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# Is the Eurozone not a Monetary Union, but an Extraordinary Exchange Rate Union?

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# Is the Eurozone not a Monetary Union, but an Extraordinary Exchange Rate Union?*

Beate Sauer and Friedrich L. Sell

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**Abstract**

The Target imbalances within the Eurozone can be interpreted as a sign of a missing balance of payments adjustment mechanism for the member countries. As the Eurozone lacks a fiscal union, in economic theory it is more an exchange rate union or a system of fixed exchange rates than a monetary union. In the latter, there would not be any national balances of payments, but only one for the whole Eurozone. This paper will show why the Target System is a crucial indicator for the Eurozone not being a monetary union, but an exchange rate union and why countries holding Target liabilities against the European System of Central Banks can be compared to a reserve currency country, e.g. like the US during the Bretton-Woods-System.

**Keywords**: Target Imbalances, Balance of Payments Crisis, Balance of Payments Adjustment Mechanism, Eurozone, Fixed Exchange Rates, Fiscal Union

**JEL Classification**: E40, E41, E42, E50, E52

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# 1. Introduction

Since 2007 and therefore the beginning of the financial crisis, an economic divergence of the European countries, especially the Eurozone countries, could be observed. Sovereign debt levels rocketed, 10-year government bond yields spread within the Eurozone, banking systems came near a collapse, and so on. Also the Target imbalances between the Eurozone countries increased immensely, leading to huge claims of – not only – the Deutsche Bundesbank against the European System of Central Banks (ESCB) and huge liabilities against the ESCB for the so called GIIPS (Greece, Italy, Ireland, Portugal, and Spain). This disequilibrium within the Eurozone results from the Eurozone structure and can therefore be interpreted as a sign of a missing balancing mechanism for the members' balances of payments. As every member country of the Eurozone still is a sovereign state with its own fiscal policy and jurisdiction, in economic theory the Eurozone has to be handled as an exchange rate union or a system of fixed exchange rates instead of a monetary union. In the latter, there would not be any national balances of payments, but only one for the whole Eurozone. This paper will show why the Target System is a crucial indicator for the Eurozone not being a monetary union, but an exchange rate union. Therefore, we integrate the Target System into an exchange rate union model based on the works of Levin (1983) and Feuerstein/Siebke (1987). One main result will be the similarity of a reserve currency country in a system of fixed exchange rates – like the US during the Bretton-Woods-System – and the Eurozone countries holding Target liabilities against the ESCB.

In part, the same would be true for the Federal Reserve System in the US as there also exist different "national" central banks – the federal reserve banks – within the system. One main difference is the fact that these banks do not cover federal states or rather political entities. Therefore, and because of a slightly different setup of their Fedwire System, a direct comparison of our conclusion and model cannot be done.

The rest of the paper is organized as follows: The next section shortly describes the Target System of the Eurozone. Section 3 integrates the Target System into a model of an exchange rate union and explains the dependency of capital mobility on risk involving interest rates. Afterwards, in section 4 we will discuss the second option of balancing, the internal depreciation and appreciation via price level changes. In section 5 we run through the scenario of fiscal policy measures in GIIPS and compare our result with IMF data for these countries. The last section concludes the paper and gives some policy implications.

# 2. The Target System

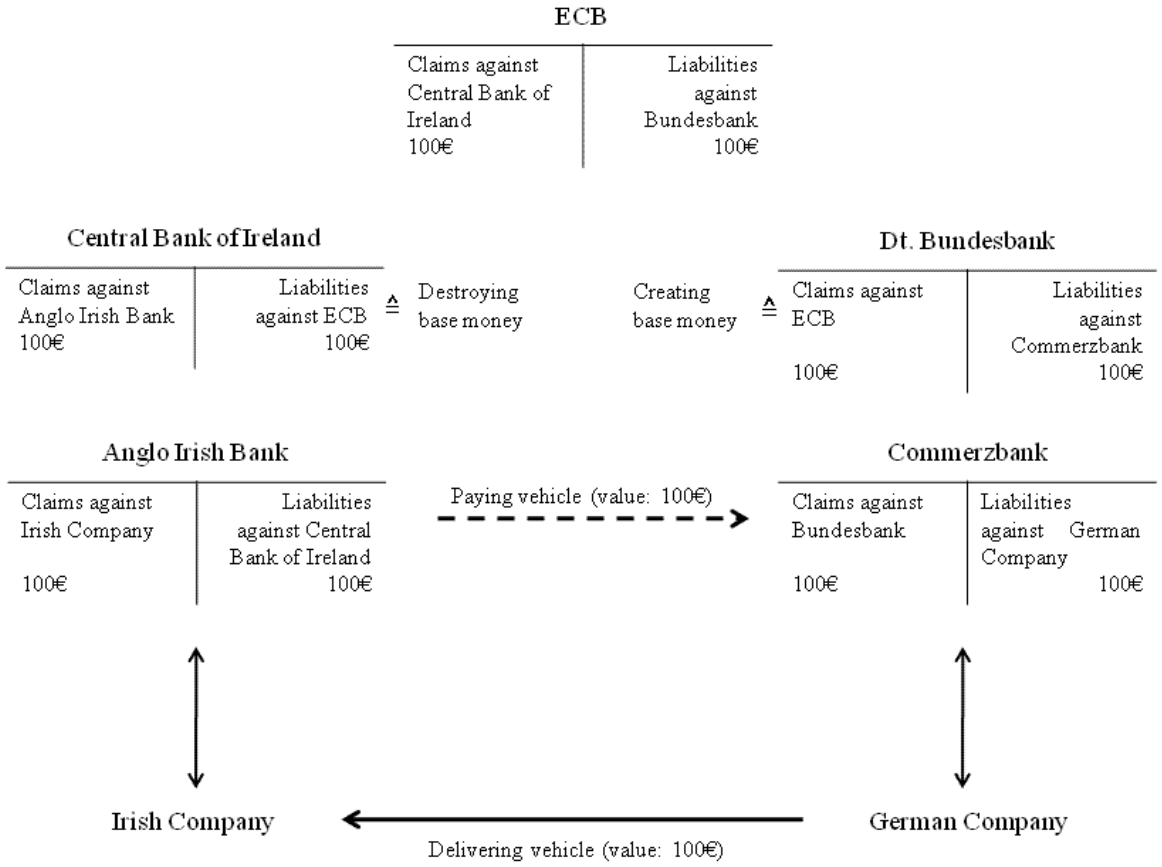
The Target System[1] is the main payment system of the Eurozone. Every cross-border payment from one member country to another has to take place via this system. As the Eurozone is a federal system with the national central banks (NCBs) still existing, the payment from a certain debtor has to be transferred from his bank account at his commercial bank to the correspondent NCB, the European Central Bank (ECB), the foreign NCB and in the end will be booked to the bank account of the creditor at his commercial bank. Figure 1 illustrates the example of an Irish company buying a German vehicle. Since there is a lot of literature on the functioning of the Target System already available, we only describe it very shortly:[2] In non-crises times goods and capital cross the borders of the Eurozone and within the Eurozone in both directions. Capital flows and payments of exports and imports are summed up for every country and in the end of the day only small differences (deficits or surpluses) remain. Throughout the year, these imbalances in the Target System nearly balance out and are therefore more or less negligible. However, in crises times capital flows are often hit by a sudden stop and/or

[1] Target is an acronym for "Trans-European Automated Real-time Gross Settlement Express Transfer". As the second generation of this system has been already installed in November 2007, it is now called Target2 System. For simplification and readability reasons we use Target System instead of Target2 System in the following.

[2] The interested reader should refer to Sinn (2012) and the special issue of the CESifo Forum, January 2012.

capital pours out of the country. Now a situation occurs where the current account is no longer financed by private capital flows. The respective balance of payments is no longer balanced automatically; it has to be financed differently. As the ECB is not able and allowed to do this directly, the countries have to find another way. The easiest and cheapest way is the Target System. NCBs have to fill all orders coming from the ECB or a commercial bank as they are only a passage of the payments. Hence, the indebtedness of countries cannot be controlled. The construction of the Target System permits this kind of passive financing without any intervention possibility of the involved country, its NCB or the ECB.

**Figure 1:** Example for Inter-Eurosystem Payment Flows




Source: Sell/Sauer (2011), p 9.

# 3. Comparison of the Eurozone with Fixed Exchange Rate Systems

The Eurozone is not a standard monetary union as it is described in economic textbooks. If it were, firstly, there would be no NCBs, secondly, there would be a European country, because as for now, the "Euro is [a] currency without country. To make it sustainable a European country has to be created" (De Grauwe 2012). The only centralized policy is monetary policy. Fiscal policy is controlled by the member countries, geared to the different national economic fundamentals. 17 heterogeneous countries introduced a common currency where "national central banks within the eurozone continue to be important players in the current balance of payments crisis" (Kohler 2012, p. 16). Therefore, in economic theory, "we need to view the eurozone as a group of countries with a fixed exchange rate system" (Kohler 2012, p. 16) due to the lack of a fiscal or political union. When comparing the Eurozone with an exchange rate union or any other fixed exchange rate system one has to be careful as the member countries do no longer have their own currencies. Nevertheless, we will show that such a comparison is feasible and useful to analyse the current situation of the Eurozone.

In the following, we present an exchange rate union model for the Eurozone which is based on the works of Levin (1983) and Feuerstein/Siebke (1987) as our base model. We have chosen these models because they are constructed very straightforward and intuitive. A lot of other authors – even in the current literature – get back to these works, too.[3]

Let us assume two countries (1 and 2) building an exchange rate union facing a third country as rest of the world (ROW). Both union countries are – for now – small and so is the union itself compared to ROW. Therefore, the world interest rate ($i$) and the ROW income ($Y^*$) are exogenous variables. This common assumption makes the analysis

[3] For a detailed literature overview see e.g. Daseking (1994).

much easier and does not change the qualitative results in the first place. Especially, the overall interest rate can also be interpreted as a result of perfect capital mobility worldwide (Levin 1983, p. 342). Thus, it is possible to handle the Eurozone as a small union in the model without losing validity. The exchange rate within the union is fixed, or rather in our case only one common currency exists. The exchange rate with the rest of the world ($e$, which is defined as price of one foreign currency unit in units of own currency) is flexible and exchange rate expectations are static.

The goods markets of the two symmetric union countries are defined as:

$$Y^1 = A^1(Y^1, \theta^1) + T(Y^1, Y^2, \frac{1}{k}) + H^1(e\frac{P^*}{P^1}, Y^1, Y^*) + G^1$$

and

$$Y^2 = A^2(Y^2, \theta^2) - T(Y^1, Y^2, \frac{1}{k}) + H^2(e\frac{P^*}{P^2}, Y^2, Y^*) + G^2$$

with $Y^i$ representing the income of country i and $A^i$ reflecting private absorption (consumption with $\frac{\partial A}{\partial Y} > 0$ and investment with $\frac{\partial A}{\partial \theta^i} < 0$). $\theta^i$ describes the risk involving interest rate of country i and is defined as (Sell 1998, p. 240):

$$\theta^i = i + \rho_i(B_i) \qquad \text{with} \quad \rho_i = \text{risk premium},\ B_i = \text{sovereign debt level},\ \frac{\partial \rho_i}{\partial B_i} > 0$$

We use the sovereign debt level instead of the debt-to-GDP ratio to keep our model as clear and intuitive as possible. Most of the countries hit by the crisis not only increase their sovereign debt, but are also confronted with a decreasing GDP. In this case, the debt-to-GDP ratio and the sovereign debt level both develop in the same direction. Therefore, the sovereign debt level seems to be an adequate alternative for the debt-to-GDP ratio without losing too much information.

$T$ and $H$ describe the trade balances within the union and with ROW, respectively. Both trade balances are positively correlated to foreign income, negatively correlated to the

countries own income, and also dependent on relative prices, respectively ($P^i$ representing the price level of country i and $k = \frac{P^1}{P^2}$). Additionally, trade balances with ROW improve with a nominal depreciation of the home currency due to the assumed holding of the Marshall-Lerner condition. Government spending is integrated as $G^i$. Index $^*$ marks ROW variables.

The union's money market is centralized and its equilibrium can be written as

$$P^1 \cdot L^1(Y^1, \theta^1) + P^2 \cdot L^2(Y^2, \theta^2) = M$$

with $L^i$ being the money demand in country i ($\frac{\partial L}{\partial Y^i} > 0$; $\frac{\partial L}{\partial \theta^i} < 0$) and $M$ being the money supply of the common central bank. Because of the dysfunctionality of the monetary transmission channel which is emphasized by the ECB when legitimating the Securities Markets Programme and the Outright Monetary Transactions, and the country specific influence of the respective risk involving interest rate on money demand in the several Eurozone countries (Vaubel 2012), we set $\theta^i$ instead of a weighted average of the $\theta$s. $M$ is an exogenous variable, whereas the distribution of $M$ between both union countries is endogenous because of the fixed exchange rate or the common currency, respectively.

The external balances of the two union countries are represented by the balance of payments of each country

$$Z^1 = T(Y^1, Y^2, \frac{1}{k}) + H^1(e\frac{P^*}{P^1}, Y^1, Y^*) + K(\theta^1, \theta^2, \theta^*) + TB(\theta^1, \theta^2, \theta^*)$$

and

$$Z^2 = -T(Y^1, Y^2, \frac{1}{k}) + H^2(e\frac{P^*}{P^2}, Y^2, Y^*) + K(\theta^1, \theta^2, \theta^*) - TB(\theta^1, \theta^2, \theta^*)$$

with $K$ as financial account[4] and $TB$ as foreign exchange account, or in our case the balances in the Target System ($TB$ =Target Balances).

For simplification purposes we assume $\theta^*$ (the risk involving interest rate of ROW) and the risk involving interest rate of the partner country within the union as constant:

$$\begin{aligned} \theta^i; \theta^* = \text{const.} \qquad & \text{with} \qquad && \theta^1 = \text{const. when discussing country 2} \\ & \text{and} && \theta^2 = \text{const. when discussing country 1} \end{aligned}$$

This leads to simplified external balances of the two union countries:

$$Z^1 = T(Y^1, Y^2, \frac{1}{k}) + H^1(e\frac{P^*}{P^1}, Y^1, Y^*) + K(\theta^1) + TB(\theta^1)$$

and

$$Z^2 = -T(Y^1, Y^2, \frac{1}{k}) + H^2(e\frac{P^*}{P^2}, Y^2, Y^*) + K(\theta^2) - TB(\theta^2)$$

From data observations over the last years, we are able to identify three sectors of *de facto* capital mobility whereas the domain of the risk involving interest rate is $[0; \infty[$:

$$\begin{aligned} 0 < \theta^i \leq \underline{\theta}^i : \qquad & \text{perfect capital mobility} \\ \underline{\theta}^i < \theta^i \leq \bar{\theta}^i : \qquad & \text{limited capital mobility} \\ \bar{\theta}^i < \theta^i : \qquad & \text{no capital mobility/no private capital flows} \end{aligned}$$

The threshold $\bar{\theta}^i$ marks a sudden stop in capital flows or a reversal of capital flows. The appearance of this important change of the capital market's situation is mentioned in most of the literature on Target2.[5]

[4] A distinction between financial and capital account is not necessary for our model. Therefore, we decided to combine them and only write financial account. But keep in mind, the capital account is always included.

[5] See e.g. Merler/Pisani-Ferry (2012) or Tornell/Westermann (2012).

*3. Comparison of the Eurozone with Fixed Exchange Rate Systems*

The first deviations of the financial account and the Target balances for union country i are therefore:

$$\begin{array}{llll} \frac{\partial K}{\partial \theta^i} > 0 & \text{and} & \frac{\partial TB}{\partial \theta^i} = 0 & \text{true for} \quad 0 < \theta^i \leq \underline{\theta}^i \\ \frac{\partial K}{\partial \theta^i} < 0 & \text{and} & \frac{\partial TB}{\partial \theta^i} > 0 & \text{true for} \quad \underline{\theta}^i < \theta^i \leq \bar{\theta}^i \\ \frac{\partial K}{\partial \theta^i} \leq 0 & \text{and} & \frac{\partial TB}{\partial \theta^i} > 0 & \text{true for} \quad \bar{\theta}^i < \theta^i \end{array}$$

As long as $\theta^i$ is somewhere below $\underline{\theta}^i$, the financial account reacts in its usual way: It improves when the interest rate increases because capital imports increase and capital exports decrease. This development can be seen in the left part of Figure 2. Dependent on the observed country, the intensity of financial account reaction is different: it nearly stayed constant (dashed), improved only slightly (dashed) or improved relatively sharply (solid line). In the Eurozone these scenarios were realized until 2007. The Target imbalances were no problem as they nearly balanced out. We assume them to be zero in that time span.

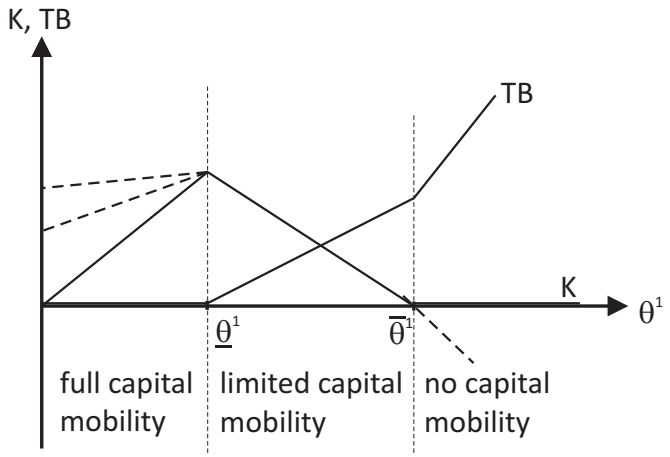
When the European debt crisis began, risk premiums of highly indebted countries rocketed. In our model, $\theta^i$ is now above $\underline{\theta}^i$, but still below $\bar{\theta}^i$, the ceiling from where on the country is no longer able to finance itself via the capital market. The financial account reacts abnormal. Capital imports decrease and capital exports increase although $\theta^i$ increases because of a credibility loss. Part of the financing need is provided via the Target System. Both can be seen in the central part of Figure 2, labeled "limited capital mobility".

When the risk involving interest rate exceeds a critical level $\bar{\theta}^i$ the private capital flows drain away completely and the only financing possibility for the member country is the Target System.[6] Target liabilities and Target claims are part of the balance of payments, more exactly the foreign exchange balance. Our modelling shows that the Target System

[6] This can be seen e.g. for Greece very clearly in Cour-Thimann (2013), Figure 13, p. 21.

is a substitute for the financial account if capital mobility is no longer realized. "The emergence of Target balances within the euro area countries' balances of payments can be interpreted as the monetary authority having largely substituted for private capital flows in the financing of the cumulated current account deficits of certain countries or beyond, when financial inflows reversed direction ..." (Cour-Thimann 2013, p. 23). In Figure 2 this is shown with a situation of stark increasing Target imbalances and either a financial account of zero or a negative financial account (dashed) indicating capital outflows.

**Figure 2:** The Target System as substitution for the capital market



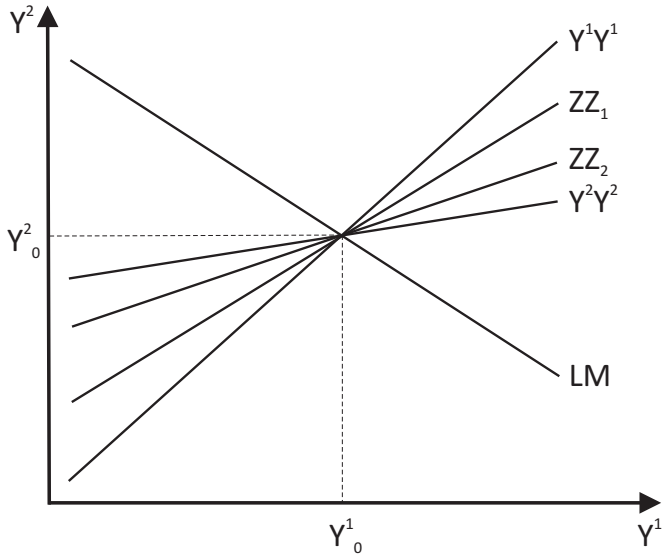

Source: Own.

Sinn/Wollmershäuser (2012) examined the causes of these capital outflows of GIIPS or capital inflows to GLNF (Germany, Luxembourg, the Netherlands, and Finland), respectively. They found that it was less capital flight out of the indebted countries than repatriation of German capital/investments. This is a very interesting finding. But overall, this conclusion does not affect our further analysis as the distinction of what caused the capital flows is not represented in our model.

Unlike previous models of monetary or exchange rate unions, we keep both goods market equilibriums and integrate the external balances into the graphical analysis. Therefore, the internal and external equilibriums of the union member countries are defined by

five straight lines as all market definitions are linear equations. Figure 3 illustrates the situation, whereas the positive slopes of the goods market equilibrium curves and the external balance curves are derived in appendix A and B. The negative slope of the money market equilibrium curve can be explained by the transaction and the speculation motive of money demand. If the income in one country increases, its money demand increases as well. Because of the constant money supply, the money demand in the other country has to decrease. This is only possible with a decrease of income in that country as the interest rate is fixed and dictated by ROW. Interestingly, all slopes are independent of the respective risk involving interest rate.

**Figure 3:** Exchange Rate Union



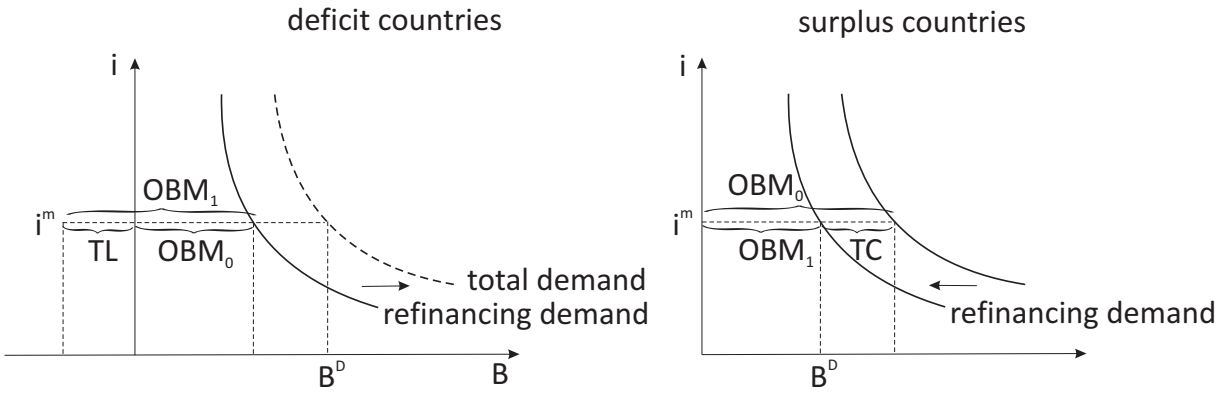

Source: Own.

Because of the supposed symmetry of the two union countries, it does not matter which country group is represented by which country in the model. We assume the deficit countries (GIIPS) to be represented by country 1 and the surplus countries (GLNF) by country 2 to get started with our model.

In a real exchange rate union a union country's central bank has to intervene if the country is no longer in its external equilibrium and the nominal exchange rate is under pressure (depreciation or appreciation). This procedure is not possible in the Eurozone, but the Target System works quite similar. Say e.g. that country 1 faces a current account deficit. In a flexible system the home currency usually would depreciate. In a system with fixed exchange rates or an exchange rate union, the central bank would have to sell foreign exchange to maintain the fixed exchange rate against country 2 and/or the central bank of country 2 would have to buy foreign exchange. In the first case base money would shrink, in the latter case base money would grow. What central bank has to react depends on the construction of the arrangement and does not matter in our argumentation. In the Eurozone as a quasi-exchange rate union, the mechanism works a little different. It is not foreign exchange transactions that solve the external imbalances, but the Target System itself: The country facing a current account deficit and not being able to finance it via the private capital flows/the capital market, automatically destroys base money (="loses reserves") and the country facing a current account surplus creates base money (="gains reserves"). How and why this happens was shown in section 2. The resulting base money distribution is illustrated in Figure 4.

The original base money is credit-created base money and "[a]t a given interest rate, there is a natural limit to *money demand* which is determined by the economic activity and the payment habits prevailing in the country..." (Sinn/Wollmershäuser 2011, pp. 17-18). The composition of base money changes because part of it is no longer created or destroyed by refinancing operations, but via the Target System. Target claims can be interpreted as "gains of reserves" of GLNF whereas Target liabilities are the "loss of reserves" of the deficit countries. In contrast to fixed exchange rate regimes or a real exchange rate union these claims and liabilities are not backed with marketable assets and they are no real currency. They are solely created by the special setting of the Target System which is one of the most important differences to the Fedwire System in the US.

**Figure 4:** Base money market




Source: Own.

with $B$ = base money $TC$ = Target claims
$B^D$ = base money demand $TL$ = Target liabilities
$i^m$ = main refinancing rate $OBM_i$ = original base money in period 0 or 1

Fact is: "Starting in 2007, the Eurosystem has reacted to balance of payments crises by *de facto* letting the troubled deficit countries play a role that in a BW-type [Bretton-Woods-type] fixed-rate system would be the privilege of the country with the reserve currency" (Kohler 2012, p. 17). The essential difference between a system of fixed exchange rates and the Eurozone is the fact that in the Bretton-Woods-System the strongest country, the US, acted as a reserve currency country, while in the Eurozone this role is taken by the weakest countries (Mayer 2011, p. 9). And this happens in a totally different dimension: "... foreign exchange reserves of the Bundesbank ... never exceeded the D-mark equivalent of 100 billion euros, whereas the net stock of Target2 claims amounted to 462 billion euros at the end of September 2011" (Schlesinger 2012, p. 12).

# 4. Internal Rebalancing

Financing via the Target System is an effective, easy and cheap way to balance the national balances of payments in the short run. But in the long run there should be another balance of payments adjustment mechanism. As long as the Eurozone does not break up, the losses are only insubstantial. But if a country with large Target liabilities leaves the Eurozone or the whole system collapses, the losses would be real as the Target claims and liabilities are not backed with marketable assets as they are in the US. Therefore it is important to find a controlled balance of payments adjustment mechanism because right now the participating countries have no chance to veto the Target financing, their only influence on financing national sovereign debt is via the European Financial Stability Facility (EFSF), the European Stability Mechanism (ESM) etc.

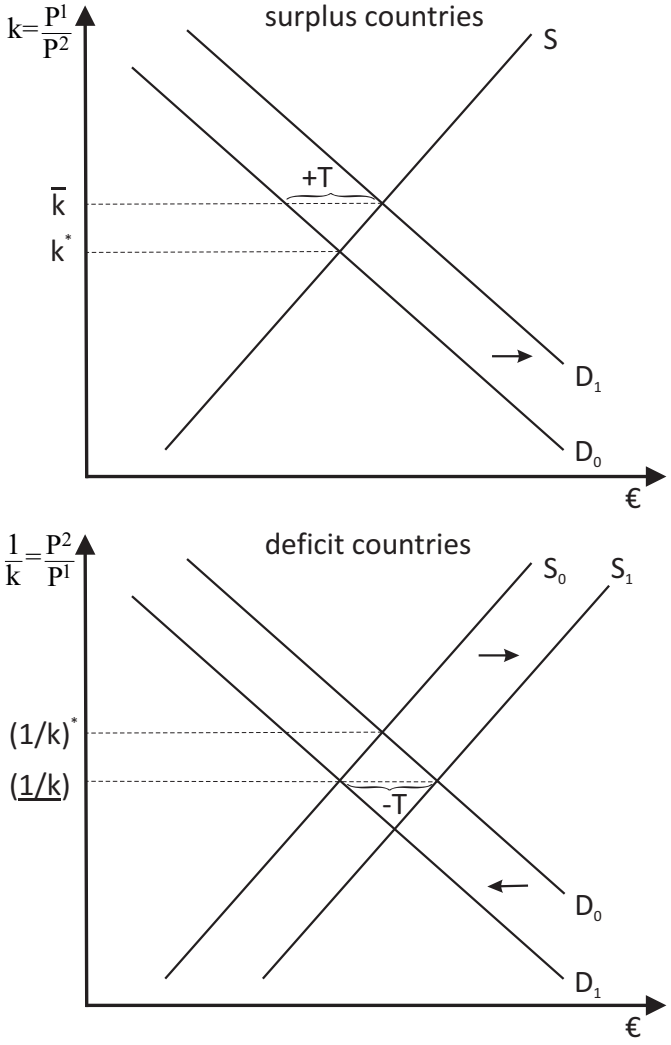
To reduce the large imbalances within the Eurozone (balance of payments and Target imbalances) in a more structural manner, one can argue with internal depreciation and appreciation and the price level as determinant variable.

Like the comparison of the Target System with the foreign exchange market of a fixed exchange rate system, it is also possible to compare these markets of Eurozone members; not in nominal, but in real terms. This is illustrated in Figure 5.

In the upper part of the diagram we have depicted the virtual foreign exchange market from GLNF's point of view vis-à-vis to GIIPS. On the vertical axis we measure the real exchange rate ($k = \frac{P^1}{P^2}$) while the amount of Euros affected by trade and capital movements between the two groups of countries is measured on the horizontal axis. Demand ($D$) and supply ($S$) would equate at the equilibrium real exchange rate ($k^*$). In this case, no Target imbalances would exist. Now as it stands, this is not the case and the existing real exchange rate ($\bar{k}$) signals a real undervaluation and creates an excess supply which is matched by Target claims ($+T$) of GLNF with regard to GIIPS. As the nominal exchange

rate between the countries in concern is fixed (because of the common currency), GLNF could contribute to make disappear the imbalance in the balance of payments by increasing either their demand for goods in GIIPS and/or exporting more capital to them (shift from $D_0$ to $D_1$). As a result, the current real exchange rate ($\bar{k}$) could become the equilibrium real exchange rate ($k^*$).

**Figure 5:** Virtual foreign exchange markets




Source: Own.

In the lower diagram, we have depicted the virtual foreign exchange market from GIIPS's point of view vis-à-vis to GLNF. On the vertical axis we measure the inverse real exchange

rate ($\frac{1}{k} = \frac{P^2}{P^1}$) while the amount of Euros affected by trade and capital movements between the two groups of countries is again measured on the horizontal axis. Demand ($D$) and supply ($S$) would equate at the equilibrium inverse real exchange rate $(\frac{1}{k})^*$. However, the relevant (inverse) real exchange rate reads $(\underline{\frac{1}{k}})$ and it signals a real overvaluation in comparison to the equilibrium inverse real exchange rate $(\frac{1}{k})^*$. The overvalued real exchange rate creates an excess demand which is matched by Target liabilities ($-T$) of GIIPS against GLNF.

As can be seen, GIIPS could contribute to make disappear the imbalance in their balance of payments by either reducing their demand for goods in GLNF and/or by reducing their capital exports to them (shift from $D_0$ to $D_1$). But they do also have a further choice: By increasing their competitiveness (wage moderation in conjunction with increases in the productivity of labour) they could cause a shift in their supply curve (from $S_0$ to $S_1$). This is an alternative or likewise complementary choice to achieve a new equilibrium in the balance of payments.

Notice that the options discussed here for GLNF and for GIIPS do reflect quite well the ongoing debate in the Eurozone: in the asymmetric case, one would ask GIIPS alone to resolve the balance of payments disequilibrium issue by cutting expenditures and/or by improving their competitiveness. In the more symmetric case, one would ask GLNF to contribute as well; of course not by deliberately damaging their own competitiveness (this would be symbolized by a shift of the supply curve S in the upper diagram to the left), but by increasing the demand for goods and financial assets in GIIPS.

A Goldman Sachs study related to this adjustment mechanism found that Portugal, Greece, Spain, France, and Italy would have to depreciate by 25-35%, 25-35%, 25-35%, 15-25%, and 5-15%, respectively, to keep up competitiveness with the average of the Eurozone and to achieve external debt sustainability. In contrast, Ireland and Germany would have to appreciate by 0-5% and 15-25%, respectively (Sinn 2013, pp. 5-6). As within the

Eurozone there is no nominal exchange rate, this can of course only happen by cutting or raising prices and thus changes in the real exchange rate. For the northern countries of the Eurozone, Sinn calls this "inflating the core" (Sinn 2013, p. 15) with all the attached problems like the loss of wealth. But also the effects in the southern countries (stagnation and unemployment) would not be accepted easily by the people.

# 5. Fiscal Policy Measures in GIIPS

The most important scenario for the Eurozone is the modelling of debt financed fiscal policy of GIIPS. This is done in the next paragraph to show how our model can be used to integrate the Target System into an exchange rate union while explaining the fiscal policy measures of GIIPS.

The realistic assumption of debt financed fiscal policy of GIIPS leads to the following equation (deviation in appendix C):

$$\frac{dY^1}{dG^1} = \frac{1}{s_1 + m_1} \left( \frac{A^1_{\theta^1} d\theta^1 + T_{\frac{1}{k}} d^1_{\frac{1}{k}} + H^1_{e^r} de^r}{dG^1} + 1 \right)$$

The most interesting question is whether or not the effect of government spending on income is unambiguously positive or negative. Therefore, we have to check the different terms. As the marginal propensity to save and the marginal propensity to import are both positive, the multiplier as a whole is positive as well:

$$\frac{1}{s_1 + m_1} > 0$$

The intuitive explanation of fiscal policy as an additional demand factor driving inflation $\left(\frac{dP^1}{dG^1} > 0\right)$ takes the country to a real appreciation $\left(\frac{d\frac{1}{k}}{dG^1} < 0\right)$ and therefore a reduced trade balance T $\left(\frac{T}{d\frac{1}{k}} > 0\right)$:

$$\frac{T_{\frac{1}{k}} d\frac{1}{k}}{dG^1} < 0$$

The same goes for the trade balance with ROW as again a real appreciation is realized $\left(\frac{de^r}{dG^1} < 0\right)$. Therefore, H decreases as well $\left(\frac{dH^1}{de^r} > 0\right)$:

$$\frac{H^1_{e^r} de^r}{dG^1} < 0$$

Now we have to find out about the impact of fiscal policy on the risk involving interest rate and on private absorption. GIIPS already lost trustworthiness and their $\theta^1$ includes a risk premium depending on the sovereign debt level. Fiscal policy increases debt and $\theta^1$ rises. We have the unambiguous positive correlation of fiscal policy and risk involving interest rate $\frac{d\theta^1}{dG^1} > 0$, whereas this includes both cases, $\theta^1 > \underline{\theta}^1$ and even $\theta^1 > \bar{\theta}^1$. Private investment (the component of private absorption dependent on the interest rate) is negatively correlated to changes in the interest rate in all sectors of capital mobility $\frac{dA^1}{d\theta^1} < 0$. That is why we get:

$$\frac{A^1_{\theta^1} d\theta^1}{dG^1} < 0$$

The provisional result is:

$$\frac{dY^1}{dG^1} = \underbrace{\frac{1}{s_1 + m_1}}_{>0} \underbrace{\left( \underbrace{\frac{A^1_{\theta^1} d\theta^1 + T_{\frac{1}{k}} d\frac{1}{k} + H^1_{e^r} de^r}{dG^1}}_{<0} \underbrace{+1}_{>0} \right)}_{\gtrless 0?}$$

To answer the question of a positive or negative correlation of fiscal policy on income in GIIPS we have to check the terms in brackets on the right hand side even further. We assume the sovereign debt level to be the most influencing factor. This is why the overall

effect of expansive fiscal policy in GIIPS depends mainly on the level of $\theta^i$. A distinction between $\underline{\theta}^i < \theta^i \leq \bar{\theta}^i$ and $\bar{\theta}^i < \theta^i$ is necessary:[7]

In the sector of limited capital mobility the debt financed fiscal policy measures of the government lead only to a partial crowding out of private investment. In this case, we assume (for a detailed deviation see appendix D)

$$\frac{A^1_{\theta^1} d\theta^1 + T_{\frac{1}{k}} d\frac{1}{k} + H^1_{e^r} de^r}{dG^1} > -1$$

what leads us to:

$$\frac{dY^1}{dG^1} = \frac{1}{s_1 + m_1} \left( \frac{A^1_{\theta^1} d\theta^1 + T_{\frac{1}{k}} d\frac{1}{k} + H^1_{e^r} de^r}{dG^1} + 1 \right) > 0$$

Debt financed fiscal policy pushes national income. We get a positive correlation of $G^1$ and $Y^1$. Of course, this is the intended effect of the governments in GIIPS.

In the sector where we have no private capital flows the debt financed fiscal policy measures of the government lead to an assumed (and also somehow realistic) nearly full crowding out of private investment. In this special case, we now assume (for a detailed deviation see again appendix D)

$$\frac{A^1_{\theta^1} d\theta^1 + T_{\frac{1}{k}} d\frac{1}{k} + H^1_{e^r} de^r}{dG^1} < -1,$$

because the negative effect $\left(\frac{dA^1}{d\theta^1} < 0\right)$ dominates the equation. This gives us:

$$\frac{dY^1}{dG^1} = \frac{1}{s_1 + m_1} \left( \frac{A^1_{\theta^1} d\theta^1 + T_{\frac{1}{k}} d\frac{1}{k} + H^1_{e^r} de^r}{dG^1} + 1 \right) < 0$$

If sovereign debt exceeds a certain level, this threshold influences $\theta^i$ as well and implicitly marks the threshold $\bar{\theta}^i$. From here on, fiscal policy measures reduce national income!

[7] The case of $0 < \theta^i \leq \underline{\theta}^i$ seems to be an unrealistic scenario for GIIPS whereas we will neglect it in the rest of the paper.

Where this particular threshold can be found in reality is a still ongoing debate. To get a clue, one can draw attention to the work of Reinhart and Rogoff (2010). These authors calculated this threshold at a debt-to-GDP level round about 90%.[8]

Let us develop the causal chain to a new internal and external equilibrium for both cases in the following:

Firstly, the fiscal policy measures in GIIPS increase national income with which consumption and imports go up as well. In our model this can be shown by a rightward shift of $Y^1Y^1$.[9] As a result, GIIPS face a balance of payments deficit whereas GLNF realize a balance of payments surplus.[10]

Secondly, as the fiscal measures generate an additional demand, they cause a higher price level in GIIPS ($P^1 \uparrow$), meaning that they have to handle a real appreciation ($k = \frac{P^1}{P^2} \uparrow$). In contrast, GLNF profit from a real depreciation. These changes in the real exchange rate of both country groups affect the goods markets equilibriums and the external equilibriums. In GIIPS we observe a reduction of income ($Y^1Y^1$, $ZZ^1$ both shift leftward), in GLNF an expansion ($Y^2Y^2$, $ZZ^2$ both shift upward).[11]

Thirdly, the debt financed fiscal policy increases the respective $\theta^1$ as the risk increases with a higher debt level. As $\theta^1$ already exceeded $\underline{\theta}^1$, capital imports decrease and the balance of payment deficit enlarges in GIIPS ($ZZ^1$ shifts further leftward).[12] The opposite happens in GLNF ($ZZ^2$ shifts further upward). So we have even larger balance of payments imbalances within the union. These capital movements could be observed in the last

[8] We are aware of the recent criticism of the Reinhart/Rogoff calculations. Nevertheless, it is indisputable that such a threshold exists, may it be somewhere below or above the famous 90% level.

[9] $\frac{dY^1}{dG^1} > 0$; $\frac{dA^1}{dY^1} > 0$; $\frac{dT}{dY^1} < 0$; $\frac{dH^1}{dY^1} < 0$.

[10] Until now, we only consider the trade balances, not the financial account or the Target balances. Therefore, country 1's balance of payments shows a current account deficit, which leads to a balance of payments in deficit in the short run. For country 2 the situation is reversed.

[11] The national income of country 1 is reduced as the declined real exchange rate reduces both trade balances $\left(\frac{dT}{d\frac{1}{k}} > 0;\ \frac{dH^1}{d(\frac{eP^*}{P^1})} > 0\right)$ and $\frac{dY^1}{dT} > 0$ as well as $\frac{dY^1}{dH^1} > 0$. As explained in footnote 10, current account changes first of all lead to an imbalance of the respective balance of payments. For country 1 we get a deficit. Given the symmetric country structure, the opposite is true for country 2.

[12] Until now, we neglect the Target System.

years as GIIPS had to bear a massive capital flight and firms as well as private investors of GLNF withdraw their capital engagements out of GIIPS.

Fourthly, the governments get the money for their fiscal policy measures at the capital market, increasing the interest rate as their demand is completely inelastic. Here, we can see the textbook alike crowding out of private investment. If the respective country's $\theta^i$ is in the sector of $\underline{\theta}^i < \theta^i \leq \bar{\theta}^i$, this crowding out works only partially. $Y^1Y^1$ shifts leftward, but not as far as to the original goods market equilibrium curve. If the respective country's $\theta^i$ is in the sector of $\bar{\theta}^i < \theta^i$, this crowding out works completely. $Y^1Y^1$ shifts also leftward, but by far further than the original goods market equilibrium curve.[13] We still have the balances of payments imbalances within the union.

Fifthly, these external imbalances are balanced via the Target System. As Target liabilities correspond to capital imports, and Target claims correspond to capital exports, the balances of payments of both country groups clear. We reach a new external equilibrium. But still the internal equilibrium of the money market is missing.

Sixthly, to reach a new money market equilibrium[14] the union's central bank (for the Eurozone this is the ECB) has to expand the money supply. The LM curve shifts rightward to the new overall equilibrium.

Seventhly, a new internal and external balance is realized with either a higher national income in GIIPS (if $\underline{\theta}^i < \theta^i \leq \bar{\theta}^i$) or a lower national income in GIIPS and indeterminate national income in GLNF, a higher nominal money supply and – and this is the most interesting fact here – large Target imbalances.

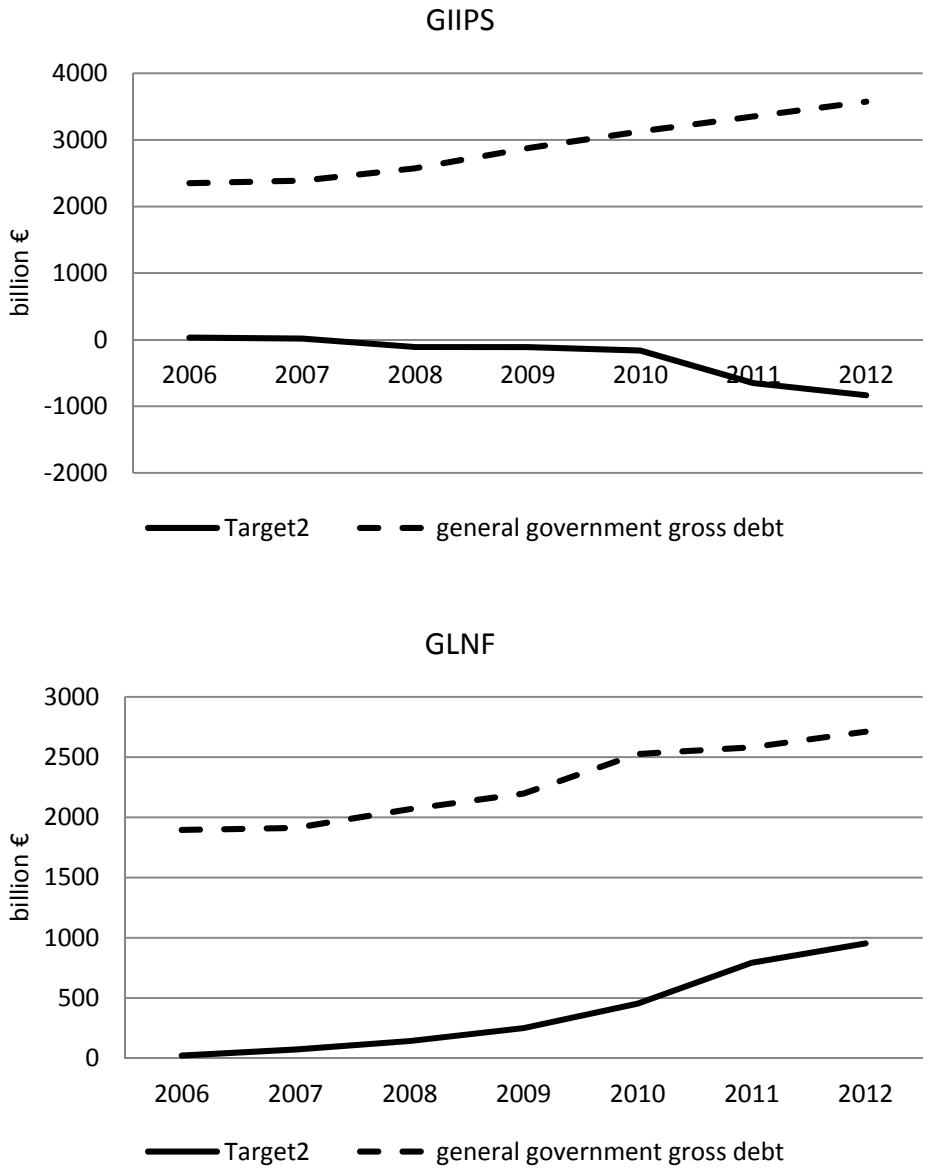
We do not show this causal chain graphically in a figure like figure 3 because this does not help to visualize the scenario as too many curves would have to be included.

[13] See also appendix D.

[14] Until now, there exists a demand surplus on the money market of the union. Demand was driven by the higher income in country 1, the higher price levels and the change in $\theta^1$.

To prove the results of our model so far, we collected the Target and government gross debt data of GIIPS and GLNF. The plotting confirms our argumentation as can be seen in Figure 6.

**Figure 6:** Target imbalances and government gross debt of GIIPS and GLNF




Source: eurocrisismonitor.com, IMF World Economic Outlook Database, April 2013.

In GIIPS, the Target liabilities grow while the governments gross debt increases, in GLNF the situation is vice versa: The Target claims grow while the governments gross debt

increases.[15] This is exactly what we predicted in the previous paragraph within our model framework.

# 6. Conclusion

As it is without controversy that the Eurozone is not an optimum currency area and not a monetary union in a theoretical view, we wanted to demonstrate how the Eurozone could be modelled as an exchange rate union. This seemed to be a more realistic option than constructing a special monetary union model.

It was possible to integrate the Target System and some virtual foreign exchange markets into our basic model to emphasize that the Eurozone is like a fixed exchange rate system without an adequate balance of payments adjustment mechanism. Within our model framework, we were able to formulate all relevant equilibriums formally and graphically in explicit linear equations. Therefore, it was possible to write a story from theory to practice (empiricism). And even if the Target imbalances decrease and balance somewhere around zero again in the future and the explosive political issue disappears, it is important to be able to model this phenomenon, to be able to analyse it and to be able to interpret the Target System and its imbalances. Also the fact that Target imbalances cause no real problem as long as the EMU exists or no country holding Target liabilities leaves the EMU, is no cause for just neglecting the topic in economic theory.

Especially in crises times when capital mobility is limited or no longer given, the Target System replaces the balancing function of capital flows and can be compared to foreign exchange movements during the Bretton-Woods-System. “The central aspect in both cases, the reserve currency mechanism of a BW-type [Bretton-Woods-type] system as well as the Target2 mechanism, is the cross-regional flow of central bank money, and not whether or

[15]The separate plot for each country can be found in appendix E.

not different currencies are involved" (Kohler 2012, p. 18). Our model is able to integrate the idea of this citation. Our aim was not solely to design the Eurozone theoretically, but to find a model framework which delivers results that can be proved empirically. And as we showed above, this works, especially when we discussed the fiscal policy measures of GIIPS: A larger sovereign debt level corresponds with larger Target liabilities.

The approach with virtual foreign exchange markets for the union countries combines the Target System as an "amount adjustment" and the intensively discussed possible internal reaction as "price adjustment". With this argumentation one can identify several possible solutions to reduce the Target imbalances within the union: reduction of sovereign debt and improvement of competitiveness in GIIPS, and a re-activation of the interbank market with (at least partial) contribution of GLNF.

A next step in further research will be to release the assumption of the union being small compared to ROW. In this case, the interest rate is no longer given as world interest rate and policy measures in one of the union's countries cause counter-reactions in ROW and the union itself. As our model is one without an explicit setup for the supply side, unfortunately it is not possible to use this framework to construct an asymmetric union. Nevertheless, the model is an intuitive and simple framework, ideally suited to produce results that can be found in empiricism as well.

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# Appendices

## A. Slope of goods market equilibrium curve and external balance curve of country 1

### A.1. Goods market equilibrium

$$Y^1 = A^1(Y^1, \theta^1) + T(Y^1, Y^2, \frac{1}{k}) + H^1(\frac{eP^*}{P^1}, Y^1, Y^*) + G^1$$

Total differentiation with $e^r = \frac{eP^*}{P^i}$:

$$dY^1 = A^1_{Y^1} dY^1 + A^1_{\theta^1} d\theta^1 + T_{Y^1} dY^1 + T_{Y^2} dY^2 + T_{\frac{1}{k}} d\frac{1}{k} + H^1_{e^r} de^r + H^1_{Y^1} dY^1 + H^1_{Y^*} dY^* + dG^1$$

$$(1 - A^1_{Y^1} - T_{Y^1} - H^1_{Y^1}) dY^1 = A^1_{\theta^1} d\theta^1 + T_{Y^2} dY^2 + T_{\frac{1}{k}} d\frac{1}{k} + H^1_{e^r} de^r + H^1_{Y^*} dY^* + dG^1$$

$$\frac{(1 - A^1_{Y^1} - T_{Y^1} - H^1_{Y^1}) dY^1}{T_{Y^2} dY^2} = 1 + \frac{A^1_{\theta^1} d\theta^1 + T_{\frac{1}{k}} d\frac{1}{k} + H^1_{e^r} de^r + H^1_{Y^*} dY^* + dG^1}{T_{Y^2} dY^2}$$

$$\frac{dY^1}{dY^2} = \frac{T_{Y^2}}{(1 - A^1_{Y^1} - T_{Y^1} - H^1_{Y^1})} \left( 1 + \frac{A^1_{\theta^1} d\theta^1 + T_{\frac{1}{k}} d\frac{1}{k} + H^1_{e^r} de^r + H^1_{Y^*} dY^* + dG^1}{T_{Y^2} dY^2} \right)$$

$$\frac{dY^2}{dY^1} = \frac{(1 - A^1_{Y^1} - T_{Y^1} - H^1_{Y^1})}{T_{Y^2}} \left( 1 + \frac{T_{Y^2} dY^2}{A^1_{\theta^1} d\theta^1 + T_{\frac{1}{k}} d\frac{1}{k} + H^1_{e^r} de^r + H^1_{Y^*} dY^* + dG^1} \right)$$

With:
- $1 - A^1_{Y^1} = s_1$ marginal propensity to save
- $-T_{Y^1} - H^1_{Y^1} = m_1$ marginal propensity to import
- $T_{Y^2} = m_{21}$ marginal propensity to import of country 2 importing goods of country 1

$$\frac{dY^2}{dY^1} = \frac{s_1 + m_1}{m_{21}} \left( 1 + \frac{m_{21} dY^2}{A^1_{\theta^1} d\theta^1 + T_{\frac{1}{k}} d\frac{1}{k} + H^1_{e^r} de^r + H^1_{Y^*} dY^* + dG^1} \right)$$

Simplification by the following assumptions: $d\theta^1 = dY^* = dG^1 = 0$

$$\frac{dY^2}{dY^1} = \frac{s_1 + m_1}{m_{21}} \left( 1 + \frac{m_{21} dY^2}{T_{\frac{1}{k}} d\frac{1}{k} + H^1_{e^r} de^r} \right)$$

## A.2. External balance

$$Z^1 = T(Y^1, Y^2, \frac{1}{k}) + H^1(\frac{eP^*}{P^1}, Y^1, Y^*) + K(\theta^1) + TB(\theta^1) = 0$$

Total differentiation with $e^r = \frac{eP^*}{P^i}$:

$$0 = T_{Y^1} dY^1 + T_{Y^2} dY^2 + T_{\frac{1}{k}} d\frac{1}{k} + H^1_{e^r} de^r + H^1_{Y^1} dY^1 + H^1_{Y^*} dY^* + K_{\theta^1} d\theta^1 + TB_{\theta^1} d\theta^1$$

$$-T_{Y^2} dY^2 = T_{Y^1} dY^1 + T_{\frac{1}{k}} d\frac{1}{k} + H^1_{e^r} de^r + H^1_{Y^1} dY^1 + H^1_{Y^*} dY^* + K_{\theta^1} d\theta^1 + TB_{\theta^1} d\theta^1$$

$$\frac{-T^2_Y dY^2}{(T_{Y^1} + H^1_{Y^1}) dY^1} = 1 + \frac{T_{\frac{1}{k}} d\frac{1}{k} + H^1_{e^r} de^r + H^1_{Y^*} dY^* + K_{\theta^1} d\theta^1 + TB_{\theta^1} d\theta^1}{(T_{Y^1} + H^1_{Y^1}) dY^1}$$

$$\frac{dY^2}{dY^1} = \frac{-(T_{Y^1} + H^1_{Y^1})}{T_{Y^2}} \left( 1 + \frac{T_{\frac{1}{k}} d\frac{1}{k} + H^1_{e^r} de^r + H^1_{Y^*} dY^* + K_{\theta^1} d\theta^1 + TB_{\theta^1} d\theta^1}{(T_{Y^1} + H^1_{Y^1}) dY^1} \right)$$

With: $-T_{Y^1} - H^1_{Y^1} = m_1$ marginal propensity to import
$T_{Y^2} = m_{21}$ marginal propensity to import of country 2 importing goods of country 1

$$\frac{dY^2}{dY^1} = \frac{m_1}{m_{21}} \left( 1 + \frac{T_{\frac{1}{k}} d\frac{1}{k} + H^1_{e^r} de^r + H^1_{Y^*} dY^* + K_{\theta^1} d\theta^1 + TB_{\theta^1} d\theta^1}{-m_1 dY^1} \right)$$

Simplification by the following assumptions: $d\theta^1 = dY^* = 0$

$$\frac{dY^2}{dY^1} = \frac{m_1}{m_{21}} \left( 1 + \frac{T_{\frac{1}{k}} d\frac{1}{k} + H^1_{e^r} de^r}{-m_1 dY^1} \right)$$

## A.3. Comparison of slopes

$$\underbrace{\frac{s_1+m_1}{m_{21}}\left(1+\frac{m_{21}dY^2}{T_{\frac{1}{k}}d\tfrac{1}{k}+H^1_{e^r}de^r}\right)}_{YY^1} \gtreqless \underbrace{\frac{m_1}{m_{21}}\left(1+\frac{T_{\frac{1}{k}}d\tfrac{1}{k}+H^1_{e^r}de^r}{-m_1dY^1}\right)}_{ZZ_1}$$

$$(s_1+m_1)\left(1+\frac{m_{21}dY^2}{T_{\frac{1}{k}}d\tfrac{1}{k}+H^1_{e^r}de^r}\right) \gtreqless m_1\left(1+\frac{T_{\frac{1}{k}}d\tfrac{1}{k}+H^1_{e^r}de^r}{-m_1dY^1}\right)$$

$$s_1+\frac{s_1m_{21}dY^2}{T_{\frac{1}{k}}d\tfrac{1}{k}+H^1_{e^r}de^r}+m_1+\frac{m_1m_{21}dY^2}{T_{\frac{1}{k}}d\tfrac{1}{k}+H^1_{e^r}de^r} \gtreqless m_1+\frac{m_1\left(T_{\frac{1}{k}}d\tfrac{1}{k}+H^1_{e^r}de^r\right)}{-m_1dY^1}$$

$$\underbrace{s_1}_{>0}+\underbrace{\frac{s_1m_{21}dY^2}{T_{\frac{1}{k}}d1k+H^1_{e^r}de^r}}_{>0}+\underbrace{\frac{m_1m_{21}dY^2}{T_{\frac{1}{k}}d1k+H^1_{e^r}de^r}}_{>0} \gtreqless \underbrace{-\frac{\left(T_{\frac{1}{k}}d1k+H^1_{e^r}de^r\right)}{dY^1}}_{<0}$$

$$s_1+\frac{s_1m_{21}dY^2}{T_{\frac{1}{k}}d\tfrac{1}{k}+H^1_{e^r}de^r}+\frac{m_1m_{21}dY^2}{T_{\frac{1}{k}}d\tfrac{1}{k}+H^1_{e^r}de^r} > -\frac{T_{\frac{1}{k}}d\tfrac{1}{k}+H^1_{e^r}de^r}{dY^1}$$

$\Rightarrow$ slope of goods market equilibrium curve steeper than slope of external balance curve

# B. Slope of goods market equilibrium curve and external balance curve of country 2

## B.1. Goods market equilibrium

$$Y^2 = A^2(Y^2, i) - T(Y^1, Y^2, \frac{1}{k}) + H^2(\frac{eP^*}{P^2}, Y^2, Y^*) + G^2$$

Total differentiation with $e^r = \frac{eP^*}{P^i}$:

$$dY^2 = A^2_{Y^2}dY^2 + A^2_{\theta^2}d\theta^2 - T_{Y^1}dY^1 - T_{Y^2}dY^2 - T_{\frac{1}{k}}d\frac{1}{k} + H^2_{e^r}de^r + H^2_{Y^2}dY^2 + H^2_{Y^*}dY^* + dG^2$$

$$(1 - A^2_{Y^2} + T_{Y^2} - H^2_{Y^2})dY^2 = A^2_{\theta^2}d\theta^2 - T_{Y^1}dY^1 - T_{\frac{1}{k}}d\frac{1}{k} + H^2_{e^r}de^r + H^2_{Y^*}dY^* + dG^2$$

$$\frac{(1 - A^2_{Y^2} + T_{Y^2} - H^2_{Y^2})dY^2}{-T_{Y^1}dY^1} = 1 + \frac{A^2_{\theta^2}d\theta^2 - T_{\frac{1}{k}}d\frac{1}{k} + H^2_{e^r}de^r + H^2_{Y^*}dY^* + dG^2}{-T_{Y^1}dY^1}$$

$$\frac{dY^2}{dY^1} = \frac{-T_{Y^1}}{(1 - A^2_{Y^2} + T_{Y^2} - H^2_{Y^2})}\left(1 + \frac{(A^2_{\theta^2}d\theta^2 - T_{\frac{1}{k}}d\frac{1}{k} + H^2_{e^r}de^r + H^2_{Y^*}dY^* + dG^2}{-T_{Y^1}dY^1}\right)$$

With:

| | |
|---|---|
| $1 - A^2_{Y^2} = s_2$ | marginal propensity to save |
| $T_{Y^2} - H^2_{Y^2} = m_2$ | marginal propensity to import |
| $-T_{Y^1} = m_{12}$ | marginal propensity to import of country 1 importing goods of country 2 |

$$\frac{dY^2}{dY^1} = \frac{m_{12}}{s_2 + m_2}\left(1 + \frac{A^2_{\theta^2}d\theta^2 - T_{\frac{1}{k}}d\frac{1}{k} + H^2_{e^r}de^r + H^2_{Y^*}dY^* + dG^2}{m_{12}dY^1}\right)$$

Simplification by the following assumptions: $d\theta^2 = dY^* = dG^2 = 0$

$$\frac{dY^2}{dY^1} = \frac{m_{12}}{s_2 + m_2}\left(1 + \frac{(-T_{\frac{1}{k}}d\frac{1}{k} + H^2_{e^r}de^r}{m_{12}dY^1}\right)$$

## B.2. External balance

$$Z^2 = -T(Y^1, Y^2, \frac{1}{k}) + H^2(\frac{eP^*}{P^2}, Y^2, Y^*) + K(\theta^2) + TB(\theta^2) = 0$$

Total differentiation with $e^r = \frac{eP^*}{P^i}$:

$$0 = -T_{Y^1}dY^1 - T_{Y^2}dY^2 - T_{\frac{1}{k}}d\frac{1}{k} + H^2_{e^r}de^r + H^2_{Y^2}dY^2 + H^2_{Y^*}dY^* + K_{\theta^2}d\theta^2 + TB_{\theta^2}d\theta^2$$

$$(T_{Y^2} - H^2_{Y^2})dY^2 = -T_{Y^1}dY^1 - T_{\frac{1}{k}}d\frac{1}{k} + H^2_{e^r}de^r + H^2_{Y^*}dY^* + K_{\theta^2}d\theta^2 + TB_{\theta^2}d\theta^2$$

$$\frac{(T_{Y^2} - H^2_{Y^2})dY^2}{-T_{Y^1}dY^1} = 1 + \frac{-T_{\frac{1}{k}}d\frac{1}{k} + H^2_{e^r}de^r + H^2_{Y^*}dY^* + K_{\theta^2}d\theta^2 + TB_{\theta^2}d\theta^2)}{-T_{Y^1}dY^1}$$

$$\frac{dY^2}{dY^1} = \frac{-T_{Y^1}}{T_{Y^2} - H^2_{Y^2}}\left(1 + \frac{-T_{\frac{1}{k}}d\frac{1}{k} + H^2_{e^r}de^r + H^2_{Y^*}dY^* + K_{\theta^2}d\theta^2 + TB_{\theta^2}d\theta^2}{-T_{Y^1}dY^1}\right)$$

With:

| | |
|---|---|
| $T_{Y^2} - H^2_{Y^2} = m_2$ | marginal propensity to import |
| $-T_{Y^1} = m_{12}$ | marginal propensity to import of country 1 importing goods of country 2 |

$$\frac{dY^2}{dY^1} = \frac{m_{12}}{m_2}\left(1 + \frac{-T_{\frac{1}{k}}d\frac{1}{k} + H^2_{e^r}de^r + H^2_{Y^*}dY^* + K_{\theta^2}d\theta^2 + TB_{\theta^2}d\theta^2}{m_{12}dY^1}\right)$$

Simplification by the following assumptions: $d\theta^2 = dY^* = 0$

$$\frac{dY^2}{dY^1} = \frac{m_{12}}{m_2}\left(1 + \frac{-T_{\frac{1}{k}}d\frac{1}{k} + H^2_{e^r}de^r}{m_{12}dY^1}\right)$$

## B.3. Comparison of slopes

$$\underbrace{\frac{m_{12}}{s_2+m_2}\left(1+\frac{-T_{\frac{1}{k}}d\frac{1}{k}+H^2_{e^r}de^r}{m_{12}dY^1}\right)}_{YY^2} \gtreqless \underbrace{\frac{m_{12}}{m_2}\left(1+\frac{-T_{\frac{1}{k}}d\frac{1}{k}+H^2_{e^r}de^r}{m_{12}dY^1}\right)}_{ZZ_2}$$

$$\frac{m_{12}}{s_2+m_2} \gtreqless \frac{m_{12}}{m_2}$$

$$\frac{m_{12}}{s_2+m_2} < \frac{m_{12}}{m_2}$$

$\Rightarrow$ slope of external balance curve steeper than slope of goods market equilibrium curve

# C. Fiscal policy in GIIPS (country 1)

Total differentiation of the goods market equilibrium leads to:

$$dY^1 = A^1_{Y^1}dY^1 + A^1_{\theta^1}d\theta^1 + T_{Y^1}dY^1 + T_{Y^2}dY^2 + T_{\frac{1}{k}}d\frac{1}{k} + H^1_{e^r}de^r + H^1_{Y^1}dY^1 + H^1_{Y^*}dY^* + dG^1$$

$$dY^1 - A^1_{Y^1}dY^1 - T_{Y^1}dY^1 - H^1_{Y^1}dY^1 = A^1_{\theta^1}d\theta^1 + T_{Y^2}dY^2 + T_{\frac{1}{k}}d\frac{1}{k} + H^1_{e^r}de^r + H^1_{Y^*}dY^* + dG^1$$

$$(1 - A^1_{Y^1} - T_{Y^1} - H^1_{Y^1})dY^1 = A^1_{\theta^1}d\theta^1 + T_{Y^2}dY^2 + T_{\frac{1}{k}}d\frac{1}{k} + H^1_{e^r}de^r + H^1_{Y^*}dY^* + dG^1$$

With: $T_{Y^2} - H^2_{Y^2} = m_2$ marginal propensity to import
$-T_{Y^1} = m_{12}$ marginal propensity to import of country 1 importing goods of country 2

$$(s_1 + m_1)dY^1 = A^1_{\theta^1}d\theta^1 + T_{\frac{1}{k}}d\frac{1}{k} + H^1_{e^r}de^r + dG^1$$

With the assumption of a small union, we set $\frac{dY^2}{dG^1} = \frac{dY^*}{dG^1} = 0$ and get:

$$\frac{dY^1}{dG^1} = \frac{1}{s_1 + m_1}\left(\frac{A^1_{\theta^1}d\theta^1 + T_{\frac{1}{k}}d\frac{1}{k} + H^1_{e^r}de^r}{dG^1} + 1\right)$$

# D. Partial and full crowding out

## D.1. Partial crowding out

$$\frac{A^1_{\theta^1} d\theta^1 + T_{\frac{1}{k}} d\frac{1}{k} + H^1_{e^r} de^r}{dG^1} > -1$$

$$A^1_{\theta^1} d\theta^1 + T_{\frac{1}{k}} d\frac{1}{k} + H^1_{e^r} de^r > -dG^1$$

$$\frac{dA^1}{d\theta^1} d\theta^1 + \frac{dT}{d\frac{1}{k}} d\frac{1}{k} + \frac{dH^1}{de^r} de^r > -dG^1$$

$$dA^1 + dT + dH^1 > -dG^1 \qquad \rightarrow \qquad dT + dH^1 > -dG^1 - dA^1$$

As we assume only a partial crowding out, one has to set: $dG^1 > -dA^1$

By definition, part of the positive effect of the fiscal policy measures is not neutralized by the crowding out effect and we get:

$$dT + dH^1 > 0$$

## D.2. Full crowding out

$$\frac{A^1_{\theta^1} d\theta^1 + T_{\frac{1}{k}} d\frac{1}{k} + H^1_{e^r} de^r}{dG^1} < -1$$

$$A^1_{\theta^1} d\theta^1 + T_{\frac{1}{k}} d\frac{1}{k} + H^1_{e^r} de^r < -dG^1$$

$$\frac{dA^1}{d\theta^1} d\theta^1 + \frac{dT}{d\frac{1}{k}} d\frac{1}{k} + \frac{dH^1}{de^r} de^r < -dG^1$$

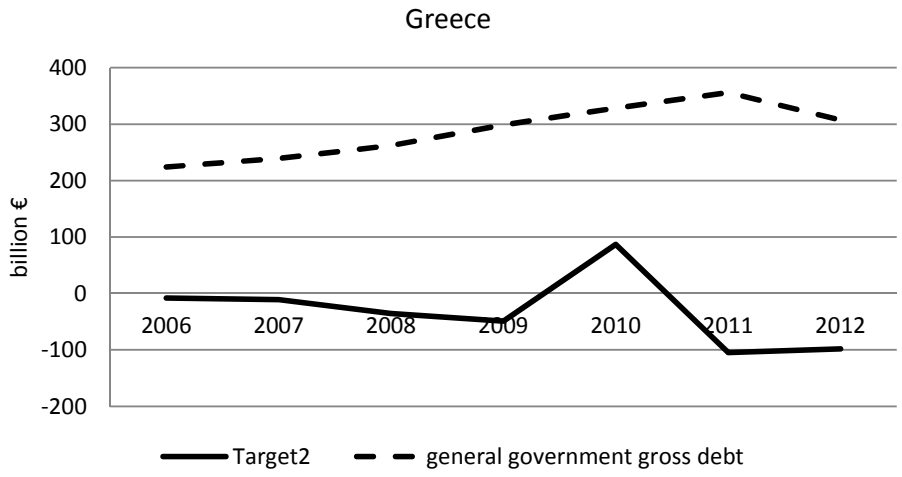
$$dA^1 + dT + dH^1 < -dG^1 \qquad \rightarrow \qquad dT + dH^1 < -dG^1 - dA^1$$

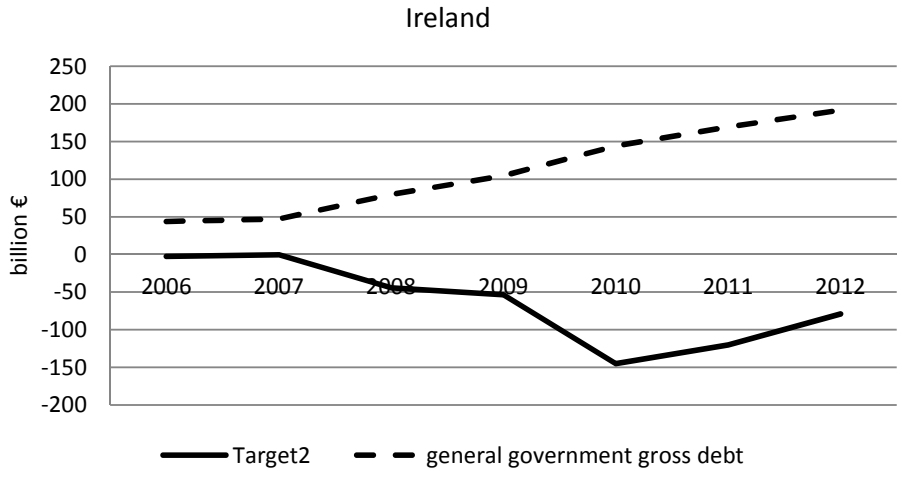
As we assume a full crowding out, one has to set: $dG^1 = -dA^1$

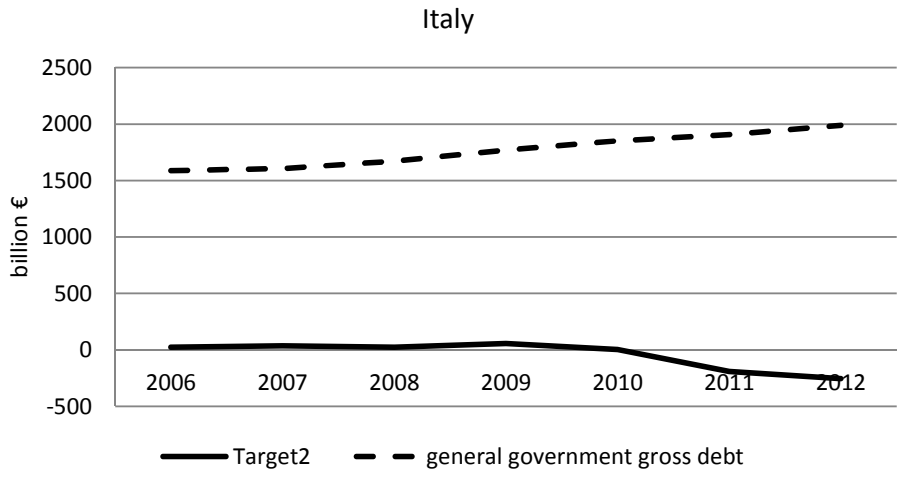
The only terms that are left over are the two changes in the trade balances ($dT + dH^1$). Both changes are negative because of the normal reaction of trade on the real appreciation:

$$dT + dH^1 < 0$$

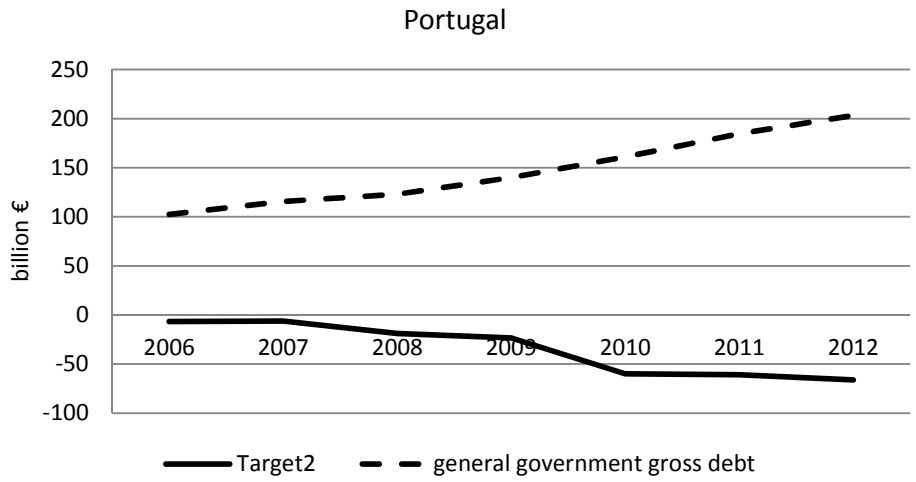
# E. Sovereign debt and Target imbalances in GIIPS and GLNF, figure for each country

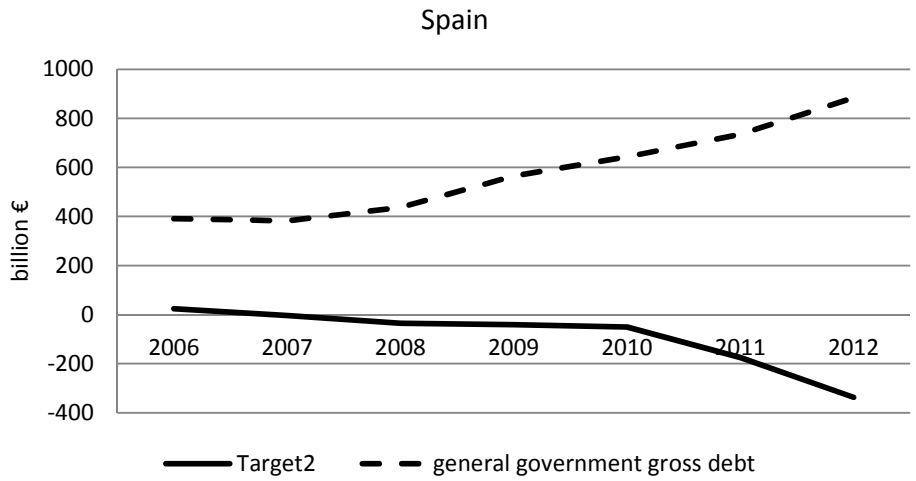


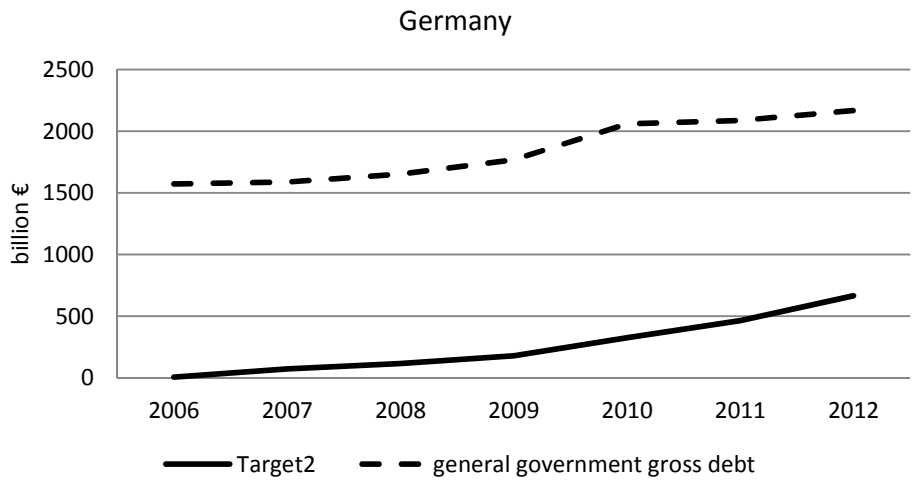



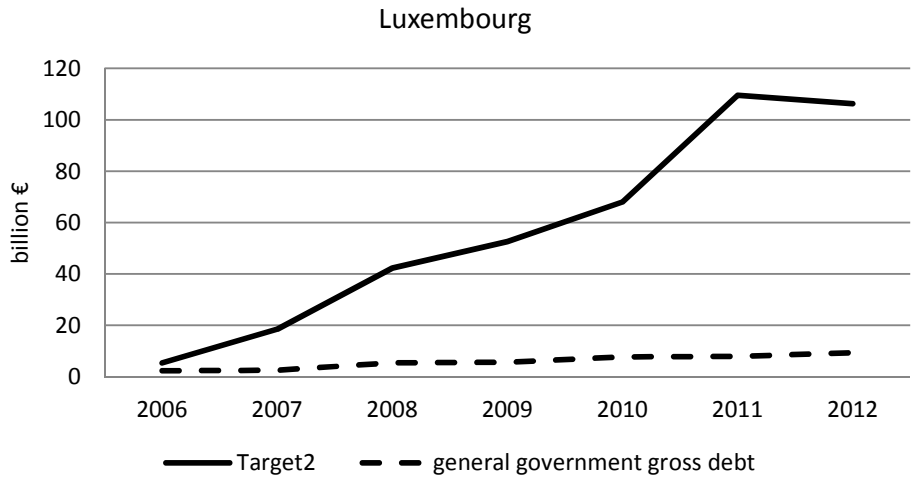



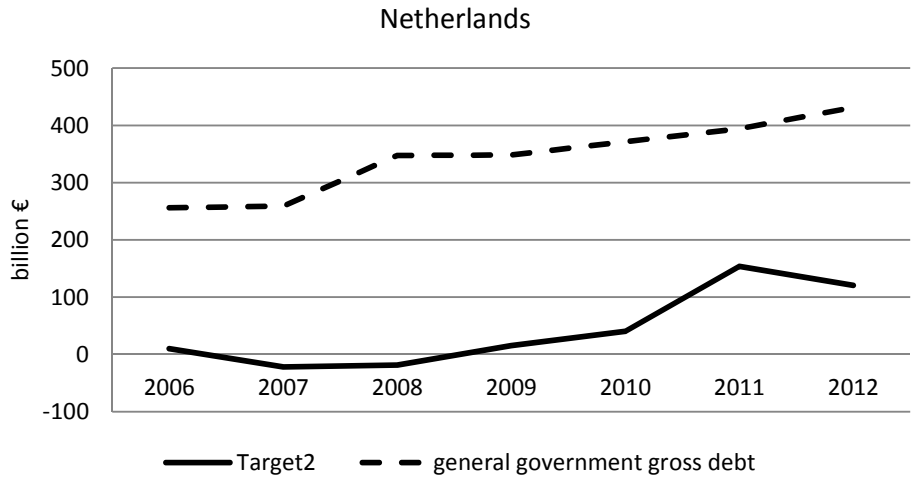
*E. Sovereign debt and Target imbalances*

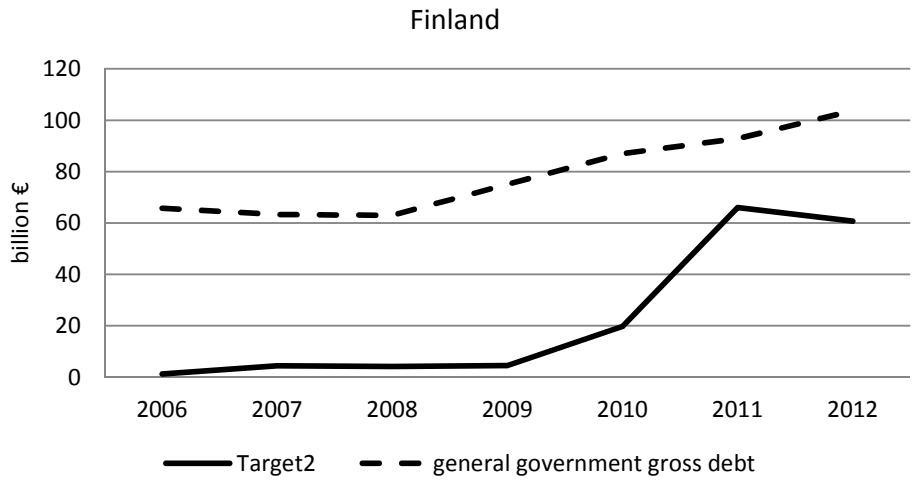


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