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**Working Paper**

## On the relation between capital flows and the current account

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Anne Oeking  
Lina Zwick

## On the Relation between Capital Flows and the Current Account

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# On the Relation between Capital Flows and the Current Account



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Anne Oeking and Lina Zwick<sup>1</sup>

# On the Relation between Capital Flows and the Current Account

## Abstract

*Imbalances in the current and financial account have been at the heart of the discussion on global imbalances. With respect to monitoring macroeconomic stability it is highly important to know whether capital flows cause reactions in the current account or whether they rather adjust to changes in the current account, and hence which variable can be used as an indicator for upcoming imbalances. In this paper, we study the dynamics of the current account and different types of net capital flows (portfolio flows, direct investment and other investment flows) for selected OECD countries applying the concept of Granger-causality. Moreover, in a non-linear model we test whether the direction of Granger-causality changes over the business cycle. Our results show that the current account generally Granger-causes the financial account components. However, for short-term flows the direction changes over the business cycle: they seem to finance the current account during economic downturns, while inducing its changes during upturns.*

*JEL Classification: F32*

*Keywords: Current Account; international capital flows; Granger-causality; Threshold VAR*

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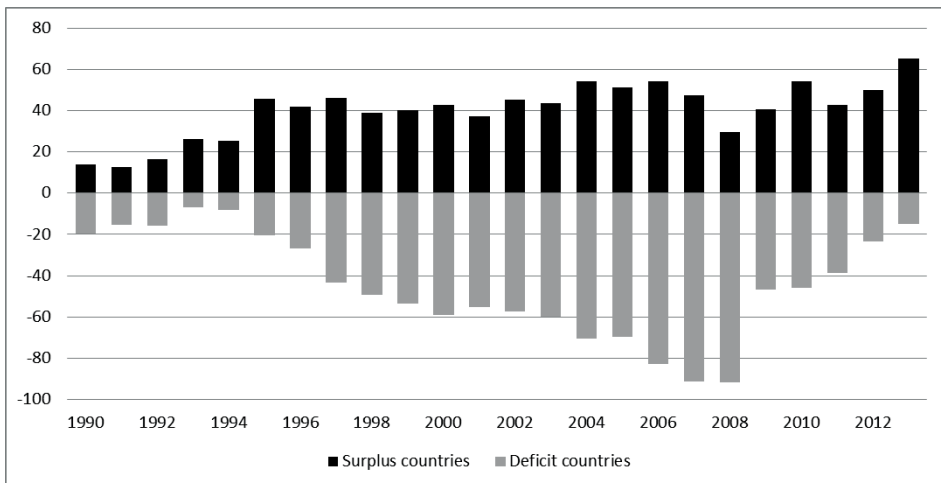
<sup>1</sup> Anne Oeking, University of Duisburg-Essen and RGS Econ; Lina Zwick, RWI and Ruhr-University Bochum. – We thank Roland Döhrn, Karoline Krättschell, Christoph M. Schmidt and Torsten Schmidt for useful comments. – All correspondence to: Lina Zwick, RWI, Hohenzollernstr. 1-3, 45128 Essen, Germany, e-mail: Lina.Zwick@rwi-essen.de

## 1. Introduction

The international financial integration during the last decades was accompanied by a built-up of imbalances with respect to countries' balance of payments, indicated by an increased dispersion of current account positions. For selected OECD countries, Figure 1 shows that current account deficits and surpluses increasingly widened from the 1990s up to the global financial crisis. Only recently, some of these imbalances have been reduced. The favourable global financial environment facilitated this built-up by providing increased investment opportunities for surplus countries, while extending the funding sources for deficit countries; this was reflected in a rapid growth in cross-border capital flows (Lane 2013).

However, it is not clear whether increased capital flows have been an active force in this process or whether they have rather reflected other macroeconomic imbalances. Given the balance of payments identity, imbalances in the current account are naturally mirrored in the financial account. For monitoring macroeconomic stability, it is however highly important to know whether capital flows cause reactions in the current account or whether they rather adjust to changes in the current account, and hence which variable could be used as an indicator for upcoming imbalances.

Figure 1: Current account balances for selected OECD countries in percent of GDP



Source: Own calculations based on feri.

Because of the balance of payments identity, these questions cannot be answered on an aggregate level. Instead, focusing on the components of the financial account (foreign direct investments, portfolio investments and other investments) may provide information about causality. Specifically, these types of capital flows behave and react differently to domestic and global economic conditions. For example, foreign direct investment flows (FDI) are more stable, and are determined by structural, long-term domestic factors, while portfolio investment flows (PI) and other investment flows (OI), mainly cross-border loans, are relatively volatile and – with respect to portfolio flows – less closely related to domestic economic conditions. Their relation to the current account might therefore differ.

Studies in the literature analysing the relationship between the current and financial account mainly focus on the difference between developing and developed countries (Fry et al. 1995, Sarisoy-Guerin 2003, Yan 2005, Yan and Yang 2012) or provide applications to emerging market economies (Yan and Yang 2008, Kim and Kim 2011, Lau and Fu 2011, Garg and Prabheesh 2015). Generally, findings suggest that the Granger-causality runs from the current account to the financial account in developed countries, while it is the reverse case in developing countries. This paper, in contrast, investigates the dynamic relationship and adjustment mechanism between the current account and the single components of the financial account for 23 selected OECD countries between 1990 and 2013. These OECD countries constitute a group with certain peculiarities important in studying current and financial account balances: sophisticated and well-developed financial systems, the absence of capital controls and free trade. Moreover, these countries were particularly involved in the global financial integration process benefiting from financial innovations and – with respect to the Euro Area countries – from the introduction of a common currency.

We proceed with our analysis in two steps. First, we apply the concept of Granger-causality to the current account and the single components of the financial account for each country of our sample in the context of a vector autoregressive (VAR) model. The concept of Granger-causality tests whether the prediction of one variable is significantly improved by including lags of the other variable. Hence, when analyzing Granger-causality between the current and the financial account components we are able to draw conclusions on whether one of the two precedes the other. Consequently, we do not identify the true causal impact of one variable on another, and hence can refrain from including additional exogenous determinants. With respect to the monitoring of macroeconomic stability, results from this time series approach can point to variables on which supervision with respect to macroeconomic imbalances should focus on.

In a second step, we extend this analysis to a non-linear VAR model to analyze whether the Granger-causality direction changes over the business cycle. Fry et al. (1995) find that during periods of stronger growth the current account would be the determining factor. However, their sample period misses the period of increased financial market integration, due to which capital flows have been rapidly growing (Lane 2013). Therefore we could expect the opposite finding from Fry et al. (1995): with positive growth expectations and less uncertainty during business cycle ups, capital flows rather precede changes in the current account. During weaker economic conditions, this finding could be reversed as capital flows rather adjust to changing economic conditions, and then mainly serve to finance the current account. This is particularly true for portfolio and other investment flows that are more volatile (Contessi et al. 2013), while FDI flows might be more robust – also in their relation to the current account – since they are of a more long-term nature. All in all, this paper is the first, to our knowledge, that explicitly investigates Granger-causality between the current account and the different types of capital flows over the business cycle.

We find that the causality direction generally runs from the current account to the different types of capital flows, and hence that capital flows serve to finance the current account. However, the non-linear analysis provides some further insights: during business cycle ups it is rather short-term capital flows, mainly other investment flows, that generally cause changes in the current account. By and large this is also true for portfolio investment flows, although the results are somewhat mixed. Thus, our hypothesis is confirmed: positive growth expectations and a low level of uncertainty attract international capital that in turn



lead to changes in the current account, e.g. through higher exports and imports which benefit from better financing opportunities. FDI flows, instead, confirm our presumption that they are more stable to economic changes. With respect to monitoring macroeconomic stability our results indicate that other investment flows, which mainly consist of banking flows, could be additionally considered as an indicator for upcoming imbalances during economic upswings.

Our paper is structured as follows. Section 2 gives some (theoretical) background on the relationship between the current and the financial account components. Section 3 presents our empirical approach and the data. Section 4 describes and discusses the results, and the last section concludes.

## 2. The (theoretical) nexus between the balance of payments components

According to the balance of payments identity a country's current and financial account have to be balanced ex post, meaning that trade deficits (surpluses) will have to be accompanied by net capital inflows (outflows) of the same magnitude. On a theoretical level, two main views have evolved in the literature that look at the balance of payments from different angles and hence implicitly investigate which factors determine the relation between the current and financial account economically.

The savings/investment view (cf. Feldstein and Horioka 1980, Bayoumi 1990, Obstfeld and Rogoff 1995, Mann 2002) is based on national accounting identities which split up domestic GDP into private and public consumption, investment, and the current account; all income is spent by either consuming or saving and savings must therefore equal investment. In an open economy, the economy can run up debt abroad or invest abroad by participating in international capital markets. Savings therefore comprise domestic and foreign savings. This implies that the current account equals the difference between domestic savings and investment,

$$CA = S - I \quad (1)$$

Specifically, a current account deficit (surplus) means that domestic savings is lower (higher) than domestic investment and the country net borrows from (gives net credit to) the rest of the world. For example, during periods of high investment demand, when domestic savings are fully engaged, additional financing from abroad is needed. Thus, this view regards the financial account as passive to such a degree as it simply captures offsetting financial transactions and capital flows serve to finance the current account.<sup>1</sup>

The portfolio view (Ventura 2001, Tille and van Wincoop 2008, Guo and Jin 2009) takes into account the strong increase in international capital flows that has been supported by technology improvements and financial product innovations.<sup>2</sup> It argues that changes in the financial account (FA) are either due to changes in a country's wealth position (growth effect  $x \cdot \Delta W$ ) or due to changes in the distribution of asset returns (composition effect  $\Delta x \cdot W$ ):

$$FA = \Delta x \cdot W + x \cdot \Delta W \quad (2)$$

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<sup>1</sup> This view has also been called the intertemporal current account model by Obstfeld and Rogoff (1995) who suggest that foreign capital inflows help to finance the gap between domestic saving and investment in order to smooth intertemporal consumption and capital flows finance the current account imbalance.

<sup>2</sup> This view is similar to the international capital markets view as identified by Mann (2002).

where  $x$  is the share of net foreign assets in total wealth,  $W$  is total wealth (the sum of domestic capital stock and net foreign assets) and  $FA$  equals by definition the change in the net foreign asset position.<sup>3</sup> Guo and Jin (2009) find that the composition effect matters for short-term variation of the financial account. Thus, changes in the financial account are mainly caused by optimization strategies of investors with regard to balancing risk and return. For example, when favourable domestic conditions attract foreign capital this would in turn lead to higher domestic investments possibly also influencing trade flows, and hence inducing a change in the current account. Consequently, this view suggests that the relation between the current and the financial account is rather determined by capital flows, and hence indicating the reverse causality direction than the savings/investment view.

Based on the theoretical views, there is a large empirical literature that investigates the determinants of trade flows and capital flows. For trade flows (see e.g. Goldstein and Khan 1985, Bahmani-Oskooee and Hegerty 2007, German Council of Economic Experts 2014), it is generally argued that import quantity depends on domestic income (or income growth) and the relative price of imports. Likewise, export quantity depends on foreign income and on relative prices. The most important economic factors determining trade and current account balance are thus domestic and foreign GDP growth and the relative exchange rate or terms of trade (DeBelle and Faruquee 1996, DeBelle and Galati 2007). In addition, Chinn and Prasad (2003) find the government budget balance and the initial stocks of net foreign assets as important determinants of the current account in the medium-term. In case of capital flows the literature (see e.g. Fernandez-Arias 1996, Agénor 1998, or more recently Mercado and Park 2011, Fratzscher 2012, Forbes and Warnock 2012) distinguishes between pull and push factors: the former ones are attractive domestic conditions which diverge from the ones abroad and thus attract foreign capital (e.g. the quality of domestic institutions or strong macroeconomic fundamentals). Push factors refer to external factors and global policies which drive capital flows, e.g. low foreign interest rates or recessions abroad which push capital into countries with more attractive conditions.

These push and pull factors are differently important for determining the financial account components, on which we rely in this analysis. Foreign direct investment flows (FDI) are more stable and are determined by structural, long-term domestic factors. The most important ones are found to be per-capita-GDP, openness, labor costs, net exports, the growth rate and exchange rates, thus mostly pull factors relating to economic fundamentals of the host country (see Chakrabarti 2001 for an extensive survey). In contrast, portfolio investment flows (PI) are relatively volatile and determined by more short-term aspects and speculative considerations such as risk diversification of investors, return differentials, but also by domestic economic conditions, such as inflation rate and economic growth. Likewise, they are strongly pushed by world interest rates and world stock market performance (see Baek (2006) for a literature overview). The determinants of other investment flows (OI) have not received as much attention in the literature (see Sula and Willett 2009 for a short overview). Since this category is a residual category and subsumes different types of flows, most importantly trade credits and banking flows, the determinants behind each of these types could differ.

Thus, from the theoretical perspective it is not clear which factors drive the relation between the current and the financial account components, and hence which causality direction

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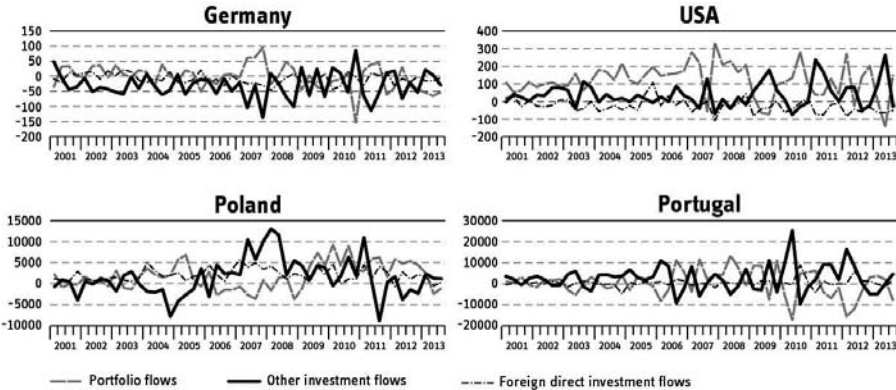
<sup>3</sup> While Guo and Jin (2009) refer to the current account (CA) in their paper, we employ the financial account (FA) for illustration purposes. Due to the balance of payments identity this does not change the content.

might dominate. Moreover, since both are affected by similar exogenous factors such as domestic and foreign income, exchange rates and interest rates, and hence more generally by macroeconomic fundamentals, they might just reflect changes in these exogenous variables.

In the following section we will therefore consider this issue empirically. The concept of Granger-causality which we apply in this paper is a common causality concept in time series analysis which does not identify true causality, but is rather based on the idea of temporal precedence, arguing that the cause must precede the effect (Granger 1980, Eichler 2012). The Granger-causality concept therefore does not imply that one variable directly causes the other, but rather gives a measure of association between them. Furthermore, we refrain from underlying economic factors in our application and focus on the direct relation between the current account and the single financial account components to overcome the problem of identifying underlying relations.

Figure 2 presents the three types of net capital flows included in the financial account for four selected countries of our sample between 2001 and 2013. It documents that FDI flows are rather stable compared to portfolio and other investment flows, and that they were more resilient to the recent financial crisis. Moreover, the pattern of net capital flows differs between these countries: Germany and the US are mostly net FDI exporters, while Poland and Portugal receive more foreign direct investments than they invest abroad; this particularly holds for Poland. The US mostly receives portfolio investments and also other investments, albeit the latter to a lower extent. In addition, portfolio and other investment flows appear to be negatively correlated, while FDI flows behave more independently from the other flows. Thus, even though the countries belong to a quite homogenous group of OECD countries, the nature of capital flows differs, supporting our strategy to carry out the analysis for each country instead of within a panel framework.

Figure 2: Net capital flows between 2001 and 2013 for selected countries



Source: IMF BoP Statistics. Data for Germany and the US in billion USD, for Portugal and Poland in million USD.

Due to these differences between the components of the financial account, their relation to the current account might differ.<sup>4</sup> If, for instance, a preceding change in the current account

<sup>4</sup> This is also found in other papers. For instance, in an early paper, Bosworth and Collins (1999) find that for emerging market and developing countries FDI influences both investment and savings and thus does not have net effects on the current account; portfolio investment seems to be relatively independent of investment,

leads to exchange rate and interest rate changes, we would expect the more volatile flows to adjust quickly, and hence finance the current account change (cf. e.g. Turner 1991). While we would expect FDI flows to react less sensitive to these short-term fluctuations, we might rather see that FDI flows based on an economy's macroeconomic fundamentals eventually lead to the other causality direction, namely an effect from FDI to the current account.

There are also reasons to argue that causality might change over the business cycle. We expect changes particularly for more volatile capital flows, portfolio and other investment flows, while FDI flows might be relatively robust since they are of a more long-term nature and cannot be withdrawn quickly due to comparatively high sunk costs. Notably during business cycle upturns we would expect the portfolio view to prevail, i.e. that due to low uncertainty and investors' search for returns capital flows in countries associated with positive growth expectations and a favourable investment environment inducing changes in the real economy and hence in the current account. In contrast, during business cycle downturns we rather expect the capital flows to rather adjust to changes in the current account, as during these times it is less likely that domestic investment exceeds domestic savings indicating less foreign financing needs, hence the savings/investments view should prevail.

### 3. Empirical strategy and data

#### 3.1 Granger-causality tests in a linear VAR model

The concept of Granger-causality states that a variable  $y_2$  Granger-causes another variable  $y_1$  if its past values improve the prediction of  $y_1$  compared to a prediction based on a simple AR process (and vice versa). Thus, in order to test for Granger-causality between two variables we estimate a vector autoregressive (VAR) model of order  $p$  based on a bivariate time series  $\mathbf{y}_t = [y_{1t}, y_{2t}]'$  where  $y_1$  is defined as the current account and  $y_2$  represents one component of the financial account. We refer to the bivariate model because (i) including all financial account components in a multivariate set up would resemble an analysis on aggregate level which is difficult due to the balance of payments identity, (ii) we are not interested in indirect causality resulting from interactions between the components of the financial account, and (iii) the sample period for several countries might be too short for the multivariate case, increasing the risk that possible Granger-causality is not detected. We estimate the following model:<sup>5</sup>

$$\mathbf{y}_t = \boldsymbol{\alpha} + \mathbf{A}_1 \mathbf{y}_{t-1} + \dots + \mathbf{A}_p \mathbf{y}_{t-p} + \mathbf{v}_t \quad (3)$$

with  $\boldsymbol{\alpha}$  a  $2 \times 1$  vector of parameters,  $\mathbf{A}_1$  to  $\mathbf{A}_p$  are  $2 \times 2$  coefficient matrices and  $\mathbf{v}_t$  is a  $2 \times 1$  error vector. The matrices  $\mathbf{A}_i$  ( $i = 1, \dots, p$ ) are given by  $\mathbf{A}_i = \begin{bmatrix} a_{11i} & a_{21i} \\ a_{12i} & a_{22i} \end{bmatrix}$ .

Based on the VAR model a Wald test is applied where the null hypothesis that the coefficients of all lagged values of  $y_2$  respectively  $y_1$  are jointly zero is tested, and hence whether  $y_2$  ( $y_1$ ) does not Granger-cause  $y_1$  ( $y_2$ ):

$$H_0: a_{21i} = 0 \forall i = 1, \dots, p \text{ (respectively } H_0: a_{12i} = 0 \forall i = 1, \dots, p).$$

---

saving, and also the current account, and the biggest correlation between capital flows and the current account arises for loans (measured under "other" flows) which raise investment while lowering savings.

<sup>5</sup> We determine the optimal lag length of the VAR model by applying the Schwarz criterion.

Thus, a rejection of the null hypothesis provides evidence for Granger-causality. Dependent on which economic forces dominate the interplay of the current and the financial account components, different Granger-causality directions between them can be expected: either the current account Granger-causes the respective financial account component or vice versa. Moreover, there could be two-way Granger-causality or no Granger-causality at all.

In order to perform Granger-causality tests a necessary first step is to check the order of integration of the series to be analyzed, i.e. testing for unit roots. We apply an augmented Dickey Fuller test with a constant for the levels and first differences of our series. The results show that the current account is integrated of order one for all countries, except for Japan and Switzerland. In contrast, the financial account components are stationary with few exceptions.

Usually, estimating VAR models requires variables to be stationary, and hence variables with an integration order of one are often differenced to achieve stationarity. However, if there is cointegration among the variables of the VAR model, differencing nonstationary variables leads to a misspecification since the long-run equilibrium relationship of the variables is excluded. On the other hand, including nonstationary variables in levels in the VAR model leads to a nonstandard distribution of the Wald test statistic (Enders 2004).

Toda and Yamamoto (1995) and Dolado and Lütkepohl (1996) propose a method to estimate a VAR model with variables of different order of integration in levels without having problems with the distribution of the test statistic. In particular they show that overfitting the VAR model and ignoring the additional lags in the Granger-causality test leads to a standard asymptotic distribution of the Wald statistic, i.e. to a  $\chi^2$ -distribution. Specifically,  $m$  additional lags are included in the VAR model on which the Granger test is based, where  $m$  is the maximum order of integration of the variables to be analyzed, but they are excluded for the Granger-causality test.

### 3.2 Granger-causality tests in a threshold vector autoregressive (TVAR) model

To study Granger-causality over the business cycle, we consider a non-linear extension for the linear VAR regression. First, we test for the presence of nonlinearity. The Regression Error Specification Test (RESET) tests the null hypothesis of linearity against an alternative hypothesis of nonlinearity, without specifying the specific type of nonlinearity. Specifically, the test is based on two steps: first, the linear model is estimated and the fitted values are calculated. In a second step, the polynomials of the fitted values are included additionally in the base regression (Bauer et al. 2009). We reject linearity if the corresponding F-statistic for the test that the coefficients on the polynomials of the fitted values are jointly zero exceeds the critical values.<sup>6</sup>

The non-linear regression is implemented by a threshold vector autoregressive (TVAR) model. The regime-switching TVAR model distinguishes two different states of the system:

$$\mathbf{y}_t = \begin{cases} \boldsymbol{\alpha}_1 + \mathbf{A}_1 \mathbf{y}_{t-1} + \dots + \mathbf{A}_p \mathbf{y}_{t-p} + \mathbf{v}_{1t} & \text{if } z_t > \tau \\ \boldsymbol{\alpha}_2 + \mathbf{B}_1 \mathbf{y}_{t-1} + \dots + \mathbf{B}_p \mathbf{y}_{t-p} + \mathbf{v}_{2t} & \text{if } z_t \leq \tau \end{cases} \quad (4)$$

Equation  $z_t = \tau$  serves as the threshold which divides system  $\{\mathbf{y}_t\}$  into two separate VAR processes on each side of the threshold. Even though  $\{\mathbf{y}_t\}$  is linear in both regimes, the

<sup>6</sup> Results for the test of nonlinearity are available from the authors upon request.

possible change in regimes makes the entire process non-linear. For each country, we estimate the threshold value  $\tau$  following the procedure in Chan (1993). Specifically, to get a meaningful threshold we drop the highest and lowest 15 percent of the threshold variable values to ensure that there is a sufficient number of observations in each regime. For each observation of  $z_t$  within the middle 70 percent of the observations, we estimate equation (6). We pick our threshold estimate based on the regression containing the smallest residual sum of squares.<sup>7</sup>

We consider two different possibilities for the threshold variable  $z$  in order to capture changes between different regimes according to the business cycle. First, we use the year-on-year growth rate of GDP as a natural indicator for the business cycle. Besides this variable whose threshold value is determined within the model, we secondly use a threshold that is set exogenously. In particular, we refer to turning point data to distinguish regimes based on whether the business cycle is improving (the time period from trough to peak) or worsening (from peak to trough), and hence the threshold variable  $z$  is a dummy. We use the latter threshold variable to check whether the threshold value determined within the model results in reasonable business cycle classifications.

A summary of the estimated threshold values for the GDP growth rate can be found in Table 1. For most countries and financial account components, the estimated threshold based on the year-on-year GDP growth rate is around four percent; few deviations to higher and lower values can be found. Higher values of the threshold mainly refer to countries of Central and Eastern Europe that usually experience higher growth rates than the more advanced European countries. Comparing the business cycle regimes resulting from this threshold with those indicated by the turning point data documents that with few exceptions both threshold variables result in similar business cycle classifications for most capital flows and countries. Therefore, we consider the threshold values found by the model as plausible.

**Table 1:** Summary of threshold values

	Year-on-year GDP growth rate			
	mean	median	minimum	maximum
PI	3.819	2.813	1.616	9.121
FDI	4.022	4.121	2.064	6.978
OI	4.208	3.928	1.505	8.524

The table lists summary statistics for the estimated threshold values over all countries for which the null hypothesis of linearity was rejected.

The final threshold VAR model is estimated by OLS for those cases in which we are able to reject the null hypothesis of linearity. As above, we test for Granger non-causality; the test is performed separately for each of the two regimes. The null hypotheses that  $y_2$  does not Granger-cause  $y_1$  are thus

$$H_0: a_{21i} = 0 \quad \forall i = 1, \dots, p \quad \text{if } z_t > \tau \quad \text{and}$$

$$H_0: b_{21i} = 0 \quad \forall i = 1, \dots, p \quad \text{if } z_t \leq \tau$$

<sup>7</sup> In detail, the smallest residual sum of squares is converted into a Chow-test type F-test statistic =  $\frac{[SSR_{all} - (SSR_{regime1} + SSR_{regime2})]/k}{(SSR_{regime1} + SSR_{regime2})/(N_1 + N_2 - 2k)}$ ; as threshold value we pick the one with the maximum test statistic.

and analogously for  $y_1$  not Granger-causing  $y_2$ . The main purpose of the test is to see whether Granger-causality changes between the two regimes. With four possible Granger-causality outcomes ( $y_1$  causes  $y_2$ ,  $y_2$  causes  $y_1$ , simultaneous causality in both directions or no causality between  $y_1$  and  $y_2$ ) and two regimes, there are  $4^2 = 16$  different combinations of Granger-causality between the two regimes.

### 3.3 Data

We analyze the relation between the current account and financial account components for 23 selected OECD countries over the period 1990 to 2013 on a quarterly basis.<sup>8</sup> For some countries the sample period is reduced depending on the data availability at the beginning of the sample. The IMF's Balance of Payments Statistics provide all data concerning the countries' balance of payments.<sup>9</sup> In particular, we include the current account as well as assets and liabilities of the financial account components (portfolio investments, foreign direct investments and other investments) in our analysis. To calculate financial account components' net flows we add the respective capital outflows (assets) and inflows (liabilities) for each component.

In addition, for the non-linear approach, we construct two threshold variables: one threshold is based on real gross domestic product (GDP), which is seasonally adjusted and provided by feri (data provider). For the second threshold, we create a dummy variable from the OECD turning point statistics that takes the value 1 if the economy's growth cycle is deteriorating (from one period after a peak up to and including the trough) and 0 if the economy is improving (period after a trough and up to and including the peak). As the turning point data is on a monthly basis, we convert the series into quarterly data, by defining a quarterly turning point whenever such a turning point occurs in any one month of the quarter.

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<sup>8</sup> The countries are EU members Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, Netherlands, Poland, Portugal, Spain, Slovakia, and Slovenia; in addition Japan, Switzerland, UK and US.

<sup>9</sup> In 2012 the IMF introduced its Balance of Payments Manual 6 (BPM6), which includes changes in the classification, in particular regarding foreign direct investments. Data in BPM6 is available from 2005 onwards, while the previous version BPM5 comprises data until 2008. In order to have the largest sample period possible we use the data from BPM5 until 2007 and convert data backwards (from BPM6 to BPM5) for the last five years.

## 4. Results

### 4.1 Granger-causality results

Table 2 presents the results from the Granger-causality tests between the current account and the financial account components. Four different test outcomes are possible: (i) the financial account components Granger-cause the current account, (ii) the current account Granger-causes the components, (iii) there exists two-way Granger-causality, and (iv) no Granger-causality is identified.

The results show that for each capital flow type uni-directional Granger-causality is found for around one third of our country sample, whereby the composition of countries differ between the flows. For the majority of these countries the Granger-causality runs from the current account to the respective type of capital flow supporting the savings/investment view, thus due to e.g. high investment and fully stretched domestic savings, capital from abroad is needed to finance the gap.

With regard to the more volatile capital flows, portfolio investments and other investments, these findings confirm our hypothesis that they are primarily used to finance the current account. The picture is clearer for portfolio than for other investment flows, which might be explained by the residual nature of other investments. More precisely, this type of capital flow includes both short-term and more long-term components, and hence to rather opposite effects on the relation to the current account. Short-term financing should lead to Granger-causality running from the current account to the financial account component, since these flows are closely related to the current account, as they bridge financing gaps at short notice, such as short-term loans. However, another part is made up by more long-term bank loans that are less flexible to react to changes in the current account and rather cause the current account to change due to financing opportunities for production or investment activities.

With respect to foreign direct investment flows, however, the results contradict our theoretical thoughts that FDI flows are determined by more structural, long-term factors, and hence that they possibly induce changes in the current account, e.g. when exports increase due to a productivity gain from FDI inflows. One explanation might be the nature of capital flows employed in the analysis. Since we use net capital flows, it is difficult to distinguish whether changes in the net flows are driven by gross inflows or outflows.

When a change in net FDI flows is driven by a change in gross outflows, the Granger-causality direction running from the current account to net FDI flows appears to be more plausible. For example, when the current account improves either because exports increase more than imports or a country receives income from abroad, this would increase the financial means of domestic enterprises to possibly invest abroad, i.e. through foreign direct investments. We find the causality direction in particular for these countries that usually invest more foreign direct investments abroad than they receive, i.e. members of the Euro Area (Forster et al. 2011) or the US and the UK. Thus, for those countries, gross capital outflows drive changes in net FDI flows, and therefore a change in the current account might lead to changes in net FDI flows. However, this argumentation is not valid for Ireland, Estonia and Poland that mostly receive foreign direct investments and renders the results implausible for these countries.



**Table 2:** Granger-causality tests between 1990 and 2013

Causality direction	Net Flows PI		Net Flows OI		Net Flows FDI		
	PI=>CA	CA=>PI	OI=>CA	CA=>OI	FDI=>CA	CA=>FDI	
	Country	p-values	Country	p-values	Country	p-values	
CA=>FAC	Austria	0.358	Austria	0.304	Germany	0.116	<b>0.022</b>
	Belgium	0.064	France	0.056	Denmark	0.181	<b>0.028</b>
	Germany	0.408	Luxembourg	0.764	Estonia	0.675	<b>0.042</b>
	France	0.108	Netherlands	0.490	Ireland	0.318	<b>0.000</b>
	Italy	0.404	UK	0.728	Italy	0.173	<b>0.032</b>
	UK	0.509			Poland	0.079	<b>0.004</b>
	Switzerland	0.588			UK	0.532	<b>0.013</b>
					US	0.372	<b>0.000</b>
					Switzerland	0.704	<b>0.019</b>
FAC=>CA	Spain	<b>0.000</b>	Spain	<b>0.000</b>	Austria	<b>0.000</b>	0.068
	Hungary	<b>0.020</b>	Slovenia	<b>0.032</b>	Spain	<b>0.000</b>	0.355
			Switzerland	<b>0.043</b>	Luxembourg	<b>0.004</b>	0.842
Two-way causality	Denmark	<b>0.045</b>	Czech Republic	<b>0.023</b>	Belgium	<b>0.014</b>	<b>0.000</b>
	Finland	<b>0.015</b>	Germany	<b>0.034</b>	Japan	<b>0.029</b>	<b>0.000</b>
	Ireland	<b>0.000</b>	Finland	<b>0.020</b>	Netherlands	<b>0.000</b>	<b>0.013</b>
	Japan	<b>0.004</b>	Hungary	<b>0.000</b>			
	Netherlands	<b>0.001</b>	Ireland	<b>0.000</b>			
	US	<b>0.020</b>	Italy	<b>0.021</b>			
			Japan	<b>0.020</b>			
			Belgium	0.122	Czech Republic	0.329	0.103
			Estonia	0.329	Finland	0.479	0.080
			Greece	0.450	France	0.824	0.641
No causality	Greece	0.120	Greece	0.062	Greece	0.312	0.055
	Luxembourg	0.093	Poland	0.441	Hungary	0.816	0.159
	Poland	0.303	Portugal	0.132	Portugal	0.497	0.285
	Portugal	0.947	Slovakia	0.111	Slovakia	0.356	0.190
	Slovakia	0.157	US	0.512	Slovenia	0.852	0.981
	Slovenia	0.904					

Notes: Null hypothesis of non-Granger-causality is rejected at a significance level of 5%. - Significant values are bold. - FAC: Financial account component.

Besides uni-directional Granger-causality, we also find two-way Granger-causality for several countries, especially for short-term flows indicating that capital flows and the current account reinforce each other. Furthermore we find no Granger-causality for another third of our country sample. In particular no Granger-causality is found in countries where the sample period is shorter, indicating the necessity of a long enough sample period to detect Granger-causality.<sup>10</sup>

**4.2 Granger-causality results over the business cycle**

In the non-linear case, we analyze whether Granger-causality changes from one regime to the other. We distinguish between the regime above threshold, indicating a business cycle up, and the regime below threshold, indicating a business cycle down. There are a total of 16 Granger-causality combinations between the two regimes. In order to facilitate discussion, we group them into four categories: (i) no change between the two regimes, (ii) a change from the current account Granger-causing the respective financial account component in the regime above threshold to the financial account component Granger-causing the current account below threshold, (iii) a change from the financial account component Granger-causing the current account in the regime above threshold to the current account Granger-causing the financial account component below threshold, and (iv) an unclear change, which involves Granger non-causality in one of the two regimes. Table 3 presents the exact classification of each of the 16 cases.

**Table 3:** Classification of Granger-causality between TVAR regimes

Granger-causality result...		...below threshold			
		CA → FAC	FAC → CA	two-way causality	no causality
...above threshold	CA → FAC	(i) no change	(ii) from CA → FAC to FAC → CA	(ii) from CA → FAC to FAC → CA	(iv) unclear change
	FAC → CA	(iii) from FAC → CA to CA → FAC	(i) no change	(iii) from FAC → CA to CA → FAC	(iv) unclear change
	two-way causality	(iii) from FAC → CA to CA → FAC	(ii) from CA → FAC to FAC → CA	(i) no change	(iv) unclear change
	no causality	(iv) unclear change	(iv) unclear change	(iv) unclear change	(i) no change

Notes: CA = current account, FAC = financial account component; arrows indicate Granger-causality

Tables 4 to 6 illustrate the results for the different financial account components when the GDP growth rate is employed as threshold variable. For each country for which we find non-linearity, we report the Granger-causality test outcome for the VAR processes above and below threshold (in each case first and second row by country of the Tables) as well as our classification into the groups defined above. Results for net other investment flows are reported in Table 4.

<sup>10</sup> Another explanation might be that the frequency of our data is not high enough. Temporal aggregation and thus lower frequency in the data may cover up Granger-causality test results, as pointed out by Granger in several papers (e.g. Granger 1980, Granger 1995).

**Table 4:** Nonlinear Granger-causality result for other investment flows

Threshold: year on year growth rate					
Net flows, OI		CA → OI	OI → CA	Granger-causality direction	change over business cycle
Austria	$Z_t > \tau$	0.1330	0.0066	OI → CA	From OI → CAI to CA → OI
	$Z_t \leq \tau$	0.0302	0.0596	both	
Czech Republic	$Z_t > \tau$	0.6142	0.0018	OI → CA	From OI → CAI to CA → OI
	$Z_t \leq \tau$	0.0237	0.0102	both	
Estonia	$Z_t > \tau$	0.9792	0.3805	none	no change
	$Z_t \leq \tau$	0.9494	0.3539	none	
France	$Z_t > \tau$	0.0260	0.0016	both	From OI → CAI to CA → OI
	$Z_t \leq \tau$	0.6068	0.0677	OI → CA	
Germany	$Z_t > \tau$	0.5946	0.5099	none	unclear change
	$Z_t \leq \tau$	0.0591	0.1628	CA → OI	
Greece	$Z_t > \tau$	0.6988	0.2932	none	no change
	$Z_t \leq \tau$	0.1333	0.8057	none	
Hungary	$Z_t > \tau$	0.7322	0.0778	OI → CA	From OI → CAI to CA → OI
	$Z_t \leq \tau$	0.0014	0.0006	both	
Ireland	$Z_t > \tau$	0.0454	0.4619	CA → OI	From CA → OI to OI → CA
	$Z_t \leq \tau$	0.1736	0.0586	OI → CA	
Italy	$Z_t > \tau$	0.5951	0.0337	OI → CA	From OI → CAI to CA → OI
	$Z_t \leq \tau$	0.0241	0.0132	both	
Netherlands	$Z_t > \tau$	0.7594	0.2222	none	unclear change
	$Z_t \leq \tau$	0.5342	0.0040	OI → CA	
US	$Z_t > \tau$	0.6580	0.7754	none	no change
	$Z_t \leq \tau$	0.1397	0.2532	none	

P-values reported from Granger non-causality test; results based on 10% significance level.

Although this type of capital flow is a residual category, the non-linear analysis displays some interesting insights. For various countries, we find a change in Granger-causality from other investment flows Granger-causing the current account above threshold to the reverse direction below threshold; only for France and Ireland we derive the opposite finding. These capital flows thus seem to play an important role by leading the current account during business cycle ups, but financing the current account during business cycle downturns. This supports the portfolio view, i.e. capital, in particular loans, flows into a country with favourable economic conditions due to investors optimization strategy inducing changes in the current account. Conversely, in business cycle downs one can suspect that the current account changes and hence less financing for production is needed, and also trade credits (as one part of other investments) should be reduced with lower exports and imports.

Table 5 presents results for net FDI flows. In this case, fewer countries show evidence for non-linearity and the two-regime distinction does not seem to play an important role. For only one country, we find a change in Granger-causality from FDI flows Granger-causing the current above threshold to the current account Granger-causing FDI flows below threshold. This indicates that FDI flows are more robust with regard to the business cycle which confirms our thoughts that FDI flows have a more long-term nature as the other two components of the financial account and do not change frequently due to higher sunk costs.

**Table 5: Nonlinear Granger-causality result for FDI flows**

Threshold: year on year growth rate					
Net flows, FDI		CA → FDI	FDI → CA	Granger-causality direction	change over business cycle
Estonia	$z_t > \tau$	0.9146	0.9812	none	unclear change
	$z_t \leq \tau$	0.7803	0.0118	FDI → CA	
France	$z_t > \tau$	0.0640	0.4974	CA → FDI	unclear change
	$z_t \leq \tau$	0.7056	0.7822	none	
Hungary	$z_t > \tau$	0.6740	0.3223	none	no change
	$z_t \leq \tau$	0.7020	0.1247	none	
Ireland	$z_t > \tau$	0.6898	0.3226	none	unclear change
	$z_t \leq \tau$	0.7508	0.0356	FDI → CA	
Italy	$z_t > \tau$	0.0241	0.0132	both	unclear change
	$z_t \leq \tau$	0.2699	0.1103	none	
Japan	$z_t > \tau$	0.4827	0.0002	FDI → CA	no change
	$z_t \leq \tau$	0.1490	0.0000	FDI → CA	
Netherlands	$z_t > \tau$	0.2064	0.0318	FDI → CA	From FDI → CA to CA → FDI
	$z_t \leq \tau$	0.0390	0.7172	CA → FDI	
Slovenia	$z_t > \tau$	0.1622	0.0932	FDI → CA	unclear change
	$z_t \leq \tau$	0.3473	0.4066	none	

P-values reported from Granger non-causality test; results based on 10% significance level.

Finally, Table 6 documents the results for portfolio investment flows. For several countries, we find Granger-causality from the capital flows to the current account in the above-threshold regime – similar to other investment flows; this also supports the portfolio view prevailing during good economic conditions, and hence our hypothesis. Results for the below-threshold regime are less clear. For many countries, a change over the business cycle therefore does not show up or remains unclear. For Ireland, we find a switch from the current account Granger-causing net portfolio flows above threshold to the opposite in the below threshold regime. For Japan and the Netherlands, however, we find support for the reverse change. Moreover, for some countries we find no Granger-causality in either one or both regimes. Overall, the results are rather mixed and possibly point to the fact that portfolio investment flows are more independent of domestic economic conditions and are rather be determined by global factors.

**Table 6:** Nonlinear Granger-causality result for portfolio investment flows

Threshold: year on year growth rate					
Net flows, PI		CA → PI	PI → CA	Granger-causality direction	change over business cycle
Austria	$Z_t > \tau$	0.1915	0.0602	PI → CA	unclear change
	$Z_t \leq \tau$	0.5935	0.1631	none	
Belgium	$Z_t > \tau$	0.3671	0.0272	PI → CA	unclear change
	$Z_t \leq \tau$	0.2700	0.2436	none	
Estonia	$Z_t > \tau$	0.8900	0.9707	none	no change
	$Z_t \leq \tau$	0.4298	0.7985	none	
Finland	$Z_t > \tau$	0.0047	0.0084	both	no change
	$Z_t \leq \tau$	0.0159	0.0245	both	
France	$Z_t > \tau$	0.2369	0.0650	PI → CA	no change
	$Z_t \leq \tau$	0.4489	0.0488	PI → CA	
Germany	$Z_t > \tau$	0.6734	0.6984	none	unclear change
	$Z_t \leq \tau$	0.3649	0.0261	PI → CA	
Greece	$Z_t > \tau$	0.0252	0.3229	CA → PI	unclear change
	$Z_t \leq \tau$	0.6988	0.2932	none	
Ireland	$Z_t > \tau$	0.0685	0.9508	CA → PI	From CA → PI to PI → CA
	$Z_t \leq \tau$	0.1217	0.0977	PI → CA	
Japan	$Z_t > \tau$	0.3155	0.0001	PI → CA	From PI → CA to CA → PI
	$Z_t \leq \tau$	0.0059	0.2080	CA → PI	
Netherlands	$Z_t > \tau$	0.1834	0.0036	PI → CA	From PI → CA to CA → PI
	$Z_t \leq \tau$	0.0132	0.0128	both	
Slovakia	$Z_t > \tau$	0.7472	0.3850	none	no change
	$Z_t \leq \tau$	0.8911	0.5118	none	

P-values reported from Granger non-causality test; results based on 10% significance level.

Among the financial account components, it seems to be other investment flows which yield the most interesting results over the business cycle, while net FDI flows generally appear to be more robust over the business cycle and portfolio flows are rather independent of domestic conditions. To support these results, we perform the same exercise with the turning point dummy as our threshold variable. By and large, results remain similar; however, less evidence of Granger-causality can be found, independent of the direction of causality. A short summary of these findings, listing the number of countries in each category, is given in Table 7.<sup>11</sup>

**Table 7:** Summary of TVAR Granger-causality results for additional threshold

Threshold variable: turning point	From CA → FAC	From FAC → CA	Unclear change	No change
	to FAC → CA	to CA → FAC		
Net Portfolio Investment	1	2	3	5
Net FDI	2	0	2	5
Net Other Investment	2	2	3	4

<sup>11</sup> Detailed results are available from the authors upon request.

## 5. Conclusion

We study for each country of our selected OECD country sample whether the current account Granger-causes the financial account or vice versa. The concept of Granger-causality allows us to draw conclusions on whether changes in one account help predict, and therefore precede, changes in the other account. Thus, our results point to these parts of the balance of payments on which supervision with respect to macroeconomic imbalances should focus on. We concentrate our analysis on the components of the financial account (portfolio flows, direct investment or other investment flows), because the question of precedence cannot be answered on aggregate level due to the balance of payments identity. Moreover, these net capital flows are determined by different underlying fundamentals and might thus have a different relation to the current account. In addition, we test in a non-linear approach whether the Granger-causality direction changes over the business cycle, and hence whether the forces that equilibrate the two accounts yield different results during economic downturns and upturns.

Overall, our findings show that the current account generally Granger-causes the financial account components. However, the non-linear analysis reveals that during economic upturns the direction rather runs the reverse direction. This is particularly true for net other investment flows, which mainly include banking flows. Therefore, these short-term flows appear to finance the current account during economic downturns, while inducing its changes during upturns. This also pertains to portfolio investment flows, albeit the results are rather mixed. Foreign direct investment flows, in contrast, confirm our presumptions that they are quite stable with respect to changing economic conditions. With respect to the built-up of imbalances prior to the financial crisis our results indicate that capital flows, mainly cross-border banking flows, obvious played a rather active role in the built-up of imbalances prior to the financial crisis.

With regard to monitoring macroeconomic stability, our results indicate that cross-border banking flows might be additionally considered as an early warning indicator for upcoming macroeconomic imbalances, as for example in the Scoreboard of the European Commission.<sup>12</sup> In particular in economic upturns they apparently induce changes in the current account, and hence might be a source of imbalances or misallocation of resources as we have seen prior to the financial crisis. Although private credit flows are already included in the Scoreboard of the European Commission, a differentiation between domestic credit and cross-border credit might be sensible against the background of increased financial market integration

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<sup>12</sup> The scoreboard consists of early warning indicators put in place by the European Commission for preventing and correcting macroeconomic imbalances in the European Union (European Commission 2012).

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