WHY ARE STABILIZATIONS DELAYED?

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ABSTRACTS

When a stabilization has significant distributional implications (as in
the case of tax increases to eliminate a large budget deficit) different
socio-economic groups will attempt to shift the burden of stabilization onto
other groups.   The process leading to a stabilization becomes a "war of
attrition", with each group finding it rational to attempt to wait the
others out.   Stabilization occurs only when one group concedes and is forced
to bear a disproportionate share of the burden of fiscal adjustment.

We solve for the expected time of stabilization in a model of
"rational" delay based on a war of attrition and present comparative statics
results relating the expected time of stabilization to several political and
economic variables.   We also motivate this approach and its results by
comparison to historical episodes.

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I. Introduction

Countries often follow policies for extended periods of time which are recognized to be infeasible in the long run. For instance, large deficits implying an explosive path of government debt and accelerating inflation are allowed to continue even though it is apparent that such deficits will have to be eliminated sooner or later. A puzzling question is why these countries do not stabilize immediately, once it becomes apparent that current policies are unsustainable and a that change in policy will have to be adopted eventually. Delays in stabilization are particularly inefficient if the longer a country waits the more costly is the policy adjustment needed to stabilize, and if the period of instability before the policy change is characterized by economic inefficiencies, such as high and variable inflation.

The literature on the pre—stabilization dynamics implied by an anticipated future stabilization (for example, Sargent and Wallace [1981], Drazen and Helpman [1987,1989]) assumes that the timing of the future policy change is exogenous.[1] Since in these models the long—run infeasibility of current policy is known from the beginning, what is missing is an explanation of why the infeasible policy is not abandoned immediately. Explanations of the timing of stabilization based on irrationality, such as waiting to stabilize until "things get really bad", are unconvincing: since the deterioration in the fiscal position can be foreseen, the argument turns on certain countries being more irrational than others. Explanations which give a key role to exogenous shocks leave unexplained both why countries do not stabilize as soon as unfavorable shocks occur and why stabilizations that are undertaken often don't seem to coincide with significant observable changes in external circumstances.

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[1]In Sargent and Wallace (1981) and Drazen and Helpman (1987) the timing of stabilization is deterministic and exogenous; in Drazen and Helpman (1989) the timing is stochastic, but the distribution of the time of stabilization is exogenous.

This paper argues that the timing of stabilizations and, in particular, their postponement cannot be understood in models in which the policymaker is viewed as a social planner maximizing the welfare of a representative individual. On the contrary, heterogeneity in the population is crucial in explaining delays in stabilization. Our basic idea is that under certain circumstances the process leading to a stabilization can be described as a "war of attrition" between different socio—economic groups with conflicting distributional objectives. This means, first, that delays in stabilization arise due to a political stalemate over distribution, and, second, that stabilization occurs when a political consolidation leads to a resolution of the distributional conflict.

More specifically, when it is agreed that stabilization requires a change in fiscal policy to eliminate budget deficits and growing government debt, there may be disagreement about how the burden of the policy change is to be shared. When socio—economic groups perceive the possibility of shifting this burden elsewhere, each group may attempt to wait the others out. This war of attrition ends and a stabilization is enacted when certain groups "concede" and allow their political opponents to decide on the allocation of the burden of fiscal adjustment. Concession may occur via legislative agreement, electoral outcomes, or (as is often observed) ceding power of decree to policymakers.

We present a simple model of delayed stabilization due to a war of attrition and derive the expected time of stabilization as a function of characteristics of the economy, including parameters meant to capture, in a very rough way, the degree of political polarization. For example, the more uneven is the expected allocation of the costs of stabilization when it occurs, the later is the expected date of a stabilization. Hence, if unequal distribution of the burden of taxation is an indicator of political polarization, more politically polarized countries will

experience longer periods of instability.[2] More institutional adaptation to the distortions associated with instability also implies later expected stabilization, while partial attempts to control the deficit prior to a full stabilization may make the expected time of full stabilization either earlier or later. We further show that if it is the poor who suffer most from the distortions associated with high government deficits and debt, they may bear the largest share of the costs of stabilization.[3] We also discuss the relation of the distribution of income to the timing of stabilization and show conditions for a more unequal distribution to imply either an earlier or a later expected date of stabilization.

Our approach is related to the literature on dynamic games between a monetary and a fiscal authority with conflicting objectives (Sargent [1986], Tabellini [1986,1987], Loewy [1988]). In that literature a "war of attrition" is played between the two branches of government: an unsustainable combination of monetary and fiscal policies is in place until one side concedes. Our shift in emphasis to a game between interest groups has several justifications. First, the assumption that the monetary authority is independent of the fiscal authority is unrealistic for most countries with serious problems of economic instability. Second, the difference in the objective functions of different branches of government may be related to their representing different constituencies; here we tackle issues of heterogeneity directly.[4] Finally, by explicitly modelling distributional conflicts, we can derive results relating the timing of stabilization to

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[2]The effects of political instability on the path of government debt is studied in a different framework by Alesina and Tabellini (1987,1989), Tabellini and Alesina (1989), and Persson and Svensson (1989).

[3]In contrast, a model with heterogeneity, but with a social planner or benevolent government would predict that the burden of costs of stabilization would be more equitably distributed.

[4]Rogoff (1985) has suggested that it may be optimal to appoint a Central Banker with preferences which do not coincide with social preferences. In this case, however, the Central Bank's preferences would be known by the public, while a war of attrition requires uncertainty about an opponent's characteristics.

economic and political characteristics of different economies.

The paper is organized as follows. Section 2 summarizes some regularities observed in a number of stabilizations which suggest using a war of attrition as a model. Section 3 presents a specific stylized model of the process leading to a stabilization based on the empirical observations and shows how delays result from individually rational behavior. Section 4 presents comparative static results on how the expected date of stabilization is affected by changes in the economy's characteristics. The final section presents conclusions and suggests extensions.

II. Delayed Stabilization as a War of Attrition

No single model can explain every episode of delay in enacting a macroeconomic stabilization. Historical evidence suggests, however, that in a large number of hyperinflations, it was disagreement over allocating the burden of fiscal change which delayed the adoption of a new policy. We begin by noting common features of the stabilization process across several episodes, features which suggest modelling stabilization as a war of attrition.

1. There is agreement over the need for a fiscal change, but a political stalemate over how the burden of higher taxes or expenditure cuts should be allocated. In the political debate over stabilization, this distributional question is central.

Sharp disagreements over over allocating the burden of paying for the war were common in the belligerent countries after World War I (Alesina [1988], Eichengreen [1989]). For example, in France, Germany, and Italy, the political battle over monetary and fiscal policy was not over the need for reducing large budget deficits, but over which groups should bear the higher taxes to achieve that end. Parties of the right favored proportional income and indirect taxes; parties of the left favored capital levies and more progressive income taxes (Haig [1929].

Maier [1975]). Though Britain after the war also faced a problems of fiscal stabilization, the dominant position of the Conservatives led to a rapid stabilization by means which favored the Conservatives' traditional constituencies. Once the need for sharply restrictive aggregate demand policies to end the Israeli inflation was widely accepted,[5] there was still a stalemate over distribution: specifically, there was an unwillingness by labor to accept sharp drops in employment and real wages.

2. When stabilization occurs it coincides with a political consolidation. Often, one side becomes politically dominant. The burden of stabilization is sometimes quite unequal, with the politically weaker groups bearing a larger burden. Often this means the lower classes, with successful stabilizations being regressive.

The successful stabilizations in France (1926) and Italy (1922−24) coincided with a clear consolidation of power by the right. In both cases, the burden fell disproportionately on the working class (Haig [1929], Maier [1975]).

The German stabilization of November 1923 followed a new Enabling Act giving the new Stresemann government power to cut through legislative deadlocks and quickly adopt fiscal measures by decree. Though the government which took power in August was a "Grand Coalition" of the right and the left, by autumn "the far right was more dangerous and powerful than the socialist left" and government policy reflected the perceived need to appease conservative interest groups (Maier [1975], pp. 384−6).

The Israeli stabilization also occurred with a National Unity government in power; more importantly, what distinguished the July program from earlier failed attempts was the heavier

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[5]In the early 1980's there was substantial disagreement over whether high inflation was due to fiscal problems, or to "bubbles" or other factors suggesting a direct attack on expectations.

burden it would place on labor. On the other side, the failure of Argentina to stabilize in the face of endemic inflation has gone hand in hand with continued political polarization and instability and the failure of any group to consolidate its power effectively (Dornbusch and DePablo[1988]).

3. Successful stabilizations are usually preceded by several failed attempts; often a previous program appears quite similar to the successful one.

In a war of attrition the cost of waiting means that the passage of time will imply concession on the same terms that a player earlier found "unacceptable". The components of the successful Poincare stabilization of 1926 are quite similar to his program of 1924. Several unsuccessful attempts in Germany appear quite similar ex ante to the November 1923 program (Dornbusch [1988]). Many aspects of the July 1985 stabilization in Israel had been previously proposed, but rejected by the government.

To summarize, the central role of conflict over how the burden of stabilization is to be shared; the importance of political consolidation in the adoption of a program; and the fact that programs which were previously rejected are agreed to after the passage of time suggests modelling delayed stabilization as arising from a war of attrition between different socio–economic groups.

In the basic war of attrition model from biology, two animals are fighting over a prize. Fighting is costly, and the fight ends when one animal drops out, with the other gaining the prize. Suppose that the two contestants are not identical, either in the costs of remaining in the fight or in the utility they assign to the prize. Suppose further that each contestant's value of these is known only to himself, his opponent knowing only the distribution of these values.

The individual's problem is to choose a stopping time based on his type, that is, the value of his costs and payoffs, on the distribution of his opponent's possible type, and on the knowledge that his opponent is solving the same choice problem. That is, he chooses a time to concede if his opponent has not already conceded. In equilibrium the time of concession is determined by the condition that at the optimal time, the cost of remaining in the fight another instant of time is just equal to the expected gain from remaining, namely the probability that the rival drops out at that instant multiplied by the gain if the rival concedes. At the beginning of the contest the gain to remaining exceeds the gain to dropping out, as there is some probability that one's opponent is of a type that drops out early. The passage of time with no concession on his part conveys the information that this is not the case, until one's own concession occurs according to the above criterion.

For a war of attrition between heterogeneous individuals to give expected finite delay in concession under incomplete information, two obvious features are important. First, there must be a cost to remaining in the fight, that is to not conceding. Second, the payoff to the winner must exceed that to the loser. In the next section we show how stabilizations may be modelled with these features in mind.

II. The Model

We consider an economy as in Drazen and Helpman (1987,1989) in which the government is running a positive deficit (inclusive of debt service) implying growing government debt.[6] Stabilization consists of an increase in taxes which brings the deficit to zero, so that government debt is constant. We assume that prior to an agreement on how to

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[6]Since we are considering an economy with constant output, this is equivalent to a rising debt—to—GNP ratio.

share the burden of higher taxes, the government is limited to highly inefficient and distortionary methods of public finance.[7] In particular, monetization of deficits, with the associated costs of high and variable inflation, is often a main source of government revenue prior to a fiscal stabilization. The level of distortionary financing, and hence the welfare loss associated with it, rises with the level of government debt. These welfare losses may differ across socio—economic groups: for example the poor may have far less access to assets which protect them against inflation.[8]

A second type of cost to continuing in a war of attrition is more directly political. For a group to prevent the burden of a stabilization being placed on it, it must mobilize and use resources for lobbying activities to influence the outcome of the legislative or electoral process. Different groups may differ in their political influence and therefore in the level of effort needed to continue fighting the war of attrition. We develop the model stressing the first interpretation of pre—stabilization costs, but will return to political interpretations in the concluding section.

The benefit of stabilization derives from the move away from highly distortionary methods of financing government expenditures. In this respect, stabilization benefits everybody. The differential benefits reflect the fact that the increase in nondistortionary taxes is unequally distributed.

Concession in our model is the agreement by one side to bear a disproportionate share of

[7]Cukierman, Edwards , and Tabellini (1989), for example, argue that unstable LDC's often exhibit highly inefficient fiscal systems in which it is extremely difficult to raise standard income taxes, leading to reliance on inflation and very wasteful forms of taxation.

[8]The view that the utility loss from living in an unstabilized economy flows from the use of distortionary financing of part of the government deficit raises an obvious question: why not simply accumulate debt until an agreemwnt can be reached on levying less distortionary taxes? We suggest there may be constraints on the rate of growth of the debt, especially if it is external, but do not model this here.

the tax increase necessary to effect a stabilization. Interpreted literally, the notion of
concession which ends the war of attrition is not observed. However, as the examples in the
previous section illustrate, effective concession may be reflected in a formal agreement between
the various sides, as in the Israeli case; in the the formation of a new government which is given
extraordinary powers, as in the French or German cases; or in the outcome of elections in which
one side gains a clear majority, and opposing groups decide not to block their program any
longer.[9]

More formally, consider a small open economy which issues external debt to cover any
deficits not covered by printing money. The economy is composed of a number of
heterogeneous interest groups which differ from one another in the welfare loss they suffer from
the distortions associated with the pre–stabilization methods of government finance. We will
first specify government behavior, then the maximizing behavior of interest groups. This
characterizes the war of attrition leading to a stabilization. From this process we can derive an
endogenous distribution of time of stabilization.

Until $t = 0$ the government budget is balanced, with external government debt
constant at level $b_0 \geq 0$. At $t = 0$ a shock hits reducing available tax revenues. From $t = 0$
until the date of stabilization a fraction of the deficit $1 - \gamma$ is covered by issuing debt and a
fraction γ by distortionary taxation. (Though the economy is non–monetary, a major type of
distortionary taxation is inflation arising from printing money.) What is important for us is
not that γ is fixed, but that it is positive. Calling g_0 the level of expenditures after $t = 0$,
debt $b(t)$ evolves according to

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[9]Elections may give one side a clear mandate not because its opponents have conceded on their
distributional objectives, but because a majority of voters see that side as more competent to
handle an economic crisis.

(1) $$\dot{b}(t) = (1-\gamma)(rb(t) + g_0)$$

where r is the world interest rate, assumed to be constant. This may be solved to yield

(2) $$b(t) = b_0 e^{(1-\gamma)rt} + \frac{g_0}{r}(e^{(1-\gamma)rt} - 1) .$$

Defining $\bar{b} \equiv b_0 + \frac{g_0}{r}$, taxes before a stabilization are

(3) $$\tau(t) = \gamma(rb(t) + g_0) = \gamma r \bar{b} e^{(1-\gamma)rt} .$$

A stabilization consists of an increase in taxes sufficient to prevent further growth in the debt. Hence taxes to be levied at the date of stabilization T are

$$\tau(T) = rb(T) + g_T ,$$

where g_T is the level of expenditures after a stabilization. If we assume for simplicity that $g_T = g_0$, we have from (2)

(4) $$\tau(T) = r\bar{b} e^{(1-\gamma)rT} .$$

An agreement to stabilize is an agreement on how the taxes $\tau(T)$ are to be apportioned between different interest groups. For simplicity assume there are only two groups (an assumption easily generalized). The "stabilizer" assumes a fraction $\alpha > 1/2$ of the tax burden

at T, the "non–stabilizer" a fraction $1 - \alpha$. The fraction α itself is not bargained on: it is a given parameter meant to capture the degree of polarization in the society. A value of α close to one represents a high degree of polarization or a lack of political cohesiveness.

Taxes after a stabilization are assumed to be non–distortionary. What is important is that they are less distortionary than taxes before a stabilization. In fact, if taxes after a stabilization were equally distortionary, there would in general be no incentive to concede, that is, to stabilize.

Infinitely–lived groups may differ from one another in two respects. One is their flow endowment of income y_i. The second is the utility loss they suffer due to distortionary taxes. Let us index group i's loss by θ_i, where θ is drawn from a distribution $F(\theta)$, with lower and upper bounds $\underline{\theta}$ and $\bar{\theta}$. What is critical is that θ_i is known only to the group itself, other groups knowing only the distribution $F(\theta)$. The results on delayed stabilization are consistent with a functional relation between y_i and θ_i, as long as θ_i cannot be inferred. (For example with uncertainty about the marginal utility of income.) For simplicity we assume that the utility loss from distortionary taxes, K_i, is linear in the level of taxes, namely[10]

$$(5) \qquad K_i(t) = \theta_i \tau(t) .$$

The flow utility of group i is linear in consumption and is of the form

$$(6) \qquad u_i(t) = c_{it} - y_i - K_i ,$$

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[10] We could adopt a more general specification for K_i, such as

$$K_i(t) = \theta_i(\tau(t))^{1+m} \quad \text{with } m > 0.$$

The qualitative features of our results do not change with this more general specification. The differences will be emphasized below.

where c is consumption. (Subtracting y_i is simply a normalization.) After a stabilization K_i = 0, as taxes after a stabilization are assumed to be non–distortionary. We suppress the i subscript on the function u_i. If θ_i is independent of y_i, distribution of income does not affect the timing of stabilization. We consider the alternative case in section IV.

The objective of each group is to maximize expected present discounted utility by choice of a time path of consumption and a date to concede and agree to bear the share α of taxes if the other group has not already conceded. Let us denote flow utility before a stabilization by $u^D(t)$ and the lifetime utility of the stabilizer and the non–stabilizer from the date of stabilization onward by $V^S(T)$ and $V^N(T)$ respectively. Lifetime utility of the stabilizer and the non–stabilizer if stabilization occurs at time T may then be written as

$$(7) \qquad U^j(T) = \int_0^T u^D(x)e^{-rx}dx + e^{-rT}V^j(T) \qquad j = S,N.$$

Expected utility as of time zero as a function of one's chosen concession time T_i is the sum of $U^N(T)$ multiplied by the probability of one's opponent conceding at T for all $T < T_i$ and $U^S(T_i)$ multiplied by the probability of one's opponent not having conceded by T_i. If we denote by $H(T)$ the distribution of an opponent's optimal time of concession (this is of course endogenous and will be derived below) and by $h(T)$ the associated density function, expected utility as a function of T_i is

$$(8) \qquad EU(T_i) = (1 - H(T_i))U^S(T_i) + \int_0^{T_i} U^N(x)h(x)dx$$

$$= (1 - H(T_i)) \left[\int_0^{T_i} u^D(x) e^{-rx} dx + e^{-rT_i} V^S(T_i) \right]$$
$$+ \int_{x=0}^{x=T_i} \left[\int_0^x u^D(z) e^{-rz} dz + e^{-rx} V^N(x) \right] h(x) dx$$

The time path of consumption and T_i are chosen to maximize (8).

With linear utility any consumption path satisfying the intertemporal budget constraint with equality gives equal utility. Denote by c^D, c^S, and c^N consumption before a stabilization, after a stabilization for the "stabilizer", and after a stabilization for the "non–stabilizer" respectively. Assuming that each of the two groups pays one–half of taxes before a stabilization, we have the lifetime budget constraints

$$(9) \qquad \int_0^T c^D(x) e^{-rx} dx + \int_T^\infty c^S(x) e^{-rx} dx =$$
$$\int_0^T (y - \tfrac{1}{2} \gamma r \overline{b}(x)) e^{-rx} dx + \int_T^\infty (y - \alpha r \overline{b} e^{(1-\gamma)rT}) e^{-rx} dx$$

$$(10) \qquad \int_0^T c^D(x)_e^{-rx} dx + \int_T^\infty c^N(x) e^{-rx} dx =$$
$$\int_0^T (y - \tfrac{1}{2} \gamma r \overline{b}(x)) e^{-rx} dx + \int_T^\infty (y - (1-\alpha) r \overline{b} e^{(1-\gamma)rT}) e^{-rx} dx.$$

The following consumption path is then clearly feasible

$(11a) \qquad c^D(t) = y - \tfrac{\gamma}{2} r \overline{b} e^{(1-\gamma)rt} \qquad\qquad 0 \le t < T$

$(11b) \qquad c^S(t) = y - \alpha r \overline{b} e^{(1-\gamma)rT} \qquad\qquad t \ge T$

(11c) $c^N(t) = \dot{y} - (1-\alpha)r\bar{b}e^{(1-\gamma)rT}$ $t \geq T$.[11]

Flow utility before a stabilization is then

(12) $$u_i^D(t) = -\frac{\gamma}{2}r\bar{b}e^{(1-\gamma)rt} - K_i$$
    $$= -\gamma r(\frac{1}{2} + \theta_i)\bar{b}e^{(1-\gamma)rt}$$

which is the income effect of taxes plus the welfare loss arising from taxes being distortionary. (Note that we assume that the distortionary cost to each group depends on the total level of distortionary taxes.)

With constant consumption after a stabilization, discounted utility V^j $(j = N,S)$ is simply constant flow utility for each group divided by r. Using (11) and (6) (with $K_i = 0$) one immediately obtains

(13) $$V^N(T) - V^S(T) = (2\alpha - 1)\bar{b}e^{(1-\gamma)rT}$$

which is the present discounted value of the excess taxes that the stabilizer must pay relative to the non–stabilizer.

We are now ready to determine T_i, the optimal concession time for a group with cost θ_i.[12] Since we do not know the distribution $H(T)$, we cannot use (8) directly. However, by showing that T_i is monotonic in θ_i, we can derive the relation between $H(T)$ and the known

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[11]Formally, a solution does not require consumption to be non–negative at each point; it is only required that at each point at which an individual does not concede, the utility from remaining is higher than the utility from dropping out. With a standard concave utility function the solution would have the property of no concession requiring non–negative consumption.

[12]This derivation of the symmetric equilibrium follows Bliss and Nalebuff (1984).

$F(\theta)$, namely $(1-H[T(\theta)]) = F(\theta)$. We therefore first establish

<u>LEMMA 1</u>: The optimal concession time for group i is monotonically decreasing in θ_i, that is $T_i'(\theta_i) < 0$.

   Proof: See Appendix.

We now want to find a symmetric equilibrium where each group's concession behavior is described by a monotonically increasing function $T(\theta)$. The idea here is to show that there exists a Nash equilibrium where if all other groups are behaving according to $T(\theta)$ group i finds it optimal to concede according to $T(\theta)$, and to characterize $T(\theta)$.[13] Having done that, the expected time of stabilization is the expected minimum T, with the expectation taken over $F(\theta)$.

<u>PROPOSITION 1</u>: There exists a symmetric Nash equilibrium with each group's optimal behavior described by a concession function $T(\theta)$, where $T(\theta)$ is implicitly defined by

(14) $$T'(\theta) = -\frac{f(\theta)}{F(\theta)} \frac{(2\alpha - 1)/r}{\gamma(\theta + \frac{1}{2} - \alpha)}$$

and the boundary condition

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[13]There may also be assymetric equilibria (that is, where groups behave according to different $T(\theta)$) even though each group's θ is known to be drawn from the same distribution $F(\theta)$. We do not investigate them and restrict our attention to the symmetric equilibrium. Of course, if different groups' endowments are perceived to be drawn from different distributions, each group will have a different $T_i(\theta)$. See, for example, Fudenberg and Tirole (1987).

(15) $T(\overline{\theta}) = 0.$

Proof: See Appendix

To understand the nature of the optimal strategy, we may write (14) as

(16) $\left[-\frac{f(\theta)}{F(\theta)} \frac{1}{T'(\theta)} \right] \frac{2\alpha - 1}{r} = \gamma(\theta + \frac{1}{2} - \alpha) \ .$

The right hand side is the cost of waiting another instant to concede. The left—hand side is the expected gain to waiting another instant to concede, which is the product of the conditional probability that one's opponent concedes (the hazard rate, in brackets) multiplied by the gain if the other group concedes. Concession occurs when the (group—specific) cost of waiting just equals the expected benfit from waiting. This is a standard result in the war of attrition.

Equation (16) is also useful in understanding the evolution of the war of attrition from the viewpoint of one side. Consider a group with $\theta > \overline{\theta}$. At time zero there is some probability that it's opponent has $\theta = \overline{\theta}$ and will concede immediately. Formally, with $f(\overline{\theta}) > 0$, the left—hand side of (16) is infinite, so the group does not concede. If no one concedes at time zero, both sides know their opponent is not type $\overline{\theta}$. At the "next" instant the next—highest type concedes, and so on, so as time passes each side learns that its opponent is not of cost above a certain level. When the conditional probability of an opponent's concession in the next instant (based on what the group has learned about his highest possible cost) is such that (16) just holds, its time to "throw in the towel."

Given concession times as a function of θ, the expected date of stabilization is then the

expected minimum T, the expectation taken over $F(\theta)$. With n players the probability that a given θ is the maximum (so that $T(\theta)$ is the minimum) is its density $f(\theta)$ multiplied by the probability that no other θ is higher, namely $(F(\theta))^{n-1}$, multiplied by n. With $n = 2$, the expected value of minimum T, that is, the expected time of stabilization T^{SE}, is thus

$$(17) \qquad T^{SE} = 2 \int_{\underline{\theta}}^{\overline{\theta}} T(x)F(x)f(x)dx.$$

As long as all participants in the process initially believe that someone else has may have a higher θ, stabilization does not occur immediately. The cumulative distribution of stabilization times T is therefore one minus the probability that every group has a θ lower than the value consistent with stabilization at T. With two groups this is

$$(18) \qquad S(T) = 1 - (F(\theta[T]))^2$$

where $\theta(T)$ is defined by $T(\theta) = T$.

Two observations are useful in helping to explain the key role of heterogeneity. Consider first what the model would imply if all groups were identical, that is, if we considered a representative agent model. If we interpret this as there being a single agent, he knows with probability one that he will be the stabilizer. Since u^D is negative, equation (8) implies that expected utility is maximized by choosing T_i equal to zero, that is, by stabilizing immediately. Intuitively, if an individual knows that he will end up bearing the cost of a stabilization, a cost to waiting implies that it is optimal to act immediately.

Heterogeneity alone is not sufficient, however, to explain why stabilization is postponed. There must also be uncertainty about the cost to waiting of other groups. If it is known to all

that a group has higher costs than anyone else, optimal behavior will imply that this group concedes immediately. Intuitively, stabilization is postponed because each interest group believes in the possibility that another group will give up first. As time passes and this expectation is not realized, one group finally concedes.

It is also interesting to compare the sense in which stabilization becomes "inevitable" .here to the sense used in Sargent and Wallace (1981) and Drazen and Helpman (1987,1989). In those papers a positive deficit (exclusive of debt service) implies that government debt is growing faster than the rate of interest, so that its present value is not going to zero. The failure of this transversality condition to hold, and hence the long—run infeasibility of the path, is what makes stabilization inevitable. In our model the war of attrition ends in finite time with a stabilization, even if the path of the debt is technically feasible, that is, even if it grows less fast than the rate of interest. Hence our approach indicates why countries whose policies are technically feasible (present discounted value of the debt goes to zero) will eventually stabilize if current policies involve welfare loss.[14]

IV. Comparative Statics

We can now ask how various changes in the parameters or distributions affect the expected time of a stabilization. Our goal is to see if observable characteristics of economies explain why some countries stabilize sooner than others. We present these results in a number of propositions, and explain each result intuitively. Proofs are in the appendix.

PROPOSITION 2: Higher Distortionary Taxes or Monetization

When the utility loss from distortionary taxation is proportional to the level of taxes, financing

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[14]Nalebuff (1982) discusses the war of attrition with a fixed endpoint.

a greater fraction of the pre—stabilization deficit via distortionary taxation (a higher γ) implies an earlier date of stabilization.

This result may seem initially surprising, for it says that an attempt to control the growth of government indebtedness may actually hasten the date of stabilization. A higher γ on the one hand implies a greater distortion for a given deficit, inducing players to concede earlier. However, making more of an effort to reduce the deficit implies that government debt grows less fast and hence the distortions which induce stabilization also grow less fast. The reason the first effect dominates is that our proportional specification in (5) implies that both the gain from being the non—stabilizer and the loss from no stabilization are proportional to the size of the debt, so that a slower growth of the debt does not in itself change their relative magnitudes.[15] Higher monetization, for example, has the effect of raising the cost of living in the unstabilized economy relative to the gain from having another group stabilize at each point in time. This result is consistent with the idea that is is easier to stabilize hyperinflations than inflations which are "only" high.

PROPOSITION 3: Higher Costs of Distortions

An increase in the costs associated with living in an unstabilized economy, for an unchanged distribution of θ, will move the expected date of a stabilization forward.

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[15]When the utility loss from distortionary taxation rises more than proportionally with the level of taxes (as in footnote 10), the effect of slower growth of the deficit may dominate. It can be shown (details are available) that low θ groups will concede later, so that if it happens that both groups have low θ, increased γ will mean a later date of stabilization.

Countries with institutions that lessen the utility loss from distortionary financing of government expenditures (such as indexation) will, <u>other things equal</u>, be expected to postpone stabilization longer. The caveat here is that increased indexation may induce greater monetization or higher prices for a given level of monetization. This appears relevant for the Israeli case.

If the utility loss is an increasing (perhaps convex) function of inflation, a sharp acceleration of inflation will lead to a stabilization. This would explain the timing of the French and German stabilizations.

PROPOSITION 4: <u>Lower Political Cohesion</u>

If $\alpha = 1/2$ stabilization occurs immediately; the larger is α above $1/2$, the later is the expected date of stabilization.

The difference in the shares of the burden of stabilization, α, could be interpreted as representing the degree of political cohesion in the society. Countries with α close to $^1/_2$ can be characterized as having high political cohesion in that the burden of stabilization is shared relatively equally, while those where the burden is very unequal, so that α is close to one, are more polarized or less cohesive. When the relative burden of a stabilization is very unequally distributed, the gain to waiting in the hope that one's opponent will concede is larger. Hence each group holds out longer.

This intuitive result suggests a relationship between certain measures of political stability and macroeconomic outcomes. Roubini and Sachs (1989a,b) argue that governments composed of large, short–lived, and uncohesive coalitions are associated with large budget deficits. They construct an index of political cohesion and stability in the government and

show a strong correlation between that index and budget deficits after 1973 in several industrial countries. One explanation of this finding consistent with our model concerns reaching decisions within the coalition. Large coalitions of politically diverse parties find it particularly hard to reach agreement on how allocate tax increases or expenditure cuts among the constituencies represented by coalition partners. In the absence of such agreement, deficits grow.

It should be emphasized, however, that empirical correlations between political and economic instability do not establish causation in one direction. Though we emphasize a causal link from political to economic instability, there may of course be causal kinks in the opposite direction.[16]

Greater dispersion in the distribution of income or resources can affect the timing of stabilization if a group's cost θ is a function of its income. Since delayed stabilization requires relative cost be unknown to other groups, this means that relative positions in the income distribution must be unknown. We find such an assumption somewhat problematic. An increase in income inequality may itself make relative positions apparent, leading to an immediate stabilization.

If one is willing to accept uncertainty about relative income, naive intuition suggests that a mean—preserving spread in the distribution of income will lead to an earlier date of stabilization, since it means some group will have a higher cost and thus concede earlier. Such reasoning is incomplete, for it ignores the change in behavior (that is, in the function $T(\theta)$) induced by the change in the distribution of costs. The fatter upper tail for costs, means that each group perceives a higher likelihood that its opponents' costs have increased. This

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[16]For a recent insightful study of economic determinants of political instability, see Londegran and Poole (1989).

perception would lead it to hold out longer. When will this latter effect dominate, so that a greater dispersion in income could lead to later expected stabilization?

PROPOSITION 5: Income Dispersion and Longer Delays in Stabilizing

If the utility loss due to distortionary taxes is a decreasing, convex function of income, and income is unobservable, a mean—preserving spread in the distribution of income $G(y)$ that keeps the expected minimum of the y's constant implies a later expected date of stabilization.

Note that if $\theta'(y) < 0$, it is the "poor" who stabilize, since the "rich" suffer from the distortions arising from budget deficits less and thus can hold out longer. The crucial assumption of uncertainty about income is perhaps more reasonable under the second interpretation of costs in section II, namely as resources that must be devoted to the political process to avoid bearing a disproportionate share of the burden of stabilization. y_i would then be resources available for political purposes. With uncertainty both about the relative political skills of groups and about what fraction of their resources they are willing to devote to the political struggle, assuming uncertainty about relative "income" seems more defensible.

An empirical finding consistent with Proposition 5 is presented by Berg and Sachs (1988), who find a strong empirical relation between the degree of income inequality and the frequency of debt rescheduling. Countries with a more unequal income distribution have experienced more difficulties in servicing their external debt. Although this evidence is not directly related to the timing of stabilization policies, it is consistent with the idea that countries with more income inequality will, at a given level of debt, find it more difficult to adopt policies necessary to insure solvency and service the debt.

IV. Extensions

    We have presented a model showing how delayed stabilization can be explained in a model of rational heterogeneous agents. In contrast, the same model with a rational representative individual would yield immediate stabilization. Since we summarized many of the results in the introductory section, we conclude first by discussing some generalizations and second by touching on some issues which the model did not address but which are important in explaining stabilization.

    First, we used the example of tax increases made necessary by budget deficits inducing a war of attrition because it is particularly relevant for hyperinflations. Our argument is far more general. Any policy change with strong distributional consequences can give rise to a war of attrition.

    Second, for simplicity we considered a case where there was no change in external circumstances following the original shock. More generally, once a war of attrition has been going on, a change in the environment (including aid or intervention from abroad) may lead to a change in agents' behavior and rapid concession by one side. Even (or especially) when this change is forseen, the war of attrition is crucial in the delay of stabilization until the external change.

    A third generalization is a more precise formalization of the political process leading to stabilization. In particular, this would lead to a more satisfactory characterization of the political costs involved in sheltering oneself from bearing the burden of stabilization. As in the model above, such costs may increase with the size of the outstanding debt: as the difference between payoffs to winners and losers rise, as a result of the growing level of the debt, each side should be willing to expend more time and resources in activities such as lobbying to induces its rivals to concede. Since different groups differ in their political influence or access to resources,

such direct political costs will be central to the timing of concession. We did not model this formally, since the simplicity of our model depended on costs being simply proportional to current taxes, an assumption which appears difficult to justify for political costs. Nonetheless we think political costs are no less important than costs of distortions in the war of attrition.

A political model also suggests alternative interpretations of some of our results. For example, in Proposition 3, the effect of a shift in θ could be interpreted as follows. Countries with political institutions which make it relatively more difficult for opposing groups to "veto" stabilization programs not ot their liking will stabilize sooner.

Finally, let us note some issues we did not discuss. First, delays in successful stabilization are related to the issue of failed stabilization and hence to what determines the probability of success. Sargent (1982,1984) identified "credibility" as a crucial ingredient of success, where a "credible" stabilization is program is one in which a "strong" policymaker is firmly committed to the plan and is not likely to give in to pressure to abandon fiscal responsibility and revert to inflationary finance. If the public is uncertain about the degree of commitment of the policymaker to fiscal responsibility, success is seen to be less likely.[17] Dornbusch (1988) criticizes this notion of credibility because of a lack of predictive power, arguing that successful and unsuccessful programs often appear quite similar ex ante. As examples, he refers to Poincare's successful 1926 stabilization in comparison with his unsuccessful 1924 attempt, and to the several unsuccessful attempts in Germany prior to the November 1923 program.

In our model Sargent's notion of credibility plays no role. Instead our model suggests that stabilizations need not be associated either with a sharp change in external circumstances.

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[17]Backus and Driffill (1985), Barro (1986), and Tabellini (1988) study dynamic games in which the public is uncertain about whether a policymaker is "strong" or "weak".

nor with the program being implemented looking sharply different than what had previously been proposed. A program which was unsuccessful at one point in time may later be successful (thus "credible" in Sargent's words) simply due to the passage of time. In the war of attrition, passage of time and the accumulation of costs leads one group to give in and make a previously rejected program economically and politically feasible.

Second, in reality successful stabilizations are not one–shot affairs. One component of success is designing how the adjustment process should be spread out over time. Our notion of timing was in the timing of the beginning of a successful program, not of the timing of its stages once it has begun. On a basic level, these could be separated, with this paper addressing the question of why significant policy changes, multistage or otherwise, are delayed. In fact, since stabilization takes time, programs often appear successful for a period of time, only to subsequently fail. Hence, the issue of delayed stabilization should ideally be considered simultaneously with issues of both partial and multistage stabilizations.

Finally, we have not explicitly considered important political events such as elections. The timing of elections may be related to the timing of stabilizations. An electoral result favorable to one side may make it far more difficult for their opponents to block their programs and shelter themselves from the costs of stabilization. Thus, one might expect successful stabilizations following elections with a clear winner. In the terminology of our model, a clear electoral result may be an important signal of the distribution of the relative strength of different groups. Future research should model this relationship more explicitly.

APPENDIX

Proof of Lemma 1

Differentiating (8) with respect to T_i one obtains

(A1) $$\frac{dEU}{dT_i} = e^{-rT_i}\left[h(T_i)(V^N(T_i) - V^S(T_i)) + \right.$$

$$\left.(1 - H(T_i))(u_i^D(T_i) - rV^S(T_i) + \frac{dV^S(T_i)}{dT_i})\right]$$

Using the definitions of $V^N(T)$, $V^S(T)$, and $u_i^D(t)$ (A1) becomes

(A2) $$\frac{dEU}{dT_i} = e^{-rT_i}\left[h(T_i)(2\alpha - 1)\overline{b}e^{(1-\gamma)rT_i} + \right.$$

$$\left.(1 - H(T_i))\left[\gamma(\frac{1}{2} - \alpha - \theta_i)\overline{b}e^{(1-\gamma)rT_i}\right]\right].$$

Differentiating with respect to θ_i we obtain

(A3) $$\frac{d^2EU}{dT_i\,d\theta_i} = -(1 - H(T_i))\gamma r\overline{b}e^{(1-\gamma)rT_i} < 0$$

Equation (A3) means that when others are acting optimally, dEU/dT_i is decreasing in θ_i. Optimal concession time T_i is therefore monotonically decreasing in θ_i.

Proof of Proposition 1 (This proof closely follows Bliss and Nalebuff [1984])

Suppose the other interest group is acting according to $T(\theta)$, the optimal concession time for a group with utility cost θ. Choosing a time T_i as above would be equivalent to choosing a value $\hat{\theta}_i$ and conceding at time $T_i = T(\hat{\theta}_i)$. Equation (8) becomes, after the change in variables

(A4) $$EU(\hat{\theta}_i, \theta_i) = F(\hat{\theta}_i))\left[\int_{\theta_i}^{\overline{\theta}} u^D(x)e^{-rT(x)}T'(x)dx + e^{-rT(\hat{\theta}_i)}V^S(T(\hat{\theta}_i))\right]$$

$$+ \int_{x=\hat{\theta}_i}^{x=\overline{\theta}}\left[\int_x^{\overline{\theta}} u^D(z)e^{-rT(z)}T'(z)dz + e^{-rT(x)}V^N(T(x))\right]f(x)dx.$$

Differentiating with respect to $\hat{\theta}_i$ and setting the resulting expression equal to zero we obtain (where we drop the i subscript)

(A5) $$\frac{dEU}{d\theta} = f(\hat{\theta})\left[(V^S(T(\hat{\theta})) - V^N(T(\hat{\theta}))\right] +$$
$$F(\hat{\theta})(u^D(\theta,\hat{\theta}) - rV^S + \frac{dV^S}{dT})T'(\hat{\theta}) = 0.$$

which becomes after substitutions

(A6) $$\frac{dEU}{d\theta} = -f(\hat{\theta})(2\alpha - 1) - F(\hat{\theta})\gamma\tau(\theta + \frac{1}{2} - \alpha)T'(\hat{\theta}) = 0.$$

Now by the definition of $T(\theta)$ as the optimal time of concession for a group with cost θ, $\hat{\theta} = \theta$ when $\hat{\theta}$ is chosen optimally. The first-order condition (A6) evaluated at $\hat{\theta} = \theta$ implies (14). (Substituting $T'(\theta)$ evaluated at $\hat{\theta}$ from (14) into (A6) one sees that the second order condition is satisfied, since (A6) then implies that sign $dEU/d\hat{\theta} = \text{sign }(\theta - \hat{\theta})$.) To derive the initial boundary condition note first that for any value of $\theta \le \overline{\theta}$, the gain to having the opponent concede is positive. Therefore as long as $f(\overline{\theta})$ is nonzero, groups with $\theta < \overline{\theta}$ will not concede immediately. This in turn implies that a group with $\theta = \overline{\theta}$ (that is, that knows it has the highest possible cost of waiting) will find it optimal to concede immediately. Thus $T(\overline{\theta}) = 0$.

Proof of Proposition 2

A higher fraction of pre-stabilization deficits financed by taxation corresponds to a higher value of γ. Comparing the optimal time of concession as a function of θ for $\overline{\gamma} > \gamma$, we have

(A7)
$$T'(\theta) = -\frac{f(\theta)}{F(\theta)}\frac{(2\alpha - 1)/r}{\gamma(\theta + \frac{1}{2} - \alpha)}$$

$$\bar{T}'(\theta) = -\frac{f(\theta)}{F(\theta)}\frac{(2\alpha - 1)/r}{\overline{\gamma}(\theta + \frac{1}{2} - \alpha)}$$

Since $V^N - V^S$ is the same in both cases, the initial boundary condition is the same for γ and

$\bar{\gamma}$, that is, $T(\bar{\theta}) = \bar{T}(\bar{\theta}) = 0$. Inspection of (A7) indicates that $T'(\theta) > \bar{T}'(\theta)$ for all values of θ. Combining these two results, we have that $T(\theta) > \bar{T}(\theta)$ for $\theta < \bar{\theta}$. Equation (17) then implies that $T^{SE} > \bar{T}^{SE}$.

Proof of Proposition 3

A multiplicative shift in θ has an identical effect to an increase in γ in Proposition 2. By an argument analogous to the one used in that proof, $T(\theta)$ will shift down and hence T^{SE} will fall.

Proof of Proposition 4

When $\alpha = 1/2$, $V^S = V^N$. Since there are costs to not conceding, it is optimal to concede immediately. To prove the second part of the proposition, the same argument as in Proposition 2 shows that $T(\bar{\theta}) = \bar{T}(\bar{\theta}) = 0$ for $\bar{\alpha} > \alpha$. Since the right–hand side of (14) increases with an increase in α, $T'(\theta) > \bar{T}'(\theta)$ for all values of θ. Using the same reasoning as in Proposition 2, we have that $T(\theta) > \bar{T}(\theta)$ for $\theta < \bar{\theta}$. Equation (17) then implies that $T^{SE} > \bar{T}^{SE}$.

Proof of Proposition 5

Suppose $\theta_i = \theta(y_i)$ with $\theta' < 0$, where a group's income y_i is unobservable. Let $G(y,\sigma)$ be the distribution of income with bounds $\underline{y}$ and $\bar{y}$, where increases in σ correspond to a more disperse income distribution. Increasing σ corresponds to a mean–preserving spread of income if for some $\bar{y}$

$$G_\sigma(y,\sigma) \geq 0 \text{ for } y \leq \bar{y}$$
$$G_\sigma(y,\sigma) \leq 0 \text{ for } y > \bar{y}$$

The expected minimum value of y can be written as

$$(A8) \qquad E(y_{min}) = 2 \int_{\underline{y}}^{\bar{y}} (1 - G(x,\sigma))g(x,\sigma)x dx.$$

which by integration by parts equals $\int_{\underline{y}}^{\overline{y}}(1 - G(x,\sigma))^2 dx$. Constant expected y_{min} implies

(A9) $\qquad\qquad \int_{\underline{y}}^{\overline{y}}(1 - G(x,\sigma))G_\sigma(x,\sigma)dx = 0.$

(A9) and (17) in the text imply

(A10) $\qquad\qquad T^{SE}(\sigma) = 2\int_{\underline{y}}^{\overline{y}} T(x,\sigma)(1 - G(x,\sigma))g(x,\sigma)dx.$

Repeated integration by parts implies that (A10) can be written as

$$T^{SE}(\sigma) = \frac{2\alpha - 1}{r\gamma}\int_{\underline{y}}^{\overline{y}}(1 - G(x,\sigma))g(x,\sigma)\frac{1}{\theta(x) + \frac{1}{2} - \alpha} dx$$

$$= \frac{2\alpha - 1}{r\gamma}\left[\frac{-1/2}{\theta(\underline{y}) + \frac{1}{2} - \alpha} + \frac{1}{2}\int_{\underline{y}}^{\overline{y}}(1 - G(x,\sigma))^2(\frac{1}{\theta(x) + \frac{1}{2} - \alpha})^2\,\theta'(x)dx\right].$$

If the change in σ does not affect the lower bound $\underline{y}$ and if $\dfrac{d^2\theta}{dy^2} \geq 0$, we have

$$\frac{dT^{SE}(\sigma)}{d\sigma} = -\frac{2\alpha - 1}{r\gamma}\int_{\underline{y}}^{\overline{y}}(1 - G(x,\sigma))G_\sigma(x,\sigma)(\frac{1}{\theta(x) + \frac{1}{2} - \alpha})^2\,\theta'(x)dx\Big]$$

$$\geq -\frac{2\alpha - 1}{r\gamma}\frac{\theta'(\underline{y})}{(\theta(\underline{y}) + \frac{1}{2} - \alpha)^2}\int_{\underline{y}}^{\overline{y}}(1 - G(x,\sigma))G_\sigma(x,\sigma) = 0.$$

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