OXFORD

Article

Balance sheets after the EMU: an assessment of the redenomination risk

Cédric Durand[1,]* and Sébastien Villemot[2]

[1]CEPN – CNRS/Université Paris 13, Campus Villetaneuse, 99 Avenue Jean-Baptiste Clément, 93430 Villetaneuse, France and [2]OFCE – Sciences Po, 10 Place de Catalogne, 75014 Paris, France

*Correspondence: cedric.durand@ehess.fr

Abstract

The probability of a partial or complete break-up of the euro has risen over the last years. Such an event could create a balance sheet problem for economic agents, if the redenomination process introduced significant currency mismatches between the asset and liability sides. We propose a new assessment of this redenomination risk, by country and by main institutional sector, for two scenarios: a single country exit and a complete break-up. Our main conclusion is that, even though the problem has to be taken seriously, its order of magnitude should not be exaggerated. Only a few sectors are at significant risk: public debts of Greece and Portugal, financial sectors of Greece, Ireland and Luxembourg. In particular, the balance sheet exposure of the non-financial private sector to the redenomination risk appears to be limited.

Key words: Europe, accounting, international economic order

JEL classification: F36

1. Introduction

When it was introduced at the turn of the millennium, the euro was widely perceived as a major achievement for Europe, being both the consequence and the cause of an ever tighter continental integration. During the first years of the European Monetary Union (EMU) the semblance of a good functioning of the single currency, coupled with cross-country convergence of several economic indicators, fueled this sentiment of success. The idea that the single currency was now 'irreversible' had settled in most minds.

A couple of years later, the picture looks dramatically different. The world financial crisis has exposed the incompleteness of the monetary union (Jones *et al.*, 2016) and the unsustainable character of its built-in financial and trade imbalances (Lane, 2012; Stockhammer *et al.*, 2016), leading to the unfolding of the sovereign debt crisis. This crisis brought the EMU on the verge of dislocation. Member states turned out to be unable to devise a

cooperative strategy, forcing the European Central Bank (ECB) to reinterpret its mandate by envisaging a massive intervention on sovereign bond markets (the Outright Monetary Transactions program). Even though this move has put a temporary halt to the crisis, monetary policy alone was not able to extricate the euro area from a protracted stagnation aggravated by austerity policies (Boyer, 2012; Flassbeck and Lapavitsas, 2015a; Gechert *et al.*, 2016; Stockhammer, 2016).

The underperformance of the EMU has only slightly weakened the popular support for the euro (Roth *et al.*, 2016a, 2016b), but it coincides with a sharp decline in the trust in the ECB (Jamet *et al.*, 2017), diverging opinion between North and South of the region (Hobolt and de Vries, 2016) and, in most affected countries, a broad-based erosion of support for the democratic political system both at the national *and* European levels (Armingeon *et al.*, 2016). Moreover, the possibility of a country exiting the euro became closer than ever in 2015 when the Greek banking system was *de facto* cut off from central bank refinancing, having to shut down for a few days and to impose capital controls during months. On the political side, the tension also reached a critical point when Wolfgang Schäuble suggested a '5-year humanitarian grexit', a threat to which the Greek people replied by rejecting the Eurogroup proposal in the July 2015 referendum, knowingly taking the risk of a euro exit. Even though the situation is now temporarily stabilized, the underlying causes of the Greek crisis have not been dealt with and, due to ongoing political tensions, the risk of a 'grexit' or another exit is still looming around.

The financial community itself has already prepared to the possibility of an exit or a dissolution of the single currency, by cutting back on cross-border positions. According to the ECB, cross-border holdings by euro area MFIs of bonds issued by non-financial borrowers (sovereign and corporate) of other euro area countries is a relevant quantitative indicator of financial integration. This indicator points to a marked decreasing integration in the past decade, with a diminution of non-domestic European government and corporate bonds from about 60% in 2007 to 40% in 2016 (ECB, 2017, graph S24). The ECB also observes a diminishing intra-European banking activity, noting that 'the crisis has caused the median degree of cross-border penetration of banking institutions to fall' from about 19% in 2008 to less than 10% in 2016 (ECB, 2017, S32). In sum, there is no coming back in terms of financial integration to the heyday of the pre-crisis period. In the meantime, the intellectual mood is also shifting: leading thinkers, such as US economist Joseph Stiglitz (2016), or German sociologist Wolfgang Streeck (2015) are among the most visible figures of a wider change of attitude in favor of the dismantlement of the eurozone.

A country exiting from the EMU, or even the dissolution of the single currency, is therefore no longer a remote possibility. Such an event would obviously have a major impact in a number of dimensions, economic, financial and political and entails numerous challenges (Eichengreen, 2010). On the economic side, the most obvious consequence would be the changing conditions in products markets due to the new exchange rates. Uncertainty would prevail in the short run as high risks of capital flight and bank run would have to be met by contingency measures such as a temporary cap on cash withdrawal and administrative controls on capital outflows above a given threshold. Such actions would echo those implemented at the height of the Cyprus and Greek turmoil in 2013 and 2015 (Flassbeck and Lapavitsas, 2015b; Hardouvelisa and Gkionisb, 2016) or in Argentina in December 2001 with the *corralito* imposed after the abandonment of the parity with the US dollar (Auguste

et al., 2006, p. 10). They could fuel political instability if the support for the government agenda is weak.

In the longer run the possibility of adjusting nominal parities would help with the reduction of current account imbalances (Mazier *et al.*, 2013; Mazier and Petit, 2013; Saadaoui, 2015). More importantly, devaluations and a more flexible exchange rate regime would allow for the revival of productive sectors weakened by the straightjacket of the single currency. The negative effects of currency overvaluation—and positive effects of undervaluation—on growth via the channel of tradable competitiveness are well known (Corden and Neary, 1982; Rodrik, 2008). Because of the centrality of the manufacturing sector for any strategy of economic development (Andreoni and Chang, 2016), including the building up of innovation capabilities (Malerba, 2002), regaining the ability to devaluate can favor the enlargement and diversification of the productive basis in countries which suffer from an overvaluation of their real exchange rate because of the euro. From a broader sociological perspective, Wolfgang Streeck recalls Karl Polanyi's insight that the gold standard imposed 'the necessary uniformity of domestic regimes within the orbit of world economy' (Polanyi *et al.*, 1944, p. 253); he argues that conversely devaluations serve as a brake on the pressure for capitalist expansion and rationalization spreading outward from core to periphery and allow for the preservation of (statically) less efficient production lines associated with idiosyncratic local arrangements of social relations (Streeck, 2014, pp. 448–453). Instead of the canonical insistence on the improved allocation of resources and increased competition associated with a wider unified market, the emphasis is put on the dynamic efficiency resulting from the socio-political resilience associated with stronger embeddedness of economic relations in local institutional arrangements and complementarities.

Beyond these crucial implications of an exchange rate regime change, there exists another impact, less discussed, but potentially highly disruptive: the changes in the balance sheet position of economic actors, resulting from the currency redenomination process. Assessing the unfolding of these balance sheet effects is crucial, because they could affect financial relations, investment and trade and, if not adequately managed, lead to productive disruption.

Indeed, the experience of financial crises in emerging countries in the nineties has underscored the vulnerability of these economies to foreign currency debt held by private actors. In some situations, negative balance sheet effects could more than offset the expansionary effects of currency devaluation. Using a large sample of non-G7 countries, Towbin and Weber (2013) establish that a high level of short-term foreign debt results in such a negative growth outcome in the case of devaluation. Similarly, Bebczuk *et al.* (2006), using a panel of 57 advanced and developing countries, conclude that devaluations are contractionary if more than 84% of foreign debt is denominated in a foreign currency; moreover, if the economy is partially dollarized, the negative effect of devaluations is even stronger.

At the micro level, there is however some evidence of opposite tendencies. On a panel of 450 non-financial Latin American firms, Bleakley and Cowan (2008) show that firms tend to self-insure themselves by matching the currency denomination of their liabilities with the exchange rate sensitivity of their profits. Consequently, after a devaluation, investment of firms indebted in dollars does not fall more than that of firms indebted in the domestic currency.

Some authors have also discussed the importance of the redenomination risk in the specific case of the euro area. Nordvig and Firoozye (2012, p. 56), for example, argue that 'balance sheets effects, *ex post* break-up, are likely to be very large for exiting eurozone

countries' because of the significant external liabilities that would stay denominated in euros following the exit. The approach of the present paper is methodologically similar to theirs, in the sense that we also build estimates of relevant liabilities and relevant net positions after a euro exit, using decomposition by institutional sectors. There are however important differences: first, our data is more recent (2015 versus 2011), and therefore takes into account the lessening of the financial integration mentioned above; second, for determining the proportion of bonds that are likely to be redenominated, we use aggregate data provided by the Bank of International Settlements, while Nordvig and Firoozye (2012) build their own estimates using financial data at the micro level (which are potentially less complete); third, we estimate expected exchange rate movements using a fundamental equilibrium exchange rate methodology, which enables us to quantify the expected balance sheet movements. The numerical results that we obtain for debts and assets at redenomination risk are broadly consistent with those of Nordvig and Firoozye (2012), though there are some specific sectors and countries for which our estimates diverge significantly. However, the conclusions that we infer from our analysis are somewhat different from theirs, in particular because we extend further the sectoral analysis, by providing estimates of balance sheet effects at the sectoral level and by discussing the sectoral-specific ways of dealing with the issue of balance sheet currency mismatch.

Another study by Amiel and Hyppolyte (2015) specifically looks at the French case, warning of the huge costs resulting from the exposure of French firms to the redenomination of liabilities registered under foreign law if the country was to exit the euro. However, this study suffers from a number of shortcomings: the authors focus only on large non-financial corporations (excluding smaller ones); on the liability side, they look only at marketable bonds, excluding loans; and on the asset side, they use a proxy based on revenues generated abroad, which means that they cannot compute a total balance sheet effect and have a potentially distorted picture of the mitigation buffer provided by assets. The authors also tend to exaggerate the problem of devaluation overshooting by considering that it concerns the total stock of debt (and not only the short-term part of it). However, we share with them the conclusion that Nordvig and Firoozye (2012) underestimate the risk on the liability side for the French non-financial private sector.

In this article, we propose a new assessment of the redenomination risk in the euro area on sectoral balance sheets and at the national level.[1] After having disentangled the mechanisms at stake, we assess the situation of cross-border financial interdependencies for eurozone countries, evaluate the risk and their distribution, and identify the relevant policies to mitigate these risks. We argue that it is important to distinguish between the various kinds of liabilities and between sectors in order to address accurately the problem. Moreover, we

---

1 The balance sheet of EU institutions and of other European bodies are not thus taken into account due to the fact that, in accordance with the European System of Account, they are not considered to be part of the domestic economy in the national accounts compiled by the Member States (Eurostat, 2017). While the budget of EU institutions is rather limited, this could be a serious flaw due to the rapidly increasing size of the Eurosystem balance sheet. However, this balance sheet is highly decentralized as most of the assets and liabilities are held by national central banks according to the key for subscription of the ECB's capital – and thus taken into account in the data on domestic economies at the national level we use in this study; only a tiny fraction of about 9-9.5% of total Eurosystem assets is directly held by the ECB (European Central Bank, 2016).

stress that the potentially negative impact would not only concern devaluing countries but also countries experiencing a reevaluation of their currency whose foreign assets expressed in their domestic currency would be depreciated, which would be a strong incentive to cooperate in order to limit the range of the exchange rate adjustment. Overall, we consider that policy discussions surrounding an alternative currency arrangement in Europe must take into account these balance sheet effects, but that the importance of the problem should not be overestimated either.

After exposing the conundrum of balance sheet redenomination issue (Section 2), we deploy our empirical analysis. Section 3 presents the International Investment Position of Euro area countries and sectors as a first—and insufficient—approximation of the problem. We then build on the dichotomy between domestic and foreign governing law criteria as a proxy for the likelihood of redenomination to detail the relevant debt (Section 4) and the relevant net position (Section 5) before examining the balance sheet movements for the various countries and sectors in the event of a new monetary arrangement (Section 6). Section 7 concludes.

2. The conundrum of balance sheet redenomination

The balance sheet impact of a euro exit not only on countries' economies depends: on the size of currency mismatches that will appear on balance sheets after the redenomination process; on the direction of the exchange rate adjustment of the new domestic currency; but also on the sectoral distribution of the balance sheet movements.

2.1 The importance of the initial foreign currency mismatch

As a result of the redenomination process in a given exiting country, various assets and liabilities that were formerly denominated in euros will be converted into the new domestic currency (see the next section for a more detailed discussion of this process). But some assets and liabilities will not, and those balance sheet items will now be counted as foreign currency items, on the same ground as assets or liabilities expressed in, for example, US dollars or UK pounds.

The exchange rate of the newly introduced domestic currency will then be adjusted relatively to the euro (or to the other European currencies in case of a complete break-up). The impact of this movement on balance sheets will of course depend not only on its direction, but also on the size and direction of the currency mismatch that may have appeared following the redenomination process. The currency mismatch is defined as the difference in currency composition between the asset and liability sides of a balance sheet, resulting from the redenomination of some of its items. It can be measured by what we call the 'initial net foreign currency position', i.e. the difference between assets and liabilities denominated in foreign currencies following the redenomination process, but before the currency movement.

More precisely, the net worth of an economic agent could be written as:

Equation 1

$$NW = A - L = (A_{DC} + A_{FC} \cdot \epsilon) - (L_{DC} + L_{FC} \cdot \epsilon) = A_{DC} - L_{DC} + (A_{FC} - L_{FC})\epsilon$$

where NW stands for net worth, A for assets, L for liabilities, the DC (resp. FC) subscript designates the domestic currency (resp. foreign currency) component, and ϵ is the exchange

rate against some reference foreign currency (an increase of ϵ means a depreciation of the domestic currency). All variables are expressed in terms of the domestic currency, except A_{FC} and L_{FC} which are expressed in terms of the reference foreign currency.

If we define the initial net foreign currency position as being $A_{FC} - L_{FC}$, then one sees that the effect of a currency move depends on the sign of that difference.

As shown on Table 1, a devaluation will negatively impact a balance sheet with a negative initial net foreign currency position, while it will benefit a sector or a country for whom foreign currency assets exceed foreign currency liabilities before the currency move. An appreciation of the domestic currency will have opposite effects, improving the balance sheet of a sector/country with an initially negative net foreign currency position, and deteriorating the position of a sector/country with a positive position.

The problem of a negative impact on balance sheets of domestic actors thus concerns not only a country with a negative net foreign currency position which will devalue, but also a country with a positive position which would experience an appreciation of its currency. Note that a negative impact tends to be the general case (though there are some exceptions), because countries for which the euro is overvalued (resp. undervalued) tend to accumulate foreign liabilities (resp. assets).

At this point, one could wonder how a currency movement could have a negative impact on most (if not all) countries. After all, it should amount to a zero-sum game, since the wealth of the appreciating countries increase as much as the wealth of depreciating countries diminishes. This is of course true when all net worth is expressed in a given third party currency, but we are here considering the impact of currency movements on balance sheets *expressed in domestic currencies*. It is perfectly possible that the net foreign position of appreciating countries both *increase* when expressed in some third-party currency, and *decrease* when expressed in the (appreciating) domestic currency; our point is that this is precisely the general case.

It should also be kept in mind that, even though the *net* foreign currency position is important, it does not summarize all the relevant information. In particular, even if the aggregate net position is positive (at the national or sectoral level), it may happen that foreign currency assets are not detained by the same agents as those with foreign currency liabilities. In that case, the mitigation potential of assets in the case of a depreciation would be rather limited (unless redistributive policies are put in place). It is therefore also important to look at *gross* assets and liabilities in foreign currency.

2.2 Varieties of instruments and legal regimes

All items on the balance sheet do not have the same relevance for assessing the risk following from a euro exit or break-up. The consequences of the asymmetries between assets detained by resident agents vis-à-vis non-residents (i.e. foreign assets) and liabilities of resident agent vis-à-vis non-resident agents (foreign liabilities) depend on two main factors: first, the kind of financial instruments and the related financial commitments; second, the currency of denomination of these foreign assets and liabilities and the fact that they are—or they are not—tied to a contract under foreign law.

Variety of commitments corresponding to variety of financial instruments
Table 2 summarizes the asymmetric distribution of vulnerabilities and countervailing forces across the spectrum of the balance of investment. Dotted cells, on the asset side, are all the

Table 1. Impact of currency moves on net worth]

	Initial net foreign currency position	
	$A_{FC} > L_{FC}$	$A_{FC} < L_{FC}$
Depreciation	+	−
Appreciation	−	+

Table 2. Sign and criticality of the impact on the balance sheet position of depreciation for various instruments]

	Foreign assets	Foreign liabilities
Foreign Direct Investment	+	0
Portfolio equity securities	+	0
Bonds (long term)	+	−
Loans (long term)	+	−
Bonds (short term)	**+**	− −
Loans (short term)	**+**	− −
Cross-border deposits	**+**	0
Derivatives	Not considered	Not considered
Reserve assets	**+**	0

foreign assets that could contribute to improving the international position of a balance sheet in conditions of financial stress due to currency devaluation. In light and dark gray, on the liability side are the instruments that make one sector vulnerable.

Since equity (both direct and portfolio investment) is not a financial contract expressed in monetary terms, there is no redenomination issue *per se*. This however does not mean that there is no effect on the balance sheet. On the liability side, a post-exit devaluation indeed does not change anything, because the accounting valuation does not depend on the exchange rate. But, on the asset side, investments being written at their market value, a devaluation increases the latter in terms of the domestic currency. As these positions could potentially be liquidated, this has a positive impact on the balance sheet position.

Governing law and the redenomination outcome

For financial contracts that involve an obligation in monetary terms (like bonds, loans and deposits), the redenomination process will determine whether they are converted to the new domestic currency (at a rate fixed by the new monetary law), if they remain in euros, or are converted to some other currency if the euro disappears.

It is not the purpose of the present article to analyze and discuss the legal aspects of this process. We rather rely on existing analyses, in particular Proctor (2011), Nordvig and Firoozye (2012, Chapter 3 and Appendix I) and Amiel and Hyppolite (2015, Section III). The picture that emerges is that, for a given contract, the governing law is the most

important factor for determining the outcome of the redenomination process. If the contract is under domestic law, it is very likely to be redenominated in the new domestic currency; on the contrary, if it is governed by foreign law (typically English or New York law), it will most likely stay denominated in euros (or, in the case of a complete euro break-up, it will most likely be redenominated into a new ECU or into the domestic currency of the counterparty—in any case a foreign currency). In this article, we therefore use the governing law as a proxy for the likelihood of redenomination.

Applying the governing law principle to cross-border deposits in euros, one sees that they will end up being denominated in the currency of the bank's residence. Therefore, they contribute positively on the asset side and are neutral on the liability side. There could be deposits denominated in some external currency that will not follow this pattern, but they represent only a small fraction of the total.

Cross-border loans tend to be governed by foreign law, typically a third-party country law, both on the liability and on the asset side. They therefore contribute positively on the asset side, and negatively on the liability side.

International bonds are most frequently governed by foreign law on the asset side (except the rare case of bonds emitted by foreign companies under the domestic jurisdiction). On the liability side, there is no general rule: domestic entities emit under both domestic and foreign law, so the breakdown between the two options has to be empirically assessed.

So far, we only looked at assets and liabilities whose counterparty is non-resident. But there are foreign currency-denominated balance sheet items whose counterparty is a resident agent. The typical case is a public or private bond emission, governed by foreign law, but purchased at least in part by domestic agents. In the case of the euro exit of a single country, the domestic holders of the bonds will be entitled to claim repayment in euros (in the case of a complete euro break-up, since both parties are resident of the same country, a redenomination into the domestic currency is more likely, though not warranted). It should however be kept in mind that, if the redenomination process in this context has a redistributive impact across domestic agents (and possibly across domestic sectors), it has no impact on the aggregate position of the country. The mitigation of those balance sheet effects could therefore be possible through redistributive fiscal policies.

To sum up, the criticality of the balance sheet effects of a redenomination is an issue between resident and non-resident agents defined at the intersection of, first, the class of asset concerned and, second, the denomination of this instrument or the governing law.

More specifically, the criticality is concentrated on short-term debt instruments denominated in foreign currency or under foreign law. Indeed, only debt instruments could lead to disruptive evolution in cases of strong exchange rate devaluation, while the economic actors can rely on a wider range of assets to mitigate negative evolutions. As noted by Frankel (2005) in the case of emerging countries, the key problem is *short-term* debt denominated in foreign currency (and under foreign law in the euro area): the principal repayment for this category of liabilities will have to be done in the aftermath of the euro exit, which is likely to be a chaotic period. In particular, there is a risk of exchange rate devaluation overshooting (Cavallo *et al.*, 2005), which can make short-term repayments even more difficult. Moreover, the mitigation actions meant to address the foreign currency debt problem (asset selling, fiscal or monetary policy intervention) may materialize with a delay, and therefore fail to solve the liquidity problems of agents facing immediate repayment obligations.

Note that the problem of derivatives contracts is not considered here (see infra Section 3). Although it is difficult to disentangle their overall impact, one can guess that it will be mainly directed to financial corporations.

Also note that, in the case of a currency appreciation, the dynamics is the opposite to that described above. The asset side of the foreign balance sheet will deteriorate across all positions, while the immediate improvement of its liquidity position will materialize only as far as its debt liabilities are reduced. Consequently, the more direct negative balance sheet effect should concern countries with a positive external position, which face a currency appreciation.

2.3 Varieties of sectoral logics

The socioeconomic problem of balance sheet deterioration differs considerably depending on the sector considered.

In the case of the public sector, the main issue is the ability of the state to fund its current activities. Indeed, for the state, defaulting is always an option, and any negative evolution of its balance sheet could lead to a restructuring of its debt whose terms would be more or less favorable, depending on its primary balance, i.e. its ability to face its obligations (other than debt and interest payments) without relying on foreign creditors.

In the case of the financial sector, unsustainable foreign currency liabilities could cut off national institutions from financial markets, which would affect domestic activity mainly through a credit crunch. A mitigation policy to prevent a collapse of domestic activity would therefore be required, including bank restructuring and recapitalization, an active monetary policy and a credit expansion by public institutions.

The impact of a deterioration of the balance sheet of non-financial firms (as defined in section 2.1) could be more directly disruptive, although it could also fuel positive aggregate dynamics on the longer term.

The first disruptive channel is straightforward. A deterioration of the balance sheet will lead to higher borrowing costs and deleveraging, with a negative impact on investment. Spillovers to the broader economy will follow through a direct short-term negative macroeconomic effect in terms of lower demand, fueling recessionary pressure and, on the longer term, degrading the development path through an obsolescence of the productive apparatus.

The second channel results from the possible default on foreign liabilities resulting from the deterioration of the balance sheet. Its immediate consequence will be a shortage of foreign credits, leading to a diminishing of imports. The impact on the domestic economy is ambiguous. On one hand, the economy could be deprived of crucial inputs, resulting in a direct contraction of the activity and, indirectly, to an obsolescence of the productive apparatus. However, it could also fuel a substitution of foreign goods by domestic goods, which could reinvigorate the domestic economy, but which implies an adaptation of the domestic demand.

Policies would be required to mitigate deleveraging by non-financial firms in order to resist the downward pressure on investment. The authorities must also identify the crucial foreign inputs and design adequate policy tools to smooth their ongoing provision. In addition, industrial policy could favor imports substitution not only on the supply side but also on the demand side, enhancing sustainable and localized consumption patterns.

In summary, currency redenomination will affect differently the balance sheets of countries, sectors and economic agents, depending on their initial foreign currency position and the instruments they hold. The wider economic effects of these balance sheet readjustments will also differ across sectors and call for specific mitigation policies. One original and important result of our

analysis is to stress that a direct negative balance sheet effect will concern countries with a positive external position which face a currency appreciation. However, considering their *a priori* stronger financial position, these are less exposed to brutal financial and economic disruptions than countries with a negative external position which face currency devaluation.

3. A look at net international investment positions

A first way to approximate the exposure of balance sheets to the redenomination risk is to look at international investment positions. Data on those are available for the economy as a whole, and for broad institutional sectors. They aggregate all financial instruments with a non-resident counterparty, i.e. liabilities of residents to non-residents, and assets of residents over non-residents.

These statistics are obviously just an approximation of the foreign currency mismatch that we want to measure. Indeed, as explained above, a part of the domestic liabilities to foreign residents is under domestic law, and are thus not subject to an exchange rate risk. Conversely, some assets governed by foreign law involve two domestic parties and therefore do not appear in international investment positions; there is an exchange rate risk on those assets, which has a redistributive impact across sectors, though it does not create an aggregate risk at the national level. These strong limitations being said, the data on national and sectoral foreign positions are quite instructive.

The data that we use for international investment positions as of Q3 2015 are based on the balance of payment statistics released by Eurostat, which for each country offer a breakdown both by sector and instrument.[2]

Figure 1 presents both gross and net international investment positions, which vary substantially across eurozone countries. Countries are ordered from left to right by decreasing net position.

The first striking fact is the astonishing level of gross assets and liabilities of Luxembourg, which are both close to 170 times GDP, confirming the country's singular status of financial intermediary and tax heaven. Medium-sized countries like Ireland and the Netherlands also have very important balance sheets with assets and liabilities well above 10 times their GDP, due to their status of financial intermediary.

Among big countries, there is a clear divide between the periphery (the GIPSI—Greece, Ireland, Portugal, Spain, Italy) plus France which have an overall net negative position, and the core (Germany, Belgium, Netherlands) with an overall positive position. This divide is consistent with the relative positions in terms of current account surpluses and deficits, since external positions are the stocks corresponding to flows accumulated over the years.[3]

2   There are a few missing figures in the raw Eurostat data, so we filled the gaps by exploiting other sources that give most of the missing information (World Bank's Quarterly External Debt Statistics, IMF international investment position data for France, Banca d'Italia, Bank of Finland). In a few rare cases (sectoral breakdown of foreign direct investment for France, Austria and Portugal), we had to compute estimates by assuming a breakdown proportionally equal to the Eurozone average.
3   Note that valuation effects also enter the dynamics of the international investment position and can make it diverge from the intertemporal sum of current account surpluses or deficits. See Puppetto and Sode (2012) for an analysis of the valuation effect on a sample of advanced and emerging countries.
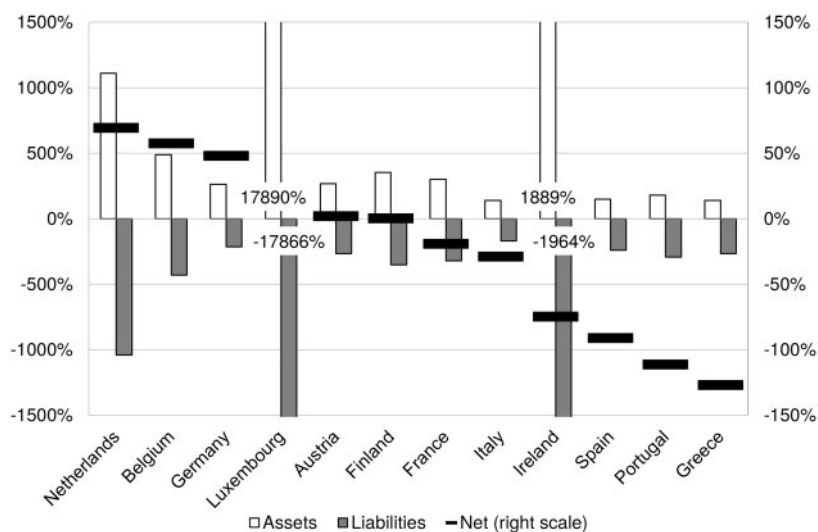
Sources: Eurostat, IMF, World Bank, Banca d'Italia, Bank of Finland, authors' computations

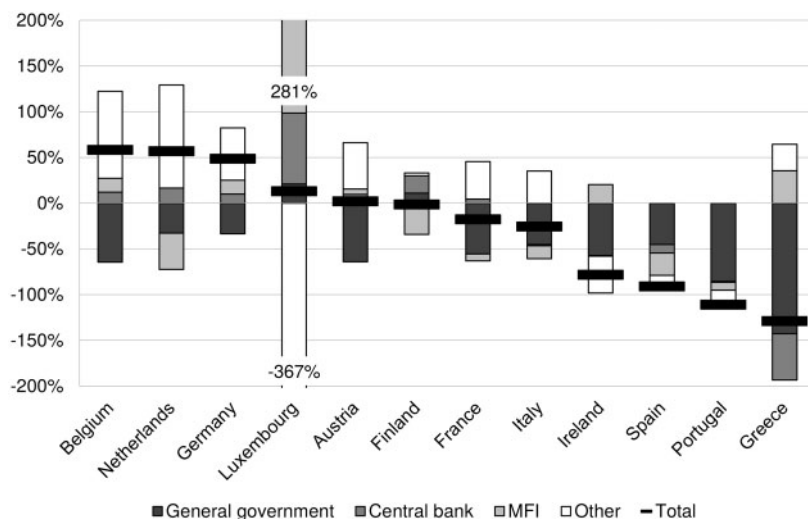**Figure 1.** Overall international investment positions of eurozone countries (% of GDP, Q3 2015)].

The aggregate statistics at the country level mask an important intra-country heterogeneity across sectors. Figure 2 shows the breakdown of the net international investment positions across four institutional sectors: general government, central bank, monetary financial institutions (MFI henceforth; mostly banks, excluding the central bank), and the other entities (which include households, non-financial firms and some financial non-banking firms).

The external balance sheet of the general government is widely negative for most countries, reflecting increasing holdings of public debt by non-residents, with Portugal and Greece being the more exposed at −83% and −143% of GDP, respectively.

The central bank position is small for most countries. It is only highly negative in the case of Greece, mostly corresponding to the TARGET2 balance of the country, which is itself the counterparty of the Emerging Liquidity Assistance (ELA) granted to Greek private banks by the National Bank of Greece.

The financial sector balance sheets are not distributed along a core-periphery axis. Greece has a net positive external position: this reflects the fact that few foreign entities accept to lend to the Greek financial sector; its imbalances are consequently mediated by the Eurosystem and are reflected in the Bank of Greece TARGET2 liabilities. Ireland and, even more, Luxembourg's financial sector external balance sheet are highly positive, reflecting their role of financial hub, while the Dutch financial sector has a strongly negative position.

The 'other' sector includes non-financial actors (households and non-financial corporations) as well as some financial non-banking actors. It is thus a wide category that allows for a conservative assessment of the exposure of the real private economy to the balance sheet redenomination risk. Figure 2 is remarkable as it stresses the very limited exposure of peripheral countries to this risk. The balance of the Greek 'other' sector is for example positive at 29% of GDP, while it is only mildly negative for Spain, Portugal and Ireland

Sources: Eurostat, IMF, World Bank, Banca d'Italia, Bank of Finland, authors' computations

Figure 2. Net international investment position, sectoral breakdown (% of GDP, excl. fin. derivatives, Q3 2015)].

at −12%, −16% and −41%, respectively. The positions of Germany and France are more strongly positive (+57% and +41%).

The international investment position data also give some information about financial derivatives that are excluded from our analysis in the remaining of this article. More precisely, we have access to the aggregate market value of financial derivatives that enter the international investment position. It appears that their weight in the *net* international investment position is rather small, below 5% of GDP in absolute value for all countries, except Portugal (+8, 9%), Luxembourg (+10, 3%) and Netherlands (+12, 8%). Moreover, in proportion of the *gross* international assets or liabilities, they typically represent less than 5% of the international position, except for Germany (about 10% on both sides) and France and Finland (about 14% on both sides).

Unfortunately, we do not have access to the notional value of the assets underlying the financial derivatives, which is needed to compute the precise impact of redenomination. However, the fact that the net positions in terms of market value are rather small means that it is likely to be the same in terms of notional value: it could be that many positions are hedged by a similar position in the other direction, with some financial institution acting as an intermediary. Hence the redenomination effect could be limited on the aggregate (though there may be redistributive effects), and in any case, it should be mostly located in the financial sector.

4. Relevant debt

The previous section presented the international investment positions by country and by sector, which gives only an approximation of the balance sheet at risk in case of euro exit.

We now turn to a more accurate assessment of the foreign currency mismatch problem, beginning with the liability side. As shown on Table 2, only the debt components (loans and bonds) are at risk. Other components will not be affected by the change of currency, either because they are not a financial contract directly expressed in monetary terms (like equity), or because they will be redenominated in the new domestic currency (like deposits in domestic banks), and among loans and bonds, some will be redenominated in the new currency, as explained in section 2.2, depending on their governing law. What we are interested in is therefore the 'relevant debt', i.e. the sum of the loans and bonds that will remain in euros (in case of a single country exit) or that will be redenominated in some other foreign currency (in case of a complete break-up).

In order to identify bonds that are governed by foreign law, we use the Bank of International Settlements' (BIS) debt securities statistics. The database distinguishes bond issues depending on their issue market, domestic or international: bonds that have a foreign governing law are always classified as international, though some bonds governed by domestic law can also be classified as international.[4] In our analysis, we therefore use international bonds as defined by the BIS as a proxy for foreign law bonds; since our relevant debt estimates may overstate the true figures, they should therefore be considered as an upper bound on the currency risk.

Concerning loans, we assume that loans from foreign bank are under foreign law, while law from domestic banks is under domestic law. The World Bank's Quarterly External Debt Statistics (QEDS) provide figures for cross-border loans, with a breakdown by institutional sector, that we use as a proxy for foreign law loans.

We begin by looking at the relevant debt of the general government sector. Figure 3 shows the international bonds emitted by eurozone governments, with a breakdown depending on the maturity. Overall, government bonds do not represent a very high risk, since international bonds represent 10% or less of GDP for most countries. It is even almost zero for France. There are two exceptions: Austria, with about 25% of GDP in international bonds, and Greece with 15% (mostly English law bonds emitted during the 2012 restructuring). Moreover, short-term bonds represent only a small fraction of the total.

Similarly, Figure 4 indicates the loans at risk for the general government sector. Countries that underwent an adjustment program clearly stand out on that graph: Greece, Ireland, Portugal and Spain, which received loans from other Eurozone governments, or from institutions like the European Financial Stabilization Mechanism (EFSM), the European Financial Stability Facility (EFSF) or its successor the European Stability Mechanism (ESM). In particular, external loans of the Greek government represent 126% of the country's GDP, and today constitute the bulk of Greece's public debt.

As mentioned in Section 3, one should also look at the central bank positions in order to get the full picture for the public sector. However, most of the external position of central banks is related to TARGET2 balances (see Appendix A.2) and to banknotes issuance (Whittaker, 2011): in both cases, it is difficult to distinguish between a liability and an asset side, and only the net position is available, as reported in the next section.

Figure 5 presents international bonds emitted by financial corporations (banks and non-banks alike), both short and long term.[5] First, one can see that the relevant debt levels are
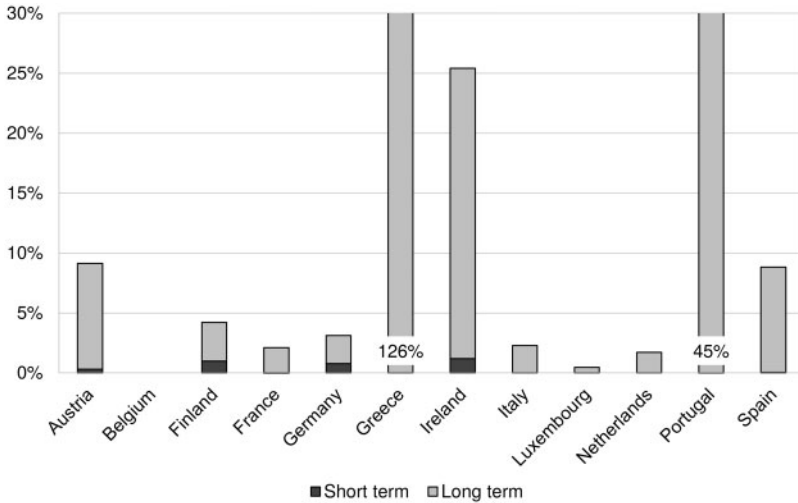
---

4   See Gruić and Wooldridge (2012, box 2, p. 70).
5   We don't report the corresponding figures for loans, since they are very small; interbank lending essentially takes the form of security trading.
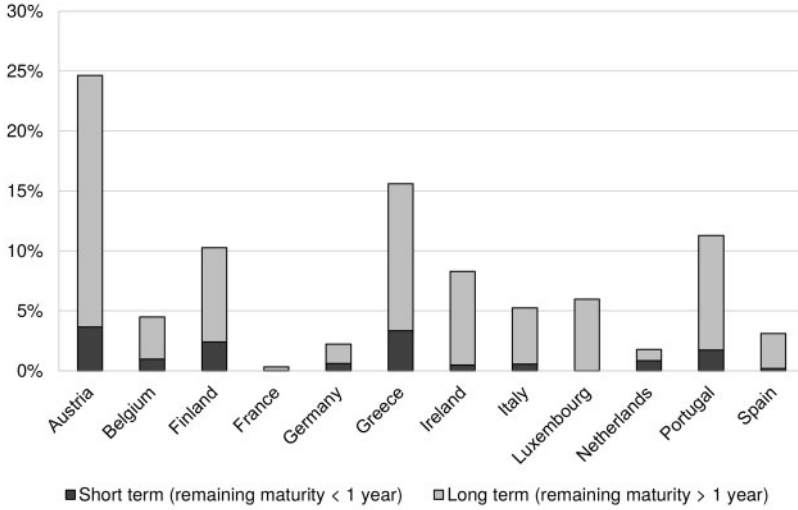
Figure 3. International bonds issued by governments (% of GDP, Q3 2015)].

Figure 4. Cross-border loans of general government (% of GDP, Q3 2015)].

higher for financial corporations than for governments: for most countries, they represent between 20% and 40% of GDP. Three exceptions stand out: Luxembourg, Ireland and the Netherlands, which have much higher levels, due to their status of financial intermediaries. Also note that the share of short-term debt tends to be higher than for governments.
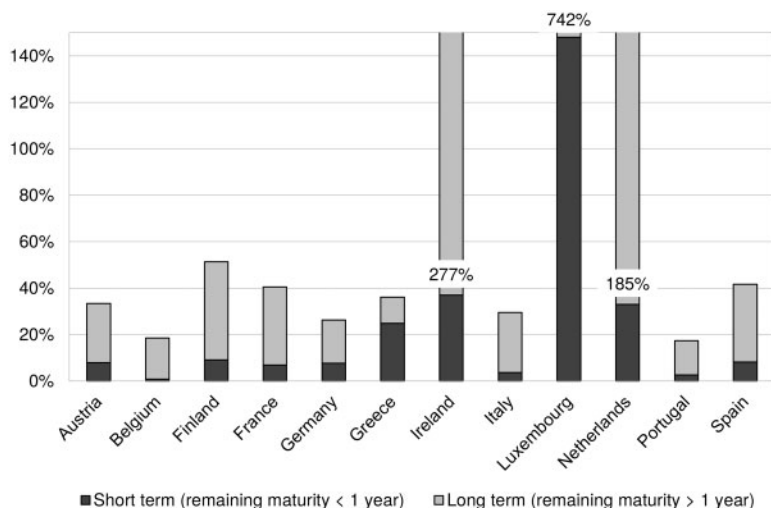
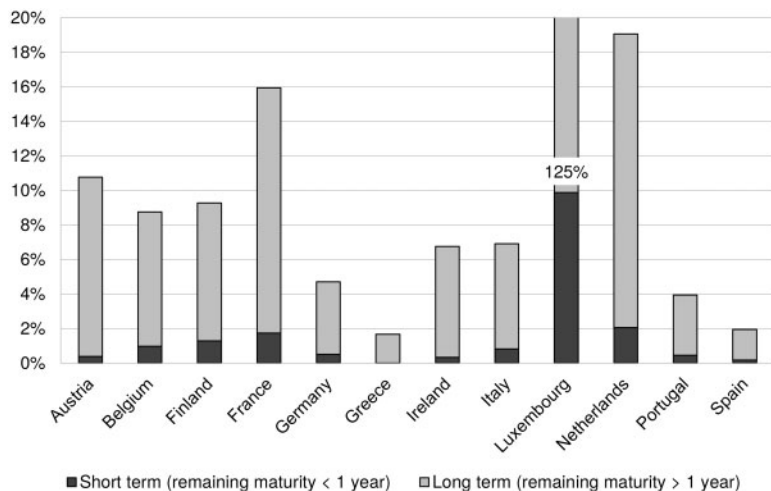Figure 5. International bonds issued by financial corporations (% of GDP, Q3 2015)].

Figure 6. International bonds issued by non-financial corporations (% of GDP, Q3 2015)].

In particular, the proportion of short-term debt is very high for Greek banks, probably due to their perceived riskiness by markets which makes long-term borrowing too expensive for them.

Figure 6 reports the international bonds issued by non-financial corporations. Luxembourg, where those stand at 25% of GDP, is the usual outlier, suggesting that some
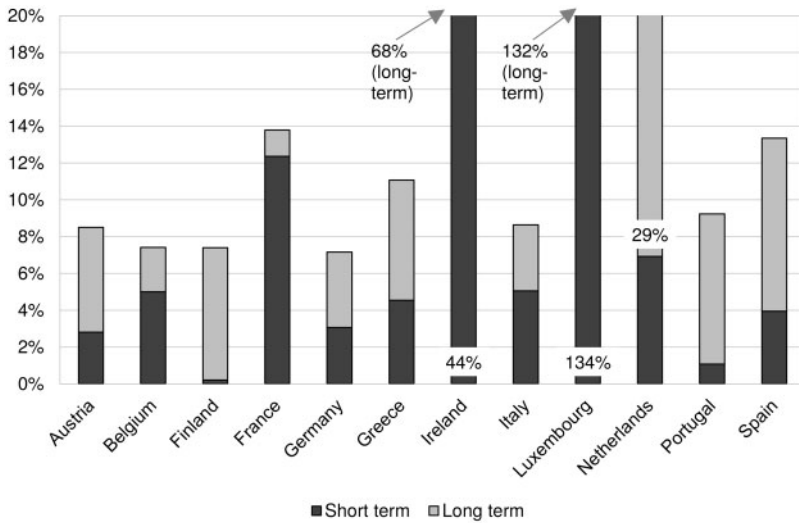
Figure 7. Cross-border loans of corporations (excl. MFI) and households (% of GDP, Q3 2015)].

corporations classified as non-financial may also be involved in financial intermediation. At the other extreme, it is interesting to see that the GIPSI countries are precisely those where non-financial corporations are the less exposed to foreign law bonds (Germany being the only other country with a similarly low exposure). Total foreign bonds levels are also rather small in absolute terms, between 2% and 6% of GDP for those countries. This may reflect either a structurally smaller financial integration or the fact that the crisis has engendered a refragmentation of eurozone financial markets, as mentioned in the introduction; in any case, the productive sector of the GIPSI countries is not so much vulnerable to a currency shock via the bond channel. The difference between Germany and France is also striking: France's non-financial sector is four times more exposed than Germany's to that kind of shock.

Concerning cross-border loans of non-financial corporations, one faces a difficulty: the only data available to our knowledge come from the balance of payments statistics (Figure 7), which aggregate non-financial corporations with non-banking financial corporations, households and non-profit private organizations. The inclusion of households and non-profit is probably not a big issue since one can reasonably assume that they don't borrow much abroad; but non-banking financial firms are susceptible to blur the picture. The statistics that we report are therefore meant to provide an upper bound of the risk for the non-financial firms. Indeed, Luxembourg, Ireland and the Netherlands appear to be the usual outliers, with very high loans levels, which suggest a significant financial component in their data. For the other countries, the average exposure is of 10% of GDP, with a significant short-term component.

We conclude this overview of the debt at risk by constructing summary statistics by sector. Table 3 gives, for each of the three sectors, the total of the debt at risk and its short-term

Table 3. Relevant debt by sector (% of GDP, Q3 2015)]

	Greece	Italy	Portugal	Spain	Ireland	France
General government	142%	8%	57%	12%	35%	2%
incl. short term	3%	1%	1%	0%	2%	0%
Financialcorporations	42%	30%	18%	43%	395%	42%
incl. short term	29%	4%	2%	8%	98%	8%
Non-financial corps. + households	13%	18%	20%	15%	312%	33%
incl. short term	5%	8%	8%	4%	53%	17%

	Germany	Netherlands	Austria	Luxembourg	Belgium	Finland
Generalgovernment	6%	5%	35%	7%	10%	17%
incl. short term	2%	2%	4%	0%	2%	6%
FinancialCorporations	28%	225%	35%	876%	22%	59%
incl. short term	9%	36%	8%	135%	1%	17%
Non-financial corps. + households	20%	66%	23%	910%	23%	20%
incl. short term	5%	18%	6%	385%	13%	4%

Source: BIS, World Bank QEDS, authors' computations.

component.[6] Note that, for the reason explained above, the loans of the non-banking financial corporations are attributed to the non-financial corporations' sector, so the latter figure is possibly overestimated (while the financial sector risk is possibly underestimated by the same amount).

5. Relevant net position

The previous section discussed the currency risk on the liability side of the balance sheet, which is the main problem in the case of a devaluation.

However, the asset side may be useful for mitigating the devaluation problem, since assets in foreign currency will become more valuable in the domestic currency. Moreover, in the case of a currency appreciation, it is from the asset side that difficulties can arise since assets denominated in foreign currency would be depreciated.

In this section, we present our estimation of the relevant net position (i.e. the net foreign currency position as defined in section 2.1) for economies as a whole and by sector. Figure 8 presents the results.

On the asset side, all components of the international investment position have been included, with the exception of the foreign direct investment[7]: we consider that, because of its relative illiquidity in comparison to other financial assets, the mitigation potential of that class of asset is too low to be relevant. On the liability side, we use the relevant debt concept presented in the previous section. The net relevant position is the difference between the

6 Note that our relevant debt measures do not include debts classified as foreign direct investment; see Appendix A.1 for more details on this issue.

7 As shown on Table 2, all assets components of the international investment position are sensitive to currency movements. Note that in addition to FDI, we also exclude financial derivatives, because of the difficulty in interpreting the data.

Figure 8. Relevant net position (% of GDP, excl. fin. derivatives, Q3 2015)].
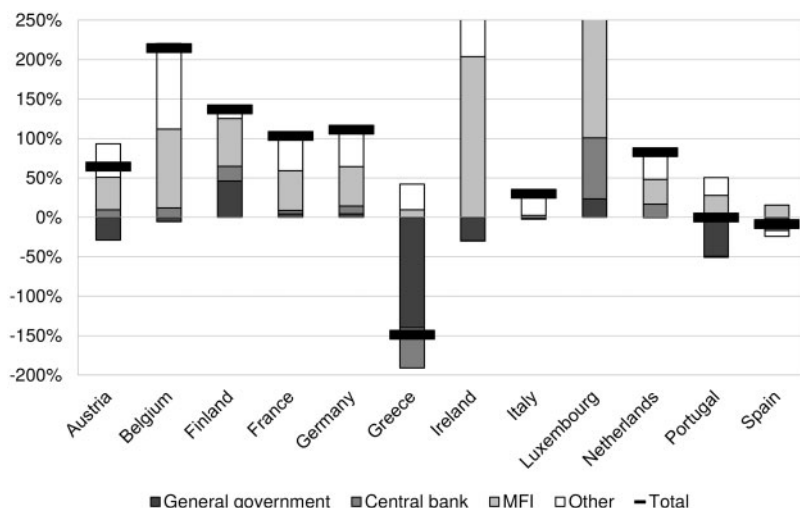
Source: Eurostat, IMF, BIS, World Bank, Banca d'Italia, Bank of Finland, authors' computations

relevant assets and the relevant debt.[8,9] A negative (resp. positive) position indicates an exposition to a nominal depreciation (resp. appreciation) risk.

As shown on Figure 8, the most striking fact that emerges from the analysis is that the relevant net position is positive for almost all countries in aggregate, the only exceptions being Greece and Spain. Moreover, the sectors representing the private sector (MFI and "other") are also always in positive territory, with the exception of the 'other' sector in Spain. On the government side, Greece and Portugal exhibit a very negative position, Austria, Spain and Ireland have a mildly negative one, while the other countries display a positive position.

8 The sectoral breakdown is the same as for the international investment position figures of Section 3. In particular, the 'other' sector includes the non-banking financial sector; this means that on the liability side we do not follow the same convention as in the previous section, for consistency with the asset side.

9 Note that there is no inconsistency of treatment between the liability side and the asset side. As a first example, consider an ESM loan granted to some periphery country. From the point of view of that periphery country, it is clearly a foreign currency debt. But from the point of view of creditor countries, it is also a foreign currency asset, because upon their exit from the euro zone the loan would remain denominated in euros (or in the equivalent of the ECU in case of complete breakup). As a second example, consider a bond emitted by a French firm under foreign law (typically English or New York law) and detained by a German entity. From the point of view of France, this is clearly a foreign currency liability, both in case of French exit or complete break-up (in the latter case, rede-nomination is unlikely to be in Francs). From the German perspective, in case of a German exit, the bond would remain in euros and it is correct to count it as a foreign currency asset. The situation is a little more complex in the case of a complete break-up: it should also be redenominated in the equivalent of the ECU but there is a higher degree of juridical uncertainty, as a court could decide to redenominate it in Deutschmarks (though other options are also possible, like UK pounds, US dollars or a basket of currencies); counting it as a foreign currency could not be correct in that case.

This result indicates that for those countries that are likely to experience a post-euro devaluation, i.e. the GIPSI and France, there is no aggregate balance sheet risk for the private sector (except for Spain), and even no risk for the public sector in some cases. This does not mean that there is no problem, because the holders of the sensitive assets may not be the same as those of the sensitive liabilities, but at least there is room for maneuver.

Conversely, the significantly positive position of those countries that are likely to experience a post-euro appreciation (Germany, the Netherlands, Austria) indicates that they are also at risk. Their assets accumulated abroad would lose part of their value if they were to abandon the single currency. This means that countries which have a weight significant enough to endanger the EMU if they were to leave, like France, Spain or Italy, have a bargaining power that is much greater than what a superficial current account analysis may suggest.

6. Balance sheet movements

In this section, we go a step further in the analysis by computing expected balance sheet movements for the three major sectors (public, private financial and private non-financial) in every country. We report changes in both the relevant debt and the relevant position, since the former is the most acute issue for countries undergoing a depreciation, while the latter can help to mitigate the debt problem, and at the same time constitutes the problem for countries undergoing an appreciation. We also isolate the short-term component of the relevant debt since it is the most problematic one in case of a depreciation.

6.1 Exchange rate adjustments

The direction of the exchange rate adjustment (depreciation or appreciation) is indeed central for assessing the nature of the country and sectoral risk. But one also needs to know the expected magnitude of that adjustment for a more precise analysis. Exchange rate movements are particularly hard to foresee—and even more so in the context of an unprecedented event like a euro exit; it nevertheless makes sense to rely on estimates of equilibrium exchange rates since, by construction, those reflect the most likely outcomes of the currency floating process, once overshooting effects have vanished.

The fundamental equilibrium exchange rate (FEER) methodology (Williamson, 1994; Cline, 2008) seems well-suited for that purpose, in particular because there is empirical evidence that FEER estimates are related to real exchange rate in the long run (Saadaoui, 2015). Table 4 presents our own estimates for real exchange rate misalignments in the euro area, upon which our risk assessment is based.[10] Consistently with the FEER approach, these estimates correspond to the required value added price adjustments within the

---

10 The numbers are derived from the analysis of the internal and external imbalances of the eurozone presented in iAGS (2015, pp. 96–101). The specific variant of the FEER methodology is described in iAGS (2014, pp. 187–189) and bears some resemblance to Jeong *et al.* (2010). The exports and imports volume and price equations are very similar. There are however important differences. First, the current account objectives differ: in iAGS (2015), the objective is the current account that stabilizes the net international investment position at a 20 years' horizon above a threshold of −35% of GDP. Second, these estimates do not rely on national models for European countries, but instead on a multinational model that includes the 11 largest countries of the euro area. Finally, the rest of the world is not disaggregated and is considered as one block.

Table 4. Hypotheses for post-euro currency movements

Country	Exchange rate adjustment
Belgium	−17%
Germany	+14%
Ireland	−6%
Greece	−38%
Spain	−10%
France	−11%
Italy	+1%
Luxembourg	+14%
Netherlands	+15%
Austria	+15%
Portugal	−14%
Finland	−18%

Source: iAGS (2015) and authors' computations.

eurozone if countries are to reach both their external equilibrium (a current account that sta-
bilizes the international investment position) and their internal one (closed output gaps). But
those adjustments within the EMU can also be reinterpreted as exchange rate adjustments in
a floating regime (under the hypothesis of fixed internal value added prices), and this is pre-
cisely the interpretation that we will be using afterwards.

The numbers that we report in Table 4 correspond to the adjustments *relative to the euro
area weighted average*. As a consequence, this means that they can be used for the two sce-
narios that we analyze in this article: in the case of a single country exiting the EMU (in
which case the number corresponds to the expected movement of the new currency relatively
to the euro), and in the case of the complete break-up.[11]

According to these estimates, Greece still needs a very significant depreciation since the
observed current account improvement is mostly artificial, relying on internal demand com-
pression and underutilization of the productive potential. Other southern countries (Spain
and Portugal) as well as France need a milder devaluation, while Germany, the Netherlands
and Austria should undergo an appreciation. More surprisingly, Italy is neither undervalued
nor overvalued with this methodology, because its structural current account is close to
equilibrium and its net international investment position is only mildly negative.

The adjustments presented above correspond to the misalignments before the euro exit.
But one could argue that inflation rates could diverge following the exit, therefore creating
an additional exchange rate drift over time. We however do not include this dimension in

---

11   In the complete break-up case, we are implicitly taking the simplifying assumption that the currency
composition of the post-euro balance sheets will reflect the weights of eurozone countries (i.e. that
the foreign currency components of the balance sheets of all countries will consist of 30% of
Deutschmarks, 22% of French Francs, 16% of Italian Lira, etc.). Moreover, for the two scenarios, we
are also assuming that the non-euro currencies (U.S. dollar, UK pound, yen, etc.) do not move rela-
tively to the euro (or relatively to the weighted average of the new currencies in the break-up
case).

our computations, because our baseline scenario is that, after the shaky period of the break-up, a new monetary arrangement would be found that would include exchange rate targets. Moreover, it should be noted that a break-up could induce a convergence rather than a divergence of inflation rates: there is currently a substantial heterogeneity of inflation rates across eurozone countries, precisely because there is a single monetary policy that does not fit all (Iacus and Porro, 2014; Höpner and Lutter, 2014).

One could also argue that the adjustments presented here correspond to long-term targets, and that there may be overshooting which is not taken into account. Since it is very difficult to quantify the risk of overshooting and to forecast the dynamic path of the exchange rate adjustment, our strategy instead consists in distinguishing the short-term debt component in our risk analysis.

6.2 Quantifying balance sheet movements

Multiplying the exchange rate adjustments with the estimates of the relevant debt (or net position), one obtains the expected relevant aggregate balance sheet movements after the euro exit.

Table 5 presents the variation of total debt for each sector following the euro exit. It is the arithmetic product of the relevant debt (Table 3) with the (opposite of the) exchange rate variation (Table 4). A positive number therefore indicates an increase in total debt. Similarly, Table 6 indicates the variation of the short-term component of debt.

Finally, Table 7 presents the variation of the total net worth for each sector following the euro exit. It is the arithmetic product of the relevant net position (Figure 8) with the (opposite of the) exchange rate variation (Table 4). A positive number therefore indicates an improvement of the balance sheet.

Taken together, those tables highlight five sectors whose balance sheet will suffer from a strong negative impact in case of a euro exit: Greece's public sector, for which a large debt restructuring seems inevitable; the financial sectors of Greece, Ireland and Luxembourg; and the non-financial sector of Luxembourg. Serial defaults and bankruptcies are highly probable in those sectors, and strong policy action is called for.

Three other sectors are also at significant risk, though to a lesser extent: Portugal's public sector, which would probably have to default on its EFSF/EFSM loans; Finland's financial sector; and Ireland non-financial sector.

It should be noted here that the assessed risk levels of Ireland's and Luxembourg's non-financial sector may be exaggerated due to the data limitations discussed in Section 4: cross-border loans of non-banking financial corporations are attributed to the non-financial sector, and this may bias the risk upward given the huge involvement of these countries in international financial relations.

The case of Italy is a bit special: since our estimate for the expected exchange rate movement is almost zero (Table 4), our methodology indicates no risk at all, neither downside nor upside, by construction. If one instead assumes a 15% depreciation of the new Lira, then the downside risk remains limited for the three sectors, qualitatively like that of Spain.

The most striking result of our analysis is that the risk for the non-financial private sector is low for most countries (and maybe even for all of them given the remark above). The negative aggregate impact on balance sheets for productive firms and for households should thus be limited and, should not lead in itself to significant disruptions. Currency redenomination should thus be manageable assuming that the appropriate policy measures are put in

Table 5. Total debt variation following euro exit (% of GDP, Q3 2015)]

	Central bank + government sector	Financial corporations	Non-financial corps. + households
Austria	−5, 4%	−5, 3%	−3, 6%
Belgium	+1, 6%	+3, 7%	+3, 7%
Finland	+3, 1%	+10, 9%	+3, 7%
France	+0, 3%	+4, 7%	+3, 7%
Germany	−0, 8%	−3, 8%	−2, 7%
Greece	+54, 1%	+16, 2%	+5, 1%
Ireland	+2, 0%	+22, 8%	+18, 0%
Italy	−0, 1%	−0, 2%	−0, 1%
Luxembourg	−0, 9%	−118, 5%	−123, 0%
Netherlands	−0, 7%	−33, 0%	−9, 7%
Portugal	+8, 0%	+2, 6%	+2, 9%
Spain	+1, 3%	+4, 5%	+1, 6%

Source: Authors' calculations.

Table 6. Short-term debt variation following euro exit (% of GDP, Q3 2015)]

	Central bank + government sector	Financial corporations	Non-financial corps. + households
Austria	−0, 7%	−1, 2%	−1, 0%
Belgium	+0, 3%	+0, 2%	+2, 1%
Finland	+1, 1%	+3, 2%	+0, 8%
France	−0, 0%	+0, 9%	+2, 0%
Germany	−0, 2%	−1, 2%	−0, 7%
Greece	+1, 3%	+11, 0%	+1, 9%
Ireland	+0, 1%	+5, 6%	+3, 0%
Italy	−0, 0%	−0, 0%	−0, 0%
Luxembourg	−0, 0%	−18, 2%	−52, 1%
Netherlands	−0, 3%	−5, 3%	−2, 6%
Portugal	+0, 1%	+0, 2%	+1, 2%
Spain	−0, 0%	+0, 9%	+0, 4%

Source: Authors' calculations.

place to contain potential domestic and international spillovers from the few hot spots where financial sector and public sector vulnerability to balance sheet redenomination is concentrated.

7. Conclusion

This article has tried to assess the balance sheet effects of a hypothetical euro exit, looking at the twelve historical members of the eurozone, both from an aggregate and sectoral perspective.

Table 7. Net worth variation following euro exit (% of GDP, Q3 2015)]

	Central bank + government sector	Financial corporations	Non-financial corps. + households
Austria	+3, 0%	−6, 3%	−6, 5%
Belgium	+1, 1%	+16, 5%	+18, 0%
Finland	+12, 0%	+11, 2%	+2, 1%
France	+1, 0%	+5, 7%	+4, 9%
Germany	−1, 9%	−6, 7%	−6, 3%
Greece	−72, 8%	+3, 7%	+12, 3%
Ireland	−1, 7%	+11, 8%	+24, 7%
Italy	+0, 0%	+0, 0%	−0, 2%
Luxembourg	−13, 6%	−181, 0%	−725, 4%
Netherlands	−2, 4%	−4, 6%	−5, 1%
Portugal	−7, 2%	+3, 9%	+3, 2%
Spain	−1, 8%	+1, 6%	−0, 8%

Source: Authors' calculations.

Our broad conclusion is that even though this issue should be taken seriously, its order of magnitude should not be exaggerated. In particular, the exposure of the non-financial private sector balance sheet to the redenomination risk is limited and should not lead in itself to major disruptions, provided that proper policy measures are implemented to prevent spillovers from a limited number of hot spots.

We have identified some specific vulnerabilities: the public debts of Greece and Portugal, for which a substantial restructuring or even a default would be the likely outcome; the financial sectors of Greece, Ireland, Luxembourg, and potentially Finland, which would have to undergo a deep restructuring; and potentially, the non-financial sectors of Ireland and Luxembourg, though that latter result may be an artifact caused by our data limitations.

Assessing the costs of a euro exit obviously matters for properly dealing *ex post* with the event, if it were to materialize. But this assessment is also interesting from an *ex ante* perspective, especially for a country which is considering whether to leave or to stay and is performing a cost-benefit analysis. From that perspective, it is important to remember that, for periphery countries, staying in the eurozone also leads to a negative balance sheet effect, because of the debt deflation strategy imposed by creditors. This is most evident in the case of Greece, whose public debt-to-GDP ratio continues to rise through the denominator effect, as growth and inflation head down.

From an international political economy perspective, this research helps to delineate the balance of forces in the case of an exit or a break-up of the single currency. By stressing the vulnerability of the balance sheet of both deficit and creditor countries to such an event, this research emphasizes the incentives to cooperate in order to prevent excessive exchange rate adjustments.

Even though this study has shed light on some critical dimensions of the issue at stake, more work could be done to refine the analysis. In particular, we did not perform an estimation of the cross-sectoral and cross-country spillover effects of possible defaults; this is

however made difficult by the large uncertainty that surrounds the policy implemented after the exit. Another critical dimension still to be investigated is the risk heterogeneity within sectors: even if the net sectoral balance sheet effect is small, are relevant assets detained by the same agents as relevant liabilities? The answer to this question significantly affects the relevant policy responses.

More fundamentally, our analysis focuses on a single dimension of a hypothetical euro exit, and a broader assessment of the risks and costs of exiting the EMU would therefore need to consider in detail the challenges related to other aspects of this process such as trade disruptions and possible contagion between classes of assets due to capital market perturbations.

In particular, a limitation concerns the impact on interest rate of an exit from the single currency. Diminishing interest rate spreads in the early 2000 was one of the most spectacular consequences of the introduction of the euro. For devaluing countries, a change in the country risk assessment could result in higher interest rates both on the domestic market and the international market as that was the case in the period before the single currency, which could weight on growth prospects. Nonetheless, one must keep in mind that the convergence of nominal interest rates was a mixed blessing: due to persistent diverging inflation rates, the effect of the ECB one size fits all monetary policy has not resulted in a convergence of real interest rates, which has contributed to the imbalances leading to the crisis.

Another limitation is that we overlook in this study the role of the European central bank in the event of a single currency exit or break-up. The ECB role is key, not only because of TARGET2 and its handling, but also because of its role as a holder of positions: its ability to acquire huge amount of assets illustrated by the asset purchase programs initiated in March 2015 imply that it could potentially be mobilized to absorb some troubled assets to bridge between two monetary arrangements and provide some relief on the most vulnerable classes of assets during the transition period. This question points to the necessity to explore the various institutional unfolding that a euro break-up or unilateral exit could take, an issue that goes well beyond the scope of this study.

Acknowledgements

References

Amiel, D. and Hyppolite, P.-A. (2015) *Is there an easy way out? Private marketable debt and its implications for a Euro breakup: the case of France*, Cahier No. 2015-02, École Polytechnique.

Andreoni, A. and Chang, H.-J. (2016) 'Industrial Policy and the Future of Manufacturing', *Economia e Politica Industriale*, **43**, 491–502.

Armingeon, K., Guthmann, K. and Weisstanner, D. (2016) 'How the Euro Divides the Union: The Effect of Economic Adjustment on Support for Democracy in Europe', *Socio-Economic Review*, **141**, 1–26.

Auguste, S. *et al.* (2006) 'Cross-Border Trading as a Mechanism for Implicit Capital Flight: ADRs and the Argentine Crisis', *Journal of Monetary Economics*, **53**, 1259–1295.

Bebczuk, R. N., Panizza, U. and Galindo, A. (2006) *An Evaluation of the Contractionary Devaluation Hypothesis*, Research Department Publications No. 4486, Inter-American Development Bank.

Bleakley, H. and Cowan, K. (2008) 'Corporate Dollar Debt and Depreciations: Much Ado about Nothing?', *The Review of Economics and Statistics*, **90**, 612–626.

Boyer, R. (2012) 'The Four Fallacies of Contemporary Austerity Policies: The Lost Keynesian Legacy', *Cambridge Journal of Economics*, **36**, 283–312.

Cavallo, M. *et al.* (2005) *Exchange rate overshooting and the costs of floating*, Working Paper Series No. 2005-07, Federal Reserve Bank of San Francisco.

Cecchetti, S., McCauley, R. and McGuire, P. (2012) *Interpreting TARGET2 balances*, BIS Working Paper No. 393, Bank for International Settlements.

Cline, W. R. (2008) *Estimating Consistent Fundamental Equilibrium Exchange Rates*, Peterson Institute Working Paper No. WP08-6, Peterson Institute for International Economics.

Corden, W. M. and Neary, P. (1982) 'Booming Sector and De-Industrialization in a Small Open Economy', *The Economic Journal*, **92**, 825–848.

ECB (2017) 'Financial Integration report 2017', accessed at https://www.ecb.europa.eu/pub/pdf/other/ecb.financialintegrationineurope201705.en.pdf on December 15, 2017.

ECB (2016) 'ECB publishes Eurosystem disaggregated balance sheet data', Press release, July 27. accessed at https://www.ecb.europa.eu/press/pr/date/2016/html/pr160727.en.html on December 15, 2017.

Eichengreen, B. (2010) 'The breakup of the euro Area', In Alesina, A. and Giavazzi, F. (eds) *Europe and the Euro*, New York, University of Chicago Press and NBER, pp. 11–51.

Eurostat. (2017) 'European sector accounts—background—Statistics Explained', accessed at http://ec.europa.eu/eurostat/statistics-explained/index.php/European_sector_accounts_-_background#European_Union_institutions_and_other_European_bodies on December 15, 2017.

Flassbeck, H. and Lapavitsas, C. (2015a) *Against the Troika: Crisis and Austerity in the Eurozone*, Chicago, Verso Books.

Flassbeck, H. and Lapavitsas, C. (2015b) 'Confronting the Failure of the European Monetary Union', In Jäger, J. and Springler, E. (eds) *Asymmetric Crisis in Europe and Possible Futures: Critical Political Economy and Post-Keynesian Perspectives*, Abingdon UK, Routledge, pp. 131–149.

Frankel, J. (2005) *Mundell-Fleming Lecture: Contractionary Currency Crashes in Developing Countries*, IMF Staff Paper No. 52, International Monetary Fund.

Gechert, S., Hallett, A. H. and Rannenberg, A. (2016) 'Fiscal Multipliers in Downturns and the Effects of Euro Area Consolidation', *Applied Economics Letters*, **23**, 1138–1140.

Gruić, B. and Wooldridge, P. (2012) 'Enhancements to the BIS debt securities statistics', *BIS Quarterly Review*, December, 63–76.

Hardouvelisa, G. A. and Gkionisb, I. (2016) 'A Decade Long Economic Crisis: Cyprus versus Greece', *Cyprus Economic Policy Review*, **10**, 3–40.

Hobolt, S. B. and de Vries, C. E. (2016) 'Public Support for European Integration', *Annual Review of Political Science*, **19**, 413–432.

Höpner, M. and Lutter, M. (2014) *One Currency and Many Modes of Wage Formation. Why the Eurozone is too Heterogeneous for the Euro*, MPIfG Discussion Paper No. 14/14, Max Planck Institute for the Study of Societies.

Iacus, S. M. and Porro, G. (2014) 'Does European Monetary Union Make Inflation Dynamics More Uniform?', *Applied Economics Letters*, **21**, 391–396.

iAGS (2014) 'The independent Annual Growth Survey 2015: A Diverging Europe on the Edge', accessed at https://www.iags-project.org/documents/iags_report2015.pdf on January 23, 2018.

iAGS (2015) 'The independent Annual Growth Survey 2016: Give Recovery a Chance', accessed at https://www.iags-project.org/documents/iags_report2016.pdf accessed on January 23, 2018.

Jamet, J.-F., Bergbauer, S. and Persson, É. (2017) 'The Reputation of the Euro and the ECB: Interlinked or Disconnected?', presented at the EUSA Fifteenth Biennial Conference, Miami.

Jeong, S.-E., Mazier, J. and Saadaoui, J. (2010) 'Exchange Rate Misalignments at World and European Levels: A FEER Approach', *International Economics*, **121**, 25–58.

Jones, E., Kelemen, R. D. and Meunier, S. (2016) 'Failing Forward? the Euro Crisis and the Incomplete Nature of European Integration', *Comparative Political Studies*, **49**, 1010–1034.

Lane, P. R. (2012) 'The European Sovereign Debt Crisis', *Journal of Economic Perspectives*, **26**, 49–67.

Malerba, F. (2002) 'Sectoral Systems of Innovation and Production', *Research Policy*, **31**, 247–264.

Mazier, J., Duwicquet, V. and Saadaoui, J. (2013) 'Désajustements De Change, Fédéralisme Budgétaire Et Redistribution: Comment S'ajuster En Union Monétaire', *Revue De l'OFCE*, **127**, 57–96.

Mazier, J. and Petit, P. (2013) 'In Search of Sustainable Paths for the Eurozone in the Troubled Post-2008 World', *Cambridge Journal of Economics*, **37**, 513–532.

Nordvig, J. and Firoozye, N. (2012) *Rethinking the European monetary union*, Wolfson Economics Prize 2012, final submission, accessed at http://jensnordvig.com/wp-content/uploads/2013/08/Rethinking-the-European-monetary-union.pdf on May 30, 2016.

Polanyi, K., Malamoud, C. and Angeno, M. (1944) *La Grande Transformation: Aux origines politiques et économiques de notre temps*, Collection Tel, Gallimard.

Proctor, C. (2011) 'The Euro Fragmentation and the Financial Markets', *Capital Markets Law Journal*, **6**, 5–28.

Puppetto, L. and Sode, A. (2012) *Ajustement extérieur et effets de valorisation*, Document de travail no. 2012/03, Direction générale du Trésor, France.

Rodrik, D. (2008) *The Real Exchange Rate and Economic Growth*, Brookings Papers on Economic Activity, Fall 2008, 365–412.

Roth, F., Jonung, L. and Nowak-Lehmann, D. (2016a) 'Crisis and Public Support for the Euro, 1990–2014', *Journal of Common Market Studies*, **54**, 944–960.

Roth, F., Jonung, L. and Nowak-Lehmann, F. (2016b) 'Public support for the euro', VoxEU.org, accessed at http://voxeu.org/article/public-support-euro on October 18, 2017.

Saadaoui, J. (2015) 'Global Imbalances: Should We Use Fundamental Equilibrium Exchange Rates?', *Economic Modelling*, **47**, 383–398.

Stiglitz, J. (2016) *The Euro and Its Threat to the Future of Europe*, Allen Lane.

Stockhammer, E. (2016) 'Neoliberal Growth Models, Monetary Union and the Euro Crisis. A Post-Keynesian Perspective', *New Political Economy*, **21**, 365–379.

Stockhammer, E., Durand, C. and List, L. (2016) 'European Growth Models and Working Class Restructuring: An International Post-Keynesian Political Economy Perspective', *Environment and Planning A*, **48**, 1804–1828.

Streeck, W. (2014) *Buying Time: The Delayed Crisis of Democratic Capitalism*, New York, Verso Books.

Streeck, W. (2015) 'Why the Euro divides Europe', *New Left Review*, **II**, 95.

Towbin, P. and Weber, S. (2013) 'Limits of Floating Exchange Rates: The Role of Foreign Currency Debt and Import Structure', *Journal of Development Economics*, **101**, 179–194.

Williamson, J. (1994) *Estimating Equilibrium Exchange Rates*, Washington DC, Peterson Institute Press.

Whittaker, J. (2011) *Eurosystem debts, Greece, and the role of banknotes*, MPRA Paper No. 38406, University Library of Munich, Germany.

Appendix

A.1. Debts classified as foreign direct investment

Intra-company lending across borders is classified by statisticians as foreign direct invest-ment. It corresponds to a situation where a parent company lends to or borrows from a sub-sidiary, or when a subsidiary lends to another one. Figure A1 presents the stocks of FDI debt and its decomposition depending on the direction of the intra-company financial flow.

Outstanding amounts are very large for the usual outliers (Ireland, Netherlands, Luxembourg), and are typically between 10% and 20% of GDP for the other countries.

We do not include those amounts in our relevant debt measure (nor do we include them in our relevant net position, since we exclude FDI from it). The rationale is the following: an exchange rate movement affecting the currency in which the loan is denominated corre-sponds to an intra-company redistribution. We therefore make the assumption that such a shock will be easily absorbed by the company, if needed through a partial debt cancellation that neutralizes the effect of the currency move.
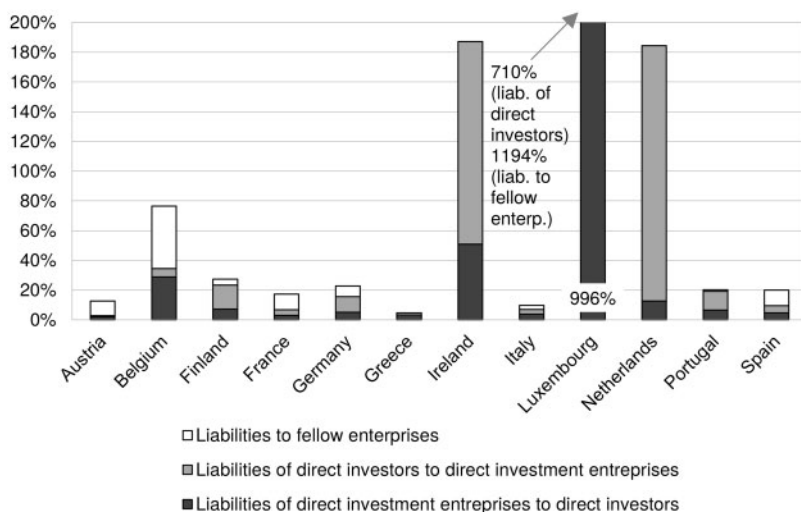
Source: World Bank QEDS

**Figure A1.** Debts classified as FDI (% of GDP, Q3 2015)].

A.2. TARGET2 balances

Figure A2 presents the TARGET2 balances of the twelve countries as of Q3 2015. To put it simply, TARGET2 balances play the same role within the EMU as foreign exchange reserves play in a fixed exchange rate regime (Cecchetti *et al.*, 2012). They move every time a current account operation is not matched by a capital operation.

Technically, those balances represent a claim or a liability of national central banks on/to the Eurosystem as a whole.

In the case of Greece, the TARGET2 claim is for most of it the counterparty of the Emergence Liquidity Assistance (ELA): since banks in other countries are not willing to lend to Greek banks to compensate for capital flights, the financing gap of the Greek banking system is filled through the intervention of the National Bank of Greece, which itself grows a liability to the ECB.

It is therefore clear that TARGET2 balances correspond to claims between sovereign states, that are distinct from official public debt figures. For example, if Greece were to leave the EMU, its TARGET2 liability would have to be settled with other eurozone countries, in addition to the existing bilateral, EFSF and ESM loans.
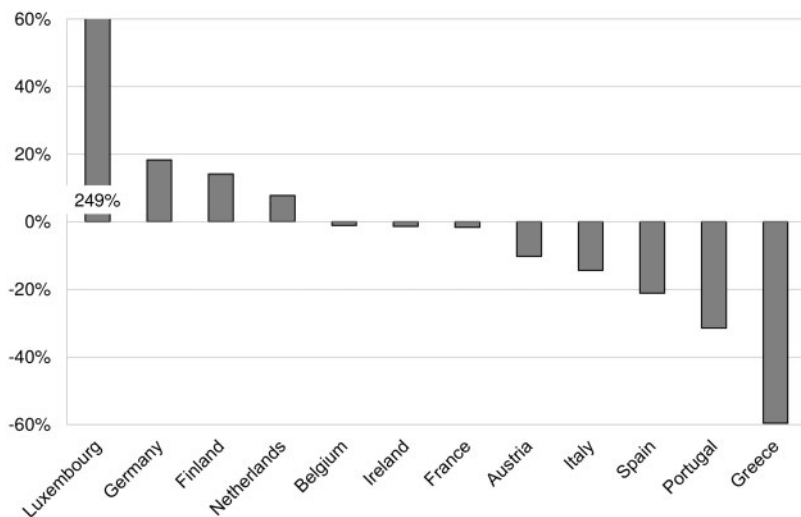
Source: ECB

Figure A2. TARGET2 balances (% of GDP, Q3 2015).