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JEL Codes: F34.

Optimal fiscal adjustment and the commitment-to-forgive issue*

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Abstract

This paper studies the incentives for fiscal adjustment for a debtor government under the risk of defaulting on its external debt. An externality arises from the bargaining process that follows default: higher tax revenues levied by the debtor lead to higher repayment to the creditor, and thus to a smaller haircut. In consequence, the optimal tax rate set by the debtor is lower than the socially optimal. If parties can negotiate contingent contracts ex-ante, the socially optimal fiscal stance can be implemented as long as creditors can commit to forgive a larger part of the debt in bad states. The model yields a different interpretation of IMF adjustment programmes and can account for some recent developments in the Eurozone debt crises.

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1 Introduction

When the possibility of a costly sovereign debt default looms large, fiscal adjustment in the debtor's country becomes one of the main policy issues for debtor and creditors as well. Fiscal policy choices made by debtors have an impact on creditors' welfare not only by affecting the probability of default but also by potentially influencing the outcome of a debt renegotiation process in case of default. This paper provides a simple framework for understanding incentives for fiscal adjustment in a default-prone environment that can be used to analyse economic policies. Our simple framework can account for some of the real world features observed during the latest european crisis and proposes a different interpretation for the IMF participation in crisis resolution.

Our simple model features two players, a debtor and a creditor benevolent governments. The debtor government chooses the degree of fiscal adjustment implemented and, after uncertainty about output is realized, whether to default or not. If repayment is not in full, two things happen: (i) the debtor government is dealt a punishment, as commonly

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assumed in the sovereign default literature and (ii) a Nash Bargain follows to decide the size of the haircut to be implemented.

The workings of the model rely on a key assumption: all that matters for the bargaining process – and thus equilibrium repayment – is the amount of resources the debtor government has available when repayment comes due. The idea is that the government cannot abruptly expropriate the private sector wealth to honor its maturing debt. Put it differently, government debt is necessarily paid out of government's currently avaible resources which in turn depend upon previous tax policy decisions. Moreover, the unavoidable wealth-destroying penalty following a default is independent of the size of the haircut. Last, both players know how much resources the debtor government has available after a random output shock is realized, there being no asymmetric information problem.[1]

Owing to the unavoidable default cost, there is a discontinuity at the point where insufficient revenues trigger default: at this point an extra tiny bit of of resources would lead to full repayment thus economizing on potentially important default-induced wealth destruction. As a consequence, optimal fiscal adjustment in the model – the first best taking into account the welfare of both players – is larger than the first-best in a model with no such frictions. To avoid (probabilistically) a costly default, the resulting socially optimum equilibrium will feature an "extra" fiscal effort from the debtor government. In the context of Europe, for example, if a highly indebted peripheral country like Greece avoids default, this is good news for creditor countries as well (and not in a zero-sum sense, since economizing on default costs is a boon to everyone).

After pinning down the first-best we analyse a model in which debtor and creditor bargain after the exogenous uncertainty is resolved, that is after the realization of the product endowment, as in Yue (2010). Fiscal adjustments – increases in fiscal primary surpluses due to higher revenues – not only affect the ability to repay but also influence the bargaining process between lender and borrower if default occurs and renegotiation follows. In equilibrium, fiscal policy is less austere than the socially optimal, for two reasons. First, as a consequence of the bargaining process, in equilibrium part of the cost of the default penalty is borne by the creditor in the form of smaller repayment. This dampens debtor's incentive for fiscal consolidation. Secondly, part of the revenue surplus from an "extra" fiscal effort aimed at averting default is captured by the creditor when default in fact occurs. In other words, a larger amount of resources on the hands of the debtor changes the bargaining outcome and leads to a lower haircut. In the context of

[1] This exogenous output shock may be related to the international price of a commodity produced by the debtor country, or to any worldwide condition that affects demand for the country's tradable products.

Europe's debt crisis, this means that part of the savings made by the greeks will wind up in germans' pockets.

There is thus an embeded externality in the model that adversely affects debtor country's incentives towards fiscal austerity. Since the debtor is not the sole residual claimant of the adjustment in the case of default, tax rates are smaller than the social optimal. In the context of Europe's crisis, the greeks do not have enough incentives for fiscal adjustment if part of their surpluses will benefit the creditors.

Could the social optimal be implemented in a decentralized setting? In principle, assuming the existence of a commitment technology or infinitely repeated games, the creditor could always coax the debtor into doing the optimal adjustment by pledging a money transfer conditional on the first best being observed. But this solution is unrealistic in practice. We simply do not observe implicit contracts like these being implemented, if anything for the mere fact that they are deemed unlawful.

We do, however, observe creditor and debtor getting together to negotiate and discuss repayment schedules, the international scenario, fiscal adjustment packages, etc, even if most debt contracts are not formally contingent. In light of this, what does the model say if debtor and creditor could go through an initial round of bargaining – that is, before uncertainty is realized – and credibly commit to a repayment schedule depending on the outcome of the state variable to be realized latter on? In that case, perhaps not surprisingly, the socially optimal outcome can be implemented. Interestingly, in this implicit contract, the debtor is allowed a larger haircut than what would arise as an outcome of a post-default bargaining process in exchange for a higher predetermined tax rate. These expost "compensating transfers" do not derive from traditional insurance channels, being rooted instead in the need to provide debtors with sufficient incentives to internalize the externalities previously mentioned.

In the sovereign debt literature, debtor commitment problems are mostly emphasized. Here, the issue is creditor's time inconsistency since it has to be able to credibly commit to later forgive a larger part of the debt if a bad realization of the exogenous shock is drawn. The implementation of the first-best thus demands a highly credible international institution or some framework that allows creditor and debtor to fullfill their promises. One policy implication is that supra-national institutions should try to strike deals between debtors and creditors in which the debtor makes an extra fiscal effort to avert default but is allowed a large hair-cut if the worldwide economic growth or the price of debtor's tradable goods decline more steeply.

IMF adjusment programmes can be thought of as an implementation of this type of contract. The debtor accepts tighter fiscal policy (the IMF conditionality) in exchange for funds at below-market rates supplied by the IMF in case conditions turn out to be bad in the future. By accepting to lose seniority status to the IMF and providing resources for loans, creditors are effectively transferring resources to debtors in some states of nature. The IMF is the organization with commitment to provide resources if the conditions on fiscal adjustment are met by the debtors.

Arguably, deals between creditors and debtors are more likely to be enforceable in tightly linked Europe than elsewhere. The model thus provides an explanation for the apparently puzzling choice of countries where default is very likely (like in Greece) to try hard to reduce fiscal deficits. This "excessive" fiscal effort from the part of the debtor coupled with later debt forgiveness from the part of creditor can be read as an implementatiom of the first-best through the fullfilment of the implicit contract mentioned above.

Relating to the literature, there are models on the relation between fiscal policy and sovereign default, but to the best of our knowledge, not about the effect of the anticipation of debt renegotiation on the incentives for fiscal adjustment. Cuadra, Sanchez and Sapriza (2010) develop a quantitative dynamic model with endogenous fiscal policy and sovereign default to account for procyclical fiscal policy. Pouzo (2010) studies how the possibility of default and the actual default event affect tax policy, but analyses a closed economy where the government's creditors are domestic households.

Section 2 presents the model and results. Section 3 relates the model to the literature on the IMF adjustment programmes and to the recent Eurozone debt crisis. Section 4 concludes.

2 The model

There are two countries, debtor and creditor, and an outstanding predetermined debt equal to D.

The debtor country's representative consumer has utility:

$$U_D = u(c) + g - P$$

where c is consumption, u is a strictly increasing and strictly concave function, g is government spending and P is punishment associated with default. P is equal to 0 in case of full repayment, and equal to γ in case of default.

The debtor country's representative agent receives a stochastic endowment y, described by probability density function f, which is continuous with full support in the $[y_L, y_H]$ interval.

Government spending g is financed through income tax. A balanced budget for both government and households implies:

$$\begin{aligned} c &= y(1-\tau) \\ g &= \tau y - R \end{aligned}$$

where τ is the tax rate and R is debt payment to the creditor. Crucially, τ is chosen before the realizatioγn of the economic shock, and it can't be raised after observing y in time to generate further revenues to service debt in bad times, or reduced to increase private consumption in good times. Debtor's utility is thus given by:

$$U_D = u(y(1-\tau)) + \tau y - R - P \tag{1}$$

The utility of the creditor country's representative-agent is linear in R:

$$U_C = R$$

After y is observed, the debtor can either repay debt in full ($R = D$), in which case there is no punishment ($P = 0$), or renegotiate it. Implicitly, we are assuming that the costs of a full default without any renegotiation is too large to bear. This is consistent with observed defaults always leading to some renegotiation.[2]

Renegotiation leads to a punishment ($P = \gamma$) and R is chosen through a Nash Bargain process. The result is the argmax of

$$S_D^{\beta} S_C^{1-\beta} \tag{2}$$

where S_C is the surplus of creditor and S_D is the surplus of the debtor and β is the bargaining power of the debtor.

To make the problem interesting, it is assumed D cannot be so large as to never be repaid in full for any realization of y.

The timing is as follows: (i) the debtor government chooses τ, (ii) y is realized, (iii) debt repayment is decided upon and (iv) payoffs are realized.

2.1 Discussion of assumptions

While it is usual in the sovereign debt literature to assume that creditor's utility is linear in debt repayment, the linearity in g in debtor's utility function imposed here requires

[2] There is large variation in observed haircuts but they are always smaller than 100% (see Sturzenegger and Zettelmeyer, 2008).

justification. Should U_D be concave in g, the debt renegotiation process would aim at transfering resources from rich agents with low marginal utility to those with high marginal utility, an undesirable feature from the viewpoint of this paper. Besides simplifying the analysis, having both U_D linear in g and U_C linear in R circumvents this issue. As a consequence all results in this paper are unrelated to the well-established insurance channels.

A debtor that fails to repay its debt in full incurs a cost, interpreted as a default penalty. There is no consensus in the literature about the underlying sources of such default costs. The usually mentioned channels include: losses from declining trade;[3] increases in international borrowing costs or exclusion from financial markets;[4] other costs related to reputational loss;[5] unplanned redistribution of income;[6] and liquidity problems that lead to reduction in domestic investment.[7] Regardless of the sources of default penalties, what is important for our purposes is that not repaying in full entails costs to the debtor. We simply follow the literature by including default penalties in a reduced-form way.[8]

The punishment is assumed to be independent of the default size, $D-R$. This assumption is consistent with some of the above mentioned default costs, but not with others. All qualitative results of this paper hold in a model where default costs are expressed by $\gamma + \alpha (D - R)$, as long as $\alpha < 1$ (see appendix A). Intuitively, all we need is that default costs do not completely offset the potential benefits of a larger haircut.

Crucially, we assume that the tax rate τ cannot be altered after y is revealed. This captures a well-known feature of tax regimes: they generally require some time to be altered. Moreover, immediately changing taxation on private wealth would be akin to sheer expropriation – our assumption then basically says that the government prefers not to repay its foreign debt in this case. Moreover, taxes are not distortionary (endowment economy). While distortionary taxation could add some twists to the results, it should not affect the main insights of the paper.

[3] Empirical evidence includes Rose (2005) and Martinez and Sandleris (2011). In Bulow and Rogoff (1989), trade sanctions are the punishment for default. See also Foley-Fisher (2011).

[4] Exclusion from international capital markets has been widely assumed in models like Eaton and Gersovitz (1981), Arellano (2006) and many others. English (1995) and Fuentes and Saravia (2010) provide empirical evidence that supports this view.

[5] Tomz (2007) argues that reputational concerns are important for default decisions.

[6] See, e.g., Broner, Martin and Ventura (2010) and Broner and Ventura (2011).

[7] See Brutti (2010) for a model. The survey in Panizza, Sturzenegger and Zettelmeyer (2009) highlights the importance of these domestic costs.

[8] Default is assumed to generate an output cost, a reduced-form way to represent the several channels through which default harms the economy, in Cohen and Sachs (1984), Arellano (2008) and many others. Mendoza and Yue (2011) provide a model where exclusion from international capital markets lead to output losses.

2.2 Benchmark case

It is useful to start with a benchmark case in which default is ruled out so that $R = D$ always. In this case, τ is chosen to maximize

$$E(U_D) = \int_{y_L}^{y_H} \left(u\left(y\left(1-\tau\right)\right) + \tau y - D\right) f(y)dy \tag{3}$$

which is strictly concave in τ.[9] Denote the benchmark value for taxes by τ_B. The following proposition states our first result.

Proposition 1 *When default is ruled out by assumption ($R = D$), τ_B is given by*

$$\int_{y_L}^{y_H} \left[y.u'\left(y\left(1-\tau_B\right)\right)\right] f(y)dy = \int_{y_L}^{y_H} yf(y)dy$$

Proof. *Maximizing with respect to τ yields the result.* ■

The intuition here is direct: the marginal cost in terms of smaller private consumption due to an increase in taxation has to equal the marginal gain from higher g in expected terms.

2.3 Repayment

We now turn to the case where the debtor might default on its obligations. After y is realized, the debtor has the option of renegotiating its debt. In that case, creditor and debtor bargain to reach a decision on R and the debtor suffers a punishment with cost γ. Since we assume a Nash bargaining protocol, the result is the argmax of (2).

In order to determine the surpluses of creditor S_C and debtor S_D, we have to establish the threat points of the bargaining game. The worst case scenario for the creditor is to get nothing in repayment, so

$$S_C = R - 0 \tag{4}$$

The worst case scenario for the debtor is either to surrender all tax revenues (if $D > \tau y$) or to honor debt in full (if $D < \tau y$). Hence the debtor's threat point is

$$u(y(1-\tau)) + \tau y - \min\{D, \tau y\} - \gamma$$

and utility for the debtor if repayment is $R < D$ is:

$$u(y(1-\tau)) + \tau y - R - \gamma$$

[9] Note that

$$\frac{\partial^2 E(U_D)}{\partial \tau^2} = \int_{y_L}^{y_H} \left[y^2.u''\left(y\left(1-\tau\right)\right)\right] f(y)dy < 0$$

The debtor's surplus is hence:

$$S_D = \min\{D, \tau y\} - R \tag{5}$$

Proposition 2 establishes the debt ceiling and the repayment schedule.

Proposition 2 *Denote the repayment by $\hat{R}(y)$:*

1. *If debt is to be fully repaid at least in some state of nature it cannot exceed a cap given by:*
$$D^{\max} = \frac{\gamma}{\beta} \tag{6}$$
2. *Whenever $\tau y \geq D$, the debtor repays its debt in full, $\hat{R}(y) = D$.*
3. *Whenever $\tau y < D$, the debtor chooses to renegotiate its debt and*
$$\hat{R}(y) = (1 - \beta)\tau y \tag{7}$$

Proof. *See appendix.* ■

If $D > \gamma/\beta$, for any value of y renegotiation is better than full repayment because the haircut obtained in the bargaining game exceeds the punishment γ. Therefore, the assumption that debt is fully repayed at least in some state requires a debt smaller than (6).[10] The maximum sustainable debt levels is increasing in punishment and decreasing in the debtor's bargaining power.

The second part of the proposition states that debt is fully repaid when government revenues exceed it. If $\tau y \geq D$, the outcome of the bargaining game is independent of τy. So if it is beneficial to repay debt in full for some τy, it is optimal to repay in full for all $\tau y \geq D$.

If the debtor does not have enough resources to repay in full and is forced into default, its repayment is a fraction of the available funds (τy). A higher τ increases the amount of funds entering the bargain, which leads to a larger repayment. Hence when default occurs, the benefits of a larger τ are shared between creditor and debtor. Moreover, the smaller is the debtor's weight in the bargaining process β, the larger the repayment will be.

Last, note that there is a discontinuity in the repayment function at $\tau y = D$: at this point a small shortfall in revenues leads to a discretely lower repayment, hence default costs end up being shared by debtor and creditor. The repayment schedule is shown in Figure 1.

[10] The debt also has to be smaller than y_H.

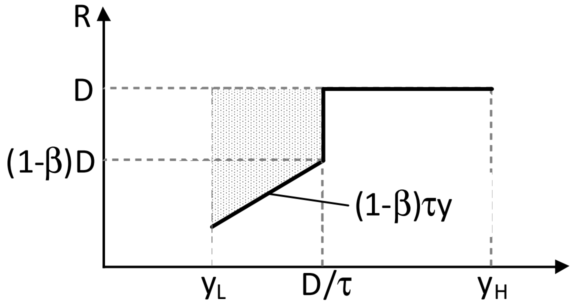

Figure 1: Repayment schedule $R(y)$

2.4 Socially optimal τ

In this section we derive the socially optimal tax rate τ_S. The debtor gets utility:

$$U = \begin{cases} u\left(y\left(1-\tau\right)\right) + \tau y - D & \text{if} \quad \tau y \geq D \\ u\left(y\left(1-\tau\right)\right) + \tau y - R - \gamma & \text{if} \quad \tau y < D \end{cases} \tag{8}$$

and the creditor gets

$$\begin{array}{lccc} D & \text{if} & \tau y & \geq & D \\ R & \text{if} & \tau y & < & D \end{array}$$

Total surplus is thus given by

$$\begin{array}{rcccc} u\left(y\left(1-\tau\right)\right) + \tau y & \text{if} & \tau y & \geq & D \\ u\left(y\left(1-\tau\right)\right) + \tau y - \gamma & \text{if} & \tau y & < & D \end{array}$$

The repayment R does not appear in the expression for the total surplus because creditor's utility is linear in R and debtor's utility is linear in g, and increases in repayment translate one to one into lower government spending. The socially optimal τ_S comes from the maximization of

$$E(U_C + U_D) = \int_{y_L}^{D/\tau} \left(u\left(y\left(1-\tau\right)\right) + \tau y - \gamma\right) f(y)dy + \int_{D/\tau}^{y_H} \left(u\left(y\left(1-\tau\right)\right) + \tau y\right) f(y)dy$$

which can be written as:

$$\int_{y_L}^{y_H} \left(u\left(y\left(1-\tau\right)\right) + \tau y\right) f(y)dy - \gamma F\left(\frac{D}{\tau}\right) \tag{9}$$

Proposition 3 *If the probability of default is in the* $(0,1)$ *interval, the socially optimal value of taxes is larger than its benchmark value from Proposition 1.*

$$\tau_S > \tau_B$$

Proof. *See appendix.* ■

The expression in (9) differs from (3) by the term $-\gamma F\left(\frac{D}{\tau}\right)$ and a constant D that does not affect the choice of τ. Since default is costly, it is socially optimal to make an "extra" fiscal effort to reduce the likelihood of default.

2.5 Equilibrium with default and renegotiation

We now turn to the decentralized equilibrium of the model. Since debtor's utility is given by (8), the debtor chooses τ in order to maximize $E(U_D)$:

$$\int_{y_L}^{D/\tau} \left(u\left(y\left(1-\tau\right)\right)+\beta\tau y-\gamma\right)f(y)dy+\int_{D/\tau}^{y_H} \left(u\left(y\left(1-\tau\right)\right)+\tau y-D\right)f(y)dy$$

where we have substituted $(1-\beta)\tau y$ for $\hat{R}(y)$ using (7).The expression for $E\left(U_D\right)$ can be written as

$$E\left(U_D\right)=E(U_C+U_D)-D+\int_{y_L}^{D/\tau}\left[D-(1-\beta)\tau y\right]f(y)dy \tag{10}$$

Denote the equilibrium taxes by τ_{eq}. Proposition 4 establishes that τ_{eq} diverges from the socially optimal value of τ.

Proposition 4 *If the probability of default is positive, the equilibrium value of taxes is smaller than its socially optimal value:*

$$\tau_{eq}<\tau_S$$

Proof. See appendix. ■

In a decentralized equilibrium, the optimal tax level is inferior to the first-best whenever there is a positive probability of debt repayment being smaller than D. The difference between the equilibrium and the social optimal value of τ comes from the last integral in 10. That expresses the expected haircut, and it is decreasing in τ (see Figure 1).

A higher τ narrows the default region reducing the probability the debtor will benefit from a haircut (the upper limit D/τ in the integral). Moreover a higher τ increases the amount of funds entering the bargain, thus increasing repayment and reducing the haircut $(D-(1-\beta)\tau y)$ if default occurs. A larger fiscal adjustment puts the debtor in a financially stronger position, hence leads to a lower debt reduction.

A debtor in default is the residual claimant only to a proportion β of its fiscal effort, which gives rise to an important disincentive to fiscal adjustment. In other words, the benefits of a tighter fiscal policy spill over to the creditor. The suboptimally low tax rate

($\tau_{eq} < \tau_S$) stems from the positive externality associated with a higher τ. This externality is all the more important if D and β are large.

Default leads to costs, which are considered in the global optimum, but not fully internalized by the debtor because part of the cost γ is shared with the creditor through the bargaining process.

2.6 Bargaining before y is realized

Now we envisage a situation in which debtor and creditor governments strike a deal before the economic shock is realized. The deal encompasses both τ and R and is contingent in nature: as long as a beforehand agreed τ is implemented by the debtor government, later repayment to the creditor will be a function of y as set at this early bargaining stage. If no deal is struck, then parties are back to the case described above where the debtor makes a sovereign decision on τ and Nash Bargain over R unfolds (if the repayment is not in full). In this conjectured intertemporal contract the fallback payoffs (threat points) are thus the expected utilities, $E(\bar{U}_c)$ and $E(\bar{U}_d)$, from section 2.5.

The choice variables of this modified problem are now τ and a schedule of repayments $R(y)$. Keeping up with the Nash Bargaining protocol, the solution comes from maximizing:

$$\left(E(U_c) - E(\bar{U}_c)\right)^{1-\beta} \left(E(U_d) - E(\bar{U}_d)\right)^{\beta} \tag{11}$$

Default being costly, full repayment is optimal for creditors and debtors as a group whenever $\tau y \geq D$.Hence:

$$\begin{aligned} E(U_c) &= \int_{y_L}^{D/\tau} R(y) f(y)dy + (1 - F(D/\tau))D \\ E(U_d) &= \int_{y_L}^{D/\tau} \left(u\left(y\left(1-\tau\right)\right) + \tau y - R(y) - \gamma\right) f(y)dy + \int_{D/\tau}^{y_H} \left(u\left(y\left(1-\tau\right)\right) + \tau y - D\right) f(y)dy \end{aligned}$$

Denote the solution to this problem by $(\tau^*, R^*(y))$. Proposition 5 determines the features of this contract.

Proposition 5 *If parties can strike a deal before y is observed:*

1. *Socially optimal fiscal adjustment is implemented:* $\tau^* = \tau_S$.
2. *(Commitment-to-forgive) Suppose the probability of default implied by Proposition 4 is positive. If* $\tau y < D$*, then repayment is lower than implied by Proposition 2:*
$$\int_{y_L}^{D/\tau^*} R^*(y) f(y)dy < \int_{y_L}^{D/\tau^*} \hat{R}(y) f(y)dy$$

Proof. *See appendix.* ■

Now both the repayment schedule and the fiscal adjustment are decided in the bargaining process. Hence, the global optimal τ is chosen and the schedule of repayments $R(y)$ adjusts to ensure that both parties benefit from the deal (as compared to their fall back option).

From the viewpoint of the debtor, given the schedule of repayments derived in Proposition 2 a larger τ ($\tau^* > \tau_{eq}$) leads to lower welfare. Thus for the debtor to agree on this larger τ it has to be compensated in another dimension. In the model, the only way to achieve this is by reducing average R (the only remaining endogenous variable). In this contract a "commitment-to-forgive" problem arises: for the first-best to be achieved the creditor shall not renege on its pledge to allow for a larger hair-cut in debt repayment should the economic fundamentals turn sour.

In practice, one could think of other ways apart from forgiving part of outstanding debt to compensate a debtor for a more restringent fiscal policy, like a direct lump-sum transfer condition on τ^*being observed. However, this sort of arrangement's resemblance of a corruption scheme renders it unlikely in practice (especially in democratic societies).

The creditor is also better off with a lower R when $y < D/\tau^*$ because, differently from the case where bargaining occurs only at the end, he is now getting full repayment more often: with higher tax rates, the full repayment region is now enlarged to include also all $y \in (D/\tau^*, D/\tau_{eq})$. The possibility of higher overall gains – in case the commitment-to-forgive problem can be overcome – comes from internalizing the positive externalities discussed above. The deal reduces the likelihood that wealth-destroying default costs are incurred and induces the debtor to equate the marginal cost of taxation to its overall benefit (part of it accruing to the creditor).

3 Discussion

3.1 IMF adjustment programmes

There is a wide debate about the roles of the IMF and the way it operates.[11] The usual role attributed to the IMF is the provision of loans to countries facing liquidity problems.[12] By lending money to countries in trouble, the IMF would allow them time to

[11] Bird (2007) provides a comprehensive survey.

[12] The IMF's Articles of Agreement state that one of the IMF's purposes is to provide confidence to members by making the general resources of the Fund temporarily available to them under adequate safeguards, thus providing them with opportunity to correct maladjustments in their balance of payments without resorting to measures destructive of national or international prosperity.

pursue economic reforms and, perhaps, help to catalyze private funds.[13] Hence, liquidity provision by the IMF would be related to imperfections in international capital markets – such as coordination problems that might give rise to self-fulfilling crises.

This paper suggests a different role for the IMF. Consider a country under the risk of defaulting on its debt. The optimal fiscal adjustment for this debtor is lower than the socially optimum because default costs are in equilibrium shared between debtor and creditors. Thus the world would be better off if the debtor implemented tough fiscal measures and creditors could transfer money to the debtor in some states of nature to compensate for the debtor's extra fiscal effort.

The IMF can be thought of as an organization that asks for tough fiscal measures ($\tau^* > \tau_{eq}$) in exchange for credit lines at below-market rates (which play the role of a lower R if y happens to be low), and the institutional arrangement guarantees it can go round the commitment-to-forgive issue highlighted by the model.

The IMF not only provides loans at rates that the debtor could not get in the market: other lenders accept IMF seniority. The IMF can commit to provide credit lines at below-market rates in a bad scenario, and the creditors are implicitly committed to become juniors to the IMF. This arrangement plays the role of a lower R in case of negative shocks.

The fiscal measures asked by the IMF can be thought of as the IMF conditionality. There is a wide debate about IMF conditionality, whether it should exist and the roles it plays.[14] In this model, the conditions imposed by the IMF (τ^*) do not correspond to the optimal choice from the debtor's point of view: they are too tough. The debtor finds it optimal to agree to those conditions only because of the cheaper credit lines (lower R).

The IMF is often criticized for imposing excessively tough measures on debtor countries. One largely held view is that if conditionality makes the country do something its citizens would not like, it is harming rather than helping.[15] Under our interpretation, the τ chosen by the Fund is not in the best interest of the debtor when looked in isolation, but the package including tough measures and conditional loans might be socially optimal. Conditionality is then not about guaranteeing senior IMF loans will be paid: it is about increasing the likelihood that other creditors will be repaid. The IMF conditions are not aimed at improving the country's welfare on its own, their objective is to have the fiscal adjustment τ reflecting not only the domestic but also the consequences of a debt default

[13] Se, e.g., Corsetti, Guimaraes and Roubini (2006).

[14] Dreher (2009) surveys the theoretical and empiricial literature on conditionality.

[15] Summarizing this view, Dreher (2009) states that "if the Fund and the governments disagree about appropriate policies, it is the government that should have the final say, and not the Fund."

on other countries.

Indeed, critics of IMF conditionality (such as Dreher, 2009) acknowledge that debtor countries agree to IMF conditionalities when signing agreements with the Fund. Implicitly, this argument acknowledges that the IMF funds (proxied in the model by a lower R) are enough to compensate for the loss in utility from choosing tough fiscal measures (higher τ) – consistently with the model. Importantly, in the model, the outcome is socially optimal.

Empirical work should thus note that the IMF measures per se might be suboptimal for the debtor if looked in isolation but the IMF programmes and loans might still be welfare improving from a social point of view.

There are many other explanations for IMF conditionality and the role of the IMF. Some of them highlight heterogeneity of agents and the political game inside the debtor country.[16] One implication of this discussion is that the social optimal policies in a benchmark model with no political failures might include conditions that do not look optimal for the debtor. Of course that does not preclude the existence of political frictions in the world. Moreover, part of the debate surrounding the IMF is about whether the recommended policies help countries to repay debt or not, this paper is not contributing to this debate.

3.2 The European sovereign debt crisis

This time it was not different: reinforcing the evidence documented by Reinhart and Rogoff (2009) that financial crisis usually lead to sovereign debt woes, some countries in Europe (most notably Greece) have been treading on the verge of debt default ever since the 2008 financial meltdown. In 2010, unable to cope with its debt obligations, Greece was granted more than 100 billion dollars in bridge loans by the IMF and the EU at subsidized rates (lower than market rates for greek debt). These loans later proved insufficient to calm investors and after intense negotiations, and as part of a broader plan to avert a break-up of the Eurozone, in December 2011 European leaders agreed on curtailing greek debt held by private lenders by a whopping 50%. Greece is not an isolated case, since subsidized loans were also extended to Ireland and Portugal after these countries failed to regain market access even in the face of substantial efforts towards fiscal consolidation.

The sequence of real world events in Europe during 2010/2011 bears a direct resemblence to the "contractual approach" laid down in section 2.6, where both $R(y)$ and τ are chosen before y materializes. Nation States in Europe meet often in EU forums and

[16] See Drazen (2002) for a more positice view and Vreeland (2003) for a more negative view on IMF programmes in presence of heterogeneous agents and political issues.

share many common long term goals, both of which facilitate enforcement of agreed implicit contracts. Moreover, since the crises erupted, leaders of major debtor and creditor countries increased the rate of their meetings to openly discuss fiscal consolidation plans and assistant loan packages. Both Germany's pressures for private lenders to accept a haircut on greek debt and the 2011 reduction in official loans rates extended to Ireland, Greece and Portugal can be understood as forgiving a portion $(D - R^*(y))$ of total debt in countries that strained to consolidate their finances.[17]

Further, indirect evidence supports the idea that fiscal policy became "too tight" in Greece and elsewhere, in the sense of τ^* being greater than τ_{eq}. A series of popular unrests following each new austerity package is one such evidence.[18] Extremely painful budget decisions also hint at "excessive" austerity to generate resoruces to payback foreign debt.[19] This glaringly suggests that Greece's fiscal policy was not focusing solely on maximizing domestic social welfare at that point in time. Creditor's welfare was probably being taken into account too.

In the light of our model, however, suboptimal short-term fiscal policy in terms of excessive austerity is not a self-defeating strategy. If it were, why would democratically elected governments agree to pursue it in the first place? Our reading is that it is the price to pay for higher overall welfare (and higher group welfare) when the consequences of debt default are taken into account. For the debtor country, the reward is a higher expost haircut if default is unavoidable (or loans at below-market rates in interim periods). For the creditors, the reward is a smaller probability of default stemming from the higher τ. Finally, for both of them the gain comes in the form of expected savings in wealth-destroying default costs.

To nail the point: if debtor and creditors interacting frequently seek to minimize inefficiencies associated with default, one possible way to go is to agree on a contract where the debtor tightens its belt more harshly than it would in lieu of a larger reduction in repayment if things turn out bad. Recent European events seem consistent with this logic and the basic assumptions of the contractual approach.

[17] Quoting Barry Eichengreen, "the crisis countries have, in fact, shown remarkable resolve in implementing painful cuts" (http://www.project-syndicate.org/commentary/eichengreen25/English)

[18] http://www.euronews.net/2011/12/07/more-clashes-as-greek-budget-approved/

[19] In september 2011, for example, Swiss drug giant Roche stopped delivering its drugs for cancer and other diseases to some state-funded hospitals in Greece that hadn't paid their bills due to reduced official budgets.

http://online.wsj.m/article/SB10001424053111904491704576574791877220786.html?mod=WSJ_hp_LEFTWhatsNewsCollection

4 Final remarks

There is a rich debate on what to do ex-ante to prevent costly sovereign default situations. Debt contracts can be made automatically contingent on important prices; clauses can be agreed on transforming debt into equity contigent on some exogenous events unfolding (CAC's), etc. But once a country is under risk of defaulting on its debt, its fiscal policy is a major policy issue. Our model proposes a simple framework for analysing debtor's incentives for fiscal adjustment and policies aimed at making debtor internalize the effects of default on others.

The model could be extended in several ways to deal with the specifics of particular episodes. For instance, creditors might be able to handle default well in some situations but not in others (e.g, banks in the creditor country might be in a more fragile situation in some states of nature). That could have an influence on the optimal contracts, even though the main insights presented here should remain valid. Besides, in a world of distortionary taxes, the optimal deal could be influenced by the particularities of a country's public finances.

Finally, political economy issues and the difficulty of implementing fiscal adjustments such as in Alesina and Drazen (1991) are absent here but might play an important role in real world fiscal adjustments. This paper provides a normative benchmark for political-economy models of fiscal policy in times of crisis.

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A Model with punishment conditional on haircut

To be added.

B Proofs

B.1 Proof of proposition 2

Proof. Maximization of (2) using (4) and (5) yields

$$R = \begin{cases} D(1-\beta) & \text{if} \quad \tau y \geq D \\ (1-\beta)\tau y & \text{if} \quad \tau y < D \end{cases} \tag{12}$$

In case $\tau y \geq D$, the debtor prefers to renegotiate debt rather than repaying it in full whenever

$$u(y(1-\tau)) + \tau y - D(1-\beta) - \gamma > u(y(1-\tau)) + \tau y - D$$

which implies

$$D > \frac{\gamma}{\beta}$$

hence when this is satisfied, debt is never paid in full. That yields the first statement in the proof. Now, whenever D is smaller than that upper bound, debtor's utility is higher repaying in full when there are enough resources available.This yields the second statement. The third statement is implied by (12). ■

B.2 Proof of proposition 3

Proof. Define

$$X = \int_{y_L}^{y_H} \left(u \left(y \left(1 - \tau \right) \right) + \tau y \right) f(y) dy$$

X is the same as $E(U_D)$ in (3) except for a constant (D) that does not affect the choice of τ. We know X is strictly concave in τ and is maximized at τ_B, hence the derivative of X is positive for all $\tau < \tau_B$.

The expression for $E(U_C + U_D)$ in (9) is equal to

$$E(U_C + U_D) = X - \gamma F\left(\frac{D}{\tau}\right)$$

Since $-\gamma F\left(\frac{D}{\tau}\right)$ is increasing in τ if the probability of default $F(D/\tau)$ is in $(0,1)$, the derivative of $E(U_C + U_D)$ is strictly positive for all $\tau \leq \tau_B$. Since f is continuous, the derivative of $E(U_C + U_D)$ is also continuous, hence the value of τ that maximizes (9) has to be larger than τ_B. ■

B.3 Proof of proposition 4

Proof. If the probability of default is positive and $D > (1-\beta)\tau y_L$, the integral term in 10 is not zero. In that case, the integral term is decreasing in τ since both the upper limit of the integral and the integrand are decreasing in τ. Since τ_S maximizes $E(U_C + U_D)$ (proposition 3), $E(U_D)$ for $\tau = \tau_S$ is larger than $E(U_D)$ for all $\tau > \tau_S$. But the derivative of $E(U_D)$ has to be negative at $\tau = \tau_S$ because the integral term is decreasing in τ. Hence the value of τ that maximizes $E(U_D)$ has to be lower than τ_S. ■

B.4 Proof of proposition 5

Proof. (i) Since transfers can be costlessly made through changes in R, the optimal deal has to maximize $E(U_C) + E(U_D)$. That is done at τ_s (proposition 3) hence $\tau^* = \tau_s$.

(ii) Denote by $\hat{R}(y)$ the repayment schedule implied by Proposition 2, $\bar{U}_D$ the utility of the debtor and τ_{eq} the optimal choice of τ implied by proposition 4. Then

$$\bar{U}_D = \int_{y_L}^{y_H} \left(u \left(y \left(1 - \tau_{eq} \right) \right) + \tau_{eq} y \right) f(y) dy - \gamma F\left(\frac{D}{\tau_{eq}}\right) - D\left[1 - F\left(\frac{D}{\tau_{eq}}\right)\right] - \int_{y_L}^{D/\tau_{eq}} \hat{R}(y) f(y) dy$$

Let $R^*(y)$ be a repayment scheduled that emerges in equilibrium in Section 2.6, U_d^* is the utility of the debtor and τ^* is the choice of τ in that case. If the probability of default implied by 4 is positive, $F\left(D/\tau_{eq}\right) > 0$, hence

$$\int_{D/\tau_{eq}}^{y_H} yf(y)dy < \int_{y_L}^{y_H} yf(y)dy$$

so Propositions 4 and 5 imply $\tau^* > \tau_{eq}$. Since τ_{eq} given by Proposition 4 is unique,

$$\bar{U}_d > \int_{y_L}^{y_H} \left(u\left(y\left(1-\tau^*\right)\right) + \tau^* y\right) f(y)dy - \gamma F\left(\frac{D}{\tau^*}\right) - D\left[1 - F\left(\frac{D}{\tau^*}\right)\right] - \int_{y_L}^{D/\tau^*} \hat{R}(y)f(y)dy$$

but the solution of 11 must imply $U_d^* \geq \bar{U}_d$. Combining that with the above equation,

$$\begin{aligned} & \int_{y_L}^{y_H} \left(u\left(y\left(1-\tau^*\right)\right) + \tau^* y\right) f(y)dy - \gamma F\left(\frac{D}{\tau^*}\right) - D\left[1 - F\left(\frac{D}{\tau^*}\right)\right] - \int_{y_L}^{D/\tau^*} R^*(y)f(y)dy \\ > & \int_{y_L}^{y_H} \left(u\left(y\left(1-\tau^*\right)\right) + \tau^* y\right) f(y)dy - \gamma F\left(\frac{D}{\tau^*}\right) - D\left[1 - F\left(\frac{D}{\tau^*}\right)\right] - \int_{y_L}^{D/\tau^*} \hat{R}(y)f(y)dy \end{aligned}$$

which yields the claim. ■