Graz Economics Papers – GEP

GEP 2014–01

Lucas Paradox and Allocation Puzzle – Is the euro area different?

Sabine Herrmann, Jörn Kleinert

February 2014

Department of Economics
Department of Public Economics
University of Graz

Lucas Paradox and Allocation Puzzle – Is the euro area different?[1]

Sabine Herrmann
Deutsche Bundesbank

Jörn Kleinert
University of Graz

Abstract

This paper examines the Lucas Paradox and the Allocation Puzzle of international capital flows referring to a panel data set of EMU countries and major industrialized and emerging economies. Overall, the results do not provide evidence in favour of the Lucas Paradox and the Allocation Puzzle. Rather, in line with neoclassical expectations, net capital flows are allocated according to income and growth differentials. The "downhill" flow of capital from rich to poor economies was particularly pronounced in intra-euro area capital flows and after the introduction of the common currency. If we control for the fact that the assumptions of the neoclassical model are not perfectly given in emerging markets, the Lucas Paradox and the Allocation Puzzle can be dismissed for these countries too. However, in periods of financial stress, the neoclassical behaviour of financial flows is to some extent dampened.

Keywords: Financial integration, International Capital Flows, European Monetary Union

JEL-Classification: E 22, F 21, F 36, O 16, O 57

1 Introduction

In a recent paper, the Bank of England predicts a substantial rise in international capital flows relative to world GDP in the years to come.[2] At the same time, the pros and cons

[1] Contact address: Sabine Herrmann, Deutsche Bundesbank, Wilhelm Epstein Str. 14, 60431 Frankfurt. E-Mail: sabine.herrmann@bundesbank.de. Discussion Papers represent the authors' personal opinions and do not necessarily reflect the views of the Deutsche Bundesbank or its staff.

[2] See Speller et al. (2011).

of financial globalization are intensively debated.[3] In particular, in response to the financial crisis, a high degree of financial integration has been blamed for making countries vulnerable to the volatile risk appetite of international investors, promoting contagion effects and, eventually, giving rise to financial turbulences.[4] Most recently, some highly indebted European peripheral countries have suffered strong capital flow reversals, jeopardizing the stability of the euro zone as a whole.

In this context, it is especially important to understand the underlying driving forces of capital flows and how capital is distributed among economies. Standard conceptions of international finance assume that liberalized capital markets allow for international consumption smoothing, risk sharing and an efficient allocation of capital. As in emerging markets rates of return are higher and growth prospects better, they should experience higher investment and lower savings than industrialized countries. Thus, economic theory suggests capital flows from rich to poor economies ("downhill") and countries experiencing a rapid catching-up process should record current account deficits.

However, the empirical evidence is ambiguous. Lucas (1990) stressed that capital flows do not always comply with the predictions of standard neoclassical growth models. At a global level, capital moves "uphill" from poor to rich countries rather than the other way round *(Lucas Paradox).* Correspondingly, from a dynamic perspective, Gourinchas and Jeanne (2007) pointed out that capital flows to emerging markets are not only small by size but they are also predominantly allocated to countries that grow less than others *(Allocation Puzzle).*

Different strands of the literature explain the empirical failure of the neoclassical theory by referring to the omission of *fundamental factors of production* or to *financial market imperfections* based on the idea that differences in the production function affect the return on capital and market failures hamper the inflow of capital to the extent proposed by theory. Indeed, some authors illustrate that if additional explanatory factors are taken on board the puzzle disappears. So far, the empirical analysis mainly focuses on institutional aspects (Alfaro et al., 2008; Alfaro et al., 2011; Reinhard, Ricci and Tressel, 2010; Ju and Wei, 2010).

In the euro area, however, empirical evidence seems to be more in line with the predictions of the neoclassical theory, i.e. more mature countries providing funds for catching-up economies since the mid-1990s. Significantly higher cross-border capital flows in the EU than in other regions of the world are the consequence. One side of

[3] See Kose et al. (2009), Obstfeld (2009).

[4] Episodes of strong capital inflows coincidence very often with financial turmoil (see Reinhart and Rogoff, 2009).

these flows is that financial integration is more pronounced in a monetary union, and the resulting imbalances are just an indicator of how well it works (Ahearne et al. 2007; Blanchard and Giavazzi, 2002; Abiad, Leigh and Mody, 2007; Herrmann and Winkler, 2009). The financial crises revealed, however, that a high degree of financial integration does not per se imply an efficient allocation of capital. Thus, the other side of the coin is that euro area members might have borrowed at too favourable terms based on too optimistic expectations and have underestimated the risks inherent to a convergence process (Frenkel and Goldstein, 1996; IMF, 2012).

In this study, we examine the Lucas Paradox and the Allocation Puzzle of international capital flows using to a panel data set of European countries as well as major industrialized countries and emerging markets. We attempt to shed light on the question to what extent the neoclassical theory holds particularly in the euro area. In other words, we verify whether the European economies are similar enough in their factors of production and whether frictions in cross-border capital flows are sufficiently low to let an equalization of returns work.

The research project goes beyond the literature in three respects: *First*, we place special emphasis on the euro area and refer to the whole sample including all countries and different subsamples in comparison. *Second*, if we find evidence for the Lucas Paradox and the Allocation Puzzle for some subsamples we verify whether differences with respect to fundamental factors and variables representing the degree of financial integration are able to dissolve the puzzle. *Third*, we analyse how the financial crises changed the pre-crisis capital flow structure.

The paper is structured as follows: In *Section 2* we review the literature. In *Section 3* we show a simple correlation analysis on the relationship between the net capital inflow and the GDP per capita/GDP growth rate with respect to different regional boundaries. In *Section 4* we explain how we account for the euro area and outline the empirical approach. In *Section 5* we present the results. In *Section 6* we describe the political implications of our findings and conclude in *Section 7*.

2 Literature Review

In a neoclassical framework liberalized capital markets ensure an efficient allocation of capital and imply that investment should take place in ex-ante (before capital inflows) capital scarce economies with higher rates of return. Thus, capital should flow “downhill”. This arises from a static framework without significant frictions, sufficient homogeneity of production factors and free flow of technology across borders.

Extending this setting to an inter-temporal framework with exogenous technological change, countries with lower GDP per capita experiencing a rapid catching-up process with better growth prospects should record low net savings, substantial current account deficits and a net inflow of capital. As a result, countries are expected to converge in per capita income which goes along with a convergence of their marginal product of capital, because both are driven by the convergence in the capital intensity in production.

However, the data do not provide unambiguous evidence that on a global scale capital flows from rich (capital abundant) to poor (capital scarce) countries (*Lucas Paradox*) and to countries that grow faster than others (*Allocation Puzzle*). The literature explains this paradoxical behaviour of capital flows by the fact that the underlying assumptions of the neoclassical theory do not hold in reality. Market failure or distortions might hamper an efficient allocation of capital and, thus, the inflow of funds to poor and fast-growing economies is lower than proposed by the neoclassical model. According to Alfaro et al. (2008) theoretical explanations are often divided in strands stressing *fundamental factors* of production and those stressing *capital market imperfections*.

Lucas (1990) showed that fundamental factors explain the bulk of the "puzzle". Although the marginal product of capital in India should have been 58 times of that in the United States in 1988 according to the neoclassical model, taking into account differences in human capital shrinks the "puzzle" enormously. As a result, the marginal product of capital in India is only 5 times as high as in the United States.[5] Thus, if we control for human capital formation the return from investing in poor countries is lower than what we expect according to their low capital labour ratios. Or, vice versa, human-capital formation in richer countries promotes investment in countries with an already larger stock of capital.

Caselli and Feyrer (2007) conclude that international financial markets do a very efficient job at allocating capital across countries. Low capital-labour ratios in developing countries are rather due to a low share of reproducible capital (compared to land and natural resources) and high prices for capital goods relative to consumption goods. Their computed returns to capital differ among countries if (i) only capital and labour are considered as factors of production[6] and (ii) prices of capital goods are assumed to be the same in all countries. Relaxing these two assumption yields a marginal productivity of capital which is fairly equalised among countries. In

[5] Lucas further argued that the remaining difference can be explained by the external effect on the productivity of every worker that is exerted by his co-workers. Lucas dismisses capital market imperfections (like the expropriation risk) as reason for the uphill-flows before 1945 arguing that today's developing countries have been colonies of richer countries what made them subject to the same law.

[6] There is no differentiation between reproducible capital and non-reproducible capital (land, resources).

consequence, Caselli and Feyrer give support to omitted factors, i.e. non-reproducible capital, and market imperfections in that the relative prices of capital goods differ.

Alfaro et al. (2008) present evidence that the quality of institutions matters for differences in per-capita inflows of capital. They argue that their measure of institutional quality renders the GDP per-capita variable insignificant and, thus, explains the Lucas Paradox. Institutional differences as a reason that hampers the equalization of capital returns are also illustrated by Acemoglu et al. (2002), Lothian (2006) and Papaoiannou (2009).[7] Eichengreen (2003), instead, focus on the different institutional capacity to use technologies. Shleifer and Wolfenzon (2002) argue that a different degree of investor protection hinders an equalization of interest rates while Razin and Sadka (2004) refer to a lumpy setup cost of international investment.

The second line of explanations, namely imperfections in the (international) capital market, is directly reflected in capital controls. Reinhart, Ricci and Tressel (2010) show that, the correlation between the current account balance and the initial level of development depends on the degree of capital account openness. They emphasize that if capital controls are taken into account standard neoclassical theory holds mainly for FDI and portfolio equity investment: in countries with an open capital market capital flows from richer to poorer countries.

Reinhard and Rogoff (2004) argue, that the differentials in the marginal productivity of capital are small, and that it is not necessarily a human capital spillover that brings about the equalization in returns (net, after subtracting all costs of transaction and risk); trade in goods might do the job or institutional differences among countries. In particular, as the odds of non repayment are as high as 65% for some low income countries Reinhard and Rogoff stress country default risk as reason for the small inflows in developing countries.

Gourinchas and Jeanne (2007) support the view that domestic distortions play an important role in their dynamic version of the puzzle. They calculate capital wedges that can be interpreted as credit market imperfections and expropriation risk. The estimated average capital wedge is substantial (11.6%) and the wedges decrease strongly with per capita income. Based on these wedges, the ratio of the actual and the predicted capital stocks in developing countries for the initial period of their sample (1980) is 0.98. Thus,

[7] Ju and Wei (2010) conclude that an inefficient financial system and bad corporate governance can be bypassed by two-way capital flows as financial globalization is a substitute for domestic institutional reforms. A bypass-effect of domestic institutions is also detected by Desai and Dhammika (2007) that conclude that international capital flows are biased to avoid higher taxes the home country as well as weak investor protection in the host country.

taking into account the imperfections, the marginal productivity of capital is almost equalised among countries.[8]

Kalemli-Ozcan et al. (2010) argue that frictions associated with national borders must be behind the Lucas Paradox. They show that within the United States, i.e. under the same institutional setting, capital flows in the right direction. Their frictionless open-economy model predicts that capital should flow into high-growth states. Indeed, according to the empirical analysis within the United States, the observed capital flows are consistent with these predictions.[9]

According to Gertler and Rogoff (1990) asymmetric information are a more subtle form of capital market imperfections. They are endogenous and depend on the country´s stage of development: more developed countries are less adversely affected as they are more suited to provide self-funding. Credit rationing is therefore more likely to restrict investment in less developed countries. Likewise, asymmetric information of investors is stressed by Gordon and Bovenberg (1996) as a reason for non converging real interest rates. Credit frictions are highlighted by Stulz (2005).[10] Obstfeld and Rogoff (2000) introduce costs of international trade as an alternative argument to explain the Lucas Paradox. Finally, Obstfeld and Taylor (2004) stress diversification aspects which provide an incentive to invest in more sophisticated developed countries as well.

In a nutshell, the literature provides evidence that the Lucas Paradox as well as the Allocation Puzzle is an empirical phenomenon which loses relevance if we take into account that the assumptions of the neoclassical model are simplifying and therefore not perfectly given in the real world. Keeping the qualification in mind, in the following section we present descriptive statistics of net capital flows with a particular focus on the euro area.

3 International Capital flows – Descriptive Statistics

The first glance at international capital flows in advanced and emerging market countries yields a very small negative correlation between the net capital flows to an

[8] Likewise, Prasad, Rajan and Subramanian (2007) pointed out that "risk adjusted returns may be much lower than the anticipated rate of return on the basis of the relative scarcity of capital and relative abundance of labour".

[9] However, the paper does not add too much to the question why capital flows uphill between countries, since all other explanations (institutions, human capital spillovers, expropriation risks) are ruled out by the theoretical frame and the choice of the United States as unit of observation.

[10] If sovereign states and corporates pursue their own interests at the expense of outside investors return on investment is lower given the cost of this so called "twin-agency" problem.

individual country and the per capita income of that country.[11] Thus, our simple correlation analysis does not confirm the so called Lucas Paradox. If anything, it indicates that based on our large dataset capital tends to flow from rich to poor countries as it is expected by the neoclassical theory *(Chart 1)*. At the utmost, the Lucas Paradox seems to be relevant for emerging market economies where the correlation is almost zero (also negative – 0.3) *(Chart 2)* or slightly positive (0.1) for private flows. By contrast, the negative correlation between net capital flows and the per capita income prevails in the more advanced industrial economies *(Chart 3)*.[12]

Restricting the dataset to European countries reveals that capital flows behave much more "neoclassical" than what we observe on a worldwide basis, i.e. the net flows of capital into European countries are the higher the lower is their income per capita. This regularity persists even if we consider not only long-term members of the EU (EU 15) but also include emerging European countries (EU 27). Thus, the outcome is not only due to the fact that most European countries are relatively well advanced. The neoclassical relationship which implies that capital flows from countries with higher per capita income to poorer countries is strongest in EU countries that have joined EMU *(Chart 4)*. On average, after the introduction of the EMU there is a negative correlation of 0.6 between the net capital inflows and per capita income revealing that the Lucas Paradox is not a relevant issue.[13]

The data indicates that within the euro area, capital flows behave "more neoclassical" than what we observe on a worldwide level. While empirical studies on capital flows, so far, do not explicitly take into account specific European characteristics, our results are basically in line with the current account literature. In their seminal paper Blanchard and Giavazzi (2002) already found a strengthened relationship between the current account balance and the income per capita over time, while the link was strongest in the euro area. Moreover, the widening of the current account positions in the EU was to a large part accounted for by differentials in income per capita. Likewise, Abiad, Leigh and Mody (2007), Herrmann and Winkler (2008) and Lane (2008b/2010) show that a stronger degree of financial integration reinforces the dispersion of current account deficits within Europe: poorer countries run larger current account deficits and richer

[11] This analysis is based on IFS data. Yearly data is transformed into 4- year- averages. The observation period goes from 1990 to 2011. Per capita income is measured as the level of per capita income one year before the start of the period under review (see *Section 4* as well as the *Annex* for details on the data).

[12] Economies are grouped as industrial countries if they are OECD member countries. All remaining countries belong to the emerging markets group (see the Annex for a list of OECD members and non-OECD countries in the sample).

[13] These results do not change substantially if we take into account a much longer dataset from 1970 to 1990 and, thus, take into account historical data that is rather comparable to the analysis done by Lucas (1990).

countries run larger current account surpluses.[14] Furthermore according to Jaumotte and Sodsriwiboon (2010), rising imbalances in Europe in the run-up to the crisis can to some extent be attributed to EMU effects.

Chart 1: Net capital flows and GDP per capita, real, 1990-2011, World

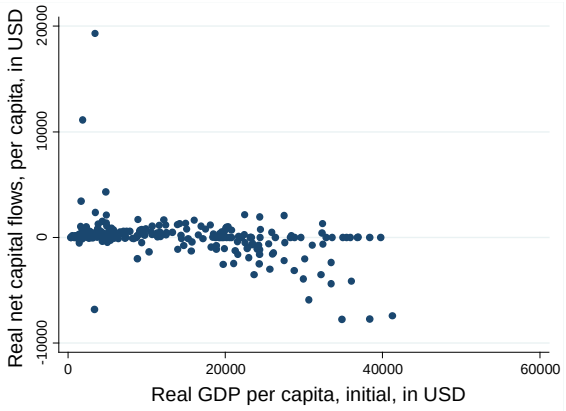


Chart 2: Net capital flows and GDP per capita, real, 1990-2011, Emerging Markets

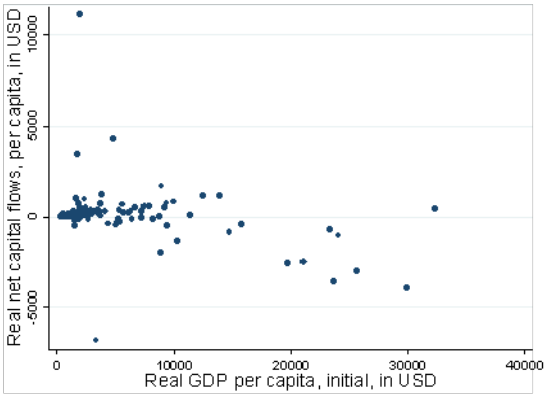


Chart 3: Net capital flows and GDP per capita, real, 1990-2011, Industrialized Countries

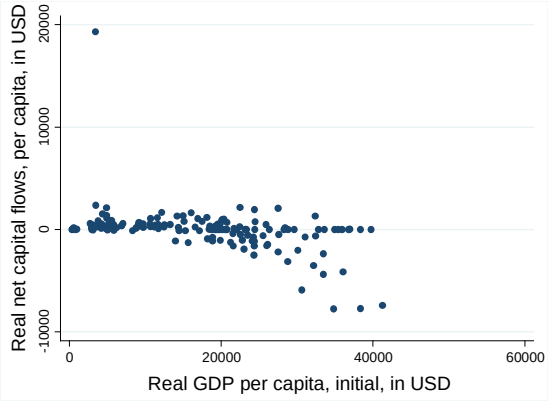
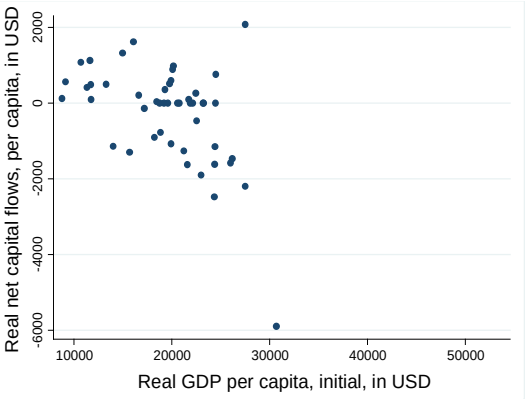


Chart 4: Net capital flows and GDP per capita, real, 1990-2011, EMU



Source: IMF, authors calculations.

[14] In the same vein, Schmitz and von Hagen (2009) claim that - based on an analysis of trade flows - capital tends to flow from high-income to low income economies in the euro area and that these flows increased with the introduction of the single currency. Likewise, Lane and Milesi Ferreti (2007) revealed a positive correlation between the net foreign asset position and the GDP per capita. In industrialized countries, the cross variation in the net foreign asset positions was to a larger part explained by the cross variation in income than it is the case in emerging market economies.

4 International Capital Flows: Empirical Approach

Lucas (1990) started from a neoclassical production function with (homogenous) capital and (homogenous) labour in a static model which he expressed in the intensive form to relate the marginal productivity of capital to the capital intensity in an economy. From the necessarily arising huge differences in the return to capital, he suggested high capital flows between the countries. Similarly, Gourinchas and Jeanne (2007) argued that in a dynamic setting capital flows should be particularly directed toward growing economies. Thus, our empirical model explains per-capita capital inflows by capital intensity, proxied by GDP per capita, and growth of GDP per capita, respectively.

Our empirical investigation follows the approach by Alfaro et al. (2008). However, we differ in five respects: (i) we use net flows of capital as we see the Lucas paradox to require net flows.[15] (ii) We use all capital flows, not just private inflows of equity. The fact that debt flows cannot be differentiated with respect to market decision and behaviour of public authorities might be, in our view, a source of additional findings rather than a source of a bias.[16] Arbitrage opportunities between different types of capital on the side of the investors do not allow excluding some types of capital flows from the net-capital out- or inflows. (iii) We run a panel analysis. (iv) Our sample is based on a longer observation period. Thus, we analyse thoroughly whether capital flows change in response to the financial crisis. Basically, it is not sure whether the impressive pre-crisis relationship of extremely high financial openness, capital imports, and convergence might survive the current turmoil. Rather, the financial crisis might imply a structural break which brings about different economic regularities. Finally, (v), we place special emphasis on the euro area. The empirical evidence presented in the literature documents a gap between results for within-country and between-countries flows of capital. While capital flows neoclassical within countries, it is "distorted" between countries. The euro area is an interesting case in between. The empirical investigation addresses the question to what extent Europe is really different with respect to the direction of cross-border capital flows using the whole sample as well as different subsamples of countries as a reference. The outcome points out to what extent institutional cross-border frictions or differences with respect to institutional settings, human capital, productivity and the sector structure exist and impose barriers that do not let the equalization of marginal returns to capital work.

[15] This does not contradict the fact that Borio and Disyatat (2011) as well as Shin (2012) point out that gross flows are the relevant measure to gauge internal risk stemming from capital flows.

[16] Alfaro et al. (2008) examine as a robustness check whether results change if total flows instead of private flows are used.

We estimate the following equations for the *Lucas Paradox*:

(1) $NET\_CAP\_INFLOW_{it} = \alpha_0 + \alpha_1 GDP\_CAP_{it} + \alpha_2 X_{it} + e_{it}$

By contrast, the *Allocation Puzzle* is analysed by:

(2) $NET\_CAP\_INFLOW_{it} = \alpha_0 + \alpha_1 GDP\_GROWTH + \alpha_2 X_{it} + e_{it}$

with NET_CAP_INFLOW denoting net inflow of capital, in real terms, using four-year-averages. The variable is expressed in per capita terms in order to control for the country-size effect. GDP_CAP is the Lucas variable, i.e. the GDP per capita one year before the start of the observation period; GDP_GROWTH is the Allocation variable, i.e. the GDP growth rate prior to the observation period. We expect a positive relationship between the net inflow of capital and the GDP per capita prior to the period if the Lucas Paradox holds and a negative relationship between the net inflow of capital and the GDP growth rate previous to the observation period according to the Allocation Puzzle. NET_CAP_INFLOW and GDP_CAP are expressed in logs, GDP_GROWTH in percent. Thus, the coefficients in both equations can be interpreted as (semi-) elasticities.[17] Finally, e_{it} is the error term of the estimation.

The two equations deal with static and dynamic efficiency, respectively, which is brought about by cross-border capital flows. While the equations look very similar, they are not measuring the same effect. Finding capital to be allocated efficiently in a particular period does not necessarily imply that cross-border flows are channelled according to growth perspectives.[18] Similarly, static inefficiency does not preclude (future) capital flows to follow marginal returns. Moreover, empirically, the correlation between GDP per capita and GDP growth over the sample period is -0.02.

In a robustness check to the Lucas equation we replace capital inflows per capita by sub-categories of per capita capital inflows as foreign direct investment per capita,

[17] The dependent variable enters the equation in logs because we estimate a linear relationship based on the underlying Cobb-Douglas production function which is non-linear by origin. We linearize the equation by taking the natural logarithm of both sides of the equation. As net capital flows can take on negative values when there is a net outflow of capital we follow a method used in Papaioannou (2009): for negative values of the dependent variable we take the logarithm of the absolute value and assign it the negative sign. This transformation preserves the sign of the original variable, the symmetry between increases and decreases in cross-border lending, and the ordering of the variable in terms of size. As the dependent variable is measured in USD the strong non-linearity between 1 and -1 is not an issue in our sample. Furthermore, our results do not critically depend on how the dependent variable is converted. Alternatively, we run the regressions using net capital flows in absolute terms. The signs of the coefficients are the same. However, as we could not offer a meaningful interpretation of the size of coefficients, we stick to the presentation in logs.

[18] Gourinchas and Jeanne (2007) find precisely this result.

portfolio equity investment per capita and debt inflows per capita in order to make the results comparable to the literature (Alfaro et al., 2008).

If we find empirical evidence in favour of the Lucas Paradox or the Allocation Puzzle, we analyse whether there are possible explanations, namely omitted factors of production and frictions in cross-border capital flows. For a factor to dissolve the Lucas Paradox or the Allocation Puzzle it is necessary that it significantly influences the net inflows of capita, and, as a sufficient condition, the factor must change the sign of the coefficient of the initial GDP per capita or the GDP growth rate.[19]

Thus, the set of control variables in X comprises *fundamental factors* of the production process as well as *imperfections* of (international) financial transactions. The set of fundamental factors include the supply of human capital proxied by the years of schooling of the total population *(SCHOOL)* and the literacy rate *(LITERACY)*. Institutional quality is represented by the International Country Risk Guide which consists of 12 components measuring various dimensions of the political and business environment in a country *(ICRG)*. Moreover, when analyzing the Lucas Paradox we control for the growth of total factor productivity *(TFP)* using data that are provided by the Total Economy Database *(TED)*.

The most direct form of frictions in (international) financial transactions is represented by capital controls. Thus, we include the Chinn-Ito-Index *(KAOPEN)* which is a capital account openness index originally provided by Chinn and Ito (2007). Trade openness additionally controls for differences of market access among the countries *(TRADE)*. To some extent, distance can be used as a proxy for the degree of asymmetric and incomplete information. Following Kalemli-Ozcan et al. (2010) we slightly modified the variable by summing up the distances from the capital city of a country to the capital city of each partner country weighted by the GDP of the partner country *(DISTANCENESS)*. It captures geographical proximity and it takes thereby the degree of interconnectedness into account. At the same time, the variable also reflects the costs of trade. We also include other costs and risks of (international) financial transactions. The individual country default risk is represented by the CDS premium *(CDS)*. In addition, global financial market risks are considered by adding the S&P 100 Volatility Index *(VIX)*. It is provided by the Chicago Board Options Exchange and measures

[19] However, it has to be kept in mind that introducing risk in static and perfect information models might render both the Lucas Paradox and the Allocation puzzle perfectly rational. Capital flows that are affected by "distortions" can easily be interpreted as a form of "safe haven flows", just as Reinhart and Rogoff (2004) claim that "… the true paradox may not be that too little capital flows from the wealthy to poor nations but that … too much capital is channelled to debt-intolerant serial defaulters". This argument is reinforced by Lane (2010) who claims that "after the outbreak of the current global crisis it is clear that those countries running the largest current account deficits are the economies hit hardest by the crisis".

expected short-term (up to 30 days) volatility of the global financial market: a high value of the VIX corresponds to more volatile markets and, hence, higher cost of options to defray the volatility risk. The difference in yield between US corporate bonds and ten-year treasuries *(SPREAD)* is widely used as an indicator of global risk aversion.

The empirical approach to test the validity of the Lucas Paradox and the Allocation Puzzle implies a severe problem of endogeneity, i.e. it cannot be excluded that causality run from net capital flows to growth and income. Rather, growth and income may be endogenous, i.e. a consequence of capital inflows. However, this should not have a major impact on the validity of the relationship. Regardless in which direction causality runs according to the neoclassical theory the link between net capital flows and GDP per capital should be negative and the link between net capital flows and GDP growth should be positive. Moreover, the puzzles are defined according to simple correlations rather than assuming a strict causality. Gourinchas and Jeanne (2007) pointed out that "… the allocation puzzle is the finding that capital outflows are positively correlated with the growth rate of productivity across countries." However, if there is a correlation among the explanatory variables and the error term of the estimation due to endogeneity the parameter of the remaining variables are biased. Thus, in order to reduce or even wipe out biased regression results, we lagged the explanatory variables GDP per capita as well as GDP growth by one period of time in the main regressions and use instrumental variable estimators as a robustness check (see section 6.4).

In addition, multicollinearity might also be a major issue in the dataset (Alfaro, 2008). Many macroeconomic data are related through size and the level of development. The size effect is not critical since we use per capita data but many variables correlate strongly with the level of development and therefore with each other. It is important to keep in mind, however, that multicollinearity reduces the efficiency of the estimation and renders the interpretation of the results more difficult, but does not yield biased results.

The analysis is based on three different data sources: (i) the International Financial Statistcs (IFS) of the IMF and (ii) a dataset provided by Lane and Milesi Ferretti (LMF) for aggregated capital flows. Both, the IFS and the LMF dataset include 27 EU countries and 32 industrialized and emerging markets. The analysis is based on annual data. In order to wipe out short-term fluctuations 4-year period averages for each country are constructed.[20] The IFS data is based on balance of payment transactions and available from 1990 to 2011. The LMF data covers a shorter time span from 1993 to

[20] Chinn and Prasad (2003) provided evidence that, in general, estimates at an annual frequency are less precise than 4-year averages.

2007, however, Lane and Milesi Ferretti have sorted out valuation effects – changes of asset prices, returns and exchange rates - which became a relevant issue given the increasing degree of financial globalization. By explicitly running and comparing the analysis for the IFS and the LMF sample, we expect additional insights.[21] On top of these two datasets, we use (iii) a combination of different stock and flow databases for the bilateral part of the analysis where the sample is split to EMU and non-EMU source countries. These data are taken from the CPIS (IMF), FDI (OECD) and the BIS Locational Banking Statistics. These different capital flow components (Portfolio, FDI and Bank data) are aggregated to an overall net flow of capital from inside or outside the EMU. Given the much shorter observation period from 1999 to 2007 data has been used at an annual frequency. For a detailed description of the data see the Annex.

In order to account for the specific behaviour of capital flows within the euro area, two different approaches are chosen: (1) We split the sample and compare the results of an EMU panel to those of other regional classifications. (2) We differentiate the net flow of capital to a particular country with respect to whether it stems from inside or outside the EMU. However, there is no direct measure of *aggregated intra* and *aggregated extra* EMU flows. Hence, we summed up the subcomponents of capital flows which are available on a bilateral basis. That, however, comes at certain costs. *First*, conceptually, we should use *aggregated* net capital flow to tackle the puzzles. Bilateral data - even the aggregation to two groups, namely, intra- and extra-EMU flows - contradicts the idea leading to the Lucas paradox.[22] However, this is also the case for the approach of within-country studies on the Lucas Paradox (see Kalemli-Ozcan et al. (2010)). The results on intra-EMU flows could well be compared to those within the USA. *Second*, bilateral data is usually not available as flow data. Thus, flows must be derived from stocks (see Waysand et al., 2010; Milesi-Ferretti et al. 2010). *Third*, not all subcategories of capital are available as bilateral data and the analysis must be restricted to some although important flows (Arvai, Driessen and Ötker-Robe, 2009).[23]

[21] Both dataset do not allow controlling for TARGET2 flows which became increasingly important during the financial crisis. The IFS data report TARGET2 flows for some countries as part of "other investment". As this category also includes other important items, e.g. bank flows, it is not possible to sort TARGET2 flows out. Likewise, the LMF does not account for the TARGET2 flows separately. Moreover, both dataset do not take into account foreign exchange reserves.

[22] In addition, it is a strong assumption to treat all foreign countries within and all foreign countries outside of the EMU alike.

[23] Alternatively, some authors apply a less precise approach and use the current account balance of EMU countries (Blanchard and Giavazzi, 2004; Abiad, et al. 2007; Lane and Pels, 2012) or trade balances (Schmitz and Von Hagen, 2009) as a measure of the intra-european linkages.

5 International Capital Flows: Empirical Results

5.1 The Lucas Paradox

The panel models are estimated using a Feasible Generalised Least Squares Estimator (FGLS) which allows estimation in the presence of AR (1) autocorrelation[24] within panels as well as heteroskedasticity across countries.[25] This set-up should allow for the most parsimonious empirical model, which also come closest to Lucas' (1990) approach. We then adjust and extent this model by focusing on different groups of countries and including additional explanatory variables. The main conclusions are as follows.

First, worldwide net capital flows develop according to neoclassical assumptions. Over the whole sample, there is a significant negative relationship between the GDP per capita before the beginning of the period and the amount of net capital inflows per capita in that period. Empirical evidence, illustrates that based on our data set of major industrial countries and emerging markets net capital flows from rich to poor countries as it is expected by economic theory. More precisely, a 1% higher income per capita at the beginning of the period reduces the amount of net capital inflows by 1.7% in that period *(Table 1, Column 1).*[26]

Second, even in the period of the financial crisis the neoclassical structure of net capital flows prevails. However, the impact of a change in per capita income on net capital flows is somewhat smaller. According to our results, the fact that poorer countries attract more capital than richer countries still holds if we restrict the analysis to the period from 2007 to 2011. However, the amount of net capital flows in response to a 1% change in per capita income slightly decreases to -1.3% *(Table 1, Column 2).*

Third, the neoclassical relationship between income and capital inflows applies to the sum of all types of capital. This, however, changes slightly if we take into account smaller sub-aggregates of capital instead of total capital.[27] While the coefficient is somewhat higher for equity capital than for total capital, it reduces (in absolute terms) to -0.202 if we allow for debt flows only. In addition, the coefficient looses significance *(Table 1, Column 3).* This outcome does to some extent explain Alfaro et al. (2008) who

[24] Stata allows that the coefficient of the AR (1) process is specific to each cross section.

[25] Non-stationary characteristics can be ignored based on the fact that we used 4-year period averages and, thus, end up with 5 time periods only. The regression was estimated with Stata 11.

[26] In estimations (1) to (5) there are no control variables included. However, the results are still valid if we include the control variables (see point seventh for details).

[27] We are well aware that by using the sub-aggregates of net capital flows we abandon to some extent the original Lucas Paradox as it focuses on total net capital flowing into a country. However, as it is standard in the literature to differentiate among different aggregates we follow that approach as well.

abstract from debt flows in most of their analysis based on the argument that debts flows are "biased" by public decisions to a greater extent than equity flows.

Table 1 Determinants of Net Capital Inflows – FGLS estimation

Dependent variable: log of net capital flows, in 2005 USD; 1991-2011

	(1) **WHOLE SAMPLE**	(2) **FINANCIAL CRISIS (2007-2011)**	(3) **DEBT FLOWS**	(4) **EMU COUNTRIES[1)2)]**	(5) **EURO AREA[1)2)] (1999-2011)**
GDP_CAP	-1.696 *(-11.90)***	-1.257 *(-2.31)***	-0.202 *(-1.71)**	-6.665 *(-3.60)***	-10.534 *(-5.58)***
Wald (prob)	141.6 *(0.00)*	*5.35 (0.02*	2.92 *(0.09)*	*12.96 (0.00)*	31.15 *(0.00)*
N	*263*	*55*	*266*	*48*	*30*
Cross Section	*56*	*55*	*56*	*10*	*10*

*Note: Standard errors in parentheses. *** Significant at the 1% level. ** Significant at the 5% level. * Significant at the 10% level. GDP_CAP: GDP per capita one year before the start of the period (in constant 2000 USD, log.). [1)] EMU COUNTRIES include all countries that belong to the EMU over the whole period; EURO AREA include the same economies, however, restricted to the period from 1999-2011.* [2] The dummy variable for euro area membership EMU enters the equation not only in the interaction terms with the GDP per capita, but also in their levels. The same is true for the GDP per capita variable. However, this is done for econometric reasons only, there are no economic implications. Furthermore, the coefficients of equation (4) as well as (5) are statistically different from the parameter estimated in equation (1) based on a rule of thumb, ie the coefficients +/- two standard deviations do not overlap.

Fourth, the neoclassical structure of net capital flows is most pronounced in the euro area.[28] Based on the sample of EMU countries, the coefficient of the income per capita variable is four times higher than in the whole sample. Again, this result is highly significant *(Table 1, Column 4).* Restricting the sample to the time period after the introduction of the euro increases the coefficient further. Thus, in the euro area, a 1% higher income per capita at the beginning of the period reduces net capital inflows per capita by approximately 11% stressing that the introduction of the common currency strengthened the impact of income per capita on capital inflows *(Table 1, Column 5).* This is very much in line with the Blanchard and Giavazzi (2004) findings that the relationship between the current account balance and income is stronger for euro area countries compared to a sample of OECD economies.

Fifth, the neoclassical behaviour of EMU countries is mainly dominated by INTRA EMU capital flows, i.e. funds *from inside the euro area* directed to *EMU member*

[28] According to the underlying model, the Lucas Paradox should apply on a worldwide basis including all rich as well as all poor countries. Thus, in a strict sense, restricting the sample to euro area countries is not a test of the "true" Lucas Paradox. However, as net capital inflows and outflows are almost balanced in the euro area it seems to be justified to regard the euro area as being closed.

states.[29] Thus, downhill flows from rich to poor member countries seem to be a specific feature *within* the euro area *(Table 2, Column 1).* By contrast, flows *from outside the euro area* that are directed towards EMU countries do not show a significant relationship with the GDP per capita variable *(Table 2, Column 2).* The coefficient of the Lucas variable is very low. There are two reasons why the coefficient in Table 2 differs strongly from those in Table 1. First, the sample is substantially different in the cross-section relative to time dimension. The variation across the countries is much larger in the sample used in Table 1. The ratio of cross-country relative to time observations is ten in Table 1 and 0.8 in Table 2. Moreover, Table 2 uses ten successive annual observations which are much more similar than the five four-year averages in Table 1. Yet, we do not have the intra-EMU data to come up with the same time dimension. Second, the countries that form the EMU have been a closely integrated area already in 1999. We should not have expected to find huge unexploited investment opportunities. The significant coefficient of the intra- and the insignificant coefficient of the extra-EMU regression however indicate that within-EMU flows are different from extra-EMU flows.

Table 2 Determinants of Net Capital Inflows – FGLS estimation

Dependent variable: log of net capital inflows, in 2005 USD; 1999-2007

	(1) **INTRA** **net capital inflows** **(from EMU countries)**	(2) **EXTRA** **EMU net capital inflows** **(from Non-EMU countries)**
GDP_CAP	-0.0001 (-2.16)**	-0.0001 (-0.48)
Wald (prob)	*4.68 (0.03)*	*0.23 (0.63)*
N	80	80
Cross Section	10	10

*Note: Standard errors in parentheses. *** Significant at the 1% level. ** Significant at the 5% level. * Significant at the 10% level. GDP_CAP: GDP per capita one year before the start of the period (in constant 2000 USD, log.).*

The results highlight that especially INTRA EMU flows are determined by the search for yield. This fits the stylised facts that we observe in the run-up to the financial crisis.

[29] The analysis of INTRA flows is based on a completely different dataset as the remaining parts in this section. In contrast to the aggregated part of the analysis, it refers to annual data as the sample is too small to calculate four-year averages. Although the analysis is based on aggregated flows (flows from EMU countries and countries outside the euro area), the differentiation whether the capital stems from inside or outside the euro area has been built on bilateral country level data. For more details, see Chapter 5.

Given the widespread believe in the pre-crises period that convergence within the euro area will take place, capital has flown to countries with a higher marginal rate of return and internal euro area current account imbalances steadily increased reflecting richer member countries financing poorer ones. Lower income countries inside the euro area seem to benefit from an `EMU bonus´, in particular, if both the recipient country and the source country of the capital flows are EMU members.[30]

In a nutshell, the Lucas Paradox does not seem to be still a prevalent empirical issue.[31] Moreover, the neoclassical behaviour of capital flows is especially remarkable for the highly integrated countries of the euro area where, in particular, intra EMU net capital flows from rich to poor countries are strongest after the introduction of the euro. Thus, based on our empirical results, we can conclude that Europe is homogenous enough to let the equalization of marginal returns to capital work. In addition, this equalization of returns to capital is also not hampered by regulatory barriers or financial imperfections that impede cross-border transactions within the EMU.

On the one hand, this is in line with the current account literature (Abiad et al., 2007; Blanchard and Giavazzi, 2004; Herrmann and Winkler, 2008). On the other hand, however, our results contradict the thinking that the Lucas Paradox is an important puzzle in international economics. In our view, this contradiction might be due to conceptual differences of our analysis to other papers in this literature.

Some authors restrict the analysis to emerging markets (see Lucas, 1990; Franken and Van Wijnbergen, 2010) and point out that among catching-up countries capital flows proceed from poor to rich countries, at least, at first glance. Obstacles that prevent neoclassical theory from being valid might be more important among emerging markets and, if these variables are neglected in the estimation, the Lucas Paradox shows up. Furthermore, some studies refer to an observation period when market segmentation might have been much stronger (see Lucas, 1990; Obstfeld and Rogoff, 2000).[32] Finally, the main paper we refer to examines gross capital flows instead of net capital flows ((see Alfaro et al., 2008; Azémar and Desbordes, 2013). According to our understanding, however, net capital flows is what the Lucas Paradox is about. Referring to gross flows diverts the focus towards portfolio diversification aspects. As a result, it makes sense that income differentials are less important and other determinants (e.g. financial sector development, reliability of institutions etc.) become more relevant. If

[30]However, based on our dataset we cannot exclude that capital from third countries flows to lower income countries inside the euro area via the German or French banking system.

[31] These results are independent of the dataset: IFS as well as LMF data produce a similar outcome.

[32] As a robustness check we replicate estimation (1) in Table 1 referring to longer time series from 1970 to 1990. This dataset is more comparable to that used by Lucas (1990). However, our results still call for a significant neoclassical relationship between GDP per capita and net capital inflows.

these factors correlate positively with per capita income portfolio decisions are seemingly diverted towards richer countries.

In total, we found no evidence in favour of the Lucas Paradox even if we look at the time period from 1970 to 1990 when market segmentation might have been much stronger. Thus, in the next paragraphs, we follow other empirical studies and verify whether, *first*, restricting the sample to emerging markets or, *second*, focusing on gross flows is the reason why their outcome differ from our results.

First, we evaluate whether the Lucas Paradox is an emerging market phenomenon. By restricting the sample to these poorer countries we assume that - as a group - they obtain capital inflows (see also Gourinchas and Jeanne (2007). We found, indeed, there is some evidence for a Lucas Paradox prevailing in catching-up countries. Running the estimation for emerging markets separately reveals a significant positive relationship between the initial GDP per capita and the amount of net capital inflows (*Table 1 in the Annex, Column 1*).[33] The result implies that among emerging markets capital flows net into richer countries. By contrast, the coefficient for the estimation with industrial countries only is highly negative (*Table 1 in the Annex, Column 2*).

However, there are still differences among catching-up economies with respect to human capital and institutions as well as with respect to information asymmetries on the financial markets and these differences play a decisive role for the allocation of capital.[34]. To see this, see *Table 1 in the Annex, (Column 3)*. The Lucas Paradox disappears if we take omitted factors and market imperfections into account. Regression (1) assumes that all emerging markets are alike or that omitted variables are not correlated with per-capita income. Yet, they are. Thus, if we consider human capital (SCHOOL), capital account openness (KAOPEN), the weighted distance (DISTANCENESS), the change in productivity (TFP), the global risk aversion (SPREAD) as well as the country risk premium (CDS), we end up with a significant negative correlation between income and net capital even in emerging markets. The switched sign of the income coefficient in response to the inclusion of the control variables is not due to the restricted sample size in estimation (3): if we restrict the sample size, however, delete the control variables we got a significantly positive parameter for GDP_cap *(Table 1 in the Annex, Column 4)*. Ultimately, the Lucas

[33] A positive correlation between GDP per capita and net capital inflows is necessary for a Lucas Paradox, however, not sufficient. For example, if all emerging markets export capital with the poorer ones providing larger flows than the richer ones.

[34] The possible problem that the Asian countries included in the panel (Hong Kong, India, Indonesia, Philippines, Singapore, Thailand and Vietnam) and especially their behavior in the aftermath of the Asian Crisis in 1997/1998 might dominate the emerging market group as a whole is disproved by the data. If these countries are deleted from the emerging market dataset the coefficients vary only slightly.

Paradox results from "missing variables". If we take these variables into account the Lucas Paradox seem to "disappear".

Second, we investigate the behaviour of gross flows and, indeed, international *gross* capital flows behave in line with the Lucas Paradox.[35] For the whole sample, there is a significant positive relationship between income and gross capital inflows: a by 10% higher income per capita at the beginning of the period yields higher gross capital inflows by 7% in that period (*Table 2 in the Annex, Column 1*). Empirical evidence is, thus, contrary to what we observed with respect to net flows.[36] Furthermore, among emerging markets, the impact of the per capita income on gross capital inflows is almost twice as high as in the whole sample (*Table 2 in the Annex, Column 2)*. By contrast, for euro area countries the income per capita variable is not a significant determinant of gross capital flows. This is in line with the analysis of net capital flows where the evidence for the Lucas Paradox was also strongest for emerging markets. The control factors that we introduced into the estimation of net capital flows in order to take account of the simplifying assumptions in the neoclassical theory are almost all highly significant to explain gross flows as well.[37] Note however, none of these variables helps to explain the `Pseudo´ Lucas Paradox, i.e. the income variable keeps its positive sign (*Table 2 in the Annex, Column 3*).

5.2 The dynamic version of the Lucas Paradox: Allocation Puzzle

The Allocation Puzzle describes the observation that (among the developing countries) faster growing economies do not feature higher net capital inflows from the rest of the world. Thus, it directs attention towards growth of GDP per capita.[38] Although the Allocation Puzzle is in its theoretical representation formulated as negative correlation

[35] Putting gross flows in the Lucas framework is somewhat controversial. However, it might be justified to have a look at gross flows as especially in the period before the financial crisis gross flows have risen to a much stronger extent than net flows. Shin (2012) identified a global banking glut where the gross flows are decisive. In addition, gross flows are especially relevant with respect to the valuation of risks and spillover effects of financial stress. Borio and Disyatat (2011) as well as Shin (2012) point out that gross flows are the relevant measure to gauge internal risk stemming from capital flows. Obstfeld and Taylor (2005) shows that modern capital flows are more about hedging and risk sharing ("diversification finance") than about the mediation of saving supply and investment demand ("development finance").

[36] The panel models are estimated using a Feasible Generalized Least Squares Estimator (FGLS) which allows estimation in the presence of AR (1) autocorrelation within panels (panel-specific coefficients) as well as heteroskedasticity across panels. The results are independent of the specific dataset we use, i.e. the outcome based on IFS data is very close to the results that rest upon the Lane-Milesi-Ferretti dataset.

[37] To make the analysis as comparable as possible we stick to the explanatory variables that we have used for the net flows.

[38] As the Lucas Paradox, the Allocation Puzzle is estimated using a FGLS which takes into account AR (1) autocorrelation within panels as well as heteroskedasticity across panels.

of net capital inflows and growth expectations, data limitations force us to proxy the expectations by current growth rates. As the endogeneity problem might be quite severe, again, we lag the explanatory variables.[39] Thus, we use the average growth per capita of the previous four year period. The main conclusions from our analysis are as follows.

First, based on our sample of industrialized and emerging markets net capital flows develop according to neoclassical assumptions. The average GDP growth rate in the past period is positively related to the amount of net capital per capita inflows in the next period. Empirical evidence, thus, illustrates that capital flows net to faster growing countries as it is expected by economic theory: an increase in the GDP growth by 1 percentage point in the former period increases the amount of net capital inflows by 12% in the following period *(Table 3, Column 1).*[40] In addition, the growth coefficient strongly increased in the second part of the sample (1999-2011) which is characterised by a higher degree of financial integration *(Table 3, Column 2).*[41]

Second, financial turbulences seem to weaken the neoclassical characteristics of capital flows. Thus, based on the whole sample, in the period after 2007 faster growing countries do not significantly obtain more capital than economies with a more subdued GDP growth rate. This is true for all economies in the sample *(Table 3, Column 3)* as well as for the sub-sample of euro area countries and results from the fact that in this period past growth performance is not a good predictor of future growth expectations. When using the WEO growth expectations instead of past period's growth per capita,

[39] Endogeneity is taken into account by alternative estimators (see section 6.3 `robustness checks´).

[40] These results are robust to various model specifications and do not depend on the chosen dataset.

[41] For emerging markets the positive relationship between growth and capital inflows loses significance, yet, there is nevertheless no *significant* evidence for the Allocation Puzzle either *(Table 3 in the Annex, Column 1)*. To some extent this supports the findings of Gourinchas and Jeanne (2007) that - if at all - the Allocation Puzzle is a phenomenon of catching-up economies. By contrast, within industrialized countries net capital flows to faster growing countries with the growth coefficient being higher than in the whole sample *(Table 3 in the Annex, Column 2)*. If we allow fundamentals to be different and market imperfections to exist there is a significant flow of capital to faster growing economies. Hence, if we consider human capital (SCHOOL), the quality of institutions (ICRG), the distanceness index (DISTANCENESS), the country risk (CDS) as well as the overall financial market uncertainty (SPREAD) income growth positively affects net capital *(Table 3 in the Annex, Column 3)*. This might indicate that, ultimately, the Allocation Puzzle - as the Lucas Paradox - results from missing variables; if we control for these variables the Allocation Puzzle "disappears" *(for a detailed explanation of the control variables see section 5).*

we find the Allocation puzzle for the sample with all countries but not for the EMU countries (*Table 6, Column 3 and 4, in Section 6.2*).

Third, the neoclassical structure is confirmed for the euro area, too. In the period after the introduction of the euro an increase of GDP growth significantly increases net capital inflows *(Table 3, Column 4)*. In addition, the coefficient is more pronounced than in the global sample implying a stronger impact of GDP growth on net capital flows. Thus, an increase in the GDP growth by 1 percentage point raises the amount of net capital inflows by 70% in the following period.

Table 3 Determinants of Net Capital Inflows – FGLS estimation

Dependent variable: log of capital inflows, in 2005 USD; 1991-2011

	(1) **WHOLE SAMPLE**	(2) **RESTRICTED SAMPLE (1999-2011)**	(3) **FINANCIAL CRISIS (2007-2011)**	(4) **EURO AREA (1999-2011)**
GDP_GROWTH	0.119 *(3.06)***	0.336 *(14.39)***	0.011 *(0.03)*	0.712 *(1.73)**
Wald (prob)	9.38 *(0.00)*	207.08 *(0.01)*	141.6 *(0.00)*	3 (0.08)
N	261	163	55	30
Cross Section	56	55	55	10

*Note: Standard errors in parentheses. *** Significant at the 1% level. ** Significant at the 5% level. * Significant at the 10% level. GDP_Growth: GDP growth rate, average, previous period (in percent).*

Fourth, for emerging markets the positive relationship between growth and capital inflows is not significant, however, there is no *significant* evidence for the Allocation Puzzle either *(Table 3 in the Annex, Column 1)*. To some extent this supports the findings of Gourinchas and Jeanne (2007) that - if at all - the Allocation Puzzle is a phenomenon of catching-up economies. By contrast, within industrialized countries net capital flows to faster growing countries with the growth coefficient being higher than in the whole sample *(Table 3 in the Annex, Column 2)*. However, if – in emerging markets - we allow fundamentals to be different and market imperfections to exist there is also a significant flow of capital to faster growing emerging economies. Hence, if we

consider human capital (SCHOOL), capital account openness (KAOPEN), the weighted distance (DISTANCENESS), the change in productivity (TFP), the global risk aversion (SPREAD) as well as the country risk premium (CDS) income growth positively affects net capital *(Table 3 in the Annex, Column 3)* This might indicate that, ultimately, the Allocation Puzzle - as the Lucas Paradox - results from missing variables; if we control for these variables the Allocation Puzzle "disappears"[42].

Fifth, in line with Gourinchas und Jeanne (2007) it might be necessary to take account of the initial endowment with capital. Thus, we include the capital stock or, alternatively, the GDP per capita for which data coverage is much better *(Table 3 in the Annex, Column 4 and 5).* In both equations, the coefficient is significantly negative implying that capital flows to countries with a lower capital endowment. Thus, we simultaneously highlight the disappearance of the Lucas Paradox and of the Allocation Puzzle. These results still hold if we include the change in total factor productivity[43] rather than the GDP growth rate, which is the explanatory variable that we actually should consider in the Allocation Puzzle. By doing so, we reduce the problem of endogeneity, too. However, as data availability is limited we do not use it for the main estimations.[44]

5.3 Robustness Check

Instrumental variable estimators

As a first step to mitigate the problems arising from endogeneity, the explanatory variables GDP per capita as well as GDP growth were lagged by one period of time. Alternatively, we consider a two stage least square estimator with instrumental variables (IV). We use several instruments, namely the first lag and second lag of the endogenous variable, both lags together as well as the GDP per capita in 1500 common era. The IV estimator is compared to an OLS/GLS estimator. A Hausman Test does not reject H_0 claiming that differences in coefficients are not systematic. In addition, in line with

[42] For a detailed explanation of the control variables see section 4.
[43] We also use the lagged variable in order to exclude endogeneity.
[44] The outcome does not differ with respect to the chosen dataset except for the countries of the euro area where the Lane and Milesi-Ferretti dataset shows a significant Allocation Puzzle. As the LMF data is corrected for valuation effects this result could indicate that part of the neoclassical relationship between net capital flows and growth within Europe might be due to price effects.

Davidson and Mc Kinnon (1993), we perform an endogeneity test, i.e. we regress the instruments on the endogenous variable and use the predicted values as an additional explanatory variable in the main regression. As the coefficients of the predicted values are not significant, this is further evidence that OLS/GLS is an unbiased estimator. Thus, the GDP per capita variable can be treated as exogenous. As the standard errors are larger for IV estimators and we cannot exclude a bias due to small sample properties, we stick to the original GLS estimation.[45]

Random effect estimators/Fixed effects estimator

We compare the results of the GLS estimations to the outcome of two alternative estimators: the Fixed Effects (FE) and the Random Effects estimator (RE). A Hausman Specification Test indicates that a RE estimator does not significantly differ from the FE model given the correct specification of the *Lucas* and the *Allocation regressions* indicating zero-correlation between random effects and explanatory variables. Thus, we use a RE estimator. Ultimately, the results of the basic estimations of the Lucas Paradox and the Allocation Puzzle are relatively similar to the GLS outcome *(Table 4 Column 1/3)*.[46] With respect to *gross capital flows* the Hausman Test significantly rejects H_0 that assumes that the difference in coefficients of the FE and the RE estimator is not systematic. Thus, the FE model is the adequate estimator. Although Franken and Van Wijnbergen (2010) point out that fixed effects are an important factor that wipes out the Lucas Paradox the `Pseudo` Lucas Paradox still holds *(Table 4, Column 2)*.

[45] However, some caution is warranted with respect to the interpretation of these tests. Thus, we cannot exclude that the test statistics are biased if we use the GDP per capita in 1500 common era or the first and the second lag jointly. While all instruments are highly correlated with the endogenous variable we found some evidence in favor of weak instruments for the GDP per capita in 1500 CE if we compare the Cragg-Donald Wald F-Statistic in the first-stage regression to the critical values provided by Stock and Yogo (2005). Furthermore, the identification structure assumes that there is no direct link between the instruments and net capital flows via the GDP per capita variable which is satisfied for all but one specification. The Sargan Hansen Test of over-identifying restrictions indicates that the equations are exactly identified, with the exception of the one with both lags.

[46] This is irrespective whether we use the standard Random effects estimator based on a GMM method or a maximum likelihood Random effects estimator.

Table 4 Determinants of Gross Capital Inflows – Random/Fixed effects estimator

Dependent variable: log of net/gross capital inflows, in 2005 USD; 1991-2011

	(1) **LUCAS PARADOX (RE)**	(2) **`PSEUDO´ LUCAS PARADOX (FE)**	(3) **ALLOCATION PUZZLE (RE)**
GDP_CAP	-1.6706 (*-4.49*)***	2.5356 (*3.22*)***	
GDP_GROWTH			0.2316 *(2.67)***
Wald (prob)	20.13 *(0.00)*	10.34 *(0.00)*	7.16 *(0.00)*
N	264	270	262
Cross Section	57	57	57

*Note: Standard errors in parentheses. *** Significant at the 1% level. ** Significant at the 5% level. * Significant at the 10% level. GDP_CAP: GDP per capita one year before the start of the period (in constant 2000 USD, log.).*

Financial Centre Effects

In general, empirical investigations of capital flows might be biased if some countries act as a financial centre. In those parts of the analysis where we refer to net flows the problem should not be that severe. However, in particular, with respect to gross flows we cannot be sure that results are not to some extent determined by the fact that there are some economies record extremely high gross inflows with respect to GDP. We address the problem by dropping three major financial centres from our data, namely Switzerland, Luxemburg and the United Kingdom, and verify whether the results still hold.

The estimations based on the adjusted sample illustrate that, first, with respect to net flows, the parameter (without financial centres) is very close to the original outcome *(Table 5, Column 1).* Although the problem should be more pronounced with respect to gross flows, the results based on the original data still hold, too *(Table 5, Column 2).* Likewise, this is also the case for the estimations of the Allocation Puzzle *(Table 5, Column 3).* Thus, the fact that the dataset includes three important financial centres does not significantly bias our results.

Table 5 Determinants of Gross Capital Inflows – FGLS estimation

Dependent variable: log of net/gross capital inflows, in 2005 USD; 1991-2011

	(1) LUCAS PARADOX (without financial centres)	(2) `PSEUDO` LUCAS PARADOX (without financial centres)	(3) ALLOCATION PUZZLE (without financial centres)
GDP_CAP	-1.548 *(-10.49)****	0.749 (11.04)***	
GDP_GROWTH			0.104 (*2.74*)***
Wald (prob)	110.04 *(0.00)*	121.89 *(0.00)*	7.52 *(0.00*
N	253	260	251
Cross Section	54	55	54

*Note: Standard errors in parentheses. *** Significant at the 1% level. ** Significant at the 5% level. * Significant at the 10% level. GDP_CAP: GDP per capita one year before the start of the period (in constant 2000 USD, log.)*

6 Implications of return-driven capital flows in the euro area

The analysis illustrated that the Lucas Paradox and the Allocation Puzzle do no longer seem to be major empirical issues in international economics. Furthermore, the degree to which capital flows from rich to poor and to fast growing countries is most pronounced within the euro area which took many actions to reduce barriers to capital flows between its member countries. In the following section, we discuss whether the euro area, as a result of this strong return-driven allocation of capital, is exposed to a specific vulnerability. Large capital inflows may be risky for two reasons: *First*, capital flows can induce real appreciations, sudden stops and capital reversals, and *second*, a lower home bias in the EMU countries improves risk diversification and hedging in normal times, however, in times of financial stress high external positions might be at particular risk.

6.1. Capital flows might induce real appreciations, sudden stops and capital reversals

In the pre-crisis period, there is a significant positive relationship between expected GDP growth and net capital inflows: for the whole sample, an increase in the expected long run growth rate by 1 percentage point increases net capital inflows by 20%. This is also true for the euro area where the coefficient is marginally higher *(Table 6, Column 1 and 2).*[47] As a result, in the pre-crisis period, poorer and faster-growing countries extensively received external funds which went hand in hand with growing current account deficits and, ultimately, rising external debt levels. The capital inflows might have contributed to the price increases in the non-tradable goods sector leading to a significant real appreciation in the deficit countries. As a result, current account deficits accumulated even further and the export performance was far from allowing external debt repayment in the future. An over-borrowing manifests itself in high and increasing sovereign debts as in Greece and Portugal or in severe debts of the private sector as in Ireland and Spain.

The strong positive link between growth expectations and capital net inflows which persist in the euro area even in times of financial stress (*Table 6, Column 4*) imposes a relatively powerful leverage. In good times, when growth is expected to increase the inflow of funds, capital fuels growth which in turn spurs capital inflows. This ends in a pro-cyclical impact of capital inflows. The flipside is that, in times of financial stress, the leverage works in the opposite direction. More subdued growth forecasts might stimulate capital outflows and, by doing so, initiate a vicious circle. This can be seen in Table 6, Column 3 and 4 which show that in the euro area the neoclassical relationship still holds in the crisis period (up to 2011) with a significantly positive coefficient of growth forecasts on capital inflows[48]. By contrast, for the whole sample, a kind of Allocation Puzzle shows up implying that capital is no longer distributed to boom regions with strong growth forecasts, but rather allocated to more saturated countries that are expected to stay on a slower growth path. This might be the result of "safe haven" flows to mature economies which are regarded as being more reliable.

[47] We use 5 year forecasts of annual percentages of constant price GDP change; in the pre-crisis period we have to refer, alternatively, to growth expectations for the actual year.

[48] Note however, that capital flows according to growth perspectives before and in the crisis imply a reversal in net capital flows, since the growth perspectives have changed significantly among the EMU member countries.

Table 6 Determinants of Net Capital Inflows – FGLS estimation

Dependent variable: log of capital inflows, in 2005 USD; 1991-2011

	(1) **WHOLE SAMPLE** ***(pre crisis)***	(2) **EURO AREA** ***(pre crisis)***	(3) **WHOLE SAMPLE** ***(crisis period)***	(4) **EURO AREA** ***(crisis period)***
GROWTH_FORECAST	0.168 *(3.26)****	0.188 *(2.28)****	-0.118 *(-2.38)***	0.272 *(4.62)****
Wald (prob)	10.62 *(0.00)*	5.22 *(0.02)*	5.67 *(0.02)*	21.31 (0.00)
N	55	21	40	17
Cross Section	13	5	16	7

*Note: Standard errors in parentheses. *** Significant at the 1% level. ** Significant at the 5% level. * Significant at the 10% level. GROWTH_FORECAST: annual percentages of constant price GDP change, 5 year forecast; in the pre-crisis period: actual year).* However, the coefficient of equation (2) is not statistically different from the parameter estimated in equation (1) based on a rule of thumb, i.e. the coefficients +/- two standard deviations do overlap. By contrast, the coefficient of equation (4) is statistically different from the parameter estimated in equation (3).

6.2. Lower euro area home bias as reaction to global financial stress

The largest shock that the euro area was exposed to was certainly the stress in the financial sector. We have therefore looked at the effects of this stress on net capital inflows particularly in the euro area. We use different stress measures. We employ CDS spreads as measure of stress in the domestic financial markets and a spread of US government bonds over corporate bonds and the VIX (CBOE Volatility Index) as measure of global financial market stress.

First, we regress the change in the country risk (CDS) on gross capital flows *(Table 4 in the Annex).* It turns out that the elasticity of net capital inflows to domestic financial market stress is one magnitude higher within the euro area than in the overall sample. Or, to put it differently, there is no sign of capital flows being oversized as a result of an underestimation of existing risks in the euro area. This result is backed by the correlation coefficients of country risk measures and different macroeconomic fundamental (*see Chart 1 to 8 in the Annex*).[49] The correlation coefficient was always significantly higher for euro area countries than for the average sample country.[50]

[49] As risk measure we use the CDS and the 10 year government bonds yield, as fundamental factors we look at the government net lending ratio, a Financial Stress Index and the GDP growth volatility.

[50] At least, the global risk indicator should be exogenous, for the macro fundamentals we cannot totally exclude endogeneity. We found the correlation coefficient between the CDS premium and the

Second, we look at how *stress in global financial markets* affects capital flows.[51] Indeed, an increase in expected global financial volatility by 10% decreases the average amount of capital inflows by 2%. Yet, increased risk calls for more diversification, not for less. Taking as given that the correlation of assets issued in different countries is lower than that for those issued in the same country, we would expect a positive sign. The wrong sign indicates an increase in the home bias which might result from distortions in the interbank market. In the euro area this wrong reaction to global risk is smaller. Thus, the tendency to prefer home markets is less pronounced which is desirable if there is no systemic element across countries in the financial stress. The flip side, however, is an increase of EMU countries´ foreign exposures. This is particularly critical if the engagement in foreign markets does result from individual firms or bank decisions that are to a large extent biased by the non-standard monetary policy measures of the ECB.[52]

Thus, the analysis highlights that euro area capital flows respond differently to domestic and global financial market stress: while euro area capital flows react to *domestic financial market stress* factors to a stronger extent than the average sample country, euro area capital flows are less diverted towards home markets as reaction to a higher global market volatility. Although this is favourable from a risk diversification and hedging perspective, high external positions might increase financial vulnerabilities in times of financial stress.

---

government net lending ratio amounting to -0.2 for the whole sample while it is -0.7 for euro area countries. If we replace the CDS premium by the interest rate of government bonds with 10 year maturity the link is, again, stronger for the euro area (-0.7) compared to the whole sample (-0.2). Likewise the correlation coefficient between the CDS premium and a national Financial Stress Index increases from 0.2 for the whole sample to 0.5 for the euro area. Moreover, the correlation of the CDS premium with the volatility of GDO growth is more pronounced in the EMU (0.6) than in the overall dataset (0.3).

[51] Global developments have an effect on capital flows beyond the effect that is already taken into account via a change in the CDS premia. The relationship between internal risk factors and global developments is also stronger in the euro area sample compared to the overall sample. As a measure of global financial stress we look at the expected short term volatility of global financial markets (VIX) as well as at the spread between 10 year US government bond and corporate rates (SPREAD).

[52] This corresponds to what we observed in the financial crisis when global risk aversion increased without having - in the first instance - major implications for the amount of capital inflows to EMU members. Rather, within the euro area capital flows were maintained for quite some time.

7 Conclusions

In a neoclassical framework, liberalized capital markets ensure an efficient allocation of capital and imply that investment should take place in capital scarce economies with higher rates of return. However, some studies provide evidence that on a global scale, capital flows "uphill", i.e. from poor (capital scarce) to rich (capital abundant) countries (*Lucas Paradox*) and to countries that grow slower instead of countries that grow faster (*Allocation Puzzle*). In contrast, within the euro area, in the pre-crisis period in particular, the build-up of large imbalances indicates that more mature countries provided funds for catching-up economies. Our analysis aimed at shedding light on the questions to what extent the euro area is really different, where we observe a paradox capital flow structure and, if this is the case, whether we identify factors – so far omitted - that are able to dissolve the puzzles.

Based on a panel data set of 57 major industrialized and emerging economies, including the member countries of the EU and the euro area from 1990 to 2011, the underlying paper illustrates that the Lucas Paradox and the Allocation Puzzle are not important phenomena in international economics. Rather, net capital flows are allocated according to income and growth differentials whereas the link is strongest in the countries of the euro area, first of all, determined by intra-euro area capital flows and fostered by the introduction of the common currency. Thus, based on our empirical results, we found that Europe is homogenous enough with respect to the production function and the financial markets are sufficiently integrated to let the equalization of marginal returns to capital work. In periods of financial stress, however, the negative link between income per capita and net capital flows is to some extent dampened. This might be due to the fact that given a higher degree of uncertainty richer countries are more attractive for investment as they are, seemingly, safer economies. Nevertheless, even in the crisis period, the "neoclassical" structure of financial funds prevails.

From a policy perspective, this strong return-driven allocation of capital might expose the euro area to a specific vulnerability. The strong positive link between growth expectations and capital net inflows imposes a relatively powerful leverage and might fuel a pro-cyclical behaviour of capital flows. The resulting excessive "downhill" flow of capital from rich to poor and fast growing countries within the euro area could induce

bubbles, a severe real appreciation and, finally, could culminate in sudden stops. Furthermore, as reaction to a global risk aversion, euro area countries increase their home bias more moderately than other countries. Thus, foreign exposures have not been reduced as much and with them European countries' external vulnerability.

To some extent, our results are contradictory to earlier empirical work. In our view, this is mainly due to conceptual differences as some authors restrict the analysis to emerging markets (see Lucas, 1990; Franken and Van Wijnbergen, 2010) and some papers study gross capital flows instead of net capital flows (see Alfaro et al., 2008; Azémar and Desbordes, 2013). Indeed, there is some evidence for the Lucas Paradox as well as for the Allocation Puzzle within emerging market economies, at least at first sight. However, this paradox behaviour of capital flows can be explained by the fact that the underlying assumptions of the neoclassical theory do not hold. Market imperfections or distortions hamper an efficient allocation of capital. As a result, the inflow of funds to poor and fast-growing economies is lower than proposed by theory. However, if we take into account that the assumptions of the neoclassical model are not perfectly given, the Lucas Paradox and the Allocation Puzzle can be dismissed even for emerging markets. In contrast, the Lucas Paradox as well as the Allocation Puzzle cannot be ruled out when we look at gross flows. As "portfolio diversification" is more important than "development finance" for gross flows, funds are directed towards more mature and reliable economies. This is the case even if we control for institutional differences as well as imperfections of the financial markets.

These results are robust to various specifications. In addition, we add a two stage least square estimation in order to take account of endogeneity problems, random effects as well as fixed effects estimators. Finally, financial centres are neither driving the results.

References

Abiad, A.; Leigh D. and A. Mody (2007), International Finance and Income Convergence: Europe is different, IMF Working Paper, No. 64, International Monetary Fund, Washington.

Acemoglu, D., Johnson, S. and J.A. Robinson (2002), Reversal of Fortune: Geography and Institutions in the making of Modern World Income Distribution, The Quarterly Journal of Economics, 117, 1231-1294.

Ahearne, A., Von Hagen, J. and B. Schmitz (2007), Internal and External Current Account Balances in the Euro Area, Paper prepared for the Conference "Policy to reduce Global Imbalances", Washington DC, 8-9 February 2007.

Alfaro, L., Kalemli-Ozcan, S. and V. Volosovych (2008), Why doesn´t capital flow from rich to poor countries? An Empirical Investigation, Review of Economics and Statistics, 90(2), 347-368.

Alfaro, L., Kalemli-Ozcan, S. and V. Volosovych (2011), Sovereigns, Upstream Capital Flows, and Global Imbalances, CEPR Discussion Paper 8648, CEPR, London.

Arvai, Z., Driessen, K. and I. Ötker-Robe (2009), Regional Financial Interlinkages and Financial Contagion within Europe, IMF Working Paper, No. 6, International Monetary Fund, Washington.

Azémar, C. and R. Desbordes (2013), Has the Lucas Paradox been fully explained? Economics Letters, 121, 183-187. Barro, R.J. and X. Sala-i-Martin (1992), Convergence, Journal of Political Economy, Vol.100(2), 223-251.

Bergin, P.R. (2006), How well can the New Open Economy Macroeconomics explain the exchange rate and current account, Journal of International Money and Finance, Vol. 25, 675-701.

Blanchard, O. and M. Giavazzi (2002), Current account deficits in the euro area: The end of the Feldstein Horioka Puzzle?, Brookings Papers on Economic Activity, Vol. 2, 147-210.

Borio, C. and P. Disyatat (2011), Global Imbalances and the Financial Crisis: Link or no Link?, BIS Working Paper, 346, Bank of International Settlement, Basel.

Caselli, F. and J. Feyrer (2007), The Marginal Product of Capital, The Quarterly Journal of Economics, 122 (2), 535-568.

Chinn, M.D. and Ito, H. (2007), East Asia and Global Imbalances: Saving, Investment, and Financial Development, NBER Working Paper, No. 13364, National Bureau of Economic Research, Cambridge.

Chinn, M.D. and E.S. Prasad (2003), Medium Term Determinants of Current Accounts in Industrial and Developing Countries: An Empirical Exploration, *Journal of International Economics*, 59, 47–76.

Dadush, U. and B. Stancil (2011), The Capital Flow Conundrum, VOX, http://voxeu,org/index.php?q=node/6718.

Davidson, R. and J.G. Mac Kinnon (1993), Estimation and Inference in Econometrics, New York, Oxford Press.

Desai, M.A. and D. Dhammika (2007), Taxes, Institutions and Foreign Diversification Opportunities, NBER Working paper 13132, NBER, Cambridge, Massachusetts.

De Santis, R. und M. Lührmann (2006), On the determinants of external imbalances and net international portfolio flows – a global perspective, ECB Working paper, 651, European Central Bank, Frankfurt.

Eichengreen, B. (2003), Capital Flows and Crisis, Cambridge University Press.

Ejsing, J.W. and W. Lemke (2009), The Janus-Headed Salvation – Sovereign and Bank Credit Risk Premia During 2008-09, ECB Working Paper 1127, European Central Bank, Frankfurt.

Ekinci, M.; Kalemli-Ozcan, S. and B. Sorensen (2007), Financial Integration within EU Countries: The role of Institutions, Confidence and Trust, NBER Working Paper 13440, NBER, Cambridge.

Fagen, G. and V. Gaspar (2008), Macroeconomic Adjustment to Monetary Union, ECB Working Paper, 946, European Central Bank, Frankfurt.

Faria, A. and P. Mauro (2009), Institutions and the external capital structure of countries, Journal of International Money and Finance, 28, 367-391.

Feldstein, M. and C. Horioka (1980), Domestic Saving and International Capital Flows, Economic Journal 90, 314-329.

Frenkel, J. A. and M. Goldstein (1996), Functioning of the International Monetary System, International Monetary Fund, Washington.

Franken, C. and S. Van Wijnbergen (2010), Private Capital Flows to Low Income Countries: Country-Specific Effects and the Lucas Paradox, Tinbergen Institute Discussion Paper, 003/2, Tinbergen Institute, Amsterdam.

Gertler, M. and K. Rogoff (1990), North-South lending and endogenous domestic capital market inefficiencies, Journal of Monetary Economics, 26(2), 245-266.

Gordon, H. and A.L. Bovenberg (1996), Why is Capital so immobile internationally? Possible Explanations and Implications for Capital Income Taxation, American Economic Review, 86(5), 1057-1075.

Gosh, A.; Kim J.; Qureshi, M. and J. Zalduendo (2012), Surges, IMF Working Paper, No. 22, IMF, Washington.

Gourinchas, P.-O. and O. Jeanne (2007), Capital Flows to Developing Countries: The Allocation Puzzle, NBER Working paper, 13602, NBER, Massachusetts (Review of Economic Studies, forthcoming).

Herrmann, S. and A. Winkler (2009), Real Convergence, Financial Markets, and the Current Account – Emerging Europe versus emerging Asia, North American Journal of Economics and Finance, Vol. 20, Issue 2, 100-123.

Hoffmann, M., Krause M. and T. Laubach (2012), Trend Growth Expectations and U.S. House Prices before and after the Crisis, Journal of Economic Behavior & Organization, Vol.83, 394-409.

IMF (2012), Towards Lasting Stability and Growth, Umbrella Report for the G-20 Mutual Assessment Process, International Monetary Fund, Washington.

Jaumotte, F. and P. Sodsriwiboon (2010), Current Account Imbalances in the Southern Euro Area, IMF Working Paper, No. 139, International Monetary Fund, Washington.

Ju, J. and Wei, S. (2006), A Solution to two Paradoxes of International Capital Flows, 7thJaques Polak Annual Research Conference, November 9-10, 2006.

Ju, J. and Wei, S. (2010), Domestic Institutions and the Bypass Effect of International Capital flows, American Economic Journal: Economic Policy, 2(4): 173-204.

Kose, A.M., Prasad E.S. and A.D. Taylor (2009), Thresholds in the Process of International Financial Integration, NBER Working Paper 14916, NBER, Cambridge, USA.

Kalemli-Ozcan, S.; Sorensen, B. and B. Turan (2007), Where does capital flow? A comparison of US Sates and EU Countries, European Economy, No. 295, European Commission, Brussels.

Kalemli-Ozcan, S., Reshef, A.; Sorensen, B. and O. Yosha (2010), Why does capital flow to rich states? Review of Economics and Statistics, 92(4), 769-783.

Lane, P.R. (2003), Empirical Perspectives on long-term external debt, Trinity college, mimeo.

Lane, P.R. (2008a), The Macroeconomics of Financial Integration: A European Perspective, IIIS Discussion Paper 265; Institute for International Integration Studies, Trinity College, Dublin.

Lane, P.R. (2008b), EMU and financial integration, IIIS Discussion Paper 248; Institute for International Integration Studies, Trinity College, Dublin.mimeo.

Lane, P.R. (2011), External Adjustment and the Global Crisis, IMF Working paper 197, International Monetary Fund, Washington.

Lane, P.R. (2010), A European Perspective on External Balances, Report No. 5, Swedish Institute for European Policy Studies, Stockholm.

Lane, P.R. (2013), Capital Flows in the Euro Areas, European Econmy, Economic papers 497, European Commission, Brussels.

Lane, P.R.. and G. Milesi-Ferretti (2007), The external wealth of nations mark II: revised and extended estimates of foreign assets and liabilities 1970-2004, Journal of International Economics 73(2), 223-250.

Lane, P.R.. and B. Pels (2012), Current Account Imbalances in Europe, CEPR Working Paper, 8958, CEPR, London.

Lothian, J.R. (2006), Institutions, Capital Flows and Financial Integration, Journal of International Money and Finance, 25(3), 358-369.

Lucas, R.E. (1990), Why doesn´t capital flow from rich to poor countries? American Economic Review, 80(2), 92-96.

Matsuyama, K. (2004), Financial Market Globalization, Symmetry-Breaking and Endogenous Inequality of Nations, Econometrica, 72(3), 853-884.

Milesi-Ferretti, G., Strobbe, F. and N. Tamirisa (2010), Bilateral Financial Linkages and Global Imbalances: A View on the Eve of the Financial Crisis, IMF Working Paper, No.257, International Monetary Fund, Washington.

Obstfeld, M. and A.M. Taylor (2004), Global capital markets: Integration, crisis and growth, Cambridge University Press.

Obstfeld, M. and A.M. Rogoff (2000), Six Major Puzzles in International Macroeconomics: Is there a Common Cause? NBER Working paper 7777, NBER, Massachusets.

Papaioannou, E. (2009), What drives international financial flows? Politics, Institutions and other determinants, Journal of Development Economics, 88(2), 269-281.

Prassad, E., Rajan, R. and A. Subramanian (2006), Patterns of International Capital Flows and their Implications for Economic Development, Federal Reserve Bank Kansas City, Proceedings, 119-158.

Prassad, E., Rajan, R. and A. Subramanian (2007), The Paradox of Capital, Finance and Development, Vol. 44, No. 1, IMF, Washington.

Razin, A. and E. Sadka (2004), Lumpy setup Costs of investment: The Lucas Paradox Revisited,

Reinhardt, D., Ricci, L.A. and T. Tressel (2010), International Capital Flows and Development: Financial Openness Matters, 235, IMF, Washington.

Reinhard, C.M. and K.R. Rogoff (2004), Serial Default and the "Paradox" of Rich-to-Poor Capital Flows, American Economic Review, Papers and Proceedings, Vol. 94(2), May 2004.

Schindler,M. (2009), Measuring Financial Integration: A New Data Set, IMF Staff Paper, Vol. 56(1), International Monetary Fund, Washington.

Schmitz, B. and J. Von Hagen (2009), Current Account Imbalances and Financial Integration in the Euro Area, CEPR Working Paper, 7262, CEPR, London.

Shin, H.S. (2012), Global Banking Glut and Loan Risk Premium, IMF Economic Review, 60(2), 155-192.

Shleifer, A. and D.Wolfenzon (2002), Investor Protection and Equity Markets, Journal of Financial Economics, 66(1), 3-27.

Speller, W., Thwaites, G. and M. Wright (2011), The future of international capital flows, Financial Stability Paper, No. 12, Bank of England.

Staiger, D. and J. H. Stock (1997), Instrumental Variables Regression with Weak Instruments, Econometrica, 65, 557-586.

Stock, J.H. and M. Yogo (2005), Testing for Weak Instruments in Linear IV Regressions. In D.W.K. Andrews and J.H. Stock, eds. Identification and Inferences for Econometric Models: Essays in Honor of Thomas Rothenberg. Cambridge, Cambridge University Press, 80-108.

Stulz, R.M. (2005), The Limits of Financial Globalization, Journal of Finance, American Finance Association, 60(4), 1595-1638.

ANNEX

Table 1 Determinants of Net Capital Inflows – FGLS estimation

Dependent variable: log of net capital flows, in 2005 USD; 1991-2011

	(1) **EMERGING MARKETS**	(2) **INDUSTRIAL COUNTRIES**	(3) **EMERGING MARKETS (with control variables)**	(4) **EMERGING MARKETS (without control variables and sample size as in 3)**
GDP_CAP	0.8685 (3.23)***	- 2.366 (-4.99)***	-1.784 (-3.11)***	1.2130 (3.80)***
SCHOOL			0.137 (4.45)***	
TFP			-0.222 (-1.96)***	
CDS			-0.002 (-3.42)***	
KAOPEN			0.300 (1.56)	
DISTANCE			-0.0002 (-1.58)	
SPREAD			-0.012 (-2.70)***	
Wald (prob)	10.45 *(0.00)*	24.91 *(0.00)*	99.43 *(0.00)*	14.42 *(0.00)*
N	128	135	49	49
Cross Section	28	28	18	18

*Note: Standard errors in parentheses. *** Significant at the 1% level. ** Significant at the 5% level. * Significant at the 10% level. GDP_CAP: GDP per capita one year before the start of the period (in constant 2000 USD, log.).SCHOOL: Secondary school enrolment (in% of gross); TFP: Total factor productivity growth (ln difference, in percent); CDS: Credit default swap, spread quoted, 5 years.*

Table 2 Determinants of Gross Capital Inflows – FGLS estimation

Dependent variable: log of gross capital inflows, in 2005 USD; 1991-2011

	(1) **WHOLE SAMPLE**	(2) **EMERGING MARKETS**	(3) **WHOLE SAMPLE**
GDP_CAP	0.7251 *(10.17)***	1.2136 (27.14)***	0.825 *(4.14)***
SCHOOL			0.009 *(1.19)*
TFP			-0.122 (-4.83)***
CDS			0.0005 (1.75)*
KAOPEN			0.129 (2.01)**
DISTANCE			-0.0002 (-2.46)***
SPREAD			-0.005 (-8.78)***
Wald (prob)	103.34 *(0.00)*	736.64 *(0.00)*	*207.80* *(0.00)*
N	270	135	136
Cross Section	57	29	50

*Note: Standard errors in parentheses. *** Significant at the 1% level. ** Significant at the 5% level. * Significant at the 10% level. GDP_CAP: GDP per capita one year before the start of the period (in constant 2000 USD, log.). LITERACY: Literacy rate, total adult (% of people ages 15 and above; SCHOOL: Total average schooling years (log); ICRG_QOG: International country risk guide Indicator of quality of Government, Index between 0 and 1; TFP: Total factor productivity growth, percent; TRADE: Trade openness, percent of GDP, KAOPEN: Openness of the capital account, Chin-Ito Index; DISTANCENESS: Distance weighted by inverse GDP; VIX: S&P 500 volatility index, implied volatility, year-end data; CDS: Credit default swaps, 5-year spread quoted. [1)] Unfortunately, the interaction variable INTERACT_EMU as well as the EMU dummy variable were omitted in the estimation with the risk interactions.*

Table 3 Determinants of Net Capital Inflows – FGLS estimation

Dependent variable: log of net capital inflows, in 2005 USD; 1991-2011

	(1) EMERGING MARKETS	(2) INDUSTRIAL COUNTRIES	(3) EMERGING MARKETS (with control variables)	(4) WHOLE SAMPLE (+ GDP per capita)	(5) WHOLE SAMPLE (+ capital stock)
GDP_GROWTH	0.040 *(1.11)*	0.309 *(4.56)***	0.234 *(1.65)**	0.119 *(3.18)***	0.635 *(6.14)***
GDP_CAP				-1.769 *(-12.43)***	
CAP_STOCK					-0.756 *(-4.77)***
SCHOOL			0.101 *(2.64)***		
TFP			-0.081 *(-0.53)*		
CDS			-0.003 *(-3.67)***		
KAOPEN			-0.048 *(-0.16)*		
DISTANCE			-0.000 *(-0.01)*		
SPREAD			-0.009 *(1.05)*		
Wald (prob)	1.24 (0.27)	20.82 *(0.00)*	39.09 *(0.00)*	166.25 *(0.00)*	57.02 *(0.00)*
N	126	135	49	261	79
Cross Section	28	28	18	56	21

*Note: Standard errors in parentheses. *** Significant at the 1% level. ** Significant at the 5% level. * Significant at the 10% level. GDP_Growth: GDP growth rate, average, previous period (in percent); GDP_CAP: GDP per capita one year before the start of the period (in constant 2000 USD, log.); CAP_STOCK: Capital stocks, per capita, in USD; CAP_STOCK: Capital stocks, per capita, in USD; SCHOOL: Secondary School Enrolment (in % of gross); ICRG: Indicator of quality of Government, Index between 0 and 1; DISTANCE: Distance weighted by inverse GDP; SPREAD: Spread between and government bond yield and corporate bond yield, US, basis points; CDS: Credit default swaps, 5-year spread quoted.*

Table 4 Determinants of Gross Capital Inflows – FGLS estimation

Dependent variable: log of gross capital flows, in 2005 USD; 1991-2011

	(1) **WHOLE SAMPLE (RISK EFFECTS)**[1)]
GDP_CAP	0.217
	*(2.50)****
SCHOOL	0.053
	*(10.11)****
TFP	-0.206
	*(-10.29)****
KAOPEN	-0.068
	*(-1.71)**
DISTANCE	-0.0002
	*(-12.13)****
SPREAD	0.015
	*(3.35)****
VIX	-0.180
	*(-4.29)****
VIX (EMU)	0.015
	*(2.18)****
CDS	-0.0005
	*(-6.42)****
CDS (EMU)	-0.004
	*(-2.60)****
Wald (prob)	5355.93 *(0.00)*
N	136
Cross Section	50

*Note: Standard errors in parentheses. *** Significant at the 1% level. ** Significant at the 5% level. * Significant at the 10% level. GDP_CAP: GDP per capita one year before the start of the period (in constant 2000 USD, log.). LITERACY: Literacy rate, total adult (% of people ages 15 and above; SCHOOL: Total average schooling years (log); ICRG_QOG: International country risk guide Indicator of quality of Government, Index between 0 and 1; TFP: Total factor productivity growth, percent; TRADE: Trade openness, percent of GDP, KAOPEN: Openness of the capital account, Chin-Ito Index; DISTANCENESS: Distance weighted by inverse GDP; VIX: S&P 500 volatility index, implied volatility, year-end data; CDS: Credit default swaps, 5-year spread quoted.* [1)] *Unfortunately, the interaction variable INTERACT_EMU as well as the EMU dummy variable were omitted in the estimation with the risk interactions.*

Chart 1: CDS and Government net lending, Whole sample

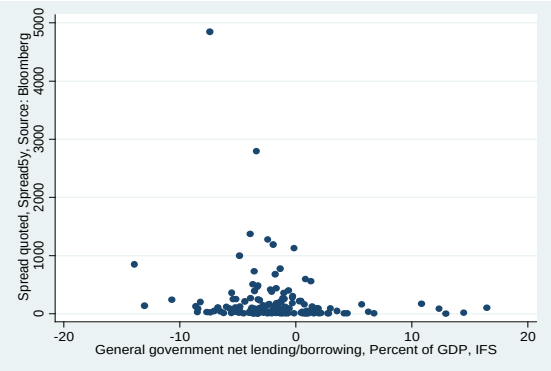


Chart 2: CDS and Government net lending, EMU Countries

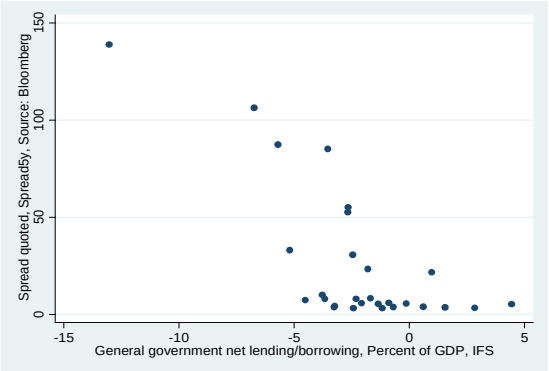


Chart 3: Interest Rates and Government net lending, Whole sample

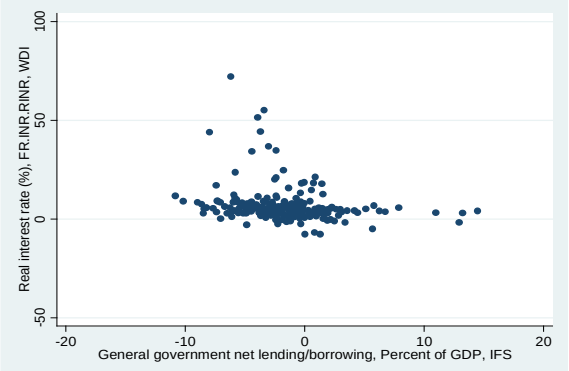


Chart 4: Interest Rates and Government net lending, EMU Countries

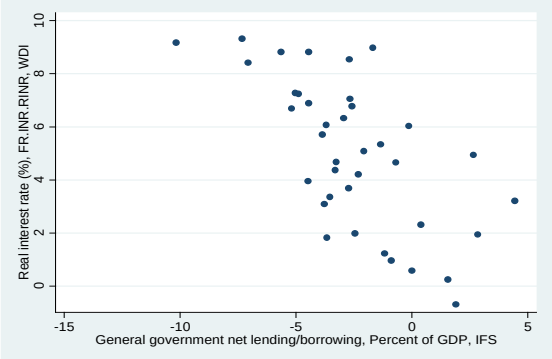


Chart 5: CDS and growth volatility, Whole sample

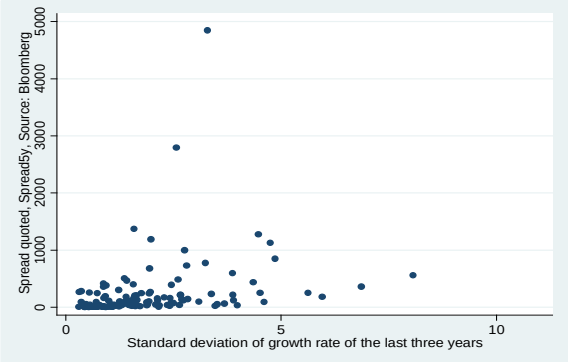


Chart 6: CDS and growth volatility, EMU Countries

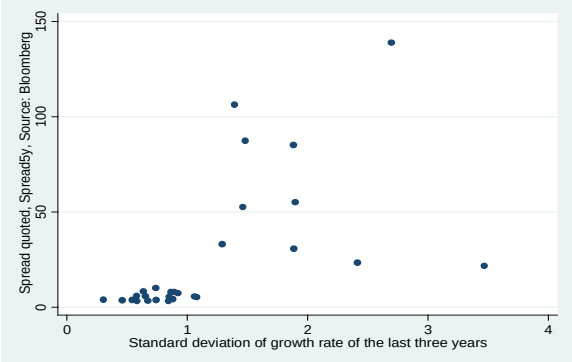


Chart 7: CDS and Financial Stress Index, Whole sample

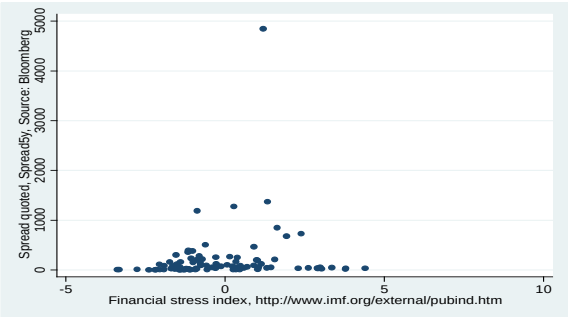
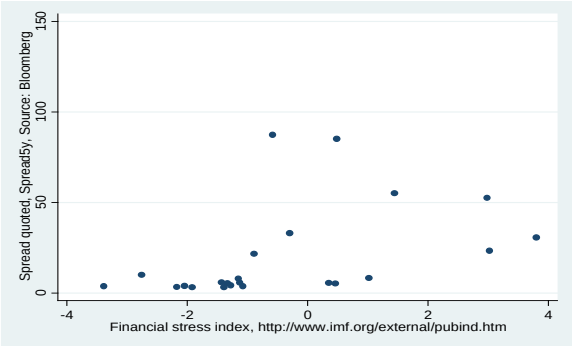


Chart 8: CDS and Financial Stress Index, EMU Countries



ANNEX DATEN

List of OECD Countries:
Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Luxemburg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turley, United Kingdom, United States.

Data Sources and Description
Aggregated Data

- Aggregated *capital inflows* are calculated from the IMF's IFS and from a dataset by Lane and Melesi-Feretti which is derived from the IFS data. Both sources give aggregated categories of out- and inflows of an economy vis-à-vis the rest of the world in millions of US$. The IFS data includes to the categories DIRECT INVESTMENT ABROAD (descriptor BDD), DIR. INVEST. IN REP. ECON., N.I.E. (BED), PI EQUITY SECURITIES ASSETS (BKD), PI DEBT SECURITIES ASSETS (BLD), PI EQUITY SECURITIES LIAB (BMD), PI DEBT SECURITIES LIAB (BND), OI BANKS ASSETS (BQD), OI OTHER SECTORS ASSETS (BRD), OI BANKS LIAB (BUD), OI OTHER SECTORS LIAB (BVD), FINAN DERIVATIVES: ASSETS (BWD) and, FINAN DERIVATIVES: NET (BYD). Net inflows are calculated as sum of the difference of the liabilities and the assets in each category. The values are year-end values. The Lane and Melesi-Feretti data are the updated and extended version of the External Wealth of Nations Mark II database developed by Lane and Milesi-Ferretti (2007)".
- *GDP per capita* is taken from the World Bank's World Development Indicators (WDI) database. The GDP per capita is given at constant 2000 US$, where the conversion is PPP corrected.
- *Population* is given in millions by the IFS from the IMF.
- *GDP growth* rates are calculated as annual growth rate from GDP at constant 2000 US$. The data is taken from the WDI by the World Bank.
- The Chinn-Ito index that measures capital account openness (*KAOPEN*). It has been originally developed by Chinn and Ito (2007).
- The Markit Credit Default Swap Calculator provides the credit default swap premium (*CDS*) which measures the default risk of a government bond. It is provided by Markit at www.markit.com as annual average values in basis points. As maturity time of the government bond five years are chosen.
- *Literacy* contains the share of people above 15 years that can read and write in percent. It is taken from WDI where it has the code "SE.ADT.LITR.ZS".
- *SCHOOL* is taken from Barro and Lee (2000). It gives the average years of schooling of the total population with age above 25.
- *ICRG_QOG* proxies the quality of the government. It is an index between 0 and 1 with mean=.695 and sd=.2. The variable is taken from the International Country Risk Guide provided by the PRS group at http://www.countrydata.com . It is the mean value of the ICRG variables "Corruption", "Law and Order", and "Bureaucracy Quality". Higher values indicate a higher quality of the government.
- *TFP* gives the growth in Total Factor Productivity in percent. We have taken the variable from The Conference Board Total Economy Database™, January 2012, http://www.conference-board.org/ data/economydatabase.
- *Trade* gives Trade in percent of GDP. It is taken from the WDI and has the code "NE.TRD.GNFS.ZS".

- *DISTANCE* is calculated as sum of the GDP weighted distances of all partner countries from a particular country. Distanceness varies over time and countries being a proxy for the remoteness of a country. Higher values point to more remote countries. GDP data to calculate the variables are taken from the WDI, geographical distance from the CEPII distances database (CEPII, 2005). The geodesic distances in kilometers are calculated according to the great circle formula, which uses latitudes and longitudes of the most important cities or population agglomerations.
- The Chicago Board Options Exchange (CBOE) Volatility Index (*VIX*) measures the market's expectation of 30-day volatility. The VIX is based on S&P 500 index option prices. We use year-end data in our analysis.
- *SPREAD* is difference between the interest rates between the US government bond (10 years maturity) and corporate bond (7-10 year maturity) of US firms in basis points. It is a risk measure indicating global risk aversion.
- The variable *CAP_STOCK* gives the capital stock per capita of a particular economy in US$. It is taken from the OECD "Economic Outlook".
- The variable *GDP per capita in 1500* gives the income per capita in this territory in 1500 and is taken from Galor and Weil (2001).
- *Expected Growth* is the average of the five-years' growth forecasts by the IMF reported in the World Economic Outlook (WEO).

Bilateral capital inflows: data and calculation

We used bilateral data from three different sources to compute flows into, within and out of the EMU. We derived capital flows into and out of the EMU by aggregating bilateral flows according to whether source and recipient country participate in the EMU. Unfortunately, bilateral capital flows are not available. We use different source for the three major groups of capital flows: FDI, Portfolio investment, and bank loans.

Data sources and description:

- The bilateral FDI flow data are from the OECD *Foreign Direct Investment Statistics*. There we used the "FDI flows by partner country" data. The values are given in million US$.
- Portfolio investments broken down by geographic area are taken from the *Coordinated Portfolio Investment Survey (CPIS)* by the IMF. It holds asset and liability positions of bilateral cross-border investments in million US$. We use differences between all successive years.
- Data of bank loans are from the *BIS locational banking statistics*. It gives banks claims against and loans from each foreign partner at the end of each quarter in million US$. We used the year end positions and calculated the flows as differences from two successive years.

Graz Economics Papers

For full list see:
http://ideas.repec.org/s/grz/wpaper.html
Address: Department of Economics, University of Graz,
Universitätsstraße 15/F4, A-8010 Graz

01–2014 **Sabine Herrmann, Jörn Kleinert**: Lucas Paradox and Allocation Puzzle – Is the euro area different?

08–2013 **Christoph Zwick**: Current Account Adjustment in the Euro-Zone: Lessons from a Flexible-Price-Model

07–2013 **Karl Farmer**: Financial Integration and EMUs External Imbalances in a Two-Country OLG Model

06–2013 **Caroline Bayr, Miriam Steurer, Rose-Gerd Koboltschnig**: Scenario Planning for Cities using Cellular Automata Models: A Case Study

05–2013 **Y. Hossein Farzin, Ronald Wendner**: Saving Rate Dynamics in the Neoclassical Growth Model – Hyperbolic Discounting and Observational Equivalence

04–2013 **Maximilian Gödl, Jörn Kleinert**: Interest rate spreads in the Euro area: fundamentals or sentiments?

03–2013 **Christian Lininger**: Consumption-Based Approaches in International Climate Policy: An Analytical Evaluation of the Implications for Cost-Effectiveness, Carbon Leakage, and the International Income Distribution

02–2013 **Veronika Kulmer**: Promoting alternative, environmentally friendly passenger transport technologies: Directed technological change in a bottom-up/top-down CGE model

01–2013 **Paul Eckerstorfer, Ronald Wendner**: Asymmetric and Non-atmospheric Consumption Externalities, and Efficient Consumption Taxation

10–2012 **Michael Scholz, Stefan Sperlich, Jens Perch Nielsen**: Nonparametric prediction of stock returns with generated bond yields

09–2012 **Jörn Kleinert, Nico Zorell**: The export-magnification effect of offshoring

08–2012 **Robert J. Hill, Iqbal A. Syed**: Hedonic Price-Rent Ratios, User Cost, and Departures from Equilibrium in the Housing Market

07–2012 **Robert J. Hill, Iqbal A. Syed**: Accounting for Unrepresentative Products and Urban-Rural Price Differences in International Comparisons of Real Income: An Application to the Asia-Pacific Region

06–2012 **Karl Steininger, Christian Lininger, Susanne Droege, Dominic Roser, Luke Tomlinson**: Towards a Just and Cost-Effective Climate Policy: On the relevance and implications of deciding between a Production versus Consumption Based Approach

05–2012 **Miriam Steurer, Robert J. Hill, Markus Zahrnhofer, Christian Hartmann**: Modelling the Emergence of New Technologies using S-Curve Diffusion Models

04–2012 **Christian Groth, Ronald Wendner**: Embodied learning by investing and speed of convergence

03–2012 **Bettina Brüggemann, Jörn Kleinert, Esteban Prieto**: The Ideal Loan and the Patterns of Cross-Border Bank Lending

02–2012 **Michael Scholz, Jens Perch Nielsen, Stefan Sperlich**: Nonparametric prediction of stock returns guided by prior knowledge

01–2012 **Ronald Wendner**: Ramsey, Pigou, heterogenous agents, and non-atmospheric consumption externalities