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Steiner, Andreas; Steinkamp, Sven; Westermann, Frank

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Exit Strategies, Capital Flight and Speculative Attacks: Europe's Version of the Trilemma^{*}

Andreas Steiner[†]
University of Groningen and CESifo

Sven Steinkamp[‡]
Osnabrück University

Frank Westermann[§]
Osnabrück University and CESifo

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ABSTRACT

In the winter 2011/12, a wave of internal capital flight prompted the ECB to abandon its exit strategy and announce an unprecedented monetary expansion. We analyze this episode in several dimensions: (i) we provide an event-study analysis, covering key variables from national central banks' balance sheets, (ii) we rationalize the empirical patterns in a formal discussion of the constraints in a monetary union and (iii) we analyze different indicators of redenomination risk in the euro area. Finally, we argue that the euro area entails an inherent policy trilemma that makes it prone to speculative attacks.

JEL Classification: E42; F36; F41; F45.

Keywords: Currency Union; Policy Trilemma; Redenomination Risk; Speculative Attack; TARGET2.

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[†] Corresponding author: Andreas Steiner, University of Groningen, Faculty of Economics and Business, Department of Global Economics and Management, Nettelbosje 2, 9747 AE Groningen, The Netherlands, e-mail: a.c.steiner@rug.nl.

[‡] Sven Steinkamp, Osnabrueck University, Institute of Empirical Economic Research, Rolandstr. 8, 49069 Osnabrueck, Germany, e-mail: sven.steinkamp@uni-osnabrueck.de.

[§] Frank Westermann, Osnabrueck University, Institute of Empirical Economic Research, Rolandstr. 8, 49069 Osnabrueck, Germany, e-mail: frank.westermann@uni-osnabrueck.de.

1 Introduction

In small open economies with fixed exchange rates, the central bank often faces the challenge that it cannot accommodate capital flight with a monetary expansion, while at the same time keeping the exchange rate fixed. At some point countries run out of reserves and a speculative attack breaks the monetary arrangements apart.

During the euro crisis, the ECB has faced a similar policy trilemma: In the winter 2011/12, internal capital flight reached its peak when national central banks (NCBs) implemented the ECB's full allotment policy and provided one trillion euros of refinancing credit to banks.¹ At the same time, the ECB started to pursue an exit strategy from unconventional policies, by raising interest rates and collateral standards. These parallel developments generated severe market tensions and rising break-up expectations. In early December 2011, when banks started using the swap line and borrowed from the ECB in US Dollars,² a major policy reversal took place. The ECB announced the "Big Bazooka", in the form of two tranches of 3-year longer-term refinancing operations (LTROs). In the summer of 2012, the whatever-it-takes statement implied that for the foreseeable future liquidity support would be unlimited. Interestingly, Christian Noyer, Governor of the Bank of France, interprets the ECB's actions during this period as a "*solid shield against further speculative attacks*."³

In this paper, we interpret the events of 2011/12 in the context of the speculative attack literature. What are the constraints for NCBs when providing refinancing credit to banks? What has been the trigger event that caused speculative capital flows? And what role do political economy considerations play?

To address these questions, we analyze the institutional characteristics of the euro area with a particular focus on the NCB's balance sheets and the TARGET2 clearing system. We show theoretically that the common central bank of a currency union cannot simultaneously control the aggregate monetary base and delegate the implementation of a full-allotment policy to NCBs⁴. Also, while de jure unlimited, there is a de-facto limit of the TARGET2 imbalances, as claims and liabilities cannot become larger than the monetary base. At the time of a speculative attack, the ECB is forced to abandon one of the following incompatible objectives: (i) the full-allotment policy, (ii) its monetary target or (iii) the single currency. This result is reminiscent of the well-known *impossible trinity*. In contrast to the literature, however, we focus on policy options within a single currency area, not on individual countries. Financial market participants anticipating this predicament will attack the currency union when the ability to accommodate internal capital flight – given a particular monetary target – reaches a critically low level.

The empirical analysis in this paper consists of two parts. First, we highlight key indicators from central bank balance sheets in an event-study analysis, centered around the ECB's monetary expansion on December 8, 2011. In particular, we document the patterns of refinancing credit, deposits, reserves, swap lines and TARGET2 balances. We derive a set of stylized facts by comparing a group of crisis countries – Greece, Italy, Ireland, Portugal and Spain (GIIPS) – with a set of countries that have been the recipients of capital flight – Germany, the Netherlands, Finland and Luxembourg (DNFL).

Secondly, we empirically analyze the redenomination risk in the euro area and illustrate that it reached a peak-value when the trilemma became binding for the first time in December 2011. This finding is based on

¹ See Sinn and Wollmershäuser (2012), who interpreted the euro crisis as a classical balance of payments crisis, and Tornell (2013), as well as references therein.

² See also Cecchetti et al. (2012), who argue that the "Flows of funds suggest that 2012's last leg up in TARGET2 balances reflected something more akin to a currency attack than current account financing or credit reversal."

³ Speech by Christian Noyer, Governor of the Bank of France and Chairman of the Board of Directors of the Bank for International Settlements, at the Institute of International Finance, Paris, 26 June 2013. The statement was made with special reference to the Outright Monetary Transactions (OMT) program.

⁴ While the ECB's target is inflation, not the monetary base, ECB president Trichet has explicitly mentioned the role of the monetary base in steering inflation in a speech on the exit strategy in 2009 (see Trichet, 2009).

different indexes of break-up risk, such as the redenomination-risk component in bond yields, Google searches for Euro break-up and the implied break-up probability from a betting platform. In a principle components analysis, we combine all three indicators to visualize their common pattern.

Finally, based on theory and the empirical analysis, we argue that the ECB's exit strategy in the summer of 2011 can be interpreted as a trigger event for speculative capital flows and the increase in redenomination risk. It added a third policy objective to the earlier decision on full allotment and the overall objective of keeping the single currency intact. The monetary expansion in December 2011 postponed the break-up scenario and the promise of unlimited liquidity ultimately forestalled the dynamics.

From a political economy perspective, we point out that the letter from Bundesbank President Weidmann to the ECB, requesting a collateralization of TARGET2 claims, may have further fueled capital flight. It has played a similar role as the well-known "Emminger Letter" before the break-up of the ERM. We discuss the link of our paper to the political economy literature on the trilemma, which analyses how central banks position themselves in the decision-triangle, and how this decision is influenced by ideology and voting pressure.

The remainder of the paper is organized as follows: The next section describes the behavior of key balance sheet variables around December 2011. Section 3 derives the European version of the trilemma and highlights similarities and differences to standard first-generation speculative attack models. Indexes of break-up risk are presented in Section 4. Links of our paper to the existing literature are discussed in Section 5, and followed by the final section on policy conclusions.

2 Empirical Patterns on Central Bank Balance Sheets

We start our analysis with the pattern of key variables on central banks' balance sheets around December 2011 when the ECB abolished its exit strategy and announced an unprecedented monetary expansion, often referred to as the "Big Bazooka".⁵ In subsequent sections, these facts will be used as a basis for the theoretical analysis.

Stylized Fact 1: In 2011, the ECB's exit strategy became incompatible with a continued monetary expansion in the GIIPS.

At the peak of the financial crisis, in October 2008, the ECB had reacted with a full-allotment policy, which led to an expansion of refinancing credit to private banks by €372 bn. Thereafter, however, it has managed to return aggregate lending back to its original trend growth (see Panel A of Figure 1). This return to trend growth was not only due to a reduced demand for refinancing credit, but rather was a result of a policy reversal of the ECB. Since mid-2009, the ECB had gradually started an exit strategy, which can be seen by the tightening of collateral standards and an increase in the main refinancing rate in the beginning of 2011 (see Panel B of Figure 1).⁶ For example, the ECB decided on additional requirements for asset-backed securities to be eligible for use as collateral (November 2009), suspended the use of foreign-currency debt instruments (April 2010), applied higher haircuts (July 2010) and underlined that the ECB is able to "suspend, limit or exclude counterparties' access to monetary policy instruments on the grounds of prudence" and to reject or limit the use of assets submitted as collateral by specific banks (October 2010). Moreover, ECB officials started talking about exit strategies and increased the main refinancing rate from 1.0% in the first quarter of 2011 to 1.5% in the third quarter. For instance ECB President Jean-Claude Trichet stated that the 12-month liquidity injections from

⁵ See also Sinn and Wollmershäuser (2012) and Sinn (2014) for a comprehensive overview. An alternative interpretation of interest rate pattern and self-fulfilling speculative dynamics, based on multiple equilibria in financial markets, is offered in De Grauwe and Ji (2013).

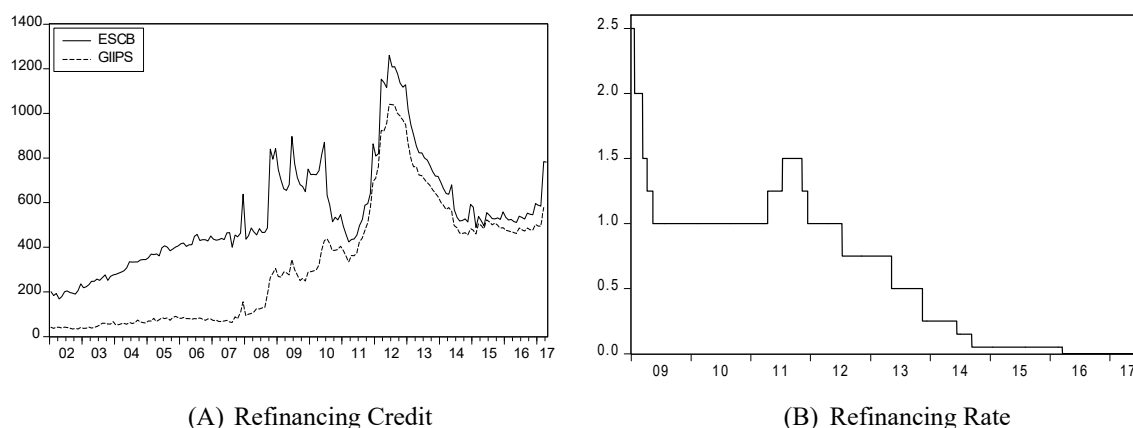
⁶ The debate was started in a speech by Jean-Claude Trichet titled "the ECB's Exit Strategy", held at the CFS conference "The ECB and Its Watchers XI", Frankfurt, 4 September 2009 (Trichet, 2009).

December 2009 would be the last of its kind (see De la Dehesa, 2009, p.3).

By mid-2010, the media widely regarded ECB monetary policy to be in the process of exiting from its exceptional credit provision. While the ECB never announced an explicit monetary base target or upper limit on credit, its President Trichet explicitly mentioned the phasing out of “enhanced credit support” as part of the ECB’s exit strategy. While the ECB’s monetary target at this point was broad money, Trichet highlighted in his speech that “Of course, central bank credit and broader monetary aggregates are linked over time.” (Trichet, 2009).⁷

Figure 1 furthermore shows that the exit strategy became incompatible with the expansion of refinancing credit in the GIIPS. Shortly before the ECB abolished its exit strategy, refinancing credit in the crisis countries accounted for the majority of the refinancing credit in the euro area as a whole. If this expansion had continued at the same pace, further credit provision in these countries could not have been offset by a parallel reduction in refinancing credit in other countries. Instead, aggregate refinancing credit would have had to increase – and thus the exit strategy of the euro area as a whole, would have had to be abolished.

Figure 1: ECB Monetary Expansion and Exit Strategy



Notes: Panel A shows total refinancing credit of the central banks of Greece, Ireland, Italy, Portugal and Spain (dashed line) versus the total Eurosystem (solid line) [bn €], Panel B shows the Eurosystem main refinancing rate for fixed-rate tenders [% p.a.]. Sources: ECB SDW (Codes: ILM.W.U2.C.A050000.U2.EUR, FM.D.U2.EUR.4F.KR.MRR_FR.LEV).

Stylized Fact 2: Monetary aggregates masked asymmetries on NCB balance sheets.

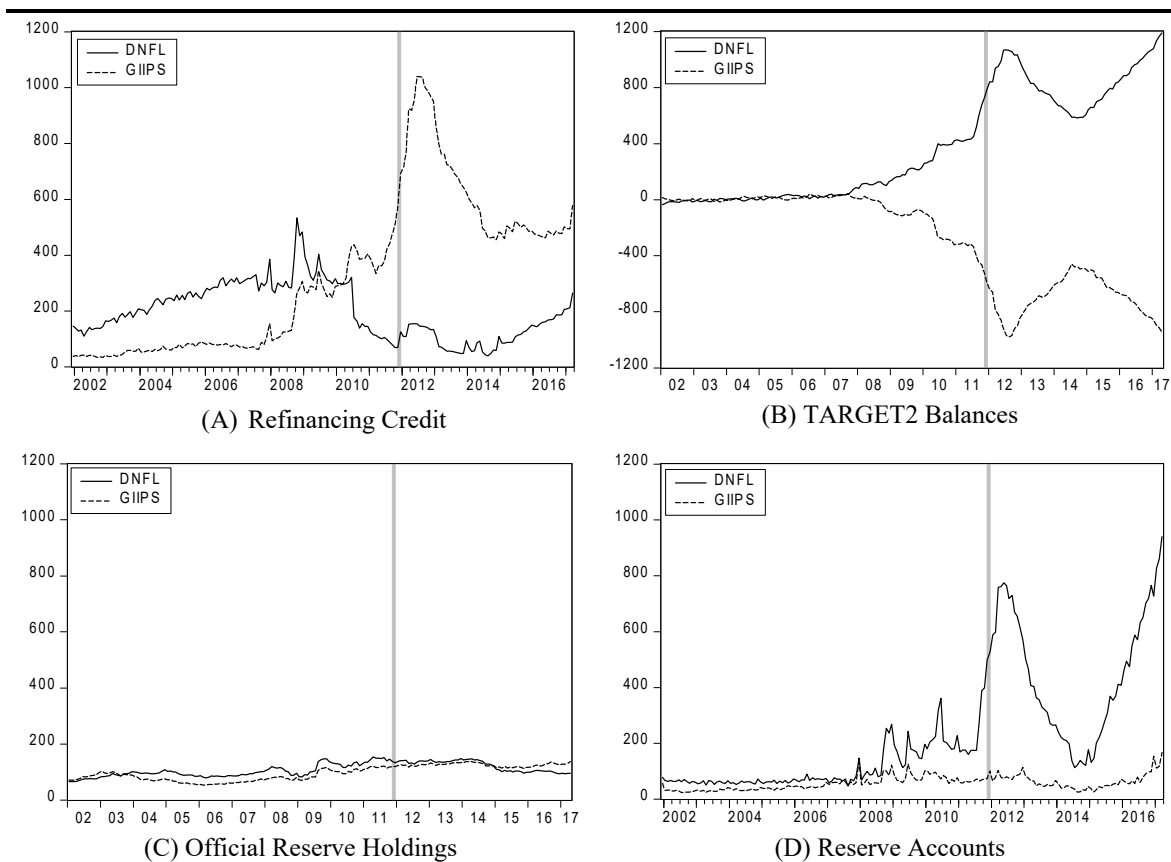
The pattern of monetary aggregates, such as the refinancing credit displayed in Figure 1, has been masking important asymmetries across NCBs. Figure 2 displays the patterns of key NCB balance sheet components for two groups of countries, the GIIPS and DNFL. In the upper left quadrant (Panel A), one can see that central bank credit expanded in the GIIPS up to the summer 2012, while it was falling in DNFL. This process of asymmetric liquidity provision was – due to a wave of capital flight - associated with a strong increase of claims and liabilities between NCBs (TARGET2 balances), depicted in Panel B of Figure 2. At the peak-value, in

⁷ See also De la Dehesa (2009), who quotes Trichet with the statement that “unconventional liquidity injections have also a limit”.

August 2012, DNFL had accumulated €1056 bn in TARGET2 claims while GIIPS had €1000 bn in liabilities.⁸ Unlike historical experiences of balance of payments crises in emerging market economies, however, official reserve holdings remained largely unchanged (see Panel C).⁹

Interestingly, the increase in TARGET2 balances that started in 2007 was initially not associated with an increase in excess reserve deposits at the central banks. Reserve accounts of private banks with their central banks have increased only moderately in both groups of countries, just up to the point where DNFL's refinancing credit was to approach zero. At this point excess reserves in the DNFL jumped sharply upwards while the reserve accounts in the GIIPS remained at their low level (Panel D).

Figure 2: Asymmetries between Core and Periphery Central Banks



Notes: Shaded area marks December 2011. All series in billions of euros. Sources: IMF International Financial Statistics (Codes: RAFA, FASMBLD, FASAD), Euro Crisis Monitor, authors' calculations.

⁸ Most recently, since 2015, TARGET2 balances have again been experiencing a rapid increase. In contrast to their earlier rise up to 2012, this increase is largely unrelated to the provision of refinancing credit by NCBs. Instead, the policy of Quantitative Easing (QE) is often implemented by asset purchases of NCBs abroad. NCBs in the countries where the assets are purchased credit the money to the seller's reserve account and get a TARGET2 claim in return. The buying NCB gets a TARGET2 liability. Given that this transaction is unrelated to the amount of refinancing credit, this accumulation of claims and liabilities is not subject to the same constraints discussed in our paper, as each additional bond purchased automatically generates the liquidity needed to accommodate the increase in TARGET2 balances.

⁹ Compared to other episodes, for instance the Tequila Crisis in Mexico (1994), this is a remarkable difference. See, for instance, Sachs et al. (1996).

3 The Trilemma of the Euro Area

In the following section, we rationalize the empirical patterns described above from a central bank perspective. To this end, we analyze how capital flight affects the balance sheets of NCBs and the common central bank. This allows us to identify a set of constraints from which Europe's version of the trilemma emerges.

3.1 Central bank balance sheets in a currency union

To illustrate the constraints of the Eurosystem, we consider the following setting: Two countries, Country 1 and Country 2, form a currency union.¹⁰ They establish a common central bank (CCB), which sets monetary policy. Monetary policy operations, however, are undertaken by NCBs. In particular, the provision of central bank money remains in the responsibility of the NCBs in accordance with common monetary policy.

Central bank liabilities consist of money in circulation (M) and deposits of commercial banks on their reserve accounts (D). Refinancing credit (C) and international reserves (R) form the central banks' assets. In practice, other assets including government bonds constitute an additional item on the asset side of central bank balance sheets. For simplicity, we abstain from explicitly including it in this analysis and assume that other assets are held constant. Moreover, we do not consider net worth, which might show up on the liability side as an accounting item.

To follow as closely as possible the current institutional settings of the euro area, our model of a currency union is characterized by the unique feature that NCBs may accumulate liabilities and claims towards each other. These are called TARGET positions (T). The interesting feature of TARGET assets is that they may become negative. They exist in the form of assets and liabilities. In the aggregate over all countries they sum up to zero and thus $T_1 = -T_2$. This is empirically confirmed by the opposed behavior of TARGET2 balances in GIIPS and DNFL countries. The other asset types – refinancing credit and foreign reserves – in turn, cannot fall below zero (refer to Figure 2 to track the behavior of these asset types in the euro area).¹¹ The stylized central bank balance sheets of our currency union are shown in Figure 4.

Figure 3: Stylized Central Bank Balance Sheets in a Currency Union

		CCB			
		Assets	Liabilities		
		C	M		
		R	D		
NCB ₁				NCB ₂	
Assets	Liabilities			Assets	Liabilities
C_1	M_1			C_2	M_2
R_1	D_1			R_2	D_2
T_1				T_2	

The consolidated balance sheet of the currency union corresponds to the sum of the balance sheets of

¹⁰ This model may easily be expanded to the case of n countries. Alternatively, Countries 1 and 2 may be interpreted as two groups of countries, with TARGET assets and TARGET liabilities, respectively.

¹¹ Unconventional monetary policies may allow central banks to hold net domestic liabilities. This presupposes that central banks issue their own securities. By way of example, the issuance of debt certificates by the ECB is one of its instruments for open market operations. To date, however, this tool has not been used. Moreover, legally, the ECB, but not the NCBs, is allowed to issue debt. Similarly, a central bank may have net liabilities in foreign currency. This, however, implies that foreign entities provide credit to the central bank. Examples are central bank swap lines.

NCBs.¹² Variables without index denote currency union-wide aggregates, e.g. $M = M_1 + M_2$. A bar over a variable denotes fixed values.

Assume for simplicity that both NCBs are of equal size such that each one accounts for half of the assets of the consolidated balance sheet. This capital share is determined when the currency union is created. It is fixed over time. The division of the components of the consolidated balance sheet between the NCBs, however, is not predetermined. Theoretically, the entire refinancing credit can move to the balance sheet of one NCB. The accounting identity implies for the currency union that

$$\sum_{i=1}^2 M_i + \sum_{i=1}^2 D_i = \sum_{i=1}^2 C_i + \sum_{i=1}^2 R_i, \quad (1)$$

where i is a country index.

Let us assume that monetary policy is determined by the common central bank, which targets the evolution of the monetary base defined as $M0 = M + D$.¹³ This assumption is consistent with Stylized Fact 1, which shows that the ECB was following an exit strategy for the euro area in its entirety. By implication, union-wide central bank assets are constant. Although NCBs continue to implement the ECB's full allotment policy, the balance sheet of the common central bank cannot be extended in the aggregate.

Assets consist of reserves and refinancing credit. For simplification, we assume that NCBs hold their reserve levels constant because they are not allowed to intervene in the foreign exchange market without approval of the common central bank.¹⁴ By implication, union-wide supply of refinancing credit is constant.

PROPOSITION 1 (*Balance sheet constraint in a consolidated currency union*)

For $M0 = \overline{M0}$ and $R = \overline{R}$, it follows from equation (1) that $C = \overline{C}$.

Let us turn to the individual NCBs' balance sheets. The balance sheet constraint (1) augmented by intra currency union TARGET claims and liabilities implies for each NCB:

$$M0_i = C_i + \overline{R}_i + T_i. \quad (2)$$

This identity shows that an increase in refinancing credit, C_i , must be balanced by a decrease (liability) of T_i assets or an increase in the monetary base $M0_i$. Remember that the NCBs' monetary base may increase or decrease; the constraint of a constant monetary base only applies to the monetary union as a whole.

PROPOSITION 2 (*Balance sheet constraint for individual members of the currency union*)

If in a monetary union with NCBs (1) $M0 = \overline{M0}$ and (2) $R_i = \overline{R}_i$, then $\Delta C_1 = -\Delta C_2$.

PROOF. Given that $T_1 = -T_2$, (2) can be rewritten for Country 1 as

$$M0_1 = C_1 + R_1 - T_2.$$

¹² In practice, NCBs might transfer capital to the common central bank. From an accounting perspective, however, it makes no difference whether the common central bank is endowed with its own capital, whether its capital enters as a liability towards the NCBs or whether its own balance sheet is empty. In any case, the union-wide central bank balance sheet is not affected by the distribution of intra-Eurosystem claims and liabilities.

¹³ Provided that the money multiplier is stable, this is in line with a policy of money targeting where the central bank's target is a money aggregate like $M1$, $M2$ or $M3$. The ECB, for instance, monitors developments of $M3$ and its components as part of its two-pillar strategy of monetary policy.

¹⁴ See "Guideline of the ECB, 23 October 2003 for participating Member States' transactions with their foreign exchange working balances pursuant to Article 31.3 of the Statute of the ESCB and of the ECB (ECB/2003/12)."

Aggregating over both countries, one gets

$$\overline{M0} = C_1 + C_2 + \overline{R}. \quad (3)$$

■

To hold the union-wide monetary base constant, any increase ΔC_1 has to be offset by an equal decrease ΔC_2 . This means that an increase in refinancing credit in one country is offset by an equal decrease in refinancing credit in the union's remaining countries.¹⁵ We call this mechanism *reserve constraint* because of its similarity to the flow of reserves between central banks outside a monetary union in the face of a balance of payments deficit.

COROLLARY 1: If the amount of aggregate refinancing credit is constant and finite, refinancing credit provided by an individual NCB cannot grow indefinitely.

TARGET balances thus can be expressed as the difference between monetary base and refinancing credit:

$$T_i = M0_i - C_i - \overline{R}_i \quad (4)$$

While, legally, there exists no upper or lower limit to TARGET balances, TARGET liabilities are constrained by the other central bank's ability to accumulate TARGET assets. As before we assume that NCB₁ increases its TARGET liabilities with respect to NCB₂.

PROPOSITION 3 (TARGET constraint)

If the common central bank follows an exit strategy for the entire monetary union ($M0 = \overline{M0}$), there exists an upper limit for TARGET balances, given by

$$T^{max} = \overline{M0} - \overline{R}_2. \quad (5)$$

PROOF. The TARGET limit can be derived from the balance sheet equation of the TARGET-assets-receiving central bank, hence NCB₂ in our example (see equation (4)) after setting $C_2 = 0$ and $M0_1 = 0$ such that $M0_2 = \overline{M0}$. In this extreme case the entire monetary base has been transferred to NCB₂.

■

TARGET balances may not exceed the aggregate monetary base minus reserves of the NCB with TARGET claims. This limit is reached when refinancing credit of the NCB with a positive TARGET position has fallen to zero. Except reserves, all assets of the NCB with TARGET claims have been transformed into TARGET claims.

3.2 Imbalances

In the following sections, we examine under which conditions the TARGET constraint might become binding. To this end, we consider two possible scenarios: (i) a current account deficit in Country 1 with respect to Country 2, which is not financed by private capital flows and (ii) capital flight from Country 1 to Country 2.

¹⁵ It is worth noting that we abstract from the presence of other assets on the central bank balance sheets. In practice, these may provide some additional leeway: To hold the monetary base constant, central banks may offset an increase in refinancing credit by a sale of other assets (e.g. government bonds) instead of reducing refinancing credit in the other country. However, once all other assets were sold, the limits as described above apply. Moreover, NCB₂ may issue debt certificates when $C_2 = 0$. This, however, would be an unconventional policy and has to be announced well in advance to impede an attack. If speculators question the sustainability of the central bank balance sheet, the announcement itself might provoke an attack. In theory, deposits of commercial banks on their reserve accounts provide an alternative source to fund cross-border transactions without affecting the monetary base.

Both transactions imply that agents from country 1 exchange central bank money of country 1 for central bank money of country 2. With respect to central bank accounting, both transactions are identical: They increase refinancing credit of NCB_1 in exchange for growing liabilities of NCB_1 towards NCB_2 . These scenarios correspond to the developments in the euro area as described in Appendix 1.

3.2.1 Imbalances without currency union

To highlight the particularities of a currency union, we first describe the effects for countries that supply their own money. A cross-border transaction from Country 1 to Country 2 implies that NCB_1 loses reserves and its balance sheet contracts. Sterilization via the provision of refinancing credit allows NCB_1 to restore the balance sheet total and to keep the amount of central bank money constant. NCB_2 's balance sheet is affected by opposed transactions: The net inflow of money increases its reserves and its liabilities to the banking sector. The increase in central bank money can be sterilized through a reduction in refinancing credit.

Note that, for both NCBs, the transaction changes the supply of central bank money in the first place. Sterilization allows the balance sheet length to remain constant and the transactions materialize as an accounting exchange on the asset side. The maximum amount of sterilization, however, is limited: When NCB_2 's assets are entirely held in the form of foreign exchange, further inflows of reserves cannot be sterilized. Comparably, the external resources of NCB_1 are limited. When NCB_1 has lost all reserves, cross-border payments can no longer be financed.

3.2.2 Imbalances in a currency union

Central bank balance sheet accounting perspective

In a currency union, the same net capital flows affect central bank balance sheets in the following way: Since we only consider transactions within the currency union, the aggregate balance sheet of the system of central banks remains unchanged. NCB_1 increases refinancing credit and accumulates liabilities with respect to NCB_2 (TARGET liabilities increase). Note that the TARGET position basically assumes the function played by reserves of an individual central bank operating outside a currency union: While an independent central bank runs down its reserves to finance a balance of payments deficit, a NCB operating in a currency union accumulates liabilities towards other member central banks. NCB_2 registers opposing effects: Its refinancing credit decreases while its TARGET assets increase.

The differences are striking: Outside a currency union, capital outflows contract the central bank balance sheet and central bank money is destroyed. Capital inflows create central bank money. Within a currency union, neither capital inflows nor capital outflows affect the amount of central bank money. That is, the effects of capital flows on the provision of central bank money are automatically sterilized.

However, analogously to the case of independent central banks, the capacity to sterilize within a monetary union is limited. Sterilization implies that domestic assets decrease in the country with capital inflows. When $C_2 = 0$, TARGET balances reach their upper limit (see equation (5)) and further capital inflows cannot be sterilized. The increase in reserves is replaced by an increase in claims towards the other central bank. In other words, while outside of a currency union assets are transferred between central banks, within a union this transaction is replaced by a claim on the assets of the other central bank.¹⁶

¹⁶ Note that the described system of TARGET claims and liabilities reflects the current institutional rules, i.e. we abstract from possible institutional reforms in our analysis of the constraints. For example, Sinn and Wollmershäuser (2012) discuss the possibility that TARGET claims could be redeemed by transferring marketable assets between the national central banks. This corresponds to the US Federal Reserve System where net capital flows also induce de facto movements of bonds between districts' Federal Reserve Banks. Rossi (2013, 2017) furthermore suggests the ECB (or, alternatively, the ESM) to assume the role of a settlement institution issuing the means of final payment between any two EMU member countries. He argues that the lack of payment finality is the monetary-structural reason facilitating imbalances in the euro area.

There exists also an analogy with central bank swap lines, which have been institutionalized during the recent financial crisis. While a swap line allows the central bank to transfer money without tapping its stock of reserves, TARGET liabilities allow money transactions without transfer of securities. As such, the TARGET assets of the central bank of the country with net capital inflows can be interpreted as a swap line provided to the central bank of the country with net capital outflows.

Balance of payments accounting perspective

The implications of TARGET balances can alternatively be illustrated by the balance of payments identity, which can be expressed for country i as

$$CA_i - KA_i = 0 \quad (6)$$

Where CA is the balance of the current account and KA denotes the balance of capital and financial account.¹⁷ KA may be split in changes in the net foreign asset position of the central bank (KA^{CB}) and changes in the net foreign asset position of the rest of the economy (KA^{PR}). The net foreign asset position of the central bank may change due to changes in international reserves, changes in TARGET balances and changes in other central bank assets (ΔOCB). Hence, equation (6) can alternatively be expressed as

$$CA_i - KA_i^{PR} = \Delta R_i + \Delta T_i + \Delta OCB_i$$

This expression shows the following: First, any deficit in the current-cum-financial account can be financed through the sale of reserves by the central bank. This is the policy of exchange rate defense through foreign exchange market interventions. Second, in a currency union, the TARGET settlement system provides additional flexibility to finance imbalances within the union. To indirectly finance a deficit, NCBs can accumulate liabilities towards other member central banks. This can be considered as an alternative way to defend the fixed exchange rate system between members.¹⁸

PROPOSITION 4 (*Refinancing credit's role as reserves*)

If the common central bank follows an aggregate exit strategy ($M0 = \overline{M0}$), the ability to finance balance of payments deficits within the currency union is restricted by the availability of refinancing credit in the surplus country.

PROOF. For given liabilities, NCB_2 can only further increase T_2 if C_2 falls. Hence, the balance of payments identity of Country 1 reads

$$CA_1 - KA_1^{PR} = \Delta R_1 + \Delta C_2 + \Delta OCB_1.$$

■

As such, refinancing credit of NCB_2 assumes the same role as international reserves do for a central bank issuing its own currency: They fall until they reach a lower bound. Payments can only be settled until $C_2 = 0$.

Implications

The TARGET system has two implications: In the short run, it provides flexibility. It buffers imbalances within

¹⁷ According to the IMF's definition, financial transactions are recorded either in the financial or capital account. For simplicity, we aggregate both accounts and refer to them as financial account in the rest of the paper.

¹⁸ Sinn and Wollmershäuser (2012, p. 488) also show that the balance of payments identity of euro countries is augmented by the TARGET position and state that "the increase of a country's Target liability over one year, i.e. its Target deficit, equals the sum of (private and public) net capital exports and the current account deficit vis-à-vis other euro countries."

a currency union. NCBs provide liquidity to each other without affecting their international reserves. In the long run, however, TARGET positions reach a limit very much alike international reserves may be exhausted. TARGET liabilities reach their limit when refinancing credit in the partner country has fallen to zero. Net transactions from Country 1 to Country 2 may no longer be feasible. As a corollary of Proposition 1, rational agents anticipate that the system of central banks can choose between three scenarios.

COROLLARY 2: *Persistent balance of payments deficits vis-a-vis other countries of a currency union will eventually require one of the following policy responses:*

- (i) *Transactions from Country 1 to Country 2 are no longer executed,*
- (ii) *the currency union collapses, or*
- (iii) *the common central bank pursues an expansionary monetary policy.*

Corollary 2 illustrates Europe's version of the trilemma, which we depict in analogy to the classical macroeconomic trilemma in Figure 4. One of three potential policy goals must be waived. In scenario (i) the unidirectional suspension of transactions from Country 1 to Country 2 lowers the value of deposits in Country 1 relative to those in Country 2. The market exchange rate deviates from the officially fixed rate. If the currency union breaks up (scenario ii) the exchange rate of Country 1 depreciates relative to Country 2 and restores the equilibrium in the balance of payments. Since the sterilized expansion of TARGET balances is no longer feasible, in scenario (iii) the common central bank relaxes this constraint by an expansionary monetary policy.

Figure 4: Europe's Version of the Trilemma



3.3 Speculative attack in the currency union

We have shown above that in the presence of free capital mobility and persistent unbalanced cross-country capital flows an exit strategy based on a monetary target is not compatible with a functioning currency union. Speculative pressures might induce the central bank to forego its monetary target. In this setting, the insights of the literature on speculative attacks on fixed exchange rate systems apply (see Flood and Garber, 1984; Krugman, 1979; Obstfeld, 1994). In these models, speculative attacks are the response to the depletion of resources in fixed-price environments: A shrinking stock of natural resources at fixed prices in the Hotelling-Salant-Henderson model (see Obstfeld, 1994; Salant and Henderson, 1978) or declining reserves in fixed exchange rate systems (see Krugman, 1979) are typical examples. In our case of a currency union, refinancing credit of the surplus country is the shrinking resource.

The nature of the attack depends on speculators' expectations about the currency union's endogenous

response to the tensions. Note that there are two conceivable scenarios without being mutually exclusive: (1) a speculative attack on the TARGET system, which causes a devaluation within the union through the introduction of national currencies or (2) a speculative attack on the union as a whole, which leads to currency depreciation with respect to the rest of the world. In either case, the attack affects the exchange rate. The nature of the attack depends on whether scenarios (i) and (ii) or scenario (iii) are the expected policy response. Anticipation of scenarios (i) and (ii) may induce speculative capital flight to Country 2, while the best ex-ante response to scenario (iii) is to move funds outside of the currency union. While the expected policy response affects the nature of the attack, its timing is independent of whether capital is reallocated within the union or whether it flows outside.

We abstain from formally modelling the attack because it follows the lines described in standard models (e.g. Flood and Garber, 1984; Obstfeld, 1994) with the difference that instead of reserves refinancing credit of the surplus country is the shrinking resource. The larger refinancing credit of the central bank in the surplus country is, the longer an exit strategy or a currency union will last. The main conclusion of these models is that rational speculators attack a currency before refinancing credit in the surplus country falls to zero.¹⁹ The rationale for the attack lies in the fact that speculators would make losses if they waited until the constraint becomes binding and devaluation sets in. The major insight of this analysis is that in contrast to conventional wisdom currency unions of the euro type might be subject to speculative attacks.

4 Redenomination Risk in the Euro Area

The model in the previous section suggests that in the presence of capital flight the ECB either faces break-up expectations of the currency union or needs to give up its monetary target. In this section, we examine whether this trilemma can be identified empirically. We show that three conceptually independent measures of redenomination risk indicate that the market participants' expectations of a break-up indeed peaked shortly before the ECB launched its first LTRO. This is consistent with the ECB's predicament implied by our model.

Figure 5 plots the evolution of three break-up indices as well as their first principal component. The first measure is derived from data of the private betting platform Intrade. Intrade allowed private agents to trade betting slips on the event that at least one country of the currency union would leave the euro area by the end of 2013.²⁰ As the betting slip provided a fixed return, their trading price can be interpreted as a direct measure of the traders' expectation about the probability of at least a partial break-up (see Shambaugh et al., 2012). The implied probability is depicted in Panel A of Figure 5. While the probability oscillates around 40% from mid-2010 to mid-2011, it increased from thereon and peaked at about 60% in November 2011. After the "whatever-it-takes" statement and the announcement of "unlimited" liquidity support in the summer of 2012, the break-up probability finally declined to about 10%.²¹

An alternative measure of redenomination risks, shown in Panel B, is the relative volume of Google searches implying the term "euro breakup".²² As absolute search volumes are not publicly disclosed, the index is standardized using its maximum. Interestingly, this peak coincides with the Intrade measure. Collapse-related searches experienced a sharp spike in November 2011 and went down after the LTROs were announced/implemented. Again a second, but smaller, peak is visible in mid-2012.

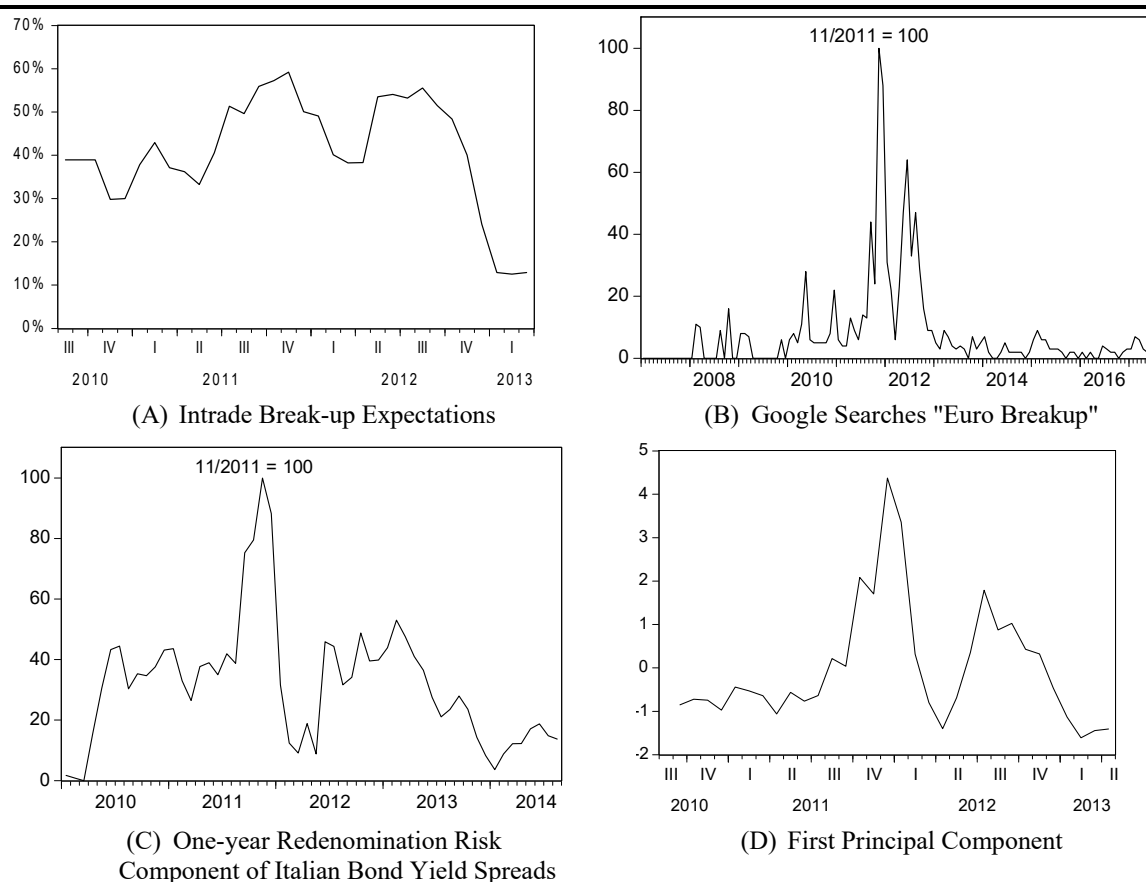
¹⁹ Note that the timing of the breakup in first generation speculative attack models may not represent an optimal policy response. Unexpected fiscal spending shocks may make it optimal to abandon a fixed exchange rate even earlier to regain access to seigniorage revenues as a means of financing the deficits (see Rebelo & Vegh, 2008).

²⁰ Following a civil law suit filed by the U.S. Commodity Futures Trading Commission, the platform suspended trading in March 2013 explaining this step with „possible financial irregularities“.

²¹ Note that it is difficult to interpret the trend component of the series due to the fixed maturity of the betting slip. Naturally, the probability of an event happening up to a certain date decreases over time.

²² See, e.g., Battistini et al. (2014) and Steinkamp & Westermann (2014) for other papers using this measure.

Figure 5: Break-up Expectations



Notes: Panel A shows the probability of at least a partial break-up of the euro area as implied by trades on the private betting platform [%]. Panel B depicts the Google search volumes for the term "euro break-up" [index 11/2011=100]. Panel C plots the return differential between bonds traded under domestic and foreign law for Italy. Panel D is the extracted first principal component of the three aforementioned breakup indices. Sources: Prediction Market Intrade, Klose & Weigert (2014), Google Application Trends, Bayer et al. (2018).

A third measure follows a more indirect approach and extracts the redenomination risk component of bond yield spreads. This method exploits legal differences between bonds with similar time to maturity which were issued under different jurisdictions. A country exiting the euro would redenominate its liabilities to the new currency. This, however, is only possible for contracts issued under domestic law. The difference between the yields of those bonds, which can be redenominated, and those, which cannot, is a measure of break-up risk (see Bayer et al., 2018). Panel C depicts the implied one-year redenomination risk for Italy.²³ The strong increase in redenomination risks in November 2011 becomes visible in this index as well. Starting in mid-2011 the index increased and almost doubled until the end of 2011. Thereafter, the implied break-up risk was considerably alleviated but returned to its former level in mid-2012. This measure somewhat differs from the other measures with regard to its evolution around the “whatever-it-takes” and OMT announcement. It takes the index almost one year longer than the other two indices to drop to its pre-crisis level.

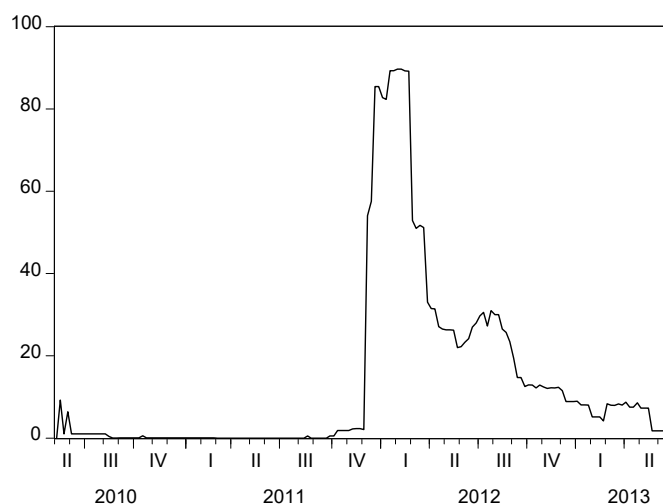
While each of the presented measures is based on different concepts and assumptions, they nevertheless exhibit remarkably similar patterns. To make this common variation more easily visible, we extract the first

²³ The data requirements for applying this approach are high and estimates for other crisis countries of the euro area not feasible.

principal component of the three measures (shown in Panel D of Figure 5).

All three variables as well as the first principal component indicate a global maximum of break-up risk at the end of November 2011 (and beginning of December 2011).²⁴ Redenomination risk spikes shortly before the level of refinancing credit in the non-crisis countries approached zero. At this time, financial market participants clearly sensed that the euro area had reached a critical limit, where conflicting goals of the ECB council – i.e. the full allotment policy implemented by NCBs and the exit strategy – would become incompatible. Only after relaxing the trilemma by following an expansionary policy in the aggregate the ECB was able to fend off speculative pressures. A second common pattern is a local maximum in mid-2012 where break-up expectations re-occurred. Uncertainty over the ECB’s crisis strategy evaporated, however, after Mario Draghi promised the ECB’s full commitment to preserve the integrity of the currency union at all costs, i.e. to prioritize one corner of the conflicting trilemma objectives.

Figure 6: ECB-FED Dollar Liquidity Swap Operations



Note: The figure shows the amount of outstanding swap line credit of the Eurosystem at the US FED [bn. \$]. Source: Federal Reserve Bank of New York.

Figure 6 furthermore shows that Euro-break-up expectations were also visible in the USD swap line. Since its reintroduction, this swap line was hardly used until early December 2011. To interpret this graph, which shows a sharp spike on December 8th, 2011, it is important to be aware of the institutional details and exact timing of monetary policy operations: In order to borrow from the NCBs in regular open market operations or swap lines, private banks need to place their requests for funding the day before the day of the allotment. Policymakers at the ECB thus knew about the demand for foreign exchange (FX) loans via the swap line the evening before the monetary expansion and the announcement of the abolishment of the exit strategy. A big jump in FX lending would have been interpreted as a sign of a beginning process of currency substitution, a clear signal of an imminent balance of payments crisis for the euro area as a whole.

To prevent this path of events, the ECB was forced to abandon its exit strategy. On the morning of December

²⁴ At the same time, the ECB also mentioned the occurrence of redenomination risks for the first time: “From the second half of 2011, we witnessed the emergence of a new source of stress, which has been defined as the risk of “redenomination”, resulting from the potential exit of a country from the euro or even from the potential collapse of the single currency. A particular form of credit risk premium was associated with these possibilities, which was unrelated to the assessment of a borrower’s solvency but which, in fact, came about owing to unfounded concerns regarding a systemic breakdown in the euro area.” Speech by ECB president Mario Draghi, Rome, 6 May 2013.

8th, the ECB abandoned its exit strategy and announced that it would flood the markets with liquidity by (a) reducing the minimum reserve requirement, (b) lowering the collateral standards and (c) offering a three-year longer-term refinancing operation (LTRO).²⁵

5 Related Literature

Our findings suggest that policy choices in a currency union – especially of the European type – are restricted by a trilemma: In the face of free capital mobility, central banks may not be able to pursue a predefined monetary policy, such as an exit strategy, while simultaneously accommodating capital flight via a full-allotment policy. These policy decisions are incompatible and ultimately generate break-up expectations on the side of investors. This is a special version of the classical macroeconomic policy trilemma (Mundell, 1963; Obstfeld and Taylor, 1998) applied to currency unions.²⁶ The main difference lies in the interpretation of monetary dependence: When the exchange rate is fixed and capital internationally mobile, the classical trilemma predicts that monetary policy is determined by the world interest rate through spillovers from center countries. In a currency union, however, the trilemma restriction applies also within the union independently of the international policy environment. After a certain threshold, the amount of net cross-border flows within the union determines the degree of monetary expansion. That is, although the euro is floating with respect to the rest of the world, monetary policy cannot be set freely.

As the global financial crisis has highlighted global interdependencies, the trilemma constraint has gained renewed interest, which shows up in a number of recently published papers. The discussion centers around the question whether the trilemma is still relevant in a highly integrated world. Three different views may be distinguished: First, in a series of papers, Rey (2013, 2016) argues that the global financial cycle has transformed the trilemma into a dilemma. A floating exchange rate regime is unable to isolate the economy from foreign shocks because capital flows obey global factors rather than domestic ones. This finding is in line with evidence provided by Frankel et al. (2004) for the post-Bretton Woods period. Second, a different view argues that central banks' international reserves help to relax the trilemma constraint and basically turned it in a quadrilemma (Aizenman, 2013; Steiner, 2017). The third view argues that the trilemma trade-off is still a valid description of the international monetary system (see, among others, Georgiadis and Mehl, 2016; Obstfeld et al., 2017). Recent empirical evidence based on trilemma indexes supports the trilemma constraint (Aizenman et al., 2013; Klein and Shambaugh, 2015).²⁷ This confirms findings from previous decades (Shambaugh, 2004; Obstfeld et al., 2005). Finally, there is a literature that puts the trilemma in a wider context by changing one of its corners leading to a financial or policy trilemma besides the monetary one.²⁸

The literature on the creation of the European Monetary Union already discussed the possibility of a speculative attack linked to the final bilateral conversion rates, the so-called "endgame problem." Garber (1999), Flood and Garber (2000), and Kenen (2000) argue that the operational rules of the TARGET system enable central banks to defend the currency union against any speculative attack. The reason for this is that NCBs can accumulate unlimited claims and liabilities towards each other. They also point out the risk of an attack, if the

²⁵ The daily data of the bond-yield-based measure of redenomination risk show a revealing coincidence: The break-up probability spikes only two days before the use of the USD swap line.

²⁶ The classical trilemma, based on the works of Mundell, states that only two out of the three potential policy goals of an independent monetary policy, a fixed exchange rate regime and free capital mobility are jointly feasible.

²⁷ Aizenman et al. (2013) and Popper et al. (2013) examine countries' policy choices within the trilemma constraint over time.

²⁸ For the euro area, Bordo and James (2014) identify a financial trilemma, which highlights the trade-off between financial stability, fixed exchange rates and capital flows. In a policy context the same authors argue that fixed exchange rates and capital flows may be incompatible with independent national policies and democratization. According to Schoenmaker (2011), there exists a financial trilemma besides the monetary one, where financial stability, financial integration and national financial policies are jointly incompatible

political support for unlimited TARGET2 balances is not given. Overall, there was a widespread consensus in the academic literature that corner solutions – purely floating exchange rates and monetary unions – are not vulnerable to speculative attacks (see, e.g., Frankel, 1999).²⁹ In our paper we add to this literature that under the specific institutional settings of the euro area speculative attacks might result from imbalances.

Our paper is closely related to Sinn and Wollmershäuser (2012). This paper was the first to interpret the euro crisis as a balance of payments crisis and the TARGET2 liabilities as an internal balance of payments deficit. It also raised the issue that refinancing credit in Germany has a lower bound and capital flight as well as current account financing via the Eurosystem cannot go on indefinitely. There is, however, an important difference with respect to our paper: The lower bound of refinancing credit by itself does not constitute a limit on capital flows, as the NCBs with net TARGET claims are able to take deposits and in principle run a negative net balance with private banks in the Eurosystem. Thus, only the combination of the lower bound of refinancing credit in the recipient countries of capital flight and the exit strategy of the ECB (or any fixed monetary target) – Europe's trilemma – create the setting for a speculative attack. Homburg (2018) follows up on this point and analyzes the case of Italy, where he argues that a speculative attack may occur via the liability side, rather than the asset side of the central bank's balance sheet.

The euro area has also reached sensitive political limits towards the end of 2011. Indicative for this is a letter written by the Bundesbank president Jens Weidmann, to ECB president Mario Draghi in February 2012, in which he calls for better collateral standards in the countries in crisis and points towards the enormous TARGET2 balances that had accumulated during the preceding five years. This letter is reminiscent of the famous 1978 Emminger Letter – also written by a Bundesbank president and directed to Helmut Schmidt, the then German chancellor (see Marsh, 2009). In this letter, Otmar Emminger pointed out the enormous risk of supporting a two-sided fixed exchange rate regime up to an unlimited amount of central bank interventions.³⁰

More generally, our paper is linked to the political economy of exchange rate regime choice. The break-up of a fixed-rate system or a currency union is not an exogenous event, but the outcome of a political process.³¹ Lahiri and Vegh (2003) and Rebelo and Vegh (2008) have modeled how long it is optimal to defend a fixed exchange rate from a central bank's perspective. In this context, the rising political instability in some euro area countries is a reason for concern, as Steinberg et al. (2015) for instance documented that political instability and a lack of transparency of democratic decisions can make currency crises more likely. Beckmann et al. (2017) explicitly analyze the trilemma, in a broad cross section of countries, and find that government ideology matters for how countries position themselves in the trilemma decision triangle. More generally, Sattler and Walter (2010) have argued that policy makers are sensitive to the opinion of voters under speculative pressure, when deciding if and how long to defend an exchange rate peg. The similarity of the euro area's rising TARGET2 position to a classical balance of payments crisis and the striking differences in political economy implications and risks for taxpayers have been highlighted by Frieden and Walter (2017).³²

²⁹ For instance, Jeffrey Frankel states that "Monetary union and pure floating are the two regimes that cannot be subjected to speculative attack." (1999, p.8). Dooley (1998, p.24) expressed this view, although more cautiously, when he pointed out that "a speculative attack is possible in a full currency union but not very likely."

³⁰ Schmidt's answer to Emminger was to sign the treaty and – if worst comes to worst – argue that the conditions under which the treaty has been signed have changed and abandon the peg if needed.

³¹ A strategy paper by Paolo Savona, the Minister for EU Affairs in Italy's Lega and Five Star Movement government, reveals that the Italian government might be fully aware of its bargaining power. The paper explicitly refers to the option of redenominating and (partly) defaulting on TARGET2-balances in the case of an exit from the euro (see Gros, 2018). This issue has by now also become a point of dispute in the German parliament. The potential threat of a default on TARGET2 liabilities is the starting point of a reform proposal of the Free Democrats (BT 19/6416), a plenary discussion initiated by the euro-sceptical AFD party on September 27, 2018, and has been raised by the Economic Council of the largest German party, the CDU ("Entschärft die Target-Zeitbombe", Wirtschaftswoche, August 9, 2018).

³² The conflict between creditor and debtor nations in the euro area's balance of payments crisis – although without reference to the TARGET2 system – has been discussed in Frieden (2015).

6 Conclusions

While TARGET balances are de jure unlimited according to the statutes of the European System of Central Banks, our analysis shows that there exists a de facto limit when the system of central banks sticks to its monetary policy goals. Unlimited credit can only be provided by national central banks if monetary policy does not constrain the length of the balance sheet in the aggregate. This implies that capital flight can only be accommodated up to a point where the policy trilemma described in this paper becomes binding. Furthermore, political limits may exist that prevent the TARGET2 claims from moving to arbitrarily large amounts.

The analysis in this paper elaborates on this de facto limit and provides the theoretical framework needed to discuss policy questions, such as the current debate on exit strategies from unconventional policies. Our analysis does not imply that the TARGET2 system is by itself responsible for the attack or the instability. In fact, without TARGET2, the monetary union would clearly be less stable. A better understanding of the 2011/12 episode is nevertheless important to improve the design of the next exit strategy, including the sequencing (see, for example, Horvath, 2017 and earlier discussions by Blinder et al., 2013), and to reduce speculative pressures under the current institutional arrangements. Moving forward, the euro area needs to take into account what is best described as the European version of the trilemma: It cannot at the same time have a single currency, independent control over the monetary base and accommodate unlimited internal capital flight via central banks.

References

- [1] Aizenman, J. (2013). The impossible trinity - from the policy trilemma to the policy quadrilemma. *Global Journal of Economics*, 2(01), 1350001.
- [2] Aizenman, J., Chinn, M. D., & Ito, H. (2013). The "impossible trinity" hypothesis in an era of global imbalances: measurement and testing. *Review of International Economics*, 21(3), 447-458.
- [3] Auer, R. A. (2014). What drives TARGET2 balances? Evidence from a panel analysis. *Economic Policy*, 29(77), 139-197.
- [4] Battistini, N., Pagano, E., & Simonelli, Saverio (2018). Systemic risk, sovereign yields and bank exposures in the euro crisis. *Economic Policy*, 29(78), 203-251.
- [5] Bayer, C., Kim, C., & Kriwoluzky, A. (2018). The term structure of redenomination risk. CEPR Discussion Papers No. 12965.
- [6] Beckmann, J., Ademmer, E., Belke, A., & Schweickert, R. (2017). The political economy of the impossible trinity. *European Journal of Political Economy*, 47, 103-123.
- [7] Blinder, A. S., Jordan, T. J., Kohn, D. L., & and Mishkin, F. S. Exit strategy - The 15th Geneva Report on the World Economy, Geneva, 2013.
- [8] Bordo, M., & James, H. (2014). The European crisis in the context of the history of previous financial crises. *Journal of Macroeconomics*, 39, 275-284.
- [9] Cecchetti, S. G., McCauley, R. N., & McGuire, P. M. (2012). Interpreting TARGET2 balances. BIS Working Papers No 393.
- [10] De Grauwe, P., & Ji, Y. (2013). Self-fulfilling crises in the Eurozone: An empirical test. *Journal of International Money and Finance*, 34, 15-36.
- [11] De la Dehesa, G. (2009). Alternative Exit Strategies for the ECB. Report for the European Parliament's Committee on Economic and Monetary Affairs, November 2009.
- [12] Dooley, M. (1998). Speculative attacks on a monetary union? *International Journal of Finance & Economics*, 3, 21-26.
- [13] Flood, R. P., & Garber, P. M. (1984). Collapsing exchange rate regimes: some linear examples. *Journal of International Economics*, 17(1-2), 1-13.
- [14] Flood, R. P., & Garber, P. M. (2000). Is launching the euro unstable in the endgame? In: Paul Krugman (ed.), *Currency Crises*, University of Chicago Press, 163-177.
- [15] Frankel, J. (1999). No single currency regime is right for all countries or at all times. NBER WP 7338. National Bureau of Economic Research.
- [16] Frankel, J., Schmukler, S. L., & Servén, L. (2004). Global transmission of interest rates: monetary independence and currency regime. *Journal of International Money and Finance*, 23(5), 701-733.
- [17] Frieden, J., & Walter, S. (2017). Understanding the Political Economy of the Eurozone Crisis. *Annual Review of Political Science*, 20, 371-90.
- [18] Frieden, J. (2015). The political economy of adjustment and rebalancing. *Journal of International Money and Finance*, 52, 4-14.
- [19] Garber, P. M. (1999). The Target mechanism: will it propagate or stifle a Stage III crisis? *Carnegie-Rochester Conference Series on Public Policy*, 51(1), 195-220.
- [20] Georgiadis, G., & Mehl, A. (2016). Financial globalisation and monetary policy effectiveness. *Journal of International Economics*, 103, 200-212.

- [21] Gros, D. (2018). How to exit the euro in a nutshell – ‘Il Piano Savona’. CEPS Commentary, 1 June 2018.
- [22] Homburg, S. (2018). Speculative Eurozone Attacks and Departure Strategies. CESifo Working Paper No. 7343.
- [23] Horvath, R. (2017). Design and sequencing of exit from non-standard monetary policy measures: What should the ECB “new normal” look like? Report for the Monetary Dialogue between ECB and European Parliament, 20 November 2017.
- [24] Kenen, P. B. (2000). Comment on: Is launching the Euro unstable in the endgame? In: Paul Krugman (ed.), *Currency Crises*, University of Chicago Press, 177-181.
- [25] Klein, M. W., & Shambaugh, J. C. (2015). Rounding the corners of the policy trilemma: sources of monetary policy autonomy. *American Economic Journal: Macroeconomics*, 7(4), 33-66.
- [26] Klose, J., & Weigert, B. (2014). Sovereign yield spreads during the euro crisis: fundamental factors versus redenomination risk. *International Finance*, 17(1), 25-50.
- [27] Krugman, P. (1979). A model of balance-of-payments crises. *Journal of Money, Credit and Banking*, 11(3), 311-325.
- [28] Lahiri, A., & Végh, C. A. (2003). Delaying the inevitable: interest rate defense and balance of payments crises. *Journal of Political Economy*, 111(2), 404-424.
- [29] Marsh, D. (2009). *The euro: the politics of the new global currency*. Yale University Press.
- [30] Mundell, R. A. (1963). Capital mobility and stabilization policy under fixed and flexible exchange rates. *Canadian Journal of Economics and Political Science*, 29(4), 475-485.
- [31] Obstfeld, M. (1994). The logic of currency crises. *Cahiers Economiques et Monétaires*, 43, 189-213.
- [32] Obstfeld, M., Ostry, J. D., & Qureshi, M. S. (2017). A tie that binds: Revisiting the trilemma in emerging market economies. *Review of Economics and Statistics*, forthcoming.
- [33] Obstfeld, M., Shambaugh, J. C., & Taylor, A. M. (2005). The trilemma in history: tradeoffs among exchange rates, monetary policies, and capital mobility. *The Review of Economics and Statistics*, 87(3), 423-438.
- [34] Obstfeld, M., & Taylor, A. (1998). The Great Depression as a watershed: international capital mobility over the long run. In: M. Bordo, C. Goldin, and E. White (eds.), *The Defining Moment: The Great Depression and the American Economy in the Twentieth Century*, University of Chicago Press, 353-402.
- [35] Popper, H., Mandilaras, A., & Bird, G. (2013). Trilemma stability and international macroeconomic archetypes. *European Economic Review*, 64, 181-193.
- [36] Rebelo, S., & Végh, C. A. (2008). When is it optimal to abandon a fixed exchange rate?. *The Review of Economic Studies*, 75(3), 929-955.
- [37] Rey, H. (2013). Dilemma not trilemma: the global cycle and monetary policy independence. *Proceedings - Economic Policy Symposium - Jackson Hole*, Federal Reserve Bank of Kansas City.
- [38] Rey, H. (2016). International channels of transmission of monetary policy and the Mundellian trilemma. *IMF Economic Review*, 64(1), 6-35.
- [39] Rossi, S. (2013). Financialisation and monetary union in Europe: the monetary–structural causes of the euro-area crisis. *Cambridge Journal of Regions, Economy and Society*, 6(3), 381-400.
- [40] Rossi, S. (2017). A structural-reform proposal for a two-speed European monetary union. In: Nazaré da Costa Cabral, José Renato Gonçalves & Nuno Cunha Rodrigues (eds), *The Euro and the Crisis*, Springer, 2017, 33-46.
- [41] Sachs, J., Tornell, A., & Velasco, A. (1996). The collapse of the Mexican peso: what have we learned? *Economic Policy*, 11(22), 13-63.

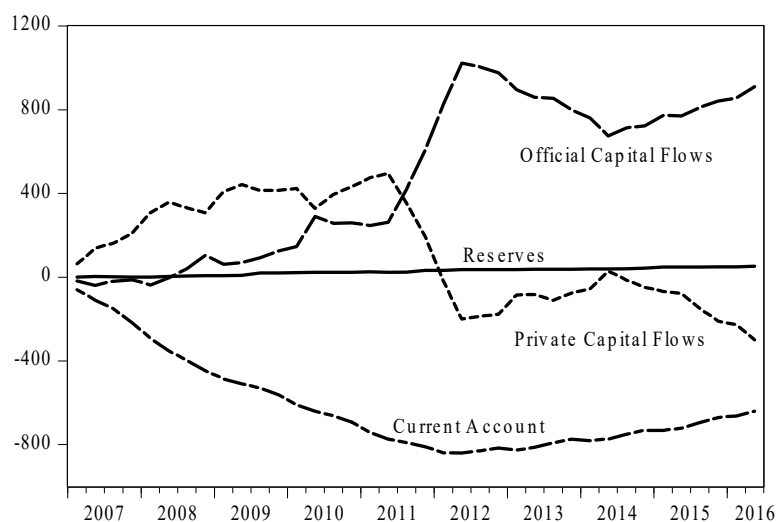
- [42] Salant, S. W., & Henderson, D. W. (1978). Market anticipations of government policies and the price of gold. *Journal of Political Economy*, 86, 627-648.
- [43] Sattler, T., & Walter, S. (2010). Monetary Credibility vs. Voter Approval: Political Institutions and Exchange-Rate Stabilization during Crises. *Economics & Politics*, 22(3), 392-418.
- [44] Schnabl, G. & Freitag, S. (2012). Reverse causality in global and intra-European imbalances. *Review of International Economics*, 20(4), 674-690.
- [45] Schoenmaker, D. (2011). The financial trilemma. *Economics Letters*, 111(1), 57-59.
- [46] Shambaugh, J. C. (2004). The effect of fixed exchange rates on monetary policy. *The Quarterly Journal of Economics*, 119(1), 301-352.
- [47] Shambaugh, J. C. (2012). The euro's three crises. *Brookings papers on economic activity*, 157-231.
- [48] Sinn, H. W. (2014). *The Euro trap: on bursting bubbles, budgets, and beliefs*. Oxford University Press.
- [49] Sinn, H. W., & Wollmershäuser, T. (2012). Target loans, current account balances and capital flows: the ECB's rescue facility. *International Tax and Public Finance*, 19(4), 468-508.
- [50] Steinberg, D. A., Koesel, K. J., & Thompson, N. W. (2015). Political regimes and currency crises. *Economics & Politics*, 27(3), 337-361.
- [51] Steiner, A. (2017). Central banks and macroeconomic policy choices: relaxing the trilemma. *Journal of Banking & Finance*, 77, 283-299.
- [52] Steinkamp, S., & Westermann, F. (2014). The role of creditor seniority in Europe's sovereign debt crisis. *Economic Policy*, 29(79), 495-552.
- [53] Tornell, A., (2013). *The dynamic tragedy-of-the-commons in the Eurozone and Target2*. Mimeograph, UCLA.
- [54] Trichet, Jean-Claude (2009). The ECB's exit strategy. Speech at the CFS conference "The ECB and Its Watchers XI", Frankfurt, 4 September 2009. Online available at: <https://www.ecb.europa.eu/press/key/date/2009/html/sp090904.en.html>.

Appendix: Current Account Deficits and Capital Outflows

The current account deficit is the "usual suspect" that has been identified as the fundamental cause of balance of payments crises in the literature. In Figure 7, which adds up the current account deficits in the GIIPS, one can clearly see an uninterrupted decline of the cumulative current account balance until 2012, when the process appears to have stabilized at about €760 bn.³³

The other two dashed lines show how this current account deficit has been financed. Up to 2011, private capital inflows were the largest source of financing. In mid-2011, however, private funding started to fall and fully reversed in the beginning of 2012. Since then, the GIIPS have been characterized by private capital outflows. Instead, public capital flows started to rise. Figure 7 shows official capital flows defined as the sum of all bilateral and multilateral lending, including loans by the European Financial Stability Facility (EFSF), the European Financial Stabilisation Mechanism (EFSM), the European Stability Mechanism (ESM), and intra-Eurosystem liabilities (TARGET2), which have become the largest component of public capital towards the end of the sample.

Figure 7: Balance of Payments of GIIPS Countries



Notes: The figure shows the cumulative current account, the cumulative capital account split into private and public sector, and the change in central banks' reserves. Public-sector entities include the IMF, EFSF, EFSM, ESM, Eurosystem and bilateral lenders. All series in billions of euros. Source: IMF BOP Statistics.

³³ See also Schnabl and Freitag (2012) for an analysis of intra-Eurosystem imbalances of the current account, and Auer (2014) on the empirical determinants of imbalances.