Majoritarian Delays*

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Abstract

This paper illustrates how delayed debt stabilizations can arise in a society without any emerging conflict of interests among its members. We argue that, under a majority voting rule, the economy may generate excessive levels of government spending and larger debts over time, and that this delay is increasing in income inequality. The intuition for this result is simple: a majority of citizens may find in delaying stabilizations a way to increase government expenditures, transferring in this way resources from the richest to the poorest citizens in the economy. This process may explain the upward trend and the difficulty to reduce public expenditures, the so called "ratchet effect."

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1 Introduction

Why do countries often engage is policies that seem systematically connected with significative increases in the levels of government spending over time, and associated to large budget deficits? Why are government expenditures systematically high, from an efficiency point of view, and why is it so difficult to cut them? Why do not economies stabilize immediately, putting an end to an increasing path in public expenditures and debt accumulation? Why to delay stabilizations behind what would be optimal and reasonable for the society? Why are some countries able to proceed with economic adjustments, stabilizing the growth rate of government expenditures, while others continually accumulate large deficits through time? These puzzling questions have concerned many economists to a great extend, and will certainly continue to be part not only of the economic, but also of the political agenda.

Some countries face serious fiscal imbalances, originated by pressures that arise at the budgetary level, which cannot be dissociated from an increasing pattern of government expenditures. This behavior of fiscal policies has a clear impact over welfare in the society, bur yet, they seem to predominate in many economies worldwide. According to a traditional view in the literature, this observed pattern has its foundations on conflicts of interests within the society, related to distributional issues imposed by the reform process, but there is not an established vision that they can be generated deliberately by the society. The objective of this paper is to propose a different approach to this phenomenon, where delays in fiscal adjustments are not motivated by a direct conflict of interests, but are rather the desire of a majority of citizens that are able to benefit with this process.

Recent years are able to provide us with a lot of situations where economic reforms, mainly at a fiscal level, were systematically postponed, not only in developing countries, but also in the most developed ones, leading to a significative increase in government expenditures and to a large accumulation of debt.[1] The most extreme cases are, perhaps, Mexico, Argentina, Bolivia and Peru, in the 80s, where drastic measures at a budgetary level were required to restore solvency a introduce a balance in public accounts. However, many European countries also presented a significative growth in the level of current expenditures, what has originated an overwhelmed government, leading to the accumulation of large deficits. The more cited examples are Italy, Belgium, Greece, France, Germany and Portugal, which presented a

[1] Many countries presented, in some period of their history, policies that were not compatible with long term fiscal sustainability, even the most developed ones. Afonso (2004) and some references therein provide excellent empirical analyses over the sustainability of fiscal policies in many different countries.

growing level of debt in the last three decades, with no evidence of a reversing trend. At the same time, some countries were able to cope with a rising pattern in the level of debt, and successfully inverted its trend in the mid 90s, or at least eliminated it, attaining a sustainable fiscal position. This is the case, for example, of Denmark, Finland, Iceland, Ireland, Netherlands, Spain, and Sweden. In a majority of cases, this trend reversion was undertaken by controlling the rate of growth of government spending.[2] Moreover, the accumulated level of debt varies largely across these countries, going from less than 40 percent of GNP in Germany, Spain and Australia, to nearly 100 percent in Italy, Belgium and Greece, but it nearly tripled in almost every country since 1970.

Since the mid 80s, but mainly in the 90s, a vast literature started to appear on the subject of inactions and delays, trying to understand the different patterns of stabilizations and suggesting some possible explanations for non-adoption of socially optimal policies, which can be divided into four categories (see Drazen, 2000: 406): (1) models that exalt the role of powerful interest groups who block any reform attempt that is not in their interest (see, for example, Olson, 1982, Krusell and Rios-Rull, 1996 and Tornell, 1998); (2) models that focus directly on delays in the adoption of welfare improving economic policies;[3] (3) models which stress the *ex-ante* uncertainty about the private benefits of the reform which could lead to a bias towards non-adoption of social optimal policies, or towards the status quo (see Fernandez and Rodrik, 1991; Rodrik, 1993); and finally (4) models which emphasize the non-adoption of social optimal policies as the result of asymmetric information between policy-makers and the electorate, as the former has usually more information than the latter (see, for example, Cukierman and Tommasi, 1998a and 1998b). A good survey on these and other related issues, with many historical examples, is given by Rodrik (1996).

The most prominent research on delayed stabilizations attempts to explain this phenomenon as a "war of attriction". In their influential article titled "Why are Stabilizations Delayed?," Alesina and Drazen (1991) justify delayed stabilizations over the level of debt through a war of attrition that is levied between different socioeconomic groups. In their model, the initial

[2] See Alesina and Perotti (1994), for a more detailed analysis on OECD countries. Some references in the previous paragraph also describe many historical examples.

[3] There are mainly two types of models that are able to explain delays: the "war of attriction model," which is discussed below, and the "common property model," which emphasizes the fact that government resources are common property out of which different members of the society can extract resources for their own benefit. In this model, stabilizations can occur, but only after a period of excessive expropriation of government resources during which government debt is built (see Velasco, 1998).

situation imposes different utility losses (from distortionary taxation) across the society, which are only known to each group itself; the others knowing only the distribution function. Economic reforms, although able to remove all distortionary taxation, require an increase in taxes in order to eliminate budget deficits, inflicting costs that will be distributed unevenly across the society, with the first group to accept the reform facing the highest share of the burden. Hence, delays in economic adjustment are just a result from a war of attriction generated across groups, with each one trying to wait as long as possible, hopping that some other group concedes first and agrees to pay the highest share of the cost of adjustment. Obviously, this group will be the one with the highest utility loss from the status quo, but no one knows who that is before she revels herself.[4] Drazen and Grilli (1993) extend this idea to contemplate an alternative source of financing government deficits. They analyze how a war of attrition can be raised in a society which finances budget deficits by issuing money, building exactly the same idea as in Alesina and Drazen. Spolaore (2004) inspects how different political settings are related to economic reforms, inaction, and delays, analyzing three types of government systems: cabinet systems, consensus systems, and checks-and-balances systems. Here, it is argued that only in unanimity systems delayed stabilizations can appear, once more as a result of a war of attrition that is raised within the society.

All these models assume that there is a deadlock in the stabilization process, motivated by this conflict that emerges between socioeconomic groups, and it seems delays can hardly be generated by any other process or decision-making mechanism. However, as Romer (2001: 566) poses, it may be as reasonable to assume that the society is composed by different socioeconomic groups with opposed interests as to assume a political process where decision-making is undertaken by majority voting and the stabilization is decided according to the median voter's bliss point. In fact, this "majoritarian view" of decision-making, which dates back to Romer (1975), Roberts (1977), and Meltzer and Richard (1981), who have used it to explain the excessive size of government, appears in many ways suitable to be adapted to the present context. This paper intends to fill in this gap in the literature, modeling delays in economic adjustments associated to an increasing level of government expenditures over time, through a majority voting model, analyzing under what circumstances delays can be motivated by the wishes of citizens in the society. We conclude that there is no need to model a conflict of interests in order to generate an increasing pattern of debt over time. Delays may be

[4] A more recent analysis of this framework is provided in a working paper by Martinelli and Escorza (2005).

motivated by citizens themselves, as they express their wishes to postpone the adjustment process.

At this point, we think a remark should be made about our analysis. The modelization of the political framework according to the majority rule should not be taken as a literal description of the political process or decision mechanism we have in mind. Even in a representative democracy, the government is likely to respond, at least to some extend, to the wishes of the majority, mainly when key issues which can influence the outcome of the electoral process are at stake.[5] As Holcombe (1989) poses, the median voter model may not describe every political framework under which decision-making is undertaken, but this does not mean that it cannot provide a reliable source for the analysis of public sector demand. In fact, good economic policies may turn out to be unpopular, especially if the lag between their implementation and economic results is long enough. This effect may even lead the most reformist politician to not exploiting such policies. On the contrary, bad policies can be popular, if temporary, enhancing the short-run popularity of policy-makers who adopt them, even at the expense of future economic problems. A striking example is given by Peru, where large populist measures adopted by president García (1985-90) found a large support in the population, but lead the economy to a profound economic crises, with the depletion of foreign reserves, hyperinflation, and the public sector and current account deficits becoming almost unbearable.

We start by building an economy where initially the level of government expenditures is growing through time, providing utility to citizens, and is covered only partially by taxes, generating an increase in the level of debt. In this setup, a stabilization is a set of actions undertaken by the government at a fiscal level in order to cut the growth of current expenditures and to eliminate all deficits in the economy. That is, as the stabilization is postponed successively, public expenditures continue to grow larger, and so does public deficits, but, when an economic reform is implemented, current expenditures stabilize and taxes increase, in order to bring the level of deficit back to zero. The government is a populist one, at least in the short run, in sense that her actions reflect the median voter's will. Our objective is to compare the outcome of this process with the optimal one, i.e., if the stabilization date was chosen by a powerful and benevolent social planner, who would not seek to adopt populist measures, but instead would undertake only policies which maximize the intertemporal expected utility of the society.

Under the assumption that the median income is lower than the mean

[5] As demonstrated by Downs (1957), under some assumptions, the majority rule outcome may be replicated by a representative democracy.

income, we find that delayed stabilizations always occur, but they can be more or less severe depending on the benefits generated by additional expenditures in public goods. The intuition for this result is simple: under this framework, a majority of citizens, composed by at least the fifty percent poorest individuals in the society, find in delaying stabilizations the only way to transfer resources from the wealthiest individuals directly into them, by letting government expenditures increase above their optimal level. This happens because it is the richest individuals who end up paying most of this increase in public expenditures, after the stabilization. Moreover, the higher the inequality in income distribution, the higher the delay lag, as the median voter becomes able to explore the resources of the society at a lower cost. Hence, the model captures not only a pattern for delaying economic adjustments, but also a trend towards an excessive level of current expenditures, attempting to explain in this way the upward trend and the difficulty to cut public expenditures, the so called "ratchet effect". In fact, this result accords with the prediction of ratchet models, namely that expenditures remain relatively high and constant after a period of upheaval.[6]

This paper is organized as follows. Section 2 setups the model and describes its particular features. Section 3 analyses the equilibrium behavior. Section 4 focuses directly on stabilization delays. Section 5 analyses two concrete examples and presents some numerical results. Section 6 concludes.

2 The basic framework

We consider an economy where the government uses her income to provide public services and public goods,[7] which have a direct impact on the utility of economic agents. The model is set in continuous time, and individuals are heterogenous only regarding their level of income, but are equal in all other aspects. We assume no economic growth, and so income is constant through time.

Concerning the budgetary framework, we assume the following. Initially, there is no budget deficit, and therefore the level of debt is constant. At some

[6] Although it is not the main focus of this paper, we also analyse the unanimity rule, which may present interesting insights. We find that stabilizations are always delayed according to this rule, but the delay lag is no lower than under majority voting. This happens because all citizens must agree with the reform proposal so that it can be implemented.

[7] For the sake of the discussion, I use public spending and public good indistinctively. As we shall see, what matters here is that public spending provides utility for economic agents, and so it can be thought of as expenditures in public goods that provide benefits throughout the society.

moment in time, an exogenous shock hits the economy, generating a positive growth rate in government spending. Taxes are adjusted only partially to this shock, and so the level of debt starts growing till a successful stabilization is implemented. An economic reform consists precisely in setting the growth rate of government spending back to zero plus in an increase in taxes, such that the deficit becomes null again.

Decision-making is as follows. At each point in time, two different proposals go to votes: to stabilize in that moment, or to postpone stabilization to some future date. Notice that, by choosing a stabilization date, the society is also choosing a level of government spending, because, once one is decided, the other is immediately set. In other words, there exists just one date of stabilization that provides a given level of public expenditures. We focus the analyses mainly in two types of decision-making: the simple majority rule and the unanimity rule.

As the policy vector is unidimensional and preferences are single-peaked, each individual has a preferred level of public goods which he would like to implement, and therefore each citizen will have his preferred date of stabilization. Hence, we can apply the median voter theorem to conclude that the stabilization date which comes out of the political system under majority voting is the one chosen by the median voter. We notice that the stabilization date under majority voting is always higher than the optimal one, implying that the outcome of the political system imply a delay in economic adjustments, when compared with the social planner's decision.[8] Moreover, an increase in inequality leads a majority of citizens to vote for a larger delay lag,[9] although the response of the median voter cannot be dissociated from how additional government expenditures benefit economic agents in the society. The unanimity rule always delays stabilizations, as a consensus is required in order to approve a reform proposal.

Budgetary framework

More formally, consider a small open economy which issues external debt to cover deficits not covered by revenues, and let r denote the constant world interest rate. Suppose initially that the economy has no budget deficit. If we let $g(t)$ denote primary government spending,[10] $\iota(t)$ the level of taxes, and

[8] We define delayed stabilization as a situation where the stabilization date verified in the society is higher than the optimal one.

[9] We define delay lag as the difference between the actual and the optimal dates of stabilization.

[10] To easy the exposition, we will refer to primary government expenditures just as government expenditures (or spending). Whenever we want to refer to total government expenditures (that is, including interest payments), we emphasize that explicitly.

$b(t)$ the level of debt at time t, the budget constraint at $t = 0$ is given by:

$$g(0) + rb(0) = \iota(0) \tag{1}$$

Let us assume that, at $t = 0$, an exogenous shock falls over the rate of growth of government spending. More specifically, consider that, from $t = 0$ till a policy change, primary government expenditures grow at an exogenous rate $\gamma > 0$. Hence,

$$g(t) = g(0)e^{\gamma t},\ \ t \in [0, T) \tag{2}$$

Where T is the date of the policy change. What is important here is not that γ is constant, but that it is positive. This simplification enables us to focus on the driving forces that allow an economic reform to take place, as well as on its expected date, without overcharging the analysis.[11]

Assume also that this increase in government spending is only partially reflected in taxes:

$$\iota(t) = \iota(0) + \alpha \left[g(t) + rb(t) - \iota(0)\right],\ \ t \in [0, T); \text{with } \alpha \in [0, 1) \tag{3}$$

Where $1 - \alpha$ is the fraction of the increase in total expenditures that is covered by issuing debt.[12] Hence, between $t = 0$ till the economic adjustment, the level of debt evolves according to:

$$\dot{b}(t) = g(t) + rb(t) - \iota(t) = (1 - \alpha)\left[g(t) + rb(t) - \iota(0)\right],\ t \in [0, T) \tag{4}$$

Let us assume that $\gamma \neq r(1 - \alpha)$. Then, equation (4) may be solved to yield:[13]

$$b(t) = b(0) + (1 - \alpha)g(0)\left[\zeta(t; \gamma, r, \alpha) - \zeta(t; \gamma = 0, r, \alpha)\right],\ \ t \in [0, T) \tag{5}$$

[11] We can think that this shock was motivated by an increase in the demand for public expenditures, driven by a change in the preferences of economic agents. For a more specific treatment on how increases in government spending may arise endogenously within the political framework, although in a different context, see for example Velasco (1998).

[12] We can think this is due to some kind of inertia by the government in adjusting taxes. As it turns out that economic agents will be indifferent regarding the level of α, the assumption that taxes are not fully adjusted to pay the increase in the level of government expenditures comes as a natural one.

[13] If instead we had assumed $\gamma = r(1-\alpha)$, the solution to the differential equation would be:

$$b(t) = b(0) + \frac{g(0)}{r}\left[1 - e^{r(1-\alpha)t} + (1 - \alpha)rte^{r(1-\alpha)t}\right]$$

And all propositions presented in this paper are still valid under this assumption.

Where,

$$\zeta(t;\gamma,r,\alpha)=\frac{e^{\gamma t}-e^{r(1-\alpha)t}}{[\gamma-r(1-\alpha)]} \tag{6}$$

In order to interpret equation (5), it may be useful to re-write it as:

$$b(t)=b(0)e^{r(1-\alpha)t}+(1-\alpha)\left[g(0)\zeta(t;\gamma,r,\alpha)-\iota(0)\zeta(t;\gamma=0,r,\alpha)\right] \tag{7}$$

Hence, the level of debt at moment t is the sum of the debt at moment 0 with the overall impact of the accumulated deficits between moment 0 and t. We can say that the first term is the level of debt at moment 0 plus the accumulated interest on public debt between moment 0 and t, the second term measures the the overall impact, in this interval of time, of the level of spending, taking into account its growth rate, and the third term is the overall contribution of taxes to the level of debt. Notice that this last effect is always negative.

A stabilization in this setup consists in setting the growth rate of government spending equal to zero, plus an increase in taxes that prevents further growth in the level of debt. Therefore, taxes from the date of stabilization T onwards are:

$$\iota(t)=g(T)+rb(T),\ t\in[T,+\infty) \tag{8}$$

Where $g(T)=g(0)e^{\gamma T}$, and $b(T)$ is given by equation (5) evaluated at $t=T$. Hence, $\dot{b}(t)=0$, $\forall\ t\geq T$.

Notice that government spending grows exponentially from $t=0$ till a policy change, but remains constant afterwards, while taxes cover only partially this increase, but face a one time jump at $t=T$ in order to achieve budget balance. Hence, the level of debt is increasing from time zero till the date of stabilization, but remains constant afterwards.

Individual decision-making

Let us turn now to individual decision-making. We consider the economy to be populated by a continuous of citizens with mass of unity. Each citizen, indexed by i, is characterized by his (constant and strictly positive) income $y_i\in\left[\underline{y},\overline{y}\right]$, which is drawn from a cumulative distribution $F_y(y)$, according to a density function $f_y(y)$. This p.d.f. is assumed single-peaked and skewed to the right, such that $y_{med}<E(y)$, where y_{med} is the median income and $E(.)$ denotes the expected value operator. This assumption is not restrictive, and is widely used in the political economy literature. Also, define $\varkappa_i=\frac{y_i}{E(y)}$ as the relative income of citizen i, and interpret $\varkappa_{med}=\frac{y_{med}}{E(y)}$ as a measure of

inequality in income distribution in the society: the higher is $\varkappa_{med}$, the more equally is income distributed. If we let θ denote the public good preference parameter, and define $c_i(t)$ as the consumption, the flow utility of agent i at time t, denoted by $u_i(t)$, is given by:

$$u_i(t) = c_i(t) - y_i + \theta \cdot v(g(t)),\ \theta > 0 \tag{9}$$

With $v'(g(t)) > 0$, $v''(g(t)) < 0$.[14] Linearity in consumption is used for analytical tractability. Subtracting y_i in the utility function was first suggested in Alesina and Drazen (1991), and constitutes a simple normalization which does not affect any conclusions. Its role will become apparent in the sequel. Also, notice that government spending presents a decreasing marginal utility, what seems a plausible assumption. We can think of this as follows. A positive level of public expenditures is essential to assure property rights and the rule of law, as well as their enforcement, what is usually known as the minimal state. Without these basic activities, the economy could not function properly. As public spending increases, it starts to be allocated to other less essential, but also extremely important activities in modern societies, such as health care, education and social security, as well as correction of other market failures. Once these activities are pursued, additional spending is applied in other less relevant activities with a relative marginal impact on welfare, such as recreation and culture.

Let $U_i(c_i^D(t), c_i^R(t); T)$ denote the lifetime utility of agent i, where $c_i^D(t)$ is the consumption path before stabilization occurs, and $c_i^R(t)$ is the consumption after the reform package has been adopted. If we assume, for simplicity, that the discount rate of an individual equals the interest rate, the lifetime utility of this citizen, given that a stabilization occurs at time T, is:

$$\begin{aligned} U_i(c_i^D(t), c_i^R(t); T) = & \int_0^T \left[c_i^D(t) - y_i + \theta \cdot v(g(t))\right] e^{-rt} dt + \\ + & \int_T^\infty \left[c_i^R(t) - y_i + \theta \cdot v(g(T))\right] e^{-rt} dt \end{aligned} \tag{10}$$

Each individual faces a tax that is proportional to income. In particular, an individual in this economy pays taxes totalizing $\delta(t) \cdot y_i$, where $\delta(t)$ is the tax rate, assumed equal for all citizens. Hence, the individual budget constraint is:

[14] And also $\lim\limits_{g(t)\to 0} v'(g(t)) = \infty$ and $\lim\limits_{g(t)\to\infty} v'(g(t)) = 0$.

$$\int_0^T c_i^D(t)e^{-rt}dt + \int_T^\infty c_i^R(t)e^{-rt}dt = \tag{11}$$
$$= \int_0^T [y_i(1-\delta(t))]\, e^{-rt}dt + \int_T^\infty [y_i(1-\delta(t))]\, e^{-rt}dt$$

Notice that total tax income in the economy at time t is given by:

$$\iota(t) = \delta(t)\int y f_y(y)dy = \delta(t)E(y) \tag{12}$$

Obviously, this implies that the tax rate at each moment in time is simply $\delta(t) = \frac{\iota(t)}{E(y)}$. If we recall that the time path of taxes is given by equations (1), (3) and (8), then we can re-write the tax rate as:[15]

$$\delta(t) = \begin{cases} \frac{(1-\alpha)(g(0)+rb(0))+\alpha(g(t)+rb(t))}{E(y)} & ,\ t \in [0,T) \\ \frac{g(T)+rb(T)}{E(y)} & ,\ t \geq T \end{cases} \tag{13}$$

Therefore, the budget constraint becomes:

$$\int_0^T c_i^D(t)e^{-rt}dt + \int_T^\infty c_i^R(t)e^{-rt}dt = \tag{14}$$
$$= \int_0^T [y_i - \varkappa_i\left((1-\alpha)\left(g(0)+rb(0)\right) + \alpha\left(g(t)+rb(t)\right)\right)]\, e^{-rt}dt +$$
$$+ \int_T^\infty [y_i - \varkappa_i\left(g(T)+rb(T)\right)]\, e^{-rt}dt$$

The objective of the consumer is, in a first step, to choose the optimal pattern of consumption, given a date of stabilization T. Hence, each individual maximizes (10) subject to (14). It is easy to see that this problem has an infinite set of solutions. However, a simple feasible consumption path that solves this problem is just:[16]

$$c_i^D(t) = y_i - \varkappa_i\left((1-\alpha)\left(g(0)+rb(0)\right) + \alpha\left(g(t)+rb(t)\right)\right) \tag{15}$$
$$c_i^R(t) = y_i - \varkappa_i\left(g(T)+rb(T)\right) \tag{16}$$

Notice that although consumption is decreasing in time before the stabilization, as taxes are adjusting to pay a fraction α of the increase in total

[15] We assume $\delta(t) < 1$, $\forall\ t$, so that the consumption path is always positive.

[16] An alternative approach is to plug directly the budget constraint into the lifetime utility. This yields immediately equation (17).

expenditures, it also has a jump at $t = T$. This occurs because, at the date of stabilization, taxes still have to increase, in order to eliminate the deficit in the economy. Also, observe that the longer the economy takes to stabilize, the higher the level of $g(T)$ (and also $b(T)$), and so the higher is the increase in taxes and the fall in consumption at $t = T$.

Using equations (15) and (16), we can write the indirect lifetime utility of agent i as:[17]

$$
\begin{aligned}
& U_i(T) = && (17)\\
= \quad & \int_0^T \left[-\varkappa_i \left((1-\alpha)\left(g(0)+rb(0)\right)+\alpha\left(g(t)+rb(t)\right)\right)+\theta\cdot v(g(t))\right]e^{-rt}dt + \\
+ \quad & \int_T^\infty \left[-\varkappa_i\left[g(T)+rb(T)\right]+\theta\cdot v(g(T))\right]e^{-rt}dt
\end{aligned}
$$

Where we choose not to substitute $b(t)$ and $b(T)$ for their expression so that the equation do not become too cumbersome. Notice that subtracting y_i in the flow utility was just a simplification, which becomes handy here.

[17] There is still another way to derive the indirect intertemporal utility. Notice that the intertemporal budget constraint for the government is:

$$b(0)+\int_0^T g(t)e^{-rt}dt+\int_T^\infty g(T)e^{-rt}dt = E(y)\left[\int_0^T \delta(t)e^{-rt}dt+\int_T^\infty \delta(T)e^{-rt}dt\right]$$

Hence, the individual budget constraint can be written as:

$$\int_0^T c_i^D(t)e^{-rt}dt+\int_T^\infty c_i^R(t)e^{-rt}dt = \frac{y_i}{r}-\frac{y_i}{E(y)}\left[b(0)+\int_0^T g(t)e^{-rt}dt+\int_T^\infty g(T)e^{-rt}dt\right]$$

And therefore,

$$U_i(T) = -\frac{y_i}{E(y)}b(0)+\int_0^T\left[-\varkappa_i g(t)+\theta\cdot v(g(t))\right]e^{-rt}dt+\int_T^\infty\left[-\varkappa_i g(T)+\theta\cdot v(g(T))\right]e^{-rt}dt$$

It can be shown that this equals equation (17). In other words, agents are "Ricardian" in this economy, as they are indifferent on how government expenditures are financed through time.

3 The Stabilization date

In this section, we solve the model for the benchmark case, and for the majority and unanimity solution concepts.

Throughout this section, assume that the following condition is satisfied:

Assumption A $v'^{-1}(\theta^{-1}) > g(0)$.

The role of this assumption will become clear in a moment. It basically rules out the case where stabilizations occur immediately. Notice that this condition is automatically verified if the initial level of expenditures is low enough.

3.1 Majority voting

The preferred date of stabilization of an individual with income y_i is found by maximizing (17) with respect to T, subject to the condition $T \geq 0$. The following proposition summarizes the result.

Proposition 1 *The preferred date of stabilization for citizen i is given by:*

$$T_i^* = \begin{cases} \frac{1}{\gamma} \ln \left(\frac{v'^{-1}\left(\theta^{-1} \cdot \varkappa_i\right)}{g(0)} \right) & \text{, if } v'^{-1}\left(\theta^{-1} \cdot \varkappa_i\right) > g(0) \\ 0 & \text{, otherwise} \end{cases} \tag{18}$$

Proof. The problem to solve is:

$$\max_T U_i(T), \text{ s.t. } T \geq 0 \tag{19}$$

Where $U_i(T)$ is defined in equation (17). The details can be found in the appendix. ■

For $g(0) < v'^{-1}(\theta^{-1} \cdot \varkappa_i)$, (18) may be written as:

$$\frac{d}{dT}\left[\theta \cdot v(g(T))\right]|_{T=T_i^*} - \varkappa_i \cdot \frac{d}{dT}\left[g(T)\right]|_{T=T_i^*} = 0 \tag{20}$$

The left hand side is the net marginal benefit of delaying the stabilization another instant, evaluated at T_i^*, for citizen i. Hence, agent i would like to stabilize when the gain generated by the increase in government expenditures for him is exactly offset by the increase in taxes he faces to finance the higher level of primary government spending originated by delaying the stabilization another instant.[18] Notice that neither the level of debt nor the fraction of

[18] Notice that taxes at time T are given by: $\iota(T) = g(T) + rb(T)$. So, we have:

$$\frac{d}{dT}\left[\iota(T)\right]|_{T=T_i^*} = \frac{d}{dT}\left[g(T)\right]|_{T=T_i^*} + r\frac{d}{dT}\left[b(T)\right]|_{T=T_i^*}$$

the increase in total government expenditures that is financed with deficits before the stabilization (that is, $1-\alpha$) have any impact on the decision-making process. In fact, delaying the adjustment another instant implies an increase on the interest over that period, which has to be paid later on. As the benefits and the costs of this process are exactly equal, they cancel each other out.[19],

Also, observe that while the gain from delaying stabilizations is equal for all citizens, the increase in the amount of taxes each agent faces depends on the relative income. This implies that poor agents desire to stabilize later, as they face a lower incentive to support stabilizations.

For $g(0) \geq v'^{-1}(\theta^{-1} \cdot \varkappa_i)$, (18) can be written as:

$$\frac{d}{dT}\left[\theta \cdot v(g(T))\right]|_{T=T_i^*} - \varkappa_i \cdot \frac{d}{dT}\left[g(T)\right]|_{T=T_i^*} \leq 0 \qquad (21)$$

In this case, the net marginal benefit of delaying the stabilization is negative, and hence the agent would like to stabilize immediately. Assumption A implies that any citizen with an income below or equal to the per capita income ($\varkappa_i \leq 1$) would not want to undertake an immediate stabilization.

It is immediate to see that unidimensionality and single-peakedness of preferences is verified.[20] Hence, a condorcet winner always exists in this problem. Under majority voting, the timing of the stabilization is then the one chosen by the median voter, the citizen with a relative income $\varkappa_{med}$:

$$T_{med}^* = \frac{1}{\gamma} \ln \left[\frac{v'^{-1}(\theta^{-1} \cdot \varkappa_{med})}{g(0)}\right] \qquad (22)$$

Which is positive, given assumption A.[21] The following proposition states how T_{med}^* depends on the different parameters of the economy.

The effect mentioned in the text concerns only the first term. Taxes will also increase to pay for the interest associated to the enlargement of the level of debt originated by this delay. See also footnote 19.

[19]Observe that equation (20) can be re-written as:

$$\frac{d}{dT}\left[\theta \cdot v(g(T))\right]|_{T=T_i^*} + \varkappa_i \cdot rb'(T_i^*) - \varkappa_i \cdot \frac{d}{dT}\left[\iota(T)\right]|_{T=T_i^*} = 0$$

Where $b'(T_i^*) = \frac{d}{dT}\left[b(T)\right]|_{T=T_i^*}$. Hence, delaying the stabilization another instant implies postponing the payment of the interest, but also an increase in taxes to reimburse the higher interest accumulated over that period. These effects cancel each other out. This is obviously an implication of the Ricardian equivalence.

[20]In the proof of proposition 1 we show that the utility function is in fact strictly quasiconcave, what implies single-peakedness of preferences.

[21]It is not difficult to see that $v'^{-1}(\theta^{-1} \cdot \varkappa_{med}) > v'^{-1}(\theta^{-1}) > g(0)$.

Proposition 2 *Let T^*_{med} be defined as in equation (22). Then, the following relationships can be established:* $\frac{dT^*_{med}}{d\gamma} < 0$, $\frac{dT^*_{med}}{dg(0)} < 0$, $\frac{dT^*_{med}}{d\varkappa_{med}} < 0$ *and* $\frac{dT^*_{med}}{d\theta} > 0$.

Proof. The proofs that $\frac{dT^*_{med}}{d\gamma} < 0$ and $\frac{dT^*_{med}}{dg(0)} < 0$ are trivial. For the last two, rearrange the first order condition of the maximization problem for the median voter as:

$$\theta \cdot v'(g(T^*_{med})) = \varkappa_{med} \tag{23}$$

Total differentiation yields:

$$\frac{dT^*_{med}}{d\varkappa_{med}} = \frac{1}{\theta\gamma v''(g(T^*_{med}))g(T^*_{med})} < 0 \tag{24}$$

And,

$$\frac{dT^*_{med}}{d\theta} = -\frac{v'(g(T^*_{med}))}{\theta\gamma v''(g(T^*_{med}))g(T^*_{med})} > 0 \tag{25}$$

■

In particular, notice the following. If γ increases, then public expenditures grow more quickly, and hence less time is needed so that g reaches the desired level by the median voter. Therefore, the stabilization occurs sooner. Similarly, an increase in $g(0)$ implies that initially the level of public expenditures is higher, and hence less time is needed so that the median voter decides to stabilize. If $\varkappa_{med}$ increases (and so the inequality in income distribution decreases), the median voter becomes relatively less poor, and therefore the cost of the public good increases for him, as, for the same T, he will have to pay more taxes. This implies an earlier stabilization date. Finally, an increase in θ means that the preference for public goods becomes higher, and so the median voter would like to implement a higher level of public expenditures. This is attained by a later stabilization.[22]

[22] One could ask why expenditures do not face a one time jump at moment 0 to achieve the median voter's optimal level. In fact, that would be utility maximizing, as agents would benefit immediately from a higher level of public goods, and no deficit would be generated meanwhile. One way to go around this problem is to consider that γ is endogenous, and assume the following flow utility:

$$u_i(t) = c_i(t) - y_i + \theta \cdot v(g(t)) - c(\gamma),\ \theta > 0$$

Where $c'(\gamma) > 0, c''(\gamma) > 0$ and $\lim_{\gamma \to \infty} c(\gamma) = \infty$. In other words, large increases in expenditures in a reduced period of time (that is, a large γ) imply a huge amount of effort by economic agents to implement a stabilization, such that it is optimal to let them increase gradually through time. One could then derive the optimal growth rate of government expenditures for the median voter. It can be shown that we can still project the policy vector in a unidimensional space, what implies that in equilibrium we would have $\gamma = \gamma^*_{med}$.

The mechanism which makes stabilizations not to occur immediately, even when decision-making is undertaken by majority voting, should now be clear. Immediate reforms are not good, because they imply a cut in the growth rate of government spending, which is benefiting a majority of citizens in the society. As long as this majority wants to block the stabilization, no economic reform can occur, and the level of debt tends to rise over time. The consequence is that the economy may accumulate a higher level of debt, and still no economic reform seems to take place. In fact, we have:

$$g(T^*_{med}) = v'^{-1}(\theta^{-1} \cdot \varkappa_{med}) > g(0) \tag{26}$$

3.2 Unanimity

Let us now consider decision-making under the unanimity rule. As each citizen has the power to block any proposal for the date of stabilization, the individual with the lowest income will block any proposal until he gets his preferred level of government spending, and so the stabilization date cannot be earlier then the one chosen by this citizen. Also, it cannot occur later. The following proposition summarizes the result.

Proposition 3 *Under unanimity voting, the date of stabilization is the one chosen by the lowest income citizen in the economy:*

$$T^*_{un} = \frac{1}{\gamma} \ln \left[\frac{1}{g(0)} \cdot v'^{-1}(\theta^{-1} \cdot \underline{\varkappa}) \right] \tag{27}$$

Where $\underline{\varkappa} = \frac{\underline{y}}{E(y)}$.

Proof. The preferred date of stabilization for the lowest income citizen can be obtained by solving the following problem:

$$\max_T U_{\underline{\varkappa}}(T), \text{ s.t. } T \geq 0 \tag{28}$$

This is done through the same steps used in the proof of proposition 1. Notice that this agent has $U_{\underline{\varkappa}}(T') < U_{\underline{\varkappa}}(T^*_{un})$, $\forall\ T' < T^*_{un}$, and so he will always block any proposal which contemplates an earlier stabilization date than the one he prefers. To assure that all agents accept to stabilize at $T = T^*_{un}$, it is enough to show that:

$$\left. \frac{dU_i(T)}{dT} \right|_{T=T'} < 0, \forall\ T' > T^*_{un},\ \forall\ i$$

But,

$$\frac{dU_i(T)}{dT} < 0 \Leftrightarrow T > \frac{1}{\gamma} \ln \left[\frac{1}{g(0)} \cdot v'^{-1}(\theta^{-1} \cdot \varkappa_i) \right] = T_i^*$$

As $T' > T_{un}^* \geq T_i^*$, $\forall\ i$, this implies the desired result. ■

Therefore, unanimity voting generates a level of expenditures no lower than majority voting:

$$g(T_{un}^*) = v'^{-1}(\theta^{-1} \cdot \underline{\varkappa}) \geq v'^{-1}(\theta^{-1} \cdot \varkappa_{med}) \tag{29}$$

3.3 The optimal solution

Now, let us consider the optimal stabilization date. If we assume that the social planner's objective is to maximize the expected utility of the economy, then he solves:

$$\max_T \int U(T) f_y(y) dy, \text{ s.t. } T \geq 0 \tag{30}$$

The result is summarized in the following proposition.

Proposition 4 *The optimal stabilization date is defined by:*

$$T_{opt}^* = \frac{1}{\gamma} \ln \left[\frac{v'^{-1}(\theta^{-1})}{g(0)} \right] \tag{31}$$

Moreover, $g(T_{opt}^*) = v'^{-1}(\theta^{-1})$.

Proof. Noticing that $\int \varkappa f_y(y) dy = 1$, the social planner's problem can be written as:

$$\begin{array}{ll} \max\limits_T & \int\limits_0^T \left[\begin{array}{l} -(1-\alpha)(g(0) + rb(0)) - \\ -\alpha(g(t) + rb(t)) + \theta \cdot v(g(t)) \end{array} \right] e^{-rt} dt + \\ + & \int\limits_T^\infty \left[-\left[g(T) + rb(T) \right] + \theta \cdot v(g(T)) \right] e^{-rt} dt \\ \text{s.t.} & T \geq 0 \end{array} \tag{32}$$

This follows exactly the same steps of the proof of proposition one. $g(T_{opt}^*)$ can be obtained re-arranging equation (31), after observing that $g(T) = g(0)e^{\gamma T}$. ■

Assumption A rules out a corner solution in both the social planner's optimization problem and in the society's decision-making. This allows us to focus on delays in economic adjustments that are yet to occur.

In order to interpret equation (31), it is useful to re-write it as:

$$\theta \cdot v'(g(T^*_{opt})) - 1 = 0 \tag{33}$$

Or,

$$\frac{d}{dT}\left[\theta \cdot v(g(T))\right]|_{T=T^*_{opt}} - \frac{d}{dT}\left[g(T)\right]|_{T=T^*_{opt}} = 0 \tag{34}$$

Hence, it is optimal to stabilize when the gain generated by the increase in government expenditures for the society from delaying the stabilization is exactly offset by the increase in taxes the society has to pay in order to finance the higher level of public expenditures if she was to delay the stabilization another instant. Notice that while the social planner considers the same gain from delays as any other citizen, he takes into account just the average cost of this process in his decision-making, and not any specific cost for any individual. Therefore, whenever $\varkappa_i < 1$, agent i contributes less to finance the public good than what is paid in average by the society, and so he would desire a higher level of government expenditures than what is socially desirable.

4 Delayed stabilizations!

In this section, we compare the stabilization dates under different decision-making mechanisms. Hence, we will focus on the delay lag generated by each voting rule:

$$T^*_{med} - T^*_{opt} = \frac{1}{\gamma}\ln\left[\frac{v'^{-1}(\theta^{-1}\cdot\varkappa_{med})}{v'^{-1}(\theta^{-1})}\right] = \frac{1}{\gamma}\ln\left[\frac{g(T^*_{med})}{g(T^*_{opt})}\right] \tag{35}$$

And,

$$T^*_{un} - T^*_{opt} = \frac{1}{\gamma}\ln\left[\frac{v'^{-1}(\theta^{-1}\cdot\underline{\varkappa})}{v'^{-1}(\theta^{-1})}\right] = \frac{1}{\gamma}\ln\left[\frac{g(T^*_{un})}{g(T^*_{opt})}\right] \tag{36}$$

As the following proposition indicates, both the majority and the unanimity rules are characterized by delays in economic adjustments.

Proposition 5 *Both the majority rule and the unanimity rule delay stabilizations, but the former generates a stabilization date no higher than the latter, i.e.* $T^*_{opt} < T^*_{med} \leq T^*_{un}$. *This immediately implies that* $g(T^*_{opt}) < g(T^*_{med}) \leq g(T^*_{un})$.

Proof. Just notice that $\underline{\varkappa} \leq \varkappa_{med} < 1$ implies that $v'^{-1}(\theta^{-1} \cdot \underline{\varkappa}) \geq v'^{-1}(\theta^{-1} \cdot \varkappa_{med}) > v'^{-1}(\theta^{-1})$. ■

Majority voting

Recall that, as $\varkappa_{med} < 1$, the median voter is contributing less to finance public goods than the society. That is, all citizens have the same benefit from public goods, but those individuals whose income is below than or equal to the median face a lower cost of provision of these goods, as the tax rate used to finance them is proportional to income. Therefore, all these citizens, which constitute a majority, vote for delaying stabilizations, increasing in this way government expenditures above what would be optimal for the society, and transferring resources from the richest individuals right into them. In other words, as they have few resources to spend in consumption, they find in delaying stabilizations a way to increase their utility, at the expense of the wealthiest citizens. The richest individuals are therefore expropriated by the political system, as they end up financing this situation. Also, the higher the inequality in income distribution, the lower the cost of provision public goods for the median voter, and so the higher the stabilization lag and the expropriation faced by high income classes.[23] Moreover, once the stabilization is achieved, public expenditures tend to remain constant, but at a higher level then what would be optimal. This is precisely the prediction of the so called "ratchet effect," and may explain the upward trend and the difficulty to cut public expenditures in many countries.

The literature traces back the harmful effects of inequality in the economic environment. For example, Alesina and Rodrik (1994) and Persson and Tabellini (1994) found that inequality can lead to a lower economic growth. Acemoglu and Robinson (2001) associate it to a higher political instability and to a theory of political transitions. The relationship between inequality and government spending is also not new in the literature, and it dates back to Meltzer and Richard (1981 and 1983). More recently, Lindert (1996), Perotti (1996), Husted and Kenny (1997), and Milanovic (2000) found some evidence between inequality and government expenditures, but mainly for welfare spending.[24]

[23] The result is immediate. Just notice that:

$$\frac{d}{d\varkappa_{med}}\left(T_{med}^{cb} - T_{opt}^{cb}\right) = \frac{1}{\theta\gamma v''(g(T_{med}^{cb}))g(T_{med}^{cb})} < 0$$

[24] Gouveia and Masia (1998), however, do not support these conclusions, as they found no significative evidence to support the relationship between inequality and the size of government.

Unanimity

Here, as we have seen, any attempt to stabilize sooner than T^*_{un} faces the opposition of the poorest individual of the society. He, as all individuals, has the same benefit from public goods, but, unlike all other citizens, faces the lowest cost of adjustment, as he only pays $\delta(T) \cdot \underline{y}$ in taxes. Hence, he expropriates all other individuals by delaying reforms and letting government expenditures increase until the optimal level for him.

As observed by Spolaore (2004), stabilization under unanimity or consensus systems occurs later than in other systems, what is no surprise. However, there is a crucial difference here. In Spolaore's paper, a war of attrition is generated between the socioeconomic groups in the society, as each group deliberately decides to wait expecting that some other group concedes and bears the cost of the reform. Hence, even if the reform benefits everyone, stabilizations are deliberately delayed. In our model, once everyone agrees on the reform, that is, once the stabilization benefits everyone, there is no reason to delay it further.

5 Two Examples

In this section, we solve the model for two different functional forms of $v(g(t))$, and provide some numerical results to analyze the responsiveness of the delay lag to changes in the economic environment. In the first example, we restrict ourselves to the particular case of a logaritmic specification for $v(g(t))$, and in the second example we use a more general form of constant relative risk aversion.

Example 1 *Let the flow utility be represented by:*

$$u_i(t) = c_i(t) - y_i + \theta \cdot \ln(g(t)) \tag{37}$$

The stabilization date

In this situation, the optimal stabilization date is given by:

$$T^{*,1}_{opt} = \frac{1}{\gamma} \ln \left[\frac{\theta}{g(0)} \right] \tag{38}$$

And the optimal level of public expenditures is $g(T^*_{opt}) = \theta$. Assumption A implies that $\theta > g(0)$, and so this date of stabilization is positive. Under majority voting, the date of stabilization is:

$$T_{med}^{*,1} = \frac{1}{\gamma} \ln \left[\frac{\varkappa_{med}^{-1} \cdot \theta}{g(0)} \right] \tag{39}$$

Implying a government spending of:

$$g(T_{med}^{*,1}) = \varkappa_{med}^{-1} \cdot \theta = \varkappa_{med}^{-1} \cdot g(T_{opt}^{*,1}) \tag{40}$$

Hence, higher levels of asymmetry in income distribution generate higher stabilization dates and larger governments.

Delay lag!

It is not difficult to show that:

$$T_{med}^{*,1} - T_{opt}^{*,1} = \frac{1}{\gamma} \ln \left[\varkappa_{med}^{-1} \right] \text{ and } T_{un}^{*,1} - T_{opt}^{*,1} = \frac{1}{\gamma} \ln \left[\underline{\varkappa}^{-1} \right] \tag{41}$$

And it is immediate the relationship between asymmetries in income distribution and the delay in economic adjustments. In fact, besides the growth rate of government expenditures, delays are exclusively determined by the relative median income.

Numerical results

To get a perspective on how the date of stabilization responds to changes in the economic environment, we illustrate numerically the model for the optimal solution, and for the case of majority voting. We fix the interest rate and the discount rate at 4 percent, and normalize the GDP of the economy to 1. Also, we set the initial level of public expenditures at 35 percent of GDP, and the optimal level at 40 percent, so that it is optimal not to stabilize immediately.[25] No initial budget deficit was considered.[26] The fraction of the increase in total expenditures that is covered by issuing debt (that is, $1 - \alpha$) is set at 0.5.

Figures 1 to 3 plot the expected utility and the median voter's utility, as a function of the stabilization date, for different values of the growth rate of government expenditures (γ) and of inequality in income distribution ($\varkappa_{med}$).[27] Figure 4 plots the timing of reform as a function of inequality in income distribution, while figure 5 represents the date of stabilization as a

[25] Pevcin (2004) empirical results suggest that the optimal level of public expenditures for European countries is approximately between 36 and 42 percent of GDP.

[26] This calibration was chosen in order to assure reasonable values for the parameters as possible and to analyse how the delay lag responds to different initial situations. We do not intend to describe any particular economy with this example.

[27] For the discussion that follows, notice that $\varkappa_{med} = y_{med}$, as the GDP is normalized to one.

function of the growth rate of government spending. In what follows, we take into account that the date of stabilization is constrained by the maximum tax rate possible, that is:

$$T^* \leq T', \text{ where } T' = \{T \in \mathbb{R} : \delta(T) = 1\}$$

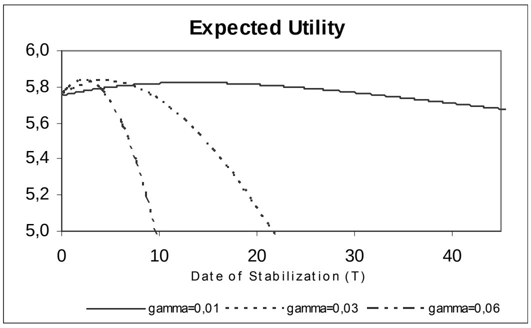

Figure 1: Expected utility for different values of the growth rate of Government expenditures ("gamma").

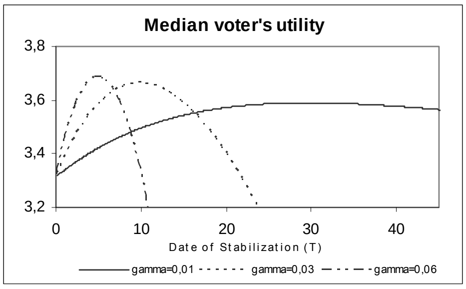

Figure 2: Median voter's utility for different values of γ ("gamma"), considering $\varkappa_{med} = 0.85$.

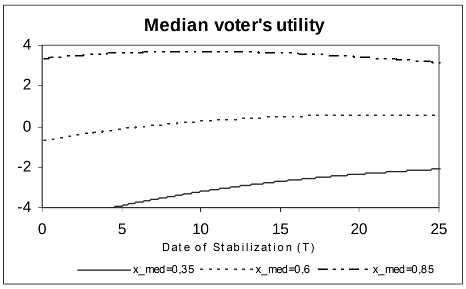

Figure 3: Median voter's utility for different values of $\varkappa_{med}$ ("x_med"), considering $\gamma = 0.03$.

Figures 1 to 3 show that immediate stabilizations are not always the best choice, neither for the social planner, nor for the median voter, as the level of expenditures is initially too low. If $\gamma = 0.03$ for instance, the optimal stabilization date would be in about 4.5 years, but, under majority voting, the stabilization date is 121 percent higher, for a median income of 85 percent,[28] what implies a government spending of 47 percent of GDP. If the median income decreases to 60 percent of GDP, then the stabilization is undertaken after 21.5 years, implying a level of government spending about 67 percent of

[28] The median income of most European countries is around 80-90 percent of GDP.

GDP. If $\varkappa_{med} = 0.35$, the restriction that imposes that the tax rate is less than 100 percent binds, and hence the median voter would like to spend all income in public goods, imposing the maximum tax rate possible.[29] This would imply a level of government expenditures of 85 percent of GDP, attained after 29 years, and all income would be devoted to pay not only these expenditures, but also the interest over the level of debt. If we decrease the growth rate of government spending to 1 percent, then both the optimal and the verified dates of stabilization would triple, but nothing else changes, namely the attained level of expenditures, as long as the tax rate restriction is not biding, as in the case presented here. Hence, the delay lag also triples. A summary of results from this numerical example may be found in appendix B.

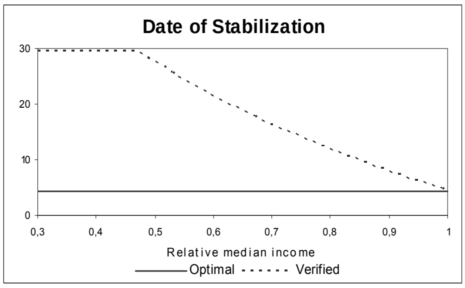

Figure 4: Date of stabilization and inequality in income distribution for $\gamma = 0.03$.

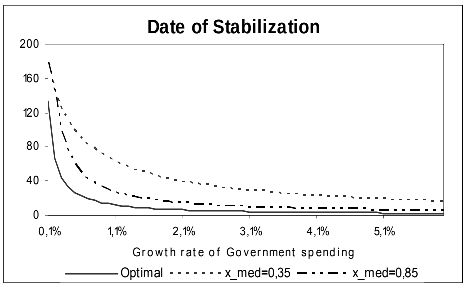

Figure 5: Date of stabilization and growth rate of Government spending.

In figure 4, we can observe the behavior of the date of stabilization, depending on the median income, for $\gamma = 0.03$. For levels of median income below 47 percent of GDP, the tax rate is at its maximum, and no further delay is possible. Also, as one should expect, as inequality decreases, the verified stabilization date approaches the optimal one. In an equalitarian society, there is no trend towards an excessive level of public expenditures. In figure 5, we plot the date of stabilization as a function of the growth rate of government spending, for two different levels of inequality. For $\varkappa_{med} = 0.35$, the tax rate restriction is always biding, and hence the society uses all her income to provide public goods, and to pay for the interest of the accumulated deficits. Notice that, even in this case, both the stabilization date under majority voting and the delay lag are decreasing.[30] If $\varkappa_{med} = 0.85$, then the tax

[29] On the contrary, Brazil and most Latin American countries have a median income about 30-50 percent of GDP.

[30] The reason for this is the following. As the growth rate of government expenditures increase, the sooner the economy reaches the tax rate restriction. Hence, it has to stabilize

rate restriction is only biding for values of γ lower than 0.002. The optimal stabilization date generates a tax rate lower than one for all values of the growth rate of government spending. Finally, observe that the gap between the optimal and the verified stabilization dates shortens as γ increases.

Example 2 *Consider now that the flow utility has a constant relative risk aversion (CRRA) specification for $g(t)$, i.e.:*

$$u_i(t) = c_i(t) - y_i + \theta \cdot \frac{g(t)^{1-\eta} - 1}{1-\eta}, \ \eta > 0, \ \eta \neq 1 \tag{42}$$

This function allows for a different sensibility of the stabilization date to inequalities in income distribution. Depending on η, this may mitigate or accentuate some results found in the previous example.

The stabilization date

The optimal stabilization date is given by:

$$T_{opt}^{*,2} = \frac{1}{\gamma} \ln \left[\frac{\theta^{1/\eta}}{g(0)} \right] \tag{43}$$

Where assumption A implies that $\theta^{1/\eta} > g(0)$. The optimal level of expenditures is then $g(T_{opt}^{*,2}) = \theta^{1/\eta}$. Under majority voting, the date of stabilization can be written as:

$$T_{med}^{*,2} = \frac{1}{\gamma} \ln \left[\frac{\left(\theta \cdot \varkappa_{med}^{-1}\right)^{1/\eta}}{g(0)} \right] \tag{44}$$

Yielding a government spending of:

$$g(T_{med}^{*,2}) = \left(\theta \cdot \varkappa_{med}^{-1}\right)^{1/\eta} = \varkappa_{med}^{-1/\eta} \cdot g(T_{opt}^{*,2}) \tag{45}$$

Delay lag!

Computing the delay lag, we have:

$$T_{med}^{*,2} - T_{opt}^{*,2} = \frac{1}{\gamma} \ln \left[\varkappa_{med}^{-1/\eta} \right] \tag{46}$$

Which is a straightforward generalization of the previous example. Observe how η influences this lag, and consequently the gap between the level of expenditures chosen by majority voting and the optimal level:

earlier.

$$\frac{d}{d\eta}(T^{*,2}_{med} - T^{*,2}_{opt}) = \frac{1}{\gamma\eta^2}\ln \varkappa_{med} < 0 \tag{47}$$

This implies that the higher the elasticity of marginal utility with respect to government expenditures, the lower the lag in the stabilization date under majority voting. Intuitively, a high η implies that the marginal utility changes very quickly when these expenditures increase. Hence, although public goods are extremely important to economic agents, their benefits dissipate very quickly, and so it does not compensate for the median voter to delay stabilizations significatively. On the other hand, a lower η originates a lesser response of the marginal utility to increases in expenditures, what may impel the median voter to choose significative delays in order to appropriate these benefits. Notice that this idea can also be expressed in the following way:

$$\frac{d}{d\eta}\left[\left|\frac{d}{d\varkappa_{med}}\left(T^{*,2}_{med} - T^{*,2}_{opt}\right)\right|\right] = -\frac{\varkappa^{-1}_{med}}{\gamma\eta^2} < 0 \tag{48}$$

That is, the absolute value of a change in the delay lag motivated by a change in the median relative income depends negatively on η. In other words, the higher the coefficient of relative risk aversion, the lower the responsiveness of the delay lag to a change in the median income.

Numerical results

We again set the same initial values for the parameters, except for θ.[31] The optimal level of public expenditures is again set to 40 percent of GDP, which imply that θ must equal 0.4^{η}. This normalization is necessary so that we can analyze the delay lag using a benchmark case which remains invariant to changes is the economy. Concerning the elasticity of marginal utility, we consider only the case of $\eta > 1$ here.[32]

This time, we do not analyze the response of the utility function to changes in the growth rate of government expenditures, because little is gained relatively to previous example, and hence we set γ at 3 percent. Instead, we inspect how different values of the coefficient of relative risk

[31] Once again, we do not intend to represent any economy, but to provide a flavor of the reaction of the stabilization date to changes in the economic environment.

[32] Recall that when η approaches one we originate the economy in the previous example. Also, as stated previously, a lower η implies a higher delay lag, and therefore considering the case of $\eta < 1$ would originate more extreme results than obtained in the previous example, what is not of much interest.

aversion may influence the date of stabilization and the shape of the utility function. This is done precisely in figures 6 to 8.[33]

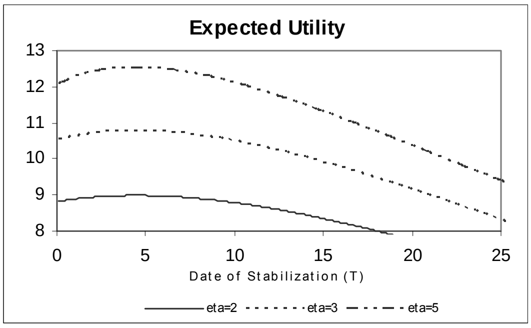

Figure 6: Expected utility for different values of η ("eta"), calibrating such that $\theta = 0.4^{\eta}$.

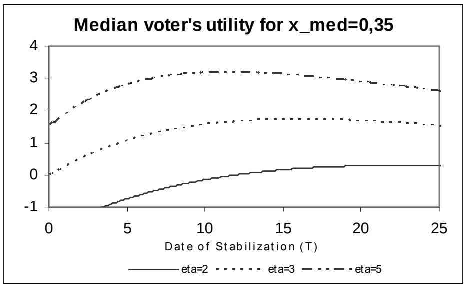

Figure 7: Median voter's utility for different values of η ("eta"), considering $\varkappa_{med} = 0.35$.

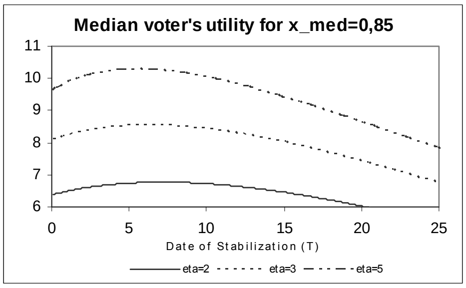

Figure 8: Median voter's utility for different values of η ("eta"), considering $\varkappa_{med} = 0.85$.

In these figures, we can see that an increase in the coefficient of relative risk aversion does not change in fact the optimal date of stabilization, but it does influence the date of stabilization chosen by the society. The higher is this coefficient, the sooner the median voter wants to stabilize, suggesting that the benefits from public spending dissipate faster, as observed before. Hence, even if the society is characterized by an extreme inequality, if $\eta = 5$, the delay lag is only 7 years, originating a government spending of 49 percent of GDP and a public debt of 41.7 percent, what contrasts with the previous example, where the delay would be maximal. With a median income of 85 percent, the delay is negligible, as it originates a government expenditure

[33]Once again, in what follows, we take into account that the stabilization dates are constrained by the maximum tax rate possible.

just slightly above the optimal one. A summary of these numerical results is presented in appendix C.

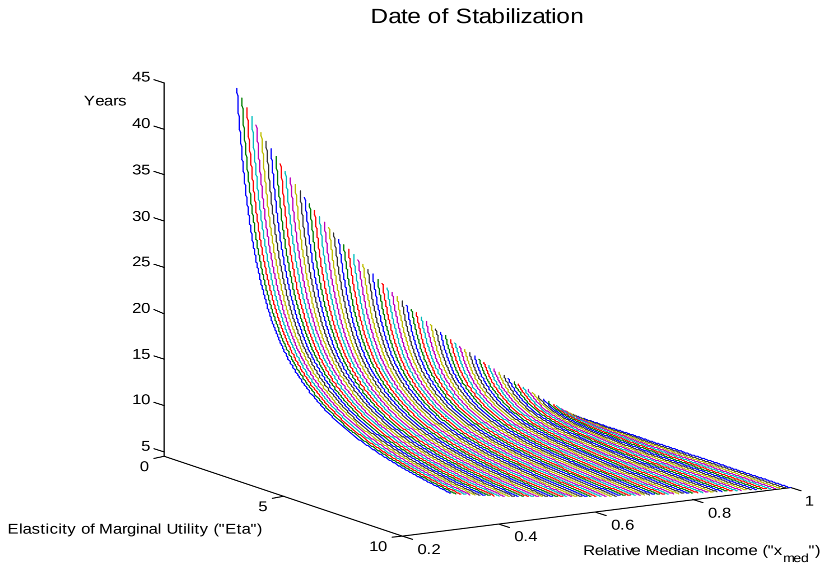

Figure 9: Date of stabilization as a function of the elasticity of marginal utility and the relative median income, for $\gamma = 0.03$. The lower plane represents the optimal stabilization date.

Finally, figure 9 shows precisely how the delay lag responds to changes in the elasticity of marginal utility and in the relative median income. We observe that the higher is this elasticity, the lower the delay and the responsiveness of the delay lag to changes in the relative median income.

6 Concluding Remarks

It is a major view in the literature that delayed debt stabilizations result from a "war of attrition", that arises between different sectors of the society, and that they can hardly subsist in other political frameworks. This paper provides an alternative explanation for the increasing pattern of debt, connecting it to a rising level of government expenditures over time, based on the median voter's hypothesis. We argued that the simple majority rule may originate excessive government expenditures, and larger debt accumulations, from an efficiency perspective, or, in other words, a delayed economic adjustment, and that higher inequalities in income distribution lead to larger delay lags. The intuition for this result is the following. If the median income is below the average, and if the tax rate is proportional to income, the median voter faces a lower cost of provision of public goods relatively to the society, while enjoying the same benefits. Hence, by delaying stabilizations and letting public expenditures grow above their optimal level, the median voter is able to expropriate the richest individuals of the society, indirectly transferring resources from these citizens to him.

We also illustrate that delays may be related to how the median voter is able to appropriate the benefits from additional expenditures in the society. If the benefits from these additional expenditures are not significative, even high levels of inequality may not originate significative delays. On the other hand, if the median voter is able to appropriate these benefits, for example, if public expenditures are devoted to redistribution policies, then delays in economic adjustments may be fairly significative.

However, some relevant issues were still left out of this exposition, such as the analysis of progressive versus regressive taxation, or the role of targeted policies (that is, policies that are directed to benefit specific groups in the society) in the timing of stabilizations. We have decided to leave these issues to be treated in a separate paper.

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7 Appendix

7.1 Appendix A: Proof of Proposition 1

First of all, recall that agent i maximizes:

$$U_i(T) = \tag{49}$$

$$= \int_0^T \left[-\varkappa_i \left((1-\alpha)\left(g(0)+rb(0)\right)+\alpha\left(g(t)+rb(t)\right)\right)+\theta\cdot v(g(t))\right]e^{-rt}dt +$$

$$+ \int_T^\infty \left[-\varkappa_i \left[g(T)+rb(T)\right]+\theta\cdot v(g(T))\right]e^{-rt}dt$$

Subject to $T \geq 0$, and where:

$$g(t) = g(0)\cdot e^{\gamma t} \tag{50}$$

And:

$$b(t) = b(0) + (1-\alpha)g(0)\left[\zeta(t;\gamma,r,\alpha) - \zeta(t;\gamma=0,r,\alpha)\right] \tag{51}$$

With:

$$\zeta(t;\gamma,r,\alpha) = \frac{e^{\gamma t}-e^{r(1-\alpha)t}}{\left[\gamma - r(1-\alpha)\right]} \tag{52}$$

$g(T)$ and $b(T)$ are given by equations (50) (51) evaluated at $t = T$.

Using the Fundamental Theorem of Calculus and the Leibniz's rule, and after a lot of extremely monotonous algebra that we do not replicate here, it can be shown that:

$$\frac{d}{dT}[U_i(T)] = \frac{\gamma}{r}g(T)e^{-rT}\left[\theta\cdot v'(g(T)) - \varkappa_i\right] \tag{53}$$

The First Order Condition yields:

$$\frac{\gamma}{r}g(T_i^*)e^{-rT_i^*}\left[\theta\cdot v'(g(T_i^*)) - \varkappa_i\right] \leq 0 \tag{54}$$

With strict equality if $T_i^* > 0$. Hence,

$$T_i^* = \begin{cases} \frac{1}{\gamma}\ln\left(\frac{v'^{-1}\left(\theta^{-1}\cdot\varkappa_i\right)}{g(0)}\right) & \text{, if } v'^{-1}\left(\theta^{-1}\cdot\varkappa_i\right) > g(0) \\ 0 & \text{, if } v'^{-1}\left(\theta^{-1}\cdot\varkappa_i\right) \leq g(0) \end{cases} \tag{55}$$

To prove that T_i^* is the unique maximizer, it is enough to show that the utility function is strictly quasiconcave, that is: $\frac{d}{dT}(E(U(T))) > 0$ if $T < T_i^*$, and $\frac{d}{dT}(E(U(T))) < 0$ if $T > T_i^*$. If $T_i^* > 0$, we have:

$$\frac{d(U_i(T))}{dT} > 0 \Leftrightarrow T < \frac{1}{\gamma}\ln\left[\frac{1}{g(0)}\cdot v'^{-1}(\theta^{-1}\cdot \varkappa_i)\right] = T_i^* \quad (56)$$

$$\frac{d(U_i(T))}{dT} < 0 \Leftrightarrow T > \frac{1}{\gamma}\ln\left[\frac{1}{g(0)}\cdot v'^{-1}(\theta^{-1}\cdot \varkappa_i)\right] = T_i^* \quad (57)$$

For $T_i^* = 0$, we simply require that $\frac{d}{dT}(U_i(T)) < 0$, $\forall\ T > 0$. This case is trivial, so we skip it.

7.2 Appendix B: Numerical results presented in example 1

1. The social planner outcome.

	case 1	case 2	case 3
Growth rate of Gov. expenditures (γ)	**0.01**	**0.03**	**0.06**
Optimal date of stabilization ($T_{opt}^{*,1}$)	13.4	4.5	2.2
Public debt ($b(T_{opt}^{*,1})$) - % GDP	17.8	5.6	2.7
Tax rate ($\delta(T_{opt}^{*,1})$) - % GDP	40.7	40.2	40.1
Optimal Gov. expenditures ($g(T_{opt}^{*,1})$) - % GDP	40.0	40.0	40.0

The social planner wants to implement the same level of public expenditures (40 percent), and hence, the higher the growth rate of government expenditures, the sooner the stabilization. Moreover, a lower γ implies a higher debt, because the interest is accumulated over more time.

2. The median voter's outcome for a relative median income of 0.85.

	case 1	case 2	case 3
Growth rate of Gov. expenditures (γ)	**0.01**	**0.03**	**0.06**
Verified date of stabilization ($T_{med}^{*,1}$)	29.6	9.9	4.9
Delay lag ($T_{med}^{*,1} - T_{opt}^{*,1}$)	16.3	5.4	2.7
Public debt ($b(T_{med}^{*,1})$) - % GDP	104	30.1	14.6
Tax rate ($\delta(T_{med}^{*,1})$) - % GDP	51.2	48.3	47.6
Verified Gov. expenditures ($g(T_{med}^{*,1})$) - % GDP	47.1	47.1	47.1

For a median income of 85 percent of GDP, the attained level of public expenditures is always the same, regardless of the rate of growth of government spending. Hence, if γ is low, the economy takes more time of stabilize, in order to reach the desired level of public expenditures by the median voter, and if γ is high, this stabilization is attained sooner. Notice however that a low growth rate may imply a huge accumulation of debt, because the economy is issuing debt to pay part of the interest that is accumulated before the stabilization takes place. Moreover, as one should expect, the delay lag is decreasing on the growth rate of government spending.

3. The median voter's outcome for growth rate of government expenditures of 3 percent.

	case 1	case 2	case 3
Median relative income ($\varkappa_{med}$)	**0.35**	**0.60**	**0.85**
Verified date of stabilization ($T^{*,1}_{med}$)	29.5	21.5	9.9
Delay lag ($T^{*,1}_{med} - T^{*,1}_{opt}$)	25.0	17.0	5.4
Public debt ($b(T^{*,1}_{med})$) - % GDP	379	174	30.2
Tax rate ($\delta(T^{*,1}_{med})$) - % GDP	100.0	73.7	48.3
Verified Gov. expenditures ($g(T^{*,1}_{med})$) - % GDP	84.8	66.7	47.1

Here, in case 1 the restriction that imposes a tax rate no higher than 100 percent binds, and hence the economy is forced to stabilize at $T = 29.5$.[34,35] Obviously, the higher the median income, the lower the attained level of government expenditures and the lower the delay lag under majority voting. In fact, with no inequality in income distribution, the optimal and verified dates of stabilization would coincide.

[34] Without this restriction, one would get $T^{cb,1}_{med} \approx 39.5$, but this would imply a tax rate of 147 percent, what is not feasible.

[35] Although not presented here, one can discover the median income above which the restriction does not bind. Any median income above 0.47 will originate a stabilization date below 29.5, and a tax rate below 100 percent. Hence, the stabilization date is constant for $\varkappa_{med} < 0.47$. See also figure 4.

7.3 Appendix C: Numerical results presented in example 2

	case 1	case 2	case 3
Elasticity of marginal utility (η)	**2**	**3**	**5**
$Theta$[36]	0.16	0.06	0.01
Optimal solution			
Optimal date of stabilization ($T_{opt}^{*,2}$)	4.5	4.5	4.5
Public debt after stab. ($b(T_{opt}^{*,2})$) - % GDP	5.6	5.6	5.6
Tax rate after stab. ($\delta(T_{opt}^{*,2})$) - % GDP	40.2	40.2	40.2
Optimal Gov. expenditures ($g(T_{opt}^{*,2})$) - % GDP	40.0	40.0	40.0
For $\varkappa_{med} = 0.35$			
Verified date of stabilization ($T_{med}^{*,2}$)	21.9	16.1	11.4
Delay lag ($T_{med}^{*,2} - T_{opt}^{*,2}$)	17.5	11.7	7.0
Public debt after stab. ($b(T_{med}^{*,2})$) - % GDP	184.0	89.6	41.7
Tax rate after stab. ($\delta(T_{med}^{*,2})$) - % GDP	75.0	60.3	51.0
Verified Gov. expenditures ($g(T_{med}^{*,2})$) - % GDP	67.6	56.8	49.3
For $\varkappa_{med} = 0.85$			
Verified date of stabilization ($T_{med}^{*,2}$)	7.2	6.3	5.5
Delay lag ($T_{med}^{*,2} - T_{opt}^{*,2}$)	2.7	1.8	1.1
Public debt after stab. ($b(T_{med}^{*,2})$) - % GDP	15.1	11.4	8.8
Tax rate after stab. ($\delta(T_{med}^{*,2})$) - % GDP	44.0	42.7	41.7
Verified Gov. expenditures ($g(T_{med}^{*,2})$) - % GDP	43.4	42.2	41.3

We set θ so that the optimal level of public expenditures is always 40 percent of GDP. Due to this normalization, η does not affect the optimal stabilization date.

[36] Recall that $\theta = 0.4^{\eta}$.