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What Drives Target2 Balances? Evidence from a Panel Analysis

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Raphael A. Auer

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What Drives Target2 Balances? Evidence from a Panel Analysis

Abstract

What are the drivers of the large Target2 (T2) balances that have emerged in the European Monetary Union since the start of the financial crisis in 2007? This paper examines the extent to which the evolution of national T2 balances can be statistically associated with cross-border private capital flows and current account (CA) balances. In a quarterly panel spanning the years 1999 to 2012 and twelve countries, it is shown that while the CA and the evolution of T2 balances were unrelated until the start of the 2007 financial crisis, since then, the relation between these two variables has become statistically significant and economically sizeable. This reflects the "sudden stop" to private sector capital that funded CA imbalances beforehand. I next examine how different types of private capital flows have evolved over the last years and how this can be related to the evolution of T2 balances, finding some deposit flight by private customers, a substantial retrenchment of cross-border interbank lending, and also an increase of bank's holdings of high-quality sovereign debt. My first conclusion from this analysis is that since T2 imbalances were caused by a sudden stop and are unlikely to grow without bounds since Euro area CA imbalances are currently diminishing at a rapid pace, there is no evidence that the institutional setup of the European Monetary Union needs to be reformed fundamentally. My second conclusion relates to how the current system transfers risks across the currency union, both in terms of risk transfer from T2 debtor to T2 creditor nations and in terms of risk transfer from the private sector to the public sector within T2 creditor nations. I evaluate existing reform proposals in the light of these risk transfers.

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1. Introduction

Cross-border payments within the European Monetary Union are to a large extent processed via the Target2 (T2) payment system.[2] With this system, the European Central Bank (ECB) keeps track of these cross-border payments in its accounting system. The net amounts of these payments are called T2 balances.

Until the start of the financial crisis in 2007, these balances were small in magnitude (when compared to the GDP of the Euro Area (EA)) and reflected mostly cross-country differences in payment habits.

Since mid-2007, however, this has changed as the magnitude of T2 balances has risen dramatically. For instance, the T2 balance of the Bundesbank had reached a surplus of EUR 751 billion at the end of August 2012, roughly equal to 30% of Germany's annual GDP. The Banca d'Italia, which had only a negligible T2 balance until June 2011, had a T2 deficit of EUR 289 billion by August 2012. Within the same time span, the Banco de España's T2 deficit rose from EUR 47 billion to EUR 434 billion.

T2 balances measure differences in the degree to which the national banking systems rely on liquidity provided by the ECB. For example, in recent times, Greek commercial banks relied heavily on funding from the ECB via the Bank of Greece, while German commercial banks only drew little liquidity from the ECB via the Bundesbank. In the ECB's balance sheet, this uneven use of central bank liquidity is visible in T2 balances: if Greek banks draw ECB liquidity in excess of the Bank of Greece's ownership share of the ECB, the Bank of Greece has a T2 liability.

There are two kinds of transactions that can lead to uneven use of central bank liquidity by national banking systems. The first kind are real transactions that affect the current account (CA), for example a Greek import from Germany. The payment for this import is channeled from the account of the Greek importer to the account of the German exporter, which in most instances means a transfer from a Greek to a German bank. The Greek commercial bank thus experiences an outflow of funds and if it does not raise an equivalent amount on private capital markets, it increasingly draws on ECB liquidity (while the opposite holds for the German bank).

The second kind of transactions that can lead to uneven use of central bank liquidity are financial transactions, for example a resident of Greece opening an account in Germany and then transferring funds from her Greek to her German bank account. Another example of a financial transaction that affects central bank liquidity use is if a German bank does not roll over an interbank loan to a Greek bank. Both these financial transactions leave the Greek bank with a shortage of funds, and if it does not raise an equivalent amount on private capital markets, it again increasingly draws on ECB liquidity (while the opposite holds for the German bank).

Because both real and financial transactions can be the underlying cause of uneven central bank liquidity use that is currently visible in T2 balances, a debate has developed on the

[2] According to the ECB's Target Annual Report 2011, 91% of the total value of payments in large-value euro payment systems was done via the Target 2 system (see European Central Bank (2011a)).

extent to which T2 balances reflect either the financing of CA deficits or the flight of private capital.

The early phase of this debate was characterized by starkly contrasting views after Sinn (2011) brought the large T2 imbalances to the public attention in a column titled "The ECB's Stealth Bailout." Among others, he claims that "Target balances are interest-bearing public loans that are being used to finance current-account deficits."[3] In contrast, other observers successively claimed that T2 imbalances reflect the flight of private capital from Greece, Ireland, Italy, Portugal, and Spain into Germany and other economies perceived to be a safe haven. For example, Buiter et al. (2011d) argue that T2 "imbalances may be – and currently likely are – a symptom of the difficulty of banking systems in a number of Eurozone periphery countries have in funding themselves in the markets without public support." The fact that such capital flight could happen within the EA had been pointed out originally in Garber (1989, 1999, and 2010).[4]

With the evolution of the European debt crisis, the viewpoints of the various observers have converged somewhat, yet there is still disagreement on the extent to which central bank liquidity are financing either CA imbalances or capital flight.[5] Sinn and Wollmershäuser (2011a) anchored this debate by the use of the balance-of-payments identity; in an update of their work, Sinn and Wollmershäuser (2012a, p. 500) state that "current account deficits of Greece and Portugal were almost entirely financed by Target credit during the crisis, and Ireland in addition accommodated a major capital flight that way, a policy that Italy and Spain copied in the summer of 2011. Germany, on the other hand, was paid for its current account surplus with the rest of the Eurozone with Bundesbank Target claims on the ECB." Fahrholz and Freytag (2012, p. 11) assert that "basic transactions pertaining to the current account will possibly result in irrecoverable TARGET2-claims."

In contrast, the view brought forward in a number of recent studies (including European Central Bank (2011b), Buiter et al. (2011 a, b and c), Jobst et al. (2012a and b), Merler and Pisani-Ferry (2012), Mody and Bornhorst (2012), Haran and Bailey (2012), Ulbrich and Lipponer (2012), Patrick and Bailey (2012), Whelan (2012), Bindseil and König (2012), Chechetti et al. (2012), De Grauwe (2012), and Cecioni and Ferrero (2012)) is that by and large, the uneven reliance on central bank liquidity across the EA is a consequence of the flight of private capital rather than of CA imbalances.

Against the backdrop of this debate, this paper examines empirically whether and to what extent cross-border private capital flows and CA balances are correlated with the evolution

[3] This viewpoint has among others been picked up by Wolf (2011) of the Financial Times, who states that the current system is "shifting so much of the eurozone's money creation towards indirect finance of deficit countries". Further, Sinn and Wollmershäuser (2011a, p. 3) state that "88% of the current account deficits of [Greece, Ireland, Portugal, and Spain] over the past three years were balance of payment deficits financed by money printing."

[4] See also Bundesbank (2011). It is important to distinguish the debate on what T2 imbalances are *financing* from a different debate on whether T2 imbalances crowd out private investments in T2 creditor countries. Sinn (2011), focusing on an example of a tractor exported from Ireland to Germany, argues that "…the [German tractor exported to Ireland] is delivered to the Irish farmer through a loan from the Bundesbank at the expense of loans to the German economy. This is a forced capital export from Germany to Ireland." This statement has been criticized by Buiter et al. (2011 a, b, c, and d) and Whelan (2011), whose arguments, in turn, have been criticized by Sinn and Woellmershäuser (2011a) (see the appendix titled "Reply to the critics"). See also Storbeck (2011) and the extensive discussion on OlafStorbeck.com.

[5] The terminology that T2 balances "finance" CA imbalances and/or capital flight is adopted for convenience. To be precise, central bank liquidity does provide financing, while T2 balances only indicate the volume of central bank liquidity drawn by the national banking systems across the EA.

of T2 balances, how this has changed with the onset of the financial crisis, and what the potential interpretations of the uncovered relations are.

The starting point of this paper is a panel estimation including the time span 1999-2012 and all original EA members plus Greece. Compared to the existing literature, the paper's main contribution is to undertake a systematic Euro-area-wide regression analysis of the correlates of T2 balances and how the correlations changed with the onset of financial crisis in 2007. Existing studies analyze the evolution of T2 and CA balances for each country separately, focusing on the heterogeneity in the EA.[6] While the existing literature thus focuses on pointing out that in some countries the CA and T2 balances have co-evolved while in others this did not seem to be the case, this paper focuses on uncovering the systematic correlates of T2 balances across the EA.

Understanding the systematic overall patterns is of importance against the backdrop that all reform proposals brought forward in the literature on T2 imbalances concern reforming the entire structure of the European Monetary System rather than reforming it for particular countries only. Corresponding to the goal of assessing the impact of such area-wide reform proposals, a systematic analysis that uncovers the average patterns across the entire EA is of the essence.

Compared to the existing literature, three further advantages of the panel analysis are that it allows testing whether there have been statistically significant structural breaks in the data (by adding interaction terms), allows examining whether the uncovered patterns depend on the adopted weighing of nations (in terms of looking at nominal magnitudes versus GDP-normalized magnitudes), and can identify whether either time-invariant cross-country differences or over-time variation within countries is behind the correlations in the data (by using fixed or random effects specifications).[7]

A first result uncovered by the estimation of this paper is that while the evolution of CA balances was entirely unrelated to the evolution of T2 balances before the onset of the financial crisis in August 2007, thereafter, the correlation between these two time series became both statistically and economically significant.

As this result reflects correlations but not causal relationships, it has to be interpreted with care; however, this change in the correlation is hard to reconcile with the view that CA imbalances in the EA are generally financed via the T2 system; rather, the change in the correlation is consistent with the fact that the financing of CA deficits changed with the onset of the financial crisis: whereas CA deficits were financed by private capital flows before 2007, private capital flows partly stopped thereafter. Since banks in CA deficit

[6] In most of the existing literature on this debate, the empirical evidence is of graphical nature (see, among many others, Sinn and Wollmershaeuser (2011 a and b and 2012a and b), Buiter et al. (2011 a, b and c), Bornhorst and Mody (2012), Jobst et al. (2012), and Bindseil and Koenig (2012)). The latter studies graphically interpret the evolution of T2 and CA balances as evidence either for or against the importance of CA imbalances for T2 imbalances. More recently, Cecioni and Ferrero (2012) estimate country-specific correlations and show how these correlations have changed over time. Closest to the current discussion is Cecchetti et al. (2012) comparison of cumulative current account balances and changes of T2 balances in various time periods (Q2 02-Q3 07, 07 Q3-09 Q4, Q1 10- Q4 11, and Q1 12-Q2 12).

[7] These three features of the empirical strategy followed in this paper are especially noteworthy against the backdrop of the criticism of regression-type analysis voiced in Sinn and Wollmershäuser (2012b). More specific, they state (2012b, p. 17) state that "[g]iven the inertia of the current account balances, none of us has ever maintained or suggested that there is a positive statistical correlation between short-run current account balances and changes in the Target balances." Sinn and Wollmershäuser (2012b) find the correlation interpretation, which they attribute to the current analysis, Bindseil and Köning (2012), and Cecchetti et al. (2012), "dumbfounding" (also see p. 17).

countries consequently began drawing more liquidity from their national central banks, large T2 imbalances arose (the possibility of such events had been pointed out by Garber (1989 and 1999).[8]

Given this possible interpretation of the change in the correlation between T2 and CA balances reflecting a "sudden stop" that followed the extraordinary boom in capital flows during the pre-crisis period (see Lane (2012) and Lane and Milesi Ferreti (2012)), I next examine how different types of private capital flows have evolved with the onset of the crisis and how this can be related to the evolution of T2 balances.

The paper's second contribution is to identify the types of private capital flows that are behind the sudden stop. I document both the timing and the magnitudes of private capital flows initiated by private customers and by banks own investment decisions, the importance of the flight into high quality sovereign debt, and the importance of inter-office banking flows.[9]

I first break down the evolution of private capital flows using the IMF's balance of payments statistics, finding that reserve accounts or financial derivatives cannot explain the stop in private capital flows. While portfolio investments and direct investments can explain some of the latter, the majority can be attributed to the "other" category in the balance of payments statistics.[10] Among other things, this category includes changes in positions on both secured and unsecured interbank markets, as well as deposit flows, i.e. it mainly comprises private capital flows between commercial banks.

To arrive at a better understanding of how banking sector capital flows have evolved, I next rely on the Bank for International Settlement's (BIS) locational and consolidated banking statistics, which also include the positions of the banking sector vis-à-vis foreign governments and nonfinancial firms. I discuss, in turn, the role of cross-border positions between banks, of cross-border credit positions between the nonfinancial private sector and banks, and of positions of banks vis-à-vis foreign governments.

By far the largest component of private capital flows initiated by banks are changes in the cross-border positions of the national banking systems (i.e. interbank markets). I find that around EUR 500 billion of the outflows from Ireland and the southern EA members can be traced to such flows and that they have markedly contributed to the evolution of T2 balances.

In contrast, T2 imbalances were somewhat reduced by the presence of banks with establishments in several countries that transferred funds to bank establishments in troubled markets.

[8] The break in the relation between CA and T2 imbalances uncovered in the analysis of this paper presents a sudden stop in the classical sense of Calvo (1998) and Dornbusch et al. (1995): massive private capital inflows that come to an abrupt halt (see also Tornell (2011) and Merler and Pisany-Ferry (2012), who have also adopted the sudden stop terminology in the context of the European debt crisis). Despite this clear evidence for the sudden stop, these result have to be interpreted with care when reaching a "verdict" on who is correct in the current discussion on what T2 balances are financing. Even if a sudden stop is the ultimate cause of the spike in T2 balances, from an accounting perspective, CA imbalances are still being financed by central bank liquidity that are visible in T2 balances. It is important to keep in mind this discrepancy between accounting realities and economic realities.

[9] Cecchetti et al. (2012) further split up private capital flows by the residence of the owners of the assets, documenting that a large volume of capital flows from T2 creditor nations to T2 debtor nations can be traced back to portfolio decisions by non-EA based investors (mostly located in the UK).

[10] The "other" category also includes changes in T2 balances. The sentence refers to the "other" component minus the change in the T2 balance.

Also changes in banks' holdings of foreign government debt have markedly contributed to the evolution of T2 balances as there has been a flight by banks into high-quality sovereign debt equivalent in the order of magnitude of EUR 200 billion.

Deposit flows of private investors and non-financial firms are correlated with the evolution of T2 balances, but the magnitudes are much smaller than the magnitudes of flows initiated by banks. While I do find some evidence of financial flight by private customers and non-financial firms, also the latter is of comparatively small magnitude.

I conclude with the implications these findings have as regards appropriate policy recommendations. My first conclusion from this analysis is that since T2 imbalances were caused by a sudden stop and are unlikely to grow without bounds since EA CA imbalances are currently diminishing at a rapid pace, there is no evidence that the institutional setup of the ECB is fundamentally flawed in the sense that it will lead to ever-increasing imbalances akin to the ones in the Bretton-Woods system. It thus does not require fundamental reform.

My second conclusion relates to how the current system transfers risks across the currency union, both in terms of risk transfer from T2 debtor to T2 creditor nations and in terms of the risk transfer from the private sector to the public sector within T2 creditor nations. I evaluate existing reform proposals in the light of these risk transfers. My main conclusion is that neither of the various proposals to periodically settle T2 balances is a viable option; rather, the main challenge is to return to a strict and uniform collateral regime and reduce the reliance on central bank liquidity as soon as possible.

2. The Target2 System: Institutional Background

Before examining the reasons that led to large T2 imbalances over the last few years, it is crucial to keep in mind two features of the institutional setup of the T2 system. The first is that the T2 system itself is exclusively a payment system. The second is that some kind of balances must be allowed for in order to make the EA a federal monetary union and that T2 balances are merely the bookkeeping manifestation of this prerequisite.

The T2 system is a payment system. It links the central bank accounts of the commercial banks of the European Union with each other. Domestic payments are booked in T2 through the respective national central bank (NCB). Cross-border payments are booked through the NCB of the sender, the ECB, and the NCB of the recipient.[11]

More concretely, assume that a private customer transfers euros from her Greek to her German bank account. This transfer is debited from her bank's account with the Bank of Greece and then credited to her bank's account with the Bundesbank. As each euro in the national banking system is a liability for the respective central bank, the liabilities side of the Bank of Greece's balance sheet is then "too small" and that of the Bundesbank's balance sheet "too large". T2 balances adjust for these discrepancies: the Bundesbank is issued a T2 claim against the ECB as an asset; the Bank of Greece has a T2 liability of the same amount vis-à-vis the ECB.

[11] In theory, banks that have establishments in multiple countries can choose to go through any of the NCBs their establishments are located in, but in practice, each establishment typically goes through the domestic NCB.

While all EA members participate in the T2 system, there are also countries that participate in the T2 system but are not part of the EA (currently: Bulgaria, Denmark, Latvia, Lithuania, Poland and Romania).

The non-EA T2 participants have to repay net outflows at the end of each business day, i.e. they can never accumulate negative T2 balances. For example, following a large-scale outflow of capital from Denmark to the EA, the Danmarks Nationalbank would either use Euros from its reserves or issue Kronas to buy Euros on the foreign exchange market in order to net these outflows.

Within a federal monetary union, balances of some form in the payment system must be allowed for as otherwise it is not possible to guarantee the free movement of capital. The reason for this is that, in a monetary union, no single NCB can print money to net its payment system balance. If balances had to be netted periodically and an NCB had run out of foreign exchange reserves, no international transfers could be made from that country, i.e. the monetary union would in effect cease to exist. Within the EA, the individual NCBs are thus not required to net their T2 balances.

It is important to note that visible T2 balances only arise owing to the federal structure of the ECB and the European System of Central Banks. Rather than money being issued centrally to commercial banks, this is done via the NCBs.

At times demand for ECB liquidity is uneven across the EA's member states, and T2 balances keep track of this heterogeneity. Conceptually, a country's T2 balance is equal to the amount of ECB liquidity the country's banks are drawing minus the allocated share of total ECB liquidity. The latter share is calculated according to the ECB's capital key. For example, assume that total ECB liquidity provision is EUR 2000 billion of which EUR 200 billion are drawn by Greek banks and also assume that the Bank of Greece's share in the ECB capital is 2%. In this example, the Bank of Greece's T2 balance is EUR 200-2%*2000 billion, or EUR 160 billion in deficit.

If the ECB were to directly issue money to commercial banks in exchange for eligible collateral, visible "balances" of NCBs would never arise. The economic reality that commercial banks in the southern EA and in Ireland rely heavily on central bank financing would of course be completely unaltered by this change of how liquidity is accounted for.

T2 balances are thus the bookkeeping manifestation of the intrinsic need to allow for unlimited balances in a federal monetary union.[12]

When these T2 balances become large in magnitude as is currently the case, this signals underlying differences in the use of central bank liquidity by commercial banks across the EA member countries.

Indeed, the majority of the ECB's overall central bank liquidity provision currently goes to banks located in Greece, Italy, Ireland, Spain, Portugal.

[12] Other forms of balances would be possible; for example, the ECB could daily net each NCB's T2 balance and credit/debit the netted amount from/to a different system. Carrying over the T2 balances is merely the most practical solution. What is important is that the T2's payment system function and the balances of this system are distinct elements that do not need to go together.

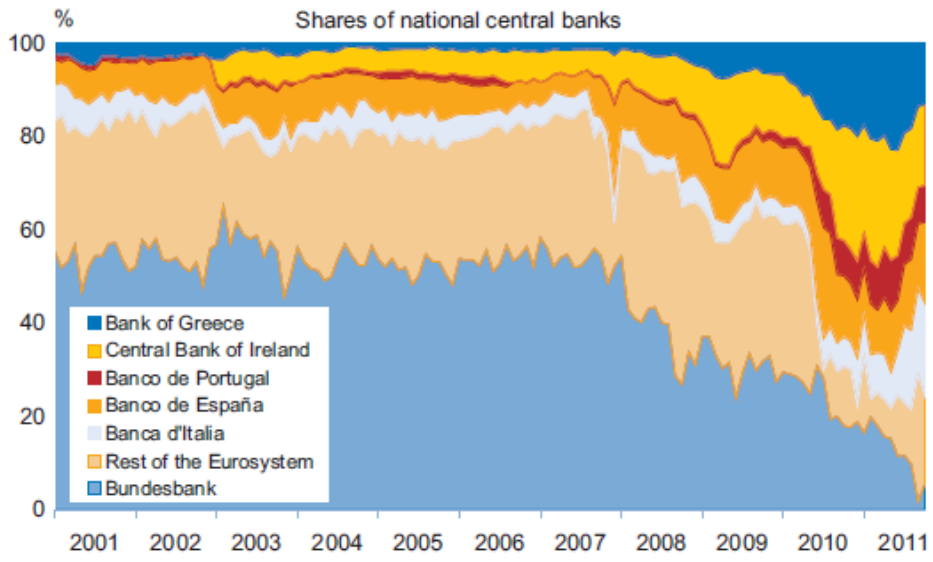


Figure 1: From Bindseil et al. (2012)

Figure 1 from Bindseil et al (2012) documents the share of liquidity provision in the EA to the national central banks of Greece, Italy, Ireland, Spain, Portugal, Germany, and the other member states combined. At the end of 2011, the T2 deficit countries accounted for around 80% of the total demand for ECB liquidity.

The uneven use of central bank liquidity across the EA mirrors the funding needs of national banking systems: a country's cumulative T2 balance is equal to the cumulative net outflows of central bank liquidity to other EA members. Net outflows, in turn, can be the result of either real transactions (imports, which also affect the CA) or financial transactions (an investor transferring funds, which does not affect the CA).

In practice, T2 balances will be small and temporary relative to outstanding liquidity-providing refinancing operations, as long as the private sector rebalancing of flows through the money market and alike functions: banks that receive net inflows, i.e. that would hold non-remunerated excess reserves, will place them with outflow banks and receive a market interest rate. However, if banks with outflows do not have access to the excess reserves of the other banks, they will then have to rely increasingly on funding from their NCB.[13]

The current full allotment policy of the ECB allows the banking system of euro zone member countries to draw extremely large credit volumes during episodes of financial crisis; T2 balances can hence become large (this possibility was first pointed out in Garber (1999 and 2010)).

[13] In normal times, the ECB provides liquidity equal to the aggregate minimum reserve requirements of the banks in the Eurosystem. It remunerates these balances up to the required minimum reserve, but not beyond. Thus, each bank has an incentive to hold exactly the minimum (which was actually the case up to the crisis). If a bank has more cash inflows than outflows at the end of the day, it will lend the amount above the required minimum in the money market. Conversely, if a bank has more outflows than inflows it will borrow the difference in the money market. Owing to this arrangement, no money can leave the banking system and overall, the difference between net outflows and net inflows must be zero.

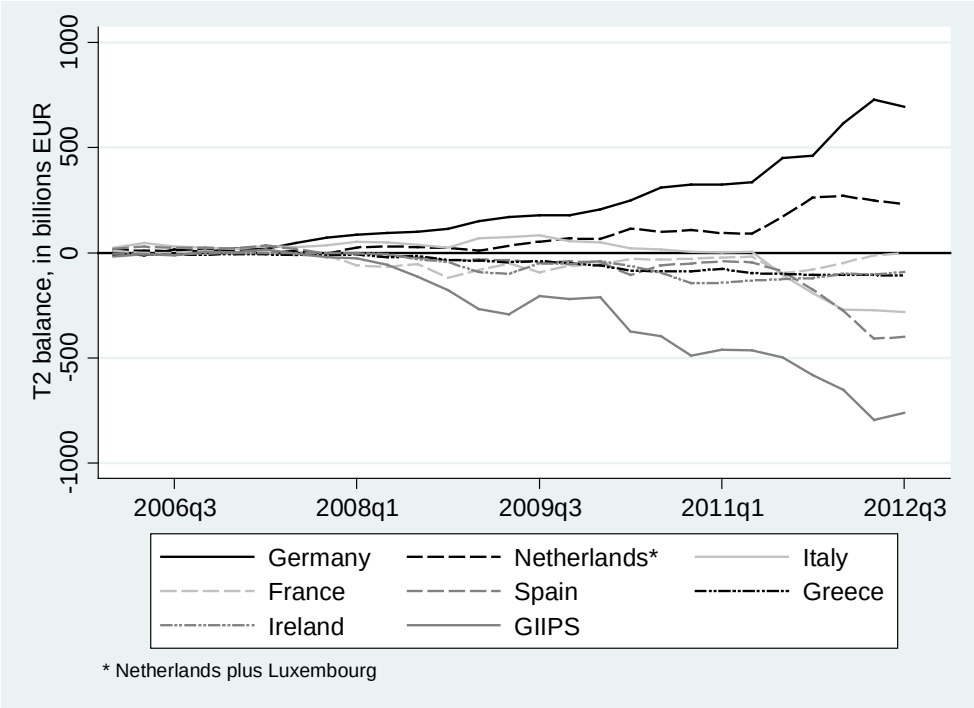


Figure 2: Target2 data are from the "Euro Crisis Monitor" of the Institute for Empirical Economic Research at the University of Osnabrueck. Accessed on 12 January 2013. "GIIPS" refers to the sum of the T2 balances of Greece, Ireland, Italy, Portugal, and Spain.

As brought to public attention by Sinn (2011), T2 imbalances have become pronounced over recent years. Figure 2 presents the evolution of T2 balances up to September 2012. Germany and the Netherlands are currently the two largest creditors. Their balances are almost completely offset by Greece, Ireland, Italy, Portugal, and Spain (GIIPS).

3. What Drives T2 Balances? Insights from a Panel Analysis

While, in principle, T2 balances can arise from either real transactions or financial transactions,[14] views are split on the extent to which T2 balances have financed CA imbalances or private capital flows. This section thus examines the evolution of T2 balances across both countries and time, and evaluates how this evolution can be related to the evolution of CA imbalances and private capital flows.[15]

It should be noted that such an econometric analysis cannot establish causality, as it can only demonstrate the extent to which the timing of certain balances coincides with the

[14] Note that T2 balances can also arise for other reasons. For example, Austria – due to its large tourism industry – is a major net recipient of banknotes, so that the Austrian National Bank (OeNB) has to issue fewer banknotes than it would be entitled to under the ECB capital key. The Austrian T2 balance tends to be negative, but this is nearly exactly offset by the OeNB's claims against the ECB from non-allocated banknotes (see Jobst et al. (2012a and b)).

[15] Portes (2009) argues that large CA imbalances were the major underlying cause of the financial crisis because large swings in cross-border private capital flows put the financial intermediation process under stress and hence generate the conditions that lead to crisis. The same argument can be made regarding the CA imbalances in the EA, which probably contributed to the creation of the European debt crisis. However, in this study I will take the two recent crises as a given, and focus instead on examining the narrower question of how private capital flows and the CA co-evolve given that a crisis has emerged.

evolution of T2 imbalances. The analysis of this section thus only has a modest primary goal: it aims at establishing whether the respective time series are statistically significantly correlated, whether the magnitudes of the correlations are economically important, and whether the correlation structure changed with the onset of financial turmoil in 2007.[16]

To fix ideas regarding the interpretation of the uncovered coefficients, it is useful to start – as proposed by Sinn (2011) and Sinn and Wollmershäuser (2011 a) – with the balance of payments identity relating the CA and the financial account (*FA*, sometimes also referred to as the capital account).[17] For every country *c* and every period of time *t*, it is true that

$$CA_{c,t} - FA_{c,t} + \mathrm{E\&}O_{c,t} = 0 \qquad (1),$$

where the balancing item $E\&O_{c,t}$ captures errors and omissions in the current and financial accounts.

The FA is equal to the change in total foreign ownership of domestic assets minus the change in domestic ownership of foreign assets. For the analysis at hand, it is useful to split the FA into the private sector FA (*PFA*) and the government sector FA (*GFA*). Changes in T2 balances are included in the *GFA*; for example, an increase in the T2 claims of de Nederlandsche Bank is recorded as a capital export in the Dutch balance of payments.

Further splitting the government account into changes in the T2 balance ($\Delta T2_{\ c,t}$) and other changes in the government's net foreign asset positions ($OGFA_{\ c,t}$, which includes the official reserve account and intra-Eurosystem claims other than T2 balances), it holds that

$$\Delta T2_{c,t} = CA_{c,t} - PFA_{c,t} - OGFA_{c,t} + E\&O_{c,t} \qquad (2).$$

In theory, if the errors and omissions were negligible and all the variables on the right-hand side (RHS) of equation (2) were known precisely, any change in a country's T2 balance could be fully accounted for by the country's CA, net private capital exports, and government capital exports from other sources (see also Bundesbank (2012) for a related discussion).

However, even aside from the existence of sizeable errors and omissions, especially during times of financial crisis,[18] this pure accounting exercise is not a useful one as it does not add to our understanding of the underlying causes for the development of individual elements on the right-hand side of equation (2).

[16] It is important to keep this modest goal of the analysis in mind when interpreting the analysis below. Words such as "explains" or "drives" refer to the statistical correlation between variables, but do not imply an economic interpretation that argues in a specific direction of causality. There exist multiple economic interpretations of the relationships uncovered below.

[17] Note that I refer to a broad concept of the FA. The IMF has adopted a different definition, in which the "financial account" is a separate entry into the balance of payments than the "capital account." More specifically, the IMF uses the term "capital account" for a small subset of financial transactions that are included in the definition of the FA in the present paper.

[18] Regarding errors and omissions, substantial efforts have been devoted to accurately capturing valuation effects in the CA following the pioneering work of Lane and Milesi-Ferretti (2001, 2002, and 2004)). Still, owing to the difficulty of valuing ever more complex structured products, considerable fluctuations in the value of international asset positions are not accurately captured in international current account data. This problem may have been especially pronounced during the two recent crises, which strongly affected the value of structured products. Gourinchas and Rey (2007) document that the riskiness of international investments differs strongly across countries, so that also the errors and omissions may systematically differ across countries during financial turmoil (Lane and Milesi-Ferretti (2011) further document the cross-country incidence of the global financial crisis).

Rather, what is of interest are the relationships between these elements, when they changed, and the likely reasons for such relationships and changes thereof. Consider, for example, a regression of the type

$$\Delta T2_{c,t} = \alpha + \beta * CA_{c,t} + \varepsilon_{c,t} \qquad (3)$$

If the estimated coefficient β is equal to 1, this means that none of the other variables on the right-hand side of equation (2) adjusts when a country's CA is smaller or larger than zero and, consequently, capital is exported or imported via the use of central bank liquidity (and thus visible in the T2 system) in response to a CA surplus or deficit. If the estimated coefficient is smaller than one, this means that other variables – most likely private capital exports – adjust whenever CA imbalances arise. If private capital flows fully offset the CA, the estimated coefficient β is equal to 0.

In a panel estimation setup, one can also investigate whether the uncovered patterns are driven mostly by time-invariant country characteristics or by over-time variation within countries. By allowing the constant α in (3) to be country-specific, all cross-country variation is eliminated and the uncovered coefficients reflect how the precise timing of CA and T2 imbalances correlates within each country.

Equation (3) can further be extended to examine if the financing of CA deficits and surpluses changed with the onset of financial turmoil by adding a dummy that equals 1 for all time periods after a certain date and the interaction of $CA_{c,t}$ with this dummy.

Based on this empirical approach, this study next investigates the degree to which CA deficits have been financed by the private sector, and also whether the relationship changed with the onset of the financial and European debt crises. Since I do find that, with the European debt crisis, the relationship between the CA and T2 balances changed substantially, in the second step of the empirical analysis I dissect the kind of private investment flows that are correlated with the evolution of T2 balances.

3.1. Data Description

For this paper, a dataset covering the quarterly evolution of T2 balances, CA balances, financial account statistics, various private capital flows, and refinancing operations since the advent of the euro in 1999 is assembled. The quarterly panel dataset spans Q1 1999 to Q3 2012 and 12 countries (initial EA plus Greece).

I collect quarterly information on the CA and the FA, as well as various subcomponents from the balance of payments statistics (BOPS) of the IMF. Information on the evolution of the national T2 balances is taken from the "Euro Crisis Monitor" of the Institute for Empirical Economic Research at the University of Osnabrueck (see Steinkamp and Westermann (2012)); these data are in turn collected from the NCBs, where T2 balances are recorded under "claims/liabilities on the Eurosystem" of individual central banks of the EA countries.

I also collect data on private capital flows from the locational banking statistics of the BIS. From this dataset, I use the location international claims of BIS reporting banks, and the

sectoral breakdown (banks, and non-banks sector). Additionally, I include inter-office positions (positions between affiliated bank establishments located in different countries). I include international bank positions by nationality, and claims and liabilities on related foreign offices from the latter data series.

Because the locational banking statistics do not differentiate between the non-bank private sector and the public sector exposure of banks, I also use information from the BIS consolidated banking statistics. It is noteworthy that this dataset is based on the residency of the Bank's Headquarter (for example, Deutsche Bank Spain is counted in the German statistics) rather than on the residency of each branch office as in the locational statistics. Thus, this dataset is noisier than the locational data.

Monthly total deposit liabilities in the EA by non-monetary financial institutions (excluding central government) are collected as a measure of private sector deposit flows.[19]

Last, I collect information on monthly program payouts by the IMF and by the institutions of the European Union (European Stability Mechanism and the European Financial Stability Facility).[20]

3.2. Central Bank Refinancing and T2 Balances

Before discussing whether private capital flows or the CA are financed by T2 balances, it is worth examining whether T2 balances are indeed closely related to central bank refinancing operations, defined as the monthly claims of central banks on monetary institutions.

Table 1 documents that the link between central bank refinancing operations and T2 balances is statistically highly significant and economically important. All estimations in Table 1 present random effect panel estimations that relate the quarterly change in a country's T2 balance to the quarterly change in the volume of refinancing operations carried out at the respective NCB.

In column (1), the sample covers all quarters from the beginning of 1999 to the third quarter of 2012. The dependent variable is the quarterly (q/q) change in a country's T2 balance and the independent variable is the q/q change in the refinancing volume at the NCB. The coefficient is estimated at –0.478, implying that if the refinancing volume at one NCB increases by EUR 1 billion, this is on average associated with the country's T2 balance decreasing by EUR 478 million. Column (2) and (3) indicate that this relationship has not changed much since the start of the financial crisis. In the estimation of column (2), the sample period is restricted to Q3 2007 to Q31 2012, resulting in a coefficient of –0.44. In the estimation of column (3), the sample period is restricted to before Q3 2007, resulting in a coefficient of –0.573.

To formally investigate whether there indeed has been a structural break around the start of the financial crisis, I next add a dummy equal to one in all quarters from Q3 2007, as well as the interaction of this dummy with the quarterly change in the refinancing volume at the

[19] See http://sdw.ecb.europa.eu/browse.do?node=2019191.
[20] See: http://www.imf.org/external/np/pdr/mona/index.aspx, http://www.efsf.europa.eu/about/operations/index.htm http://www.esm.europa.eu/about/assistance/spain/index.htm, and http://ec.europa.eu/economy_finance/eu_borrower/efsm/index_en.htm

Table 1 - Refinancing Operations and T2 Balances (RE Panel Estimations)

Model Name:	(1) Nominal, Full Sample	(2) Nominal, from Q3 07	(3) Nominal, before Q3 07	(4) Interaction Full Sample	(5) Normalized by 2007 GPD	(6) Normalized, from Q3 07
Sample Period:	Q1 99 - Q3 12	Q3 07 - Q3 12	Q1 99 - Q3 12	Q1 99 -Q3 12	Q1 99 -Q3 12	Q3 07 - Q3 12
Dependent Variable:		**(1)-(4) q/q ch. T2 Balance in EUR**			**(5)&(6) q/q ch. (T2 Balance/2007 GDP)**	
Q/Q ch. Refinancing Volume reported by NCB	-0.478***	-0.440***	-0.573***	-0.573***		
	[0.034]	[0.049]	[0.066]	[0.132]		
Q/Q ch. Refinancing Volume reported by NCB * D Aft Q3 07				0.093		
				[0.137]		
Dummy=1 if After Q3 2007				1.024		
				[1.423]		
Q/Q ch. (Ref. Volume/ 07 GDP)					-0.547***	-0.552***
					[0.042]	[0.064]
Observations	597	240	357	597	556	220
Number of Countries	12	12	12	12	11	11
R-Square (within)	0.252	0.246	0.181	0.256	0.241	0.260
R-Square (between)	0.243	0.543	0.0292	0.197	0.0290	0.0834
R-Square (overall)	0.249	0.262	0.175	0.250	0.232	0.241

Standard errors in brackets; *** p<0.01, ** p<0.05, * p<0.10

NCB. This specification is presented in column (4), indicating that the difference in the relation between T2 balances and refinancing volume is not significant. The coefficient of the main effect is equal to -0.573, the coefficient in column (3). The interaction coefficient is equal to 0.093.

It is noteworthy that the independent variable in Table 1 does not include the provision of liquidity to banks under emergency loan assistance (ELA), which also affects T2 balances. The fact that the coefficient on the refinancing volume is actually smaller in the post-crisis period than early on in the sample could hence be explained by the increasing use of ELA in countries with stressed financial systems after Q3 2007. Because data on the volume of ELA is not publicly available, this issue cannot be addressed in the empirical analysis, however.

Also a normalization by GDP confirms that there is no change in how refinancing volume correlates with T2 balances. The data used in columns (1) to (4) are measured in billions of euros, and the regression coefficients are thus heavily influenced by the larger economies countries, most notably Germany. In columns (5) and (6), therefore, I repeat these specifications but normalize both the change in the T2 balance and the change in the refinancing volume by GDP. To make sure that this normalization does not itself drive changes in dependent and independent variables, the normalization is done using pre-crisis (2007) GDP rather than current GDP.[21]

3.3. CA Balances and T2 Balances

I next investigate the degree to which CA deficits have been financed by the private sector, and also whether the relationship changed with the onset of the financial and the European debt crises.

Figure 3 documents the average relation between the CA balance and the evolution of the T2 balance. The figure presents a scatter plot relating the quarterly change in a country's T2 balance to its quarterly CA balance. If some EA members are currently financing their CA

[21] When evaluating T2 balances and refinancing operations in terms of GDP, Luxembourg is excluded from the analysis as the country's T2/GDP ratio is a clear outlier. See the appendix for a discussion.

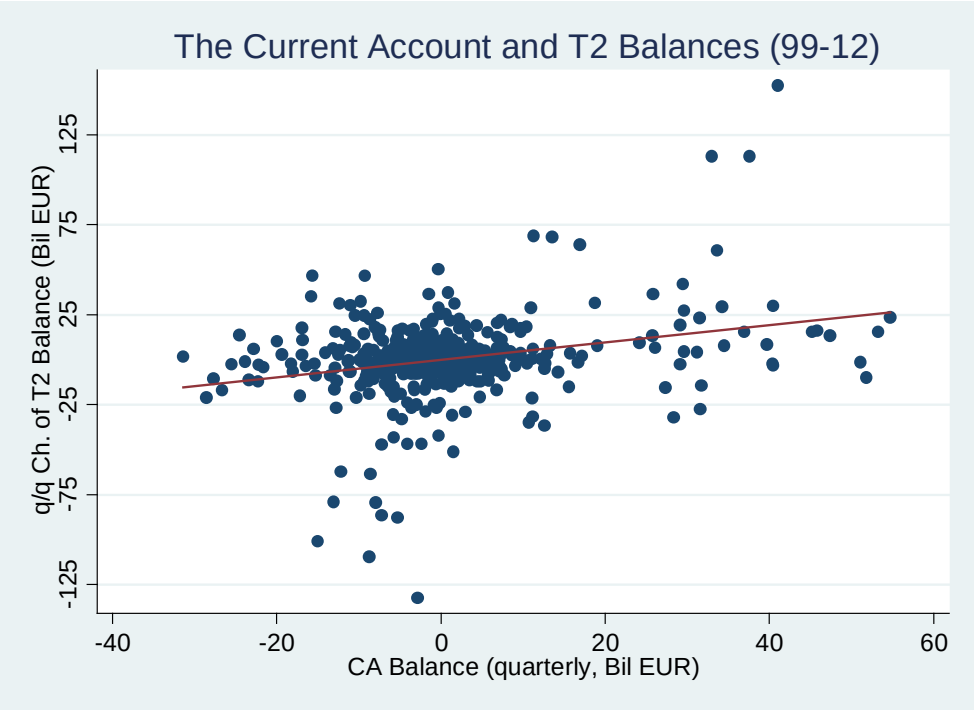


Figure 3: Sample of 597 quarterly observations from Q1 1999 to Q4 2011 in the 12 original EA members; data from IMF IFS.

deficit via the ECB, a negative CA should be associated with a negative change in the country's T2 balance.

Indeed, the correlation between the CA and the change in the T2 balance is highly significant in both economic and statistical terms. The coefficient of the displayed regression line is estimated at +0.484. If one were to interpret this coefficient as reflecting a causal relationship, for Greece, which ran an average quarterly CA deficit of EUR 5.4 billion during 2010 and 2011, this would imply that the country's CA deficit during that time increased its T2 deficit by EUR 2.6 billion (=0.484 x 5.4) each quarter. The CA deficit would thus "explain" around a third of the total increase in the country's T2 deficit (on average EUR 7 billion per quarter during 2010 and 2011).

Table 2 presents a panel analysis of this pattern. It examines whether the correlation has changed with the crisis and whether the relationship between the CA balance and the evolution of the T2 balance is both statistically and economically significant for a range of robustness tests.

In columns (1) to (5) of Table 2, the dependent variable is the quarterly change in the country's T2 balance and the independent variable includes the quarterly CA balance.

Table 2 - Are T2 Balances Driven By Current Account Imbalances?

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Model Name	Baseline	Country	(1) from Q3	(1) before Q3	Interaction	Interaction	Interaction	Normalized	(8) from	Interaction	(10) &	(10) adding
	Full Sample	Characterstics	2007 onwards	2007	Regression	Fixed-Effects	& 3 lags	by GDP	Q3 07	GDP norm.	FE	Lux
Estimation Type	RE Panel	FE Panel	RE Panel	RE Panel	RE Panel	FE Panel	RE Panel	RE Panel	RE Panel	RE Panel	RE Panel	RE Panel
Sample Period:	(1)&(2): Q1 99-Q3 12		Q3 07-Q3 12	Q1 99-Q3 07	Q1 99-Q3 12	Q1 99-Q3 12	Q1 99-Q3 12	Q1 99-Q3 12	Q1 99-Q3 07	(10)-(12) Q1 99-Q3 12		
Dependent Variable			**(1) to (7): Quarterly Ch. T2 Balance in Euro**						**(8) to (12): Q. Ch. of (T2 Balance/GDP)**			
Quarterly CA in Euro	0.484***	0.355***	0.792***	-0.016	-0.016	-0.248*	-0.465*					
	[0.069]	[0.111]	[0.124]	[0.056]	[0.109]	[0.146]	[0.244]					
1 Quarter Lag							0.089					
							[0.293]					
2 Quarter Lag							0.259					
							[0.291]					
3 Quarter Lag							0.212					
							[0.261]					
Quarterly CA *					0.808***	0.878***	0.312					
Dum Aft Q3 07					[0.139]	[0.142]	[0.267]					
1 Quarter Lag							0.235					
							[0.349]					
2 Quarter Lag							-0.146					
							[0.352]					
3 Quarter Lag							0.455*					
Dum Aft Q3 07							[0.272]					
Quarterly CA / 2007 GE								0.737***	-0.055	-0.055	-0.407*	-0.055
								[0.217]	[0.055]	[0.152]	[0.238]	[0.152]
Quarterly CA / 2007 GE										0.792***	0.930***	0.792***
* Dum Aft Q3 07										[0.208]	[0.216]	[0.208]
Dummy=1 if After Q3 2					-0.481	-0.594	-0.130			-0.183	-0.208	-0.183
					[1.529]	[1.535]	[1.513]			[0.301]	[0.302]	[0.301]
Statistics For Cummulative Dynamic Impact of CA												
Sum of Interaction Coefficients							**0.855*** **					
							[0.158]					
Observations	597	597	240	357	597	597	580	220	336	556	556	556
Number of Groups	12	12	12	12	12	12	12	11	11	11	11	11
R-Square (within)	0.0171	0.0171	0.0181	6.30e-06	0.0737	0.0778	0.110	0.00305	0.00377	0.0348	0.0387	0.0348
R-Square (between)	0.915	0.915	0.902	0.0394	0.863	0.773	0.912	0.624	0.0533	0.562	0.00990	0.562
R-Square (overall)	0.0762	0.0762	0.146	0.000230	0.126	0.116	0.169	0.0502	0.00302	0.0503	0.0372	0.0503

Standard errors in brackets; *** p<0.01, ** p<0.05, * p<0.10

Column (1) presents a random effects panel estimation reproducing the fitted line in Figure 5. The regression coefficient is estimated at 0.448 and is highly significant.[22]

An important concern with Figure 3 and column (1) is that these correlations are driven only by time-invariant cross-country differences. For example, Germany had a positive CA balance nearly throughout the entire sample, and its T2 balance grew most of the time. On the contrary, Greece had a negative CA balance, while its T2 balance continued to decrease.

Thus, the correlation presented in column (1) could be entirely driven by the fact that countries are different; it is much stronger evidence for the argument that CA imbalances are being financed with T2 claims if the precise timing of the two series also correlates within each country.[23]

Column (2) thus documents that the evolution of a country's T2 balance can actually be tracked well by the precise timing of changes in the CA balance for that country. For this, country fixed effects are added to the estimation, which absorb country-specific averages.

The remaining variation is that, over time, both the CA and changes in the T2 balance fluctuate around the country-specific mean. Also when accounting for country

[22] It is important to note that in Figure 5 and in the entire analysis that follows below, each country's global CA is used rather than the CA against the EA or the bilateral CA with specific nations such as Germany. The use of this variable is expedient as also CA balances against non-EA countries affects each country's financing needs and thus potentially its T2 balance.

[23] The importance of this concern is also documented by the high between-R^2 compared to the low within-R^2, i.e. most of the model's explanatory power is driven by the variation across countries rather than the variation over time within each country.

characteristics, the estimated coefficient of the CA is highly significant and economically large, at 0.355. A Hausman test does not reject the null hypothesis that the random effects in column (1) are correlated with the errors. Thus, the remainder of Table 2 continues with random effects estimations.

It is likely that the correlation between the CA and T2 balances intensified during the crisis. Indeed, column (3) reproduces the specification of column (1), but the sample only starts in Q3 2007. The coefficient of CA balances increases markedly compared to the estimation spanning the entire sample (to 0.792). The estimation in the pre-crisis subsample column (4) even documents that the entire correlation displayed in column (1) can be attributed to the post-crisis period. In column (4), the sample is restricted to the pre-crisis period, resulting in an insignificant and economically small coefficient.

Column (5) documents that there has been a statistically significant structural break in the relation between T2 balances and CA balances. It adds a dummy equal to one in all quarters from Q3 2007, as well as the interaction of this dummy with the quarterly CA. The coefficient of the main effect is (since the panel is balanced) equal to the coefficient in column (4). The interaction coefficient is equal to 0.808, the difference in the coefficients in columns (3) and (4).

Columns (3) to (5) present two important findings regarding the financing of CA imbalances via the use of central bank liquidity. First, there is no evidence that central bank liquidity had financed CA imbalances before the financial crisis (see (4)).

Second, the coefficient of 0.808 in (5) is consistent with the interpretation that at the current juncture, 80.8% of CA imbalances are being financed by central bank liquidity that has replaced private capital flows after the sudden stop in Q3 2007. Of course, as has been mentioned already above, this interpretation is an economic one and does not hold in an accounting sense. If the CA of Greece moves from balanced to a deficit of EUR 1 billion and private capital flows stay exactly unchanged, a country's T2 balance must from an accounting perspective increase by exactly EUR 1 billion. In reality, when a country's CA deficit moves EUR 1 billion in deficit, private capital flows increase by EUR 198 million and the increase in a country's T2 balance is hence EUR 808 million.

The structural break in the correlation between CA and T2 balances implies that the way CA in which deficits are financed has changed with the financial crisis. Private financing was substituted by public funding via central bank liquidity, which is visible in the T2 balances.

This raises the immediate question of what kind of changes in private sector capital flows took place with the onset of the financial crisis, a question that will be answered in the next section.

Before that, however, it is worth establishing the robustness of the correlation between CA and T2 balances and of the structural break.[24] Column (6) adds fixed effects to the

[24] Cecioni and Ferrero (2012) provide some evidence for the existence of a further structural break of this relation around mid-2010 in Greece and Portugal using monthly CA data. In contrast, I do not find any evidence for a structural breaks in the entire data around that date (or any other date after Q3 07 for that matter), but this could also reflect the lower frequency of the dataset employed here (information on monthly CAs is not available for all initial EA members). In fact, the comparison of cumulative current account balances and changes of T2 balances in various time periods (Q2 02-Q3 07, 07 Q3-09 Q4, Q1 10-Q4 11, and Q1 12-Q2 12) by Cecchetti et al. (2012) indicates the existence of further structural breaks.

interaction specification of column (5), documenting that the structural break is also found when only taking into account the within-country variation of the data.

Column (7) enlarges the sample horizon to cover four quarters, again finding evidence for the structural break. It is noteworthy that the BOP identity outlined above holds at every moment in time, so that adding a lag structure to the regression in theory does not add any information. In practice, firms make errors when recording the timing of their real and financial transactions, for example by recording a shipment in the wrong quarter. Second, payments for exports might lag the physical export by a considerable time, so that private capital flows follow the lagged CA rather than the instantaneous CA. Thus, it is useful to consider also the lagged CA. The total dynamic impact of a CA balance is reported at the bottom of Table 2 and is equal to 0.855 over the period of one year (the current CA and 3 lags).

Columns (8) to (12) next document that the structural break is also found when normalizing by GDP. Columns (8) to (10) reproduce columns (1), (3), and (4), respectively finding roughly comparable results. When including fixed effects, the structural break is estimated somewhat higher in the GDP-normalized specification (compare (6) to (11)).

Column (12) documents the effect of including Luxembourg in the estimation. The latter inclusion greatly increases the estimated interaction coefficient (compare (11) and (12)), but closer inspection (see the appendix for a discussion) indicates that this is driven by Luxembourg being an outlier with a moderately positive CA balances and extremely large and positive changes in T2 balances compared to GDP. The country is thus not included in the remainder of the analysis when normalizing by GDP.

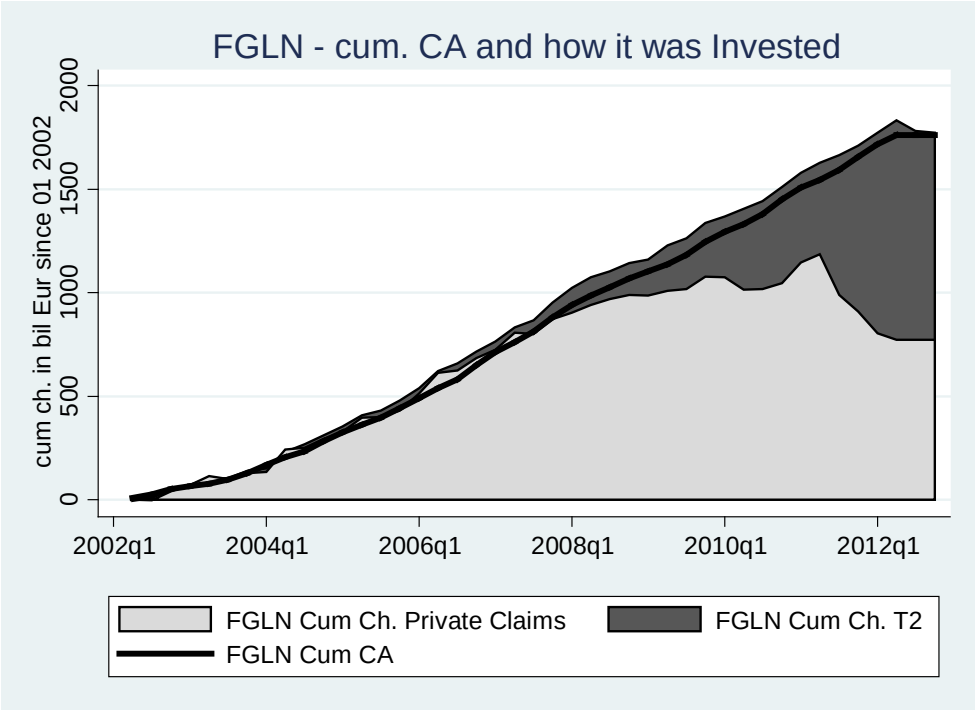
4. The Shift in Financing of CA Balances

4.1. Overall Importance of the Shift to Central Bank Liquidity Financing

The change in the coefficient of Table 2 implies that the onset of the financial crisis in 2007 led to CA balance being financed differently. The overall importance of this shift is documented in the upper and lower panels of Figure 6, which displays the cumulative evolution of the financial and CA for the last decade. [25]

For Figure 4, I create two subgroups of countries. The first is the group of large T2 creditors and is termed “FGLN” as it comprises Finland, Germany, Luxembourg, and the Netherlands. The second includes the group of large T2 debtors and is termed “GIIPS” as it comprises Greece, Ireland, Italy, Portugal, and Spain. Of the initial EA members, this sample split thus excludes Austria, Belgium, and France, whose T2 balances have not changed drastically over the last few years. For both groups, I construct the cumulative CA, the cumulative change in the T2 balance, and the cumulative FA minus the T2 balance starting from the beginning of 2002.

[25] Milesi-Ferretti and Tille (2011) document the global drying-up of private capital flows during the financial crisis, while Brutti and Sauré (2012) document the renationalization of the European banking industry during the financial and European debt crisis.



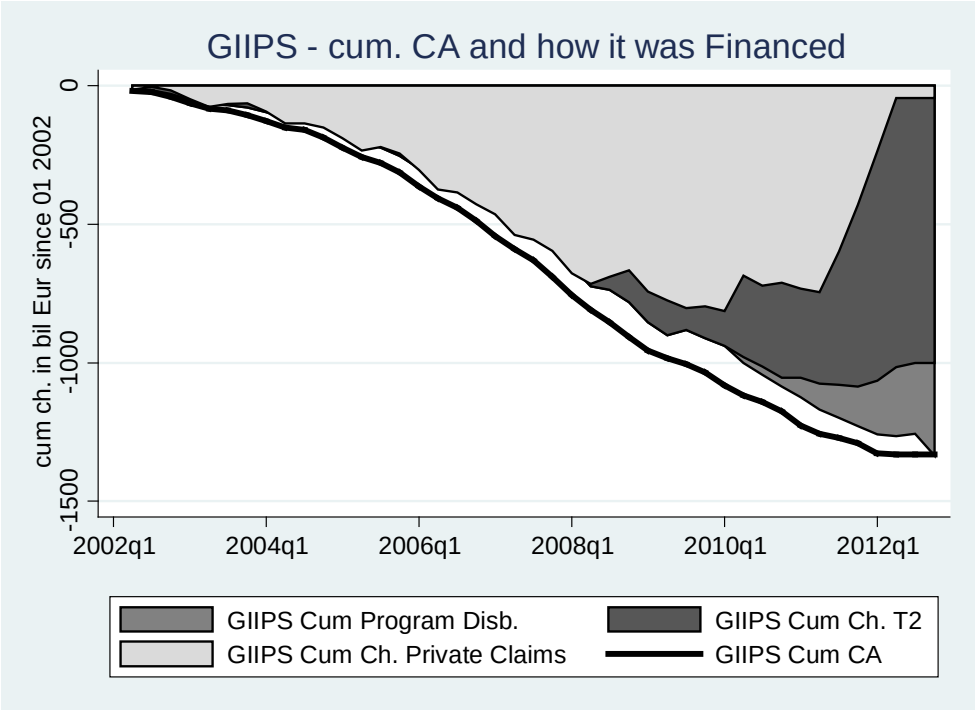


Figure 4 –Shifting CA Financing

The bold line in the upper plot of Figure 6 displays the cumulative CA since the start of 2002 for the FGLN group. The total colored area represents the cumulative FA since the start of 2002 for the same group of countries.[26] This area is split into the dark grey area, representing the cumulative change in the T2 balance, and the light grey area, representing other financing in the FA.

The lower plot of Figure 6 presents the same time series for the GIIPS group of T2 debtors. Again, the dark grey area represents the cumulative change in the T2 balance and the light grey area other financing. Note that in recent times, there have been substantial disbursements under EU/IMF assistance programmes. These also affect the financial account and are presented in the medium-dark grey area in the lower plot of the figure.

As is evident from these two plots, the onset of the financial crisis brought about a change in the way the CA imbalances in the EA were financed. Whereas in the years leading up to August 2007, T2 balances did not accumulate because private capital inflows to the GIIPS group more or less exactly offset the CA deficit of this group, while capital outflows from the FGLN group more or less offset the CA surplus of this group.

With the onset of the financial crisis, private capital flows suddenly stopped and later reversed substantially. Since the CA reacted much less to the financial crisis, this resulted in a net financing need in the GIIPS group of countries, which led to the banking system drawing liquidity from national central banks, and thus to negative T2 balances. Mirroring this development, T2 balances in the FGLN group turned positive.[27]

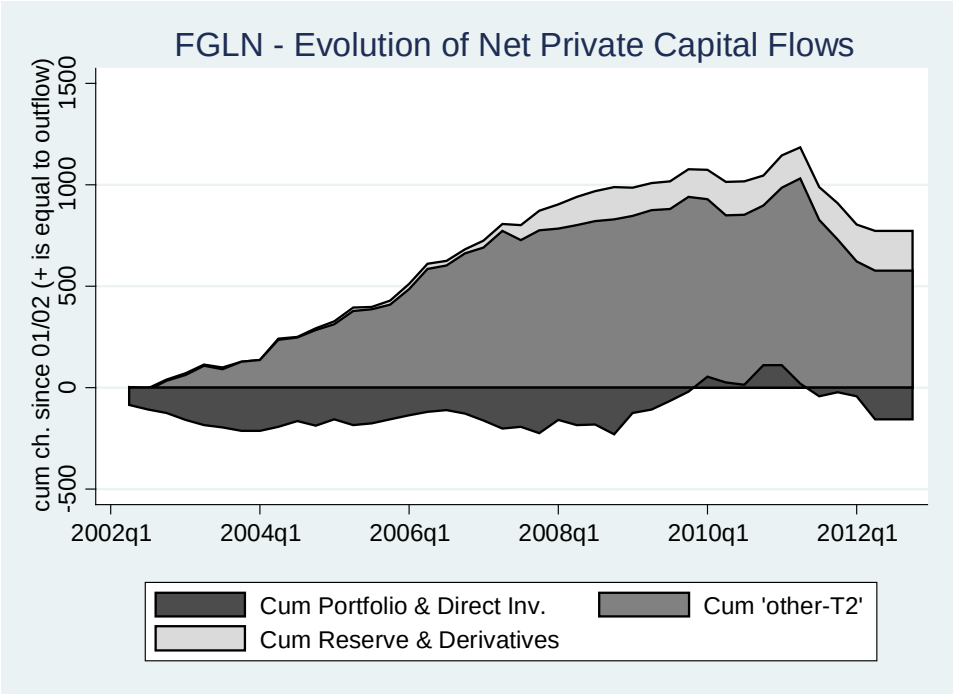
Note that the outflows of private capital from the GIIPS group of countries is larger than the inflow into the FGLN group. This points at the importance of either EA members not included in the graph (France, Belgium, or Austria), or of non-EA members such as the UK and US. Indeed, Cecchetti et al. (2012) find that private capital flows initiated by banks based outside the EA are behind a substantial share of the capital movements in the EA during the recent years.

4.2. A Closer Look at the Financial Account

Which kinds of changes in private capital flows are behind the shift from private to public financing of CA deficits? I first present an overview of the large investment patterns in the data that are behind the shift using the IMF's Balance of Payments Statistics (BOPS). The BOPS database includes information on a country's CA and FA, and it also splits the FA data into the main categories.

The upper and lower panels of Figure 5 split the FA into changes in portfolio investment and direct investment capital flows, changes in reserves and financial derivatives, and "other". As the "other" category includes T2 balances, I present the evolution of "other" capital flows minus the change in the T2 balances. As in Figure 6, I again present the cumulative evolution since the start of 2002 for the FGLN and GIIPS group.

[26] Because of errors and omissions and lags in reporting, the sum of the cumulative FA balance does not align exactly with the cumulative CA balance.
[27] See Merler and Pisani-Ferry (2012). For a related observation for Germany, see Bundesbank (2012) and Whelan (2012).



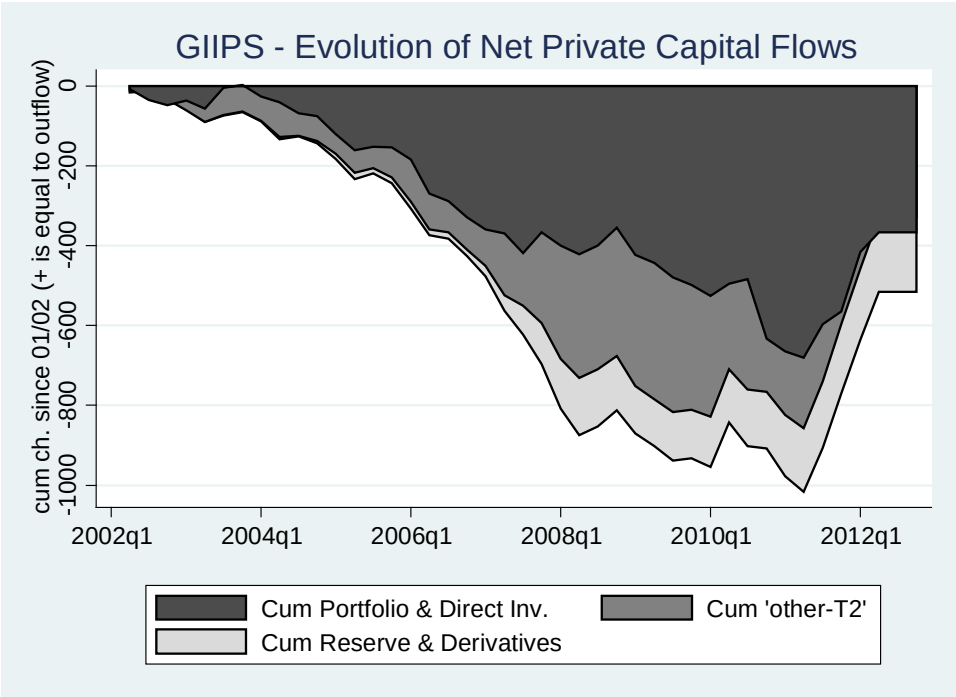


Figure 5: Evolution of Private Capital Flows

The upper panel of Figure 5 presents the evolution of private capital outflows for the FGLN group. The total colored area is equal to the (negative) cumulative FA minus the change in T2 balances.

For the FGLN group, the entire decrease in the flow of private sector capital can be traced back to the "other minus T2" category of capital flows ("other" is equivalent to the "Other Investment" category in the IMF's BOPS, minus the change in T2 balances). Capital flows from portfolio and direct investment exports from the FGLN group actually increased somewhat during the financial crisis. Whereas this group was receiving net capital inflows in these categories before the crisis, it became a net exporter in late 2009. There is thus no evidence that portfolio and direct investment flows suddenly dried up in the wake of the crisis. Also, changes in official reserves or changing positions in financial derivatives (light gray area) do not seem to be the reason for the drying-up of private sector financing from the FGNL group.

For the GIIPS group (see lower panel), the sudden stop in private capital inflows can be traced back mostly but not exclusively to changes in "other minus T2" balances. Also changes in portfolio and direct investment do explain some of the capital reversal.[28]

The "Other Investment" category in the IMF BOPS statistics "includes all financial transactions not covered in direct investment, portfolio investment, or reserve assets" (see IMF (2012, p. 95). Among other things, this category includes changes in positions on both secured and unsecured interbank markets, as well as deposit flows, i.e. it mainly comprises private capital flows between commercial banks. Also portfolio flows include a substantial amount of bonds held by banks. I thus next take a close look into which kind of banking flows changed with the onset of the crisis.

4.3. The Role of Banking Sector Positions for Cross-Country Private Capital Flows and T2 Balances

Against the backdrop of the above findings, it is of particular interest to evaluate how and which bank private capital flows changed with the onset of the financial crisis and how this change correlates with T2 balances.

In this section, I thus use additional data from the consolidated and locational banking statistics of the BIS. The advantage of these data is that they include positions of the national banking system against sectors (banks, non-bank private sector, public sector), thus enabling me to better trace the exact source of the sudden stop.[29]

I discuss, in turn, the role of cross-border positions between banks, cross-border credit positions between the nonfinancial private sector and banks, and positions of banks vis-à-vis foreign governments.

[28] Again, note that the capital outflow of GIIPS has been more pronounced than the inflow into FGLN. The residual amount thus must have flown into other EA members or outside the EA.

[29] The BIS banking statistics do include information on foreign claims of banks headquartered in country A on the three sectors in country B for every given point in time. However, when it comes to changes in these positions, the banking statistics cannot discern valuation effects from portfolio flows. For a discussion of these limitations, see pp. 16-17 in BIS (2011).

Again, the results of the regression estimated in this section have to be interpreted with care. The coefficients do not reflect causal relationships; as is clear from the accounting identity laid out above, in an accounting sense any type of financial flow has a 1-to-1 impact on T2 balances. Rather, the estimation results reflect the endogenous response of both changes in T2 balances and the specific private capital flows to economic shocks. Understanding this endogeneity, how it is different for different types of private capital flows, and how it has evolved over time can enhance our understanding of the sudden stop that led to the growth of T2 balances.

4.3.1. The Role of Cross-Border Bank Flows

Regarding cross-border positions between banks, columns (1) to (3) of Table 3 examine the role of the cross-border interbank market, that is, the changes in positions between banks that are located in different countries. I use the change in a country's cross-country interbank claims and liabilities from the BIS locational banking statistics that summarize the claims and liabilities of all branch offices residing in a given country.

A positive change in a country's net interbank claims is expected to be associated with a T2 deficit as it is equivalent to a capital outflow. Such a change either reflects that domestic banks have higher claims against the foreign counterparties or that foreign banks have lower claims against domestic counterparties. Both can only be achieved by funds being transferred abroad, i.e. by capital outflows.

Column (1) investigates the relationship between quarterly changes in T2 balances as the dependent variable and quarterly changes in net cross-country interbank claims as the independent variable in the post-crisis period. The changes in net cross-country interbank claims are defined as the difference between the change in claims (e.g. a change in the amount that Dutch banks are owed by banks located in any other country of the world) and liabilities (e.g. a change in the amount that Dutch banks themselves owe banks located in any other country of the world).

The estimation in the post-crisis sample yields a coefficient of –0.430, i.e. on average an increase in net cross-border interbank claims of EUR 1 billion is associated with a decrease in the T2 balance by EUR 430 million. Column (2) documents that the correlation between T2 balances and such positions has intensified since Q3 2007: the coefficient is estimated at –0.101 in the period before the crisis.

Column (3) shows that there has been a statistically significant break in the estimated relation. The interaction coefficient is estimated at -0.306 (because the panel is unbalanced in this case, the interaction coefficient is not equal to the difference in the coefficients in columns (1) and (2)).

Column (4) shows that the interaction coefficient is estimated higher when 3 lags are included (Table 3 only reports the sum of the four coefficients).

Table 3 - Flows Between Banks, Interoffice Flows, and the Evolution of Target2 Balances

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Post Crisis	Pre Crisis	Interaction	Interaction & Lags	Claims & Liab.	(5) & Interactions	Normalizing by GDP	Fixed Effects	Intoffice Post Crisis	Intoffice Pre Crisis	Intoffice Interact	Intoffice Claim&Liab
	Estimations (1)-(7) snd (9)-(12) present random effect and (8) Fixed Effect panel estimations											
	from Q3 07	before Q307					(3)-(12) Full Sample					
	Dependent Variable is the Quarterly Ch. T2 Balance expressed in: (1)- (6) Euro						**T2/GDP**		**(8)-(12) Ch. T2 Euro**			
Q/Q Ch. in Net Interbank Position	-0.430***	-0.101***	-0.146***					-0.166***				
	[0.046]	[0.031]	[0.056]					[0.057]				
Q/Q Ch. in Net Interbank Position * Dummy			-0.306***					-0.279***				
			[0.067]					[0.068]				
Q/Q Ch. in Net Interbank Pos (4 Q CUM Effect)				0.008								
				[0.954]								
Q/Q Ch. in Net Interbank Pos (4 Q CUM Effect) * Dumm				-0.608***								
				[0.122]								
Q/Q Ch. in Interbank Claims					-0.420***	-0.177***						
					[0.038]	[0.064]						
Q/Q Ch. in Interbank Claims * Dummy						-0.357***						
						[0.081]						
Q/Q Ch. in Interbank Liabilities					0.354***	0.101*						
					[0.030]	[0.060]						
Q/Q Ch. in Interbank Liabilities * Dummy						0.346***						
						[0.070]						
Q/Q Ch. in Net Interbank Position / GDP							-0.040					
							[0.048]					
Q/Q Ch. in Net Interbank Position/GDP * Dummy							-0.322***					
							[0.054]					
Q/Q Ch. in Net Interoffice Flows									0.097	-0.038	-0.038	
									[0.082]	[0.033]	[0.064]	
Q/Q Ch. in Net Interoffice Flows * Dummy											0.142	
											[0.088]	
Q/Q Ch. in Interoffice Claims												-0.069
												[0.068]
Q/Q Ch. in Interoffice Claims * Dummy												0.190*
												[0.097]
Q/Q Ch. in Interoffice Claims Liabilities												-0.013
												[0.072]
Q/Q Ch. in Interoffice Liabilities * Dummy												-0.085
												[0.095]
Dummy= 1 from q3 2007			0.856	0.850		-0.027	-0.161	0.904			-0.028	-0.397
			[1.411]	[1.422]		[1.472]	[0.263]	[1.411]			[1.575]	[1.612]
Observations	240	357	597	572	597	597	556	597	240	368	608	608
Number of Groups	12	12	12	12	12	12	11	12	12	12	12	12
R-Square (within)	0.265	0.0269	0.235	0.280	0.220	0.246	0.286	0.236	0.00581	0.00398	0.00544	0.0137
R-Square (between)	0.433	0.156	0.329	0.426	0.328	0.220	0.509	0.307	0.0511	0.0390	0.0451	0.485
R-Square (overall)	0.267	0.0285	0.231	0.285	0.197	0.240	0.291	0.230	0.00588	0.00377	0.00557	0.00698

Standard errors in brackets; *** p<0.01, ** p<0.05, * p<0.10

Columns (5) and (6) document that the structural break concerns both changes in interbank claims and changes in interbank liabilities. Column (5) allows for the magnitude of the coefficient of changes in external interbank liabilities and changes in interbank claims to differ, and it includes both these variables as independent variables. As expected, changes in claims have a negative coefficient, while changes in liabilities have a positive coefficient. Column (6) adds interactions of the two variables with the post-crisis dummy, documenting that the break is equally pronounced for both claims and liabilities.

Column (7) documents that the break is also present when normalizing both independent and dependent variables by GDP (the specification excludes Luxembourg).

While the interbank market has thus contributed to the drying-up of private capital flows in the EA, the latter may have been stabilized by the presence of banks with establishments in several countries. In addition to using the cross-border interbank market, European banks also transfer funds between their various offices located in different countries. The resulting positions are collected in the BIS locational banking statistics under the heading "inter-office claims and liabilities".[30]

[30] Unfortunately, the BIS locational banking statistics do not give a geographic breakdown of each national banking system's inter-office position. Thus, changes in the flows could also be driven by changes in inter-office positions vis-à-vis non-EA countries. Given that during the financial crisis especially transatlantic flows were large, the inter-office flows might hence be subject to considerable measurement error that exerts a downward bias on the estimated coefficients.

Columns (9) to (11) document that the correlation between T2 balances and such inter-office flows is positive in the post-crisis sample, but the structural break is not significant. Columns (9) and (10) include the pre- and the post-crisis sample respectively and the change in the inter-office position as dependent variable. Column (11) includes the full sample and adds an interaction, which is estimated positive (instead of the negative interaction for interbank markets, see (3)) but not significantly so.

Column (12) documents that there has been a significant break in the correlation of changes in interoffice claims and changes in T2 balances. It spills the change in the net claims position into changes of claims and changes of liabilities and it also adds the interactions of these two variables with the post-crisis dummy, indicating that changing interoffice claims might have stabilized the European financial system.

Figure 6 documents the evolution of interbank market flows and inter-office flows, and contrasts these flows with the evolution of T2 balances. For this, I first split the sample into the group of large T2 creditors (Finland, Germany, Luxembourg, and the Netherlands; termed "FGLN") and the group of large T2 debtors (Greece, Ireland, Italy, Portugal, and

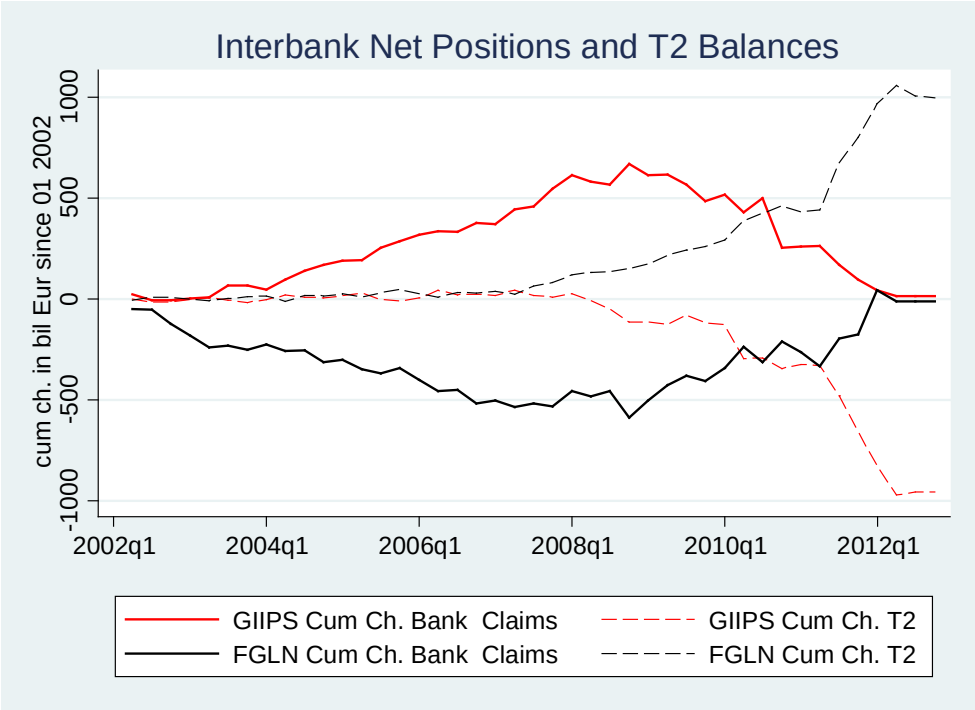
Spain; termed "GIIPS"). The upper panel of Figure 6 documents the cumulative change in the T2 balance (dotted lines) and in the net interbank market position (solid lines) of these two groups of countries since the beginning of 2002. The cumulative change for the GIIPS group is plotted in red, while that for the FGLN group is plotted in black. In terms of magnitude, changes in the interbank market net claims position can account for a very substantial proportion of T2 balances since the start of the crisis. From 2002 to mid-2008, banks in the GIIPS group increased their indebted themselves by around EUR 670 billion on international markets, nearly all of which (EUR 655 billion) left the country in the time since. On the contrary, from 2002 to mid-2008, banks in FGLN loaned around EUR 500 billion abroad and subsequently fully retrenched these funds until the end of 2012.

The lower panel of Figure 6 documents that the stabilizing effect of inter-office flows was comparatively small in magnitude. This panel presents the cumulative change in T2 balances (dotted lines) and in the net inter-office position (solid lines) since the start of 2000. The cumulative change for the GIIPS group is plotted in red, while that for the FGLN group is plotted in black.

Although inter-office flows have moved such that T2 imbalances are reduced, the overall magnitude is small (the 2007-2012 flow is around EUR 50 billion for the GIIPS group and EUR 200 billion for the FGLN group) compared to interbank market positions or T2 imbalances.

4.3.2. Cross-Border Flows Initiated by the Non-bank Private Sector

The above section documents the evolution of interbank positions and examines whether they were a possible source of T2 imbalances. In addition, transactions between the non-bank sector and the banking sector can potentially affect T2 balances; for example, if a Spanish resident decides to open an account in Germany and transfers funds from her old Spanish account to the new German account, this is reflected in an equivalent increase in the non-bank private sector liabilities of German banks. This transaction is also likely to affect the Spanish and German T2 balances, as the German bank will eventually react to the



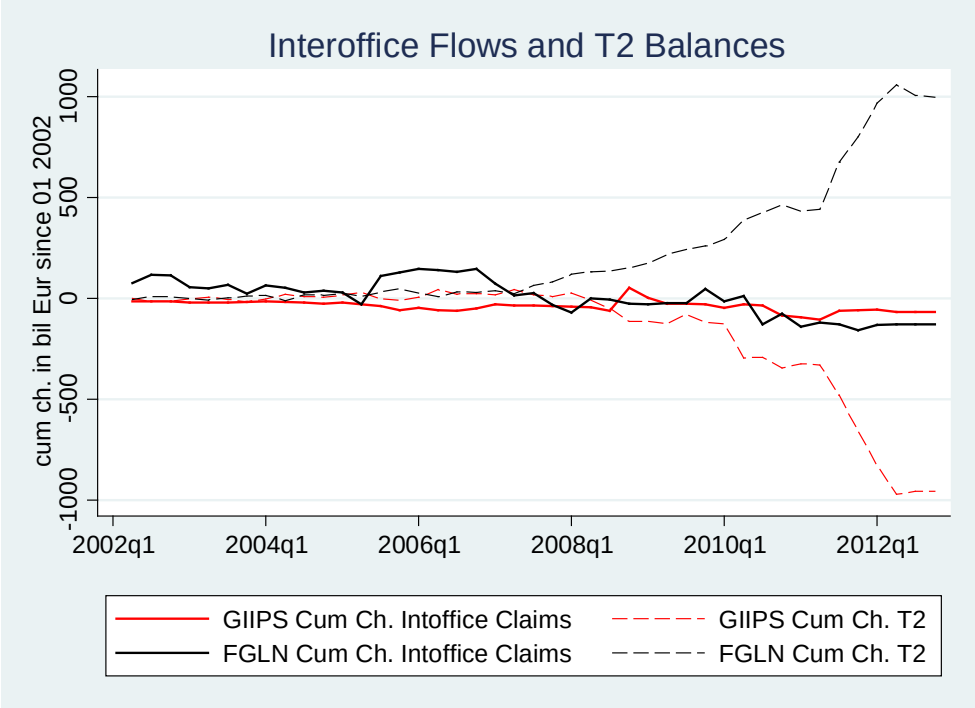


Figure 6 - Interbank and Interoffice Flows

liquidity it has received and draw less liquidity at the Bundesbank, while the Spanish bank will draw more liquidity from the Banco de España.

Columns (1) to (8) of Table 4 document the evolution of T2 balances and cross-country positions in claims and liabilities of the non-bank private sector against banks. The dependent variable is the quarterly change in the T2 balance. In (1) to (6), the independent variable is the quarterly change in net cross-country claims of the non-bank private sector against banks, i.e. the change in what domestic residents and non-bank enterprises are owed by foreign banks minus what domestic banks owe to foreign residents and non-bank enterprises.

There is a correlation between changes in net claims of the non-bank private sector and the evolution of T2 balances, and it has substantially intensified with the crisis. The coefficient is negative and significantly so in the pre-crisis sample of column (2), but the coefficient is smaller in magnitude than in the post-crisis sample (-0.184 compared to -0.666).

Column (3) shows that there has been a statistically significant break in the estimated relation between T2 balances and the evolution of international non-bank positions of banks. The interaction coefficient is estimated at -0.355.

Column (4) shows that the interaction coefficient is estimated about twice as high when 3 lags are included (Table 4 only reports the sum of the four coefficients). This estimation is undertaken as it may take time until financial transactions are reflected in T2 balances. For example, German banks might adjust their ECB liquidity demand to the inflow of funds from private depositors only after these have persisted for some time and are no longer viewed as transitory.

The structural break concerns both changes in claims and changes in interbank liabilities vis-a-vis foreign non-banks. Column (5) allows for the magnitude of the coefficient of changes in external interbank liabilities and changes in interbank claims to differ, and it includes both these variables as independent variables. As expected, changes in claims have a negative coefficient, while changes in liabilities have a positive coefficient.

The structural break in the correlation between T2 balances and net claims can primarily be attributed to changing liabilities rather than changing claims. Column (6) adds interactions of the two variables with the post-crisis dummy, documenting that the break is only significant for liabilities.

The structural break can be documented across various specifications. Column (7) documents that the break is also present when normalizing by GDP (the specification excludes Luxembourg). Column (8) documents that it is present when adding fixed effects.

Table 4 - Flows Between Banks and the Nonbank Private Sector & Deposit Flows

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	Post Crisis	Pre Crisis	Interaction	Interaction & Lags	Claims & Liab.	(5) & Interactions	Normalizing by GDP	Fixed Effects	Dep. Flows Post Crisis	Dep. Flows Pre Crisis	Dep. Flows Interact
	Estimations (1)-(7) snd (9)-(12) present random effect and (8) Fixed Effect panel estimations										
	from Q3 07 before Q307					(3)-(12) Full Sample					
	Dependent Variable is the Quarterly Ch. T2 Balance expressed in: (1)- (6) Euro T2/GDP								**(8)-(12) Ch. T2 Euro**		
Q/Q Ch. in Net Interbank Position	-0.666***	-0.184**	-0.264*					-0.344**			
	[0.136]	[0.072]	[0.140]					[0.140]			
Q/Q Ch. in Net Interbank Position * Dummy			-0.355**					-0.292*			
			[0.173]					[0.172]			
Q/Q Ch. in Net Interbank Pos (4 Q CUM Effect)				0.200							
				[0.284]							
Q/Q Ch. in Net Interbank Pos (4 Q CUM Effect) * Dumm				-0.787**							
				[0.364]							
Q/Q Ch. in Interbank Claims					-0.385***	-0.339**					
					[0.098]	[0.168]					
Q/Q Ch. in Interbank Claims * Dummy						-0.089					
						[0.206]					
Q/Q Ch. in Interbank Liabilities					0.568***	0.225					
					[0.092]	[0.153]					
Q/Q Ch. in Interbank Liabilities * Dummy						0.551***					
						[0.191]					
Q/Q Ch. in Net Interbank Position / GDP							-0.060				
							[0.085]				
Q/Q Ch. in Net Interbank Position/GDP * Dummy							-0.277***				
							[0.102]				
Q/Q Ch. in Net Interoffice Flows									0.127	-0.107	0.048
									[0.388]	[0.084]	[0.363]
Q/Q Ch. in Net Interoffice Flows * Dummy											0.173
											[0.473]
Dummy= 1 from q3 2007			0.595	0.542		0.388	-0.318	0.641			0.364
			[1.571]	[1.624]		[1.595]	[0.300]	[1.555]			[3.720]
Observations	240	357	597	572	597	597	556	597	252	332	584
Number of Groups	12	12	12	12	12	12	11	12	12	12	12
R-Square (within)	0.100	0.0203	0.0723	0.0789	0.0724	0.0903	0.0631	0.0727	0.000372	0.00698	0.00100
R-Square (between)	0.216	0.000852	0.549	0.000880	0.536	0.524	0.300	0.576	0.0201	0.228	0.00826
R-Square (overall)	0.0620	0.0183	0.0552	0.0729	0.0538	0.0672	0.0634	0.0542	0.00123	0.00168	0.00108

Standard errors in brackets; *** p<0.01, ** p<0.05, * p<0.10

Figure 7 presents the overall evolution of non-bank net positions since the beginning of 2000 and contrasts that with the evolution of T2 balances. The cumulative change for the GIIPS group is plotted in red, while that for the FGLN group is plotted in black.

It is noteworthy that the net position of the GIIPS group underwent strong fluctuations. While the cumulative change compared to 2002 was at plus EUR 63 billion in 2008, it stood at negative EUR 16 billion in 2009 to improve to plus EUR 6 billion at the end of 2012. For the FGLN group, the biggest changes actually took place during 2007 and 2008, with the cumulative change going from EUR -86 billion in 2006 to EUR – 290 billion in 2007. Thus, much of the fluctuations in the banking sector's exposure in the FGLN group against non-banks actually predate the European debt crisis.

Columns (9) to (11) of Table 4 document that private sector deposit flight is not a statistically significant correlate of T2 balances. For these specifications, I use the total deposit liabilities in the EA by non-monetary financial institutions (excluding central government) as a measure of private sector deposit flows between countries. This is a more direct measure of deposit flows than the data from the BIS, which also include other items such as bank bond holdings by the non-bank private sector.

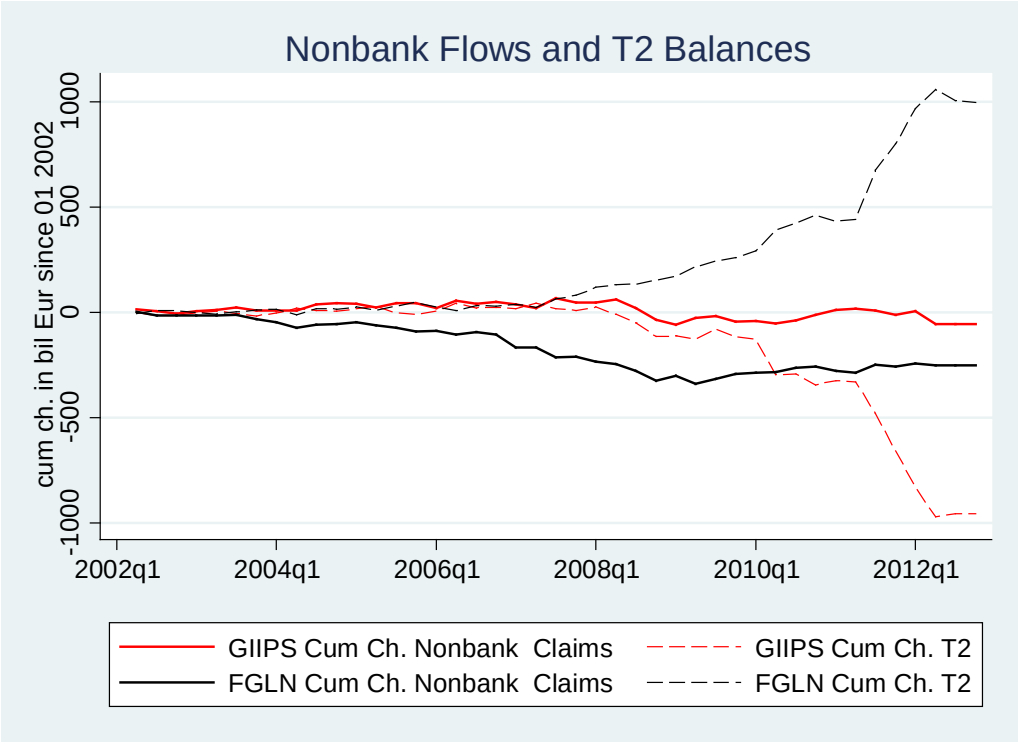


Figure 7: Changes in Holdings of Non-bank Claims

In columns (9) to (11), the independent variable is the 12-months change in net deposit liabilities, i.e. the inflow/outflow of deposits to/from a country over the last year (data is only available in this format). The dependent variable is the change in the country's T2 balance during the same 12-months period.

The relationship between deposit flows and changes in T2 balances is very strong in the crisis sample but there is no significant relationship in the pre-crisis sample. The coefficient in column (9) is estimated at 0.127, which is insignificant at the 5% level. In the pre-crisis sample of column (10), the coefficient is negative but again not significant. Also the change in the relationship between deposit flows and T2 balances is statistically insignificant (and even positive).

4.3.3. Banks' Evolving Positions vis-à-vis Foreign Governments

A third position of interest are banks' holdings of foreign government debt. The changes in these positions were potentially large as banks in T2 creditor countries reduced their holdings of sovereign debt of the GIIPS group.

Table 5 examines the importance of the quarterly change in net banking sector claims against foreign governments, defined as the change in the claims of domestic banks against foreign governments minus the change in the claims of foreign banks against the domestic government. In all estimations, the dependent variable is the quarterly change in the T2 balance.

Table 5 documents the evolution of T2 balances and cross-country positions in net claims of banks against foreign governments. The dependent variable is the quarterly change in the T2 balance. In (1) to (6), the independent variable is the quarterly change in net cross-country claims of banks against foreign government, i.e. the change in what the domestic banks are owed by foreign government minus what the domestic government owes to foreign banks.

There is a correlation of changes in net claims of the non-bank private sector and the evolution of T2 balances, and it has substantially intensified with the crisis. The coefficient is negative and significantly so in the pre-crisis sample of column (2), but the coefficient is smaller in magnitude than in the post-crisis sample (-0.118 compared to -0.409).

Column (3) shows that there has been a statistically significant break in the estimated relation between T2 balances and the evolution of international non-bank positions of banks. The interaction coefficient is estimated at -0.344.

Column (4) shows that the interaction coefficient is estimated about twice as high when 3 lags are included (Table 5 only reports the sum of the four coefficients and the corresponding standard error). This estimation is undertaken as it may take time until financial transactions vis-à-vis foreign governments are reflected in T2 balances. For example, if German banks do not roll over a loan to the Greek government, the latter might resort to domestic bank funding only with a lag and in the meantime delay payment of bills.

When it comes to changes in banking sector claims against foreign governments, there is an asymmetry between how changes in claims and changes in liabilities affect T2 balances. If claims of domestic banks against foreign governments decrease, this reflects direct decisions by domestic banks. However, if claims of foreign banks against the domestic government change, this primarily affects the domestic government rather than domestic banks directly. For example, if foreign banks do not roll over a maturing government debt, foreign liabilities decrease, but the domestic banking sector is only affected if the domestic government then turns to local banks to fund its cash needs.

Columns (5) and (6) examine whether the structural break concerns both changes in claims and changes in interbank liabilities vis-a-vis foreign non-banks. Column (5) allows for the magnitude of the coefficient of changes in liabilities of the domestic government and changes in claims against foreign governments to differ, and it includes both these variables as independent variables. As expected, changes in claims have a negative coefficient, while changes in liabilities have a positive coefficient.

The large size of the coefficient for changes in liabilities could be explained by the fact that governments of peripheral countries that no longer received funds from foreign banks turned increasingly to domestic banks, who bought domestic sovereign bonds to use as collateral at their NCB in exchange for central bank liquidity.

Also the structural break in the correlation between T2 balances and net government positions can primarily be attributed to changing liabilities rather than changing claims.

Column (6) adds interactions of the two variables included in column (5) with the post-crisis dummy, documenting that the break is only significant for liabilities. The structural break is significant when adding fixed effects, but it is not significant when normalizing by GDP. Column (7) presents a GDP-normalized specification and Column (8) adds fixed effects.

Table 5 - Bank Positions Against the Public Sector

	(1) Post Crisis	(2) Pre Crisis	(3) Interaction	(4) Interaction & Lags	(5) Claims & Liab.	(6) (5) & Interactions	(7) Normalizing by GDP	(8) Fixed Effects
	Estimations (1)-(7) present random effect and (8) Fixed Effect panel estimations							
	from Q3 07 before Q307				(3)-(8) Full Sample			
	Dependent Variable is the Quarterly Ch. T2 Balance expressed in: (1)- (6) Euro						**T2/GDP**	**Ch. T2 Euro**
Q/Q Ch. in Net Public Position	-0.409***	-0.118***	-0.118					-0.099
	[0.121]	[0.043]	[0.084]					[0.084]
Q/Q Ch. in Net Public Position * Dummy			-0.344***					-0.324***
			[0.120]					[0.120]
Q/Q Ch. in Net Public Pos (4 Q CUM Effect)				-0.067				
				[0.183]				
Q/Q Ch. in Net Public Pos (4 Q CUM Effect) * Dumm				-0.723***				
				[0.256]				
Q/Q Ch. in Public Claims					-0.135*	-0.085		
					[0.070]	[0.103]		
Q/Q Ch. in Public Claims * Dummy						-0.157		
						[0.141]		
Q/Q Ch. in Public Liabilities					0.542***	0.179		
					[0.085]	[0.139]		
Q/Q Ch. in Public Liabilities * Dummy						0.622***		
						[0.177]		
Q/Q Ch. in Net Public Position / GDP							-0.042	
							[0.066]	
Q/Q Ch. in Net Public Position/GDP * Dummy							-0.098	
							[0.125]	
Dummy= 1 from q3 2007			0.195	0.200		0.771	-0.441	0.311
			[1.404]	[1.459]		[1.397]	[0.323]	[1.399]
Observations	216	321	537	504	537	537	498	537
Number of Groups	12	12	12	12	12	12	11	12
R-Square (within)	0.0388	0.0227	0.0474	0.0672	0.0622	0.0846	0.00638	0.0475
R-Square (between)	0.550	0.0333	0.698	0.509	0.686	0.674	0.210	0.686
R-Square (overall)	0.0612	0.0231	0.0555	0.0786	0.0711	0.0938	0.00785	0.0554

Standard errors in brackets; *** p<0.01, ** p<0.05, * p<0.10

Figure 8 documents the overall evolution of net banking sector claims against foreign governments. It also contrasts these time series with the evolution of T2 balances. Again, the sample is split into the group of large T2 creditors and the group of large T2 debtors.

In terms of magnitude, changes in banking sector claims against foreign governments are non-negligible compared to the evolution of T2 balances. Figure 8 documents the cumulative change in the T2 balance (dotted lines) and net banking sector claims against foreign governments (solid lines) of these two groups of countries since 2002. The cumulative change for the GIIPS group is plotted in red, while that for the FGLN group is plotted in black.

Figure 8 documents that changes in bank's positions vis-à-vis governments have fluctuated by a relatively sizeable amount. While the GIIPS' group cumulative inflow since 2002 was EUR 19 billion in 2007, in 2012, there was a cumulative outflow of EUR 190 billion. On the flip side, while the cumulative inflows into the FGLN group was at EUR 120 billion in 2007, they had increased to EUR 273 billion by Q3 2012.

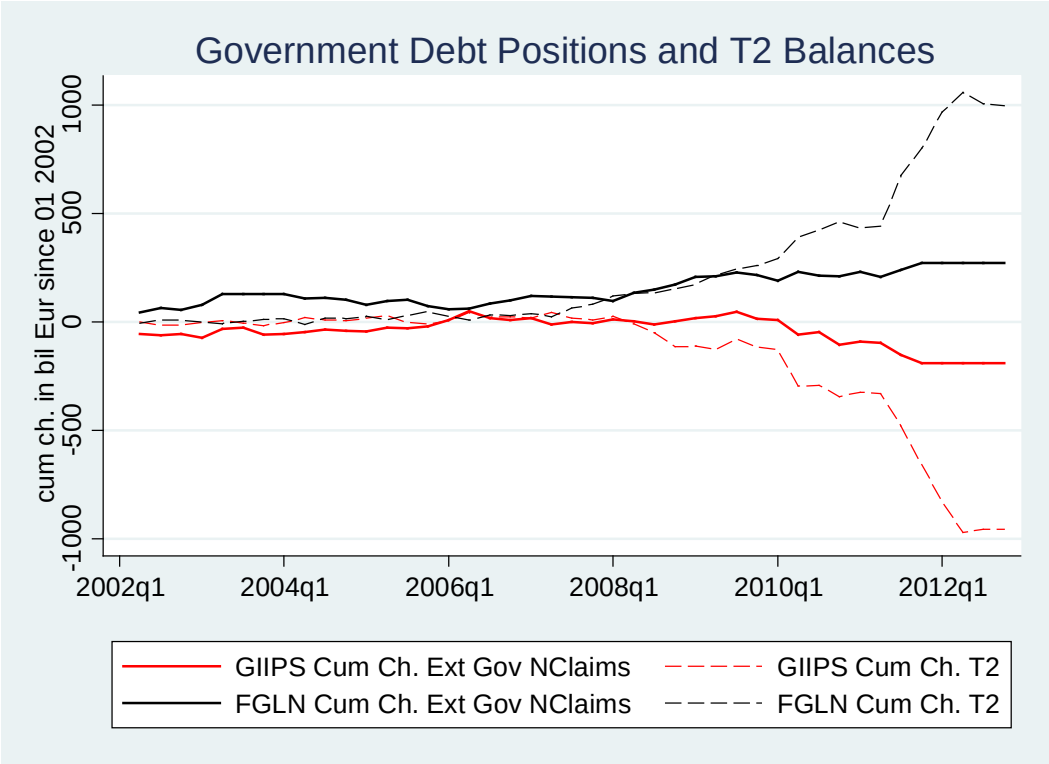


Figure 8: Cumulative Change in Banks' Net Claims Against Foreign Governments

5. Interpretation of the Results and Policy Conclusions

This section interprets the results of the analysis so far and derives appropriate policy conclusions. It is centered on two questions: first, does the current system lead to ever-increasing T2 imbalances or are there sufficient corrective forces at work such that system is fundamentally sound? Second, even if the system is fundamentally sound, there always exists the possibility that the EA undergoes drastic changes such as the exit of a country amidst a major external shock. Then, one has to consider how this remote possibility combined with at times large T2 imbalances transfer risk within the EA and how this risk transfer affects incentives across the area.

5.1. Are Corrective Forces at Work or is the European Monetary System Bound to fail?

> *"What I am sure of, if we remain in the same regime, we shall some day arrive at the end of the means of external payment[.]"*
>
> Triffin (1960)[31]

[31] As cited in Garber (1993).

The large balances of the T2 system are the prime symptom of macroeconomic and financial imbalances within the European Monetary Union. The most important policy question concerning the current institutional design is whether the current system will lead to sustained or even ever-increasing T2 imbalances because self-corrective forces are not sufficiently at work.

Fears that rebalancing is not properly at work are for example voiced in Sinn (2012c), a book that is titled "The Target Trap" and subtitled "Dangers for our Money and our Children."[32] Also Fahrholz and Freitag (2012) voice the concern that T2 balances will persist. More generally, these concerns are connected to the broader question if a group of countries as heterogeneous as the current EA can ever form a lasting currency union. For example, Feldstein (2010), p. 11 argues that "[a]fter eleven years of smooth sailing since the euro's creation, the arrangement's fundamental problems have become glaringly obvious."

In the light of these concerns, two aspects are of interest. The first is whether central bank liquidity is "too" cheap in the sense that banks will rely on such liquidity on a large scale also when the crisis is over, which could perpetuate CA and T2 imbalances.

The analysis of the pre-crisis period unambiguously documents that that such worries are unfounded. Although CA imbalances between the start of the Euro and Q3 2007 were substantial, they were absolutely unrelated to the use of central bank liquidity and the buildup of T2 deficits. If the pre-crisis period is any indication of the time after the crisis, T2 balances will stop growing and recede once trust in financial markets and sovereign solvency has been reestablished across the EA.[33]

The second aspect is whether T2 imbalances have financed CA deficits during the crisis, and if so, whether the amount financed by the ECB was too "large", a question deliberated in Sinn and Wollmershäuser (2012a, p. 496): "The ECB eases the pain, but it also undermines the allocative function of the capital market and preserves the periphery's wrong set of goods, factor and asset prices, with the result of unremitting financial needs and rising foreign debt levels that eventually might become unsustainable."

The answer to this second aspect is more difficult to come by due to the impossibility of finding the "optimal" level of easing the ECB should provide. For better interpretability, it is helpful to first discuss the evolution of T2 balances under some counterfactuals, and to then asses what these counterfactuals imply in economic terms.

A first, straightforward, counterfactuals is that, had the sudden stop not happened in 2007 or later, we would until today not witness any T2 balances as private capital flows would have continued to fully finance CA deficits.

A second counterfactual is one of extremely fast external adjustment after the sudden stop happens in Q3 of 2007. The coefficient of 0.8 in the post Q3 07 sample - per definition of

[32] In German "Die Target Falle" and "Gefahren für unser Geld und unsere Kinder", respectively.

[33] In fact, while there are many uncertainties as to how the world economy will look like once the European debt crisis is over, a crucial novelty will be the phasing in of the Basel III Accord, which much higher equity standards for banks and potentially also scarcer collateral. These developments imply that the use of central bank liquidity by banks in excess of minimum requirements is likely to be lower than was the case before the crisis.

the balance of payments identity - implies that in a pure accounting sense central bank liquidity (visible in the T2 balances) has "financed" the 80% of the CA deficit of T2 debtors nations (cumulatively equal to more than EUR 600 billion since Q3 2007). Thus, if we could run the simple counterfactual (we can't) that the troubled economies had somehow been able to reduce their CA deficits to zero without this having any other effects on the European economy, T2 imbalances would have been around EUR 0.8*600=480 billion smaller than the levels we are currently witnessing.

These two counterfactuals make clear that in an accounting sense, had the sudden stop been avoided, T2 imbalances would be almost nonexistent. Had the sudden stop happened but CA deficits would have been eliminated instantaneously, T2 imbalances would be around half the magnitudes we are currently witnessing.[34]

Stepping beyond these counterfactuals, the answer to this issue ultimately depends on what one perceives to be the optimal level of external support a country in a monetary union that is facing a sudden stop should receive. On the one side, the CA is slow-moving in nature and any CA-deficit country that is hit by a sudden stop should be given some level of support in order for it to bring down the CA over time. On the other side, since CA deficits cannot be financed forever by such support, so there has to be some rebalancing eventually.

While pointing out the optimal level of reforms and external adjustment in the EA at the current juncture is well beyond the scope of this paper, it is noteworthy that rebalancing is actually well underway and may even be nearly complete.

Figure 9 documents that CA deficits of the four southern EA members are currently either very small or close to zero. The upper graph of Figure 9 presents the monthly summed CA balance of Greece, Italy, Portugal, and Spain.[35]

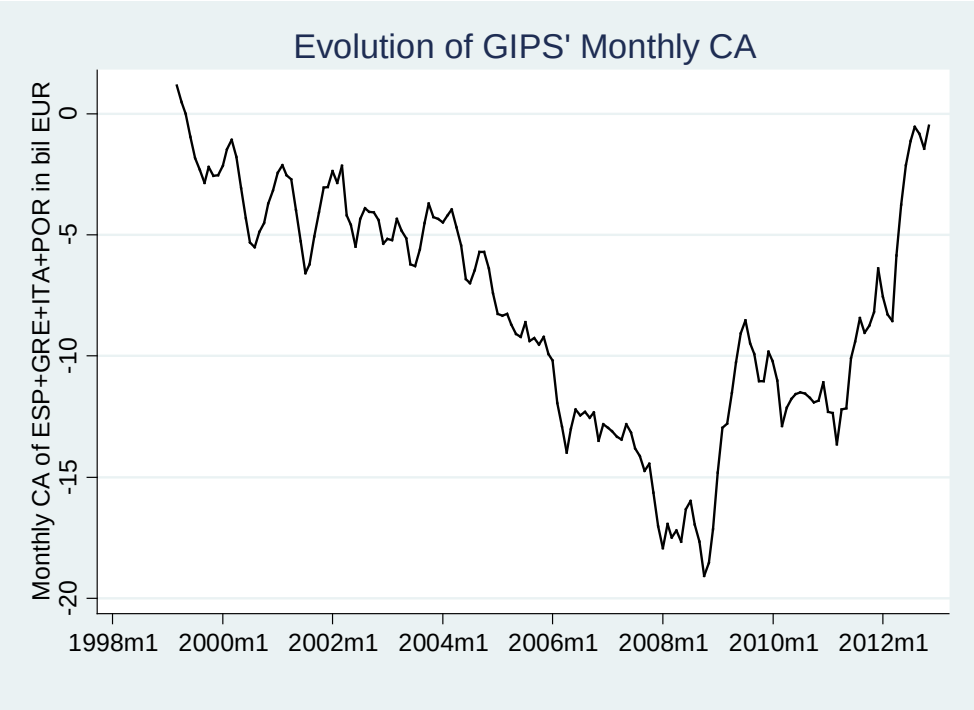
While the monthly CA deficit of these countries nearly reached EUR 20 billion around 2008, the monthly deficit has been less than 5 billion for over a quarter of a year. This constitutes a rapid improvement: at an annualized rate, these five countries have switched expenditures equivalent to EUR 180 billion.

The lower part of Figure 9 documents that all four countries have achieved substantial external adjustment. It plots the evolution of the CA balances of Greece, Italy, Portugal, and Spain as a percentage of GDP.[36] In terms of pre-crisis GDP, from the first quarter of 2008 to the third quarter of 2012, Greece has switched expenditures worth the equivalent of 15% its economic output, while in Spain and Portugal the external adjustment was around 10% of pre-crisis GDP. In Italy, the CA had first deteriorated during 2008 and 2009, but the CA is currently close to being balanced.

[34] In reality, it is obviously beyond policy makers' control to bring private capital flows to a move on once a sudden stop has happened and it is also impossible (and highly unadvisable) to force instantaneous external adjustment. In fact, an abrupt reduction the CA deficit may have had catastrophic consequences for the growth of these economies, thus crippling the ability to repay T2 balances in the future and would have also worsened the capital flight. As a result, T2 imbalances could have even been more pronounced than is currently the case.

[35] The series plotted in the upper part of Figure 9 is adjusted for seasonality and a 3-months moving average is plotted to reduce the variability of the series; a monthly CA time series is unavailable for Ireland.

[36] All four series are seasonally adjusted and the lines present 3-months moving averages. The series are normalized by pre-crisis GDP (2007) so that changes are driven by changing CA balances rather than contracting GDP (without this normalization the recent improvement of the CA balances would even be more pronounced). For correct interpretability, the monthly CA balance is divided by the monthly GDP (both seasonally adjusted).


Evolution of GIPS' Monthly CA
Monthly CA of ESP+GRE+ITA+POR in bil EUR
0
-5
-10
-15
-20
1998m1
2000m1
2002m1
2004m1
2006m1
2008m1
2010m1
2012m1

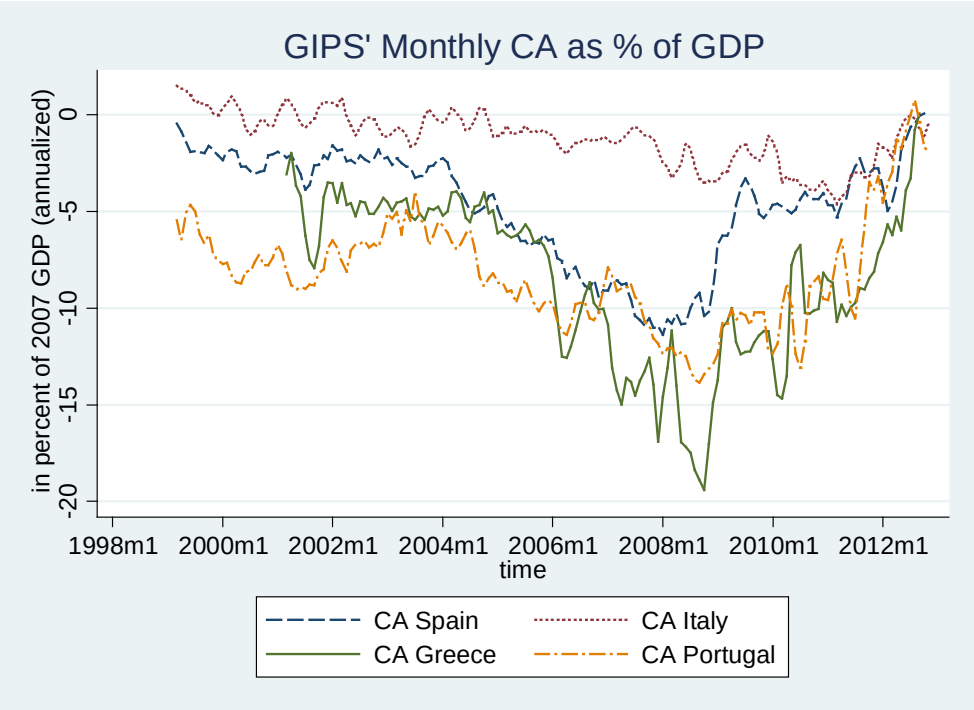

GIPS' Monthly CA as % of GDP
in percent of 2007 GDP (annualized)
0
-5
-10
-15
-20
1998m1
2000m1
2002m1
2004m1
2006m1
2008m1
2010m1
2012m1
time
CA Spain
CA Italy
CA Greece
CA Portugal

Figure 9

The speed of CA rebalancing in the southern EA is actually much faster than the typical rate of CA rebalancing around the world. Chinn and Wei (2008) construct a sample of over one hundred rebalancing episodes from 1970 onwards and estimates the rate of CA persistence from a specification of the form

$$CA/GDP_{c,t} = \alpha_c + \beta * CA/GDP_{c,t-1year}$$

Repeating Chinn and Wei's exercise for the monthly sample in the post crisis-period in Greece, Italy, Spain, and Portugal, the coefficient on the one-year lagged monthly CA is equal to 0.576. This rate of CA persistence in the southern EA is below any of the average rates estimated by Chinn and Shang-Jin Wei (2008), be that for the average persistence rate for fixed exchange rate regimes (0.63, see their Table 1A), for flexible exchange rate regimes (0.73, see their Table 1A), or for the average rate of CA adjustment in industrialized countries (0.867, see their Table 2). 0.576 is also below the rates of CA persistence found in Atish et al. (2010).[37]

The above exercise documents that the current speed of CA adjustment in the EA is actually much faster than the typical rate of adjustment. Together, the evidence for the "sudden stop" uncovered in the panel analysis and the signs that rebalancing is well underway since corrective forces seems to be well at work and are currently limiting external imbalances.

The first policy conclusion from the analysis of this paper is hence that there is no evidence that the institutional setup of the European Monetary Union is fundamentally flawed in the sense that it will lead to ever-increasing imbalances akin to the ones in the Bretton-Woods system. It thus does not require fundamental reform.

5.2. Limiting Within-Euro Area Risks Transfers

The current system has dampened the effect of the European debt crisis on real activity in T2 debtor countries. Given the extent to which the sudden stop of private capital flows was offset via central bank liquidity, it is likely that the economic crisis in Greece or Spain would have been much more pronounced had T2 balances been limited in some way.

This being said, it is nevertheless true that reducing the large T2 balances accumulated during the crisis will not be a trivial endeavor. Such a reduction could in theory be easily achieved by higher interest rates on central bank liquidity, more stringent collateral requirements, and bigger haircuts on collateral. In practice, since such policies will be quite costly to the economies of the T2 debtor countries, it might prove politically hard to decide upon and implement them.

This issue ultimately relates to the transfer of risk from T2 debtor nations to T2 creditor nations that has been emphasized in Sinn (2011, 2012a and b) and Burda (2012). There are three types of scenario under which losses for T2 creditor countries would arise.

[37] It is difficult to compare the speed of CA rebalancing in the EA to other episodes of CA reversals during crises, as the latter took place mostly in emerging markets. However, it is noteworthy that also in emerging markets, CA imbalances are not always sharply reduced after a currency crisis (see Milesi-Ferreti and Razin (1998 and 2000)).

The first risk is that T2 debtor NCBs could suffer losses if the commercial banks drawing liquidity from them cannot repay their loans and these loans are under-collateralized. Any such losses would be shared among the EA members according to their relative contributions to the ECB's capital key and hence also affect the T2 creditor nations.

A second risk could arise if a T2 debtor country were to exit the EA. Losses could then arise for the remaining EA members if the exiting country would not honour its liabilities vis-à-vis the ECB. Also these losses would be shared among the remaining EA members according to their relative contributions to the ECB's capital.

The third risk is of a different type and arises if a T2 surplus country were to exit the EA. Losses could then arise for the NCB of the exiting country. For example, if Germany were to exit and reintroduce the Deutschmark at an exchange rate of initially 1-to-1 to the Euro, the Deutschmark was likely to successively appreciate against the Euro. The Bundesbank would then be owed its T2 balances by the ECB in Euros, but it would in turn owe the same amount in Deutschmarks to German Banks. Due to this mismatch of the denomination of assets and liabilities, losses could arise for the Bundesbank if the Deutschmark were to appreciate against the Euro.

Although the probability that large scale losses will result for T2 creditor countries is arguably very small, the current system in effect has transferred risk from T2 debtor to T2 creditor nations. Given that such a transfer of risk is generally associated with a distortion of the incentives to engage in structural reforms, it is worthwhile to consider how aspects of the current system could be reformed to reduce T2 imbalances and avoid a re-emergence of such imbalances in the future.

There has also been a transfer of risk from the private to the public sector via the increased provision of central bank liquidity. The above analysis documents that the drying-up of private capital flows to T2 debtor countries mainly resulted from banks in T2 creditor countries reducing their cross-country interbank loans and cross-country holdings of foreign debt. Ultimately, this constitutes a transfer of risk from the banking sector to the government *within* the T2 creditor nations (see De Grauwe (2012) and Whelan (2012)).

There now exist several proposals to reform aspects of the European Monetary System related to the T2 system. Sinn (2011) proposes limiting T2 balances or settlement with gold-backed securities or treasury bills,[38] Schlesinger (2011) proposes that T2 debtor NCBs pay an interest premium in excess of the ECB's main refinancing rate, and Sinn (2012a) proposes settlement of T2 balances with senior rights to future tax revenue.

Building on the authors' earlier work and on European Economic Advisory Group (2012), Sinn and Wollmershäuser (2012a) propose "the redemption of the Target debt by handing over marketable assets to the creditor countries" (p. 499). The European Economic Advisory Group (2012) also proposes such an option, but recommends to precede it by the

[38] To be precise, Sinn (2011) suggested to institute a system similar to the "interdistrict settlement account" (ISA) for the twelve regional Reserve Banks of the Federal Reserve system, arguing that in "the US, the [ISA] (the US equivalent to the Target system) must be settled once a year with gold-backed securities or Federal treasury bills." Sinn's statement is not entirely correct: while the predecessor of the ISA required such settlement, currently, the balances are settled once a year by adjusting each Reserve Bank's securities in the System Open Market Account (SOMA), which is the portfolio of securities acquired by the Federal Reserve System via open market operations (see Lubik and Rhodes (2012)).

introduction of "euro-standard bills" that are guaranteed by each government separately but adhere to strict requirements and joint supervision.

In my view, limiting T2 balances or periodically netting them with senior assets that are scare for some EA members is not a viable option if the EA is to remain a true monetary union.[39] For example, under such a policy a NCB could hit its limit or run out of foreign exchange reserves or assets that can be used for settlements to net its T2 balance. Then, no private citizen could transfer money from the country in question to another part of the EA.[40]

Whelan (2012) proposes to implement "annual settlement of TARGET2 balances with settlement taking place using assets acquired during monetary policy operations." The difference between this proposal and earlier ones is that since each NCB always receives an amount of collateral that is at least equal to (or exceeds, due to haircuts) the value of the liquidity it distributes (except for emergency loan provisions), this solution would allow to continue settlements and hence the monetary union at any point in time.

While this proposal is conceptually appealing, I deem it hard to implement since collateral needs to be returned to the commercial bank once the liquidity operation (i.e. the repurchasing agreement) matures. This would make the settlement of T2 balances between NCBs quite a cumbersome process: with such a settlement of T2 balances, for example the Bank of Finland would currently receive a large set of collateral originally posted by Greek commercial banks to the Bank of Greece. Once the underlying liquidity operation of the Bank of Greece matures, the Bank of Finland would then either have to transfer the collateral directly to the Greek commercial bank or to the Bank of Greece. Since many of the Eurosystem's liquidity operations are short term, such transfers would occur all the time, hence complicating the organization of the Eurosystem's open market polices.

My general assessment of the proposed settlement procedures is hence that they are either against the spirit of a monetary union or operationally difficult to implement within the federal setup of the European Monetary Union.

If one deems settlements of T2 balances a necessity (I do not), a more readily implementable variant of Whelan's (2012) proposal would be to directly issue claims to national collateral baskets between the EA's NCBs. To continue the above example, instead of receiving the actual Greek collateral, the Bank of Finland would then receive an ownership claim to the total collateral pool of the Bank of Greece. While the security the Bank of Finland were to receive would be the same as under Whelan's proposal (or higher than that if the Bank of Finland were to receive some seniority status) the administrative burden would be much smaller because instead of dealing with thousands of different assets that need to be replaced on a weekly basis, such an exchange would only involve the periodic transfer of one net claim.

In general, any promising policy should aim at improving the alignment between who decides upon the distribution of central bank liquidity and who bears potential losses arising

[39] Also see Bundesbank (2012) and European Central Bank (2011b). The proposal of the European Economic Advisory Group (2012) is in principle implementable, but of course this is conditional on assuming that the strict rules would be adhered too.

[40] This may happen even in the absence of a crisis. For example, Jobst (2011) argues that annual settlement of all Euro-system balances "would have required the Bundesbank in 2006 to pay close to €80 billion, equivalent to its entire gold and foreign exchange holdings (€81 billion)."

from such decisions.[41] To do so, the costs to T2 debtor nations could be increased and the control of the ECB and T2 creditors over liquidity provision could to be improved. The former could be achieved by making each national government responsible for losses arising from the liquidity operations of its NCB, but this is can only be a long term solution given that it would likely require changing the treaties of the European Monetary Union and in some sense it would also go against the EA's policy aimed at reducing the risk of spillovers from national banking systems to national public finances. The latter could be achieved by a move towards a more centralized system in which the ECB has more direct control over how liquidity is distributed.

A first step towards achieving better control over liquidity provision would be a strict homogenization of collateral policy across the NCBs in the euro zone, as was the case before the financial crisis.[42] Once the effects of the crisis have abated, should the member states of the EA decide that they want to consider a more fundamental reform this should be based on a more stringent management of the assets that are eligible as ECB collateral.

Overall, based on these considerations, my second conclusion is hence that T2 balances should not be settled, but that instead the focus should be on harmonizing collateral policies across the EA as soon as possible and working on long term policies that guarantee the quality of collateral.

Last, it is noteworthy that the risk transfer from the private to the public sector cannot be limited by changing the design of the Eurosystem. Rather, it requires that the health of the European banking system is homogeneous across the EA. In this context, the recent decision to have a common bank supervision that ensures the homogeneity of bank regulation seems promising also in the context of minimizing the likelihood of a re-emergence of large T2 imbalances in the future.[43]

6. Conclusion

T2 balances arise owing to the federal structure of the ECB. Rather than money being issued centrally to commercial banks, this is done via the NCBs. At times demand for ECB liquidity is uneven across the EA's member states and T2 balances keep track of this heterogeneity.

Uneven usage of central bank liquidity across the EA signals underlying differences in the health of the financial system and/or macroeconomic imbalances. Because both real and financial transactions can be the cause that underlies uneven central bank liquidity, a

[41] In some sense, Schlesinger's (2011) proposal that T2 debtor NCBs pay an interest premium in excess of the ECB's main refinancing rate is the most direct way to correct this distortion. However, it is against the EMU's founding principle that liquidity operations are subject to different rates across the EA, which would be the case under this proposal unless the interest premium is paid by the national government and not by the commercial banks of T2 debtor nations.

[42] Tornell (2012) and Dinger et al. (2012) argue that at the current juncture, because the costs of additional liquidity provision are born by the EA as a whole, but benefits occur nationally, incentives are distorted and is a tendency for excess liquidity provision. See also Sinn and Wollmershäuser (2012a) ans Sinn (2012).

[43] Along with common supervision, the intra-European diversification of the banking sector should also be encouraged. The above analysis shows that, while the interbank market has strongly re-nationalized in the wake of the crisis and thus contributed to T2 imbalances (see also Brutti and Sauré (2012), Milesi-Ferretti and Tille (2011), and Lane (2012) for evidence on this re-nationalization of the financial system during recent crises), inter-office flows between affiliated bank establishments have actually stabilized the financial system. The creation of truly European commercial banks would thus contribute to the overall stability of the European financial system.

discussion has developed on the extent to which current T2 balances have financed either CA deficits or flight of private capital.

To shed light on whether the large T2 imbalances in the EA in recent years were financing real or financial imbalances, I examine how the evolution of T2 balances across both countries and time correlates with the evolution of CA imbalances and private capital flows in a panel analysis.

A first result is that the evolution of CA balances was entirely unrelated to the evolution of T2 balances before the onset of the financial crisis in 2007, but that the correlation in the period thereafter is pronounced both statistically and in terms of magnitudes.

This change in the correlation is consistent with the explanation that the financing of CA deficits changed with the onset of the financial crisis. Whereas CA deficits were financed by private capital flows before 2007, private capital flows from T2 creditor countries partly stopped thereafter. Since banks in CA deficit countries had to respond to this funding gap by drawing more liquidity from their national central banks, T2 imbalances increased.

Given this interpretation of the change in the correlation between T2 and CA balances reflecting a partial "sudden stop," I next examine how different types of private capital flows evolved with the onset of the crisis and how this can be related to the evolution of T2 balances. Among other things, I find that the stop in capital flows can be traced back to the interbank market, to banks' holdings of foreign public debt, and to a small extent also to deposit flows of the non-bank private sector. I also find that banks with establishments in multiple countries transferred funds from T2 creditor nations to T2 debtor nations, i.e. they actually reduced T2 imbalances.

My first conclusion from this analysis is that since T2 imbalances were caused by a sudden stop and are unlikely to grow without bounds since EA CA imbalances are currently diminishing at a rapid pace, there is no evidence that the institutional setup of the European Monetary Union needs to be reformed fundamentally.

My second conclusion relates to how the current system transfers risks across the currency union, both in terms of risk transfer from T2 debtor to T2 creditor nations and in terms of risk transfer from the private sector to the public sector within T2 creditor nations. I evaluate existing reform proposals in the light of these risk transfers. I argue that T2 balances should not be settled between the EA members as the various proposals are either against the spirit of the European Monetary Union or operationally very difficult to implement. Rather, the ECB should have more centralized control over how liquidity is distributed. A first step towards achieving the latter would be a strict homogenization of collateral policy across the NCBs in the EA, as was the case before the financial crisis.

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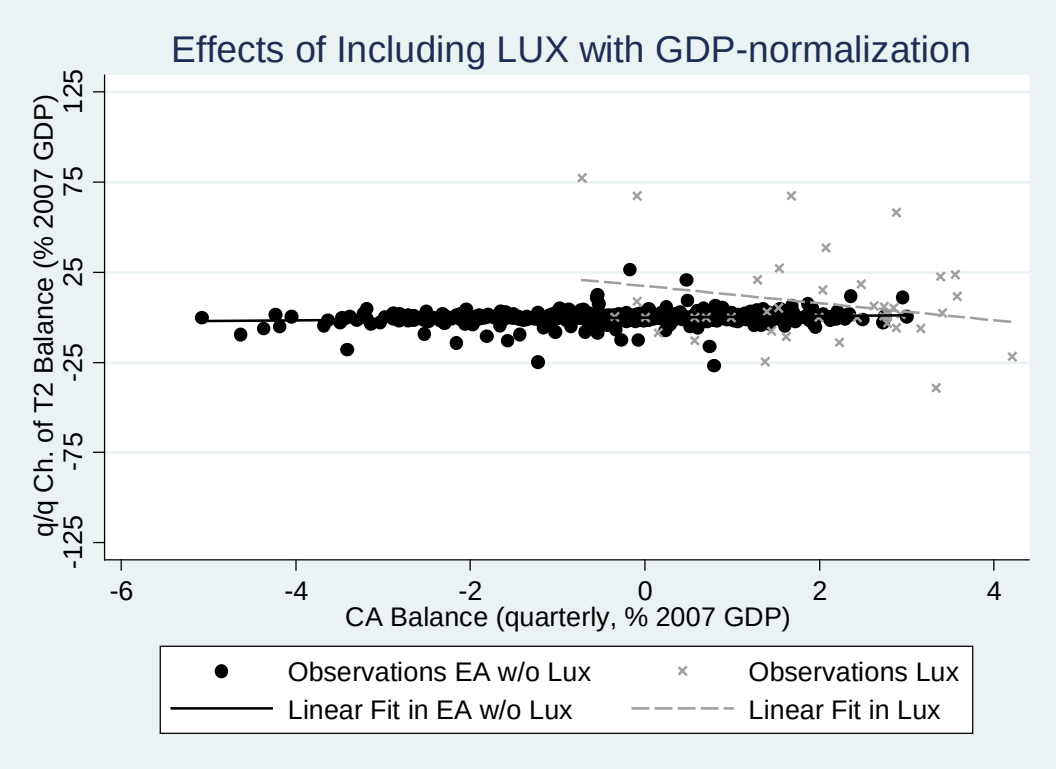
8. Appendix: Including Luxembourg when Normalizing by GDP

The below figure A1 documents the effect of including Luxembourg in the analysis relating GDP-normalized changes of T2 balances to the GDP-normalized CA. It includes a scatterplot separately highlighting observations in the EA without Luxembourg (black circles) and observations in Luxembourg (grey crosses). It also displays two fitted lines for these two groups of observations.

Because the increases of the T2 balance of Luxembourg are very large while CA balances are positive (but not extremely large), most observations for Luxembourg lie in the first quadrant. Thus, while the within-group covariation between changes in T2 and CA imbalances is actually negative in Luxembourg (see fitted line), the overall regression coefficient of the CA for T2 balances is substantially increased when the country is added to the specification.

Given these starck patterns that reflect the dominance of private capital flows over the CA in Luxembourg, the country is excluded from the analyis when normalizing by GDP.