In order to test for the robustness of these results Lane (2004) uses alternative inflation measures. For example, the GDP deflator delivers the lowest estimate -0.07 referring to 0.7% higher annual inflation while private consumption deflator refers to annual inflation that is 0.4% higher. Similar estimates in Rogers (2002) are -0.04 for Europe and -0.06 for euro area 11 countries, but this paper uses slightly different specification. These results clearly refer to price level convergence in Europe up to the beginning of this century. However, more recent papers that look at price dispersion measure have found that price convergence has stopped and the introduction of common currency has not given additional stimulus to it. See for example Cuaresma et al. (2007), Engel and Rogers (2004), Bergin and Glick (2007). The last paper finds the U-shaped pattern for 70 countries – price levels were converging until 1997 when divergence that is still ongoing started. Divergence is more pronounced for developing countries, but it is also weakly present in the eurozone countries. They explain the price dispersion between countries by trade frictions like distance between countries, tariffs, adjacent national border, area, language and etc. The upward sloping section of the U-shape can statistically be explained by increasing oil price, which increases transportation costs and therefore prices in locations, which are more distant from each other.

2.2.4 Inflation measurement issue

There is some evidence that inflation measurement in the transition economies could be subject to an upward bias stemming mostly from quality improvements. Another source of inflation differences is the weight structure in the consumer basket, which may also discriminate the NMS.

In 1996 the Boskin Commission published the report where recommendations to changes in the consumer price methodology were made. The report identified four sources of potential biases in the calculation of consumer price index. These sources are: substitution bias because fixed weight consumer basket fails to reflect changes in consumer preferences in response to relative price changes. The second is outlet substitution bias if shifts to lower price outlet take place. The third is quality change bias, which is present when quality adjustments are inaccurately measured. The last is new product bias, which is about introducing new products in the consumer basket. The commission found that due to these biases the inflation in the U.S. was overestimated by 1.1% per year on average.

Inflation calculations within the HICP framework take quality changes to some extent into account but there is substantial variability in these adjustments across countries. See Camba-Mendez et al. (2001), Wynne & Rodríguez-Palenzuela (2002). There is very limited literature on inflation biases in the transition economies. Filer & Hanousek (2000, 2003) have found that reported inflation levels in mid to late transition Czech economy might be up to twice actual inflation. The main bias stems from the quality improvements. Wynne & Rodríguez-Palenzuela (2002) provide a comparison of several studies for Germany, France and UK. The results indicate that measurement bias remains between 0.1 and 0.8%, which is substantially smaller than Filer & Hanousek (2000, 2003) have found for the Czech's consumer price index.

Another aspect that causes inflation differences stems from differences in the structure of the consumer basket. To get some intuition on the extent of the consumer basket effect, 12 EU15 inflation components are taken and weighted as in the Estonian HICP. The maximum inflation gap between these two weighting schemes is 0,6% between January 2002 and November 2006. The average inflation gap for the period when Estonia was the member of the ERMII is 0.3%, which is one fifth of the allowed 1,5% margin in the inflation criterion. It is difficult to argue why the common monetary agent in Frankfurt should be worried about.

2.3 The data

The data for the empirical section are collected from the Eurostat and IFM data warehouses. Eurostat's economy and finance database and the AMECO database are used mostly but some missing observations are taken from the IFS. The sample consists of the following countries: Bulgaria (BG), Cypros (CY), Czech Republic (CZ), Estonia (EE), Hungary (HU), Latvia (LV), Lithuania (LT), Malta (MT), Poland (PL), Romania (RO), Slovenia (SI) and Slovakia (SK). Data availability allows estimations for the period from 1997 to 2006.

The time coverage of data is often an issue for the NMS. For example the HICP observations start from 1996, which is the main reason why estimations start since 1997. The data on price level of GDP are available in the Eurostat database since 1995 but on private final consumption and services since 1999. When it comes to fiscal stance, the AMECO database provides various estimates but not for all countries since the beginning of the sample period. For the purposes of this paper, the cyclically adjusted net lending excluding interest, which is calculated by using trend GDP is used. To find the output gap, data are HP filtered and for this purpose the Spring' 2007 forecast of the European Commission for 2007 is employed. When it comes to nominal effective exchange rate (NEER) measures, both Eurostat and IFS data are used. In the Eurostat NEER is measure against 41 countries while the IFS measure can be found under the code ..NECZF....

The empirical exercise is conducted by using mostly yearly data but some regressions are estimated with quarterly data. However, data for a few variables (fiscal stance, price level) are not available at quarterly frequency. In this case the method of quadratic-

match-average is used to generate the higher frequency observations. To calculate the output gap variable at quarterly frequency, the GDP data are first seasonally adjusted with TRAMO/SEATS (TRAMO - Time series Regression with ARIMA noise, Missing observations, and Outliers and SEATS - Signal Extraction in ARIMA Time Series) program detecting the outliers and choosing automatically the level transformation and ARIMA order and then HP-filtered.

Figure 7 shows inflation differentials for all 12 countries in the sample and table 1 provides the statistics of the unit root test for both common and individual unit root assumptions. There are countries like the Czech Republic and Malta where inflation has moved in a close neighborhood to inflation in EU27 average but many countries have experienced reform-induced disinflation, especially in the first half of the sample period. One can see that 2002-03 was the period when inflation was low in almost all countries referring to a common component that drives inflation in the EU region. Furthermore, inflation was lower in 2003 not only in the Eastern European countries but also in the euro area as compared to the preceding and subsequent years. This is an indication of goods market integration and of the view that inflation is at least a EU-wide phenomenon. The panel unit root tests for the inflation differentials estimated in levels and including individual intercepts give very low probability to common unit root except for the Breitung test and the probability of individual unit root is also a way beyond the levels of reasonable doubt.

2.4 Empirical findings

The empirical strategy uses the specific-to-general approach and starts from the simplest unconditional specification relating inflation difference and the price level. Thereafter more general specifications are estimated. The robustness of the inflation-price level relationship is tested by using alternative specifications, inflation measures, instruments, data frequencies, and estimation techniques. One grouping of countries is made on the basis of the monetary policy framework because the adjustment mechanism in fixed versus flexible exchange rate regimes is not the same.

To summarize the results, the relationship between price level gap and inflation difference is expectedly well-founded – lower price level is associated with higher inflation. The price level gap explains a substantial part of the inflation difference. The results for the period 1996-2006 say that a 10% lower price level implies inflation that is up to 1% higher. In currency boards inflation is expectedly 0.2-0.4% above this estimate. Although most of the estimations are carried out with annual data, the results are made available also for quarterly frequencies. All the results are collected in tables 2-8 in the appendix. My results suggest that the price level convergence is substantially higher than is predicted by the BS effect.

One of the common features that almost all specifications share is the inclusion of time fixed effects, which is expected to capture the common inflation component. However, should the common component have asymmetric effects across countries, due to the reasons which were discussed in the previous section (for example weights of the basket, pass-through), the estimates of the inflation drivers might potentially be biased. In order to clean the residuals, I have used the generalized least squares to correct for cross-section specific variances. There are obviously more sources of country-specific heterogeneity besides asymmetric effects of the common inflation component. The inclusion of the correction term substantially improves both the simple and adjusted R-squared measures. Given that inflation difference is declining for several countries due to price liberalization and opening up for international trade, there is some heterogeneity across periods as well. Correcting cross-period heterogeneity delivers a point estimate that is close to the cross-sectionally corrected estimate. However, as this correction does

not provide any improvement in adjusted R-squared, it is left aside in most of the cases. Besides, cross-period correction turns the sign of the output gap coefficient negative.

The central interest in this paper is the coefficient on the price level variable. The intuition is very similar to the level of initial GDP in cross-country growth regressions – low value of initial GDP refers to faster growth given that convergence occurs. Low price level refers in similar fashion to higher inflation. The NMS have already closed a substantial part of the price level gap due to higher inflation during the last ten years. Bulgaria remains currently the only country with price level below 50% of the EU-27 average in GDP terms. See figure 2 in the appendix. The NMS started convergence a decade ago from a level that was below 40% for 7 countries. See figure 3 in the appendix. Decreasing income level gap, goods market integration and higher labor mobility work strongly towards equalizing the prices of goods and services.

How to interpret the results in tables 2 through 8? Column (1) in table 2 is the unconditional relationship between inflation difference at time *t* and price level at time *t-1*. The value of the price level coefficient is -0.24, which means a 2.4% difference in inflation for every 10% gap in price level. This estimate is way too high because one would not imagine a 10% difference in inflation in the European Monetary Union, where price levels remained between 80% and 120% relative to the EU27 as average in 2006. One reason why the estimate is so high is because the other components of the inflation generating mechanism are missing. The usage of generalized least squares the coefficient to -0.12, which is intuitively a more reasonable result. See column (2). These components are exchange rate, cyclical position of the economy and fiscal stance. Although one could argue that the effect of fiscal policy is captured by the output gap variable, it is not necessarily true if output gap is mostly driven by external factors. One would expect positive coefficients for both the output gap and fiscal stance but negative for the nominal effective exchange rate variable. I start by replicating the exercise of Lane (2003) as closely as possible, including variables, specification, lag structure, and etc.

My findings are the following:

1. Price level is always and everywhere in the NMS a significant explanatory variable of the inflation difference to EU average – lower price level refers to higher inflation. This relationship is statistically relevant and is invariant to alternative specifications, alternative price level measures, econometric techniques, which all give relatively similar results. The only specification in which the relationship fails is the one where the output per capita (in PPS) variable is included.
2. Nominal effective exchange rate explains relatively well inflation, when the sample covers the whole period 1997-2006. However, when the sample period is split into two five-year periods, the role of NEER as inflation driver surprisingly disappears in the second period. There are several speculations regarding that. The first, the lag structure of the pass-through changed. In current setting the lag is set for one year but quarterly estimations confirm that it could be shorter. The second, U.S. dollar, which reversed its appreciation in early 2002 and thereafter depreciated until the end of the sample period is causing this behavior because of potential asymmetries. Similar feature is also present for the EMU countries but these results are not presented.
3. The results suggest an ambiguous role for the output gap – in many cases this variable obtains a wrong sign and is statistically insignificant. This can be due to the past because some of the countries were still recovering from initial decline in GDP in the second half of the 90s. Removal of Bulgaria and Romania from the sample makes output gap significant and the size of the coefficient (0.2) reasonable. Furthermore, if the sample is shortened and a dummy for currency boards is added like in columns (23), (25) and (26), the coefficient is also of reasonable size (0.3-0.4) and statistically significant. On the other hand, the

effect of fluctuations in the output gap may not be clear enough because the NMS-s have not experienced sufficient number of fluctuations at business cycle frequency as one decade is too short period for that. The results in all tables are presented for the contemporaneous output gap. Although these results are not presented, in some cases there is some improvement if output gap is lagged by one period. Is the role of the output gap different in NMS versus OMS? Lane (2003) has obtained the output coefficient in majority of cases remaining between 0.2-0.3, which is comparable to column (7) in table 6.

4. Fiscal stance in the NMS exhibits plentiful heterogeneity both across time and across countries. See figure 10. Although the results provide not so clear evidence on the size of fiscal stimulus to the price level, it is still positively correlated with inflation gap in all regressions except for those cases where autocorrelation in the residuals is corrected in quarterly estimates. According to columns (6) and (7) an expansionary change in the fiscal stance by 1% causes inflation to rise by 0.1-0.2%. In column (13) this coefficient is 0.3% and when currency boards where the soundness of the fiscal house is even more crucial are separated, the coefficient increases up to 0.5% as in column (23).
5. Testing the relevance of price level by using alternative inflation and price level measures (services, HICP without food, alcohol, tobacco and fuel) confirms the importance of price level and reveals a few more features of the inflation generating mechanism. The role of services price level as a predictor of services inflation difference is less important. The coefficient is almost the same like for the whole consumer basket, which undermines the BS type of price level convergence hypothesis. One would expect higher inflation for services. However, the output gap is expectedly more important predictor of the services inflation difference. The other inflation measures – HICP excluding energy and seasonal food and HICP excluding energy, food and alcohol reveal that the exchange rate looses its explanatory power when more volatile components are removed. This contrasts with the view that exchange rate determines inflation also at least in the part of durable goods in the consumer basket. One would not expect the price level to matter when it comes to the difference between export deflators because small open countries are price takers in the world market and therefore the domestic factors have no explanatory power. This is exactly the case in regression (13). However, NEER is a substantial component in pricing exports and also for the GDP deflator but this is reasonable because the latter is a wide aggregate than the former. Private consumption deflator is affected by fiscal stance but not by the output gap.
6. The nature of the relationship between price level and inflation difference is likely nonlinear – the higher the price level the lower the convergence component and pressure on inflation. This is expected and robust result, which can be found when the sample period is divided into two five-year periods. See columns (22) versus (23) where the coefficient dropped from -0.12 to -0.08 and (24) versus (25) where the coefficient changed from -0.14 to -0.09. However, due to the change in the size of the coefficient, it is difficult to determine the contribution from price level to inflation for future periods. The quarterly data, however, show a lower drop in coefficient value from -0.06 to -0.05.
7. Inflation performance is clearly different in fixed versus flexible exchange rate countries. Price level convergence occurs either via higher inflation or exchange rate appreciation in flexible exchange rate countries but only via higher inflation in fixed exchange rate countries. The results confirm that in fixed exchange rate countries the adjustment occurs via higher inflation, which is reflected by a negative coefficient of the currency board (CB) dummy variable in columns (20)-(26). The extra inflation in currency boards is between 0.4 and 1.1% per year.

The columns (22)-(26) indicate that the extra component has also declined in the second half of the sample period remaining between 0.2 and 0.5%. An anomalous is the result that including the currency board dummy increases also the effect of price level for flexible exchange rate countries by a few decimals.

8. The results are also tested against possible outliers. The column (7) excludes Romania and Bulgaria where macro stabilization policies were applied later as compared to others. This step expectedly increases the significance of the output gap in inflation performance and reduces the size of the price level coefficient from -0.09 to -0.06 while retaining statistical significance. This is so because the observations with lower price level and higher inflation are removed.
9. There are also some concerns arising from the statistical properties of the results. A glance at the DW statistics suggests to autocorrelation problem. This is corrected in two ways – including either the autoregressive component or the lagging error term. See, for example, columns (15), (33) for the former. However, at the same time changes, although not substantial, take place in the coefficients as well. Most importantly, the coefficient on price level increases – a 10% difference in price level refers on average to 2.2% inflation difference during the period of 1997-2006. The impact of correcting the autocorrelation problem is substantially smaller if the second half of the sample period is considered because disinflation had come to a successful end in several countries.
10. One of the shortcomings of this type of specification is the failure to provide country-specific price level estimates. The reason is that the price level coefficient overtakes the country-specific unobserved effects with which it is likely correlated. This occurs even at the presence of country-specific fixed effects and therefore the estimates of the price level coefficient cannot be interpreted it in the same way like above.

Which of these findings is the most interesting? Although there is some variability in the size of the price level parameter, one can be confident that its' economic relevance has been statistically proved. If someone asks, which regression is my favorite to predict the contribution of price level to inflation for the coming years, I believe it is important to rely on the estimates of the second half of the sample rather than the whole period. It is also important to distinguish currency boards from flexible exchange rates because inflation in the former is higher.

In a country where price level has reached to 70% of the EU-27, inflation is at least 1.5-2.0% above the EU-27 average due to lower price level. Of course, the question is also whether the economy is assumed to be in transition towards the steady state or it is already in a near steady-state equilibrium. The results indicate that the NMS are still in transition because the initial conditions are important. When a country has reached the steady state neither initial condition nor shocks should have statistically significant effects on inflation differences. Therefore it is possible that a country may also land in a low price level steady state where the contribution from the price level to inflation is negligible even over longer horizons. In this case meeting the Maastricht inflation criterion is no longer problem.

However, the situation is different when the economy is still converging in terms of the income and price levels. The converging countries are penalized as it is more difficult for them to meet the criterion. Given that the coefficient is rarely below -0.06 (except for quarterly estimates!), the results say that the window of opportunity[8] becomes more but not systematically open for a country to meet the Maastricht inflation criterion when its price level has reached the neighborhood of 75% of the EMU best performers price level.

[8] By window of opportunity I mean the period of time during which a candidate country's inflation remains below the average inflation of three best performing (with lowest inflation) member states of the EU27 plus 1.5%.

This means that the country has to reach ca. 85% level of the EU-27 average. In this calculation the decline in the coefficient driven by increase in price level is neglected for simplification. For flexible exchange rate countries the window opens earlier than for the fixed exchange rate countries. The preceding calculation also means that all other inflation determinants must meet the ceteris paribus condition. If the ceteris paribus condition is not fulfilled it is still possible to meet the Maastricht inflation criterion earlier because differences in the cyclical position of the economy or fiscal stance have asymmetric effects to inflation. Table 9 shows how the output gaps for the period 1997-2006 in the EU-27 are correlated. One can generalize that the output gaps are more correlated within the new member states than with the old member states. However, given the overall trend of goods, services and labor market integration asymmetries in cyclical position are likely to diminish. Based on the estimates for the period since 2002 to 2006 in regression (26), in order to undo for example the 30% difference in price level requires a recession in the economy with a negative output gap around 3%. The same holds for the fiscal stance measure, which must be in surplus of around 3% of GDP. Therefore, if the converging country wants to join the euro club it is required to pay a high price to have the entrance ticket in the hip pocket. The gains of being in the club, however, may not outweigh the pains, at least not in the short run.

2.5 Conclusions

This paper deals with inflation differentials between the new and old EU member states. Namely, the question about the extent of inflation that can be ascribed to lower price level in the new member states is asked. I have exploited the framework used by Lane (2003, 2004), Rogers (2002) and others to answer this question.

My main finding is that a 10% lower price level explains about 0.5-0.7% higher inflation in the period from 1997 to 2006. In other words, in a country where price level is ca. 50% of the EU27 average inflation has to be 2.5-3.5% higher than the EU27 average. I have also obtained that inflation gap attributed to lower price level is larger for currency boards as compared to floating exchanging rate regimes. My results are statistically relevant and the main conclusion is invariant to alternative specifications. Besides lower price level, the cyclical position of the economy is expectedly one explanation to inflation differentials. This is due to negative correlation between the output gap in Eastern and Western European countries.

The literature review section of this paper discusses the reasons why inflation rates are different across countries. The discussion starts with the Balassa-Samuelson (BS) effect, which is perhaps the most widely acknowledged structural explanation stemming from lower price level to inflation differentials. However, my results are substantially higher than the most recent estimates of the BS effect. This refers that there must be other factors besides the BS effect explaining higher inflation in the new member states. The literature refers to a number of reasons which give raise to goods market imperfections but is less conclusive on the size of these factors.

The empirical findings of this paper have also a policy implication. Namely, in the light of my estimates it is unlikely that the new member states will be able to meet the Maastricht inflation criterion in the nearest future due to their lower price level given that all other inflation driving factors are the same.

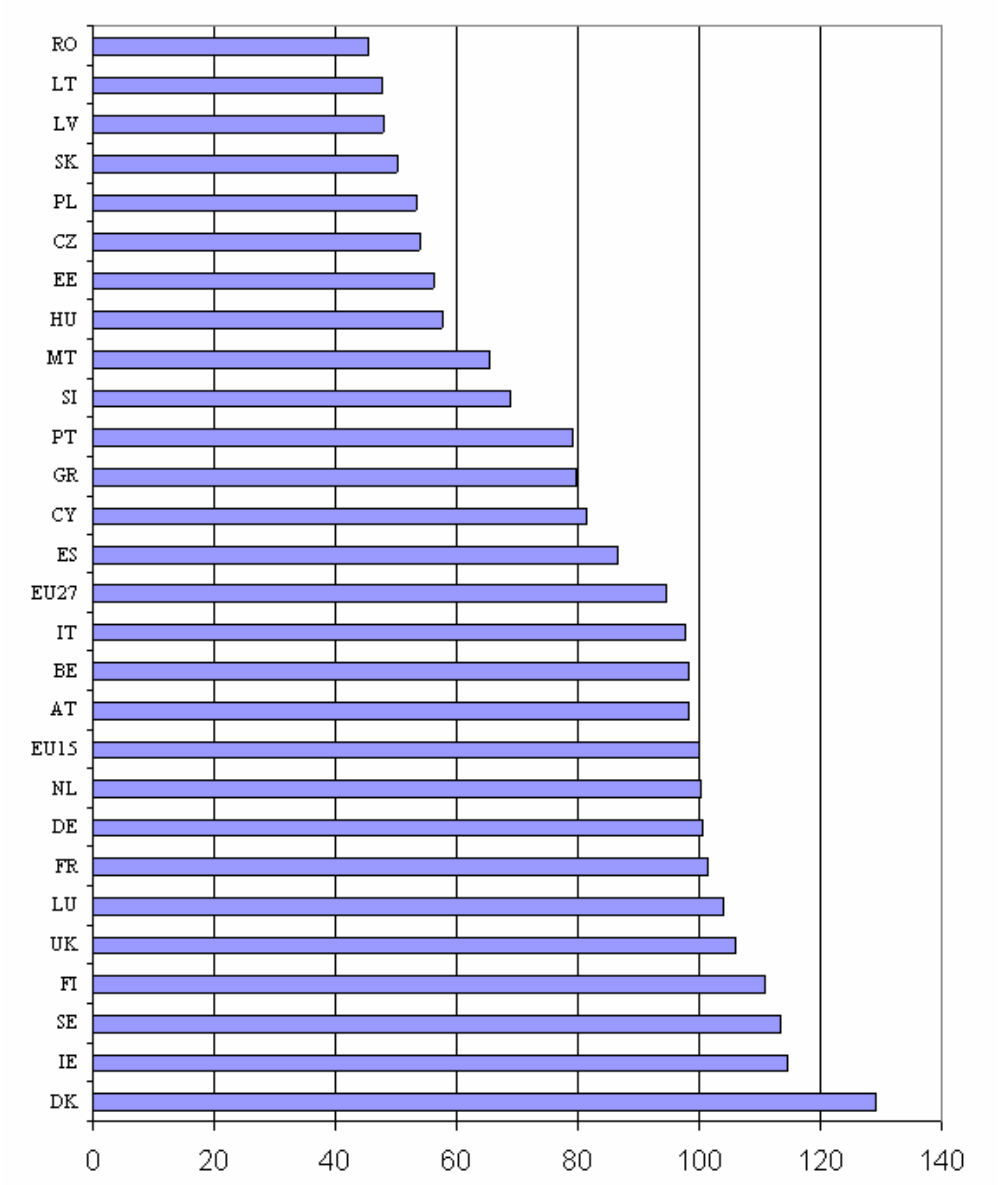

Figure 1: Price levels in EU27 (EU15=100, 2005): gross domestic product (source: Eurostat)

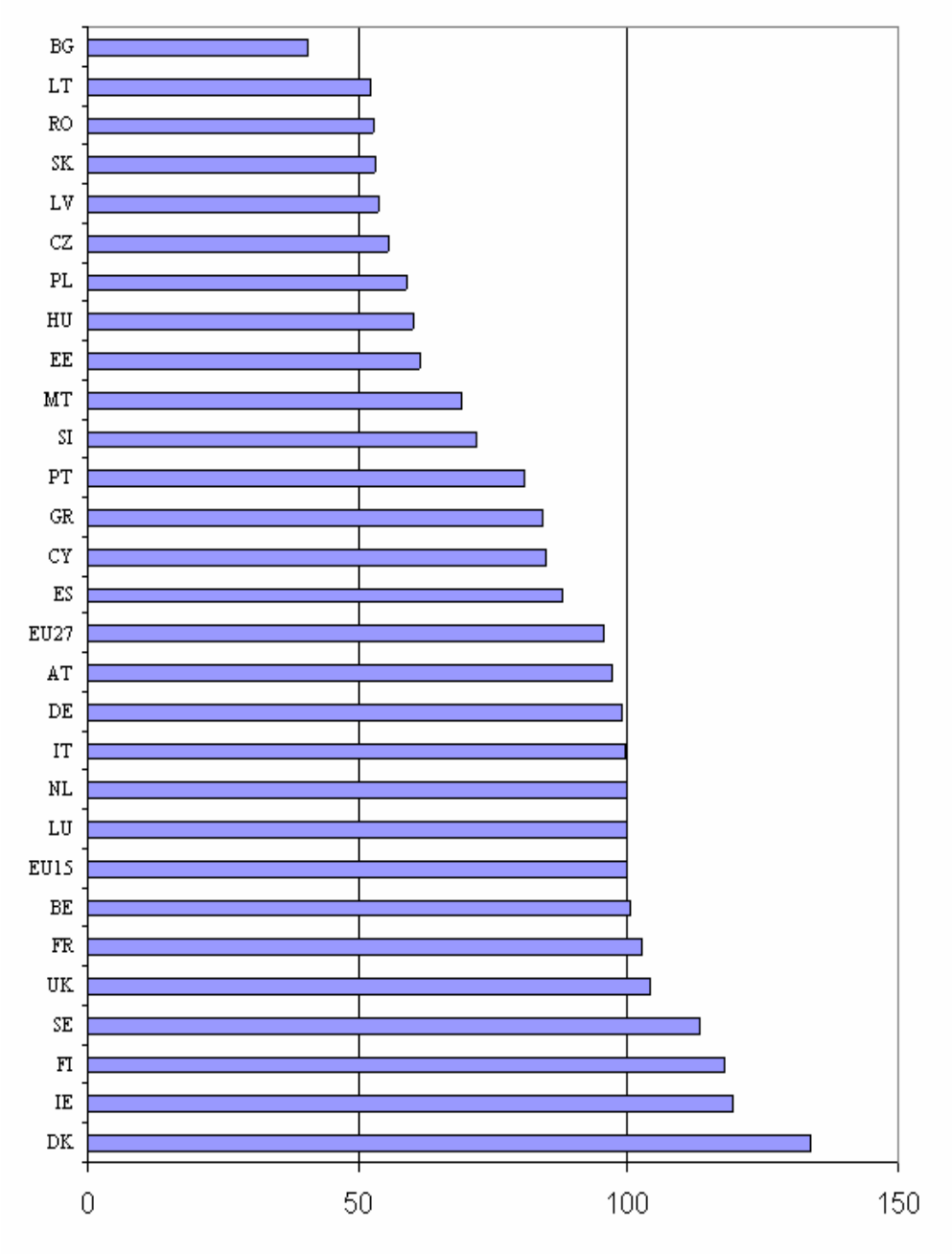

Figure 2: Price levels in EU27 (EU15=100, 2005): household final consumption expenditure (source: Eurostat)

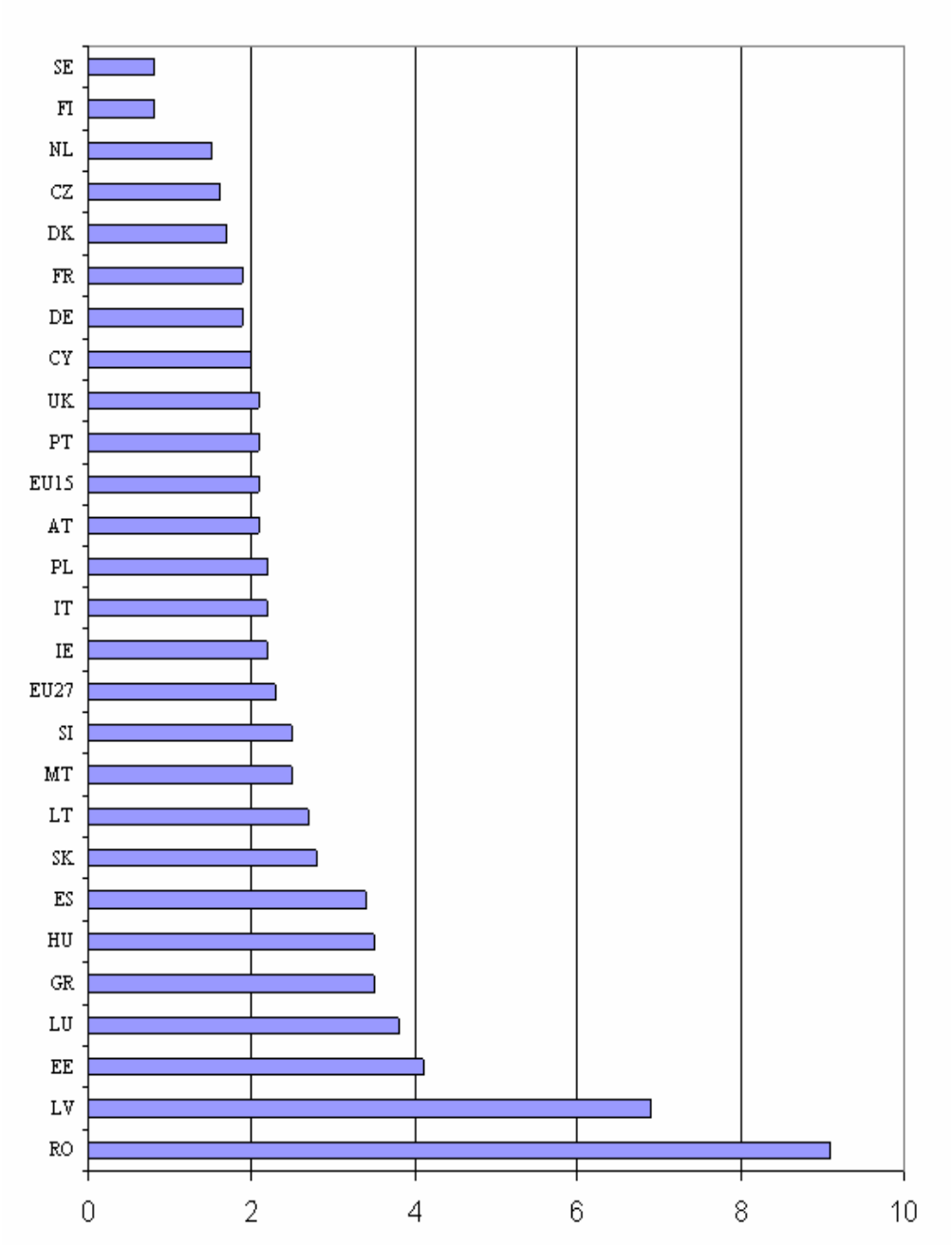

Figure 3: Inflation in EU27: HICP, 2005 (source: Eurostat)

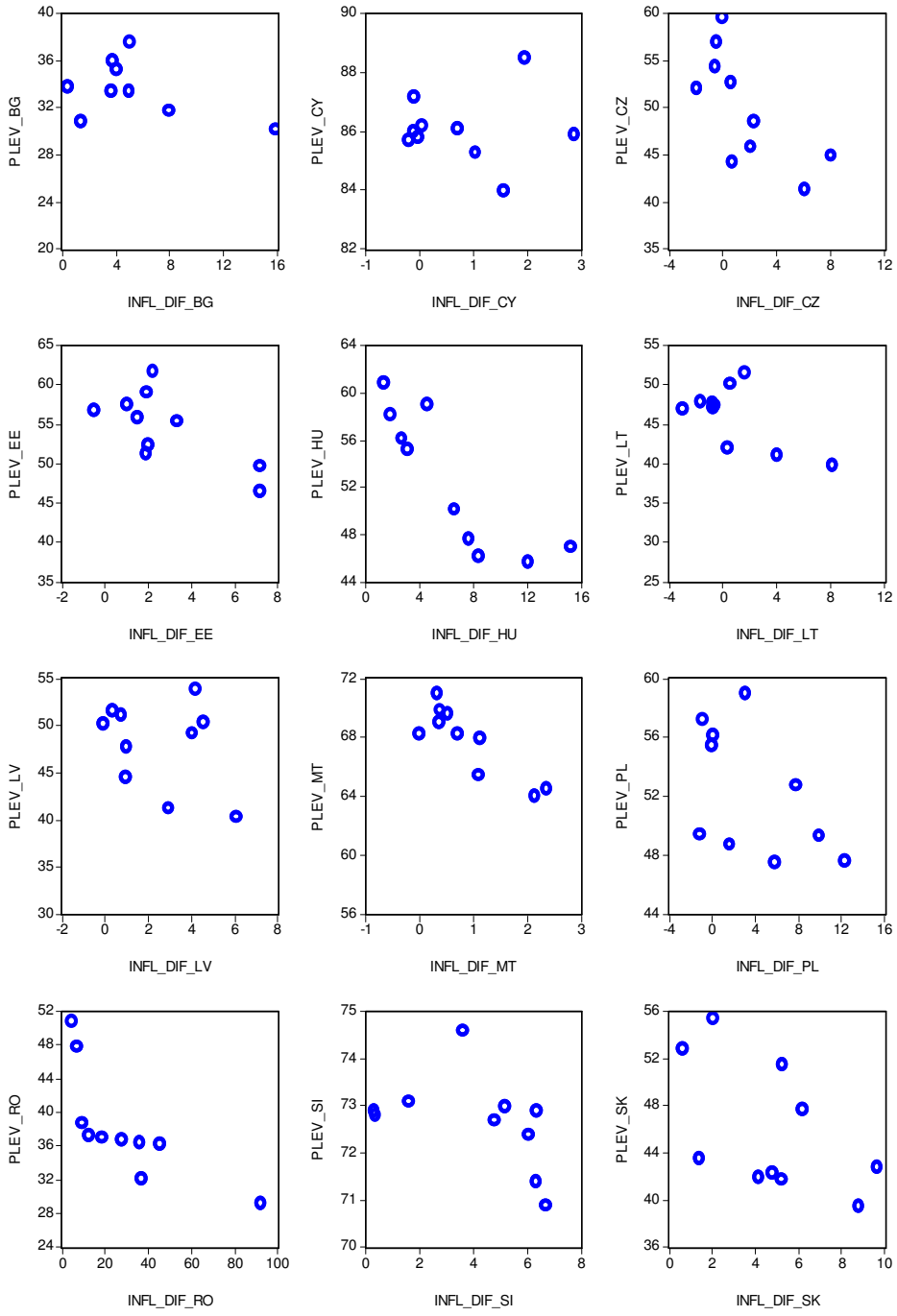

Figure 4: GDP PPS versus price level (GDP) – country view (source: Eurostat)

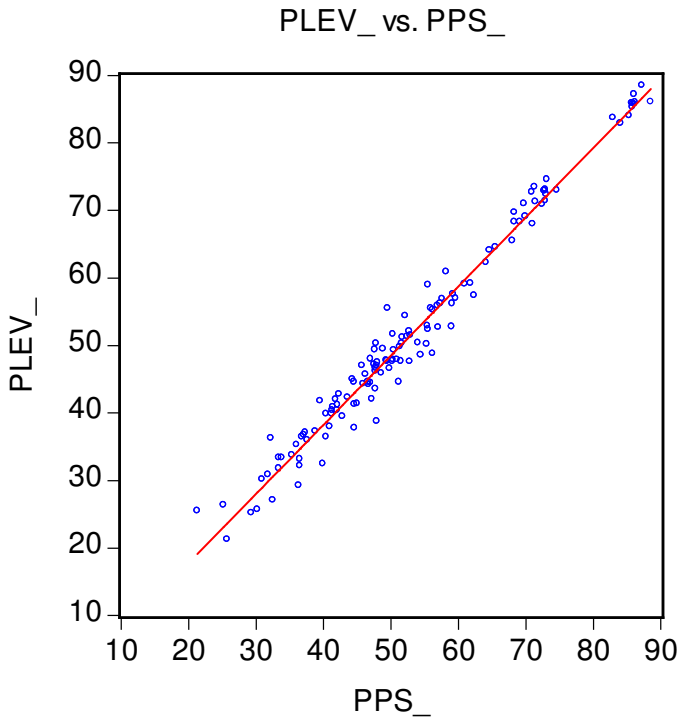

Figure 5: GDP PPS versus price level of GDP – cross-section view, 1995-2006

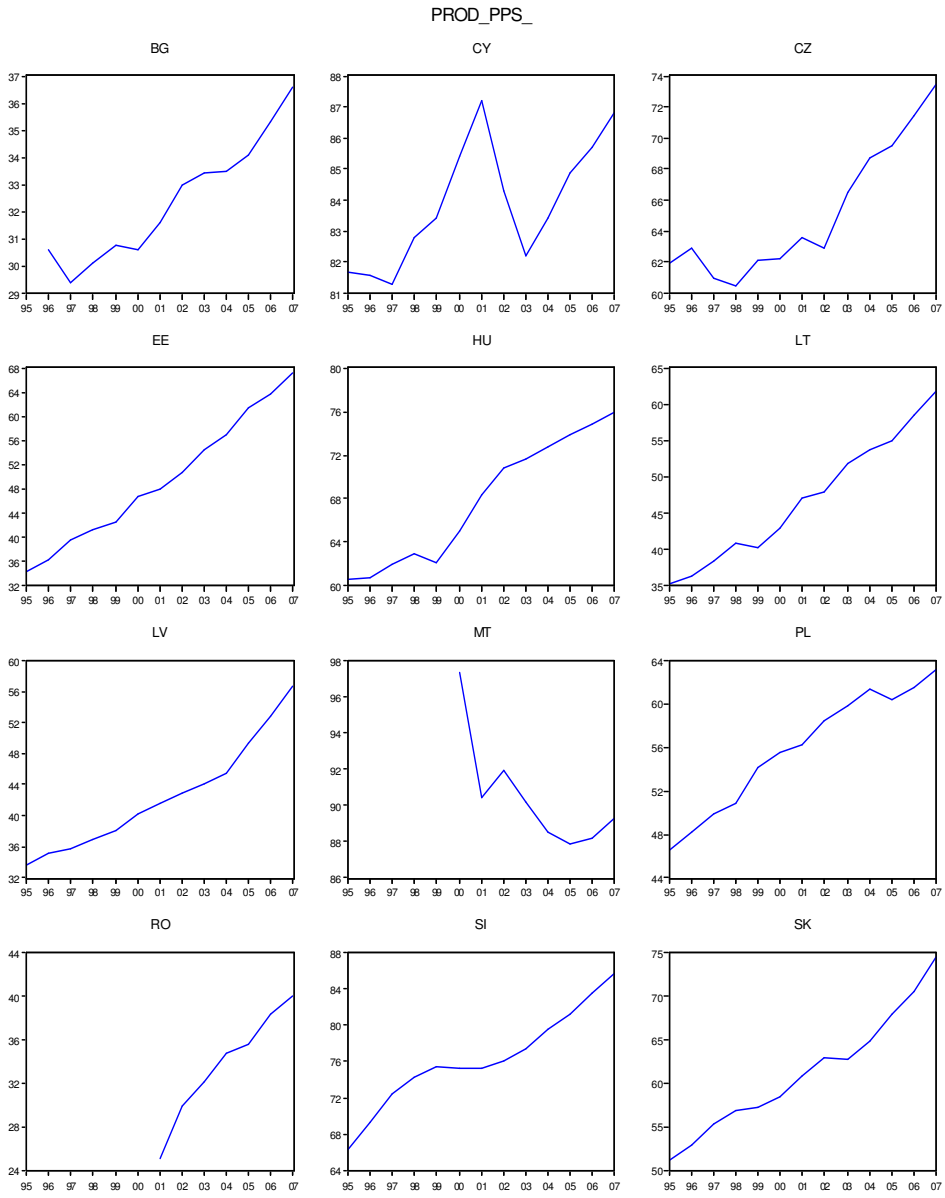

Figure 6: Productivity convergence in the NMS to EU-27=100 (source: Eurostat)

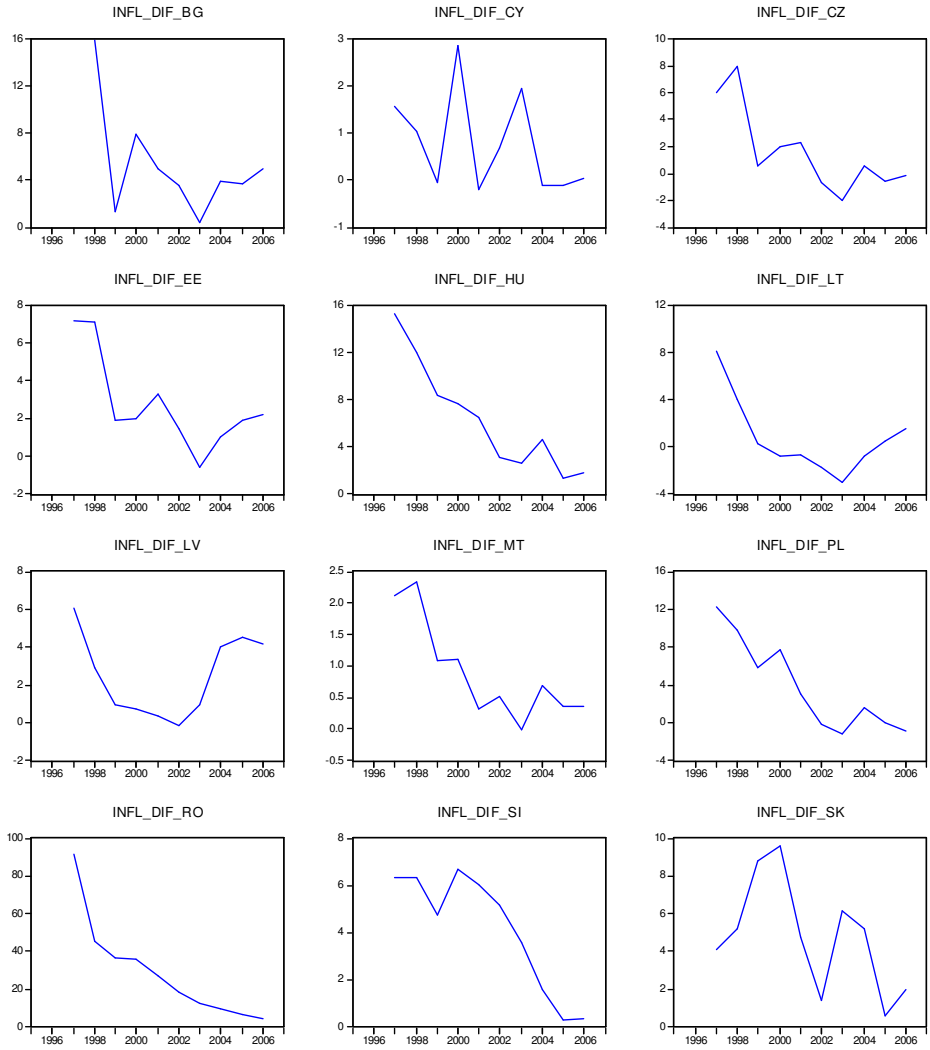

Figure 7: Inflation differential between each country out of NMS-12 and EU-27 inflation where HICP is the measure of inflation (source: Eurostat)

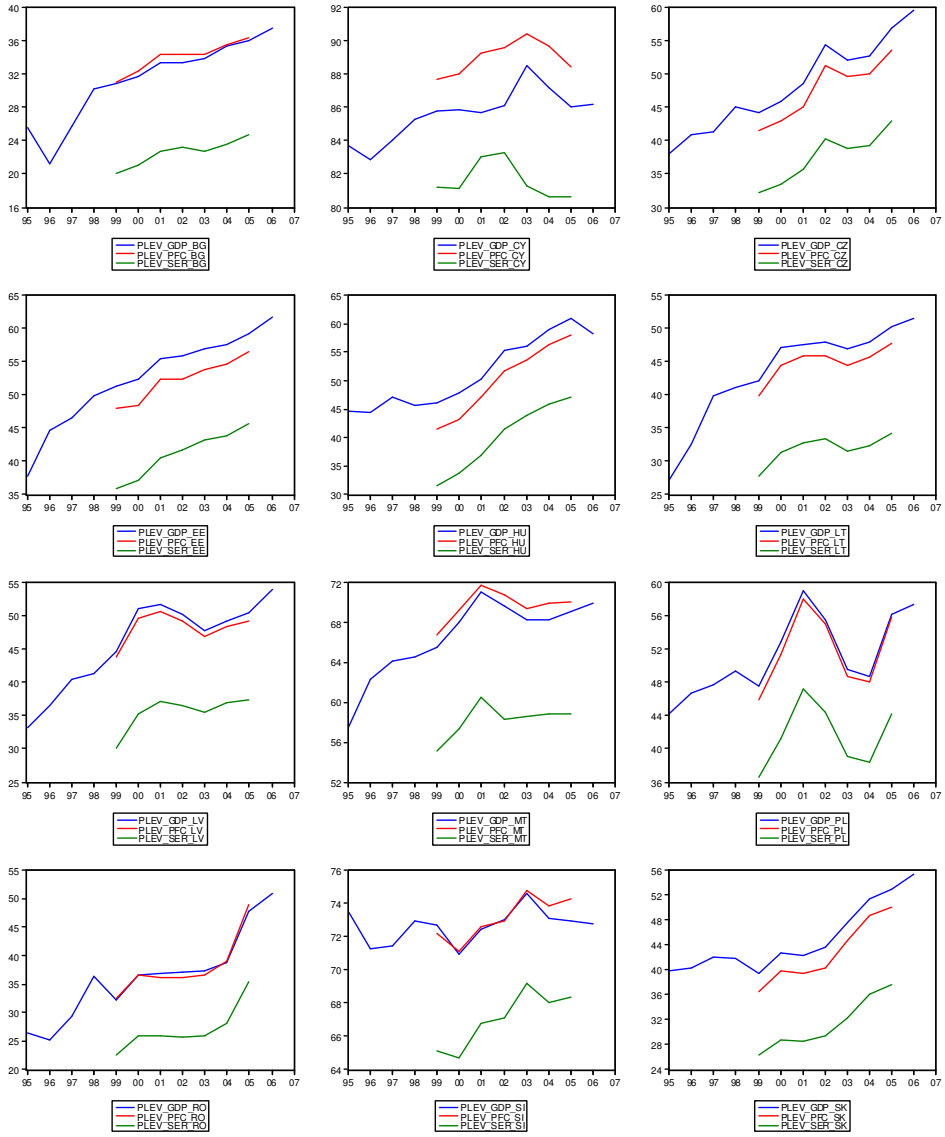

Figure 8: Price levels in the NMS-12 for GDP, private final consumption and services (source: Eurostat)

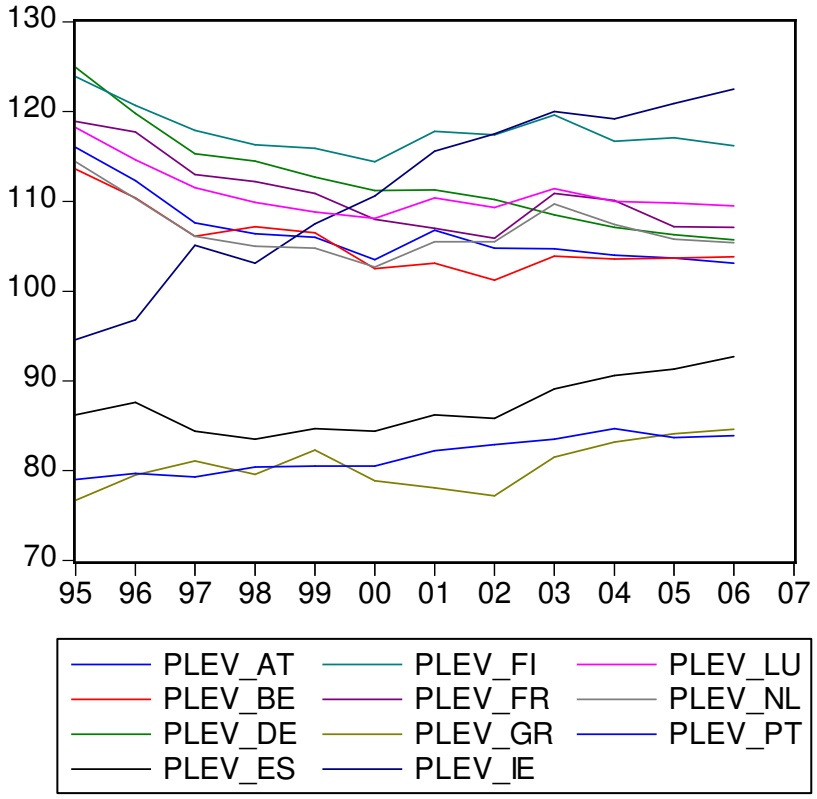

Figure 9: Price levels in terms of GDP relative to EU27 average: developed countries (source: Eurostat)

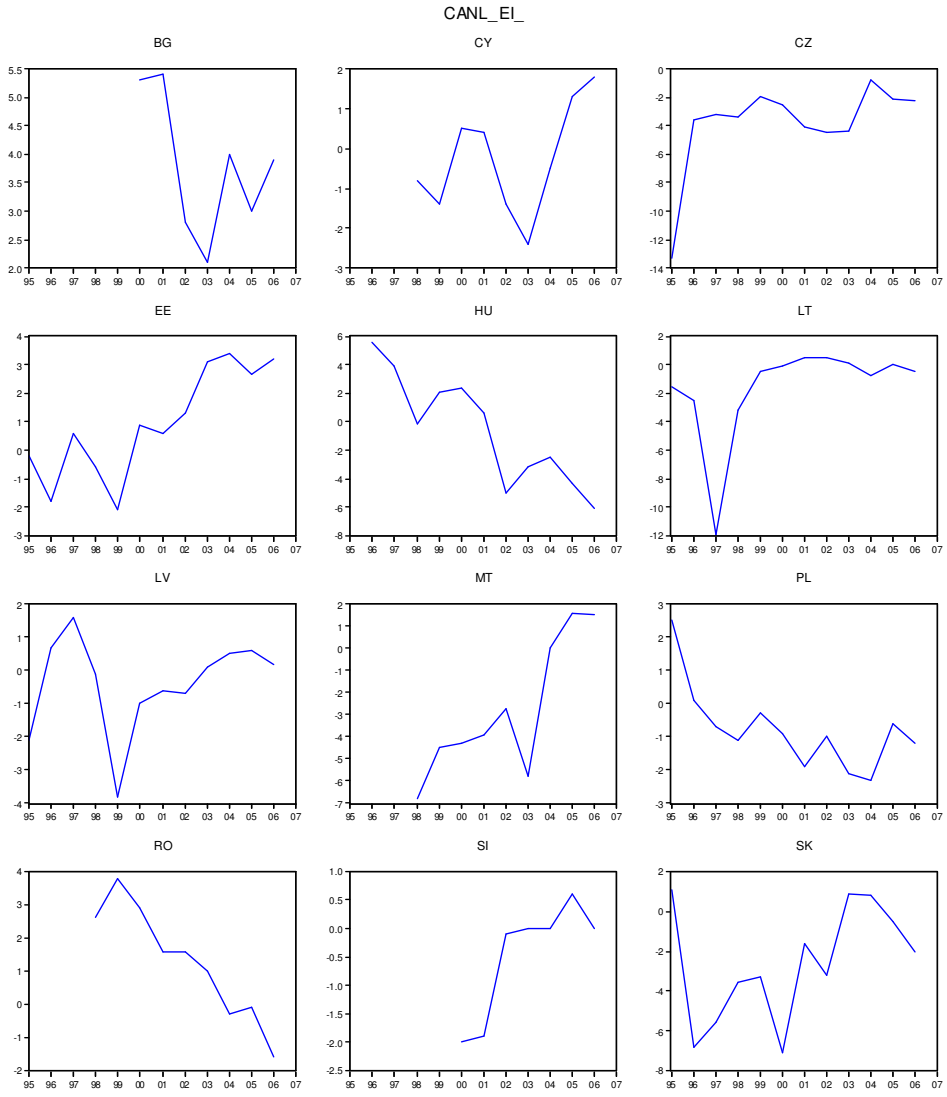

Figure 10: Fiscal stance in NMS-12 (source: Eurostat AMECO)

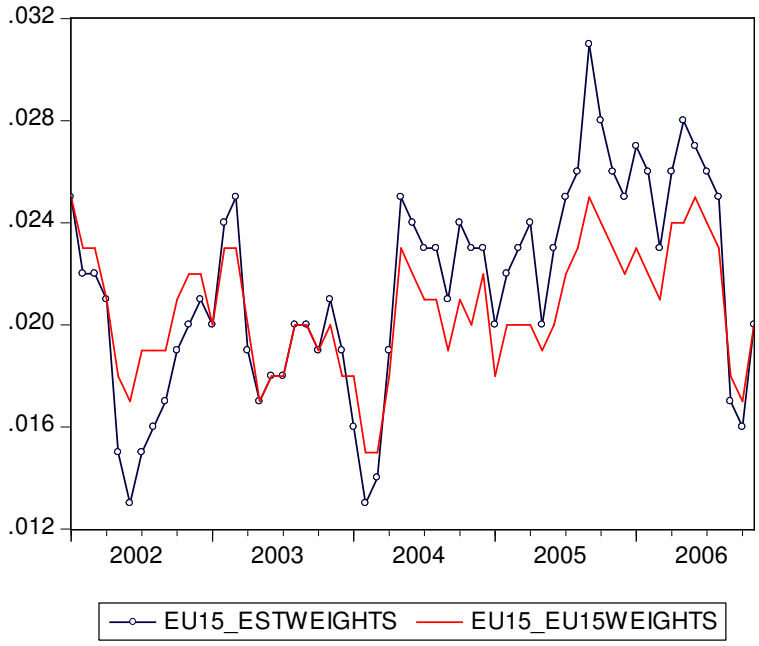

Figure 11: Inflation gap due to differences in the consumer basket (author's calculations, source: Eurostat)

Table 1: Unit root test of NMS-12 and EU-27 inflation difference based on the HICP (estimated in levels including individual intercepts)

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-6,91938	0	12	102
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-2,51424	0,006	12	102
ADF - Fisher Chi-square	47,7597	0,0027	12	102
PP - Fisher Chi-square	72,4918	0	12	107

Table 2: Inflation difference between NMS-12 and EU-27 explained by NEER, output gap, fiscal stance and price level

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
NEER (-1)					-0,16	-0,17	-0,12
					(-5.74)	(-9.17)	(-5.59)
Output Gap				0,14		0,05	0,16
				(0.82)		(0.44)	(1.6)
Fiscal Stance			0,40			0,20	0,16
			(3.43)			(2.48)	(2.07)
Price Level (-1)	-0,24	-0,12	-0,08	-0,11	-0,08	-0,09	-0,06
	(-3.13)	(-4.71)	(-4.41)	(-5.06)	(-5.34)	(-6.63)	(-4.54)
R-squared	0,25	0,82	0,57	0,70	0,70	0,83	0,72
Adjusted R-squared	0,18	0,80	0,53	0,67	0,67	0,81	0,68
S.E. of regression	9,74	8,47	5,32	7,48	5,45	4,15	2,33
Observations	119	119	111	119	119	111	102

Notes: columns (1)-(7) are using the HICP based inflation differentials as the dependent variable, Sample: 1997-2006, 12 EU NMS (except for column (7) in which Romania is excluded). The pooled least squares estimates, the columns (2)-(7) have been corrected for cross-section heteroscedasticity in the GLS specification. Time fixed effects included. The t-statistics in parenthesis is based on White-corrected standard errors.

Table 3: Various inflation measures: HICP, HICP_xesa, HICP-xefa, HICP_serv, GDP deflator, private final consumption deflator, export deflator

	(6)	(8)	(9)	(10)	(11)	(12)	(13)
NEER (-1)	-0,17	-0,01	-0,01	0,04	-0,13	-0,08	-0,12
	(-9.17)	(-0.55)	(-0.3)	(1.17)	(-5.82)	(-1.65)	(-3.79)
Output Gap	0,05	0,20	0,18	0,22	0,04	-0,01	-0,24
	(0.44)	(2.16)	(1.93)	(1.62)	(0.32)	(-0.04)	(-1.03)
Fiscal Stance	0,20	0,10	0,16	0,12	0,24	0,20	0,29
	(2.48)	(1.37)	(2.05)	(1.32)	(2.28)	(2.07)	(1.79)
Price Level (-1)	-0,09	-0,06	-0,08	-0,06	-0,07	-0,06	-0,01
	(-6.63)	(-5.56)	(-6.88)	(-0.06)	(-4.12)	(-4.47)	(-0.64)
R-squared	0,83	0,43	0,51	0,35	0,62	0,47	0,32
Adjusted R-squared	0,81	0,35	0,43	0,25	0,57	0,39	0,23
S.E. of regression	4,15	2,64	2,65	3,07	4,57	4,64	5,58
Observations	111	97	95	78	111	84	111

Notes: The following dependent variables are used: HICP excluding energy and seasonal food based inflation differentials in column (8), HICP excluding energy, food, alcohol and tobacco based inflation differentials in (9), HICP services based inflation differentials in (10), GDP deflator based inflation differentials in (11), private final consumption deflator based inflation differentials in (12), export price index based inflation differentials in (13). Sample: 1997-2006, except for columns (10) and (12) where time coverage is shorter: 2000-2006, 12 EU NMS. The pooled least squares estimates; the results have been corrected for cross-section heteroscedasticity in the GLS specification. Time fixed effects included. The t-statistics in parenthesis is based on White-corrected standard errors.

Table 4: Testing with pooled GMM

	(6)	(14)	(15)	(16)	(17)	(18)	(19)
NEER (-1)	-0,17	-0,18	-0,03	-0,21	-0,18	-0,12	-0,13
	(-9.17)	(-7.34)	(-6.39)	(-10.69)	(-6.2)	(-3.65)	(-3.97)
Output Gap	0,05	-0,26	0,17	-0,02	-0,26	-0,25	-0,04
	(0.44)	(-1.25)	(3.43)	(-0.1)	(-1.29)	(-1.38)	(-0.24)
Fiscal Stance	0,20	0,22	0,06	0,28	0,24	0,23	0,19
	(2.48)	(1.19)	(1.09)	(2.29)	(1.34)	(1.38)	(1.5)
Price Level (-1)	-0,09	-0,14	-0,21	-0,08	-0,14	-0,12	-0,05
	(-6.63)	(-4.13)	(-6.67)	(-2.9)	(-4.22)	(-3.61)	(-2.3)
AR(1)			0,81				
			52,37				
Instruments:							
NEER (-2)				+			+
Output Gap (-1)					+		+
Output Gap (-2)					+		+
Fiscal Stance (-1)						+	+
R-squared	0,83	0,76	0,91	0,80	0,76	0,51	0,47
Adjusted R-squared	0,81	0,73	0,91	0,77	0,73	0,45	0,40
S.E. of regression	4,15	4,82	1,91	4,96	4,83	4,79	5,07
Observations	111	111	99	104	111	106	99

Notes: columns (6), (14)-(19) are using the HICP based inflation differentials as the dependent variable, sample: 1997-2006, except for the columns (16) and (19) in which the sample cover the period of 1998-2006, 12 EU NMS. The pooled least squares an estimate is used in column (6), for the rest the GMM is used. The results have been corrected for cross-section heteroscedasticity in the GMM estimation. Time fixed effects included in all columns except for the column (15). The t-statistics in parenthesis is based on White-corrected standard errors.

Table 5: Pooled LS and pooled GMM estimates on sub-periods and adding currency boards dummy

	(20)	(21)	(22)	(23)	(24)	(25)	(26)
NEER (-1)	-0,14	-0,15	-0,18	0,08	-0,23	0,06	-0,01
	(-5.3)	(-4.41)	(-7.4)	(2.88)	(-8.22)	(3.42)	(-4.01)
Output Gap	0,02	-0,31	-0,12	0,40	-0,41	0,29	0,25
	(0.2)	(-1.67)	(-1.09)	(2.82)	(-1.46)	(1.49)	(3.59)
Fiscal Stance	0,29	0,62	0,31	0,46	0,21	0,39	0,27
	(3.02)	(3.83)	(2.63)	(3.05)	(0.93)	(2.27)	(2.56)
Price Level (-1)	-0,10	-0,17	-0,12	-0,08	-0,14	-0,09	-0,09
	(-6.86)	(-5.46)	(-5.43)	(-4.32)	(-3.56)	(-4.86)	(-3.7)
Price Level (-1)_CB	-0,04	-0,11	-0,05	-0,04	-0,06	-0,03	-0,02
	(-4.33)	(-4.43)	(-3.61)	(-2.7)	(-1.63)	(-1.7)	(-1.07)
AR(1)							0,63
							51,94
R-squared	0,69	0,74	0,86	0,41	0,88	0,51	0,99
Adjusted R-squared	0,65	0,70	0,83	0,31	0,85	0,42	0,99
S.E. of regression	3,46	4,35	3,36	2,61	4,09	2,69	1,40
Observations	111	111	51	60	51	60	60

Notes: columns (20)-(26) are using the HICP based inflation differentials as the dependent variable, sample: 1997-2006 in the columns (20) and (21), 1997-2001 in (22) and (24), 2002-2006 in (23), (25) and (26), 12 EU NMS. The pooled least squares estimates is used in columns (20), (22) and (23), for the rest the GMM is used. The estimates are corrected for cross-section heteroscedasticity. Time fixed effects included. The t-statistics in parenthesis is based on White-corrected standard errors.

Table 6: Testing alternative measures of NEER and fiscal stance, adding productivity and output measures, pooled GMM estimates

	(27)	(28)	(29)	(30)	(31)	(32)	(33)
NEER (-1)		-0,18	0,01	0,00	-0,12	-0,10	-0,02
		(-7.09)	(0.46)	(0.18)	(-3.21)	(-2.5)	(-2.15)
Output Gap	-0,48	-0,26	0,42	0,42	-0,30	-0,19	0,14
	(-1.69)	(-1.27)	(3.12)	(3.18)	(-1.38)	(-0.84)	(1.92)
Fiscal Stance	0,37		0,25	0,22	0,06	0,31	0,08
	(2.35)		(2.15)	(2.14)	(0.38)	(1.64)	(1.04)
Price Level (-1)	-0,13	-0,13	-0,10	-0,08	-0,01	-0,12	-0,22
	(-3.91)	(-4.11)	(-3.27)	(-6.09)	(-0.25)	(-4.67)	(-3.46)
AR(1)							0,77
							17,94
NEER (-1)	-0,06						
	(-1.35)						
Fiscal stance		0,34					
		(1.79)					
Productivity level (-1)			0,02				
			(0.66)				
Productivity growth				0,06			
				(0.42)			
Output p. c. (PPS)					-0,11		0,09
					(-2.05)		(1.84)
Output p. c. growth						-0,14	
						(-0.84)	
R-squared	0,39	0,76	0,45	0,45	0,54	0,49	0,86
Adjusted R-squared	0,31	0,73	0,37	0,37	0,47	0,42	0,85
S.E. of regression	5,79	4,77	3,19	3,19	4,57	4,71	1,86
Observations	111	111	104	104	110	107	98

Notes: columns (27)-(33) are using the HICP based inflation differentials as the dependent variable, sample: 1997-2006 in columns (27)-(32), 1998-2006 in (33), 12 EU NMS, GMM estimates, corrected for cross-section heteroscedasticity. Time fixed effects included. The t-statistics in parenthesis is based on White-corrected standard errors.

Table 7: Testing with quarterly data

	(34)	(35)	(36)	(37)	(38)	(39)	(40)
NEER (-4…-9)	-0,13	-0,21	0,15	-0,02	-0,10	-0,11	-0,02
	(-9.05)	(-20.09)	(6.43)	(-3.2)	(-6.06)	(-7.07)	(-3.2)
Output Gap(-4)	0,37	0,37	0,10	0,08	0,36	0,21	0,08
	(4.38)	(5.2)	(0.61)	(1.33)	(3.95)	(2.29)	(1.33)
Fiscal Stance	0,16	0,06	0,00	-0,01	0,25	0,08	-0,01
	(2.89)	(0.64)	(0.05)	(-0.1)	(3.12)	(1.36)	(-0.1)
Price Level (-4)	-0,04	-0,06	-0,05	-0,16	-0,06	-0,05	-0,16
	(-4.31)	(-6.22)	(-3.62)	(-3.41)	(-5.39)	(-5.55)	(-3.41)
Price Level (-4) * CB					-0,03		
					(-3.62)		
AR(1)				0,94			0,94
				(58.02)			(58.02)
R-squared	0,70	0,84	0,36	0,93	0,67	0,58	0,93
Adjusted R-squared	0,65	0,82	0,25	0,93	0,61	0,51	0,93
S.E. of regression	2,59	2,26	1,90	1,06	2,48	2,66	1,06
Observations	309	111	144	301	309	309	301

Notes: columns (27)-(33) are using the annual HICP based inflation differentials as the dependent variable, sample: 1997Q2-2006Q4 is used in columns (34), (38) and (40), 1997Q3-2006Q4 in (37) and (40), 1997Q2-2001Q4 in (35), and 2002Q1-2006Q4 in (36), 12 EU NMS, pooled EGLS is used for columns (34)-(38),the GNN for columns (39) and (40), all estimates are corrected for cross-section heteroscedasticity. Time fixed effects included. The t-statistics in parenthesis is based on White-corrected standard errors.

Table 8: Cross country correlations in output gap in EU-27, 1997-2006

UK	SK	SI	SE	RO	_PT	PL	NL	LT	LV	LU	LT	IT	IE	HU	GR	FR	FI	ES	EE	DK	DE	CZ	CY	BG	BE	AT	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	AT
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0,75	BE
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0,17	0,04	BG
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0,55	0,72	0,74	CY
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0,40	0,70	0,04	0,23	CZ
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-0,03	0,70	-0,08	0,86	0,82	DE
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0,91	0,08	0,60	-0,19	0,77	0,89	DK
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0,12	0,04	0,91	0,33	0,62	0,11	0,24	EE
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0,28	0,68	0,79	0,28	0,94	0,49	0,86	0,73	ES
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0,62	0,04	0,95	0,91	-0,06	0,56	-0,28	0,75	0,88	FI
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0,74	0,73	-0,33	0,70	0,82	-0,34	0,68	-0,09	0,80	0,70	FR
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-0,35	-0,65	0,03	0,28	-0,64	-0,43	0,29	0,04	0,72	-0,21	-0,54	GR
-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0,59	-0,02	-0,20	0,28	0,39	-0,20	-0,22	0,47	0,38	0,71	0,10	0,00	HU
-	-	-	-	-	-	-	-	-	-	-	-	-	1	-0,34	-0,32	0,80	0,69	0,59	-0,39	0,65	0,83	-0,46	0,44	-0,27	0,70	0,44	IE
-	-	-	-	-	-	-	-	-	-	-	-	1	0,95	-0,22	-0,15	0,82	0,64	0,72	-0,27	0,65	0,86	-0,31	0,56	-0,08	0,78	0,48	IT
-	-	-	-	-	-	-	-	-	-	-	1	-0,67	-0,76	0,38	0,36	-0,63	-0,30	-0,16	0,86	-0,29	-0,40	0,75	-0,05	0,50	-0,32	-0,08	LT
-	-	-	-	-	-	-	-	-	-	1	-0,30	0,75	0,73	0,02	-0,28	0,78	0,78	0,92	0,15	0,82	0,89	0,12	0,83	0,23	0,90	0,82	LU
-	-	-	-	-	-	-	-	-	1	0,19	0,85	-0,30	-0,40	0,40	0,22	-0,29	0,07	0,31	0,98	0,14	0,04	0,93	0,40	0,64	0,12	0,30	LV
-	-	-	-	-	-	-	-	1	-0,22	0,72	-0,56	0,70	0,78	-0,44	-0,76	0,74	0,88	0,48	-0,23	0,90	0,85	-0,29	0,38	-0,46	0,65	0,72	LT
-	-	-	-	-	-	-	1	0,92	-0,28	0,72	-0,61	0,74	0,81	-0,39	-0,72	0,86	0,91	0,54	-0,32	0,86	0,87	-0,37	0,45	-0,45	0,72	0,77	NL
-	-	-	-	-	-	1	0,46	0,44	0,56	0,40	0,38	-0,02	-0,01	-0,14	-0,59	0,21	0,65	0,28	0,51	0,64	0,47	0,39	0,33	-0,08	0,40	0,76	PL
-	-	-	-	-	1	0,02	0,85	0,79	-0,68	0,44	-0,85	0,77	0,87	-0,55	-0,56	0,75	0,64	0,25	-0,67	0,55	0,67	-0,74	0,13	-0,65	0,46	0,36	PT
-	-	-	-	1	-0,85	0,10	-0,66	-0,62	0,80	-0,17	0,78	-0,43	-0,60	0,48	0,57	-0,55	-0,41	0,05	0,80	-0,31	-0,31	0,90	0,17	0,76	-0,17	-0,14	RO
-	-	-	1	0,15	0,08	0,70	0,54	0,49	0,50	0,78	0,10	0,35	0,26	0,32	-0,29	0,62	0,68	0,78	0,43	0,73	0,67	0,46	0,84	0,37	0,77	0,90	SE
-	-	1	0,83	0,55	-0,30	0,71	0,17	0,21	0,86	0,61	0,49	0,09	0,01	0,33	-0,08	0,16	0,47	0,63	0,81	0,53	0,46	0,79	0,68	0,54	0,55	0,67	SI
-	1	0,74	0,38	0,56	-0,42	0,77	-0,06	-0,01	0,85	0,15	0,75	-0,28	-0,30	-0,09	-0,15	-0,31	0,23	0,11	0,83	0,24	0,14	0,69	0,16	0,23	0,06	0,35	SK
1	0,31	0,62	0,87	0,02	0,16	0,74	0,56	0,43	0,35	0,56	0,11	0,29	0,17	0,28	-0,32	0,60	0,70	0,59	0,30	0,67	0,61	0,28	0,64	0,13	0,67	0,86	UK

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Chapter 3

Credit Booms and the Exchange Rate Regime

3.1 Introduction

There are periods when bankers are extraordinarily keen to increase lending and people are willing to borrow extensively. Often these periods are followed by times when bankers become worried about having been too kind, while people regret easy borrowing from future income streams. My data show that the number of credit booms has been increasing in the last three decades.

In this paper I investigate whether exchange rate flexibility makes it easier for credit booms to develop. There are reasons to think that rigid exchange rates create a more fertile soil for credit booms to emerge. One can intuitively think about curative and preventive effects that the exchange rate provides. On the one hand, a flexible exchange rate should a priori make it easier to cure a credit boom, as fixing the exchange rate makes monetary policy ineffective. However, success in controlling undesired credit growth even being forearmed with the tools of effective monetary policy is not guaranteed. On the other hand, if credit growth is fed by foreign savings, a flexible exchange rate may respond to capital inflows as an automatic stabilizer that curbs the boom: exchange rate appreciation reduces the country's competitiveness and therefore the incentives to continue borrowing are reduced.

The literature tends to favor the view that being drunk on credit characterizes mostly middle- and low-income countries. Indeed, the selection of credit boom episodes in this paper supports this view, although all currently developed countries have had credit booms at some point of time in the past. Emerging and middle-income countries are usually net borrowers, which means that the automatic stabilizing role of the exchange rate could be important.

Is booming credit a part of the growing pains that threaten countries at certain stages of development, or is it a symptom of a disease or even disease-like state that no country is immune to? Rapid financial integration and credit deepening raises questions that economics is often asking – is it an equilibrium process or is policy intervention needed. Our current state of understanding of the causes and consequences of booms in the credit sector is not ready to give complete answers to these questions. Credit booms are usually an indication of good health of the economy but some booms do not have a happy ending. The literature clearly fails to identify the good ones.

Although the empirical section of the paper does not include current credit booms in the Central and Eastern European (CEE) countries because they are too recent, the developments in this region have motivated my interest in asking the questions of this paper. Financial deepening in the CEE countries, especially in the Baltic States, has been extremely fast, at least according to the standards of financially liberalized developed economies. The Baltic States share a common feature -- currency board -- which raises a question whether a fixed exchange rate provides a more favorable environment for credit booms to unfold. A crucial distinction that separates the exchange rate regimes in the CEE region as compared to other countries is the perspective of joining the European Monetary Union. The circumstance that currency boards in the CEE countries are temporary arrangements may have different implications for the borrowing and lending behavior as compared for example to Argentinean currency board for which the ultimate end of monetary policy strategy was unclear.

My empirical results show that the exchange rate system is a part of the credit boom story in a sense that the exchange rate flexibility measure is able -- statistically significantly -- to explain the movements in the credit variable. I was not able to detect the existence of a solid relationship between exchange rate flexibility and the credit variable in the non-boom periods. When it comes to a boom period, credit expansion tends to be larger, the higher is exchange rate flexibility. This is in contrast to what one would expect. Literature has highlighted excessive borrowing in fixed exchange rate regimes, for example, due to moral hazard problems. One of my results says that in a freely floating exchange rate system credit expansion is higher by 2.1% in a boom period as compared to a country which uses foreign currency as a legal tender. A more detailed view of the different stages of the credit boom shows that credit expansion in flexible exchange rate systems is faster in the build-up and peak stage, while the results are ambiguous for the ending stage. The database that I use starts from 1960s and contains 166 countries where altogether 549 credit booms can be documented. My definition of a credit boom is explained in the data section. I would like to highlight that my results cannot be used to conclude whether a particular exchange rate regime provides better safeguarding remedies against excessive credit booms.

The paper is organized as follows. The next section presents an eclectic set of issues in which the literature builds links to credit booms in one or another way. The focus is still kept on the exchange rate. The third section describes the data sources and provides some descriptive statistics of credit booms. The fourth and fifth sections are documenting and commenting the results and lay down a few ideas for future work.

3.2 Discussion of selected issues in the credit boom story

The purpose of this section is to provide an overview of issues related to lending booms. This overview, however, is eclectic because placing a narrow focus on the exchange rate and credit boom relationship would leave only a few references in hand.

A credit boom need not be a shock in itself but a response of the economy to various types of shocks. Credit growth is at the intersection of several fields of the literature, such as economic growth, development finance, financial and banking crises, credit

market imperfections, international capital flows, asset prices, and etc. The factors underlying credit booms are often categorized into two basic types: either related to domestic or external macroeconomic environment. The literature is less clear when it comes to the question what brings a lending boom to an end. The discussion is usually about accumulating imbalances that start eroding the economy's competitiveness. Another view is that increasing risks undermine credibility and capital inflows stop. Crisis is a third possibility. These constraints arise mostly from the supply side. However, demand factors may also bring the credit boom to an end. The situation in which sufficient credit but no borrowers are available is likely to differ in its implications from the situation in which lenders have no funds despite a waiting line of borrowers with creditworthy projects. Therefore, the range of reasons why credit booms emerge, evolve and come to the end is broad and does not necessarily mean that each boom has a clear nexus to nominal exchange rate.

Most developed countries have experienced lending booms during the past half-century. In order to distinguish between boom and non-boom episodes, we need to define a criterion. This is difficult because a boom in a developed country may not be a boom in an emerging country. The discussion over the boom definition is an empirical issue, which is left for the data section. All countries in the sample of this paper have had credit booms at some point in time. The overall number of booms has increased in the last three decades but it has decreased for developed countries. While the number of booms in high-income countries was 49 between 1965 and 1984, it has declined to 30 between 1985 and 2005. The evidence is supporting the view that credit booms characterize economies more likely at certain stage of development.

The remaining part of this section proceeds as follows. I first present some visions of understanding the relationship between economic growth and credit expansion and discuss how the understanding has evolved. Thereafter I review the linkages between credit booms, financial liberalization and crises. In the following step I review the analysis of credit booms and the exchange rate and then turn to the data section.

3.2.1 Economic growth and credit expansion

Boom-bust growth performance is often associated with rapid credit expansion because credit booms are usually followed by falling GDP growth and sometimes even by costly recessions. The economic growth literature has been struggling for a long time with the chicken-and-egg type of problem while investigating the nexus of cause and effect between economic growth and the evolution and performance of the financial system. The development economics literature has started to acknowledge the importance of financial development and included the growth-finance nexus in the attention focus not so long ago. This conclusion was well-stated by Ross Levine (1996) a decade ago: "Although conclusions must be stated hesitantly and with ample qualifications, the preponderance of theoretical reasoning and empirical evidence suggests a positive, first-order relationship between financial development and economic growth. A growing body of work would push even most skeptics toward the belief that the development of financial markets and institutions is a critical and inextricable part of the growth process and away from the view that the financial system is an inconsequential side show". While the credit boom literature has placed a lending variable on the left hand side and a growth variable on the right hand side, it is the other way around in the growth literature. Both of these regressions are subject to the endogeneity bias. A thorough discussion of the current state of understanding this relationship and ample of references are presented in Levine (2004).

The fluctuations of high-income countries are currently of substantially smaller amplitude than in middle-income countries, which is consistent with the finding that there are fewer credit booms as well. The discussion over boom-bust cycles nevertheless is not fully unfamiliar to developed European economies and it has a direct connection to the

exchange rate. Going back in time the discussion was developed in the context of inflation convergence in the European Monetary System (EMS). Currently it is referred to as the 'Walters critique'. (See Walters (1986).) The critique says that the EMS does not produce inflation convergence but divergence across member states with fixed exchange rates. The intuition is based on pro-cyclical effects of monetary policy. Suppose that one country experiences 10% inflation while the other 3% inflation and the nominal interest rate is 8% in both countries because the fixed exchange rate is fully credible. It means only 2% real interest rate in one country and 5% real interest rate in the other. Therefore in a fixed exchange rate system common monetary policy amplifies boom-bust behavior if the cyclical position of the economies is not the same. For this example to be valid, full cross-border capital mobility is an additional precondition allowing nominal interest rate equalization. If capital restrictions are present, like it was the case in the EMS, the consequences are less severe. Overall, this example says that in certain circumstances credit booms in fixed exchange rate systems are more likely to arise.

Are credit booms inevitable parts of economic performance, or do they endanger economies only at a certain stage of development? As credit booms occur more frequently in low- and middle-income countries, there are lots of discussions about credit growth and financial deepening is in the context of economic and financial development. In this literature the understanding of credit deepening and the attitude towards credit growth has changed over time. In the more recent literature credit boom is treated as an ambiguous or even a positive phenomenon while it was seen before mostly as a part of early warning system. In recent years consensus is shifting towards the view that development without credit booms should be considered as inferior to development with credit booms-caused boom-bust growth cycles. (See Tornell and Westermann (2005), Ranciere et al. (2004).) The boom-bust growth discusion has also been extended to the sectoral level. Schnure (2005) for example argues that changes in the mortgage market structure, which have resulted in stabilizing the growth of residential investment and housing starts, could be the reason why the volatility of U.S. output has declined in last decades. Recent developments in the U.S. housing market, however, put this conclusion to a severe test. One can nevertheless conclude that credit booms are inevitable parts of economic performance, which have higher likelihood to emerge in earlier stages of development.

3.2.2 Financial liberalization, crisis and credit booms

Everything does not always go smoothly in the growth process and time after time economies experience crises. Literature has been keen to bridge crises and fast credit growth because many crises episodes share a common feature - preceding lending boom. This does not imply, however, that lending booms are necessarily followed by crises. The stylized statistical facts show that the conditional probability of having a banking crisis after a lending boom is higher than having a banking crisis during tranquil times. The probabilities in both cases are relatively small and rarely exceed 20%. (See Tornell & Westermann (2005) and Gourinchas et al. (2001).) Literature clearly fails to identify when credit growth switches from equilibrium to a disequilibrium process and to distinguish ex ante why some credit booms have a happy ending and the others do not.

About a decade ago, especially after the Asian financial disturbance which also brought up the exchange rate issue, literature associated credit booms closely with banking and currency crises. A substantial part of this literature has found credit growth having the properties of an early warning indicator or explanatory power in crisis regressions. This is empirically confirmed for example in Burnside et al (1999), Eichengreen and Arteta (2001), Frankel and Rose (1996), Kroszner et al (2007) and others. In Kaminsky (2006) credit is an explanatory variable for one type of crisis. When it comes to the exchange rate then abandoning the fixed exchange rate is sometimes one act of the crisis play. The empirical results in Domaç and Martinez Peria (2000),

however, confirm that fixed exchange rate regimes in developing countries diminish the likelihood of banking crises. When a banking crisis has already occurred, the real costs associated to it are more severe in fixed exchange rate regimes. They also find evidence that lending-based consumption booms emerge more easily in fixed exchange rate regimes. Therefore it is crucial to check for changes in the exchange rate arrangement while looking at the implications of the exchange rate system in boom years. The crises literature also highlights that imprudent lending may cause unwarranted increases in asset prices (usually land and real estate). Kiyotaki and Moore (1997) show how increasing asset prices help sustaining the credit boom. This is due to a dynamic interaction mechanism between asset prices and credit limits that has powerful implications on the persistence of the credit boom. Increases in asset prices reduce borrowing limits because the value of collateral also increases, which allows borrowing even more.

Financial liberalization process, which has often unleashed credit booms, has incurred uncertainty. On the one hand growth potential is raised because access to financial sources improves investment but on the other hand increase in financial exposure is seen as a source of fragility. Some roads from financial liberalization to financial integration and financial deepening are jumpy. There are various reasons to explain that. In the theoretical set up of Dell'Ariccia & Marquez (2005) a reduction in informational asymmetries across banks gives rise to a switch from a tight lending standards regime to a looser regime when the proportion of unknown borrowers is high. Banks reduce collateral requirements in order to increase their market share and for this sake credit standards are relaxed even if the overall creditworthiness of borrowers remains the same, which results in a lending boom. Therefore credit booms may contain not only a cyclical but also a structural component. Another explanation to the boom-bust nature of a credit expansion is due to changes in banks' screening quality. The claim is that credit busts appear because after financial liberalization during the lending booms the ability of banks to screen borrowers deteriorates. This may lead to a deterioration of the portfolio and make profits lower and more volatile. Therefore credit booms may either be lending or borrowing booms or both.

3.2.3 Credit booms and the exchange rate

The issue whether credit booms behave differently depending on the exchange rate regime (or whether exchange rate regimes behave differently faced with a credit boom) depends on whether the functioning of the financial sector depends on the exchange rate regime. The most powerful theoretical argument to distinguish between different exchange rate regimes is the effectiveness of monetary policy. In a fixed exchange rate system monetary policy is not independent. Therefore this mean may not serve the interest of the domestic economy over the credit cycle in the best way. In a flexible exchange rate system monetary policy is endogenous to economic performance. This argument can be disputed on empirical grounds because conducting monetary policy may be inefficient, especially in middle- and low-income countries. Otherwise it is unlikely that transaction and information frictions are different enough across exchange rate regimes that resource allocation efficiency is affected. Should it be true, substantial diversity in the structure of financial market institutions and contracts would be observed. But this is not the case.

There are also arguments on moral hazard, which claim that in a fixed exchange rate regime banks may take on too much risk. It has been shown how abandoning a fixed exchange rate is one act in the crisis play. (Therefore the conclusion is that fixed exchange rates are more prone to moral hazard problems.) Burnside et al. (1999) consider lending booms a crucial component preceding the crisis. They argue that fixed exchange rates work as a guarantee that is provided by government against exchange rate exposure. This guarantee leads banks to underhedge against the exchange rate risk and, as a result, a

wave of bankruptcies follows currency devaluations. This is because this guarantee is an imperfect substitute to a well-functioning forward market. The same issue has also been dissected by Eichengreen & Hausmann (1999) who emphasize the importance of moral hazard problems, which may give rise to excessive borrowing by banks from abroad and consequently to a lending boom. A credible pegged exchange rate, which provides insurance against the risk of exchange-rate changes, being one form of implicit guarantees, is a source of moral hazard. The story is exactly the same like above – if insurance is available, banks do not hedge against exchange rate changes. However, should an exchange rate change occur, it is more devastating if hedging is not done. A slightly different focus is in Tornell and Westermann (2005) who study the situation in which the nontradable sector borrows in foreign currency but its cash flows are in domestic currency. Therefore exchange rate depreciation increases the debt burden but leaves cash flows at the same level. Fixed exchange rate, given that it survives, is not subject to this mechanism but then the adjustment must take place in the real economy. Tornwell and Westermann (2005) use lending booms stemming from credit market imperfections to explain boom-bust cycles in financially liberalizing middle-income countries. In this framework the amplifying mechanism is present due to the boom in the nontradable sector because its access to credit improves. The interaction of two credit market imperfections – contract enforceability and systematic bailout guarantees – creates leveraged expansions of the nontradable sector.

When it comes to empirics, the literature becomes rather thin. Tornell and Westermann (2005) have answered the question about the role of nominal exchange rate regime in financial liberalizations initiated boom-boost cycle based on a small sample of countries. Their sample includes only 10 countries: Mexico, Thailand, Korea, Peru, Finland, Sweden, The Philippines, Israel, Malaysia and Brazil. They conclude that boom-boost cycles do not differ significantly in fixed versus non-fixed exchange rate regimes. Ötker-Robe et al. (2007) in contrast conclude that greater exchange rate flexibility is always a part of a successful policy mix against large capital inflows. However, this conclusion stems from the qualitative analysis based mostly on the Central and Eastern European countries and explicit empirical evidence is not provided. Two references from Sebastian Edwards are also in favor of a flexible exchange rate regime. Edwards (2007) looks at capital flows contractions and sudden stop episodes. The empirical finding is that a flexible exchange rate reduces the probability of experiencing a capital flow contraction and the benefits become larger the larger is capital inflow. Edwards (2004) investigates whether sudden stops and current account reversals are related. Among other things it is also tested whether the exchange rate system matters in accommodating the shocks stemming from a reversal. The results indicate that a flexible exchange rate system absorbs such shocks better. These results are somewhat in contrast to the findings of Domaç & Martinez Peria (2003), which were discussed above.

3.3 The data

This section overviews my data sources, discusses issues regarding the definitions and measurement of credit booms and provides some statistical regularities on credit booms. My sample consists of 166 countries and the yearly observations cover 1960-2006 inclusive.

The empirical part uses data from the IMF International Financial Statistics database. As the paper investigates the nexus between exchange rate flexibility and credit booms, a measure for exchange rate flexibility is needed. For this purpose the classification of exchange rate systems provided by Reinhart and Rogoff (2002) is employed. In this classification market-determined parallel exchange rates are extensively used in order to correct the de jure exchange rate system. Exchange rate systems are divided into 14

categories where a higher number corresponds to higher exchange rate flexibility. The data end in 2001 and this is the reason why estimates are carried out until 2001. Figure 1 shows how this average exchange rate flexibility measure has evolved over time in my sample. It was stable throughout the 1960s until the collapse of the Bretton-Woods system in 1971. Thereafter exchange rate flexibility gradually increased until the beginning of the 1990s when a declining trend started due to changes in several low-income countries and continued in the end of the decade when EMU started. The changes in exchange rate regimes are in figure 2. In this figure the value of 0.1 refers that 10% of countries changed their exchange rate arrangement.

The starting point of the empirical exercise is defining a credit boom, which is done in this paper similarly to Gourinchas et al. (2001). According to this definition, it is not that all rapid increases in the ratio of credit over GDP qualify immediately as credit booms. There are a threshold and a trend needed to separate boom episodes from non-booms. This paper defines the trend as a five year moving average lagging by one year, i.e., data from *t-6* to *t-1* are used for *t*. The deviation of private sector credit to GDP from its trend is the first credit variable that I use in my empirical work. In order to qualify an increase in credit over GDP ratio as a credit boom, it has to exceed the trend by a certain threshold. More precisely, the increase in additional lending has to exceed the size of the banking sector by a threshold. The empirical section of this paper uses the 15% threshold. The boom episodes calculated in this way define the second credit variable that I use. The 15% threshold is relatively low but the reason is that lower threshold leaves more boom episodes in hand. Altogether 549 boom episodes are documented. The statistical properties of credit booms are provided also for 18, 24, 30, 36 and 42% thresholds in tables 2-5. This is to make some comparisons with the statistical properties of credit booms in Gourinchas et al. (2001) who use the same definition of a credit boom. Although my credit variables are stationary from economic concept point of view because credit cannot be expanded indefinitely, the stationarity tests for both of them can be found in tables 16 and 17.

A fully-fledged credit boom episode consists of three parts: build-up, peak and ending phases. The peak year, which separates the build-up and ending phases, is the highest deviation of credit over GDP ratio from its trend. This is the way in which Gourinchas et al. (2001) have defined a credit boom. However, it is disputable whether a credit boom must have all three phases. For example, if a credit boom comes to an end immediately after the peak because of a banking crises or a currency crash, it is still a valuable observation. An extended discussion on measuring credit booms is in Gourinchas et al. (2001). Rearranging all boom episodes so that the peak year coincides and taking the cross-section mean delivers the average credit boom, which is presented in figure 3. The peak year is denoted with solid vertical line. There credit boom in figure 3 has two peaks but figure 4 shows that the left hand side peak consists of a fairly small number of observations. There are only 11 yearly observations on the left hand side of the dotted vertical line, which is about 0.6% of the total pool of observations. The longest boom in figure 3 lasts for 18 years.

Differently from Gourinchas et al. (2001) my strategy in constructing the sample does not discriminate between economies by population size. As a result, the number of countries, which have at least 10 observations for credit over GDP ratio between 1960 and 2006, is 166. (See table 1.) Applying the 15% threshold gives that all countries have had at least one credit boom between 1965 and 2006. The number of boom episodes depending on the threshold is presented in table 2. The last observations in the end of the table describe countries in crises. For example, the threshold of 2500% contains three boom episodes: the Brazilian, Argentinean and Polish crises in the end of 80s and beginning of 90s, which all are ill-conditioned boom episodes. Although the table agrees with Gourinchas et al. (2001) that the number of booms is increasing in the threshold, it is not always true for some incremental increases in the threshold. The reason is that in

some cases a higher threshold splits one long boom episode into two separate episodes. With regard to the distribution of credit booms over time, one can see from table 2.1 that the five-year period between 1995 and 1999 provides the highest number of episodes while during the preceding five-year period from 1990 to 1994 the number of credit booms was almost twice smaller. There were also relatively many booms in the second half of 1960s. The number of boom episodes has been lower in the first half of the decade in the 70s, 80s and 90s but overall the number of credit booms has been increasing in the last three decades.

Tables 3 to 5 compare the duration of the lending boom depending on the presence of three boom phases. The results in table 5 are comparable to the results in Gourinchas et al. (2001). In table 3 all episodes are included which have at least the peak phase. In other words, the duration of the build-up and ending phases for those episodes, which consist only of a peak phase, is in calculations zero. Table 4 includes all episodes, which have peak and either the build-up or the ending phase. Table 5 contains only those episodes, which have all three components: the peak, build-up and ending phases. Table 5 expectedly delivers the longest durations for both the build-up and ending phase of the boom. The results in table 5 are relatively close to what Gourinchas et al. (2001) has documented. In their case the average lending boom lasts approximately 6 years. In table 5 the duration of the credit boom is between 5.1 and 6.7 years depending on the threshold. While Gourinchas et al (2001) have documented the ending phase to last somewhat longer than the build-up phase, my finding is the other way around. However, if one takes into account also those episodes, which have ended abruptly, the duration of credit booms becomes substantially shorter. In table 3 the duration varies between 2.1 and 3.9 years while in table 4 it is between 3 and 4.8 years depending on the threshold value. The duration of the credit boom is shorter in these cases mostly because the duration of the ending phase is shorter.

The empirical exercise has used various macro variables in combination with the exchange rate flexibility measure and boom dummies in order to explain the credit boom. The IFS codes for all variables can be found in table 6 together with the number of observations.

Domestic macroeconomic variables:

i. Credit over GDP is calculated by dividing total credit to the private sector by nominal GDP. As in Gourinchas et al. (2001) I have calculated the ratio of private sector debt to GDP by using the geometric average of credit stock at t and $t+1$ for period t private sector credit
ii. Consumption over GDP and investment over GDP are both found by dividing nominal consumption and nominal investment respectively with nominal GDP
iii. Domestic interest rate is proxied by lending rate in most of the cases
iv. Price level is measured by both consumer price index and GDP deflator. In estimations these variables are transformed into first differences.
v. Budget deficit is chosen as one of the main domestic policy variable

International and external variables:

i. Openness is calculated as a ratio of the sum of exports and imports over GDP. All variables are in nominal terms.
ii. Real effective exchange rate is calculated mostly on the basis on consumer price index and it enters into equations in first difference
iii. World interest rate is proxied by Eurodollar rate in London, quoted for 6 monthThe measure for capital inflow is the balance of the capital account, which is also divided by nominal GDP

One of the issues is the appropriateness of using the ratio of nominal credit growth over nominal GDP. The reason is that credit growth boosts demand, which gives rise to price pressures. In a fixed exchange rate economy this results in higher inflation, which rises nominal GDP. However, in a flexible exchange rate economy the response might be an appreciation of the

exchange rate. Such an asymmetric response might have implications to the question whether credit booms across exchange rate systems differ.

3.4 Empirical findings

The central question that the empirical exercise tackles is whether credit booms are different across various exchange rate systems. To answer this question, the data are organized into an unbalanced panel in which boom episodes are investigated in two alternative versions: together with non-boom episodes and separately thereafter. In summarizing the main findings of the exercise, I note that there is no clear evidence that credit performance is different across exchange rate regimes when there is no boom. However, when it comes to a boom period, credit is growing faster in more flexible exchange rate systems. This result is obtained in both cases when boom episodes are considered together with non-boom episodes and when they are kept separate. Furthermore, distinguishing between different stages of the boom delivers that flexible exchange rate systems experience faster credit expansion mainly in the build-up and peak stages while this cannot be concluded for the ending stage. There is some indication that post-peak contraction of the boom is faster in flexible exchange rate systems.

The credit variable in the first version is defined as the gap between private credit to GDP ratio and its trend for each cross-section while the second version chooses only those deviations from the trend, which qualify as boom episodes. These two credit measures are presented in the form of cross-section mean in figure 5 and 6. In boom episodes financial deepening is 4% faster amounting on average to 5.5% as compared to 1.5% when averaging over all deviations is done. Altogether, the results for 56 regressions are provided to test various specifications, variables of possible interest, and the robustness of these results. The exercise starts from the simplest version of the regression and thereafter a number of control variables and interaction terms are stepwise added.

$$\begin{aligned} gap(credit/gdp)_t = \quad & \alpha + \beta * exchangerateregime_t + \\ & + \chi * (investments/gdp)_{t-n} + \\ & + \delta * (consumption/gdp)_{t-n} + \upsilon_t \end{aligned} \tag{1}$$

The empirical test looks at the extent to which the exchange rate arrangement explains the performance of the credit variable in various specifications. i.e. the coefficient β in equation (1) is in the centre of interest. The demand components to be affected by domestic private credit expectedly the most are investment and household consumption. Therefore the ratios of these demand components to GDP are taken as the drivers of private credit usage as well. When it comes to χ and δ, the main shortcoming of this specification is the endogeneity bias because the causality may run in either direction. That is why in the majority of regressions n takes the value of one but the results are also reported when it takes the value of two. As credit booms are usually characterized by abundantly available loanable funds that are met by high demand from the real sector, one should be less concerned about the reversal causality in these periods. However, it is likely a more severe issue in the ending stage of the boom, especially if supply constraints appear in the financial sector. Therefore investment and consumption both enter in the regressions with a lag of one year but the robustness is also tested with estimation using a two year lag. This, however, does not affect substantially the results, which alleviates the doubts pertaining to causality[9]. The exchange rate regime is assumed

[9] On the other hand, due to the autoregressive nature of investment and consumption, the AR(1) coefficients for the panel with country-specific effects are relatively high: 0.78 and 0.75 respectively.

to be orthogonal to consumption and investment behavior and my empirical results do not detect significant variation in the value of β when I used either various lags for consumption and investment or the subsample.

To give a more structured answer to the core question a number of interaction terms are used, which are aimed to discriminate between booms and non-booms and between stages of a boom. These interaction terms combine the exchange rate flexibility measure with dummy variables that control the distance from the trend of the credit to GDP ratio. For that purpose three dummy variables adopting the unitary value in the building, peak, and the ending phase of the boom are used. The fourth dummy is a summation of all three dummies.

I have taken the exchange rate flexibility measure from Reinhart & Rogoff (2002) where various regimes are identified for a large number of countries up to 2001 and can be presented in ascending order of flexibility. Higher value of the exchange rate regime variable refers to higher flexibility. Therefore positive value of β refers to faster credit boom in more flexible exchange rate systems.

An extended version of equation (1) includes variables to control for macroeconomic environment and it reads as follows:

$$\begin{aligned} gap(credit/gdp)_t = \quad & \alpha + \beta * exchangerate_t + \\ & + \chi * (investments/gdp)_{t-n} + \\ & + \delta * (consumption/gdp)_{t-n} + \varepsilon * deflator_t + \\ & + \phi * reer_t + \varphi * domesticlendingrate_t + \\ & + \gamma * (capitalaccount/gdp)_t + \\ & + \eta * openness_t + \iota * eurodollarrate_t + \upsilon_t \end{aligned} \tag{1A}$$

For example, inflation is considered as a control variable which measures the soundness of the macro environment in which the economy operates. Another similar cyclical measure is the balance of the general government budget. Additionally, the change in the real effective exchange rate is used to capture changes in external competitiveness of the country. Domestic lending rate should directly impact the country's credit performance as well. The price of funds in the world markets is likely to affect domestic credit – higher interest rate makes borrowing more expensive or it may even reverse the flow of funds between countries. The size of the country determines how vulnerable the country is to external shocks and to what extent it may depend on foreign capital flows. The latter is important because credit booms in many countries have been made feasible due to capital inflows. Therefore the ratio of capital account over GDP is meant to control for this channel.

The robustness of results is tested not only by using various specifications including alternative macroeconomic variables but with autoregressive terms, country-specific effects, and differencing transformation as well. As the sample includes a wide range of countries with substantial heterogeneity in terms of income level, macroeconomic environment, institutional organization, efficiency of the financial sector and etc., which are not all observable, various methods allowing cross-sectional heterogeneity are extensively exploited. Heterogeneity becomes especially apparent, when regional estimates are obtained. Therefore besides country-specific fixed effects, generalised least squares is computed with a weighting transformation correcting country specific heteroskedasticity in the residuals. The robustness of the coefficient variance is also tested by accommodating cross-section and serial correlation but this has no substantial effect on the results. Therefore the white diagonal coefficient covariance method is chosen, which allows the same cross-section or period to have different variances. There could be heterogeneity over time as well because the time span covers several decades

that is sufficiently long time to allow catch-up, changes, and sometimes credit deepening last for substantial time periods.

All results are collected in tables 7-15. Columns (1)-(7) in table 7 provide the estimation results of equation (1) augmented by a number of heterogeneity corrections terms and autoregressive components. The specifications in columns (8)-(14) are essentially the same with the only difference that two year lags are used instead of the one year lag. (See table 8.) In columns (15)-(21) the regressions are complemented with the interactions terms in which boom dummies interact with other explanatory variables in order to control for the behaviour of the latter over the boom period. (See table 9.) In columns (20) and (21) are the regressions, which test whether consumption and investment behavior varies across exchange rate regimes with different flexibility. Columns (22)-(28) in table 10 are estimated in differences. Columns (29)-(35) in table 11 test the robustness of the results by adding other macroeconomic control variables that were discussed in one of the preceding paragraphs. Columns (36)-(42) in table 12 provide a regional view while columns (43)-(49) in table 13 a glance to the behavior of domestic demand components across exchange rate systems. Table 14 provides results for the second data panel in which non-boom episodes are disregarded. However, due to substantially smaller number degrees of freedom the same set of regressions is not provided on this case. Table 15 contains in columns (58)-(60) an additional robustness test in which the exchange rate regime variable is replaced by an alternative but similar variable. Columns (61)-(63) in the same table are estimated for those observations when capital inflow is large. I have defined the threshold for large capital inflow as capital account surplus exceeding 5% of GDP.

My results can be summarized as follows:

1. The exchange rate regime is a part of the credit boom story in a sense that the exchange rate flexibility measure is able -- statistically significantly -- to explain the movements in credit variable. This conclusion is independent of whether the credit booms are considered together with non-booms or separately. The results also suggest due to low statistical significance and variation in sign that in the non-boom periods the existence of any solid relationship between exchange rate flexibility and credit variable cannot be detected. When it comes to a boom period, however, this is not true any more because the deviations from the trend of the credit variable tend to be larger the higher is exchange rate flexibility. This last conclusion stems from the interaction terms of the exchange rate regime and boom dummies, which have positive signs and high statistical significance. See columns (16), (17), (20), (21) and (24). For example, according to column (16) the deviation of the private credit to GDP ratio from its trend in freely floating exchange rate system (flexibility measure is 14) is higher by 2.1% as compared to a country which uses foreign currency as a legal tender (flexibility measure is 1). According to regression (24) credit expansion could be faster even by 3.6% in the boom years. Thus credit booms seem to be amplified by flexible exchange rate regimes.
2. When it comes to different stages of the boom, the results show that the gap between credit to GDP ratio and its trend is on average 3.7% in the build-up, 5.6% in the peak and 3.5% in the ending stage. Interacting the boom stage dummies with the exchange rate flexibility measure delivers that in the build-up phase credit expansion in freely floating exchange rate economy is 2.2-4.3% higher than in an economy which uses someone else's legal tender. See column (27), (28) and (56). For this estimate I have considered only those results which are significant at least at the 5% level. In the peak phase the same difference remains between 1.7 and 4.6%. The lowest estimates for the peak phase are obtained in those regressions in which other macroeconomic control variables are included. See the discussion in point 7. The inclusion of macroeconomic

variables decreases somewhat the statistical significance of the boom variables but the peak phase interaction term nevertheless highly exceeds the 5% threshold. The results are ambiguous for the ending stage because some results show that credit boom contraction can be faster in floating exchange rate systems as compared to a country which uses foreign legal tender by 0.9% but some results show the opposite – contraction is faster in more rigid exchange rate systems. In many cases the interaction term of the ending stage is statistically insignificant.

3. I have also tested whether the change in the exchange rate arrangement matters to credit growth. The preceding results could be misleading if a country switches from one regime to another during the credit boom. The example could be abandoning a fixed exchange rate because of unsustainable credit boom and establishing a freely floating exchange rate. In this case the early years of freely floating exchange rate could be characterized by rapid downward adjustment in credit growth. Therefore I have included the exchange rate change dummy with one year lag. It takes unitary value when the exchange rate regime changes. The results for the first version in which booms are together with non-booms show that this dummy has almost always negative sign but it is not significant at conventional 10% level, i.e., exchange rate system change is always related to decline in credit growth in the consecutive year. When booms are considered alone, exchange rate dummy has also negative sign and it is statistically significant at the 5% level. Regional view gives to this dummy a meaningful statistical significance for Latin-American countries.
4. Estimation results show that investing activity is strongly correlated with credit booms. The finding that the relationship between investment over GDP ratio in both data panels is positive and statistically highly significant is predominant, which is reasonable given that credit from the banking sector is an important source of funding in investment financing. Although there are a few results (mostly with differenced data, see column (26), (27) and (54), (55)), which do not match the overall pattern, the results from both data panels are consistent. There is less confidence about the true value of χ and δ and therefore saying anything explicitly on the contribution of this demand component to credit performance is riskier. Given that the nature of relationship between investment and credit does not change substantially throughout the boom episode (which could be wrong), the contribution of investment culminates in the peak phase of the boom and thereafter it falls even below its tranquil times' level in some regressions. Overall, this is consistent to the findings of Gourinchas et al (2001) and Tornell and Westermann (2005).
5. Estimating the role of consumption in credit growth is more demanding. On one hand there is credit-based consumption frontloading (positive sign expected) but on the other hand consumption decisions determine the amount of savings that the financial sector can distribute (negative sign expected). The estimation results for this coefficient are indeed less conclusive as compared to the investment coefficient. Although the indication that consumption is negatively related to credit booms is dominant, its statistical significance rarely exceeds the 10% level. If the endogeneity issue is neglected, the results of several regressions (see columns (17) and (36) for example) show that the explanatory power of consumption increases in the ending phase of the credit boom and its statistical significance also improves. This is in line to the findings of Gourinchas et al (2001) according to which the share of consumption raises in the ending phase of the boom episode.
6. My empirical setting allows an easy testing of the impact from exchange rate flexibility to credit variable through consumption and investment. For example the question, whether investment contributes to credit performance more in

flexible or in fixed exchange rate systems, can be answered. The regressions (20) and (21), which are also using lagged consumption and investment variables, contain this information but the results are not robust, especially if I used more general specifications. Therefore I have not found that the exchange rate flexibility affects credit performance differently across various exchange rate systems.

7. Regressions in columns (29)-(35) and (43)-(49), which provide a robustness check to regression in column (17) by including more control variables, offer some surprises. Overall, the claims that were made on the role of the exchange rate flexibility are sustained despite some decline in the statistical significance level. The parameters on consumption and investment, especially in the boom periods, are somewhat more sensitive to augmented regressions. This could be an indication of the endogeneity issue. One of the observations to highlight is that investment in the peak year still retains its statistical significance at conventional levels. I have found that the inclusion of the real effective exchange rate destroys the sign and significance of the exchange rate flexibility measure. The role of domestic lending rate remains unexpectedly inconclusive because one would expect a negative sign. Similar symptoms characterize world interest rate. The openness variable has negative effect on credit variable but not very significant. The policy variable -- budget deficit -- does not play any role in determining the behavior of private credit. Capital account is expected to have a positive sign because credit booms depend on foreign capital inflows, although it is likely that there is substantial heterogeneity across countries in this respect. My estimation result, however, is opposite. Overall, the control variables are not functioning well. Table 15 contains an additional robustness test in which the exchange rate regime variable is replaced by an alternative one. In the alternative variable 14 types of exchange rate regimes are collapsed into 5 types. The results in columns (58)-(60) do not contradict with my main findings but indicate that in non-boom periods credit growth could be faster in fixed exchange rate regimes.
8. The regional regressions provide several interesting insights into the heterogeneity that the sample contains. I have estimated the same specification for developed (the IMF's definition of advanced countries), African, Asian, Middle-East, Latin-American, and Eastern European and Former Soviet Union (FSU) countries. See regressions in columns (36)-(42). One of the surprising features is that exchange rate flexibility may affect credit expansion exactly in opposite directions depending on the region. For example, in Eastern Europe and FSU in non-boom periods higher exchange rate flexibility implies higher -- while in boom periods lower -- credit growth. However, in Latin-America it is exactly the other way around. One feature that distinguishes Latin-America from other regions is that the exchange rate regime change is -- statistically more significantly -- associated to decline in the credit to GDP ratio. This is likely due to the fact that the probability of having a currency crisis is higher in this region for both credit boom periods and tranquil times. The latter is documented in Gourinchas et al (2001). Summing up the non-boom and boom period coefficients, and leaving the endogeneity issue aside, delivers that credit booms are mostly consumption booms in Middle-East and developed countries but investment booms in Asian, Eastern European and FSU, and developed countries. The size of the investment coefficient in the Eastern Europe and FSU is remarkable exceeding the world average by almost ten times. I have also shortened the sample period for developed countries (these results are not reported) from 1965-2001 to 1980-2001 and obtained that in last two decades the statistical significance of the exchange rate flexibility measure has substantially declined. At the same time the coefficients on investment has increased and its

contribution over the credit cycle has flattened. The reason behind this type of changes could be attributed to more efficient functioning of the financial sector. Estimating equation (1) for those observations when foreign capital inflow is large does not alter the main conclusions. These results are collected in columns (61)-(63). Although the coefficient for investment has substantially jumped up, these results still confirm that in boom periods credit expansion is faster in more flexible exchange rate regimes

3.5 Conclusions

In this paper I have investigated some empirical regularities that I expected to see between exchange rate flexibility and credit booms. I started with the conjecture that rigid exchange rate regimes provide a more fertile soil for credit booms to develop because fixing the exchange rate makes monetary policy ineffective. Besides that, the exchange rate in a floating exchange rate regime may respond in a way that curbs credit boom.

The results did not fully confirm my conjecture. To summarize my findings, I was not able to detect the existence of a solid relationship between exchange rate flexibility and credit variable in the non-boom periods. But in boom periods credit expansion tends to be faster the higher is exchange rate flexibility. This is in contrast to what I expected to find. I have also taken a more detailed look and separated the build-up, peak and ending stages of the credit boom. I find that credit is growing faster in more flexible exchange rate regimes in the build-up and peak stages while the results are less clear about the ending stage. This could be an indication that either monetary policy or exchange rate appreciation or both these channels start counteracting the boom. The last view is less in conflict with my conjecture.

The work that I have done could be improved in several aspects. Firstly, in calculating the private credit to GDP ratio I have currently defined the private credit as the geometric mean of two consecutive years. If there is a crisis at $t+1$, which results in hyperinflation, an outlier is produced. Therefore other definitions of the private credit to GDP ratio could be tested. Secondly, the results can be tested with other than the 15% threshold value. These ideas may provide extra insights into the robustness of my findings. Additionally, thirdly, it is possible to provide complementing views to those presented in this paper by considering credit busts. My results cannot be interpreted as suggesting that a particular exchange rate regime is a way to escape from excessive credit booms. Fourthly, this issue could be the subject for further investigation. One option to start with is to apply a more structured approach to ending stage of the credit boom. This might perhaps help to separate good credit booms from bad ones.

There are a few other concerns as well. For example, the linkage between exchange rate and credit boom may not be direct. One train of though is related to other sources of credit besides the banking sector. Large capital inflow may provide equivalent implications to domestic credit boom. If there is heterogeneity across countries in this respect, the results could be affected. Another potential issue is that fixed exchange rates are correlated to country size and the development level. The choice of an exchange rate regime is a compromise between flexibility and credibility – country can obtain credibility by fixing the exchange rate and importing stability of the anchor currency. Due to low level of credibility economic conditions and the overall behavior of the economy could be more erratic in fixed exchange rate regimes.

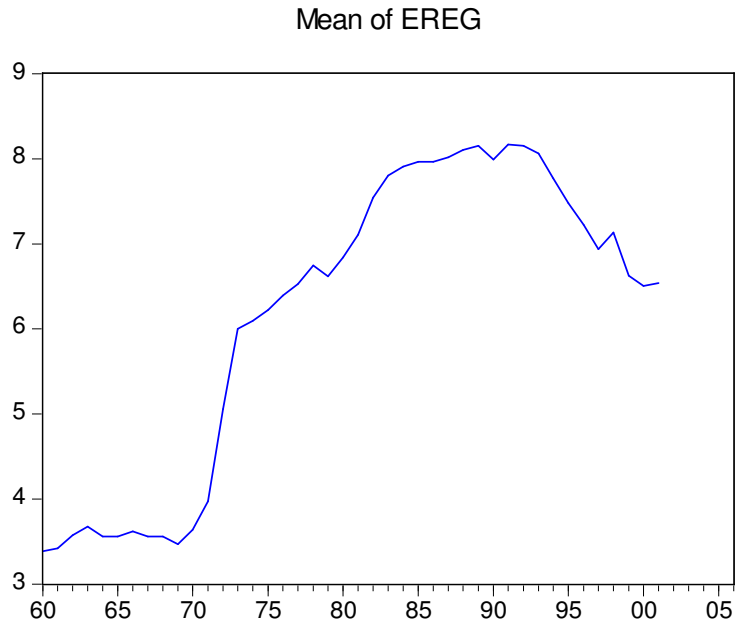

Figure 1. Cross-section average of the exchange rate flexibility measure

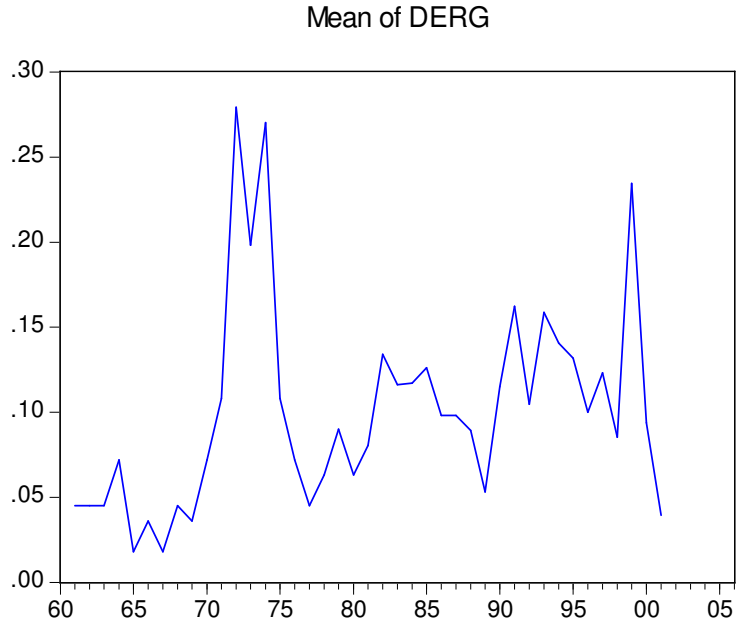

Figure 2. Changes in exchange rate regime: cross-section average

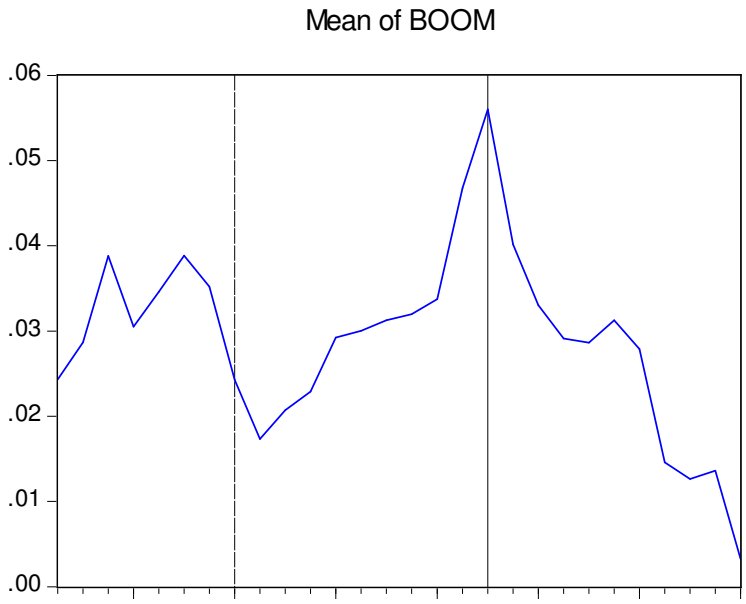

Figure 3. Cross-section average of boom episodes (the solid vertical line denotes the peak year while the observations on the left from the dotted vertical line are calculated only form two credit booms, see figure 4)

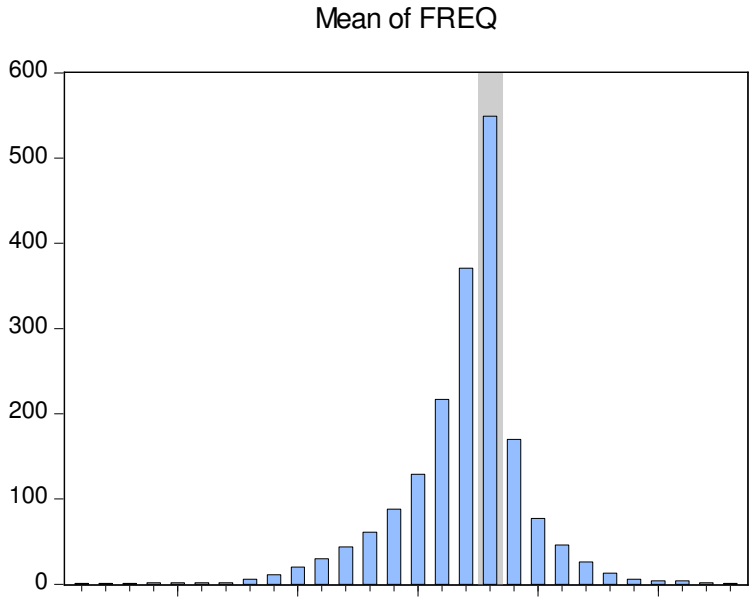

Figure 4. The number of boom observations in figure 3 (the peak year of the boom is shaded).

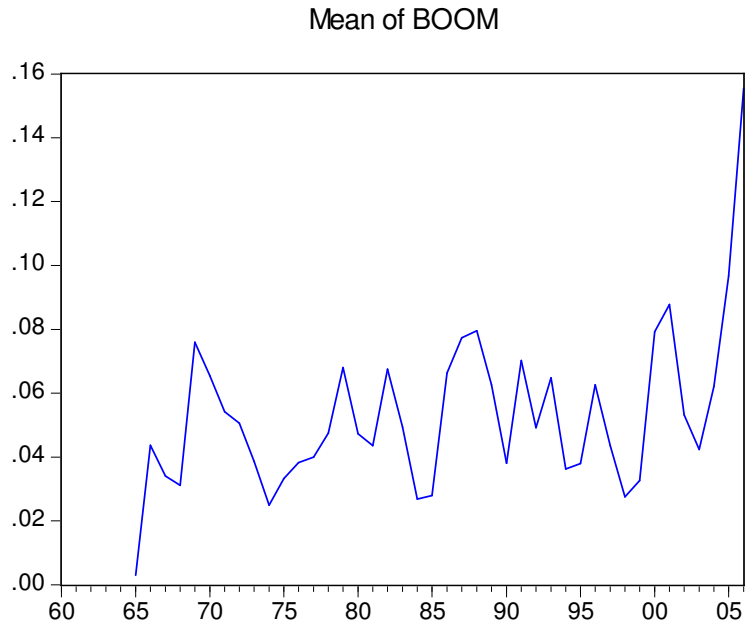

Figure 5. Boom episodes of the deviation from the trend of the private credit to GDP ratio: cross-country mean

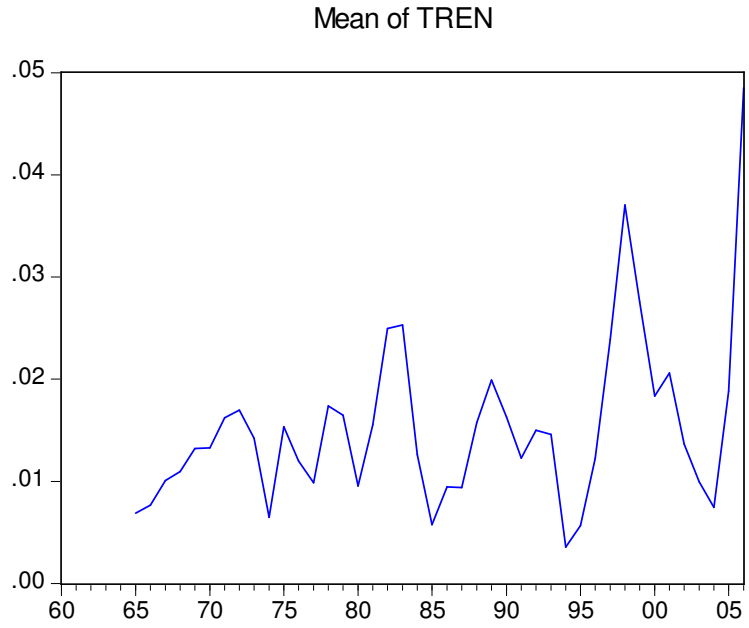

Figure 6. Deviations from the trend of the private credit to GDP ratio: cross-country mean

Table 1: Country list

ALBANIA	GABON	NIGERIA
ALGERIA	GAMBIA, THE	NORWAY
ANGOLA	GEORGIA	OMAN
ANGUILLA	GERMANY	PAKISTAN
ANTIGUA AND BARBUDA	GHANA	PANAMA
ARGENTINA	GREECE	PAPUA NEW GUINEA
ARMENIA	GRENADA	PARAGUAY
ARUBA	GUATEMALA	PERU
AZERBAIJAN, REP. OF	GUINEA-BISSAU	PHILIPPINES
AUSTRALIA	GUYANA	POLAND
AUSTRIA	HAITI	PORTUGAL
BAHAMAS, THE	HONDURAS	QATAR
BAHRAIN, KINGDOM OF	HUNGARY	ROMANIA
BANGLADESH	ICELAND	RUSSIA
BARBADOS	INDIA	RWANDA
BELARUS	INDONESIA	SAMOA
BELGIUM	IRAN, I.R. OF	SAUDI ARABIA
BELIZE	IRELAND	SENEGAL
BENIN	ISRAEL	SEYCHELLES
BHUTAN	ITALY	SIERRA LEONE
BOLIVIA	JAMAICA	SINGAPORE
BOTSWANA	JAPAN	SLOVAK REPUBLIC
BRAZIL	JORDAN	SLOVENIA
BULGARIA	KAZAKHSTAN	SOLOMON ISLANDS
BURKINA FASO	KENYA	SOUTH AFRICA
BURUNDI	KOREA	SPAIN
CAMBODIA	KUWAIT	SRI LANKA
CAMEROON	KYRGYZ REPUBLIC	ST. KITTS AND NEVIS
CANADA	LAO PEOPLE S DEM.REP	ST. LUCIA
CAPE VERDE	LATVIA	ST. VINCENT & GRENS.
CENTRAL AFRICAN REP.	LESOTHO	SUDAN
CHAD	LIBYA	SURINAME
CHILE	LITHUANIA	SWAZILAND
CHINA,P.R.: MAINLAND	LUXEMBOURG	SWEDEN
CHINA,P.R.:HONG KONG	MACEDONIA, FYR	SWITZERLAND
CHINA,P.R.:MACAO	MADAGASCAR	SYRIAN ARAB REPUBLIC
COLOMBIA	MALAWI	ZAMBIA
COMOROS	MALAYSIA	ZIMBABWE
CONGO, DEM. REP. OF	MALDIVES	TANZANIA
CONGO, REPUBLIC OF	MALI	THAILAND
COSTA RICA	MALTA	TOGO
COTE D IVOIRE	MAURITANIA	TONGA
CROATIA	MAURITIUS	TRINIDAD AND TOBAGO
CZECH REPUBLIC	MEXICO	TUNISIA
CYPRUS	MOLDOVA	TURKEY
DENMARK	MONGOLIA	UGANDA
DOMINICA	MONTSERRAT	UKRAINE
DOMINICAN REPUBLIC	MOROCCO	UNITED ARAB EMIRATES
ECCU	MOZAMBIQUE	UNITED KINGDOM
EGYPT	MYANMAR	UNITED STATES
EQUATORIAL GUINEA	NAMIBIA	URUGUAY
ESTONIA	NEPAL	VENEZUELA, REP. BOL.
ETHIOPIA	NETHERLANDS	VIETNAM
FIJI	NEW ZEALAND	YEMEN, REPUBLIC OF
FINLAND	NICARAGUA	
FRANCE	NIGER	

Table 2: The number of credit boom episodes depending on the threshold and the number of countries that have experienced credit booms countries and, 1965-2006

Threshold (%)	Number of countries	Number of boom episodes	Threshold (%)	Number of countries	Number of boom episodes
12	167	567	90	30	40
15	166	549	93	28	38
18	162	512	96	27	37
21	157	461	99	25	35
24	146	400	100	25	35
27	144	346	120	21	26
30	132	301	140	17	22
33	124	260	160	15	19
36	116	218	180	13	17
39	106	194	200	11	14
42	94	167	220	9	10
45	86	148	240	7	8
48	80	139	260	7	8
51	72	121	280	7	8
54	65	108	300	7	8
57	62	98	320	7	8
60	58	90	340	7	8
63	57	83	360	6	7
66	50	72	380	6	7
69	45	64	400	6	7
72	44	59	500	6	7
75	41	55	1000	3	4
78	40	52	1500	3	4
81	36	47	2500	3	4
84	33	42	5000	0	0
87	31	41			

Table 2.1: The distribution of credit booms over time

Threshold	Number of credit booms in								
	1965-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04	2005-06
12	77	57	60	58	76	53	93	74	19
15	64	64	58	54	70	49	94	76	20
18	45	66	59	53	69	52	86	64	18
24	25	59	51	33	55	44	65	55	13
30	13	43	49	26	37	31	51	44	7
36	8	33	32	15	27	24	40	31	8
42	5	23	28	10	22	17	30	23	9

Table 3: Duration of credit boom (in years) – booms with either peak, build-up phase and ending phase or all

	Threshold %	Number of boom episodes	Duration (st. dev.)
Build-up phase			2,1 (2.7)
Ending phase	12	567	0,8 (1.5)
Total			3,9 (3.3)
Build-up phase			1,8 (2.3)
Ending phase	15	549	0,6 (1.3)
Total			3,4 (2.8)
Build-up phase			1,5 (1.9)
Ending phase	18	512	0,5 (1.1)
Total			3,0 (2.4)
Build-up phase			1,2 (1.6)
Ending phase	24	400	0,3 (0.8)
Total			2,5 (1.9)
Build-up phase			1,1 (1.5)
Ending phase	30	301	0,2 (0.7)
Total			2,3 (1.7)
Build-up phase			1,0 (1.5)
Ending phase	36	218	0,2 (0.7)
Total			2,2 (1.8)
Build-up phase			0,8 (1.3)
Ending phase	42	167	0,2 (0.8)
Total			2,1 (1.6)

Table 4: Duration of credit boom (in years) – booms with either missing build-up stage or missing ending stage

	Threshold %	Number of boom episodes	Duration (st. dev.)
Build-up phase			2,7 (2.7)
Ending phase	12	437	1,1 (1.6)
Total			4,8 (3.3)
Build-up phase			1,8 (2.3)
Ending phase	15	405	0,6 (1.3)
Total			3,4 (2.8)
Build-up phase			2,2 (1.9)
Ending phase	18	349	0,7 (1.3)
Total			4,0 (2.3)
Build-up phase			1,9 (1.7)
Ending phase	24	260	0,4 (1)
Total			3,3 (1.9)
Build-up phase			1,8 (1.6)
Ending phase	30	183	0,4 (0.9)
Total			3,1 (1.7)
Build-up phase			1,8 (1.7)
Ending phase	36	121	0,3 (0.9)
Total			3,1 (1.9)
Build-up phase			1,6 (1.4)
Ending phase	42	88	0,4 (1.1)
Total			3,0 (1.7)

Table 5: Duration of credit boom (in years) – booms with distinguishable peak, build-up phase and ending phase

	Threshold %	Number of boom episodes	Duration (st. dev.)
Build-up phase			3,4 (2.9)
Ending phase	12	175	2,3 (1.8)
Total			6,7 (3.6)
Build-up phase			3,1 (2.4)
Ending phase	15	136	2,2 (1.7)
Total			6,3 (3.1)
Build-up phase			3,0 (2.2)
Ending phase	18	103	2,0 (1.5)
Total			5,9 (2.5)
Build-up phase			2,5 (1.8)
Ending phase	24	49	1,7 (1.4)
Total			5,3 (2.2)
Build-up phase			1,8 (1.4)
Ending phase	30	29	1,6 (1.5)
Total			4,4 (2)
Build-up phase			2,1 (1.6)
Ending phase	36	14	2,0 (1.9)
Total			5,1 (2.4)
Build-up phase			1,8 (0.8)
Ending phase	42	11	2,3 (2.1)
Total			5,1 (2.3)

Table 6: Data sources

Variable	Source	Observations
GDP	IMF IFS line ..99B..ZF…	6331
Real GDP	IMF IFS line ..99BVPZF...	5104
Budget balance	IMF IFS line ..cCSD.BA… or ..cCSD.GG…	3295
Consumption	IMF IFS line ..96F..ZF...	5669
Investment	IMF IFS line ..93E..ZF...	5343
Exports	IMF IFS line ..90C..ZF...	5481
Imports	IMF IFS line ..98C..ZF...	5480
Prices	IMF IFS line ..64...ZF...	5596
REER	IMF IFS line ..RECZF...	2472
NER	IMF IFS line ..NECZF...	3202
Lending rate	IMF IFS line ..60P..ZF...	3963
Private credit	IMF IFS line ..22D..ZF...	6386
Eurodollar (London)	IMF IFS line ..60D..ZF...	47
National currency per U.S. dollar	IMF IFS line ..RF.ZF...	7009
Capital account	IMF IFS line ..78BCDZF...	4192

Table 7: Deviations of credit expansion from its trend, annual data 1965-2001. Acronyms: EREG - exchange rate regime, DERG – exchange rate regime change, INVE - investment/GDP, CONS - consumption/GDP, DEFL - GDP deflator, REER - real effective exchange rate, INTR - domestic nominal interest rate, CAAC - capital account/GDP, OPENNESS - (exports + imports)/GDP, WINT - world interest rate, CSFE - cross-section fixed effects, CSSC - cross-section specific coefficients, DUMT - boom episode dummy, DUMB – dummy for build-up phase of boom, DUMP - dummy for peak phase of boom, DUME - dummy for ending phase of boom)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Constant							-0,0021
							(-0,18)
EREG	0,0000	-0,0002	-0,0002	0,0001	0,0002	0,0002	0,0001
	(0,2)	(-1,84)	(-1)	(0,88)	(1,17)	(0,89)	(0,24)
EREG*DUMT							
EREG*DUMB							
EREG*DUMP							
EREG*DUME							
INVE(-1)	0,1304	0,1148	0,1013	0,0601	0,0578	0,0624	0,1340
	(14,38)	(20,32)	(10,81)	(7,08)	(6,47)	(7,99)	(5,2)
INVE(-1) *DUMT							
INVE(-1) *DUMB							
INVE(-1) *DUMP							
INVE(-1) *DUME							
CONS(-1)	-0,0194	-0,0142	-0,0068	-0,0042	-0,0045	-0,0042	-0,0139
	(-5,65)	(-8,42)	(-3,36)	(-1,6)	(-1,58)	(-1,45)	(-1,15)
CONS(-1) *DUMT							
CONS(-1) *DUMB							
CONS(-1) *DUMP							
CONS(-1) *DUME							
No of AR terms			1	2	3	4	2
Country fixed effects							incl
R-squared	0,02	0,10	0,71	0,76	0,77	0,77	0,62
Adjusted R-squared	0,02	0,10	0,71	0,76	0,77	0,77	0,61
Observations	3285	3285	3146	3007	2872	2742	3007

Note: dependent variable is the deviation from the trend of the private credit over GDP ratio; the results in columns (2)-(6) have been corrected for cross-section heteroscedasticity in the GLS specification. The t-statistics in parenthesis in columns (2)-(7) is based on White diagonal standard errors.

Table 8: Deviations of credit expansion from its trend: testing with 2-year time lags.
Note: dependent variable is the deviation from the trend of the private credit over GDP ratio; the results in columns (9)-(13) have been corrected for cross-section heteroscedasticity in the GLS specification. The t-statistics in parenthesis in columns (9)-(14) is based on White diagonal standard errors. See acronyms in table 7.

	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Constant							0,0307
							(2,59)
EREG	0,0001	-0,0002	0,0000	0,0004	0,0002	0,0002	0,0001
	(0,39)	(-1,57)	(0,1)	(2,77)	(1,18)	(0,97)	(0,22)
EREG*DUMT							
EREG*DUMB							
EREG*DUMP							
EREG*DUME							
INVE(-2)	0,1235	0,1092	0,0555	0,0403	0,0223	0,0232	0,0495
	(13,49)	(18,76)	(5,49)	(5,27)	(2,95)	(3,34)	(2,36)
INVE(-2) *DUMT							
INVE(-2) *DUMB							
INVE(-2) *DUMP							
INVE(-2) *DUME							
CONS(-2)	-0,0176	-0,0130	0,0004	0,0024	0,0055	0,0054	-0,0353
	(-5,15)	(-7,68)	(0,12)	(1)	(2,09)	(2,08)	(-2,8)
CONS(-2) *DUMT							
CONS(-2) *DUMB							
CONS(-2) *DUMP							
CONS(-2) *DUME							
No of AR terms			1	2	3	4	2
Country fixed effects							incl
R-squared	0,03	0,09	0,69	0,75	0,76	0,76	0,62
Adjusted R-squared	0,03	0,09	0,69	0,75	0,76	0,76	0,60
Observations	3281	3282	3142	3004	2868	2738	3142

Table 9: Deviations of credit expansion from its trend: testing with credit boom interaction terms.

	(15)	(16)	(17)	(18)	(19)	(20)	(21)
Constant	-0,0030	-0,0075	-0,0072	-0,0082	-0,0079	-0,0132	0,0136
	(-0,26)	(-0,68)	(-0,68)	(-0,86)	(-0,83)	(-1,59)	(2,84)
EREG	0,0002	-0,0003	-0,0003	-0,0002	-0,0003	0,0003	-0,0038
	(0,42)	(-0,59)	(-0,73)	(-0,54)	(-0,72)	(0,18)	(-2,37)
EREG*DUMT		0,0016		0,0016		0,0016	0,0016
		(4,18)		(5,45)		(4,04)	(3,86)
EREG*DUMB			0,0012		0,0012		
			(2,13)		(2,94)		
EREG*DUMP			0,0022		0,0022		
			(4,32)		(6,12)		
EREG*DUME			0,0012		0,0012		
			(2,69)		(2,19)		
DERG(-1)	-0,0020			-0,0019	-0,0020	-0,0005	-0,0008
	(-1,15)			(-1,23)	(-1,33)	(-0,26)	(-0,43)
INVE(-1)	0,1343	0,1250	0,1202	0,1254	0,1205	0,1245	
	(5,2)	(4,81)	(4,8)	(7,21)	(7,03)	(4,84)	
INVE(-1) *DUMT		0,0134		0,0123		0,0135	0,0232
		(1,1)		(1,05)		(1,11)	(2,17)
INVE(-1) *DUMB			0,0138		0,0119		
			(0,87)		(0,68)		
INVE(-1) *DUMP			0,0339		0,0329		
			(2,21)		(2,35)		
INVE(-1) *DUME			0,0001		0,0003		
			(0)		(0,02)		
INVE(-1)*EREG							0,0151
							(4,02)
CONS(-1)	-0,0136	-0,0086	-0,0091	-0,0084	-0,0090		
	(-1,13)	(-0,73)	(-0,81)	(-0,7)	(-0,76)		
CONS(-1) *DUMT		0,0078		0,0081		0,0078	0,0051
		(1,85)		(1,73)		(1,81)	(1,23)
CONS(-1) *DUMB			0,0089		0,0094		
			(1,63)		(1,43)		
CONS(-1) *DUMP			0,0086		0,0090		
			(1,59)		(1,58)		
CONS(-1) *DUME			0,0144		0,0144		
			(2,84)		(1,67)		
CONS(-1)*EREG						-0,0009	0,0007
						(-0,36)	(0,33)
No of AR terms	1	1	1	1	1	1	1
Country fixed effects	incl	incl	incl	incl	incl	incl	incl
R-squared	0,62	0,62	0,66	0,65	0,66	0,65	0,65
Adjusted R-squared	0,61	0,61	0,65	0,63	0,65	0,63	0,63
Observations	3140	3146	3146	3140	3140	3143	3142

Note: dependent variable is the deviation from the trend of the private credit over GDP ratio. The t-statistics in parenthesis in columns (15)-(21) is based on White diagonal standard errors. See acronyms in table 7.

Table 10: Deviations of credit expansion from its trend: testing with differences data.

	(22)	(23)	(24)	(25)	(26)	(27)	(28 **)
Constant							
EREG	0,0000	0,0000	-0,0009	0,0000	-0,0008	-0,0010	-0,0010
	(0,13)	(0,15)	(-7,69)	(0,13)	(-8,58)	(-5,85)	(-8,11)
EREG*DUMT			0,0028				
			(16,66)				
EREG*DUMB					0,0028	0,0032	0,0033
					(14,87)	(11,19)	(14,72)
EREG*DUMP					0,0033	0,0035	0,0035
					(13,01)	(11,32)	(13,89)
EREG*DUME					-0,0005	-0,0002	-0,0001
					(-1,63)	(-0,58)	(-0,33)
DERG(-1)	-0,0021	-0,0021	-0,0025	-0,0021	-0,0026	-0,0024	-0,0025
	(-0,86)	(-0,89)	(-1,08)	(-0,87)	(-1,36)	(-1,13)	(-1,34)
d(INVE(-1))	0,1262	0,1322	0,1219	0,1425	0,1306	0,0910	-0,0142
	(4,91)	(3,73)	(3,58)	(3,8)	(6,81)	(2,89)	(-0,71)
d(INVE(-1))*DUMT		-0,0168	-0,0757				
		(-0,38)	(-1,89)				
d(INVE(-1))*DUMB				0,0120	-0,0659	-0,0596	0,0029
				(0,22)	(-1,4)	(-1,31)	(0,06)
d(INVE(-1))*DUMP				-0,0535	-0,1072	-0,0903	0,0497
				(-0,81)	(-2,18)	(-1,82)	(1,05)
d(INVE(-1))*DUME				-0,1533	-0,1595	-0,1118	0,0022
				(-3,19)	(-2,48)	(-2,61)	(0,04)
d(CONS(-1))	-0,0122	-0,0041	-0,0043	-0,0001	-0,0016	-0,0087	-0,0171
	(-1,14)	(-0,36)	(-0,39)	(-0,01)	(-0,13)	(-0,82)	(-1,52)
d(CONS(-1))*DUMT		-0,0345	-0,0184				
		(-1,24)	(-0,77)				
d(CONS(-1))*DUMB				-0,0694	-0,0492	-0,0440	0,0219
				(-2,29)	(-1,61)	(-1,93)	(0,76)
d(CONS(-1))*DUMP				0,0192	0,0279	0,0362	-0,0988
				(0,32)	(0,66)	(0,73)	(-2,23)
d(CONS(-1))*DUME				-0,0584	-0,0017	-0,0138	0,0356
				(-1,73)	(-0,03)	(-0,34)	(0,68)
No of AR terms						1	1
Country fixed effects							incl
R-squared	0,02	0,02	0,11	0,02	0,12	0,18	0,17
Adjusted R-squared	0,02	0,02	0,11	0,02	0,12	0,17	0,17
Observations	3152	3152	3152	3152	3152	3152	3010

Note: dependent variable is the deviation from the trend of the private credit over GDP ratio. The t-statistics in parenthesis in columns (22)-(28) is based on White diagonal standard errors. Column (28) is estimated using 2-year lags instead of 1-year lags. See acronyms in table 7.

Table 11: Deviations of credit expansion from its trend: testing the robustness of the results

	(29)	(30)	(31)	(32)	(33)	(34)	(35)
Constant	-0,0061	0,0125	-0,0056	0,0034	-0,0026	-0,0115	-0,0061
	(-0,6)	(0,51)	(-0,36)	(0,27)	(-0,21)	(-0,33)	(-0,53)
EREG	0,0000	0,0020	-0,0002	0,0000	0,0000	0,0005	0,0000
	(-0,11)	(1,27)	(-0,37)	(-0,06)	(-0,1)	(0,43)	(-0,09)
EREG*DUMB	0,0007	0,0006	0,0007	0,0007	0,0007	0,0014	0,0007
	(1,53)	(0,58)	(1,25)	(1,42)	(1,41)	(1,46)	(1,47)
EREG*DUMP	0,0014	0,0005	0,0013	0,0014	0,0014	0,0010	0,0014
	(3,73)	(0,45)	(2,69)	(3,66)	(3,66)	(1)	(3,72)
EREG*DUME	0,0007	0,0011	0,0008	0,0007	0,0007	0,0021	0,0007
	(1,13)	(0,8)	(1,36)	(1,5)	(1,49)	(0,98)	(1,58)
DERG(-1)	-0,0023	-0,0038	-0,0023	-0,0016	-0,0023	-0,0016	-0,0023
	(-1,42)	(-0,95)	(-1,13)	(-0,91)	(-1,33)	(-0,44)	(-1,34)
INVE(-1)	0,1282	0,1474	0,1421	0,1235	0,1294	0,1878	0,1282
	(6,94)	(3,34)	(4,69)	(4,39)	(4,59)	(4,86)	(4,53)
INVE(-1) *DUMB	0,0089	0,0124	-0,0035	0,0126	0,0089	0,0163	0,0089
	(0,45)	(0,41)	(-0,16)	(0,58)	(0,43)	(0,4)	(0,43)
INVE(-1) *DUMP	0,0364	0,0253	0,0131	0,0375	0,0363	0,0190	0,0364
	(2,32)	(0,94)	(0,67)	(2,4)	(2,43)	(0,5)	(2,45)
INVE(-1) *DUME	-0,0008	-0,0031	-0,0005	0,0020	-0,0012	0,0392	-0,0008
	(-0,04)	(-0,13)	(-0,02)	(0,15)	(-0,1)	(0,58)	(-0,07)
CONS(-1)	-0,0129	-0,0357	-0,0147	-0,0132	-0,0131	-0,0249	-0,0129
	(-1,01)	(-1,37)	(-0,69)	(-1,14)	(-1,13)	(-0,75)	(-1,12)
CONS(-1) *DUMB	0,0048	0,0189	0,0104	0,0039	0,0053	0,0138	0,0048
	(0,64)	(1,55)	(0,95)	(0,38)	(0,52)	(0,75)	(0,48)
CONS(-1) *DUMP	0,0018	0,0108	0,0135	0,0015	0,0021	0,0151	0,0018
	(0,28)	(0,79)	(1,52)	(0,21)	(0,32)	(0,85)	(0,27)
CONS(-1) *DUME	0,0148	0,0193	0,0166	0,0148	0,0150	0,0099	0,0148
	(1,08)	(0,62)	(1,5)	(1,72)	(1,8)	(0,26)	(1,75)
DEFL	-0,0005	-0,0001	-0,0004	-0,0004	-0,0005	-0,0001	-0,0005
	(-2,48)	(-0,64)	(-1,21)	(-1,21)	(-1,24)	(-0,33)	(-1,24)
DEFL *DUMB	0,0055	-0,0014	0,0054	0,0055	0,0055	-0,0009	0,0055
	(2,46)	(-0,17)	(0,6)	(0,63)	(0,63)	(-0,08)	(0,63)
DEFL *DUMP	0,0069	0,0148	0,0068	0,0069	0,0069	0,0118	0,0069
	(9,31)	(1)	(2,12)	(2,19)	(2,19)	(0,91)	(2,18)
DEFL *DUME	0,0022	-0,0010	0,0016	0,0017	0,0024	-0,0101	0,0022
	(0,26)	(-0,04)	(0,29)	(0,33)	(0,48)	(-0,41)	(0,43)
REER		-0,0130				-0,0070	
		(-1,43)				(-0,62)	
INTR			0,0670			0,0000	
			(1,25)			(-0,6)	
CAAC				-0,0119		0,1249	
				(-1,38)		(1,3)	
OPEN					-0,0005	0,0231	
					(-1,63)	(1,2)	
WINT						-0,0001	
						(-0,16)	
No of AR terms	1	1	1	1	1	1	1
Country fixed effects							incl
R-squared	0,66	0,68	0,68	0,67	0,66	0,72	0,66
Adjusted R-squared	0,65	0,66	0,65	0,65	0,65	0,69	0,65
Observations	2816	1238	2111	2754	2816	903	2816

Note: dependent variable is the deviation from the trend of the private credit over GDP ratio. The t-statistics in parenthesis is based on White diagonal standard errors in columns (29)-(35). See acronyms in table 7.

Table 12: Deviations of credit expansion from its trend: regional view.

	(36)	(37)	(38)	(39)	(40)	(41)	(42)
Constant	-0,0079	-0,0467	-0,0092	-0,0774	-0,1033	-0,1742	-0,0165
	(-0,75)	(-1,47)	(-0,89)	(-1,07)	(-2,87)	(-1,08)	(-0,67)
EREG	-0,0003	-0,0012	0,0004	-0,0015	0,0069	0,0150	-0,0023
	(-0,58)	(-1,65)	(0,81)	(-1,12)	(2,81)	(2,48)	(-3,75)
EREG*DUMB	0,0012	0,0025	0,0007	0,0009	-0,0041	-0,0044	0,0021
	(2,13)	(1,8)	(1,82)	(0,65)	(-1,45)	(-1,31)	(1,34)
EREG*DUMP	0,0022	0,0034	0,0009	0,0008	-0,0048	-0,0061	0,0046
	(4,3)	(2,7)	(2,66)	(0,62)	(-1,84)	(-1,93)	(3,35)
EREG*DUME	0,0012	0,0016	0,0003	0,0020	0,0006	-0,0065	0,0026
	(2,67)	(0,98)	(0,49)	(1,11)	(0,11)	(-2,23)	(3,51)
DERG(-1)	-0,0020	-0,0031	0,0008	-0,0030	-0,0008	0,0031	-0,0036
	(-1,26)	(-0,64)	(0,46)	(-0,66)	(-0,11)	(0,27)	(-1,51)
INVE(-1)	0,1205	0,4478	0,0471	0,6878	0,3608	1,0117	0,0862
	(4,8)	(5,21)	(3,66)	(4,05)	(2,13)	(1,93)	(2,45)
INVE(-1) *DUMB	0,0119	-0,1146	0,0085	-0,0268	-0,1413	-0,3760	0,0442
	(0,75)	(-1,92)	(0,48)	(-0,36)	(-0,95)	(-1,55)	(1,65)
INVE(-1) *DUMP	0,0329	-0,1066	0,0349	0,0509	-0,2164	-0,2119	0,0803
	(2,15)	(-1,95)	(2,99)	(0,74)	(-1,37)	(-1,49)	(2,69)
INVE(-1) *DUME	0,0003	-0,0756	0,0101	0,0498	0,0602	-0,0219	0,0350
	(0,02)	(-1,67)	(0,75)	(0,53)	(0,26)	(-0,11)	(0,88)
CONS(-1)	-0,0090	-0,0140	-0,0101	-0,0904	-0,0127	-0,2677	0,0270
	(-0,79)	(-1,15)	(-0,78)	(-1,21)	(-0,13)	(-1,37)	(0,75)
CONS(-1) *DUMB	0,0094	0,0475	0,0094	0,0135	0,1838	0,2136	0,0009
	(1,72)	(2,07)	(1,59)	(0,59)	(1,78)	(2,25)	(0,06)
CONS(-1) *DUMP	0,0090	0,0589	0,0113	0,0048	0,2648	0,1767	-0,0146
	(1,67)	(2,75)	(2,3)	(0,24)	(2,38)	(2,36)	(-1,05)
CONS(-1) *DUME	0,0144	0,0406	0,0159	-0,0128	0,0325	0,1231	-0,0019
	(2,85)	(1,84)	(2,15)	(-0,52)	(0,2)	(1,27)	(-0,15)
No of AR terms	1	1	1	1	1	1	1
Country fixed effects	incl	incl	incl	incl	incl	incl	incl
R-squared	0,66	0,67	0,72	0,75	0,59	0,75	0,63
Adjusted R-squared	0,65	0,65	0,71	0,73	0,51	0,66	0,61
Observations	3140	921	909	298	97	127	752

Note: dependent variable is the deviation from the trend of the private credit over GDP ratio. Column (36) includes all economies, column (37) developed economies, column (38) Afrian economies, column (39) Asian economies, column (40) Middle-East economies, column (41) Eastern-European and FSU economies, and column (42) Latin-American economies. The t-statistics in parenthesis is based on White diagonal standard errors in columns (36)-(42). See acronyms in table 7.

Table 13: Deviations of credit expansion from its trend: the behavior of demand components across exchange rate regimes.

	(43)	(44)	(45)	(46)	(47)	(48)	(49)
Constant	0,0035	0,0333	0,0644	0,0443	0,0265	0,0421	0,0296
	(0,28)	(2,32)	(1,94)	(1,75)	(1,42)	(2,75)	(0,79)
EREG	-0,0017	-0,0043	-0,0079	-0,0044	-0,0041	-0,0043	-0,0089
	(-0,9)	(-2,26)	(-2,05)	(-1,6)	(-1,74)	(-2,22)	(-2,02)
DERG(-1)	-0,0018	-0,0029	-0,0049	-0,0032	-0,0033	-0,0021	-0,0031
	(-1,09)	(-1,64)	(-1,24)	(-1,2)	(-1,62)	(-1,22)	(-0,62)
INVE(-1)	0,0946	0,0970	0,0256	0,0898	0,1292	0,0938	0,1068
	(3,12)	(3,13)	(0,6)	(2,48)	(3,97)	(3,02)	(2,62)
INVE(-1) *EREG	0,0050	0,0071	0,0330	0,0094	0,0040	0,0071	0,0262
	(0,97)	(1,33)	(3,03)	(1,6)	(0,6)	(1,29)	(2,82)
INVE(-1) *EREG *DUMT	0,0048	0,0037	0,0032	0,0040	0,0033	0,0037	0,0065
	(2,36)	(1,75)	(1,24)	(1,66)	(1,38)	(1,65)	(1,88)
CONS(-1)	-0,0123	-0,0082	-0,0107	-0,0196	0,0002	-0,0089	-0,0044
	(-1,07)	(-0,7)	(-0,3)	(-0,67)	(0,01)	(-0,75)	(-0,11)
CONS(-1) *EREG	0,0004	-0,0002	-0,0009	-0,0007	-0,0004	-0,0002	-0,0006
	(0,16)	(-0,07)	(-0,2)	(-0,21)	(-0,14)	(-0,06)	(-0,1)
CONS(-1) *EREG *DUMT	0,0020	0,0010	0,0031	0,0034	0,0012	0,0010	0,0030
	(3,48)	(1,36)	(2,84)	(3,91)	(1,47)	(1,31)	(2,25)
DEFL		-0,0232	-0,0248	-0,0244	-0,0226	-0,0229	-0,0241
		(-4,47)	(-3,61)	(-3,75)	(-4,24)	(-4,37)	(-3,44)
DEFL *EREG		0,0016	0,0018	0,0017	0,0016	0,0016	0,0017
		(4,39)	(3,61)	(3,74)	(4,17)	(4,3)	(3,44)
DEFL *EREG *DUMT		0,0005	-0,0005	-0,0007	0,0005	0,0005	-0,0006
		(2,18)	(-1,03)	(-2,09)	(2,15)	(2,19)	(-1,15)
REER			-0,0106				-0,0056
			(-1,17)				(-0,58)
INTR				0,0000			0,0000
				(0,89)			(0,51)
CAAC					0,0437		0,0639
					(0,84)		(1,41)
OPEN						-0,0114	0,0355
						(-1,34)	(1,79)
WINT							-0,0003
							(-0,33)
No of AR terms	1	1	1	1	1	1	1
Country fixed effects	incl	incl	incl	incl	incl	incl	incl
R-squared	0,65	0,66	0,68	0,70	0,67	0,66	0,72
Adjusted R-squared	0,63	0,64	0,66	0,67	0,65	0,65	0,70
Observations	3140	2816	1238	1794	2111	2754	903

Note: dependent variable is the deviation from the trend of the private credit over GDP ratio. The t-statistics in parenthesis is based on White diagonal standard errors in columns (43)-(49). See acronyms in table 7.

Table 14: Deviations of credit expansion from its trend: boom episodes (explanatory variables: EREG - exchange rate regime, DERG – exchange rate regime change, INVE - investment/GDP, CONS - consumption/GDP, DEFL - GDP deflator, REER - real effective exchange rate, INTR - domestic nominal interest rate, CAAC - capital account/GDP, OPENNESS - (exports + imports)/GDP, WINT - world interest rate, CSFE - cross-section fixed effects, CSSC - cross-section specific coefficients, DUMT - boom episode dummy, DUMB – dummy for build-up phase of boom, DUMP - dummy for peak phase of boom, DUME - dummy for ending phase of boom)

	(50)	(51)	(52)	(53)	(54)	(55)	(56)
Constant							
EREG	0,0017 (5,4)	0,0014 (9,48)	0,0006 (2,35)	0,0010 (2,07)	0,0018 (11,28)	0,0019 (12,81)	
EREG*DUMT							
EREG*DUMB							0,0017 (11,52)
EREG*DUMP							0,0035 (14,99)
EREG*DUME							-0,0007 (-5,33)
DERG(-1)						-0,0042 (-2,31)	-0,0030 (-2,08)
d(INVE(-1))	0,0062 (0,07)	0,0364 (3,11)	0,1106 (2,27)	0,2049 (5,5)	0,1490 (5,02)	0,1467 (4,67)	
d(INVE(-1))*DUMB					-0,1420 (-3,64)	-0,1464 (-3,72)	
d(INVE(-1))*DUMP					-0,2088 (-3,37)	-0,2031 (-2,93)	
d(INVE(-1))*DUME							
d(CONS(-1))	0,0087 (0,12)	-0,0105 (-0,71)	-0,0753 (-2,29)	-0,0568 (-2,01)	-0,4333 (-6)	-0,4293 (-5,63)	
d(CONS(-1))*DUMB					0,4515 (5,49)	0,4536 (5,35)	
d(CONS(-1))*DUMP					0,6101 (7,57)	0,6128 (7,32)	
No of AR terms			1	2			
Country fixed effects		incl	incl	incl	incl	incl	incl
R-squared		0,06	0,60	0,93	0,94	0,82	0,53
Adjusted R-squared		0,05	0,59	0,92	0,93	0,81	0,52
Observations	187	187	93	58	187	186	191

Note: dependent variable is the boom episode, i.e., those deviations from the trend of the private credit over GDP ratio, which exceed the 15% threshold; the results in columns (51)-(56) have been corrected for cross-section heteroscedasticity in the GLS specification. The t-statistics in parenthesis is based on White diagonal standard errors in columns (51)-(56). See acronyms in table 7.

Table 15: Deviations of credit expansion from its trend: results conditional on large foreign capital inflow and robustness tests with the alternative exchange rate regime variable.

	(57)	(58)	(59)	(60)	(61)	(62)	(63)
Constant			-0,018	-0,026		-0,132	-0,149
			(-1,73)	(-2,61)		(-1,97)	(-2,49)
EREG	0,000						
	(0,2)						
EREG*CAAC5%					0,0023	0,0063	0,0084
					(2,19)	(0,56)	(1,15)
EREG*DUMT*CAAC5%							0,0059
							(4,6)
EREG1		-0,0011	-0,0033	-0,0064			
		(-1,49)	(-3,02)	(-6,18)			
EREG1*DUMT				0,0154			
				(16,97)			
INVE(-1)	0,1304	0,1331	0,2042	0,1829	0,2936	0,3860	0,4051
	(10,81)	(11,01)	(9,61)	(9,11)	(9,05)	(3,68)	(4,63)
CONS(-1)	-0,0194	-0,0165	-0,0052	0,0082	-0,0880	0,0416	0,0399
	(-5,42)	(-4,39)	(-0,47)	(0,75)	(-6,28)	(0,61)	(0,6)
No of AR terms	-	-	-	-	-	-	-
Country fixed effects			incl	incl		incl	incl
R-squared	0,04	0,04	0,18	0,27	0,48	0,68	0,75
Adjusted R-squared	0,04	0,04	0,15	0,24	0,47	0,58	0,67
Observations	3285	3285	3285	3285	73	73	73

Note: dependent variable is the deviation from the trend of the private credit over GDP ratio. The t-statistics in parenthesis is based on White diagonal standard errors. The results in columns (58)-(60) are based on a narrower exchange rate regime classification in which 5 types replace 14 types as it is in column (57). The alternative exchange rate regime measure is denoted by EREG1. The results in columns (61)-(63) are based on those observations which coincide with capital account surpluses exceeding 5% of GDP (denoted by the acronym CAAC5%). The rest of the acronyms see in table 7.

Table 16: Panel unit root test summary for the deviation of private credit to GDP ratio from its trend

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-13,2672	0.0000	168	4691
Null: Unit root (assumes individual unit root process)				
ADF - Fisher Chi-square	809.708	0.0000	168	4691
PP - Fisher Chi-square	882.032	0.0000	168	4691

Note: ** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

Table 17: Panel unit root test for the boom observations of the deviation of private credit to GDP ratio from its trend

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-2,11388	0.0173	17	84
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-0,53521	0.2963	17	84
ADF - Fisher Chi-square	42.0045	0.1628	17	84
PP - Fisher Chi-square	42.5353	0.1495	17	94

Note: ** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality. Exogenous variables: individual effects.

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