

The Dynamic Tragedy-of-the-Commons in the Eurozone, the ECB and Target2 Imbalances

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Abstract

We present a political-economy model that helps account for the explosive behavior of Target2 imbalances and central bank domestic credit in the Eurozone periphery. We then use the equilibrium to analyze the effects of ECB policies. The existence of a commons-pool problem implies that, in the absence of conditionality, the benefits of greater ECB monetary generosity are squandered in equilibrium.

1 Introduction

The Eurozone periphery has witnessed a more than 1000% increase in central bank credit to banks since 2007. This massive increase in domestic central bank credit has been associated with the explosive path of the Target2 liabilities of the periphery national central banks vis-a-vis northern national central banks of the Eurozone.¹ Unfortunately, after four years, the Eurozone periphery still needs major financial infusions to cover its fiscal and current account deficits. There has been no long-lasting fiscal adjustment, with the possible exception of Ireland.

In this paper, we present a minimal political-economy model to account for these facts. We then use the equilibrium of the model to rationalize the oft-heard assertion that rounds of ECB liquidity injections reduce the politicians' efforts to adjust. In equilibrium, all the benefits from greater ECB generosity are squandered, in the absence of conditionality.

The main driver in the model is a dual tragedy-of-the-commons: an inter-country commons-problem which acts mainly via the EuroSystem of central banks; and a within-country commons problem that arises because there are organized groups with the power to extract fiscal transfers from their government.

The ECB has regularly pronounced the need for governments to urgently implement structural reforms and fiscal adjustment. However, it has regularly undertaken non-standard policies that have de facto supported a continuous and ongoing path of central bank credit extension. These expansionary ECB policies have not been the design of a central planner. Rather, they have been the haphazard response to threatening situations, with ugly consequences for ECB inaction.

The conundrum is that when the ECB has used its big bazooka to avoid a liquidity squeeze and open a window of opportunity for governments to adjust, politicians have responded by reducing their enthusiasm for painful measures. The delay and watering-down of reforms has made more acute such emergency situations, which in turn have increased the pressure for the ECB to intervene. Well-known is the Italian and Spanish response to the December 2011 LTRO, and the Greek continuous delay in reform.

Our tragedy-of-the-commons view is not inconsistent with the multiple-equilibria view,

¹Target2 liabilities are automatic loans from one national central bank to another within the Eurozone. See Tornell and Westermann (2011) and the references therein.

under which bond markets grossly overestimate the risk that a country will break away from the Eurozone. However, an important implication of our analysis is that if EU and ECB policies are designed to solely eliminate the multiple-equilibria syndrome, they will exacerbate the tragedy-of-the-commons syndrome. As a result, such policy stance would make more likely the horrific outcome it is meant to avoid in the first place. In other words, our analysis implies that "doing whatever is necessary to save the Euro" cannot only mean an unwavering commitment to a never-ending process of central bank credit expansion in the GIIPS. It must mean that—in addition to support policies—strict conditionality is imposed concurrently, not mañana.

The structure of the paper is as follows. In Section 2 we present some stylized facts and describe institutional characteristics of the Eurosystem and monetary instruments that have been used in the Eurozone. In Section 3 we present a dynamic game that captures such institutional characteristics. In Section 4 we derive the equilibrium and analyze the effects of policies on fiscal adjustment.

2 Eurozone Stylized Facts

The ECB's balance sheet expansion since 2007 is of the same order of magnitude as that of major central banks.² This aggregate number, however, masks a huge cross-country asymmetry: central bank domestic credit in the Eurozone periphery has increased by more than 800bn Euro between January 2007 and May 2012, as shown in Figure 1.³ This more than 1000% increase is massive and unprecedented in the post-war period. Even Mexico's infamous domestic credit blow-up in the run-up to the Tequila crisis pales compared with this massive increase.⁴

Historically, massive central bank credit creation—in the name of avoiding a recession—is a well established *sin* and its punishment is swift. Typically, there are natural limits imposed by either a depletion of reserves or runaway inflation. For instance, in emerging markets, during the latter stages of an exchange rate peg—when it is obvious to markets that the peg is unsustainable—central banks typically engage in massive credit creation. This strategy

²During this period the balance sheet of the ECB has increased by 167%, that of the US Fed by 220%, and that of the Bank of England by 350%.

³For details see Tornell and Westermann (2012).

⁴See Sachs, Tornell and Velasco (1996) for an analysis of Mexico's Tequila Crisis.

usually fails because the central bank loses international reserves, suffers a speculative attack, and is forced to terminate the peg. A huge–unwanted–depreciation results.⁵

In the Eurozone, these natural limits have been muted, and so the massive NCB credit creation in the GIIPS has not met a full-blown BoP crisis. The reason for this anomaly is that GIIPS NCBs can finance such domestic credit creation by borrowing—indirectly— from other Eurozone NCBs, via the European Central Bank (ECB), rather than by drawing down their own gold and international reserves. Such borrowing has been facilitated by the Target2 mechanism.⁶

To analyze Eurozone dynamics, we must add the Target2 balances as a new item in the standard textbook central bank’s balance sheet

<u>Assets</u>	<u>Liabilities</u>
<i>Credit to Domestic Agents</i>	<i>Money Balances</i>
<i>Gold&Reserves</i>	<i>Target2 net liabilities</i>

Figure 2 shows the evolution of the Target2 liabilities of the GIIPS. As we can see, there is a remarkable similarity between the increase in NCB domestic credit and Target2 liabilities. Meanwhile, international reserves have not changed significantly.

2.1 Dual Common-Pool Problem in the Eurozone

The reader may wonder, how come the ECB has allowed domestic credit to follow such an explosive path in the GIIPS? The short answer is that such an explosive process is not the design of a textbook benevolent central planner at the ECB. Rather it has been the result of the interaction of two commons-pool problems: an inter-country problem and a within-country problem. The first problem arises because central bank domestic credit decisions in the Eurosystem are not made by a *unitary decision-maker*. Instead, they are the results of decision taken by the ECB in Frankfurt and by 17 national central banks (NCBs)—that are to a large extent independent from the ECB. There is a common-pool problem among the countries in the Eurosystem because each NCB can indirectly access the money demand of

⁵In standard Balance-of-Payments models an increase in domestic credit is met by an equal reduction in international reserves if money demand is unchanged. When reserves hit a lower limit, a speculative attack takes place and the exchange rate peg ends with a sharp depreciation of the currency.

⁶For a description of the Target2 mechanism see Garber (1998), Sinn and Wollmershäuser (2011), and Tornell and Westermann (2011).

the entire Eurozone. The within-country problem arises because NCBs tend to respond to domestic political pressures. Let's consider each in turn.

In the short-run, each country in the Eurozone has de facto power over its domestic credit. The ECB has only indirect control over this process via interest rates and eligibility criteria on its refinancing operations.⁷ There are several reasons for this:

- The Eurosystem uses so-called *full allotment tenders*, under which the ECB announces the interest rate at which it is willing to satisfy any amount of loan demands by banks. Every bank can then borrow as much as it wants from its NCB, as long as:
 1. It is financially sound and
 2. It has eligible collateral.

A key institutional characteristic that gives rise to the inter-Eurozone common pool problem is that:

- The regulatory power to decide whether a bank is financially sound rests with national authorities, not with the ECB in Frankfurt.

Even though the above institutional setup is lax, *ceteris paribus* the availability of eligible collateral would have imposed a natural limit to NCB domestic credit expansion. However, not all else has been equal:

- The ECB has relaxed significantly the criteria for eligible collateral since 2008. So much so that currently national authorities have significant leeway in determining what is eligible collateral. In particular, the requirement rating agency grading has been eliminated. Now even private loans count as eligible collateral—against "appropriate haircuts".

If all of the above fails to generate enough eligible collateral, an NCB has recourse to emergency liquidity assistance:

⁷The details of this argument and of the relaxation of collateral rules are presented in Tornell and Westermann (2012).

- ELAs. Under an ELA, a bank that has no collateral, can borrow from its NCB if the government guarantees that loan.⁸

The ECB bylaws forbid the funding of fiscal deficits. This prohibition, however, can be circumvented in several ways. First, an NCB can lend money to banks, who in turn can use that money to buy government bonds. This setup allows a government to issue new bonds to finance its deficit and sell them to banks, who in turn use these bonds as collateral to borrow from the NCB.⁹ Second, another channel that indirectly helps the government finance fiscal deficits is the SMP:

- SMP. Under the secondary market purchase program, government bonds of up to 10-year maturity have been purchased in the secondary market.

By promising to buy bonds in the secondary market, the ECB provides implicit guarantees to private investors that bond yields will not increase significantly. Investors, in turn have more incentives to buy government bonds in primary Treasury auctions, making it easier for governments to run fiscal deficits. Therefore, this program has been controversial, specially within the Bundesbank.

In the Summer of 2012 pressure mounted on the ECB as the yields on Italian and Spanish bonds increased significantly. In response—and despite the opposition of the Bundesbank to government bond purchases—on September 6 the ECB announced a new government bond-buying program of unlimited size

- OMT. Under the "Outright Monetary Operations" program the ECB will purchase government bonds of up to three years in unlimited amounts, provided a country submits itself to conditionality for reform with the ESFS/ESM and the IMF.

From our perspective, the key points are: (i) when the EZ periphery has been in the brink of a BoP crisis, the ECB has enacted measures that allow periphery's NCBs to increase domestic credit and delay adjustment; (ii) the ECB understands that such programs eliminate the

⁸This mechanism was used heavily in Greece in the run-up to the 2012 elections. Greek banks suffered a huge deposit flight, which was financed via ELAs. ELAs have also been used in Ireland, Portugal. During 2012 they have been used in Spain.

⁹Such a process has been going on in Spain.

urgency for reform and so tries to introduce conditionality. These points were made by Mario Draghi, who said: "you may have self-fulfilling expectations that feed upon themselves and generate very adverse scenarios. So, there is a case for intervening, in a sense, to “break” these expectations, which, by the way, do not concern only the specific countries, but the euro area as a whole. And this would justify the intervention of the central bank. But then, we should not forget why countries have found themselves in a bad equilibrium to start with. And this is because of policy mistakes. That is why we need both legs to fix this situation and move from a bad equilibrium to a good equilibrium. If the central bank were to intervene without any actions on the part of governments, without any *conditionality*, the intervention would not be effective and the Bank would lose its independence. At the same time, we see that we are in a bad equilibrium and, therefore, policy action, though convincing, does not seem to produce – at least not in the relatively medium term – the results for which it is geared. So that is why we need both legs for this action."¹⁰

In sum, as long as a country is considered solvent by the ECB, its NCB has ample leeway in extending domestic credit–i.e., printing Euros.

Target2 Mechanism

The Target2 mechanism is an automatic payments system that permits NCBs to send and receive transfers across countries in the Eurozone. The original objective of this mechanism was to generate a seamless monetary union by allowing the smooth financing of inter-bank and trade imbalances that would be netted out in the short-run. However, as an unintended consequence, Target2 has generated an open-ended transfer mechanism, whereby an NCB can borrow–without asking for anyone’s approval–from other NCBs, via the ECB.

As a consequence, via Target2, an NCB can increase its domestic credit without risking loosing its international reserves. It can simply borrow from other NCBs as long as it has eligible collateral and the country is considered to be solvent. Three institutional characteristics make Target2 an open-ended transfer mechanism across countries in the Eurozone:

1. The ECB bylaws do not impose any upper limit to the size of an NCBs Target2 liabilities.
2. There is no explicit upper bound on the maturity of Target2 liabilities. Unlike standard

¹⁰Draghi’s press conference, September 6, 2012.

debt contracts, when a Target2 liability is incurred, it is not specified when it has to be repaid.

3. Decisions at the ECB are made by majority voting and one-country one-vote applies.

Since creditor countries in the Target2 mechanism—Finland, Germany, Luxembourg, and Netherlands—are a minority, they can easily be outvoted by deficit countries. Therefore, Target2 imbalances can, de jure, grow indefinitely.

Of course, as Tornell and Westermann (2011) have argued, there are de facto limits to the accumulation of Target2 liabilities. For instance, in order to fund Target2 loans, the Bundesbank reduced its credit to domestic financial institutions to practically zero. When this limit was hit in the fourth quarter of 2011, the ECB launched the famous LTRO which increased significantly the ECB's balance sheet. Although this process may continue for a relatively long time, political limits will be hit in creditor countries, and political opposition to Target2 imbalances will rise over time.

ESFS and ESM

The ESFS and its successor—the ESM—are bailout agencies that give periphery country's access to fiscal resources subject to conditionality. The capital of these agencies come from governments not from the ECB. However, there are proposals to give a banking license to the ESM, which will allow it to de facto tap ECB credit.

Within-country Commons-pool Problem

It is well-known that country-level decisions, such as bank-solvency and fiscal deficits, are not decided by a unitary agent—a dictator—but by the interactions of several powerful groups within a country. In a democracy, such powerful groups include: local authorities, unions, industrial groups, banks, etc. NCBs and bank regulators do not act in a vacuum, but interact with such powerful groups. In particular, there are strong pressures for central bank financing of fiscal deficits and for regulatory forbearance. The latter includes decisions such as not declaring a bank insolvent when it is de facto insolvent and allowing banks to refinance de facto non-performing loans (ever-greening).

Puzzlingly, the ample power that NCBs and domestic regulators have over domestic credit expansion, makes them politically weak. It generates strong temptations for powerful groups to influence them. In the typical small economy, this temptation is checked by the

NCB's stock of gold and internal reserves. In the Eurozone, Target2 has weakened such discipline. It has opened the possibility for an NCB to borrow from the Eurosystem and extend domestic credit beyond its stock of gold and internal reserves.

Finally, note that the common-pool problem at the Eurosystem of central banks is not operative in the Fed system in the USA. The Federal Reserve Bank of San Francisco cannot buy bonds from the State of California! There are other common-problems in the USA, but not this one.

3 Model

In this paper, we present a minimal dynamic-game model that helps us analyze the Eurozone crisis. In particular, the model characterizes the within-country commons-pool problem and it analyzes how it is affected by the commons-pool problem across countries in the Eurozone. The model should be considered only as a building block in a political-economy analysis of the Eurozone.

We consider a periphery economy that belongs to a monetary union, which we will refer to as the Eurozone (EZ). This economy is small, open, and it has a single consumption good, which is perfectly tradable across the EZ. Because the economy is open and purchasing power parity holds, the domestic price level equals that in the rest of the EZ. Because the country is small it does not affect the EZ's price level, which we set to one (i.e., there is no inflation in the EZ).

We consider a setup where the country will never break away from the EZ, and so the price level in the country is expected to be constant over the entire horizon.¹¹

The economy is composed of a private sector and a government. The private sector consists of private competitive agents. The government consists of a national central bank (NCB) and a fiscal authority (FA), like in Tornell and Velasco (2000). There are 3 key ingredients:

1. The FA is not a unitary agent, but rather it is divided among n groups that have power to appropriate fiscal resources.

¹¹In a different paper we consider the case where such a break-away might take place and a BOP crisis might occur.

2. The NCB passively satisfies the fiscal demands of the FA, which in turn simply aggregates the fiscal demands of the groups.
3. The EZ central bank—the ECB—does not have the power to directly restrain the ability of the NCB to extend credit to domestic agents. The ECB can only influence the upper bound of the NCB’s liabilities.

The groups include public sector agents—government agencies, subnational governments, NGOs—as well as private actors, such as banks and industrial groups in protected industries.

Every period, each group chooses a fiscal appropriation $g_{i,t}$. The FA transfers $g_{i,t}$ to group i provided $g_{i,t}$ is in the feasible appropriation set—defined below. To finance such transfers the FA issues bonds that are purchased by the NCB.

The NCB passively satisfies the fiscal demands from groups—as long as it has enough reserves and borrowing capacity from the ECB.¹² Thus, the change in NCB domestic credit is

$$D_{t+1} - D_t = \sum_{i=1}^n g_{i,t}. \quad (1)$$

Notice that in the EZ, NCBs are not allowed to lend directly to governments, so they either lend to banks—who in turn buy government bonds—or they buy government bonds in secondary markets—via the SMP program. In this paper we do not model explicitly banks and do not distinguish these two channels. We simply consider the NCB’s credit to the powerful groups, and we will refer to it as NCB credit.

Consider next the budget constraint of the NCB. It follows from the NCB’s balance sheet (described in Section 2) that the change in the NCB’s Target2 net liabilities ($\Delta Tg2_t \equiv Tg2_t - Tg2_{t-1}$) equals the change in NCB domestic credit (ΔD_t) plus the change in international reserves (ΔIR_t) minus the seniorage (ΔM_t)¹³

$$\Delta Tg2_t = \Delta D_t + \Delta IR_t - \Delta M_t \quad (2)$$

As we discussed in Section 2, it is important to recognize that, although *de-jure* the Target2 imbalances can grow without bound, *de-facto* there is an implicit limit. This is because the ECB requires eligible collateral and also because political opposition in creditor

¹²In practice, this depends on whether there is enough collateral and the country is considered solvent.

¹³Notice that we have set to zero the return on international reserves. Furthermore, there is no inflation revenue because inflation is zero.

countries might arise over time if Target2 imbalances increase beyond a threshold. We capture this implicit limit on Target2 imbalances via an upper bound (\bar{L}_t) on the loans that the NCB can tap from the Eurosystem—via ECB.

It will be useful to express things in terms of the distance between the upper bound \bar{L}_t and periphery country's Target2 liabilities

$$L_t \equiv \bar{L}_t - Tg2_t, \quad L_t \geq 0, \quad L_0 > 0. \quad (3)$$

We will refer to L_t as the "available ECB credit to the NCB."¹⁴

In order to analyze the effects of ECB policy changes—such as the relaxation of collateral rules—we will let this upper bound \bar{L}_t grow at a rate ζ_t , which could be set to zero or any positive level

$$\bar{L}_t = [1 + \zeta_t] \bar{L}_{t-1}, \quad \text{with } \zeta_t \equiv \lambda \cdot \frac{L_{t-1}}{\bar{L}_{t-1}}, \quad \lambda \geq 0. \quad (4)$$

Substituting (1), (3) and (4) in the NCB's budget constraint (2), we get common-access accumulation equation faced by the groups

$$L_{t+1} = [1 + \lambda]L_t - \sum_{i=1}^n g_t^i - \Delta IR_t + \Delta m_t. \quad (5)$$

This difference equation makes clear that groups have de facto access to a common-pool resource: available ECB credit to the NCB.

As is well known, elites in the GIIPS—the model's powerful groups—can invest their assets abroad to keep them safe from expropriation. In order to allow for this possibility, we decouple a group's fiscal appropriation $g_{i,t}$ from its consumption $c_{i,t}$.¹⁵ To do so we allow each group to save its fiscal appropriation safely from appropriation by others by sending it to a core EZ country, rather than consuming it immediately.¹⁶

The resources that a group invests safely abroad earn a rate of return β , which can be set to either a positive or non-positive number. Thus, the group i 's "safe assets abroad" evolve

¹⁴If the country were to hit the lower bound on its net debt with the rest of the EZ, then the ECB would stop accepting the country's collateral, and so the country will have to let its exchange rate float. If such a crisis event were to occur at τ , then all groups would get zero transfer forever after ($g_{it}^j = 0$ for all $t \geq \tau$).

¹⁵There is another standard channel for capital outflows, via a fall in m_t . This channel is not operative in this paper as we concentrate on the case where the EZ will stay intact forever.

¹⁶This is a realistic setup as we see it happening currently in the EZ. Alternatives may be storing the Euros behind the mattress or buying gold and forex, all of which entail risk.

according to¹⁷

$$b_{i,t+1} = (1 + \beta)b_{i,t} + g_{i,t} - c_{i,t} \quad (6)$$

As is standard in dynamic models of common-access (e.g., Benhabib and Radner), we impose an upper bound on fiscal appropriation to ensure that there are enough resources to satisfy the fiscal demands of all groups

$$g_{i,t} \in [0, \bar{g}L_t], \quad \text{with } \bar{g} < \frac{1 + \lambda}{n}. \quad (7)$$

The upper bound on the appropriation rate \bar{g} is low enough so as not to deplete the available credit of the NCB.

During every period, each group chooses fiscal appropriation and consumption sequences in order to maximize the discounted value of the utility it derives from consumption

$$U_i(s) = \sum_{t=s}^{\infty} \frac{1}{\delta^{t-s}} \log(c_{i,t}), \quad \delta > 1. \quad (8)$$

It does so subject to the NCB's budget constraint (5), its private assets accumulation equation (6), and the upper appropriation bound (7). Furthermore, the group takes as given the strategies of the other $n-1$ groups. This set of n problems constitutes a dynamic game, which we solve in Section 4.

The Private Sector

The only role of the private sector is to generate a demand for money. There is a mass of measure one of competitive infinitely-lived private agents that derive utility from consumption of the single good and from real money balances

$$\sum_{t=s}^{\infty} \frac{1}{\delta^{t-s}} [\log(c_t) + \log(M_t)]. \quad (9)$$

The representative private agent receives an endowment of the consumption good y_t every period. Since she can accumulate her wealth in either money or an internationally traded bond (b_t) that pays a real interest rate $\delta - 1$, it follows that her budget constraint is

$$y_t - c_t = b_t + \delta b_{t-1} + M_t - M_{t-1} \quad (10)$$

¹⁷One could think of β as the gross rate of return a group receives minus the costs of keeping it effectively private for latter consumption.

4 The Tragedy-of-the-Commons Equilibrium

We will characterize equilibria in which the country will remain in the monetary union forever, and this is known by all agents in the economy.¹⁸ Thus, there are no expectations of explosive inflation that would result from a break away from the EZ. Inflation is equal to that in the rest of the EZ, which we have set equal to zero.

The representative private agent maximizes (9) subject to (10). The solution is

$$\begin{aligned} c_t &= \bar{c} \\ M_t &= \frac{\delta}{\delta - 1} \bar{c} \end{aligned} \quad (11)$$

We will use Markov perfect equilibria (MPE) as the solution concept in the game among groups. In an MPE, the strategies depend only on the value of the payoff-relevant state variables $(L_t, b_t^1, \dots, b_t^n)$. We allow groups to choose appropriation policies from the class of continuously differentiable functions of the payoff-relevant state variables

$$\hat{g}_{j,t} = g_j(L_t, b_{j,t}) \in C^1, \quad g_j(0, b_{j,t}) = 0 \quad (12)$$

In an MPE each group i takes as given the strategies of the other groups. In order to derive the MPE, let's consider n optimization problems—one for each group—and in each Problem- i , let's consider the strategies of the other $n - 1$ groups as undetermined differentiable functions of the state $g_j(L_t, b_{j,t})$ for $j \neq i$.

We will construct an interior MPE in which all groups set their fiscal appropriation in the interior of the appropriation set: $g_{i,t} < \bar{g}L_t$ for all t .¹⁹

Since inflation is zero, it follows from the private agent's problem that $\Delta M_t = 0$. Thus, each group solves the following problem.

Problem i. Taking as given the appropriation strategies of the other $n - 1$ groups (12), select $\{g_{it}, c_{it}\}_{t=s}^{\infty}$ to maximize $U_i(s)$ subject to accumulation equation (6), the upper appropriation bound (7) and the NCB's budget constraint

$$L_{t+1} = (1 + \lambda)L_t - g_{i,t} - \sum_{j \neq i} \hat{g}_{j,t}(L_t, b_{j,t}), \quad t = s, s + 1, \dots \quad (13)$$

¹⁸If this country were to break apart from the monetary union, its inflation rate would be time-varying. In a companion paper we consider this possibility.

¹⁹There are other "extreme MPE" where $g_{i,t} = \bar{g}L_{t-1}$.

In an interior solution to Problem (i), group i 's optimal plan satisfies the following conditions:

$$\frac{\hat{c}_{i,t+1}}{\hat{c}_{i,t}} = \frac{1 + \beta}{\delta} \quad (14)$$

$$\hat{g}_{j,t} < \bar{g}L_t \text{ only if } \sum_{j \neq i} \frac{\partial \hat{g}_{j,t}(L_{t+1}, b_{j,t+1})}{\partial L_{t+1}} = \lambda - \beta \quad (15)$$

$$\lim_{t \rightarrow \infty} \frac{\hat{L}_t}{\delta^t \hat{c}_{i,t}} = 0, \quad \lim_{t \rightarrow \infty} \frac{\hat{b}_{i,t}}{\delta^t \hat{c}_{i,t}} = 0 \quad (16)$$

The first optimality condition is the familiar Euler equation: along an optimal path consumption grows at the rate $\frac{1+\beta}{\delta}$. The second optimality condition says that group i finds it optimal to set its appropriation $\hat{g}_{i,t}$ in the interior of the appropriation set (7) only if the equilibrium strategies of the other $n - 1$ groups satisfy $\sum_{j \neq i} \frac{\partial \hat{g}_j(L_{t+1}, b_{j,t+1})}{\partial L_{t+1}} = \lambda - \beta$. The third condition is the transversality condition, which requires the marginal discounted value of both L and b_i to converge to zero.

In order to derive the interior MPE notice that the pair of optimality conditions (14)-(15) must hold for each of the n groups. Thus, an interior MPE exists only if the following set of n conditions holds simultaneously

$$\sum_{j \neq i} \frac{\partial \hat{g}_{j,t}(L_{t+1}, b_{j,t+1})}{\partial L_{t+1}} = \lambda - \beta \quad \text{for } i = 1, 2, \dots, n. \quad (17)$$

This set of n equations holds simultaneously only if $\frac{\partial \hat{g}_{j,t}(L_{t+1}, b_{j,t+1})}{\partial L_{t+1}} = \frac{\partial \hat{g}_{i,t}(L_{t+1}, b_{i,t+1})}{\partial L_{t+1}}$ for all i and all j . Thus, (17) holds only if $[n - 1] \frac{\partial \hat{g}(L_{t+1}, b_{j,t+1})}{\partial L_{t+1}} = \lambda - \beta$. Integrating we have $\hat{g}(L_{t+1}, b_{j,t+1}) = \frac{\lambda - \beta}{n - 1} L_{t+1} + \text{constant}$. Since fiscal transfers must be zero if $L_{t+1} = 0$, i.e., $g_{i,t}(0) = 0$, the constant must be zero. Hence, in an interior MPE the undetermined appropriation functions are uniquely determined, as stated in the next Proposition.

Proposition 4.1 (Interior Equilibrium) *There exists an interior MPE of the common-pool fiscal appropriation game if and only if*

$$\beta < \lambda < \beta + [1 + \beta][n - 1] \quad \text{and } \bar{g} > \frac{\lambda - \beta}{n - 1}. \quad (18)$$

The interior MPE is unique. In this equilibrium, each group appropriates a constant share of the National Central Bank's available credit from the ECB

$$\hat{g}_i(L_t) = \frac{\lambda - \beta}{n - 1} L_t, \quad i = 1, 2, \dots, n \quad (19)$$

Each group consumes a constant share of the stock of assets to which it has access

$$\hat{c}_{i,t}(L_t, b_{i,t}) = [1 + \beta] \left[1 - \frac{1}{\delta} \right] [L_t + b_{i,t}], \quad i = 1, 2, \dots, n \quad (20)$$

To see the intuition for appropriation strategy (19) notice that from group i 's 'private' perspective the rate of return on the L-asset is $\lambda - \sum_{j \neq i} \hat{g}_j(L_t, b_{j,t})/L_t$, while that on the b-asset is β . Thus, group i expects the same return on both assets, i.e., $\beta = \lambda - \sum_{j \neq i} \hat{g}_j(L_t, b_{j,t})/L_t$, if and only if the other $n-1$ groups set their appropriation rates as in (19). Of course, the same is true for each of the other groups. Thus, group i must set its appropriation rate as in (19) in order for each of the other groups to find strategy (19) optimal.

4.1 Equilibrium Central Bank Credit and Target2 Imbalances

Here, we link the equilibrium of our model economy to the path of credit extended by the periphery's NCB and the Target2 liabilities of this NCB (Figures 1 and 2 in Section 2).

In the interior equilibrium, the credit extended by the periphery's NCB evolves according to

$$\begin{aligned} \hat{D}_{t+1} - \hat{D}_t &= \sum_{i=1}^n \hat{g}_{i,t} \\ &= \frac{n}{n-1} [\lambda - \beta] L_t \end{aligned} \quad (21)$$

Since $\lambda > \beta$ is necessary for the existence of an interior equilibrium, NCB credit is positively linked to the NCB's available credit from the ECB. To obtain the equilibrium path of the NCB's available credit from the ECB we substitute (19) in (5)

$$\hat{L}_t = \left[1 + \frac{n\beta - \lambda}{n-1} \right] L_{t-1}. \quad (22)$$

The condition on parameters for existence of equilibrium (18) can be rewritten as $\beta < \lambda < n\beta + n - 1$. Thus, along the equilibrium path L_t may be increasing if $\lambda \in (\beta, n\beta)$ or decreasing if $\lambda \in (n\beta, n\beta + n - 1)$. In either case, L_t does not hit zero in finite time.

Notice that the equilibrium is consistent with a situation in which the periphery country never breaks away from the EZ, and private agents do not expect a future increase in inflation above the Eurozone inflation (which is zero). Thus, $\Delta m_t = 0$. It follows from the NCB's budget constrain that the change in Target2 liabilities equals the change in NCB domestic credit. Thus, we can state the following Corollary.

Corollary 4.1 *Along the equilibrium path, Target2 liabilities and domestic credit extended by the NCB are always increasing. They evolve according to*

$$\Delta Tg_{t+1} = \Delta D_{t+1} = \frac{n[\lambda - \beta]}{n - 1} \left[1 + \frac{n\beta - \lambda}{n - 1} \right] L_t$$

Target2 liabilities and domestic credit are always increasing because an interior equilibrium exists only if $\lambda < n\beta + n - 1$.

In our model economy, the difference between what a periphery country's powerful groups appropriate and consume is saved abroad. Replacing consumption and accumulation policies (20) and (19) in accumulation equation (6), we have that the 'safe private assets' of each group evolve according to

$$\hat{b}_{i,t} = \left[1 + \frac{\beta}{\delta} \right]^{t-s} b_{i,s} + \left\{ \left[1 + \frac{\beta}{\delta} \right]^{t-s} - \left[1 + \frac{n\beta - \lambda}{n - 1} \right]^{t-s} \right\} L_s \quad (23)$$

The stock of private assets abroad might increase or decrease depending on the size of L_t relative to b_t and on parameter values.

A few words about the link between the model and the real world are in order. First, real world private assets abroad are linked to the increase in Target2 liabilities when capital outflows take the form of transfers from the periphery banks to the core countries' banks. Such bank transfers are intermediated by the respective NCBs and so are reflected as higher Target2 liabilities of periphery NCBs and higher Target2 claims of core NCBs. Second, an increase in Target2 liabilities need not reflect capital outflows. Target2 imbalances may also reflect transitory trade imbalances that will be netted out in the medium-term. Third, an increase in fiscal appropriation need not be reflected in a change in Target2 imbalances if resources are not sent to other EZ countries via the banking system or if they are sent to countries outside the EZ.

4.2 Effects of ECB Policies

Here, we use the equilibrium of our model to assess the effect of ECB policy changes on the behavior of powerful groups, and NCB credit expansion.

As we described in Section 2, the ECB can indirectly relax the constraints on periphery NCBs country that face capital flow reversal and a large increases in yields in several ways:

(i) By authorizing the purchase of bonds in the secondary market (the controversial SMP program); (ii) The ECB can further relax the criteria for "acceptable collateral," and in this way allow an NCB to grant more credit to banks. Banks in turn can use this extra credit to buy domestic (government) bonds and in this way reduce the yield on government bonds; (iii) ELAs can be authorized when there is no more eligible collateral (this is what has kept Greece's banks and government afloat since the run-up to election in the Summer 2012).

Recently, more direct ECB support policies have been called for. The Italian prime minister Monti and the Spanish finance minister Luis de Guindos have called for the ECB to set a ceiling on periphery's interest rates by committing to an open-ended policy of purchasing unlimited amounts of bonds. Previous experience has shown that when the ECB showers the EZ with liquidity and yields fall, the incentives to reform and reduce budget deficits also falls. For example, following the December 2011 LTRO, there was a backtracking on promised reforms in Italy under Berlusconi, and Spain's Rajoy announced that it will slow deficit reduction. More recently, in August 2012, Spain has announced it will not close down Bankia, the failed bank, but rather recapitalize it.²⁰

For this reason, Mr. Draghi has said that a necessary condition for the ECB to intervene is that the country first asks for help from the bailout agencies—ESFS and ESM. Such request for help, in principle, entails some conditionality.

The equilibrium of our model can help us rationalize a situation in which an announcement of more ECB commitment to support the periphery, might fail to induce the desired outcome (i.e., give governments a window of opportunity to adjust). Instead, the promise of more ECB liquidity injections induces more fiscal appropriation.

Our model suggest that, to the extent that there is divided fiscal control within countries, a tragedy-of-the-common equilibrium develops within each country. In such equilibria, policies that would be helpful in a unitary framework (where the country's authorities internalize the consequences of their actions) generate the opposite response in a divided control setup. This is because each group—individually—has no incentive to reduce its fiscal appropriation. If group i were to do so, then other groups might appropriate what group i did not appropriate. So why bother! Furthermore, the properties of the equilibrium characterized in Proposition 4.1 imply that groups will respond with more appropriation demands following

²⁰Such a decision avoids forcing losses on many junior debt holders of Bankia, which might be politically costly for Rajoy's government.

the announcement of a more generous ECB stance. Neither Mr. Monti's nor Mr. Samarras should be blamed for such a lack of policy ineffectiveness. They are not dictators, but simply preside over democracies dominated by powerful groups.

In terms of our model, an increase in the ECB's generosity (or its willingness to intervene in the future in case of a liquidity squeeze) can be represented by an increase in the growth rate of the NCB's available credit at the ECB (λ). Algebraically, to see the effects on equilibrium fiscal appropriation let's consider an unexpected permanent increase in λ , which is announced at time $t = 0$. This increase in λ leads to an increase in a groups' fiscal appropriation, but does not affect the groups' consumption

$$\frac{\partial \hat{g}_{i,t}}{\partial \lambda} = \frac{1}{n-1} L_t > 0, \quad \frac{\partial \hat{c}_{i,t}}{\partial \lambda} = 0.$$

Thus,

Proposition 4.2 (Ineffectiveness of Greater ECB Generosity) *Along an interior equilibrium, an ECB shift into a more generous policy stance towards the periphery is completely squandered:*

- *An increase in the ECB's willingness to grant more credit to a periphery's NCB (higher λ) results in higher fiscal voracity and higher capital outflows from the periphery.*
- *Neither groups' consumption nor welfare increase.*

That is, the ECB's more generous stance is reflected in a more inefficient political economy environment in the periphery. The equilibrium strategies call for groups to be more fiscally voracious. So much so that the groups' consumption opportunities do not increase! As a result, groups' consumption remains unchanged and the entire increase in ECB generosity is simply reflected in more private assets abroad (i.e., capital outflows).

To see the intuition for why the change in λ does not affect the groups' consumption, rewrite equilibrium consumption (20) as follows

$$\hat{c}_{i,t} = [1 + \beta] \left[1 - \frac{1}{\delta} \right] [L_t + b_{i,t}] = \left[\frac{1 + \beta}{\delta} \right]^t [L_0 + b_{i,0}] \quad (24)$$

A group's consumption increases only if higher λ leads to an increase in the total assets to which the group has access: $L_t + b_{i,t}$. Even though the direct effect of higher λ is to increase the growth rate of L_t (because $L_{t+1} = (1 + \lambda)L_t - \sum_{i=1}^n g_{i,t}$), higher λ also leads to a more than

proportional increase in fiscal voracity $\sum_{i=1}^n \Delta g_{i,t}$. The net result is a fall in the growth rate of NCB available credit from the ECB. Algebraically, since $\hat{L}_{t+1} = \left[1 + \frac{n\beta - \lambda}{n-1}\right] \hat{L}_t$, the growth rate of \hat{L}_t is decreasing in λ

$$\frac{\partial \left(\hat{L}_{t+1} / \hat{L}_t \right)}{\partial \lambda} = -\frac{1}{n-1} < 0.$$

Even though each group increases its appropriation rate—and so it accumulates more private assets abroad ($b_{i,t}$ increases)—in equilibrium its wealth fails to increase because of the fall in the growth rate of L_t . It follows from (23) that the future path of group's total assets is unaffected by λ

$$\hat{b}_{i,t} + \hat{L}_t = [b_{i,0} + L_0] \left[1 + \frac{\beta}{\delta}\right]^t$$

Therefore, higher λ does not improve the groups' consumption possibilities.

To confirm that all the direct benefits of greater ECB generosity are dissipated and that groups' welfare does not improve, substitute consumption policy (24) in utility function (8). As we can see, the group i 's value function is independent of λ .

$$V_i(0) = \frac{\delta}{\delta-1} \left[\log(L_0 + b_{i,0}) + \frac{1}{\delta-1} \log\left(\frac{1+\beta}{\delta}\right) \right]$$

The result that the greater ECB generosity is completely dissipated by greater fiscal voracity captures the common-person wisdom that, in the absence of reform, more bailouts to Greece are not helping the 99% of Greeks. In order to be effective, ECB policies *must* include strict conditionality. It is not sufficient for ECB to announce a future policy rule that unconditionally commits to bound interest rates on governments on an open-ended fashion.

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Figure 1. Central Bank Credit to Domestic Agents in GIIPS

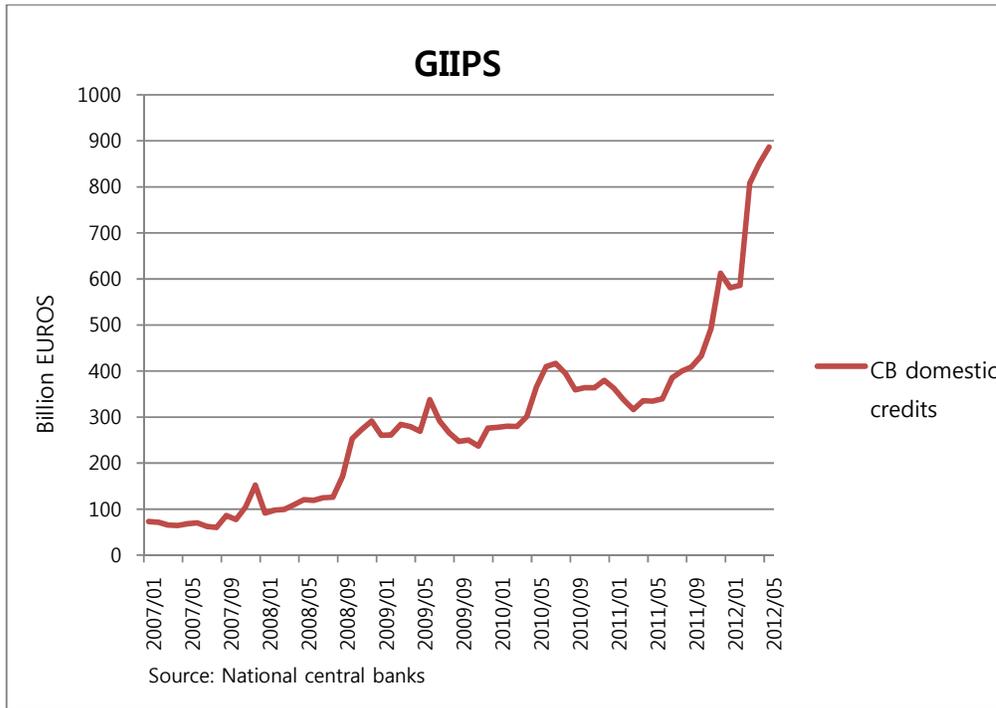


Figure2. Target2 Liabilities of GIIPS

