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The economics of TARGET2 balances

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The economics of TARGET2 balances*

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Abstract

It has recently been argued that intra-eurosystem claims and liabilities in the form of TARGET2 balances would raise fundamental issues within the European monetary union. This article provides a framework for the economic analysis of TARGET2 balances and discusses the key arguments behind this recent debate. The analysis is conducted within a system of financial accounts in which TARGET2 balances can arise either due to current account transactions or cross-border capital flows. It is argued that the recent volatility of TARGET2 balances reflects capital flow movements, while the previously prevailing current account positions did not find a strong reflection in TARGET2 balances. Some recent statements regarding TARGET2 appear to be due to a failure to distinguish between the monetary base (a central bank liability concept) and the liquidity deficit of the banking system vis-à-vis the central bank (a central bank asset concept). Furthermore, the article highlights the importance of TARGET2 for the stability of the euro area and points out that the proposal to limit the size of TARGET2 liabilities essentially contradicts the idea of a monetary union.

Keywords: TARGET2, central bank balance sheet, liquidity deficit, financial crisis
JEL Codes: E58, F33, F55

1 Introduction

Recently, the Eurosystem's real-time gross settlement (RTGS) system TARGET2[1] has attracted the attention of the general public. In particular, Sinn (2011a, 2011b, 2011c, 2011d) has discussed and criticized the operation of TARGET2 during the current European sovereign debt crisis.

Published opinions on this issue range from charging the European Central Bank (ECB) with secretly bailing out governments of several peripheral countries at the expense of other euro area members, see Sinn (2011b) or Wolf (2011), to the view that a segmented interbank market is causing

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[1]TARGET stands for Trans-European Real-time Gross settlement Express Transfer.

the strong increase in TARGET2 balances, see Ruhkamp (2011). Some commentators seem to have a strong opinion on this matter but often fail to explain the underlying mechanics of the TARGET2 system in a way that allows to follow their reasoning properly. Moreover, with the exception of the papers by Garber (1999, 2010) and Whittaker (2011), as well as the more technical discussions in Bank for International Settlements (2003), Kokkola (2010), or recently in Deutsche Bundesbank (2011, p. 34), hardly any detailed discussion of the TARGET system and its implications is available. This article aims to fill this gap. Firstly, similar to Gurley and Shaw (1960) or Bindseil and Jablecki (2011), it provides a stylized framework of financial accounts that can be used to understand the mechanics of intra-eurosystem claims and liabilities. Secondly, it explains that drawing conclusions solely from observing developments of TARGET2 balances is misleading, as different causes can give rise to observationally equivalent TARGET2 developments. Thirdly, as Sinn (2011a, 2011b, 2011c) alleges to have identified several pronounced implications of the mechanics of the TARGET2 system, this article picks up some of his core hypotheses and discusses them in greater detail.

We thereby hope to provide some clarification on the mechanics and details of the TARGET2 system, their relation to euro area monetary policy implementation and on the implications that can be drawn from the observed TARGET2 balances and balance sheet developments of euro area central banks.

1.1 Previous Literature

Garber (1999) has argued that the TARGET system might have fueled a speculative attack on weak currency countries during stage III of the European Monetary Union when legacy currencies were still in circulation but interbank payments were already denominated in euro. Garber (2010) discusses the mechanics of an intra-euro area capital flight and explains how the structure of TARGET2 claims and liabilities would change if a euro area member became subject to a capital outflow. Whittaker (2011) compiles the figures of intra-eurosystem claims of Germany, Luxemburg, Netherlands, Finland, and Italy vis-à-vis the remaining euro area countries and notes that as of March 2011 claims of up to 457 bn euro have been accumulated. He points out that this figure has grown since 2004 by a factor of 7. Furthermore, he writes that intra-eurosystem credit to Ireland (via the Central Bank of Ireland) is more than twice the amount that he believes has been paid under so-called emergency liquidity assistance (ELA). While Garber (2010) and Whittaker (2011) largely confine their analyses to a positive discussion of the mechanics of TARGET2 and a presentation of available statistics, Sinn (2011a, 2011b, 2011c) goes one step further and essentially concludes that the operation of TARGET2 might eventually undermine the sustainability of the Eurosystem's single monetary policy. The main points in Sinn (2011a, 2011b, 2011c) can be summarized as follows:

1. The Eurosystem finances via TARGET2 the current account deficits of several euro-area member countries, e.g. Greece, Ireland or Portugal.

2. This 'Kreditersatzpolitik' (credit replacement policy, or replacement lending) comes at the expense of central bank lending and the issuance of 'fresh money' in other euro-area member countries (notably Germany). The resulting increase in TARGET2 liabilities 'eats up' the monetary base in these countries and can at most continue for two more years before the Eurosystem must sell its gold and foreign exchange reserves.

3. Therefore the Eurosystem should introduce limits on TARGET2 accounts in order to keep the current account deficits of the TARGET2 debtor countries in check.

We will discuss these three points in more detail in section 8. Sinn's articles and also Wolf (2011) have recently triggered strong opposing reactions from journalists and financial market participants.[2] Buiter, Rahbari, and Michels (2011) is the only recent discussion that uses an analytical approach. Their approach is similar to ours in that they consider the balance sheet developments triggered by different types of transactions.

1.2 Outline of the paper

The rest of this paper proceeds as follows. Section 2 explains institutional aspects of TARGET2 and highlights the importance of TARGET2 for the monetary union. Section 3 introduces a stylized system of financial accounts of the real and financial sectors. Section 4 uses this framework to show how shifts of household deposits with banks (or, equivalently, capital market funding) and related interbank payment flows affect the balance sheet of the central bank and the financial accounts of the remaining sectors. In section 5 we discuss the expansion of the central bank's balance sheet during a financial crisis when the interbank market dries up due to a lack of confidence among the participating banks. This is illustrated empirically with examples of central bank balance sheet expansion during the recent crisis. Section 6 extends the analysis of the previous sections to the case of a monetary union between two initially separated financial areas and a central bank system that is composed of two national central banks. Section 8 discusses Sinn's points 1-3. Section 9 concludes.

2 TARGET2

2.1 Institutional aspects of TARGET2

As enshrined in Article 105(2) of the Treaty establishing the European Community and Article 3 of the Statute of the European System of Central Banks and of the European Central Bank, the Eurosystem is charged with the task of providing, guaranteeing and overseeing the operation of payment and settlement systems in the euro area. As explained in Bank for International Settlements (2003), a smooth operation of payment and settlement systems is key for the success of the monetary union, because an efficient and well-functioning payment system is (a) essential for maintaining the stability of the financial system, (b) needed to preserve the confidence in the common currency, (c) a necessary condition for the implementation of the single monetary policy. Therefore the Eurosystem has been assigned the dual role of regulator and service provider for payment services in the euro area. The first generation of the Eurosystem's own payment system TARGET was put into operation in 1999. It was replaced in November 2007 by its successor system TARGET2. Initially, TARGET was a decentralized payment system that provided the linkage between the RTGSs of national central banks (NCBs) and the ECB's payment mechanism. While TARGET contributed to the integration of intra-European money markets, its decentralized nature had several shortcomings, in particular with respect to cost efficiency and technical maintenance. The successor TARGET2 was designed to overcome these shortcomings. It is based on a single technical platform. The rules for participation

[2] See e.g. Whelan (2011), Storbeck (2011), or Buiter, Rahbari, and Michels (2011).

in the system as well as the transaction cost structure are to a large extent harmonized between the members of the European system of central banks.

TARGET2 provides payment and settlement services for its participants without imposing any upper bound on the amounts that can be processed during the day. Except for payments related to Eurosystem monetary policy operations and for the settlement of positions in large-value net settlement systems that effectively operate in euro, market participants are free to make use of other payment and settlement systems and arrangements.[3] Intra-day credit created by TARGET2 transactions needs to be collateralized. Collateral is subject to the same eligibility requirements and risk control measures as applied in Eurosystem liquidity-providing monetary policy operations (i.e. reverse transactions and recourse to the marginal lending facility).[4]

2.2 The importance of TARGET2 for the monetary union

The introduction of the euro as a common currency in 1999 required that cross-border payments within the monetary union should be treated as payment flows within the borders of a single country. This requirement constitutes the crucial difference between a system of pegged exchange rates and a monetary union. The maintenance and stability of the former depends on the availability of a sufficiently large stock of foreign reserves. By definition, the latter means that all payments and transactions undertaken within the currency area and which are denominated in the single currency are considered as domestic payments and transactions.[5] The establishment of a single currency therefore requires that deposits of banks with the central bank are fully fungible and that such deposits in one country of the currency area can be 'exchanged' at the lowest possible cost against such deposits in another member country. As pointed out by Garber (2010, p. 2), the TARGET mechanism is the Eurosystem's operational tool that "irrevocably unifies the former national currencies (...) whose exchange rates are merely fixed at par into a single currency". Anticipating the discussion of Sinn's point 3, we can already conclude from these considerations that putting limits on the size of TARGET2 liabilities questions the nature of the European monetary union. It would throw the common currency area back to a system of fixed exchange rates with those central banks that face TARGET2 limits being forced to struggle to maintain their stock of internationally fungible reserves.

3 Stylized system of financial accounts

In this section we lay out a stylized closed system of financial accounts of the real and financial sectors of an economy. This framework captures the mechanics and development of intra-system claims and liabilities. It is the basis for understanding the nature of TARGET2 balances and any subsequent analysis of their significance. The starting point is a household sector which initially holds real assets against equity.

[3] A detailed account of the development of the TARGET and TARGET2 systems are provided in European Central Bank (2009). More detailed explanations of the functioning of the European payment mechanisms are laid out in Kokkola (2010)

[4] See European Central Bank (2011, ch. 6) for a description of the collateral framework of the Eurosystem.

[5] Kokkola (2010)

Household			
Assets		Liabilities	
real assets	E	equity	E

Money is introduced in the form of banknotes and deposits. It is assumed that the household sector allocates part of its initial wealth to banknotes. Therefore it sells some of its assets to a corporate sector which has the capability of employing the assets for productive purposes. Initially, the corporate does not own any assets. In order to purchase the household's assets, the corporate sector obtains loans from a bank (in the balance sheet of the bank this is henceforth simply referred to as 'credit corp.'). The bank in turn transacts with a central bank (CB) which has been granted the monopoly right to issue banknotes. Hence, the bank obtains banknotes of an amount B from the central bank and lends these to the corporate. The corporate sector uses the banknotes to purchase the real assets from the household. The corporate can obtain only those real assets that the household wants to substitute for financial assets. The system of financial accounts now consists of two real sectors, household and corporate, and two financial sectors, bank and central bank. In this simple case, the corporate is only financed via the bank and the bank is only financed via the central bank. In addition, we assume that the household diversifies its asset portfolio further and holds deposits of amount D with the bank. This necessarily releases additional real assets which the corporate sector can employ for productive purposes. Correspondingly, the balance sheets of the bank and of the corporate sector expand by the volume of household deposits.

Household			
Assets		Liabilities	
real assets	$E-B-D$	equity	E
banknotes	B		
deposits	D		

Corporate			
Assets		Liabilities	
real assets	$B+D$	to bank	$B+D$

Bank			
Assets		Liabilities	
credit corp.	$B+D$	deposits	D
		CB funding	B

Central bank			
Assets		Liabilities	
credit bank	B	banknotes	B

Next, consider what happens when the central bank also engages in outright purchases of securities and not only conducts credit operations with the bank. In order to avoid the introduction of a further sector such as the government, it is assumed that these outright holdings are claims against corporates in the form of corporate bonds (Z). This direct financing of the corporates by the central bank reduces (a) the need of the corporate to finance through the bank and (b) the need of the bank to finance through the central bank. Hence, in the present framework, banknotes in circulation (determined by household demand) and the decision of the central bank how much assets to hold outright determine mechanically the liquidity position of the bank vis-à-vis the central bank. The liquidity position

of the banking system vis-à-vis the central bank is defined as the net sum of all monetary policy operations (netted on the asset side of the central bank's balance sheet). The banking system is in liquidity deficit whenever this sum is positive, else it is in liquidity surplus, see Bindseil (2004, p. 49). In the example, the liquidity position of the bank vis-à-vis the central bank is given by $B - Z$ and the bank is in liqudity deficit.

Household			
Assets		Liabilities	
real assets	$E - B - D$	equity	E
banknotes	B		
deposits	D		

Corporate			
Assets		Liabilities	
real assets	$B + D$	to bank	$B + D - Z$
		to CB	Z

Bank			
Assets		Liabilities	
credit	$B + D - Z$	deposits	D
		CB credit	$B - Z$

Central bank			
Assets		Liabilities	
credit bank	$B - Z$	banknotes	B
outright	Z		

4 Bank funding flows and liquidity buffer

To understand how funding flows between different banks affect the system of financial accounts, the banking sector is split into two banks with ex-ante identical balance sheets. The household is assumed to hold deposits with both banks. Other forms of investments in bank liabilities, i.e. debt instruments such as commercial paper, certificates of deposits, bank bonds, covered bonds, can be considered equivalent to household deposits from the perspective of the following analysis of financial flows and creation of TARGET2 balances. The different forms of banks liabilities have different characteristics in terms of stability or potential evaporation. This does not matter here since the following simple framework is restricted to a single period. Hence, when the following refers to "deposits of households" or "deposit shift shocks", this should be understood to encompass any form of investment into bank debt instruments by households and other investors.

We consider a deposit shift shock, i.e. a re-allocation of household deposits between the two banks. This deposit shift shock is a random variable, denoted by $\tilde{\mu}$. A realization of the random variable $\tilde{\mu}$ is denoted by μ. The financial account representation for a realization of the shock, causing a shift of deposits from bank 2 to bank 1, is depicted below.

Household			
Assets		Liabilities	
real assets	$E - B - D$	equity	E
banknotes	B		
deposits bank 1	$D/2 + \mu$		
deposits bank 2	$D/2 - \mu$		

Bank 1			
Assets		Liabilities	
credit corp.	$(B+D-Z)/2$	deposits	$D/2+\mu$
CB reseves	0	CB credit	$(B-Z)/2-\mu$

Bank 2			
Assets		Liabilities	
credit corp.	$(B+D-Z)/2$	deposits	$D/2-\mu$
CB reserves	0	CB credit	$(B-Z)/2+\mu$

Corporate			
Assets		Liabilities	
real assets	$B+D$	to bank	$B+D-Z$
		to CB	Z

Central bank			
Assets		Liabilities	
credit bank 1	$(B-Z)/2-\mu$	banknotes	B
credit bank 2	$(B-Z)/2+\mu$		
outright	Z		

Whether banks can withstand shocks of a given size μ depends on their *funding liquidity buffers*. For the purpose of this article, it is sufficient to define funding liquidity buffers as the maximum amount of deposit withdrawals that a bank can absorb within a given time horizon before it has to sell off corporate loans.[6] In the present simplified framework, banks' liquidity buffers are essentially determined by the collateral framework of the central bank, i.e. by the eligibility of bank assets to be used as collateral in liquidity providing monetary policy operations and by the haircuts applied to these assets.

In particular, since only a single asset class is considered here, liquidity buffers are determined by the eligibility of corporate loans for central bank operations. In reality, not all central banks accept corporate loans as collateral. Those who do, as e.g. the Eurosystem, impose relatively high haircuts on such loans. Note that the limitation of bank assets to corporate loans in this framework comes without loss of generality because the restriction of bank assets to corporate loans was only a matter of simplicity. The framework could easily be extended by adding further asset classes.

[6] Alternatively, one could define funding liquidity buffers in probabilistic terms as the probability that the banks does not need to sell corporate loans within a given time horizon.

Consider bank 2 which suffers from liquidity outflows of size μ. It now needs to refinance $(B-Z)/2+\mu$ via the central bank. Denote the haircut that the central bank applies on corporate loans by $\psi \in (0,1)$. Therefore, the maximum amount that bank 2 can refinance with the central bank is given by $(1-\psi)(B+D-Z)/2$. This implies that the maximal liquidity shock that the bank can withstand without having to sell off assets is given by[7]

$$\mu^* = -\psi\left(\frac{B-Z}{2}\right) + \frac{(1-\psi)D}{2}.$$

If the shock exceeds the liquidity buffer of bank 2 (the case $\mu > \mu^*$), the bank can apply to the central bank for emergency liquidity assistance (ELA). [8] The central bank can in such a situation provide funding against non-eligible collateral (i.e. the entirety of the remaining assets of the banks can be pledged). Alternatively, if no assets to be pledged are left (as in our example), the central bank can demand a government guarantee to protect itself against potential default risk.[9] If the central bank declines the request for ELA, two possibilities arise. Either the bank manages to close the funding gaps through asset (fire) sales (possibly exerting downward pressure on prices and creating an asset fire sale spiral), or it defaults and its entire assets are seized by its creditors (which are likely to incur losses).

5 Intra-bank intermediation by central banks

During the recent crisis, in particular in the aftermath of the Lehman crash in September 2008, interbank lending in most developed countries temporarily came to a standstill. In order to maintain the stability of the banking system, central banks took over the role of an interbank market-maker which resulted in unprecedented expansions of the respective central banks' balance sheets. Even though the central bank may become engaged in larger risk-taking when it expands its balance sheet, such policy may be required to sustain the economy's financial stability. This is part of the Bagehotian heritage that almost all major central banks adhered to during the crisis (see the example balance sheet snapshots in table 1). The trade-off between central bank liquidity support during crises and the subsequent increase in risk exposure has been a core issue in the debate on financial crisis management ever since the early 19th century. As the Bank of England's Jeremiah Harman explained regarding the crisis of 1825, (quoted from Bagehot (1873, p. 51)): "We lent it [money] by every possible means and in modes we had never adopted before (...) Seeing the dreadful state in which the public were, we rendered every assistance in our power." Bagehot (1873) also emphasized

[7] μ^* is calculated from

$$(1-\psi)\left(\frac{B+D-Z}{2}\right) < \frac{B-Z}{2} + \mu \Leftrightarrow \mu > \mu^* \equiv -\psi\left(\frac{B-Z}{2}\right) + \frac{(1-\psi)D}{2}.$$

[8] ELA provision in the euro area is within the discretion of the NCB of the euro area member where the respective financial institution is located. Access to ELA is not automatized, (as is the access to standing facilities), but has to be assessed and approved by the NCB and the decision making bodies of the ECB, see European Central Bank (2007, p. 80).

[9] Assuming that the central bank is willing to close the resulting funding gap with ELA, then total central bank lending $(B-Z)$ will be split up into two sub-positions, normal central bank lending equal to $(B-Z)/2+(1-\psi)(B+D-Z)/2-\mu$ and ELA provision equal to $(B-Z)/2+\mu-(1-\psi)((B+D-Z)/2)$. All other positions in the financial accounts would remain unchanged.

the importance of central bank liquidity provision, "(...) in time of panic it [Bank of England] must advance freely and vigorously to the public" (p. 196). And yet, while he was well aware of the associated increase in risk-taking, he considered it the only possibility to safeguard financial stability: "The only safe plan for the Bank [of England] is the brave plan, to lend in a panic on every kind of current security, or every sort on which money is ordinarily lent." (p. 199).

Besides having the possibility to increase liquidity support during crises, most central banks today provide additional absorbing facilities (often automated) that can substitute for the market's borrower side. The use of such facilities by banks comes usually at the cost of a lower remuneration. Banks will thus rely on it only if interbank counterparties are perceived as rather credit risky, or if a systemic liquidity crisis leads to a general hoarding of liquidity. Once this happens, the central bank's balance sheet expands and the central bank assumes the the role of an interbank market-maker.

This situation can be displayed in the system of financial accounts as follows. Assume, for the sake of simplicity, that the haircut is equal to zero ($\psi = 0$) and that the central bank does not own an outright portfolio ($Z = 0$). The bank that experiences a liquidity inflow will be overly liquid. Whenever $\mu > B/2$, the bank has liquidity in excess of its needs. In normal times it would then offer liquidity on the interbank market. Yet, when the interbank market has broken down, it will deposit the excess liquidity with the central bank. In this case, the financial system's accounts become:

Bank 1			
Assets		Liabilities	
credit corp.	$(B+D)/2$	deposits	$D/2+\mu$
CB reserves	$\mu - B/2$	CB credit	0

Bank 2			
Assets		Liabilities	
credit corp.	$(B+D)/2$	deposits	$D/2-\mu$
CB reserves	0	CB credit	$B/2+\mu$

Central bank			
Assets		Liabilities	
credit banks	$B/2+\mu$	banknotes	B
		bank reserves	$\mu - B/2$

As a consequence, the central bank's balance sheet expands by $\mu - B/2$. The central bank may wish to actively absorb the excess reserves that the liquidity-rich banks hold with the central bank. Its balance sheet will then look as follows, where "liquidity absorbing operations" may stand for the issuance of debt certificates, the collection of fixed term deposits, or liquidity absorbing repo

operations. With respect to the monetary base[10] (a concept still considered economically relevant by some), such absorbing operations neutralize the effects of central bank intermediation on the base.

Central bank			
Assets		Liabilities	
credit banks	$B/2+\mu$	banknotes	B
		bank reserves	0
		liquidity absorbing operations	$\mu - B/2$

Table 1 provides some examples for such an increase in intermediation activities of central banks during the recent crisis. It shows snapshots of the balance sheets of the Bank of England (BoE), the Federal Reserve System (Fed), the Eurosystem (ES) and the Riksbank. Balance sheet items are aggregated into autonomous factors,[11] outright holdings of securities, reserves of banks and liquidity providing / absorbing operations. It is visible from the respective first rows that prior to the crisis all four central banks had relatively lean balance sheets and provided liquidity (more or less) to the extent that was just sufficient to cover their banking system's liquidity needs.[12] In the aftermath of the Lehman bankruptcy, interbank lending came to a halt. As described above, central bank intermediation replaced interbank lending and borrowing. The liquidity provision through outright holdings and through credit operations increased considerably, while at the same time all four central banks chose to conduct absorbing operations to recapture part of the liquidity in order to retain control over interbank interest rates. The Fed and the BoE decided to remunerate reserves of banks in October 2008 and March 2009 respectively. Such policies are similar to absorbing liquidity via issuance of debt certificates or auctioning of fixed term deposits (unless, of course, one sticks to a strict definition of the monetary base).[13] The figures that best highlight the extent of intra-bank intermediation by the central bank are in bold. With respect to the most recent figures of the Bank of England and the Fed, it should be noted that the excess liquidity,[14] of around GBP 138 bn and USD

[10]Strictly defined, the monetary base is the sum of bank reserves and currency in circulation.

[11]Autonomous factors refers to those items on the central bank's balance sheet that are not controlled by the monetary policy function of the central bank. In the stylized system of financial accounts the only autonomous factor was banknotes in circulation, whereas in reality further autonomous factor items are central bank capital, investment portfolios, gold or foreign reserves, see e.g. Bindseil (2004, ch. 2).

[12]The liquidity needs of the banking sector are defined as the sum of autonomous factors and average minimum reserve requirements. Of the four central banks above, the ES imposes the largest minimum reserve requirements (in relative terms) on its banking sector. The Riksbank and the BoE did not had reserve requirements in place in 2006, while the reserve requirements of the Fed have been relatively small. A meaningful 'leanness indicator' for a central bank balance sheet is the ratio of monetary policy operations (outright purchases or credit operations) to banknotes in circulation. Whenever this is close to unity one may speak of a lean balance sheet.

[13]In fact, Ben Bernanke, chairman of the Fed, explained the introduction of reserve remuneration with the inability of the Fed to absorb the huge surplus liquidity and therefore to control the federal funds rate effectively. In a speech on 7 October 2008, Bernanke said:

> The expansion of Federal Reserve lending is helping financial firms cope with reduced access to their usual sources of funding. Recently, however, our liquidity provision had begun to run ahead of our ability to absorb excess reserves held by the banking system, leading the effective funds rate, on many days, to fall below the target set by the Federal Open Market Committee. (...) Paying interest on reserves should allow us to better control the federal funds rate, as banks are unlikely to lend overnight balances at a rate lower than they can receive from the Fed; thus, the payment of interest on reserves should set a floor for the funds rate over the day.

[14]Excess liquidity is defined as the difference between reserves of banks plus net recourse to the deposit facility and

Table 1: Comparison of simplified balance sheet snapshots

	Assets		**Liabilities**		
	Outright holdings	Liquidity providing operations	Autonomous factors (net liability)	Liquidity absorbing operations	Reserves of banks
Bank of England (in billion GBP)					
26/06/07 (pre-crisis)	33	47	60	0	20
14/01/09 (post Lehman)	45	190	78	**101**	**56**
09/03/11 (recent)	231	13	106	0	**138**
Federal Reserve System (in billion USD)					
26/06/07 (pre-crisis)	790	20	763	30	17
14/01/09 (post Lehman)	495	583	143	89	**846**
09/03/11 (recent)	2358	21	942	56	**1381**
Eurosystem (in billion EUR)					
29/06/07 (pre-crisis)	0	463	230	1	182
02/01/09 (post Lehman)	0	857	353	**291**	213
11/03/11 (recent)	139	454	266	**93**	234
Riksbank (in billion SEK)					
23/01/07 (pre-crisis)	0	4	3	1	0
07/01/09 (post Lehman)	0	266	80	**186**	0
09/03/11 (recent)	0	1	6	7	0

1381 bn respectively, is currently driven by a huge expansion of outright holdings of securities under the so-called quantitative or credit easing programs. This does not necessarily point to a failure of the interbank market which needs to be cushioned through central bank intermediation. Therefore, for the BoE and the Fed, one observes intermediation of the kind described above only in the aftermath of the Lehman breakdown.

For the Eurosystem, some intermediation still prevailed in January 2011, although intermediation reached its peak two years earlier in January 2009. Reserves of banks in the Eurosystem tend to be required reserves since excess reserves are not remunerated. A more detailed account of the factors leading to the lengthening of the Eurosystem balance sheet during the current financial crisis can be found in Papadia and Valimäki (2011).

The Riksbank is the only central bank amongst the four that had phased out crisis measures as of January 2011. Neither central bank intermediation, nor large outright portfolios continue to lengthen its balance sheet. However, one should not infer from the reported numbers that the Riksbank's balance sheet is actually so short. The provided figures are the result of a netting of liquidity providing and absorbing autonomous factors. Specifically, the Riksbank holds large foreign reserves which tend to counterbalance the liquidity absorbing autonomous factors. For example, in January 2011, total assets of the Riksbank were SEK 327 bn, of which SEK 284 bn were held in foreign reserves. Banknotes were around SEK 100 bn.

One can conclude from the depicted balance sheet snapshots that central banks became the interbank market makers after the interbank market broke down in the aftermath of the Lehman crash. The substantial increase in liquidity supplies ensured that all banks (even those which lost investor and depositor confidence but which were nevertheless sound) did not experience a damaging shortage of their liquidity coverage. The resulting excess supply of liquidity was then largely absorbed through absorbing operations, thereby creating a sort of artificial borrower side of the interbank market. Finally, it is important to note that intermediation measures do not provide a measure for the size of the deposit shift shocks μ. The deposit shift shocks are obviously larger, because the prevailing total liquidity deficit of the banking system vis-à-vis the central bank can be re-allocated amongst banks before central bank intermediation and a corresponding expansion of the central bank balance sheet occurs.

6 Representing a monetary union

This and the following section are devoted to the analysis of the case of a monetary union between two previously separated monetary areas. The present section describes a consolidated and a deconsolidated representation of the central bank's balance sheet in a monetary union. In section 7 we will then explain how different types of transactions affect the economy's balance sheets and how the balance sheets develop when the central bank takes over the role of an interbank market-maker, as in section 5. These exercises are useful to understand the relationship between developments of intra-system balances (essentially TARGET2 balances in the euro area), the size of the central bank's balance sheet and the role of the central bank during a liquidity crisis.

Consider a monetary union between two previously separated monetary areas, indexed by $i \in \{1, 2\}$. The balance sheets of the monetary areas before joining the union are essentially identical to the

minimum reserve requirements. For the Fed and the BoE, we approximate this by reserves of banks.

balance sheets in section 3.

The liquidity deficits $B_i - Z_i$ of the two areas, which need to be closed via central bank funding, may initially differ as a result of institutional differences like banknote demand of households, outright security portfolios of central banks, reserve requirements, payment habits etc.

The newly created monetary union is depicted in the following tables. For simplicity the households and the corporate sectors have been merged into a single balance sheet. As regards the central bank balance sheets, both a separated and a consolidated version will be provided.

Household			
Assets		Liabilities	
banknotes	$\sum_i B_i$	equity	$\sum_i E_i$
deposits	$\sum_i D_i$		
real assets	$\sum_i (E_i - B_i - D_i)$		

Corporate			
Assets		Liabilities	
real assets	$\sum_i (D_i + B_i)$	to bank	$\sum_i (D_i + B_i - Z_i)$
		to CB	$\sum_i Z_i$

Bank area 1			
Assets		Liabilities	
credit corp.	$B_1 + D_1 - Z_1$	deposits D_1	
CB reserves 0	CB credit	$B_1 - Z_1$	

Bank area 2			
Assets		Liabilities	
credit corp.	$B_2 + D_2 - Z_2$	deposits	D_2
CB reserves	0	CB credit	$(B_2 - Z_2)$

Consolidated central bank			
Assets		Liabilities	
credit bank area 1	$B_1 - Z_1$	banknotes	$\sum_i B_i$
credit bank area 2	$B_2 - Z_2$		
outright area 1	Z_1	reserves of banks	0
outright area 2	Z_2		

The liquidity deficit is now given by $\sum_i (B_i - Z_i)$. If the figures were not broken down explicitly into figures for the individual areas, it would be impossible to track down the individual shares of the areas in the overall liquidity deficit. As will be explained in greater detail below, deposit shift shocks between the areas could be reflected in a lengthening of the central bank's balance sheet if the interbank market broke down and if the shocks became sufficiently large.

In the disaggregated presentation of central bank balance sheets below, it is assumed that the bank in area 1 cannot become a counterparty of the central bank in area 2 and vice versa. The areas' central banks retain their stock of counterparties after joining the monetary union. This corresponds to the case of the Eurosystem where banks can access the Eurosystem's facilities and operations only via the NCB of the member country in which they are established.[15] Hence, all transactions between a bank and the system of central banks are then reflected on the balance sheet of its respective NCB and appear on the consolidated balance sheet of the Eurosystem.

Central bank area 1			
Assets		Liabilities	
credit bank	$B_1 - Z_1$	banknotes	B_1
outright	Z_1	reserves	0

Central bank area 2			
Assets		Liabilities	
credit bank	$B_2 - Z_2$	banknotes	B_2
outright	Z_2	reserves	0

7 Implications of cross-border transactions in a monetary union

There would be no role for intra-system balances as long as neither real nor financial transactions between area 1 and area 2 would take place. The existence of a monetary union would then merely be reflected in the fact that prices in the two areas would be denominated in the same currency and agents in both areas would use the same banknotes.

We identify two key sources of balances, namely those relating to current account transactions (section 7.1) and those relating to funding flows (section 7.2). Finally in section 7.3 we consider the incidence of both transactions and take up again the issue of an expansion of the central bank's balance sheet due to intra-bank intermediation that was discussed in section 5.

7.1 Current account transactions

Suppose that the corporate in area 2 wants to purchase some of the remaining real assets from the household sector in area 1. Further, suppose that the bank in area 2 is willing to provide a credit to the corporate such that the latter can purchase the assets. The decision to grant such a credit is completely independent of the bank's reserve holdings with the central bank. While the bank would need some central bank money (reserves) to settle transactions via the central bank payment system, its initial decision to provide credit is in no way constrained by its reserve holdings. The bank grants a credit only in case that it deems the borrower creditworthy and as long as it considers

[15] Cf. European Central Bank (2011, ch. 2). However, it is important to note that cross border use of collateral is allowed, and that the larger banking groups have typically Eurosystem counterparties in more than one country. Therefore they can easily centralize their liquidity management through such group structures.

such a decision to be in line with its other objectives, as e.g. maintaining a certain value-at-risk, maximizing profits etc.

Furthermore, assume that the household in area 1 does not want to hold deposits with the bank in area 2. The household has a deposit account with the bank in area 1. The corporate's bank therefore needs to transfer the purchase price to the household's bank. Accordingly, the transaction gives rise to a payment flow between the two areas and it therefore requires the existence of a suitable payment mechanism / system. Suppose that such a payment system is in place (in fact, as explained in the introduction, such a payment system is a necessary precondition for establishing a monetary union). The transaction just described is depicted in the following tables. The assets to be transferred are denoted by α. As reserve accounts with the central bank cannot become negative (they may contain an intra-day overdraft provision, but have to be balanced overnight), bank 2 needs to obtain additional funding from the central bank to be able to process the transfer of the purchase price. What happens with the positive reserve holdings of bank 1? As bank 1 has still credit outstanding with the central bank, it will use α to reduce its central bank borrowing. In case $\alpha > B_1 - Z_1$, bank 1 retains a positive balance on its reserve account. It could thus offer the reserves in the interbank market where bank 2 could borrow it to repay part of its central bank debt. The resulting payment flows between the banks would neutralize the intra-system claims of central bank 1 towards central bank 2. The following tables show the flows of payments and assets for the case where $\alpha < B_1 - Z_1$ for both, the consolidated central bank and the separated central banks (the Eurosystem case).

Household			
Assets		Liabilities	
banknotes	$\sum_i B_i$	equity	$\sum_i E_i$
deposits area 1	$D_1 + \alpha$		
deposits area 2	D_2		
real assets	$\sum_i (E_i - B_i - D_i) - \alpha$		

Corporate			
Assets		Liabilities	
real assets	$\sum_i (D_i + B_i) + \alpha$	to bank	$\sum_i (D_i + B_i - Z_i) + \alpha$
		to CB	$\sum_i Z_i$

Bank area 1			
Assets		Liabilities	
credit corp.	$B_1 + D_1 - Z_1$	deposits	$D_1 + \alpha$
CB reserves	0	CB credit	$B_1 - Z_1 - \alpha$

This transaction does not affect the length of the consolidated central bank's balance sheet, which looks as follows.

Bank area 2			
Assets		Liabilities	
credit corp.	$B_2 + D_2 - Z_2 + \alpha$	deposits	D_2
CB reserves	0	CB credit	$B_2 - Z_2 + \alpha$

Consolidated central bank			
Assets		Liabilities	
credit bank area 1	$B_1 - Z_1 - \alpha$	banknotes	$\sum_i B_i$
credit bank area 2	$B_2 - Z_2 + \alpha$		
outright area 1	Z_1	reserves of banks	0
outright area 2	Z_2		

However, when the central bank balance sheets are disaggregated, then the balance sheet of the area 2 central bank must expand by α, because lending to banks has increased. On the other hand, the length of the balance sheet of the area 1 central bank remains unchanged. The transaction constitutes only an asset swap for the area 1 central bank. The respective offsetting positions are now called *intra-system claims and liabilities*. The intra-system claims and liabilities are initiated between banks. Indeed, when the household (or an institutional investor) decides to sell something to a household or corporate in area 2 (alternatively if a household in area 2 increases its deposits in area 1 at the expense of its deposits in area 2 by μ (see example 2 below)), it will make a payment order to the bank in area 2 to transfer the funds to its account with the bank in area 1. Eventually, the banks settle such transactions in batches within the payment system. Hence the bank in area 2 will give instructions to the payment system to transfer central bank deposits from its account with the area 2 central bank to the account of bank 1 with the area 1 central bank.

Central bank area 1			
Assets		Liabilities	
credit bank	$B_1 - Z_1 - \alpha$	banknotes	B_1
outright	Z_1	reserves	0
intra-system claims	α		

Central bank area 2			
Assets		Liabilities	
credit bank	$B_2 - Z_2 + \alpha$	banknotes	B_2
outright	Z_2	reserves	0
		intra-system liabilities	α

It is important to note that the bank in area 2 only needed to borrow additional funds from the central bank to initiate the transaction via the payment system and not because it decided on increasing its credit operations. The union-wide liquidity deficit does not change in neither case. The liquidity deficits in the individual areas have changed, but as long as $\alpha < B_1 - Z_1$ (as assumed above), or the interbank market functions smoothly, this does not affect the consolidated central bank balance sheet length. If, in contrast, $\alpha > B_1 - Z_1$ and the interbank market breaks down, then the central bank provides the liquidity to one area that it absorbs in the other area.

7.2 Capital movements

It is now assumed that area 2 is for some reason perceived to be more credit risky than area 1 and that the banking system of area 2 therefore suffers from related negative funding shocks. We restrict attention to the deposit shift shock $\tilde{\mu}$, although one could easily extend the analysis to incorporate a shift from deposits towards banknotes.

We consider a moderate shock again such that $\mu < B_1 - Z_1$. Such a shock leaves unchanged the length of the consolidated central bank balance sheet, while it 're-allocates' the total liquidity deficit between the two areas. This deposit shift is reflected in the system of financial accounts as follows:

Household			
Assets		Liabilities	
banknotes	$\sum_i B_i$	equity	$\sum_i E_i$
deposits area 1	$D_1 + \mu$		
deposits area 2	$D_2 - \mu$		
real assets	$\sum_i (E_i - B_i - D_i)$		

Corporate			
Assets		Liabilities	
real assets	$\sum_i (D_i + B_i)$	to bank	$\sum_i (D_i + B_i - Z_i)$
		to CB	$\sum_i Z_i$

Bank area 1			
Assets		Liabilities	
credit corp.	$B_1 + D_1 - Z_1$	deposits	$D_1 + \mu$
CB reserves	0	CB credit	$B_1 - Z_1 - \mu$

Bank area 2			
Assets		Liabilities	
credit corp.	$B_2 + D_2 - Z_2$	deposits	$D_2 - \mu$
CB reserves	0	CB credit	$B_2 - Z_2 + \mu$

The length of the balance sheet of the consolidated central bank remains unchanged. Lending shifts only from banks in area 1 to those in area 2.

Consolidated central bank			
Assets		Liabilities	
credit bank area 1	$B_1 - Z_1 - \mu$	banknotes	$\sum_i B_i$
credit bank area 2	$B_2 - Z_2 + \mu$	reserves of banks	0
outright area 1	Z_1		
outright area 2	Z_2		

When the balance sheets are shown separately, it becomes clear that the length of the balance sheet of the area 1 central bank remains unchanged while the balance sheet of the area 2 central bank expands.

Central bank area 1			
Assets		Liabilities	
credit bank	$B_1 - Z_1 - \mu$	banknotes	B_1
outright	Z_1	reserves	0
intra-system claims	μ		

Central bank area 2			
Assets		Liabilities	
credit bank	$B_2 - Z_2 + \mu$	banknotes	B_2
outright	Z_2	reserves	0
		intra-system liabilities	μ

7.3 Cross-border transactions and intra-bank intermediation

This section combines the two previous transactions and in addition takes up the case of intra-bank intermediation by the central bank when the interbank market between area 1 and area 2 has broken down. Specifically, consider the case where area 2 purchases equity of amount α from area 1 while the area 2 households shift deposits of amount μ to area 1 banks. In addition, we allow for the possibility that the combined size of the transactions becomes so large such that the funding needs of the area 2 banking system exceed the total liquidity deficit of the entire monetary area. This implies that the central bank balance sheet lengthens and the central bank intermediates the banking system.

The two types of transactions may again be interpreted as current account transactions (α) and capital flows (μ). We proceed by simply adding both, α and μ, to the same system of financial accounts that was used in the previous two sections. Central bank intermediation sets in whenever $\alpha + \mu > B_1 - Z_1$.

Household			
Assets		Liabilities	
banknotes	$\sum_i B_i$	equity	$\sum_i E_i$
deposits area 1	$D_1 + \mu + \alpha$		
deposits area 2	$D_2 - \mu$		
real assets	$\sum_i (E_i - B_i - D_i) - \alpha$		

Corporate			
Assets		Liabilities	
real assets	$\sum_i (D_i + B_i) + \alpha$	to bank	$\sum_i (D_i + B_i - Z_i) + \alpha$
		to CB	$\sum_i Z_i$

Bank area 1			
Assets		Liabilities	
credit corp.	$B_1 + D_1 - Z_1$	deposits	$D_1 + \mu + \alpha$
CB reserves	$\max\{0, -(B_1 - Z_1 - \mu - \alpha)\}$	CB credit	$\max\{0, B_1 - Z_1 - \mu - \alpha\}$

Bank area 2			
Assets		Liabilities	
credit corp.	$B_2 + D_2 - Z_2 + \alpha$	deposits	$D_2 - \mu$
CB reserves	0	CB credit	$B_2 - Z_2 + \mu + \alpha$

Consolidated central bank			
Assets		Liabilities	
credit bank area 1	$\max\{0, B_1 - Z_1 - \mu - \alpha\}$	banknotes	$\sum_i B_i$
credit bank area 2	$B_2 - Z_2 + \mu + \alpha$	reserves of banks	$\max\{0, -(B_1 - Z_1 - \mu - \alpha)\}$
outright area 1	Z_1		
outright area 2	Z_2		

The consolidated central bank balance sheet expands by $\max\{0, -(B_1 - Z_1 - \mu - \alpha)\}$, i.e. this is the amount of central bank intermediation that will be observed. In the deconsolidated system of central bank balance sheets, intra-system claims will be simply $\mu + \alpha$, i.e. their size does not depend on whether or not the point of central bank intermediation has been reached. Area 1 banks keep the excess liquidity on their reserve accounts with the central bank because they do not (want to) find

a borrower in the interbank market. This comes at a cost, since the remuneration of central bank reserves or of liquidity absorbing monetary policy instruments is typically below the interest that banks short in liquidity have to pay to the central bank (and which, accordingly, would be paid by these banks in the interbank market).[16]

Finally, suppose that the interbank market would re-open again such that the banks would take over the intermediation function from the central bank again. In this case, the balance sheets of banks become:

Bank area 1			
Assets		Liabilities	
credit corp.	$B_1 + D_1 - Z_1$	deposits	$D_1 + \mu + \alpha$
CB reserves	0	CB credit	$\max\{0, B_1 - Z_1 - \mu - \alpha\}$
interbank lending	$\max\{0, -(B_1 - Z_1 - \mu - \alpha)\}$		

Bank area 2			
Assets		Liabilities	
credit corp.	$B_2 + D_2 - Z_2 + \alpha$	deposits	$D_2 - \mu$
CB reserves	0	CB credit	$B_2 - Z_2 + \mu + \alpha - \max\{0, -(B_1 - Z_1 - \mu - \alpha\}$
interbank lending	0	interbank credit	$\max\{0, -(B_1 - Z_1 - \mu - \alpha)\}$

For the case of deconsolidated balance sheets, a re-opening of the interbank market would lead to a decline of intra-system claims and liabilities in the amount of interbank lending, i.e. resulting claims and liabilities would be $\mu + \alpha - \max\{0, -(B_1 - Z_1 - \mu - \alpha)\}$.

8 Current account deficits, 'replacement lending' and cross-border controls

We now discuss the three core statements extracted from Sinn as summarized in section 1.[17] The balance sheet logic established above is used to analyze these statements.

8.1 Current account deficits

According to Sinn's first hypothesis, the Eurosystem finances via TARGET2 the current account deficits of several euro-area member countries, e.g. Greece, Ireland or Portugal. Sinn (2011b) writes:[18]

[16] In the case of the Eurosystem, the banks would move their excess liquidity at day end to the deposit facility because excess reserves are not remunerated. The remuneration rate stands currently 75 basis points below the rate charged in weekly main refinancing operations. Using the recourse to the deposit facility as a measure for the extent of central bank intermediation shows high intermediation in the euro area during 2009 and 2010 when large levels of excess liquidity led to large recourses to the deposit facility with peaks of up to 350 bn. Recently, these recourses have declined to levels around 10-30 bn thereby pointing to a general reduction in the intermediation activities of the Eurosystem.

[17] Recently, Karl Whelan has brought forward some arguments similar to ours in a blog entry, see Whelan (2011).

[18] Sinn uses the term GIPS to refer to Greece, Ireland, Portugal, Spain.

> Normally, a country's current-account deficit (trade deficit minus transfers from other countries) is financed with foreign private capital. In a currency union, however, central-bank credit may play this role if private capital flows are insufficient. This is what happened in the eurozone when the interbank market first broke down in mid-2007. The GIPS' own central banks started to lend newly printed money to their private banks, and this money was then used to finance the current account deficit. (...) Had the ECB failed to finance these deficits, the GIPS would have had a hard time finding the money to pay for their net imports.

Recall that the example in section 7.1 did not make any assumptions about the occurrence of a crisis. Hence, current account deficits may have also given rise to TARGET2 balances prior to the crisis. Almost all cross-border payment flows are associated with corresponding intra-system claims and liabilities. If the corporate in area 2 were able to obtain a credit directly from the bank in area 1 or if the bank in area 2 were able to borrow on the interbank market from the bank in area 1, offsetting Target2 balances would have occurred. Consider the latter situation. If the interbank market functions well, TARGET2 balances could have been small because liquidity-rich banks in the exporting area may have lent to liquidity-seeking banks in importing areas in the interbank market. When, again for whatever reasons, the interbank market breaks down, the central bank may substitute for this role in two steps: Firstly, the overall liquidity deficit of the banking system vis-à-vis the central bank can be re-allocated across banks; secondly, the central bank can intermediate by accepting surplus funds from liquidity-rich banks and extend lending to liquidity-seeking banks (see section 5 and section 7.3). Moreover, a breakdown of the interbank market is usually associated with a loss of funding of individual banks, i.e. a capital movement away from these banks towards a safe haven. As the examples in section 7.3 have shown, both, current account imbalances and cross-border capital flows, give rise to observationally equivalent TARGET2 balances. Therefore, an assessment of the contribution of current account deficits to variations of intra-eurosystem claims and liabilities, i.e. whether $\alpha < \mu$ or vice versa, requires an empirical analysis. While a rigorous empirical assessment of this issue is difficult due to a lack of publicly available data, we can nevertheless draw some conclusions based on available statistics.

Consider for example the case of Greece, Sinn's prime example. Figure 1 shows quarterly data of Greek current account deficits together with the changes in TARGET2 liabilities. The current account data is taken from the OECD's balance of payments statistics, whereas the changes in TARGET2 liabilities are computed from the balance sheet data provided by the Bank of Greece. Current account deficits increased between 2004 and June 2008 before they started to decline slowly. Recently they hover around EUR 5 bn per quarter which corresponds approximately to the level in 2006. The changes in TARGET2 liabilities do not show a systematic pattern. While relatively low, even sometimes negative, prior to the crisis, they do not show a systematic increase to the level of the current account deficits (even when accounting for possible leads or lags between the two series). But if Sinn's hypothesis, that the current account deficits are financed by the Eurosystem were true, one would observe a systematic pattern in changes of TARGET2 liabilities of approximately the same order of magnitude as the current account deficits. According to the data, this is not the case. There are however several pronounced spikes in TARGET2 liabilities between June 2008 and June 2010. Yet, these spikes are a reflection of the developments during the financial crisis and the ensuing sovereign debt problems. The increase of around EUR 20 bn in the fourth quarter of 2008 mirrors the flight to quality that occurred in the aftermath of the Lehman breakdown in September 2008. The revision of

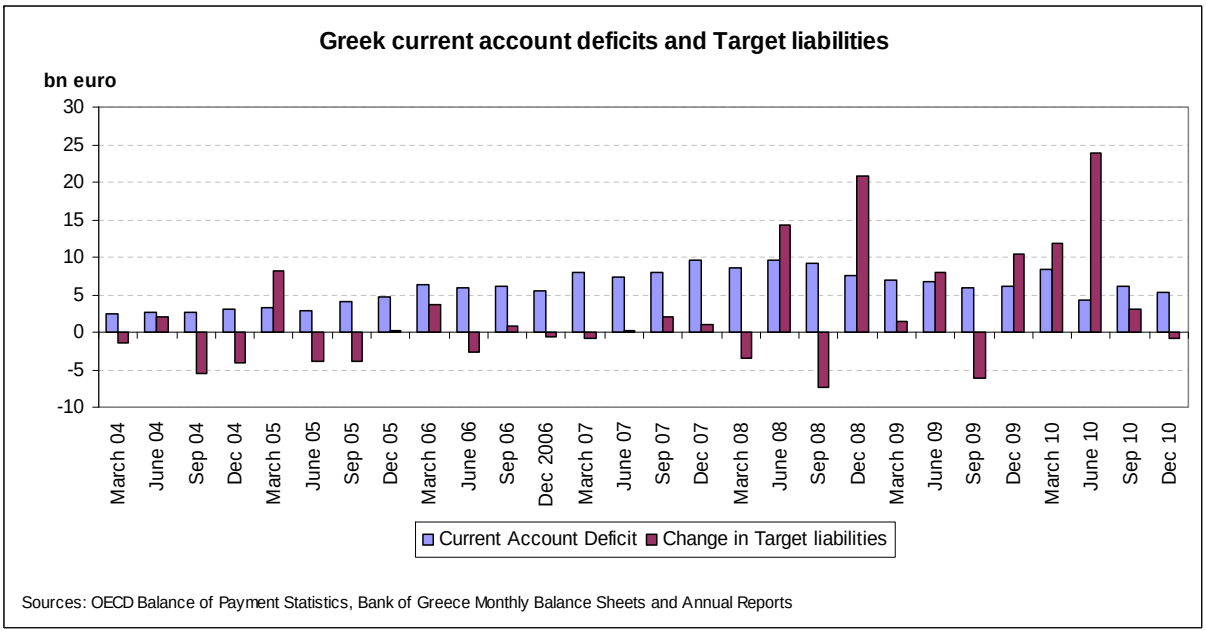

Figure 1: Greek current account deficits and change in TARGET2 liabilities.

the Greek government budget deficits in the second half of 2009 together with repeated news about the Greek government's funding gap sparked new doubts and resulted in further capital outflows during the last quarter 2009 and the first quarter 2010. Eventually, the Greek sovereign crisis reached its peak in May 2010 after further revisions of official figures caused another round of confidence loss in early 2010 and repeated downgrades of Greek government debt by major rating agencies and an incipient roll-over of several billions by the Greek government. These factors contributed to a further movement of capital away from Greece which is reflected in an increase of TARGET2 liablities of around EUR 25 bn in the second quarter 2010.

These events illustrate the example in section 7.2 where the arising funding gaps are due to a shift of deposits and capital market funding away from banks that suddenly lost investor and depositor confidence. In such a situation, central banks normally allow for an increase of central bank funding, in particular if banks can provide collateral in line with the central bank collateral framework.[19] Such a phenomenon is therefore independent of the prevailing level of current account deficits and it can also affect a country with moderate or even no current account deficits. An example is Ireland which during the last ten years exhibited only moderate current account deficits. Figure 2 shows annual data of the Irish current account deficit and the changes in TARGET2 liabilities (Irish intra-system claims and liabilities are only publicly available in a yearly frequency). Again, the current account data is taken from the OECD's balance of payments statistics while the changes in TARGET2 liabilities are computed from the annual reports of the Central Bank of Ireland. The recent changes in TARGET2 claims and liabilities strongly exceed the current account deficits. As reported in the Central Bank of Ireland's annual report 2010, the year-end level of TARGET2 liabilities is at around EUR 145.2 bn,

[19]It should be kept in mind that the collateral framework is standardized across all euro area members. Moreover, with the exception of Spain, all euro area members use pooling systems where banks pledge a pool of collateral that can be fully seized to cover outstanding credit. Therefore, central bank credit is normally over-collateralized. Moreover, assets are valued at transactions prices on which a haircut is applied and the Eurosystem has the right to make margin calls should the credit operations appear to be not sufficiently secured anymore.

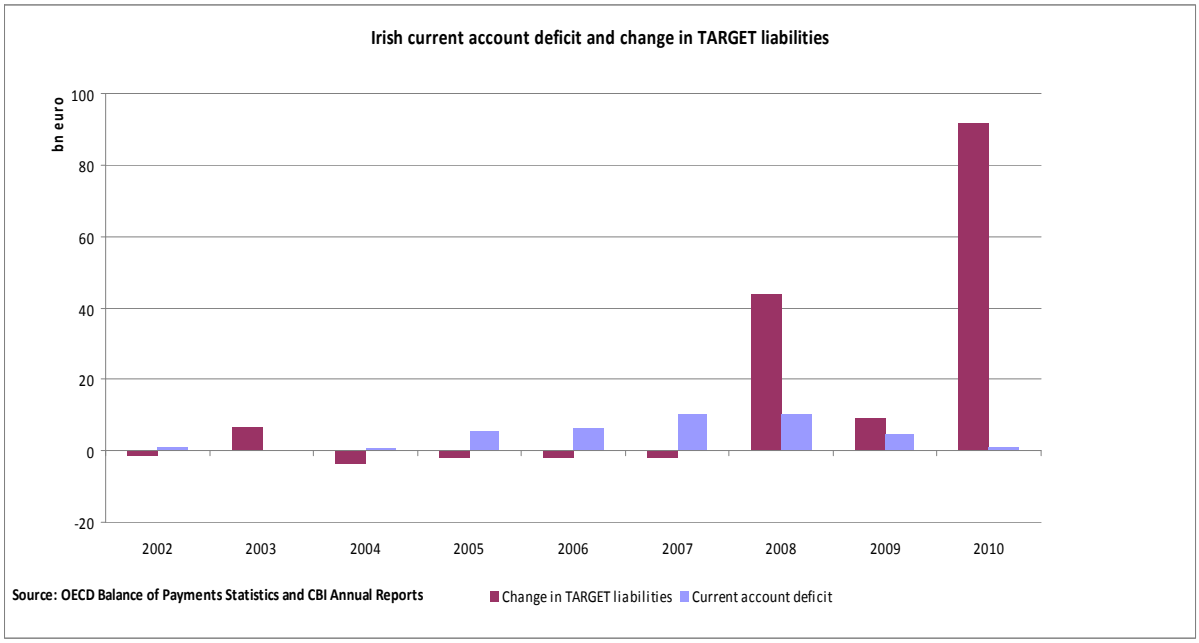

Figure 2: Irish current account deficits and change in TARGET2 liabilities.

whereas the accumulated current account deficits, even if one were to add up the last ten years, sums up to only EUR 41.1 bn.

The large increase in TARGET2 liabilities of around EUR 91.7 bn between the end of 2009 and the end of 2010 can be almost exclusively attributed to the ongoing difficult situation of the Irish banking system and the loss of access to private sector funding. Funding outflows of this order of magnitude could enforce massive asset fire sales of banks, if the central bank was not stepping in to close these gaps. In terms of the financial account logic in section 7.3, the market funding gaps of banks, and hence the gap that may have to be closed temporarily by the central bank to avoid asset fire sales, are a reflection of the bank liability shifts μ (rather than current account transactions α) which reflect preferences (and collective dynamics) of private fund providers, and not necessarily the current account position of the respective country.[20]

8.2 'Credit replacement lending'

According to Sinn's second hypothesis, the increase in TARGET2 liabilities, termed by him as 'Kreditersatzpolitik' (translated as credit replacement policy or replacement lending) comes at the expense of central bank lending and the issuance of 'fresh money' in other euro-area member countries.[21]

[20]In Sinn (2011e) and in a personal correspondence, Sinn explains that his remarks refer to the comparison of the *sum* of the current account deficits with the *sum* of TARGET2 liabilities of Spain, Ireland, Greece, and Portugal. In our opinion, such a comparision is not meaningful. Consider for example just the case of Ireland and Spain. While Ireland has moderate current account deficits (ten year average of around 3.7 bn), Spain has large current account deficits (ten year average of around 55.9 bn). And while Ireland has relatively high TARGET2 liabilities (2010: 145 bn), Spain has relatively moderate TARGET2 liabilities (2009, latest available figure: 41 bn). Suppose that the sum of Irish and Spanish current account deficits (accumulated over some particular period) matches the sum of Irish and Spanish TARGET2 liabilities? Would this observation be sufficient to conclude that the transactions governing the TARGET2 build-up are α- rather than μ-shocks? Clearly not. Moreover, such an exercise depends crucially on the period over which the current account deficits are accumulated.

[21]Sinn is particularly concerned about Germany and the Bundesbank, see e.g. Sinn (2011a) or Sinn (2011e).

The resulting increase in TARGET2 liabilities 'eats up' the monetary base in these countries and can at most continue for two more years before the Eurosystem must sell its gold and foreign exchange reserves.

In particular Sinn (2011b) writes,

> (...) it is time to end this policy - not least because the ECB is running out of ammunition. By the end of last year, the aggregate stock of central-bank money in the euro area was EUR 1.07 trillion euros, and EUR 380 billion euros was already absorbed by ECB credit to the GIPS. So financing a continued GIPS current-account deficit of about EUR 100 billion a year would consume the entire stock of base money within another six or seven years.

And in Sinn (2011c),

> Year by year, the money flowing from the GIPS countries to the other Eurozone countries is crowding out central bank money issued there as well as ECB loans given to those countries commercial banks.

This reasoning is the result of a misunderstanding of the relationship between central bank assets (in particular lending to banks) and central bank liabilities (reserves of banks with the central bank, banknotes, or the sum of the two, the "monetary base"). The TARGET2 claims on the balance sheets of NCBs are matched on the liability side by a corresponding increase in banks' current accounts. Banks can use these current account balances to fulfil their minimum reserve requirements or to pay off central bank credit. If they have no use for the balances they will either offer them in the interbank market or they will shift them onto the deposit facility. If the Eurosystem would consider the system-wide liquidity to be too high, it could absorb the excess liquidity by issuing debt certificates or fixed term deposits. For example, the Eurosystem currently absorbs on a weekly basis the liquidity that is injected via the so-called Securities Market Programme by means of fixed term deposits. Secondly, the lending business of banks in core countries like Germany is in no way constrained by the evolution of TARGET2 liabilities. The evolution of (broader) credit aggregates such as M1, M2 or M3 is not constrained when the banking sector of a particular country has large current account balances or when it shifts balances onto the deposit facility.[22] In particular, it is completely irrelevant whether the reserve holdings of banks are due to a credit from its NCB or whether they are due to transfers of reserves from other banks via the payment system. Gresham's law does not apply in a monetary union.

Moreover, as it was argued above, the TARGET2 balances do not only reflect current account deficits, but, currently to a much larger extent, deposit outflows and the inability of banks to roll over capital market funding. Therefore, if one believes that once TARGET2 balances exceed a certain threshold, a regime change and additional problems may arise, one should rather focus on deposit outflows of banks and the remaining capital market funding in order to estimate how further funding gaps may develop over time.

Finally, it is not clear what "consuming the entire stock of base money" would mean. Firstly, the counterpart of base money is largely in the form of central bank financial assets other than lending to

[22]Consider for example the development of M2 and M3 in Germany. The Bundesbank reports an increase in Germany's contribution to M2 and M3 between December 2009 and December 2010 of 4.2% and 4.4% respectively, *despite* an increase of 83% in the Bundesbank's TARGET2 claims in the same period.

banks (foreign reserves, domestic investment portfolios, etc.). For instance, in the case of the Fed and the BoE, central bank outright holdings of securities exceed banknotes in circulation and have created a huge amount of excess reserves of banks (remunerated at the central bank target rate). Applying Sinn's logic, this should probably also be considered as "consuming the stock of base money" (even if, taking a strict definition of the monetary base, one could argue that base money is endogenous to the outright security holdings of the central bank, and therefore it makes no sense to talk about a consumption of a monetary base in this case). What Sinn may have had in mind is that the countries under an EU/IMF programme could 'consume' the entire liquidity deficit of the euro area banking system vis-à-vis the central bank. Once this would be the case, we would enter the regime of central bank intermediation as described in section 5 above. In this situation, the central bank balance sheet lengthens overall because the central bank provides and absorbs funds at the same time. As the balance sheet examples above illustrate, this is not a problematic situation per se.[23] In particular, there is little intuition in saying that the peripheral countries have "consumed the stock of base money" since banknotes are still being held by, say, German households and German banks have their (growing) share in the total reserve requirements of the the euro area banking system.

8.3 Limits on TARGET2 balances

In order to limit the exposure of the TARGET2-creditors, Sinn proposes to put caps on TARGET2 accounts in order to keep the current account deficits in check. In (Sinn 2011b) he writes,

> It would be better if (...) the ECB instructed its member institutions in the GIPS to demand significantly better collateral for their lending operations. Tight national caps on Target balances could provide the right incentive to comply. Such a cap would not eliminate current-account deficits, but it would reduce deficits to the flow of private capital willing to finance them.

Sinn's proposal to limit Target2 balances essentially implies that a euro in the form of a deposit with the central bank of a country under an EU/IMF programme is not the same as a euro held as a deposit with a core country central bank. This however contradicts the core constituting element of a monetary union - namely that one euro is equal to one euro - across the entire monetary base. Moreover, when announced in advance, such a policy would probably lead to renewed capital flight away from countries facing TARGET2 limits. Among the possible consequences are widespread bank defaults (and a related impairment of the monetary transmission mechanism) and a resulting credit crunch in the respective countries which in turn would be associated with high social costs for *all* parties, including the core countries.

Sinn (2011c) makes a concrete proposal of how to limit the build-up of TARGET2 liabilities. He suggests to settle TARGET2 liabilities once a year by transferring gold, exchange reserves or other marketable assets from TARGET2 debtor NCBs to TARGET2 creditor NCBs. This proposal goes even one step further than simply putting a cap on TARGET2 liabilities in *particular* countries. It implies that *all* countries that may end the year with net TARGET2 liabilities face the threat of being

[23] Sinn (2011f) correctly explains the re-allocation of the liquidity deficit between the banks in the euro area. However, he errs when he writes that this process is limited by the gold or FX reserves of the Eurosystem. As we have explained above, when the central bank deems the banking sector's liquidity too large, it can conduct absorbing operations to withdraw any excess liquidity.

cut off from the monetary union. Moreover, to maintain their membership in the monetary union even countries with low, but constant net TARGET2 liabilities would need to spend considerable resources each year to sustain their banking sector's ability to pay. If such a rule would have been applied since the start of the common currency, the Bundesbank would have depleted almost its entire gold stock during 2000 and 2001[24] and other countries with only moderate net TARGET2 liabilities, e.g. Slovenia, would probably already been unable to make payments to other euro area member countries.[25] Needless to say that such a limit rule invites speculation. A speculator could (a) obtain a credit from a bank in a country perceived to be a potential TARGET2 debtor, (b) transfer the funds to a country within the monetary union that is considered to be a TARGET2 creditor, and (c) invest into a credit default swap with reference asset being a sovereign bond of the debtor country. If only sufficiently many speculators would engage in such transactions, the intra-system liabilities would sooner or later exceed the gold or foreign exchange reserves of the central bank, implying that it becomes unable to process intra-system payments. Maintaining membership in the monetary area would become untenable as maintaining the ability to pay would consume a too large amount of the country's resources. Suppose that the country would therefore decide to leave the monetary union and that its newly introduced currency would depreciate. Given that the government's liabilities would still be denominated in the monetary union's currency (and since its entire gold and foreign exchange reserves have already been depleted) it would default, in which case the CDS buyers would receive a payoff. Hence, Sinn's proposal is first of all tantamount to abandon the monetary union and to replace it by a hybrid system: a monetary union between the TARGET2 creditor countries to which the TARGET2 debtor countries peg their exchange rates. And secondly, this proposal would immediately give rise to self-aggravating speculation against all TARGET2 debtor countries.

Furthermore, during a banking crisis, any limit on intra-system liabilities would not prevent agents from moving their funds away from particular banks. If an electronic transfer via the payment system becomes impossible, accounts could be depleted by withdrawing banknotes. This would increase the amount of banknotes in circulation in the respective countries and would therefore increase the liquidity deficit of the banking sector. The central bank would thus need to close the resulting liquidity gap by increasing its lending operations to the banks in question.

Summarizing, one can certainly not reduce current account imbalances by simply cutting these countries off the payment system as Sinn proposes. Firstly, such a proposal puts into question the mere existence of the monetary union, and secondly, it would not resolve the underlying fundamental factors that led to the build-up of such imbalances, such as in particular different degrees of external competitiveness and diverging fiscal policies. In fact, it is highly questionable whether a cut-off from the rest of the euro area would align the incentives of the governments in the respective countries to enforce the needed structural reforms.

[24] As of 31 December 2001, the Bundesbank's annual report shows gold reserves of amount EUR 35,005 million and TARGET2 liabilities of EUR 30,862 million, see Deutsche Bundesbank (2001, p. 182)

[25] The sum of asset items 1 to 4.1 (since Sinn (2011c) just writes that gold, FX reserves and other marketable assets could be used to balance TARGET2 claims and liabilities, hence we therefore added up all assets not related to monetary policy purposes) in the latest annual report of Banka Slovenije amounts to around EUR 1 billion, while TARGET2 liabilities amount to around EUR 3.3 billion, see Banka Slovenije (2009, p. 80).

9 Conclusion

This article has provided a framework of financial accounts that can be used to analyze the development of the liquidity deficit of the banking system vis-à-vis the central bank and the evolution of intra-system claims and liabilities in a monetary union. Such a framework is needed in oder to understand the mechanics and economics behind TARGET2 developments in the euro area. We explained how central banks world-wide have reacted to the financial crisis and to the resulting halt of interbank lending and capital market funding by intermediating the financial system. While this caused a lengthening of their balance sheets, central banks were thus able to close the funding gaps of financial institutions that would have otherwise led to devastating asset fire sales spirals and widespread defaults.

By using the stylized framework of financial accounts, we showed that current account deficits and capital movements give rise to observationally equivalent variations in intra-system claims and liabilities. In addition, we explained that there is little evidence for the hypothesis that recent TARGET2 developments reflect the financing of current account deficits of euro area members Greece and Ireland but that they rather mirror the still ongoing funding crisis in these countries. Moreover, as was argued in section 8, the hypothesis that rising TARGET2 claims constrain the monetary development in creditor countries is false and is based on a confusion of the concepts of a *liquidity deficit* and the *monetary base*. Accordingly, the limitation of TARGET2 liabilities in several member countries would neither have an effect on the lending business of banks in TARGET2 creditor countries, nor would it realign the incentives of governments to implement needed structural reforms. It would, however, put into question the existence of the monetary union and the common currency.

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