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Preemptive Austerity with Rollover Risk*

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ABSTRACT

When is it optimal for the government to run a fiscal surplus? In the context of a model of self-fulfilling debt crises we show how preemptive austerity can be the optimal response to a recession. By preemptive austerity we mean the situation when the optimal policy is to increase taxes and reduce the level of debt in order to deter potential rollover crises. The key ingredient for this counter-intuitive result is the fact that in our model tax rates are announced at the beginning of the period, so that commiting to a high tax in advance guarantees the government continuing access to cheap credit. This tax policy deters international lenders' panics, but is ex-post suboptimal and that is why the sovereign reduces the level of debt to a point where high taxes are no longer necessary to deter panics.

JEL Codes: E6, F34, H2, H3
Keywords: Debt crisis; fiscal policy; commitment; Eurozone

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*The views expressed herein are those of the authors and not necessarily those of the Federal Reserve Bank of Minneapolis or the Federal Reserve System.

1 Introduction

This paper provides a rational for fiscal austerity when facing a severe recession. The typical argument in favor of consumption smoothing that would call for fiscal deficits can be dominated by the desire to deter potential panics that could trigger a debt crises.

In order to evaluate under what value of economic fundamentals that might occur, we extend the model of Conesa and Kehoe (2017) to determine endogenously tax policy. In a world where tax rates are pre-announced and fixed during one period (the fiscal year), setting up a high tax rate in advance might prevent lender panics from becoming self-fulfilling, thus guaranteeing continued access to cheap sovereign credit. As a result the sovereign might respond to a recession by optimally increasing taxes and lowering government expenditures, instead of borrowing against future income.

When the 2008-09 recession hit Europe different countries reacted differently. Some countries reacted by increasing debt even when faced with a spike in interest rates, and we have analyzed the incentives to engage in this form of "gambling for redemption" in Conesa and Kehoe (2017). In the light of that model, as in the standard approach of Cole and Kehoe (1996, 2000), countries that are not vulnerable to a rollover crisis can still borrow at the risk-free interest rate and it would be optimal to do so. Why would countries like Germany choose to run fiscal surpluses right after a recession? This seemingly sub-optimal behavior is inconsistent with the standard model, and was the source of many criticisms from political and even academic circles. As an example, Tooze (2012) wrote "The financial conditions for such spending have never been more favorable: interest rates for public borrowing are approaching zero. And yet due to a 2009 constitutional amendment requiring both the federal and the state governments to maintain balanced budgets, the German public sector has denied itself the opportunity to borrow and invest." Our exercise shows that the logic goes the other way around: It is precisely because of the fiscal path chosen by Germany that interest rates stayed low. In contrast, our exercise suggest that the recession might have been severe enough in Southern European countries that the increases in tax rates can't keep the countries out of the crisis zone. As a result these countries became vulnerable to lenders' panics generating the sudden spikes in interest rates that occured in Southern European countries during the debt crisis of 2010-12, triggering the famous "whatever it takes" intervention of Draghi at the ECB.

The existence of preemptive austerity for certain values of the economic fundamentals hinges crucially on the timing of decisions in our model. If the tax rate were chosen at the end of the period once the state of international lenders panics has been revealed, the optimal behavior would be standard: Inside the safe zone countries have access to credit at the risk-free rate and should borrow in bad times in order to smooth consumption. Such a timing would imply that the tax rate can be determined after production has taken place, generating substantial distortions in production decisions (in our model, labor supply decisions). High income countries do not typically behave this way. For example, in the US the income tax schedule is announced in November of 2021 for the fiscal year of 2022, and is applied to all income generated during the fiscal year once it is over (in April of 2023). While this type of commitment is natural in many countries, others might lack the credibility necessary for it, opening a window for a role of institutions such as the European Stability Mechanism, or the IMF in a broader context.

LITERATURE REVIEW AND COMPARISON OF RESULTS

2 The Benchmark Model

We introduce two critical departures from Conesa and Kehoe (2017). First, we endogeneize the tax rate that was fixed in our previous work. Second, we introduce a labor supply decision that together with productivity (that is stochastic) determines output. Given our parameterization, an increase in tax rates discourages labor supply and further depresses output. As such, increasing taxes is not only painful because of its direct impact on disposable income but in addition it is costly in terms of aggregate production, even more so during a recession. This feature adds a Keynesian rational for lowering taxes during recessions, making our results even stronger.

2.1 Technology and Production

Output y is linear in labor supplied by the household, ℓ,

$$y(a,z) = \theta(a,z)\ell, \tag{1}$$

where aggregate productivity is $\theta(a,z) = A^{1-a}Z^{1-z}\bar{\theta}$, with $A < 1$ and $Z < 1$. Productivity depends on the business cycle and the default history of the government. In *normal times* $a = 1$, while in a *recession* $a = 0$ and productivity is reduced by the factor $1 - A$. Similarly $z = 1$ indicates that the government has not defaulted in the past, and a default $z = 0$ implies that productivity immediately and forever falls by the factor $1 - Z$.

At the beginning of period 0 the economy is in normal times and the government has never defaulted, $(a = 1, z = 1)$. Then in period 0, the economy unexpectedly enters a recession and productivity falls. Every period there is a Poisson probability $p \in (0,1)$ of an economic recovery, and for simplicity we assume that once the economy recovers it stays there forever.

2.2 Households

There is a continuum of measure one of identical households with the following utility function:

$$u(c, \ell, g) = (1/\rho)\log[\mu c^{\rho} + (1-\mu)(1-\ell)^{\rho}]^{1/\rho} + \gamma \log(g - \bar{g}) \tag{2}$$

Preferences depend on private consumption c and leisure $1-\ell$ in a CES-type aggregator, and on government expenditure g that enters separately in the utility function. Following Conesa and Kehoe (2017), we assume a non-homotheticity in government consumption that takes the form of a minimum level of government consumption $\bar{g}$. It can be interpreted as the level of government expenditure that is necessary for the country to function.

The parameter ρ governs the labor supply elasticity. A value of $\rho \in (0, 1)$ guarantees that an increase in taxes will have a negative impact on hours worked.

We do not allow households private borrowing and lending, so that the household problem is static and simply implies that private consumption c is equal to after-tax income (equal to output), where τ denotes the tax rate:

$$c = (1-\tau)\theta(a, z)\ell \tag{3}$$

The solution to the households' problem depends only on productivity and the tax rate, generating a policy function, $\ell(a, z, \tau)$, that the government takes as given.

2.3 Government

The government finances government expenditure and the debt service to international lenders by raising taxes and issuing new debt that is sold in a public auction.

As in any other model of rollover crises, the maturity of debt plays a key role since it determines how often governments need to refinance their existing debts. Following **?** and **?** we assume that a fraction δ of the existing stock of debt comes due in each period.

The government's budget constraint is:

$$g + z\delta B = \tau\theta(a, z)\ell(a, z, \tau) + q(B', s)(B' - (1-\delta)B), \tag{4}$$

where $q(B', s)$ is the price schedule for new debt, and z takes a value of 1 if the government services the debt and 0 if the government defaults on debt payments. This price schedule depends on the state of the economy $s = (a, z_{-1}, B, \zeta)$. If $z_{-1} = 0$ then $q = 0$, i.e. if the government has defaulted in the past then it is excluded from lending markets permanently. Otherwise the price will depend on the probability that the government repays next period.

2.4 International Lenders

There is a continuum of measure one of international lenders. Following Cole and Kehoe (1996, 2000) we use an exogenous sunspot variable, ζ, as the coordination mechanism among international lenders. This sunspot variable is uniformly and independently distributed on the interval $[0, 1]$. If $\zeta > 1 - \pi$, where π is an exogenous number, each individual lender knows that other lenders will not show up at the public auction for new debt. Since each one of them individually is measure zero, they will evaluate whether a failed auction would trigger a default or not. If the answer is positive then they will optimally choose to not show up at the auction and a default will occur. In contrast, if they understand that the government will have no incentive to default even if the auction fails, then they rationally choose to attend the auction and purchase any level of debt the government chooses given the competitive price schedule. In other words, panics are self-fulfilling for certain values of economic fundamentals and otherwise are inconsequential.

In order to simplify the pricing of debt, we assume that lenders are risk-neutral and have "big pockets". That implies that lenders are never individually constrained and they can lend as much as the government auctions, and the pricing is actuarially fair (lenders break even on expectation). Under these assumptions, the unit price of bonds is:

$$q(B', s) = \beta \times Ez(B'(s'), s', q(B'(s'), s)). \tag{5}$$

That means that the price is equal to the discount factor times the probability of repayment next period. If there is no risk of default, i.e. $Ez(B'(s'), s', q(B'(s'), s)) = 1$, the interest rate is the risk-free rate $1/\beta - 1$.

2.5 The timing of decisions

Within a period, the general sequence of events is:

1. The government chooses the tax rate, given the state of the economy, the stock of debt outstanding and its history of default (a, B, z_{-1}).

2. The random variable ζ is realized and the government chooses B', given the equilibrium price schedule.

3. The government chooses to default or not, households decide how much to work and production takes place.

Crucially, the government does not know the value of the sunspot at the time of choosing the tax rate. This is the simplified way in which we introduce the notion that taxes are announced in advance to the beginning of the fiscal year, and that investors' sentiment is a high frequency phenomenon that can unfold at any moment during the fiscal year. We will compare this environment with a world where the sunspot is known at the time the tax rate is chosen.

3 The characterization of the equilibrium prices

As in Conesa and Kehoe (2017), the equilibrium can be characterize by debt thresholds that separate the "safe zone" (debt is low enough so that the country can borrow at the risk-free rate) from the "crisis zone" (debt is large enough that a rollover crises is possible if the sunspot realization indicates lenders panic). No borrowing is posible above the crisis zone, since that would imply immediate default. These thresholds depend on the state of the economy, and the lower threshold in a recession is below that in normal times, i.e. $\bar{b}(0) < \bar{b}(1)$, and the same for the upper thresholds, $\bar{B}(0) < \bar{B}(1)$. The crucial difference is that in this model the choice of the tax rate is going to affect these thresholds.

We report prices for the case that $\bar{b}(0) < \bar{b}(1) < \bar{B}(0) < \bar{B}(1)$, since this is the relevant case in our computational exercise. Also, those prices depend only on the debt issued, conditional on no default history and no panics today. Otherwise, if the government defaulted in the past or if the economy is in a crisis today (there is a panic in the crisis zone today), then the price of debt is zero.

The prices in normal times are given by:

$$q(B', (B, 1, 1, \zeta)) = \begin{cases} \beta(\delta + (1-\delta)q'(\cdot)) & \text{if } B' \leq \bar{b}(1) \\ \beta(1-\pi)(\delta + (1-\delta)q'(\cdot)) & \text{if } \bar{b}(1) < B' \leq \overline{B}(1) \\ 0 & \text{if } B' > \overline{B}(1) \end{cases} \tag{6}$$

Remember that any bond issued today will pay one unit of the consumption good tomorrow with probability δ and with probability $(1-\delta)$ you have a bond tomorrow with value $q'(\cdot)$. That explains the term that multiplies the discount factor in the safe zone. In the crisis zone the bond is only worth anything if there is no panic, and that happens with probability $(1-\pi)$.

In a recession the pricing is more complex and is affected by the probability of an economic recovery:

$$q(B',(B,0,1,\zeta)) = \begin{cases} \beta(\delta + (1-\delta)q(\cdot)) & \text{if } B' \leq \bar{b}(0) \\ \beta(p + (1-p)(1-\pi))(\delta + (1-\delta)q'(\cdot)) & \text{if } \bar{b}(0) < B' \leq \bar{b}(1) \\ \beta(1-\pi)(\delta + (1-\delta)q'(\cdot)) & \text{if } \bar{b}(1) < B' \leq \bar{B}(0) \\ \beta p(1-\pi)(\delta + (1-\delta)q'(\cdot)) & \text{if } \bar{B}(0) < B' \leq \bar{B}(1) \\ 0 & \text{if } B' > \bar{B}(1). \end{cases} \tag{7}$$

Here prices need a bit more explanation. In the zone between the lower threshold in bad times and in good times, the government repays if the economy recovers, and that happens with probability p, or if the economy does not recover but there is no panic, and that happens with probability $(1-p)(1-\pi)$. For levels of debt in the crisis zone regardless of the state of the economy the price is adjusted by the probability of a panic. Finally, there is another area between the upper threshold in recessions and normal times. In that area the government only repays tomorrow if the economy recovers and there is no panic, and that happens with probability $p(1-\pi)$.

4 Optimal tax and debt policies

In this section we provide a discussion of the optimal tax and debt policies and the corresponding equilibrium thresholds in a quantitative version of the model. Given a guess for the thresholds, we know prices and then we can compute optimal tax and debt policy. Given those policies and their associated value functions we can then generate a new guess for the thresholds and iterate on those until convergence. Now we describe the parameterization of the quantitative model and its policy prescriptions.

One period in the model corresponds to one year. We will parameterize the model in order to capture the key features of the European experience following the 2008-09 recession. We follow Conesa and Kehoe (2017) for many of these targets. The parameters are summarized in table I.

We choose $\beta = 0.98$ to target a risk-free rate of two percent.

We choose $\pi = 0.03$ so that the interest rate jumps to five percent when in the crisis zone. The increase in interest rates in 2011-12 for Spain or Italy were even larger than that.

Table I – Parameters

	Value	Target/assumption
A	0.95	productivity loss in recession = 5%
Z	0.95	default penalty
p	0.20	expected recovery = 5 years
β	0.98	safe bond yield = 2% (annual)
π	0.04	real interest rate in crisis zone = 5% (annual)
δ	1/6	average debt maturity = 6 years
γ	0.08	government revenue/output = 32%
μ	0.08	share of time devoted to work = 0.33
ρ	0.5	labor supply elasticity = 0.7
$\bar{g}$	7.0	2/3 of government expenditure is neccesary

We set $\delta = 1/6$, so that the average debt maturity is six years.

We set $p = 0.2$ so that the expected duration of the recession is five years.

Upon the recession productivity drops by five percent ($A = 0.95$). Also, a default this period or in the past implies five percent less productivity ($Z = 0.95$).

Chetty (2012) reports a labor supply elasticity of 0.7. Our choice of $\rho = 0.5$ is consistent with that value. That implies that upon the recession or because of a default labor supply drops by a bit less than five percent, so that output falls by around ten percent (both in a recession or because of a default). This number is within the range of the output drops observed in European economies and also consistent with the output losses reported in the literature. Papers that endogeneize the output loss of a default, such as **?** and **?**, find output loses between 6 and 12 percent of output. In order to simplify the analysis we make the productivity loss permanent, while in reality the output losses due to defaults last only for a few years since countries eventually regain access to international lending markets.

We choose $\mu = 0.08$, this implies that the representative household works 33 percent of its time, which is a value that is standard in the literature.

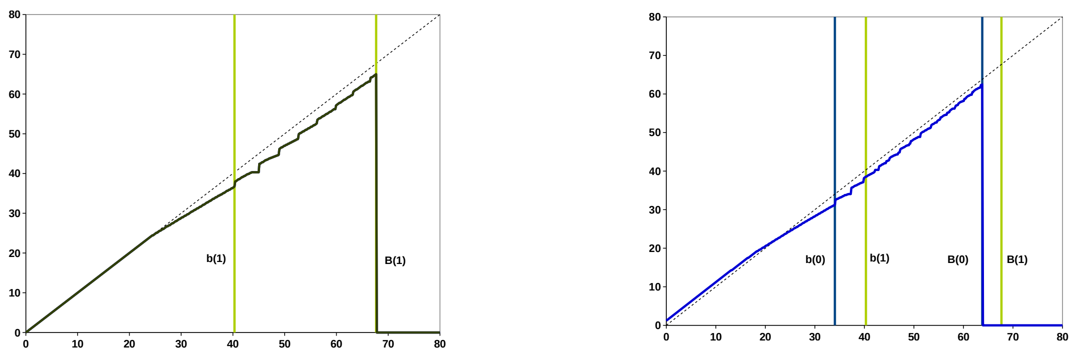
The parameter γ governs the relative weight of public consumption in the household's utility function. We choose $\gamma = 0.08$ so that government revenues as a share of output are 32 percent in normal times.

We assume that two thirds of government expenditure is necessary, which pins down $\bar{g}$.

FIGURE 1 – Debt policy function

(A) Normal times

(B) Recession



4.1 The optimal tax and debt policy in the benchmark economy

Figure 1 shows the optimal debt issuance as a function of debt today, conditional on the country not having defaulted in the past and in the absence of an investors panic today (remember that in those cases the price of debt is zero). On the left pannel we plot the optimal debt policy in normal times, and in the right pannel we plot the equivalent figure in a recession.

The X-axis displays the level of debt today. Remember that productivity is normalized to 100 in normal times, and output is productivity times hours, so that the level of output in normal times is around 33 for a country well in the safe zone. In addition hours also depend on the tax rate, which itself depends on the level of debt, see hours in Figure 2. Given that, the lower threshold implies a debt to output ratio slightly around 120 percent, and the upper threshold implies a debt to output ratio around 230 percent.

We start with the discussion of the debt policy function in normal times. Remember that we have made the simplifying assumption that normal times are an absorbing state, so that the government does not need to worry about potential future recessions. As is standard in the literature, for very low levels of debt the optimal policy is simply to rollover the inherited debt forever, so that any level of debt in that range is a steady state. That is simply the consequence of the desire to smooth consumption in a situation where the price of bonds equals the discount factor.

However, notice what happens near the lower threshold that defines the safe zone. In that area we observe fiscal austerity, the optimal policy implies fiscal surpluses and running down the level of debt even though the government has access to risk-free lending. That novel element is the result of the new features we introduce in this model. The government preemptively sets a high tax, so that even if a panic would unfold it would not be self-fulfilling. The government optimally enlarges the safe zone by the choice of the tax rate, which we report in Figure 2. Of course, by construction no debt crisis can happen in that area, fiscal revenues will be so high that the government would choose to repay even in the event of a panic. In that area, though, fiscal revenues are too large ex-post, since in equilibrium the government will always have access to cheap credit. One possible action would be to set high government expenditures and rollover the existing debt. That turns out not to be optimal, and that is the reason why paying out the debt is preferable. That way debt goes down to a level where preemptive austerity is no longer necessary.

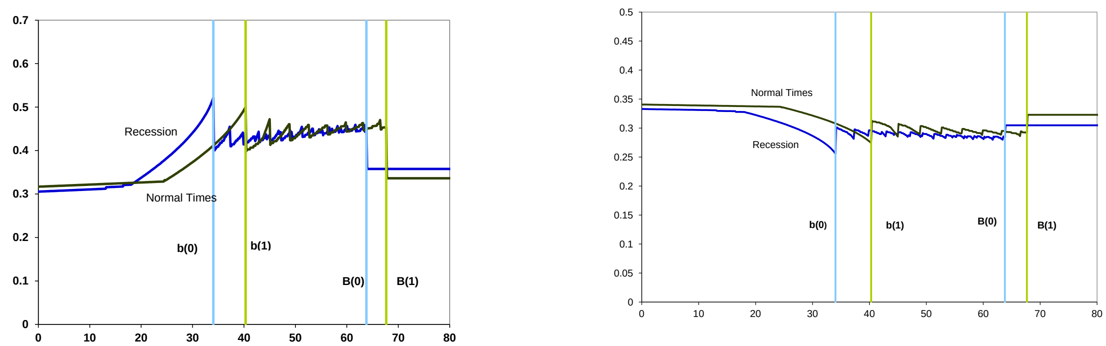
The debt policy in the crisis zone is completely standard in the literature going back to Cole and Kehoe (1996, 2000). In the crisis zone any period a panic could trigger a default (that is of course reflected in the price of bonds), and it is always optimal to pay out debt in a finite number of periods to exit the crisis zone. This is always true in normal times, but it is not necessarily the case during recessions, where governments could gamble in the hope of an economic recovery, which is exactly what Conesa and Kehoe (2017) focused on. In this parameterization, though, the government finds it optimal to lower the level of debt during a recession for all levels of debt inside the crisis zone. Notice that inside the crisis zone austerity is driven by the desire to exit the crisis zone, while what we call preemptive austerity is a policy that is used in order to enlarge the safe zone. While both situations prescribe fiscal surpluses and reductions in debt, they can still be clearly distinguished in that preemptive austerity involves fiscal surpluses and reductions in debt even when the country has access to cheap credit, while in the crisis zone the government is engaging in austerity while having to pay a spread for its access to credit.

We see that preemptive austerity is present both in normal times and during a recession. The comparison of the tax rate under both cases is very revealing, and that is why we plot them together in Figure 2. Consider the situation where a country is in normal times and suddenly is surprised by an unexpected recession. For very low levels of debt, the country was in a steady state rolling over debt forever. Now a recession hits this country and the optimal policy response implies lowering the tax rate (that estimulates labor supply) and increase the level of debt in order to smooth consumption (both private and public) by borrowing against future income once the recovery occurs. This is the standard policy response in Conesa and Kehoe (2017).

However, for higher levels debt (but still inside the safe zone) notice that the optimal

Figure 2 – Tax policy function and hours

(a) Tax Policy (b) Hours worked



policy response could be exactly the opposite. There is a large range of values of debt below the lower threshold $\bar{b}(0)$ for which the optimal policy involves an increase in the tax rate. Since a recession lowers that threshold shrinking the safe zone, we find that preemptive austerity might be optimal for lower levels of debt than in normal times. As such, we observe a range of values of fundamentals (level of debt and severity of the recession) for which the response to a severe economic crisis is costly austerity even though the country has access to cheap credit. Our exercise shows that the logic goes the other way around: It is because of the austerity painfully imposed during a recession that the country can still avoid the possibility of a default and consequently retain access to credit at a low interest rate.

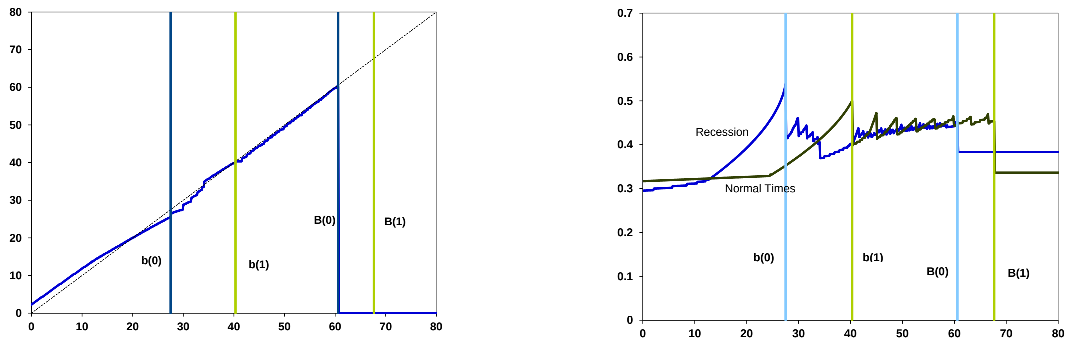
4.2 A more severe recession

Consider now the case when the recession is more severe. We simply assume that in a recession productivity falls by ten percent (it was five percent in the benchmark), i.e. $A = 0.9$. Notice that this productivity drop, together with our elasticity of labor supply, would imply a recession where output drops between fifteen and twenty percent. We compare this case to the benchmark in order to think about the differences in fiscal response to the 2008-09 between countries like Germany, where the recession was less severe, with Southern European countries like Spain or Italy, where the recession was much more severe.

In a severe recession the government still has incentives to increase taxes, but because of the severity of the recession fiscal revenues drop much more than in the benchmark and the pace of debt repayment is slower. Figure 3 displays the results. In the left pannel we report debt policy in recession times. Notice that since normal times are an absorbing state

Figure 3 – Policy functions in more severe recessions

(a) Debt Policy (b) Tax Policy



the debt and tax policies in normal times are not affected by the severity of the recession.

Compared to the benchmark scenario, a severe recession is going to shift the thresholds to the left by a larger magnitude, and notice that the optimal response is still to increase tax rates. In fact, the range of values of debt for which it is optimal to increase taxes upon a recession is larger. Taxes increase for all values of debt between 15 and 35, while in the benchmark this range of values of debt is smaller. Moreover,

Unlike in the benchmark, though, there is an area inside the crisis zone (for levels of debt between 35 and 40) where the government finds it optimal to gamble hoping for a recovery, and it does so until the point where debt is safe in normal times. In this area tax rates are low, there are fiscal deficits and debt goes up, even though interest rates are high. This happens because of the standard arguments discussed in Conesa and Kehoe (2017), in that area austerity is so costly that the optimal policy gives up on austerity and increases debt, hoping that a recovery will happen soon.

5 Conclusions

We have used a simple model of rollover risk in order to illustrate what we call "preemptive austerity", referring to the optimal policy of high taxes upfront in order to deter a potential rollover crisis. This happens always, but we have shown that this can happen even more in recession times. As a result, a country facing a severe recession might find it optimal to respond to it by increasing taxes, generating fiscal surpluses and repaying debt. We believe such a model can shed light on the events that followed the recession of 2008-09, where many countries found themselves more exposed to potential rollover crises.

6 References

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