EMU STABILITY: DIRECT AND INDIRECT RISK SHARING*

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Abstract

Our paper aims to analyze the effectiveness of different risk-sharing mechanisms in providing stability to a monetary union. We select two stylized tools with extreme and opposite features. The first is an expansionary but conventional monetary policy that is used to help EMU's most fragile member states manage their public debts; the second is a centralized fiscal policy that allows for the transfer of a portion of these public debts from EMU's most fragile member states to those considered EMU's "core". By a stylized periphery-core model of a monetary union, we compare the strengths and weaknesses of these two tools in order to reach some welfare implications in terms of union stability.

1. INTRODUCTION

After the eruption of the sovereign debts crisis and the crisis of the banking sector in the euro-area, which sparked a vicious circle between the two crises, the risk sharing issue and the European Monetary Union (EMU) stability have become a crucial target for policy interventions and are central topics of policy debates. As for the policy interventions, let us recall a number of initiatives taken by the European Central Bank (ECB): the extension of the Security Market Program to Italy and Spain in mid-2011, the launch of LTROs a few months later, the design of the Outright Monetary Transactions (OMT) in July-September 2012, and the different forms of quantitative easing (QEs) implemented since the fall 2014.[1] These initiatives have different risk sharing intensity, and some of them are subordinated to conditionality. In any case, they differently combine risk sharing and risk reduction. The same applies to the policy debate (e.g., Issing, 2009; CESifo, 2011; Corsetti *et al.*, 2011; Favero and Missale, 2012; Beetsma and Mavromatis, 2014; Furceri and Zdzienicka, 2015). The orthodox view maintains that risk reduction in the most fragile member states (the so-called peripheral countries) represents a precondition for implementing risk sharing mechanisms; on the other hand, a more unorthodox view recalls that risk diversification is an instrument of risk reduction, even according to the most standard portfolio theories.

The opposition between risk sharing and risk reduction is thus analytically misleading. Moreover, it had the actual effect of causing a stalemate in the institutional evolution of the euro-area from the end of 2013 to mid-2017. Given the opportunity to re-start innovative processes in the European governance after the German elections of September 2017, it becomes necessary to overcome this opposition by clarifying possible implementations of risk sharing. Our paper contributes to this aim by analyzing the effectiveness of two extreme risk-sharing mechanisms in providing stability to a monetary union. In fact, we focus on two stylized and opposite cases. First, we consider an indirect risk sharing mechanism operating through conventional monetary policies. In the second case, we look at a centralized fiscal policy regime allowing the direct transfer of a portion of public debts from EMU's peripheral to EMU's 'core' countries.

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[1] Other risk sharing initiatives are due to the new EMU's aid programs and financial regulation. It suffices to recall the launch of the European Stability Mechanism (ESM) in December 2010 and the consequent Treaty in March 2012, as well as the Banking Union process opened by the Euro-summit of June 2012 and currently centered on the single supervisory mechanism and the single resolution mechanism.

In the first case, the central bank does not purchase sovereign debt bonds in the secondary markets, as in the QEs, but it has recourse to an expansionary monetary policy along the lines of a standard Keynesian model (e.g. Modigliani 1944). The only specificity is the target of this conventional monetary policy: it aims to reduce the pain incurred by the peripheral countries to implement national fiscal consolidation processes, even at the cost of increasing the positive gap between the expected and the "natural" inflation rates in the monetary union. This policy design creates an undesired inflationary pressure in 'core' countries, which is here assimilated to a sort of indirect (or implicit) risk sharing mechanism. In the second case, there is a policy setting characterized by a hierarchy of institutions along the lines of neo-institutional models (see Williamson 1985). In particular there is a centralized fiscal institution, here reduced to a common financial fund, and a number of subordinated national fiscal institutions. The common financial fund can transfer a predetermined portion of national public debts through the financial markets.

We are obviously aware that, both, a pro-inflation central bank and a centralized fiscal solution aimed at internalizing negative externalities produced in a monetary union, would be politically unfeasible in today EMU's institutional setting. However, it is interesting to specify the pros and cons of these extreme mechanisms in order to appreciate their relative (un)convenience in implementing a gradual process of partial risk sharing. This is the reason why our stylized periphery -core model compares the strengths and weaknesses of these two polar mechanisms in order to reach some welfare implications in terms of the monetary union stability. The first mechanism, centered on an expansionary monetary policy, introduces an indirect risk sharing through an indirect and partial "monetization" of the public debts issued by peripheral countries. The second mechanism, centered on a form of centralization of the union's fiscal policy, introduces a direct risk sharing by creating a market for eurobonds.

Several papers are related to our work. The emergence of the EMU's crises and the response mainly based on the ECB's initiatives ignited a debate on possible mechanisms or policies apt to prevent systemic breakdowns. In this vein, a large number of authors maintain that the EMU's sovereign debt crisis could have been managed by introducing properly designed eurobonds (see for instance: Depla and Weizsäcker 2010, Messori 2011, and Favero and Missale 2012). However, as showed by the critical remarks of Issing (2009), CESifo (2011), and Corsetti *et al*. (2011), eurobonds remain highly controversial. Furceri and Zdzienicka (2015) suggest a milder solution. They compare the performance of different risk sharing tools by concluding that a supranational fiscal stabilization mechanism, financed by a relatively small contribution, would be able to fully insure the euro-area

countries against severe, persistent and unanticipated downturns. The two authors add that, among the possible debt-risk sharing tools, only a suitably chosen and limited guarantee could induce the countries of a monetary union to reduce their government debt and raise the collective welfare. The union welfare would improve, if this guarantee was made conditional to policy adjustments. The rationale of these results depends on the dominant time-consistent solution when the rest of a union faces costs by giving up the financial rescue of a member state in difficulty.

This rich literature shows that the impact of each different risk sharing mechanism is largely dependent on its specific design with respect to the embedding institutional framework, so that it is difficult to have an assessment of its relative effectiveness in general terms. In this respect, the EMU offers a good example. In this specific monetary union, the possible implementation of risk-sharing mechanisms produces different policy externalities which depend not only on the mechanism itself but also on the degree of (de)centralization of various decisions. It follows that there is room for theoretical models aiming to investigate the peculiar institutional setting of a monetary union, since this setting limits the effectiveness of the different risk-sharing mechanisms. In the recent literature, there are several papers which show that the institutional framework matters for the general working of a monetary union.[2] However, as far as we know, there is a lack of appropriate researches focused on risk sharing and on the impact of the consequent possible policies. Our model aims to fill this gap, at least partially.

Our main results are the following. The indirect risk sharing mechanism, here exemplified by a conventional expansionary monetary policy, stimulates a fiscal consolidation in the peripheral countries and reduces the probability of a monetary union breakdown at the cost of excess inflation in the whole area. This mechanism thus implies a sort of indirect redistribution of fiscal charges from periphery to core countries. The lack of coordination between the central bank and the fiscal authority of the core countries represents a major source of inefficiency: The core countries will unsuccessfully attempt to offset the central bank's action by implementing national restrictive fiscal policies, which lead to unnecessary recessionary adjustments. On the other hand, in the centralized fiscal policy regime neither the central bank nor the national fiscal authorities of the core countries take any counter-initiative towards the centralized form of risk sharing. However, this policy regime too is inefficient since it is unable to internalize the externalities between the risk-sharing common

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[2] E.g., Beetsma and Bovenberg (1998), Dixit and Lambertini (2001), Acocella *et al.* (2007a, 2007b), Galí and Monacelli (2008). See Beetsma and Giuliodori (2010) for a survey.

fund and the peripheral countries. The impact of the risk-sharing plan will be too weak since it incentivizes the peripheral countries to lower their consolidation efforts. The efficiency of the monetary union as a whole would thus improve, if the internalization of policy externalities was explicitly attributed to specific institutions.

The remainder of the paper is organized as follows. In Section 2, we list the assumptions and formalize the analytical structure of our stylized model; we also analyze possible choices of the policy makers at the national and union levels. In Section 3, we then examine the Nash equilibrium used as a benchmark, where no risk-sharing mechanism is at work. This offers us an analytical basis to specify the main features of the indirect and direct risk-sharing regimes (see Section 4). Section 5 is devoted to the comparison of the strengths and weaknesses of these two different regimes in order to fix some welfare results in terms of the monetary union's stability. In the Conclusions, we point out the main features of our model that could be improved by further research.

2. THE MODEL

According to the two-country setup of Alesina and Barro (2002), we build a stylized model of the working of a monetary union composed by two representative member states: a core and a peripheral country. In a New Keynesian fashion (e.g. Blanchard and Galì 2007), a representative firm produces a final good out of an imperfectly substitutable intermediate good and uniform units of labor in both countries of the monetary union. In each of these countries, intermediate and final goods are produced under imperfect competition, so that prices are set above marginal costs. We assume an idiosyncratic and negative shock that hits the peripheral country increasing its level of real public debt over a given threshold threatening its fiscal stability, and thus increasing the breakdown probability for the monetary union. Nominal wages and prices are sticky and determined before the occurrence of this shock; hence, changes in the centralized monetary policy have short-term real effects in both countries.

2.1 Policymakers

In our stylized monetary union, three policy makers interact: a single central bank and two fiscal authorities (one each for the core and peripheral countries).

The single central bank focuses on the monetary union's inflation target; however, it also cares that this union does not breakdown. Formally, the central bank loss function is:

(1)
$$B = \frac{1}{2} \pi^2 + \frac{c}{2} prob_B^2$$

where: π is the difference between the actual average inflation rate and the inflation target, put equal to 0 for sake of simplicity;[3] $prob_B$ is the breakdown probability of the monetary union (which will be later explained); c is the relative weight of the probability of the monetary union's breakdown, that is, the weight of this probability with respect to the price stability goal.

The central bank controls the inflation rate by means of the money aggregate, $\pi = \gamma (m - m_n)$, so that it can inflate the economy by raising the money supply m over its natural rate m_n, which is consistent with its zero-target inflation.

Let now turn to the national fiscal authorities. Each of these two authorities is focused on the real output and fiscal stability of its country, and it is constrained by the expected impact of its national fiscal policy on the actual working of the monetary union. Both fiscal authorities also care that the monetary union does not breakdown. Formally, the loss of the fiscal authority i (where the index $i \in \{c, p\}$ can refer either to the core (c) or to the peripheral country (p)) is thus defined by:

(2)
$$F_i = \frac{1}{2} (y_i - \bar{y})^2 + \frac{a_i}{2} \pi^2 + \frac{b_i}{2} \left(d_i - \bar{d}\right)^2 + \frac{c_i}{2} prob_B^2$$

where: y_i is the actual output of country i and d_i is a measure of its government debt in real terms; $\bar{y}$ and $\bar{d}$ are the fiscal authority's targets.

We assume that these two targets coincide, respectively, with the natural output and the amount of public debt compatible with fiscal stability. Moreover, as already stated, $prob_B$ is the breakdown probability of the monetary union.[4] Parameters a_i, b_i, and c_i (a_i, b_i, $c_i > 0$) are the relative weights that the fiscal authority i attributes to the inflation rate, public debt stabilization problems, and breakdown probability. It is worth noting that these three parameters may differ between the two national fiscal authorities. The deviation $d_i - \bar{d}$ captures the fiscal stability goal. The breakdown probability of the monetary union depends on the fiscal stability: when $d_i - \bar{d}$ is zero in both countries, $prob_B$=0.

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[3] It is worth noting that a discussion on the optimal rate of inflation is beyond the scope of our paper. Hence, our simplification does not imply any loss of generality. On the other hand, it allows us to label π as the actual average inflation rate in the monetary union.

[4] The breakdown probability is analyzed in some details in Section 2.3.

2.2 The stylized economy

The working of our stylized monetary union is described by the following two relations:

(3)
$$y_i = \bar{y} + (\pi - \pi_e) - f_i$$

(4)
$$d_i - \bar{d} = -f_i + \varepsilon_i$$

Equation (3) defines the actual output for country i in terms of a percentage deviation from its natural level.[5] These deviations depend on $\pi - \pi_e$ and f_i. The former is the deviation of the actual average inflation rate in the monetary union from its long-run expected rate. The latter is an index of the fiscal policy stance of country i, which is here expressed by taking into account the distortionary effects of taxation (see Alesina and Tabellini 1987; De Kock and Grilli 1993; Beetsma and Bovenberg, 1998; Acocella *et al.* 2007a, 2007b). Equation (4) describes the public debt deviations from its target (i.e., the country i's fiscal stability); f_i is the fiscal consolidation that can offset the consequences of an idiosyncratic stochastic shock, ε_i.

2.3 The monetary union stability

Let us now discuss the breakdown probability of the monetary union focusing on the peripheral country. Given our previous assumptions, we can state that the gap between the peripheral public debt and its target determines – *per se* – a fiscal instability in the peripheral country, which has a varying negative impact on the stability of the monetary union as a whole. This allows a simple formalization of the breakdown probability for the monetary union ($prob_B$), i.e.:

(5)
$$prob_B = \max\{d_p - \bar{d}, 0\}$$

Equation (5) specifies that a sovereign debt crisis in the periphery, which occurs when the level of the real debt exceeds the target (domestic fiscal instability), leads to an increase of the breakdown probability in the monetary union as a whole.

2.4 Natural equilibrium and sovereign debt crisis

In absence of shocks, the monetary union reaches a *natural* equilibrium. Since no action to maintain the levels of public debts is needed, all targets are met. Fiscal authorities set f_i.=0, and the central bank fixes the money supply at its natural level ($m = m_n$) so that $\pi = 0$. It follows that inflation

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[5] All variables are expressed in logs.

rate and the output gap are zero (as well as inflation expectations). No risk sharing mechanism is needed.

Let us now assume that a country-specific-debt shock hits the periphery (i.e., $\varepsilon_p > 0$ and $\varepsilon_c = 0$). If no policy action is taken, this shock will create a sovereign debt crisis in the peripheral country ($d_i > \bar{d}$) and a positive probability of breakdown in the monetary union as a whole ($prob_B = \varepsilon_p > 0$). Hence, the peripheral country needs to pursue some consolidation policies ($f_p > 0$) to manage its debt crisis, but it faces a trade-off between fiscal stabilization and its output goal: the higher the consolidation (and thus the fiscal stabilization), the higher its output gap with respect to the natural rate. Let us also recall that, by assumption, the stability of the monetary union is a public good (cf. above, equations (1) and (2)). Hence, when equation (5) signals that $prob_B$ is positive, all the other policy makers face trade-offs which appear similar to that faced by the peripheral fiscal authority. There is, however, a significant difference: the possible management of these additional trade-offs depend on the policy regime adopted in the monetary union. These different regimes are discussed in the next sections.

3. THE NASH EQUILIBRIUM

We start by studying the Nash equilibrium, where monetary and fiscal authorities interact and a specific-debt shock hits the peripheral country but no risk sharing is assumed. Hence, all the burden of stabilization falls on the peripheral country. This case is our benchmark regime that is compared to the other two extreme policy regimes.

As we stated in the previous section, the central bank is focused on the monetary union's inflation target; however, it also cares that this union does not breakdown. Hence, when an idiosyncratic shock (ε_p) affects the peripheral country, the central bank aims to minimize not only the deviation of the actual inflation rate from its natural level (here equal to 0), but also the monetary union instability. This implies that the central bank minimizes (1) subject to (3)–(5). However, in the current benchmark regime, the policy rule followed by the central bank is simply to target the natural level of money:

(6) $$m = m_n$$

The rationale is that the central bank does not want to utilize monetary policy to affect the fiscal stability of the monetary union. The latter only depends on the choices of the fiscal authority in the peripheral country (cf. eqs. (4) and (5)).

Both the national fiscal authorities minimize (2) subject to (3)–(5). Hence, the general form of the core fiscal authority's reaction function is:

(7) $$f_c = \gamma \frac{m - m_n}{1 + b_c};$$

and the general form of the peripheral fiscal authority's reaction function is:

(8) $$f_p = \frac{c_p + b_p}{1 + c_p + b_p} \varepsilon_p + \gamma \frac{m - m_n}{1 + c_p + b_p}$$

Equation (7) implies that the core country's fiscal authority would react to the peripheral country's specific-debt shock by a restriction of its fiscal policy, if the central bank adopted an expansionary monetary policy leading to (undesired) increases in prices. However, in the current benchmark regime, equations (6) and (7) lead to:

$$f_c = 0.$$

Although the monetary union stability is a public good, the core country fiscal authority does not take any action due to the passive behavior of the central bank.

Equation (8) implies that the peripheral country's fiscal authority reacts to the shock, ε_p, by a consolidation of its public debt, which would become more severe if the central bank adopted an expansionary monetary policy. However, in the current benchmark regime, equations (6) and (8) lead to:

$$f_p = \frac{c_p + b_p}{1 + c_p + b_p} \varepsilon_p$$

This means that the peripheral country's fiscal authority does not pursue any additional consolidation due to the passive behavior of the central bank.

We can rephrase the reached results by emphasizing that: the central bank does not internalize the effects of fiscal consolidation, so that it sets $m^N = m_n$ and $\pi^N = 0$;[6] the core fiscal authority does not implement fiscal restrictions, so that $f_c^N = 0$; and the peripheral fiscal authority has to suffer the full burden of reducing its government debt and stabilizing the monetary union, so that $f_p^N = \frac{c_p + b_p}{1 + c_p + b_p} \varepsilon_p$.

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[6] The apex N indicates that we are referring to the Nash equilibrium case.

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It is easy to verify that this Nash equilibrium implies:

(9)
$$prob_B^N = \frac{1}{1+c_p+b_p} \varepsilon_p$$

Equation (9) represents our benchmark, i.e., the breakdown probability observed when no action is taken by the central bank and the core fiscal authority. It is worth notice that this benchmark probability is smaller than the probability evoked at the end of the previous section under the assumption that no policy action was taken. More precisely, if $f_p = f_c = m = 0$, then $prob_B = \varepsilon_p > prob_B^N$). This does not mean that $prob_B^N$ is the smallest breakdown probability that can be reached in a monetary union hit by an idiosyncratic shock. Better results can be achieved incorporating different forms of risk sharing. Let us investigate these options in the next section.

4. DIRECT VS. INDIRECT MECHANISMS OF RISK SHARING IN THE EMU

4.1 Alternative policy regimes

Fiscal consolidations are required to stabilize debt shocks. However, as long as these shocks threaten the stability of the whole monetary union and not only that of the country directly hit, the readjustment burden can be shared by all the member states. The effectiveness and cost of the possible sharing mechanisms depend on the institutional setting and governance of the monetary union as well as on the specific tools utilized to implement them. For instance, a fiscal adjustment will be under the full control of the national fiscal authority involved, if it is based on the increase in taxation or on the reduction in public spending. Nevertheless, its actual implementation can be affected by the monetary policy initiatives and by the interaction with different national fiscal adjustments. As we already stated, two possible risk sharing mechanisms are introduced in our model in order to modify the benchmark case.

The first mechanism leads to an implicit public debt and risk redistribution from the peripheral to the core country by implementing expansionary monetary policies. In our model, the central bank is not assumed to purchase public debt bonds in the financial markets, but to operate through conventional monetary policies. In fact, the central bank may support public debt reductions in the peripheral country by announcing an expansion in its money supply. Formally, this means that the central bank commits to $m > m_n$. The rationale is that the central bank's announcement, which follows the idiosyncratic debt shock, reduces the costs of the periphery fiscal consolidation: the peripheral na-

tional fiscal authority anticipates that the consolidation costs in terms of output reduction will be partially offset by the inflation pressure due to the monetary expansion. According to equation (8), this anticipation stimulates further consolidation by the peripheral fiscal authority. However, the direct cost of this additional consolidation is lower than the relative benefits due to the decrease in output reduction. The problem is that the inflationary pressure, caused by the expansionary monetary policy, is a cost for the monetary union as a whole, that is also for the core country. This is the reason why the central bank's intervention represents a sort of indirect (or implicit) risk-sharing mechanism.

The second mechanism is a direct and explicit form of risk sharing across member states. As suggested by Furceri and Zdzienicka (2015), it can work through a sort of common financial fund that directly reallocates (or transfers) the excessive public debt, determined by the idiosyncratic shock, across the countries. In our model this means that (part of) the excessive debt of the peripheral country, e_p, is absorbed by the core country, thus reducing the probability of the monetary union's breakdown. To formalize this new institutional setting, we have to modify the previous equation (4) which becomes:

(10) $$d_i - \bar{d} = e_i - f_i + \varepsilon_i$$

where $e_c + e_p = 0$.

In this regime, the impact of an idiosyncratic stochastic shock in the periphery, ε_p, can be partially offset by a new policy tool: $|e_i| \in [0, \varepsilon_p]$. As long as $e_c = -e_p > 0$, part (or the whole) of the periphery excessive debt is transferred to the core country.
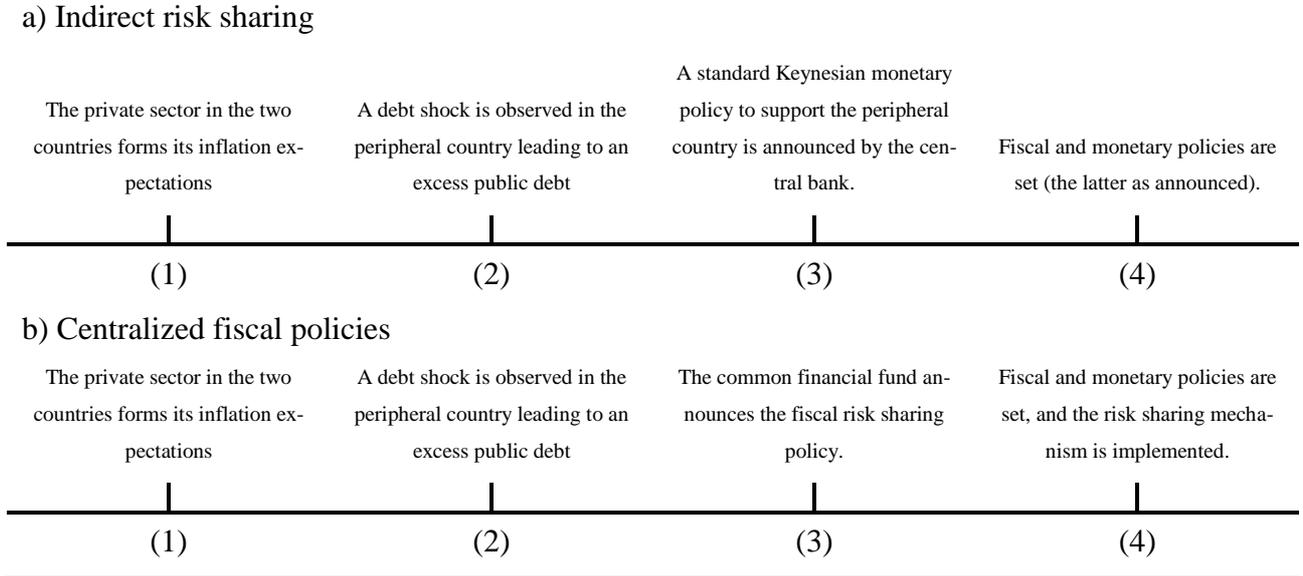
We can sum up the above discussion by stating that we consider two alternative policy regimes:

1. Indirect risk sharing (monetary activism): after the debt shock and before the national fiscal authorities' reactions, the central bank announces a recovery plan for the economy of the union, i.e., a monetary expansion.

2. Centralized fiscal policies (towards a fiscal union): the instability associated to debt shocks is solved by a debt transfer from the peripheral to the core country under the control of the latter.[7]

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[7] The allocation of the control to the core country eases the analytical tractability of our model. We could reach richer results by assuming that the fund is under the control of both countries or, better saying, is centralized at the union level so that the monetary union evolves towards a 'complete' fiscal and economic union. It is quite obvious that the last scenario fits with the possible construction of a European Ministry of Finance in the euro-area. However, the discussion of this governance evolution is beyond the scope of this paper (see Bastasin *et al.* 2017).

The timing of the two policy regimes is described in Figure 1.

Figure 1 – Timing of the two policy regimes

a) Indirect risk sharing

The private sector in the two countries forms its inflation expectations	A debt shock is observed in the peripheral country leading to an excess public debt	A standard Keynesian monetary policy to support the peripheral country is announced by the central bank.	Fiscal and monetary policies are set (the latter as announced).
(1)	(2)	(3)	(4)

b) Centralized fiscal policies

The private sector in the two countries forms its inflation expectations	A debt shock is observed in the peripheral country leading to an excess public debt	The common financial fund announces the fiscal risk sharing policy.	Fiscal and monetary policies are set, and the risk sharing mechanism is implemented.
(1)	(2)	(3)	(4)

4.2 The indirect-risk-sharing solution

The central bank commits to the already discussed plan for supporting the consolidation program of the peripheral country, hit by the shock. In so doing, the central bank internalizes the effects of its monetary policy on the peripheral country as well as on the core country. It is aware that monetary expansion will support fiscal consolidation in the periphery but will also induce the core fiscal restriction aimed at limiting price instability.

Solution for this regime is obtained by backward induction. The two national fiscal authorities still behave according to – respectively – equations (7) and (8). The central bank too continues to minimize equation (1) subject to (3)–(5); however, it also internalizes equations (7) and (8). It follows that the optimal monetary policy requires that the central bank commits to:

(11)
$$m = m_n + \frac{1}{\gamma} \frac{c}{c + \left(1 + c_p + b_p\right)^2} \varepsilon_i$$

The resulting equilibrium inflation rate is determined by:

(12)
$$\pi^K = \frac{c}{c + \left(1 + c_p + b_p\right)^2} \varepsilon_i$$

Due to the policy commitment, the peripheral fiscal authority will pursue an additional effort to stabilize its debt, providing additional support to the stability of the union. Formally:

(13)
$$f_p^K = \frac{c_p+b_p}{1+c_p+b_p}\varepsilon_p + \frac{c}{c+(1+c_p+b_p)^2}\varepsilon_p > f_p^N$$

where the second term on the r.h.s. of (13) represents the additional effort in stabilizing the monetary union induced by the central bank's announcement.[8]

The breakdown probability becomes:

(14)
$$prob_B^K = \frac{1+c_p+b_p}{c+(1+c_p+b_p)^2}\varepsilon_p < prob_B^*$$

Equations (11)–(14) state that the indirect risk sharing regime is characterized by a monetary expansion (see 11) combined with a fiscal consolidation in the peripheral country (see 13). This combination reduces the probability of the union breakdown (see 14), at the cost of a positive inflation rate (see 12). It is worth adding that the core country attempts to offset the impact of the expansionary monetary policy on prices by implementing a restrictive fiscal policy (cf. equations 7 and 11). However, this attempt fails in reducing the inflation rate and only leads to an unnecessary contraction in the core country.[9]

The conclusion is that this policy regime is able to improve the monetary union stability, but at the cost of inefficiencies. The latter stem from the lack of coordination between the core country and the single central bank in setting domestic fiscal and common monetary policy.

4.3 Centralized fiscal policy solution

The centralized fiscal policy solution too is obtained by backward induction. The objective-functions of the central bank and the two national fiscal authorities are those described in Section 3. However, their behaviors are under the constraint of equation (10) instead of equation (4). It follows that the reaction functions of the central bank and the core fiscal authority coincide with those of Section (3), as stated by equations (6) and (7). At the opposite, the reaction function of the periphery fiscal authority differs from equation (8) becoming:

(15)
$$f_p = \frac{c_p+b_p}{1+c_p+b_p}\varepsilon_p + \gamma\frac{m-m_n}{1+c_p+b_p} - \frac{c_p+b_p}{1+c_p+b_p}e_p$$

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[8] The apex K indicates that we are referring to the equilibrium in the indirect risk sharing case, also labelled as the Keynesian case.

[9] The intuitive explanation of the core fiscal authority's failure in affecting the equilibrium inflation rate is due to the fact that, in our model, the latter just depends on the money supply which is under the full control of the central bank. As a consequence, the core fiscal authority is also unable to influence the peripheral country's output gap.

A comparison between (8) and (15) shows that a rescue plan (i.e., $e_p > 0$) incentivizes the peripheral country to lower its effort in fiscal consolidation.

The risk sharing tool is determined by the specific utilization of the common fiscal fund. Given that this fund is under the control of the core country (see above, fn 7), its utilization aims at minimizing the loss of the core country. Hence, the implementation of the risk sharing tool minimizes (2) with respect to e_i, it is subject to (3) and (10), and it internalizes the policies (i.e. (6), (7), and (15)). By solving the above-described problem, the monetary union's risk sharing implies the following rescue plan:

$$(16) \qquad e_p^S = -e_c^S = \frac{c(1+b_c)}{c(1+b_c)+b_c\left(1+c_p+b_p\right)^2}\varepsilon_p$$

Equation (16) indicates the amount of the excessive public debt that will be transferred from the peripheral country to the core country at the equilibrium.[10] Moreover, by referring to equations (6) and (7), it is clear that the inflation rate as well as the core output gap are equal to zero (i.e., $\pi^N = 0$ and $y_C^N = \bar{y}$) in this policy regime. Finally, as already said and as shown by equation (16), the risk sharing mechanism dis-incentivizes the consolidation in the peripheral country. Formally:

$$(17) \qquad f_p = \frac{c_p+b_p}{1+c_p+b_p}\left(1 - \frac{c(1+b_c)}{c(1+b_c)+b_c\left(1+c_p+b_p\right)^2}\right)\varepsilon_p < f_p^N$$

The breakdown probability becomes:

$$(18) \qquad prob_B^S = \frac{b_c\left(1+c_p+b_p\right)}{c(1+b_c)+b_c\left(1+c_p+b_p\right)^2}\varepsilon_p < prob_B^*$$

Equations (15)–(18) state that the centralized fiscal policy regime is characterized by a public debt and risk transfer from the peripheral country to the core country, which incentivizes the former to reduce the effort in its consolidation policy. Moreover, the central bank and the core fiscal authority hold a passive behavior. As a result, the centralized fiscal policy regime reduces the union instability, but it does not internalize the externalities between the management of the common fund and the behavior of the periphery fiscal authority.[11]

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[10] The apex *S* indicates that we are referring to the equilibrium in the direct risk sharing case.

[11] This result highlights the content of fn. 7. If we had assumed that the management of the common fund is under the control of a single centralized fiscal authority, it would have been necessary to analyze the hierarchy and the coordination mechanisms between this centralized authority and the two national fiscal authorities. Our simplification also explains why we did not label this policy regime as a neo-institutional regime.

5. RISK SHARING AND THE EMU STABILITY

The two risk-sharing mechanisms, analyzed in the previous section, decrease the probability of a breakdown in the monetary union with respect to the benchmark case (no-risk-sharing case). However, it is still unclear which of the two mechanisms is the most effective regime in reducing the likelihood of this breakdown. In order to address the issue, we have to compare (14) and (18). We first obtain that:

(19) $$prob_B^K > prob_B^S \leftrightarrow = \frac{1+b_c}{b_c} > \frac{c}{c_c}$$

Equation (19) states that the direct risk sharing regime would dominate the indirect risk sharing regime, if the single central bank and the core fiscal authority attributed the same weight to the stability target *vis a vis* their other goals. In fact, given that $b_c > 0$, (14) and (18) imply that $prob_B^K > prob_B^S$ in (19) if $c = c_c$.[12]

However, due to the lack of coordination between the central bank and the national fiscal authorities, we cannot assume that the previous condition is always met. At the opposite, when the value of b_c is higher and/or $c > c_c$, it becomes more likely that the indirect risk sharing regime dominates the direct one, that is: $prob_B^K < prob_B^S$. The intuitive explanation of this possible result, due to higher values of b_c, is that the direct risk sharing mechanism becomes more costly. Moreover, when the value of c increases relative to the value of c_c, the positive impact of the indirect risk sharing regime improves since the central bank becomes more active in supporting the union stability. The opposite holds obviously true when the value of c_c increases relative to that of c. This means that the core fiscal authority becomes very active in supporting the union stability by means of the direct risk sharing mechanism.

We can also analyze the impact of the different policy regimes by referring to the space of inflation rate (π) and risk sharing (e_p) and by considering a case which is more general than our two previous cases: a policy game between the single central bank and the common financial fund manager which includes the indirect as well as the direct risk sharing regimes. In this more general scenario, the expansionary monetary policy regime and the centralized fiscal policy regime can be obtained as particular cases (assuming $e_p = 0$ and $\pi = 0$, respectively).

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[12] The same obviously holds if $c < c_c$, that is if the core fiscal authority attributes a larger relative weight to the stability target (see below).

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The general policy game is illustrated in Figure 2.[13] The *kk* line represents the reaction function of the central bank; the *ss* line is the reaction function of the common fund manager. The figure clearly shows the strategic substitutability of the two mechanisms. The central bank would not announce a recovery plan, if the risk sharing was announced; and vice versa. Point *K* and *S* are the solutions associated to the indirect risk sharing case and to the centralized fiscal policy case, respectively. Point *F* is the non-cooperative solution when both the risk-sharing mechanisms are implemented (the solution of the general policy game). The curve *cc* is the locus of the efficient solution. The origin *N* is the Nash equilibrium described in Section 3, where both e_p and π are zero.
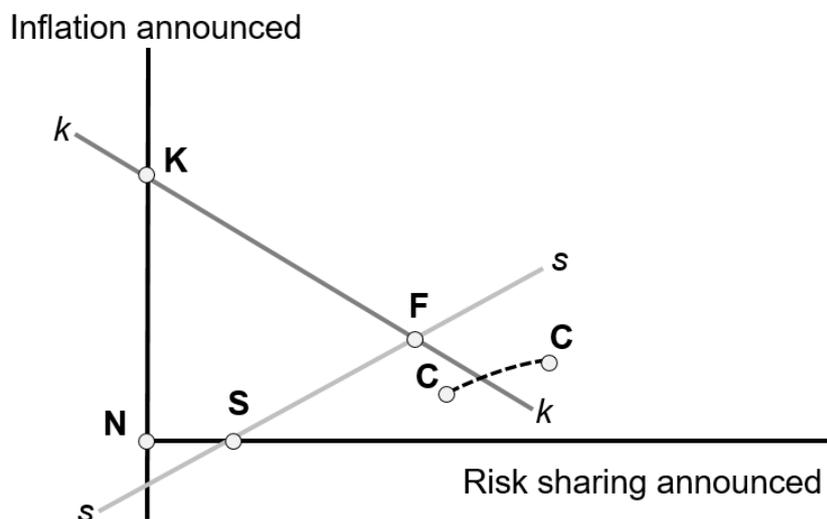

Figure 2 – A graphical illustration of the policy game

The figure clearly illustrates the inefficiencies of the two regimes discussed above. The indirect risk sharing regime is characterized by an excessive inflation rate and a negative fiscal contraction in the core country, due to the distortionary strategic interaction between the central bank and the core fiscal authority. By contrast, the centralized fiscal policy regime is characterized by an inefficient level of risk sharing due to the lack of discipline in the periphery fiscal authority that is anticipating the rescue plan and, as a consequence, reduces the consolidation effort. Efficient solutions require moderate monetary intervention and large risk sharing.

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[13] The analytical solution is available upon request.

6. CONCLUSIONS

The stability of a monetary union is a public good and depends on the public debts of its members. In this paper, we stressed the role of institutional design and the need of promoting risk sharing to enhance an efficient solution of excessive public debt threatening the general stability. In particular, two simplified polar cases have been studied. According to the first regime, public debt and risk can be indirectly redistributed among member states using a conventional expansionary monetary policy. The central bank can support public debt reductions in the country with excessive public debt (the peripheral country) by announcing expansionary policies that decrease the costs of these reductions. This policy regime creates an inflationary pressure in the other country (the core country), and thus represents a sort of indirect (or implicit) risk-sharing mechanism. Alternatively, a second mechanism can be based on an explicit form of risk sharing across member states. It could work through a monetary union's financial fund that directly reallocates the debt across countries. As in the indirect risk sharing mechanism, the transfer goes from the country with an excessive debt to the country in fiscal equilibrium.

We compared these different mechanisms of risk sharing emphasizing that both are inefficient. We also discussed the conditions which allow us to state that one of the two mechanisms delivers more effective stability results with respect to the other, that is, it is dominant in terms of stabilization. The indirect risk sharing regime reduces the probability of the monetary union breakdown at the cost of increasing the inflation rate in the monetary union as a whole. In this regime the lack of coordination between the central bank and the core fiscal authority represents an additional and important source of inefficiency. The core fiscal authority aims at offsetting the effects of the expansionary monetary policy on inflation by implementing a national restrictive fiscal policy. However, this attempt only leads to an unnecessary 'real' contraction in the core country, and eventually to an excessive expansion in the monetary policy. The centralized fiscal policy regime is instead characterized by an explicit transfer of the excessive public debt from the peripheral to the core country. This transfer, which is accompanied by a passive behavior of the central bank and the core fiscal authority, supports the monetary union stability. However, the centralized fiscal policy regime is unable to internalize the externalities between the common fund management and the peripheral country: the announcement of the risk sharing incentivizes the periphery fiscal authority to decrease the effort in its consolidation policies. As a consequence, the risk-sharing plan will be inefficiently weak.

We specified some of the different sets of conditions which make each of these two policy regimes dominant with respect to the other. This specification, which relates to the values of various parameters, emphasizes that a policy regime becomes dominant when it is able to better internalize the externalities characterizing the working of the monetary union. It follows that an adequate institutional combination of the two risk sharing mechanisms could improve the performance and the stability of the monetary union. However, even this combination would not be sufficient to internalize all the externalities due to a residual lack of coordination between the single central bank, the common fund management, and the national fiscal authorities.

This last result suggests that, in principle, there is a centralized solution able to maximize the internalization of the externalities characterizing the monetary union: the full *ex ante* cooperation between the single central bank and a single Ministry of Finance. The construction of the latter and the following harmonization between the centralized monetary and fiscal policies are not at work in the EMU. Hence it is important to study the pros and cons of mechanisms that only approximate this possibly optimal institutional design. In our consequent second-best world, it is useful to specify the space for improvements. For instance, in the indirect risk sharing regime, efficiency can be improved by a coordination between the central bank monetary policy and the fiscal policy of the core country. By contrast, in the centralized fiscal policy regime the problem is represented by the interaction between the common fund management and the peripheral country. The risk-sharing outcome can be improved by imposing some constraints to fiscal consolidation in the periphery, i.e., a sort of conditional risk sharing.

Finally, let us stress the main limits of our model in analyzing the stability of the monetary union. This model does not offer a complete comparison either between the risk sharing cases and the benchmark case in terms of the breakdown likelihood, or between the costs and benefits of the two risk-sharing policy designs. To achieve complete comparisons, we would have to build a dynamic model: in a dynamic setup, all risk sharing mechanisms can open the doors to moral hazard problems. The analysis of these last problems, which are largely discussed in the literature, was outside the scope of the present paper. Let us just note that moral hazard can explain why the periphery fiscal authority decreases the effort in its consolidation policies when the indirect risk-sharing mechanism is at work.

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