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# Bargaining over reform

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**Abstract**

This paper models the delay in a macroeconomic stabilization as the outcome of a bargaining game between two parties who must reach an agreement over how the stabilization cost is to be shared. The paper modifies Alesina and Drazen's (1991, American Economic Review 81, 1170–1189) war of attrition model by endogenizing the distribution of the stabilization costs through a bargaining game. Using this bargaining framework, the paper analyzes the role of crises and foreign assistance in bringing about a settlement to the distributional conflict. In the bargaining game, a crisis that increases the welfare loss from not stabilizing the economy will *lower* the probability of delay. In contrast, foreign aid that is used to reduce the stabilization costs will further *increase* the delay in reaching an agreement between the two parties. 

*JEL classification:* H6; D7

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## 1. Introduction

Countries often pursue policies that are widely recognized as unsustainable and costly to all parties. A prominent example is high and variable inflation caused by monetization of large budget deficits. The puzzle is why reforms are

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not undertaken immediately, once it is clear that current policies are inefficient and that reforms have to be undertaken eventually. Historical and current evidence suggests that delayed stabilization is frequently associated with a political stalemate over how the burden of higher taxes and reduced expenditures should be distributed. For example, the German hyperinflation of 1923 is commonly attributed to a distributional conflict between capitalists who pressed for lower wages and workers who demanded a capital levy and other forms of progressive taxation. Roubini and Sachs (1989) argue that the buildup of public debt in several Western European countries is due to the inability of weak and divided coalition governments to agree on a fiscal reduction package. The frequent bouts of hyperinflation in Argentina since the Peronist era is frequently explained as the outcome of a distributional struggle between export-oriented landowners and the urban working class.

In this paper, I model the delay in a macroeconomic stabilization as an outcome of a bargaining game between two parties who must reach an agreement over the distribution of the adjustment costs. While all groups lose from delayed stabilization, socioeconomic groups are bargaining over how the burden of higher taxes is to be shared. Delay in stabilization is a screening device in this bargaining process where there is incomplete information about the burden of higher taxes other groups are willing to bear. Groups with substantial resources lose more from delay than groups with fewer resources and hence will agree to bear a large burden of the adjustment cost, while groups with fewer resources will delay an agreement until they are asked to pay a lower share of the adjustment cost. A settlement is reached when the benefit from delay – the difference in the proposed share of the higher taxes between the current and next period – is smaller than the cost of continued inefficient policies. The reason why the groups battling over the distribution of higher taxes cannot do better by avoiding delay is that there is no way for a group with small resources to credibly prove that it has small resources except by undergoing a costly delay.

If the delay of economic reform is caused by a distributional conflict within society, the task is to design institutions and policies to end the destructive conflict. A policy that has often been suggested is foreign aid. Foreign assistance, it is argued, can play a critical role in the reform process by moderating the sacrifices required in order to stabilize. For example, Casella and Eichengreen (1993) argue that US Marshall Plan aid played a pivotal role in stabilization in post World War II France and Italy by bringing about an accommodation between capital and labor. Jeffrey Sachs (1994a) has passionately argued that foreign aid could have promoted economic reform in the former Soviet Union by supporting market reformers in their political struggle against the old Communist party *nomenklatura*.

On the other side of the debate are those who claim that an economic crisis can pave the way for reforms since the cost of a crisis creates an incentive for the

resolution of social conflict (Drazen and Grilli, 1993). Foreign aid, by reducing the cost of continued delay, will encourage vested interests to resist adopting adjustment measures. For example, Dani Rodrik (1994) argues that Turkey did not stabilize in 1980–81 because the loose conditions on fiscal policy and generous foreign aid eroded the political perception that it was necessary to take painful measures to reduce the budget deficit. By increasing the cost of continued delay, the withdrawal of foreign aid will thus encourage interest groups to adopt reform measures. For example, it is frequently argued that the reforms of the early 1960s in Korea and Taiwan took place because the large amounts of foreign aid provided by the US in the 1950s were coming to an end.[1]

I analyze these points of view in the context of the bargaining game. Holding the distribution of the adjustment cost fixed, a crisis that increases the cost of continued delay will increase the urgency of stabilizing. However, in the bargaining game, a crisis will also affect the distribution of the stabilization cost. In particular, the group deciding whether to reach an agreement may now be asked to bear a higher share of the cost, which decreases the incentive to stabilize sooner. Since the direct effect of a higher cost of continued delay outweighs the effect of a worse offer, a crisis induces an agreement over policy change. In addition, this result tells us that foreign aid, by reducing the cost of further delay, is actually counterproductive because the provision of foreign aid will *decrease* the probability of an agreement.

This paper builds on Alesina and Drazen's (1991) model, in which seemingly irrational delay is explained as a consequence of a war of attrition. The model presented in this paper is another variant of this basic approach, but allows the distribution of the adjustment costs to be determined endogenously by a bargaining game, rather than being fixed exogenously as in Alesina and Drazen's model. Since parties in most conflicts do communicate and exchange offers in the process of reaching an accommodation, it is important to determine whether the endogenous determination of the cost shares changes the main results of existing work which appeal to games of timing to explain delays in stabilizing the economy.

The paper proceeds as follows. Section 2 presents a model of bargaining between two parties (workers and capitalists) and solves for the perfect bayesian equilibrium. Sections 3 and 4 analyze the effect of crises and foreign aid on the probability of a settlement in the context of the bargaining game. Section 5 discusses the sensitivity of the model's results to alternative assumptions about the bargaining game. Section 6 concludes.

[1] See, for example, Ranis and Mahmood (1992) and Haggard (1990).

## 2. A bargaining model

A logical point of departure in analyzing distributional conflict is the literature on equilibrium strikes.[2] The insight from this literature is that although strikes are costly to both the firm and the workers, a firm's willingness to endure a strike provides the only convincing evidence that it is unable to pay a high wage. Strikes therefore enable the workers to distinguish between more and less profitable firms based on their willingness to endure delays.

Similarly, in the distributional conflict over the burden of stabilization, a delay in the implementation of reform allows the party making the offers to discriminate between groups that can bear a large burden of the adjustment cost and groups that cannot. Delay therefore serves as a screening device. I assume there are two groups, workers and capitalists, bargaining over the distribution of the tax burden. Workers' income is denoted by $w$ and is common knowledge. Capitalists' income, denoted by $\pi$, is uniformly distribution on $[0, \pi_h]$ but the true value of $\pi$ is privately known by the capitalists.[3] In the first period, a shock hits the economy, reducing the amount of available tax revenues. $T$ denotes the amount of higher tax revenues needed to close the budget gap. The deficit is financed by inflationary taxation, which is costly to all parties in society.[4] Inflation and the associated welfare losses could be avoided if an agreement is reached to 'stabilize' the economy, that is if an agreement is reached over the allocation of higher (nondistortionary) taxes.

For simplicity, I assume the bargaining lasts for two periods and the bargaining power is vested in the workers. The workers make the offers and the capitalists are only allowed to accept or reject each offer. In the first period, workers propose that capitalists pay a fraction $\alpha_1$ of the higher taxes, $T$, needed to close the budget gap. If the capitalists accept the offer then the economy avoids a hyperinflation: the workers' payoff is $w - (1 - \alpha_1)T$ and the capitalists' payoff is $\pi - \alpha_1 T$. These payoffs represent the net present value of workers' and capitalists' payoffs over the expected life of the economy.

[2] Some examples are Cramton and Tracy (1992), Card (1990), and Hart (1989).

[3] Section 5 shows that the main result of this paper does not change when we move away from a uniform distribution and make alternative assumptions about the distribution of the capitalists' profits.

[4] One could ask why inflation is costly. One cost is the 'shoe leather' cost that arises from the use of non-interest bearing money as a medium of exchange. However, except for episodes of hyperinflation, these costs are probably small. The main cost of inflation does not lie in the degraded role of money as a medium of exchange, but rather in the uncertainty and transaction costs caused by the diminished role of money as a unit of account. However, we do not have a good framework to analyze the role of money as a unit of account.

If the capitalists reject this offer, then the economy slips into hyperinflation and the game proceeds into the second period.[5] Workers make a second offer, $\alpha_2$. If capitalists accept this offer then the present value of the payoffs (as measured in the first period) are $\delta w - (1 - \alpha_2)T$ for the workers and $\delta\pi - \alpha_2 T$ for the capitalists, where $\delta$ is bounded between zero and one. $1 - \delta$ represents the fraction of each group's income lost due to the hyperinflation. I assume that the extent of inflationary taxation increases with the size of the budget gap, $T$. Therefore, the loss from inflationary taxation, $1 - \delta$, is also an increasing function of the budget gap, or $\partial\delta/\partial T < 0$. If the capitalists reject the workers' second period offer, then the game ends and the payoffs are zero for both parties.

I solve for the perfect Bayesian equilibrium by first considering the second period problem. In the second period, suppose the workers believe that $\pi$ is distributed on $[0, \pi_c]$, where $\pi_c$ is arbitrary for the moment. If workers offer $\alpha_2$, capitalists will accept if $\delta\pi > \alpha_2 T$.[6] The workers' problem can then be stated as

$$\max_{\alpha_2} (\delta w - (1 - \alpha_2)T)\Pr(\delta\pi > \alpha_2 T), \tag{1}$$

where $\Pr(\delta\pi > \alpha_2 T) = (\delta\pi_c - \alpha_2 T)/\delta\pi_c$. The optimal offer of the workers is

$$\alpha_2^*(\pi_c) = \frac{\delta(\pi_c - w) + T}{2T}. \tag{2}$$

The task then is to characterize the workers' optimal belief about $\pi_c$ in the second period if an agreement is not reached in the first period. Notice that

[5] Some delay between the first and second period is necessary in order to maintain the effectiveness of delay as discrimination procedure. If the delay between offers is small, then rejection does not cost much for the capitalists since it expects a better offer to be proposed soon afterwards. Thus, the capitalists are relatively patient, which undermines the effectiveness of delay as a screening device. This is known as the Coase conjecture and was originally formulated in the context of monopoly pricing of durable goods (see Bulow, 1982; Stokey, 1982).

[6] As a referee pointed out, delay is effective as a screening device in this two period game only if there is some probability that the game will end without stabilization after the second period. Specifically, if the lower bound of $\delta\pi$ is greater than $T$, the capitalists will accept *any* offer in the second period. If this is the case, then the capitalists will prefer to pay the entire burden of the adjustment costs in the first period to avoid the costs of delay. In this paper, I assume that $\pi$ has a lower bound of zero, $\delta$ lies between zero and one, and $T$ is positive. Thus, the lower bound of $\delta\pi$ is zero, which is smaller than $T$.

In a more realistic setup in which there is no fixed limit on the number of bargaining periods, the game does not unravel even when the lower bound of $\delta\pi$ is greater than $T$. In this case, the capitalists will not necessarily agree to pay all the adjustment costs, even when the lower bound of $\delta\pi$ is greater than $T$, because they have the option of rejecting the current offer and getting a better offer in the next period.

$\alpha_2^*(\pi_c)$ is increasing in $\pi_c$ – if the workers believe that the capitalists' profits are higher, they will propose that the capitalists pay a higher share of the adjustment costs.

We now return to the two period game. For arbitrary values of $\alpha_1$ and $\alpha_2$, if workers offer $\alpha_1$ in the first period and are expected to offer $\alpha_2$ in the second period, then the capitalists' potential payoffs are $\pi - \alpha_1 T$ from accepting $\alpha_1$, $\delta\pi - \alpha_2 T$ from rejecting $\alpha_1$ and accepting $\alpha_2$, and zero from rejecting both offers. Capitalists prefer $\alpha_1$ to $\alpha_2$ if $\pi - \alpha_1 T > \delta\pi - \alpha_2 T$ or

$$\pi > \frac{T(\alpha_1 - \alpha_2)}{1 - \delta} \equiv \pi^*(\alpha_1, \alpha_2) \tag{3}$$

and capitalists prefer $\alpha_1$ to rejecting both offers if $\pi - \alpha_1 T > 0$. So for arbitrary values of $\alpha_1$ and $\alpha_2$, capitalists will accept $\alpha_1$ if $\pi > \max\{\pi^*(\alpha_1, \alpha_2), \alpha_1 T\}$ and reject $\alpha_1$ if otherwise.

Given the capitalists' strategy, if the first period offer is rejected, the workers' belief must be that the capitalists' profit is distributed uniformly on $[0, \pi_c]$, where $\pi_c = \max\{\pi^*(\alpha_1, \alpha_2), \alpha_1 T\}$ and $\alpha_2$ is the workers' optimal offer given this belief. Substituting our expression for the workers' optimal offer from Eq. (2) gives us an implicit equation for $\pi_c$ as a function of $\alpha_1$:

$$\pi_c = \max\left\{\pi^*\left(\alpha_1, \frac{\delta(\pi_c - w) + T}{2T}\right), \alpha_1 T\right\}. \tag{4}$$

To solve this implicit equation, we note that if $\delta w > T$ (workers prefer to bear the entire tax burden in the second period over continued delay), then $\pi^*(\alpha_1, \alpha_2) > \alpha_1 T$. I assume $\delta w > T$ for the remainder of this paper, which allows us to rewrite Eq. (4) as

$$\pi_c = \pi^*\left(\alpha_1, \frac{\delta(\pi_c - w) + T}{2T}\right). \tag{4'}$$

Combining Eqs. (3) and (4′), we can solve for $\pi_c$ as a function of $\alpha_1$:

$$\pi_c(\alpha_1) = \frac{T(2\alpha_1 - 1) + \delta w}{2 - \delta}. \tag{5}$$

We can now solve for $\alpha_2$ as a function of $\alpha_1$ by combining our equation for $\pi_c(\alpha_1)$ and our expression for the workers' optimal second period offer (Eq. (2)):

$$\alpha_2(\alpha_1) = \frac{\delta\alpha_1}{2 - \delta} - \frac{\delta(1 - \delta)w}{(2 - \delta)T} + \frac{1 - \delta}{2 - \delta}. \tag{6}$$

The game is now reduced to a single period optimization problem for the workers. Given the workers' first period offer, $\alpha_1$, we have specified the capitalists' optimal first period response, the workers' belief about the distribution of

the capitalists' profits if the first period offer is rejected, the workers' optimal second period offer, and the capitalists' optimal second period response. The workers' problem can thus be expressed as

$$\max_{\alpha_1} (w - (1-\alpha_1)T)\Pr[\text{capitalists accept } \alpha_1] + (\delta w - (1-\alpha_2(\alpha_1))T)\Pr[\text{capitalists reject } \alpha_1 \text{and accept } \alpha_2], \tag{7}$$

where $\Pr(\text{capitalists accept } \alpha_1) = \Pr(\pi > \pi_c)$ and $\Pr(\text{capitalist reject } \alpha_1 \text{ and accept } \alpha_2) = \Pr(\alpha_2 T/\delta < \pi < \pi_c)$. Since $\pi$ is uniformly distributed, these two probabilities can be expressed as

$$\Pr(\pi > \pi_c) = 1 - \frac{T(2\alpha_1 - 1) + \delta w}{\pi_h(2-\delta)}, \tag{8}$$

$$\Pr\left(\frac{\alpha_2 T}{\delta} < \pi < \pi_c\right) = \frac{T(2\alpha_1 - 1) + \delta w}{\pi_h(2-\delta)} - \frac{\alpha_2 T}{\pi_h \delta}. \tag{9}$$

Using the expressions for the two probabilities, we can now solve the workers' problem which yields (*after many steps*) the workers' optimal first period offer $\alpha_1$:

$$\alpha_1^* = \frac{1}{2} + \frac{(4 - 4\delta - 3\delta^2)\pi_h - (4 - 2\delta - \delta^2)w}{2T(4-3\delta)}. \tag{10}$$

We can then describe the game as follows. The workers offer $\alpha_1^*$ in the first period. If the capitalists' profit, $\pi$, exceeds

$$\pi_c^* = \frac{T(2\alpha_1^* - 1) + \delta w}{2-\delta} = \frac{\pi_h(2-\delta) - 2w(a-\delta)}{(4-3\delta)}, \tag{11}$$

then the capitalists accept $\alpha_1^*$; otherwise, they reject $\alpha_1^*$. If the first period offer is rejected, then the workers update their beliefs about the capitalists' profits. The workers now believe $\pi$ is distributed uniformly on $[0, \pi_c^*]$. The second period offer is then

$$\alpha_2^* = \frac{\delta\alpha_1^*}{2-\delta} - \frac{(1-\delta)(\delta w - T)}{T(2-\delta)} = \frac{(4-3\delta)T + (2\delta - \delta^2)\pi_h - (6\delta - 5\delta^2)w}{2T(4-3\delta)}. \tag{12}$$

If the capitalists' profit, $\pi$, exceeds $\alpha_2^* T/\delta$, then they accept the offer; otherwise, they reject it. Note that $0 < \delta < 1$, which implies that $\alpha_2^* < \alpha_1^*$; if the capitalists reject the first period offer, they will receive a better offer in the second period. The expectation of a better offer in the second period causes the delay in stabilizing the economy.

## 3. Do crises promote stabilization?

When are distributional conflicts resolved and reforms implemented? A common argument is that policy reforms emerge in response to a crisis. For example, an agreement to adopt painful measures to reduce the budget deficit in 1923 Germany and 1926 France was only possible when high rates of inflation sharply increased the pain from not stabilizing.[7] In a war of attrition model, Drazen and Grilli (1993) show that a crisis, by increasing the cost of continued delay, creates an incentive for the resolution of social conflict and implementation of economic reform.

When the cost shares are determined endogenously, a crisis will not only affect the cost of continued delay, but will also change the distribution of the adjustment costs. To see this, recall that in the bargaining game, capitalists and workers reach an agreement in the first period if the capitalists' profit, $\pi$, exceeds $\pi_c^*$. The probability of a settlement is therefore higher when $\pi_c^*$ is lower. Since the loss from inflationary taxation is given by $1-\delta$, a crisis which increases the pain from not implementing reforms can be represented as an increase in $1-\delta$, or equivalently, a decrease in $\delta$. The effect of a crisis on the probability of a settlement can thus be evaluated by examining the effect of a lower $\delta$ on the equilibrium level of $\pi_c^*$. Taking the derivative of $\pi_c^*$ with respect to $\delta$, we obtain

$$\frac{\partial \pi_c^*}{\partial \delta} = \frac{2w + (2\alpha_1^* - 1)T}{(2-\delta)^2} + \frac{2T}{2-\delta}\frac{\partial \alpha_1^*}{\partial \delta}. \tag{13}$$

The first term is the effect of a change in the cost of hyperinflation, holding $\alpha_1^*$ fixed. This term is positive since $\delta w > T$ and $\alpha_1^*$ is bounded between 0 and 1. Holding $\alpha_1^*$ fixed, an increase in the cost of delay (decrease in $\delta$) lowers $\pi_c^*$, which increases the probability of reaching an agreement in the first period. As in Drazen and Grilli (1993) war of attrition model, a crisis will increase the probability of a settlement if the distribution of the adjustment burden is fixed.

However, in bargaining model, a crisis will also change the distribution of the adjustment costs. If workers are bargaining with capitalists over the distribution of the stabilization costs, an increase in the cost of delay to the capitalists may prompt the workers to take advantage of this to make a worse offer in the first period. To see this, we take the derivative of $\alpha_1^*$ (Eq. (10)) with respect to $\delta$, which yields

$$\frac{\partial \alpha_1^*}{\partial \delta} = \frac{(-4 + 8\delta - 3\delta^2)(\pi_h + w)}{2(-4 + 3\delta)^2 T}. \tag{14}$$

[7] For a discussion of these episodes, see Maier (1975).

Since $T$, $w$, and $\pi_h$ are all positive, the sign of $\partial\alpha_1^*/\partial\delta$ depends on the sign of $-4+8\delta-3\delta^2$. This expression is positive when $\delta > 2/3$ and negative when $\delta < 2/3$. Therefore, $\partial\alpha_1^*/\partial\delta > 0$ when $\delta > 2/3$ and $\partial\alpha_1^*/\partial\delta < 0$ when $\delta < 2/3$. When the crisis is relatively mild and the cost of further delay is less than a third of each party's income ($\delta > 2/3$), a higher cost of continued delay will decrease $\alpha_1^*$. This implies that the capitalists will now be asked to bear a lower share of the tax burden in the first period, which increases the probability that a settlement will be reached.[8] Therefore, when $\delta > 2/3$, the effect of a better offer for the capitalists in the first period complements the direct effect of a higher cost of hyperinflation, which implies that an increase in the cost of further delay unambiguously increases the probability of a settlement.

However, when the costs of hyperinflation are already very high and each party stands to lose more than a third of their income from further delay ($\delta < 2/3$), a worsening of the crisis will increase $\alpha_1^*$. In other words, when the crisis is already very severe, a worsened crisis will prompt the workers to propose that the capitalists pay a higher share of the adjustment cost in the first period. Since the capitalists are now asked to bear a larger share of the adjustment burden in the first period, this effect taken alone increases their expected benefit from further delay, thereby reducing the probability of an agreement.

To obtain the net effect of a change in $\delta$ on $\pi_c^*$, we substitute our expression for $\partial\alpha_1^*/\partial\delta$ into Eq. (13), which yields

$$\frac{\partial\pi_c^*}{\partial\delta} = \frac{2(\pi_h + w)}{(-4+3\delta)^2} > 0 \tag{15}$$

which is positive since $\pi_h$ and $w$ are both assumed to be positive. When the crisis is severe ($\delta < 2/3$), the indirect effect of a crisis, namely a *worse* first period offer for the capitalists, counters the direct effect of an increase in the cost of continued delay. However, this latter effect outweighs the effect of a worse first period offer, so the net effect of a higher cost of continued delay is an increase in the probability of a settlement. When the crisis is relatively mild ($\delta > 2/3$), the

[8] In another model of delay due to a bargaining game, Perraudin and Sibert (1996) also show that if the losses from delay are relatively small, an increase in the cost of postponing reform will reduce the equilibrium delay. However, there are significant differences between Perraudin and Sibert's model and the one presented in this paper. Therefore, one has to be cautious when comparing this paper's results with those from Perraudin and Sibert's model. More precisely, the bargaining model in this paper assumes that the losses from delay affects both parties whereas only one side suffers from delay in Perraudin and Sibert's model. In addition, Perraudin and Sibert's model assumes that uncertainty takes the form of two types, whereas the bargaining model in this paper adopts a formulation of a continuous uniform distribution. In Section 5.1, I analyze the solution of the bargaining game for a number of other continuous (non-uniform) distributions.

indirect effect of a higher cost of continued delay – a better offer in the first period for the capitalists – complements the direct effect of a higher cost of hyperinflation, and both forces increase the probability of a settlement. Therefore, for all possible values of $\delta$, we can state the following proposition:

*Proposition 1. A crisis which increases the cost of living in an unstable environment will lower the equilibrium level of* $\pi_c^*$, *thereby increasing the probability of a settlement in the first period.*

As in Drazen and Grilli (1993) who find that a crisis facilitates an agreement in a model with a fixed distribution of adjustment costs, a crisis in a bargaining model will increase the probability of a stabilization. Countries in which the welfare losses from inflation are extremely high will implement stabilization programs. Equivalently, countries with institutions that lessen the welfare loss from inflation will stabilize later.

## 4. Does foreign aid facilitate stabilization?

Another common argument is that foreign assistance can play a pivotal role in the reform process by moderating the sacrifices required in order to stabilize. Casella and Eichengreen (1993) argue that the US Marshall Plan played a critical role in stabilization in post World War II France and Italy by bringing about a resolution to the distributional conflict between capital and labor. Jeffrey Sachs (1994b) argues that foreign assistance was a critical factor in most successful reforms. On the other side of the debate, Haggard (1990) argues that Taiwan and South Korea implemented their reforms in the 1960s only after it was clear that the high levels of US aid in the 1950s were coming to an end. Similarly, Dani Rodrik (1994) suggests that the provision of foreign aid to Turkey in the early 1980s delayed the implementation of budget reforms.

While the historical evidence is ambiguous about whether foreign aid accelerates the implementation of economic reforms, what do models of delayed stabilization tell us about the effect of foreign aid? In Alesina and Drazen's model, the timing of stabilization does not depend on the size of the budget deficit (Casella and Eichengreen, 1994). Therefore, unanticipated foreign aid used to finance the budget deficit does not affect the timing of stabilization. Stabilization is accelerated only by the provision of anticipated foreign aid that is announced and disbursed early into the game. However, this result is due to special assumptions in the Alesina–Drazen model. In particular, Alesina and Drazen assume that the costs of distortionary taxation are *linear* in the level of distortionary taxes and that in the absence of an agreement, a fixed fraction of the budget deficit is financed by distortionary taxes. These assumptions are not central in their model and once they are removed, the size of the budget deficit,

and thus the provision of foreign aid used to reduce the deficit, will affect the probability of an agreement.[9]

In the bargaining game, unanticipated foreign aid used to balance the budget has an effect on the probability of an agreement to stabilize the economy. To analyze the effect of foreign aid, I assume that foreign assistance is used to finance public expenditures, reducing the total amount of tax revenues needed to be raised to avoid the advent of inflation. Again, the probability of a stabilization is higher when $\pi_c^*$ is lower. The effect of foreign aid on the probability of a settlement can thus be evaluated by examining the effect of a lower $T$ on the equilibrium level of $\pi_c^*$. Taking the derivative of $\pi_c^*$ with respect to $T$, we obtain

$$\frac{\partial \pi_c^*}{\partial T} = \frac{2\alpha_1^* - 1}{(2-\delta)} + \frac{2T}{(2-\delta)} \frac{\partial \alpha_1^*}{\partial T} + \frac{\partial \pi_c^*}{\partial \delta} \frac{\partial \delta}{\partial T}. \tag{16}$$

The first term represents the effect of a reduction in the burden of adjustment, holding the cost of delay $(1-\delta)$ and the distribution of the adjustment costs $(\alpha_1^*)$ fixed. This effect is positive when $\alpha_1^* > 1/2$ and negative when $\alpha_1^* < 1/2$. In addition, a change in the tax burden will also change the workers' optimal offer in the first period. In turn, a change in $\alpha_1^*$ will change the equilibrium level of $\pi_c^*$. This effect is captured by the second term in Eq. (16). To determine the magnitude of this second effect, we need an expression for $\partial \alpha_1^* / \partial T$, which is

$$\frac{\partial \alpha_1^*}{\partial T} = \frac{(4 - 2\delta - \delta^2)w - (4 - 4\delta - 3\delta^2)\pi_h}{2T^2(4-3\delta)}. \tag{17}$$

Substituting this expression into Eq. (16), we find that this second effect exactly cancels out the direct effect of a change in taxes (the first expression in Eq. (16)).

Since the first two terms in Eq. (16) cancel each other out, the effect of a change in $T$ on the equilibrium value of $\pi_c^*$ is given by $\partial \pi_c^* / \partial T = (\partial \pi_c^* / \partial \delta)(\partial \delta / \partial T)$. We know from Proposition 1 that $\partial \pi_c^* / \partial \delta > 0$. What about the sign of $\partial \delta / \partial T$? If the budget gap is smaller, the extent of inflationary taxation is lower. The loss from inflationary taxation, $1-\delta$, will also be smaller. We can express this relationship as $\partial \delta / \partial T < 0$. Since $\partial \pi_c^* / \partial \delta > 0$ and $\partial \delta / \partial T < 0$, this implies that $\partial \pi_c^* / \partial T = (\partial \pi_c^* / \partial \delta)(\partial \delta / \partial T) < 0$. We state the following proposition:

*Proposition 2. If foreign aid is used to reduce the cost of adjustment, $T$, the equilibrium level of $\pi_c^*$ will be higher, thereby lowering the probability of a settlement.*

Foreign aid affects the probability of a stabilization through three channels. First, a reduction in the total tax burden required to close the budget gap

[9] I am grateful to a referee for making this point.

directly affects the benefit of further delay. Second, a lower tax burden indirectly affects the probability of a settlement by changing the share of the adjustment costs the capitalists are asked to bear. In the bargaining model presented in this paper, this second effect exactly cancels out the direct effect of a reduction in the tax burden. We are left with the third effect, which is the effect of a lower tax burden on the welfare loss from continued delay. It is reasonable to assume that a lower tax burden lowers the welfare loss from continued delay. In addition, Proposition 1 tells us that a reduction in the loss from delay decreases the probability of a settlement in the first period. Therefore, the net effect of foreign aid used to lower the burden of inflationary taxation is to *decrease* the probability of a settlement.

## 5. Extensions

To make the model tractable, I have made a number of unrealistic assumptions. First, I have assumed that the capitalists' profits are distributed uniformly. Second, bargaining only takes place for two periods, whereas in reality, bargaining can go on for many periods. Third, there is only uncertainty about the capitalists' payoffs and workers are vested with the bargaining power. In reality, both parties have private information about their payoffs and are able to make and accept offers. How sensitive are the results to these simplifying assumptions? I discuss them in turn.

### *5.1. Non-uniform distribution of profits*

The main result of this paper is that a crisis increases the probability of a settlement of the distributional conflict (Proposition 1). How sensitive is this result to the assumption that the capitalists' profits are distributed uniformly? In this section, I analyze the solution of the bargaining game when the distribution of the capitalists' profits are represented by a number of non-uniform distribution functions – the Cauchy, Chi Square, Exponential, Extreme-Value (Gumbel), *F*-Ratio, Rayleigh, Weibull, Normal, Lognormal, and Logistic distributions. The results suggest that the main result of this paper does not change once we move away from a uniform distribution.

The main advantage of assuming a uniform distribution is that it allows us to obtain a closed form solution to the bargaining game.[10] Once we move away from a uniform distribution, there is typically no closed form solution to the

[10] When the capitalists' profits are distributed uniformly, there is a closed form solution to the bargaining game because the cumulative distribution function is a linear function of the random variable (profits).

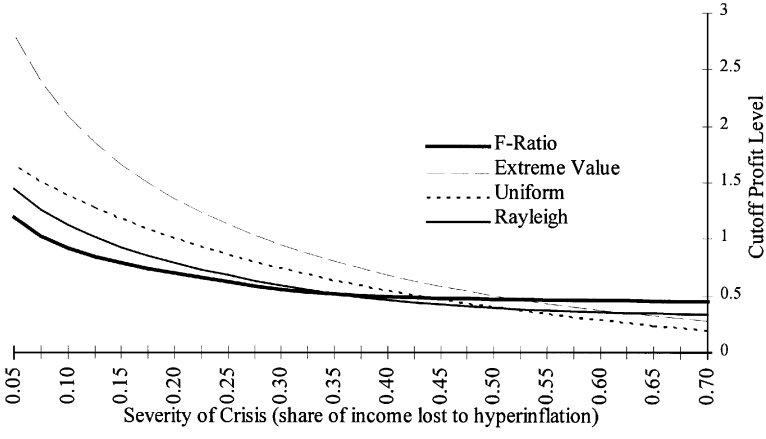


Fig. 1. Uniform, extreme value, *F*-ratio, and Rayleigh distributions.
*Note*: The parameters of all distributions were chosen so that the median was equal to 1.

game. Therefore, when the capitalists' profits are not distributed uniformly, we have to resort to numerical techniques to analyze the solution to the bargaining game. Fig. 1 presents the numerical solutions to the bargaining game for the Extreme-Value, *F*-Ratio, and Rayleigh distributions.[11] For comparison, Fig. 1 also presents the numerical solutions for the base case bargaining game in which the capitalists profits are distributed uniformly. The horizontal axis represents the share of income lost to hyperinflation ($1-\delta$); the crisis is more costly when $1-\delta$ is higher. The vertical axis is the cutoff value of the capitalists' profits ($\pi_c^*$); a capitalists whose profits are above $\pi_c^*$ will accept the first period offer and thus prevent the economy from sliding into hyperinflation. For the distributions shown in Fig. 1, a higher cost of hyperinflation (a higher $1-\delta$) lowers the probability of a settlement (a higher $\pi_c^*$).

The solutions to the bargaining game for a Chi-Square, Exponential, and Weibull distributions display the same relationship between the cost of hyperinflation and the probability of a settlement (see Fig. 2), as well as the solutions for Lognormal distributions with different variances (see Fig. 3). Lastly, the solutions to the game for the Normal, Logistic, and Cauchy distributions (also with different variances) are plotted in Figs. 4–6. As can be seen, for every distribution shown in Figs. 4–6, there is also a positive relationship between $\pi_c^*$ and $1-\delta$.

[11] To solve the model numerically, wages were set at 4 and taxes at 1. In addition, for every distribution shown in Figs. 1–6, the parameters were chosen such that the median of the capitalists' profits was 1. I experimented with other parameter values for wages and taxes and the central result – the positive relationship between $\pi_c^*$ and $1-\delta$ (the severity of the crisis) – does not change.

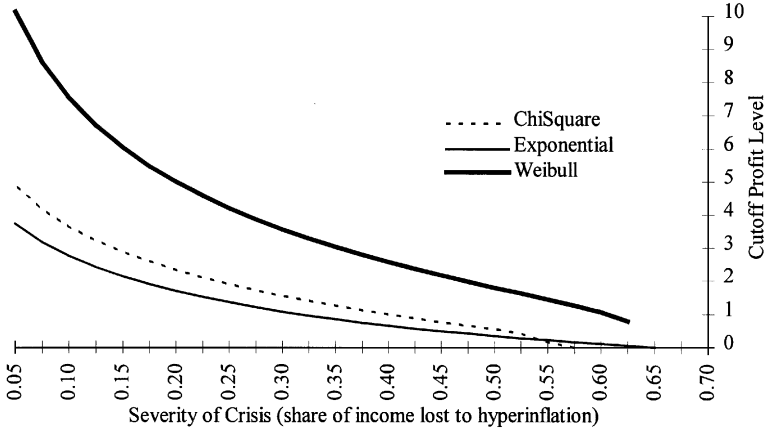


Fig. 2. Chi square, exponential, and Weibull distribution.
*Note*: The parameters of the three distributions were chosen to set the median to 1.

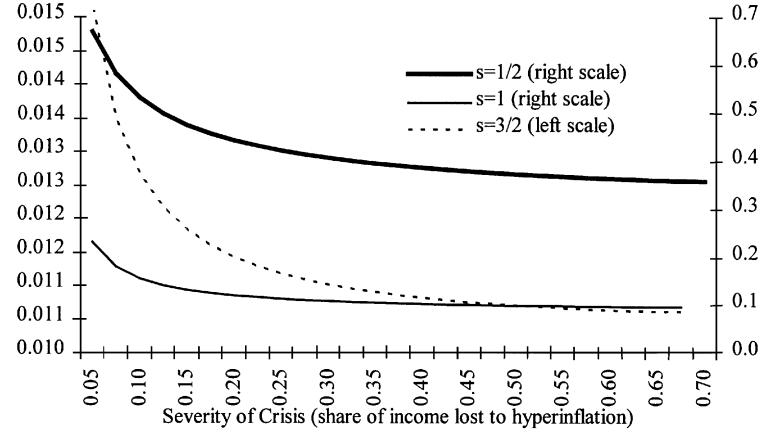


Fig. 3. Lognormal distribution.
*Note*: The parameters of the lognormal distribution were chosen to set the mean to one, while $s$ is the variance parameter.

These results suggest that the main proposition of the paper – that a crisis will increase the probability of a settlement – is robust to alternative assumptions about the distribution of the capitalists profits.

### 5.2. *Multi-period game*

In an infinite-horizon bargaining game, the continuation game beginning in the second period will be a rescaled version of the game as whole: there are again

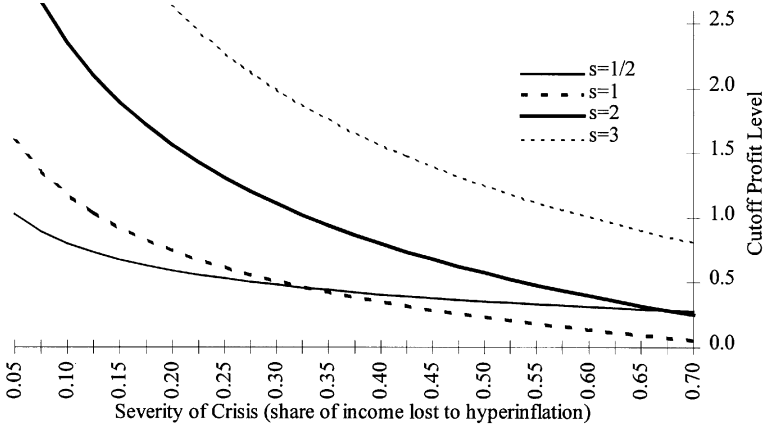


Fig. 4. Normal distribution.
*Note*: Normal distribution with mean = 1 and variance = $s$.

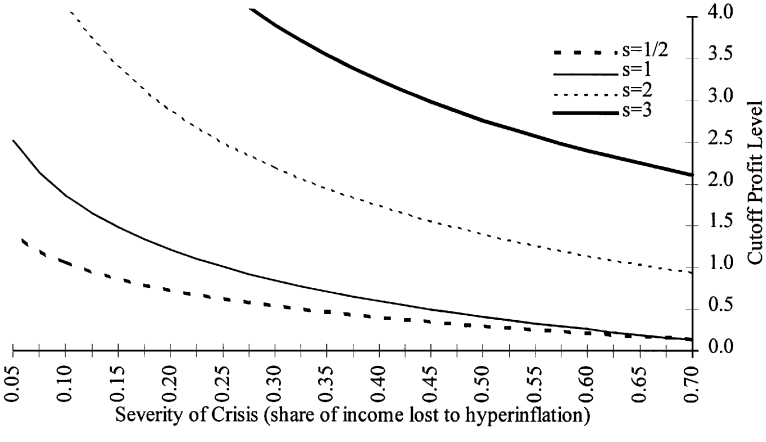


Fig. 5. Logistic distribution.
*Note*: Logistic distribution with mean = 1 and variance = $(s^2\pi^2)/3$.

an infinite number of potential bargaining periods, and the capitalists' profits are bounded from zero to an upper bound.[12] Thus, we can think of the second period in the game presented in this paper as the truncation of the infinite horizon game starting in the second period. Extending the bargaining game to

[12] This insight was first applied by Shaked and Sutton (1984). For an infinite horizon bargaining game, see Sobel and Takahashi (1983).

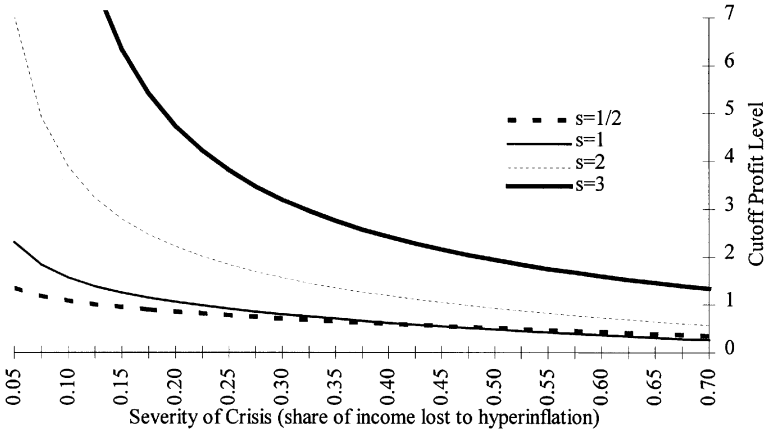


Fig. 6. Cauchy distribution.

*Note*: The probability density function of the Cauchy distribution is defined as $f(x) = 1/\pi s(1 + ((x - \alpha)/s)^2)$. The parameter $\alpha$ was chosen so that the median was equal to 1.

an infinite horizon will allow us to determine the expected length of the delay, but will not change the fundamental nature of the game.

### 5.3. *Alternating offers*

If we allow both workers and capitalists to have private information and make alternating offers, the results will probably change substantially. If party with private information does make the offer, then there are many equilibria depending on the significance the other party attaches to an unexpected offer. This calls for refinements, such as the criterion that if capitalists make an unexpected offer, workers infer that capitalists are of those types that would profit if the offer is accepted.[13] Allowing for asymmetries on both sides of the bargaining table is the obvious next item on the research agenda.

## 6. Conclusion

This paper models the delay in a macroeconomic stabilization as an outcome of a bargaining game between two parties who must reach an agreement over the distribution of the adjustment costs. Using a bargaining framework, I analyze the role of crises and foreign assistance in bringing about a settlement to the

[13] See Cramton (1984) and Cho (1990) for bargaining models in which both parties have private information.

distributional conflict. In the bargaining game, a crisis that increases the welfare loss from not stabilizing the economy will decrease the probability of delay. In contrast, foreign aid that is used to reduce the stabilization costs will not facilitate an agreement between the two parties. These results are reasonably robust to different assumption about the distribution of uncertainty.

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## References

Alesina, A., Drazen, A., 1991. Why are stabilizations delayed? American Economic Review 81, 1170–1189.

Bulow, J., 1982. Durable-goods monopolist. Journal of Political Economy 90, 314–332.

Card, D., 1990. Strikes and wages: a test of an asymmetric information model. Quarterly Journal of Economics 105, 625–659.

Casella, A., Eichengreen, B., 1993. Inflation and stabilization in Italy: 1946–1951, In: Dornbusch, R., Nolling, W., Layard, R. (Eds.), Post-War Economic Reconstruction and Lessons for the East Today. MIT Press, Cambridge, MA, 57–82.

Casella, A., Eichengreen, B., 1994. Can foreign aid accelerate stabilization? Working paper no. 4694. NBER, Cambridge, MA.

Cho, I.-K. 1990. Uncertainty and delay in bargaining. Review of Economic Studies 57, pp. 575–595.

Cramton, P., 1984. Bargaining with incomplete information: An infinite horizon model with two-sided uncertainty. Review of Economic Studies 51, 579–593.

Cramton, P., Tracy, J., 1992. Strikes and holdouts in wage bargaining: Theory and data. American Economic Review 82, 100–121.

Drazen, A., Grilli, V., 1993. The benefits of crises for economic reforms. American Economic Review 82, 598–607.

Haggard, S., 1990. Pathways From the Periphery: The Politics of Growth in the Newly Industrializing Countries. Cornell University Press, Ithaca, NY.

Hart, O., 1989. Bargaining and strikes. Quarterly Journal of Economics 104, 25–43.

Maier, C., 1975. Recasting Bourgeois Europe: Stabilization in France, Germany, and Italy in the Decade After World War I. Princeton University Press, Princeton, NJ.

Perraudin, W., Sibert, A., 1996. The timing of reform. Global Economic Institutions working paper no. 10.

Ranis, G., Mahmood, S.A., 1992. The Political Economy of Development Policy Change. Basil Blackwell, Oxford.

Rodrik, D., 1994. Comment. In: Williamson, J. (Ed.), The Political Economy of Policy Reform. Institute for International Economics, Washington, DC, pp. 212–215.

Roubini, N., Sachs, J., 1989. Political and economic determinants of budget deficits in the industrial democracies. European Economic Review 33, 903–933.

Sachs, J., 1994a. Betrayal. The New Republic, January 31, 14–18.

Sachs, J., 1994b. Life in the economic emergency room. In: Williamson, J., (Ed.), The Political Economy of Policy Reform. Institute for International Economics, Washington, DC, pp. 503–523.

Shaked, A., Sutton, J., 1984. Involuntary unemployment as a perfect equilibrium in a bargaining model. Econometrica 52, 1351–1364.

Sobel, J., Takahashi, I., 1983. A multi-stage model of bargaining. Review of Economic Studies 50, 411–426.

Stokey, N., 1982. Rational expectations and durable goods pricing. Bell Journal of Economics 12, 112–128.