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THE BENEFITS OF CRISES FOR ECONOMIC REFORMS

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ABSTRACT

This paper presents a model in which economic crises have positive effects on welfare. Periods of very high inflation create the incentive for the resolution of social conflict and thus facilitate the introduction of economic reforms and the achievement of higher levels of welfare. Policies to reduce the cost of inflation, such as indexation, raise inflation and delay the adoption of reforms, but have no effect on expected social welfare.

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1. INTRODUCTION

> When expenditures consistently outrun revenue the resulting inflation may have the effect of convincing the public and government that taxes must be raised to finance public investment. In the advanced industrial countries income taxation, and big spurts in taxation generally, have become possible only under the impact of major emergency and crisis, mostly in wartime. In a number of developing countries inflation has acted as an equivalent of war in setting the stage for more forceful taxation.
>
> Albert Hirschman [1985]

Standard economic theory, not to mention common sense, suggests that economic welfare is maximized when distortions are minimized. The preference for non–distortionary taxes to finance government spending provides a leading example. Similar reasoning is used to support gradualism in the introduction of policies, in order to prevent the development of unstable processes which could degenerate into economic crises and emergencies.

A very different point of view is represented in the passage from Hirschman. The welfare losses associated with economic distortions and crises enable societies to enact measures which would be impossible to enact in less distortionary circumstances. In other words, distortions and crises may raise welfare if they are the only way to induce major necessary policy changes. For example, this argument has been used to explain how hyperinflations are ended. In many cases an agreement among political groups to take painful measures to end inflation was achieved only because of the very high welfare costs associated with extremely high rates of inflation. (See, for example, Maier [1975], for a discussion of 1923 Germany and 1926 France.) This suggests that the heavy costs of extremely high inflation, and the situation of emergency associated with it, were necessary to force the adoption of stabilization programs.

In this paper we explore this argument that, from a dynamic prospective, crises and emergencies may be welfare improving and hence desirable. When ongoing social conflict implies that an economy has settled in a Pareto inferior equilibrim, radical changes are often needed to break the stalemate and put the economy on a welfare superior path. The necessary introduction of drastic measures, which may involve sharp tax increases and expenditure cuts, are usually unpopular and forcibly resisted. The distress associated with living through an economic crisis may make these measures more acceptable. The destabilization of the economy, therefore, may facilitate the transition to a welfare superior equilibrium.

We have two main reasons for formalizing the argument that crises may be welfare improving, an argument which may be seen as a variant of the Theory of the Second–Best (see below). First, our view is that crises may be necessary to induce structural change because of distributional implications of large policy changes. Drastic but necessary policy changes are resisted because economic participants believe someone else can be forced to bear the burden of the change. Formalizing the distributional conflict makes clear the role that crises play. The argument that social conflict between groups can explain the failure to adopt necessary policy changes was suggested by Alesina and Drazen (1990) and has been used in the sociological literature (for example Hirsch [1978]). Here we argue that the "benefit of crises" view is a normative implication of this positive argument.

A second reason for formalizing the "benefit of crises" argument is that it enables us to examine more carefully basic results which have come out of a closely related literature. It has been argued that measures which are meant to raise welfare may have potentially the opposite effect when considered in a general equilibrium framework. Fischer and Summers (1989), for example, argue that policies meant to reduce the cost of inflation, such as indexation, lead governments to follow more inflationary policies and thus may ultimately lower welfare.[1] We agree that anti–inflationary policy which may appear optimal from a static point of view, can have negative effects on welfare over time precisely because of its positive effects on instantaneous welfare. However, in a dynamic model, we find that indexation, though it raises the rate of inflation, will leave expected

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[1] Ball and Cechetti [1989] further explore the Fischer–Summers model.

welfare unchanged.

More specifically, Fischer and Summers consider the effect of indexation on inflation and welfare in the Barro–Gordon (1983) model of time inconsistency and monetary policy choice. This leads to there being possible perverse effects of changes in economic structure on welfare via the inducement on government to choose a higher rate of inflation. The process by which policies are adopted is in the background. In our model the government uses a policy (higher inflation) to induce a welfare–improving change in economic structure not otherwise attainable, where the goal is attainable precisely because the policy imposes costs on individuals.

In considering the welfare effects of indexation, Fischer and Summers consider a steady state model where indexation leads to higher permanent inflation. As the above discussion indicates, we consider a dynamic process for inflation, where a shift towards higher current inflation will induce an earlier shift to noninflationary financing. Assessing the welfare effects of a change such as indexation requires considering not only its current possible inflationary effects, but also the effects on the future path of inflation via endogenous government policy. In our dynamic model, in contrast to the Fischer–Summers results, we find that a structural change which reduces the costs of inflation will increase current inflation, but will leave welfare over the whole path unchanged. As argued below, this result will be true in a wide class of models.

More generally, our argument can be seen as an example of the theory of the Second Best, albeit a non–standard one. In our model increasing the level of distortionary taxes clearly reduces instantaneous welfare, and the positive effects of such an increase on total welfare do not depend on starting with positive distortionary taxation. The "pre–existing distortion" is the nature of the policy–making process. Hence our result is in a sense one level removed from the standard application of the Theory of the Second–Best to policy choice, being concerned with constraints on the policy choice mechanism itself.

For the story to be complete, we also need an explanation of how an economy may find itself in a suboptimal equilibrium. While this aspect is not explicitly modelled in this paper, in our approach the mechanism responsible for the sub–optimal state of the economy is the same one that makes crises potentially useful. In a society composed of socio–economic groups with conflicting interests, where there exists no consensus over economic policy and the distribution of the benefits and costs associated with policy change, welfare can be seriously reduced. In such a situation, the economy can proceed for a long time, and potentially indefinitely, on paths which are well below its potential.

The plan of the paper is as follows. In the next section we present a model of individual behavior in agreeing to changes in policy, focusing on the role of inflation in inducing agreement. This leads to an expression for expected social welfare as a function of the rate of inflation. In section three we solve the model via simulation, deriving the optimal rate of inflation and the expected date of policy change for different specifications of the costs of inflation. The invariance of welfare to the costs of inflation emerges. In the fourth section we interpret this as well some other nonintuitive results and consider general lessons of the simulations. The final section contains conclusions.

2. SET–UP OF THE MODEL

Our general argument that distortionary financing can be welfare improving can be applied to any type of distortionary taxation in a model of endogenous policy change. Here we apply the argument to inflation raising welfare by inducing tax reform. Consistent with the historical experience of many countries, we consider an economy in which monetization is due to the inability to reach agreement about the distribution of non–distortionary (or less distortionary) taxes. That is, the government budget can be fully financed by non–distortionary taxes only when it is agreed how to allocate taxes between different individuals or social groups. In the interim, at least part of the budget must be covered by printing money.

One can think of agreement over allocation of tax burdens as coming when one of the parties agrees to bear an unequal share of the taxes. The failure to adopt a non–distortionary tax package therefore is due to each individual or social group attempting to "wait the other out", with interim use of the inflation tax imposing costs on the whole collectivity.

Operationally, we model problems of agreement and the implied delay in tax reform as a "war of attrition" between two individuals, seen as representative agents of two conflicting groups. We follow Alesina and Drazen [1990], where it was argued that the war of attrition is an appropriate way to model delay in adopting policy changes when conflict over the distributional consequences of the policy change is important.

A. The Government Budget and Monetization

For simplicity, we assume that all of the government budget is covered by some sort of taxation, including the inflation tax. This implies constant government debt, which we set equal to zero. The presence of deficit, however, would not affect our argument. In fact, if bond financing were used and current bond issuance is covered by non–distortionary taxes in the future, our set–up captures the choice between distortionary and non–distortionary taxation that a model with the choice between monetization and bond issuance would imply.

Denote by γ the fraction of expenditures covered by seigniorage before an agreement over a non–distortionary tax package is reached ("agreement"), the remainder covered by lump–sum taxes. The government budget constraint prior to an agreement at time T is then

$$(1) \qquad i(t)m(t) + \tau(t) = g \qquad\qquad t < T,$$

where i is the nominal interest rate, m is real money balances, τ is total non–distortionary taxes, and g government expenditure.[2] The government's choice over how to finance expenditures can be summarized by

[2] Here we use $i(t)m(t)$ as a measure of seigniorage revenues. Our argument, however, does not depend on the particular definition of seigniorage.

(2) $$i(t)m(t) = \gamma g .$$

If γ is constant over time, τ and $i(t)m(t)$ will be as well.

After an agreement at T, the government budget is simply

(1′) $$\tau(t) = g \qquad t \geq T.$$

In addition to specifying the total level of taxes, we must specify how tax burdens are divided between the two individuals. Since the distribution of the cost of stabilization is the crucial element, what is important is that agreement entails that one side bears a larger fraction of total taxes after agreement has been reached than before. In general, any distribution of taxes after T where one side agrees to bear a fraction $1 \geq \alpha > 1/2$ of the tax burden will yield a delay in reaching an agreement. For simplicity we assume that taxes are divided half–half before a stabilization and fall entirely on one individual after a stabilization (i.e α=1). None of the conclusions depend on this last assumption.

B. Individual Behavior

We imagine the economy to be populated by two different representative individuals (social groups). At each point in time, utility for each individual is a positive function of consumption c and a negative function of inflation π. The utility cost of inflation is group specific and may be written $w(\theta,\pi(t))$. Let instantaneous utility of the representative individual of type θ be

(3) $$u^{\theta}(t) = c^{\theta}(t) - w(\theta,\pi(t)) ,$$

This specification of utility could be derived from an underlying utility function over consumption and real money balances.

At the beginning of time, the group–specific component θ is independently drawn from a distribution $F(\theta)$ with lower and upper bound $\underline{\theta}$ and $\overline{\theta}$. The group specific θ is known only to the group itself, while the other group only knows the distribution $F(\theta)$. The form of $w(\theta,\pi)$ will be crucial, and we want to study how changes in the function affect the timing of agreement and hence the welfare implications of inflationary policies. We therefore consider a general function of the form

$$(4) \qquad w(\theta,\pi) = a + b\theta\pi^{n}$$

where a, b, and n are constants.

In order to compute the equilibrium level of inflation we need to specify the aggregate demand for real balances. In this type of heterogeneous agent model it is difficult to derive money demand starting from utility maximization. Therefore, we make the reasonable assumption that aggregate money demand is given by:

$$(5) \qquad m^{d} = ke^{-\alpha i_t/(1+i_t)}$$

which has been shown to be the compatible with individual maximization (see Calvo and Leiderman (1989)).

Substituting (5) into (2), and assuming a constant real interest rate r, we have

$$(2') \quad (r+\pi)ke^{-\alpha(r+\pi)/(1+r+\pi)} = \gamma g$$

which implicitly defines the equilibrium level of inflation as a function of γ.

The infinitely–lived individual's objective is to maximize expected present discounted utility by choice of a time path of consumption and a date, T_i, to agree to bear the tax burden if the other individual has not already volunteered. Let us denote by S(T) the distribution of the opponent's optimal concession time, and by s(T) the associated density function. (These will of course depend on $F(\theta)$ and on his strategy.) Expected utility as a function of chosen concession time, T_i , can then be written

$$\text{(6)} \qquad EU(T_i) = (1 - S(T_i))\Big[\int_0^{T_i} u^P(x)e^{-\rho x}dx + e^{-\rho T_i} V^H(T_i)\Big]$$

$$+ \int_{x=0}^{x=T_i}\Big[\int_0^x u^P(z)e^{-\rho z}dz + e^{-\rho x} V^N(x)\Big]s(x)dx$$

where ρ is the discount rate, u^P the flow utility prior to agreement, V^H the present discounted utility from the time of stabilization onward of the individual who agrees to bear high taxes, and V^N the present discounted utility from the time of stabilization onwards of the individual who bears low taxes. The first term represent the expected utility if the agent will be the one to concede (at time T_i), while the second term represent the expected utility deriving from the possibility that the other agent will concede before T_i (at time x).

The assumption that instantaneous utility is linear in consumption means that any feasible consumption path yields the same utility. We therefore assume that individuals simply consume their current income, net of regular and inflation taxes. Consumption may then be written as

$$c^P = y - \frac{\mu m + \tau}{2} = y - \frac{g}{2}$$

$$\text{(7)} \qquad c^H = y - g$$

$$c^N = y$$

where y is current pre–tax income, c^P is consumption prior to before agreement, c^H is consumption of the individual who bears heavy taxes, and c^N is the consumption of the individual who bears light taxes (in this specific example no taxes).

To find the optimal time that an individual of type θ agrees to bear taxes if his opponent has not already conceded, denoted $T(\theta)$, we solve (following Alesina and Drazen [1990]) for a symmetric Nash equilibrium where if the other individual is behaving according to $T(\theta)$, it is optimal to behave according to $T(\theta)$. In the appendix we prove that the $T(\theta)$ function defined by the following equation is such an equilibrium

$$T'(\theta) = -\frac{f(\theta)}{F(\theta)} \frac{g/\rho}{[w(\theta,\pi)-g/2]} . \tag{8}$$

where $T(\bar{\theta}) = 0$, that is, if the group is characterized by the maximum possible cost of inflation, it will concede immediately. Also note that $T(\theta)$ is monotonically decreasing in θ, so that high cost groups concede first.

To understand the nature of the optimal strategy we may write (8) as

$$-\left[\frac{f(\theta)}{F(\theta)} \frac{1}{T'(\theta)}\right] \frac{g}{\rho} = (w(\theta,\pi) - g/2) . \tag{8'}$$

The right hand side is the cost of waiting another instant to concede, that is the difference between the utility loss due to inflation, and the increase in taxes implied by the stabilization. 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, i.e the present discounted value of the future government expenditures. Concession occurs when the cost of waiting just equals the expected benefit from waiting.

We will work with the case where $f(\theta)$ is uniform over $[\underline{\theta},\bar{\theta}]$, i.e.

$$F(\theta) = \frac{\theta - \underline{\theta}}{\bar{\theta} - \underline{\theta}},$$

so that

$$-\frac{f(\theta)}{F(\theta)} = \frac{1}{\underline{\theta} - \theta}.$$

Under this assumption, using (8), $T(\theta)$ is given by

$$\text{(9)} \qquad T(\theta) = \int_{\underline{\theta}}^{\theta} \frac{-g/\rho}{(\theta - \underline{\theta})(w(\theta,\pi) - g/2)} d\theta,$$

where, we recall, $w(\theta,\pi) = a + b\theta\pi^n = a + b\theta(\gamma g/m)^n$. Using the method of partial fractions and integrating, we obtain the optimal time of concession of an individual of type θ, namely

$$T(\theta) = -\frac{-g/\rho}{w(\gamma g/m,\underline{\theta}) - g/2}\left[\ln(\theta - \underline{\theta}) + \ln(w(\gamma g/m,\overline{\theta}) - g/2)\right] + C_0,$$

where the constant C_0 is defined by the condition that the highest cost type concedes immediately, that is, $T(\overline{\theta}) = 0$. We thus have

$$\text{(10)} \qquad T(\theta) = -\frac{-g/\rho}{w(\gamma g/m,\underline{\theta}) - g/2}\left[\ln[(\theta - \underline{\theta})/(\overline{\theta} - \underline{\theta})] + \ln\left[\frac{w(\gamma g/m,\overline{\theta}) - g/2}{w(\gamma g/m,\theta) - g/2}\right]\right]$$

C. Social Welfare

We consider a social planner who weights each of the two individuals equally. Ignoring for a moment the direct dependence of individual utility on θ (in contrast to its dependence via T) we may write social welfare if agreement comes at time T and the monetization parameter until T is γ, as

$$\text{(11)} \qquad L(T;\gamma,) = \int_{z=0}^{z=T} u^P(z;\gamma)e^{-\rho z}dz + e^{-\rho T}\,\frac{V^H + V^N}{2},$$

where we use the fact that V^H and V^N are independent of both T and γ. Expected social welfare is then the expectation of $L(T;\gamma)$ taken over the distribution of possible agreement dates, namely

$$\text{(12)} \qquad ESW(\gamma) = \int_{T=0}^{T=\infty} L(T;\gamma)g(T)dT ,$$

where G(T) is the cumulative distribution of someone conceding by time T, and g(T) = dG(T)/dT. To calculate this and take into account the dependence of utility on an individual's type, we must express the distribution in terms of θ and integrate individual lifetime utility L( ) over the distribution of θ.

First we calculate g(T) the probability of agreement at each point in time. Using the characteristics of $T(\theta)$, we have that the probability that no one concedes by T, 1 – G(T), is

$$\text{(13)} \qquad 1 - G(T(\theta)) = (F(\theta))^2.$$

Differentiating we find the probability that someone concedes at T, namely g(T) = dG(T)/dT is

$$\text{(14)} \qquad g(T) = -2(T'(\theta))^{-1}F(\theta)f(\theta).$$

Using (14) and the fact that $dT = T'(\theta)d\theta$, expected social welfare becomes, after a change in variables,

$$\text{(15)} \qquad ESW(\gamma) = 2\int_{\theta=\underline{\theta}}^{\theta=\overline{\theta}} L(T(\theta,\gamma),\gamma)F(\theta)f(\theta)d\theta.$$

Substituting (10) into (11) and the resulting expression into (15) gives the expected social welfare function to be maximized. We note that γ enters (15) only through the dependence of social welfare on individual utility and the dependence of individual utility (via $w(\theta,\pi)$) on γ.

3. OPTIMAL MONETIZATION AND INFLATION

We can now ask whether positive inflation can be welfare increasing. The reason why this may be true should, by now, be clear. Higher inflation, by raising the cost of living in the economy prior to stabilization, will shorten the delay in reaching agreement. There is thus a trade off, higher inflation lowering welfare until an agreement is reached, but inducing an earlier time of agreement on use of non–distortionary financing. There should therefore be a positive, but finite level of inflation which maximizes expected utility. The simulation results which we present below confirm this intuition.

Since inflation can increase welfare over the whole path precisely because it inflicts instantaneous welfare costs, we are especially interested in how the welfare–maximizing rate of inflation changes as we vary the specification of the costs of inflation. For example, how will welfare be affected if the loss from inflation is not linear in inflation? How will welfare be affected if there is a fixed cost of inflation independent of the level of inflation?

We find first that positive inflation is in general optimal in inducing a policy change. Second, when the distortionary cost of inflation is an increasing, convex function of the rate of inflation, the optimal rate of inflation may be either higher or lower than than when costs are linear. Third, for the specification of costs we consider, expected social welfare when inflation is chosen optimally is in general invariant to changes in the cost function, even though the timing of the induced policy change depends crucially on the specification of the cost function. This arises because the monetization parameter affects social welfare only through its effects on the cost function w( ), as noted above.

A. Benchmark case

In all of the following simulations, we fixed the level of real interest rate and the discount rate at 4%, and we choose a value of $\alpha = 3$ which we take from the estimate in Calvo and Leiderman (1989). The ratio of government expenditure to output was set at 50% and $k = 0.12$, so that money balances are 10% of output at zero inflation. We first present as a benchmark the case in which $a = 0$, and $b = n = 1$. In figure 1 we plot the expected level of utility as a function of the rate of inflation. The figure reveals that the first best is one in which Friedman's rule prevails, i.e. when the rate of inflation is equal to –r (–4%). This is the case in which $\gamma = 0$, that is non distortionary taxes fully cover government expenditure and thus seigniorage revenues are not needed. Consider now the situation in which an agreement on the non–distortionary tax package is not yet achieved, and the use of inflation is necessary for revenue purposes. Figure 1 makes clear that low levels of inflation are not always the optimal (second best) choice. In this example, if the deficit that has to be financed by seigniorage exceeds 2.2% of output or, equivalently, if inflation exceeds 9%, it would be preferable to finance a much larger fraction of expenditure (5.8% of output) by seigniorage and thus induce much higher level of inflation (133%) than the one strictly necessary for static budgetary reasons. Figure 2 clarifies the nature of the trade–off. There we plot the expected time of resolution as a function of inflation. As expected, the time of resolution is a negative function of inflation. The interesting aspect is the particular shape of this function. The reduction in the time of resolution is concentrated at relatively small values of inflation. At high level of inflation, the utility costs outweigh the benefits deriving from a quicker stabilization.

B. Changes in b and n

The effects of changing b , i.e. the linear component of the cost of inflation, are presented in table 1. At $b = 3$ optimal inflation is $\pi^*_{b=3} = 46\%$, and for $b = 5$ it is $\pi^*_{b=5} = 26\%$.

The immediate implication of these results is that economies in which the cost of inflation are low require high levels of inflation to induce agreement on policy change. The analysis suggests that changes that tend to increase the cost of inflation reduces the need for high level of inflation. Conversely, economies which have high degree of protection against inflation, for example because of pervasive indexation, will be characterized by high levels of optimal inflation. While our model is different from the one used by Fischer and Summers [1989], it produces the same result that increasing indexation increases inflation. As we shall see, a key difference is that in our framework the increase in the level of inflation does not change the level of welfare.

The effects of introducing non–linearities by changing n are more complicated. In figures 3 and 4 we present the main results. The direction of the change in n crucially depends on whether $\pi^*_{n=1} \gtrless 100\%$, that is whether, under the linear specification, the economy supports an optimal rate of inflation greater or smaller than 100%. In table 1 we first present the case in which $\pi^*_{n=1} = 133\%$, which correspond to the case in which the fixed cost zero (a=.0). Here we see that increases in n generates a reduction in the optimal rate of inflation. In fact, $\pi^*_{n=.5} = 172\%$, while $\pi^*_{n=2} = 115\%$.

In table 1 we also presents the case in which $\pi^*_{n=1} = 72\%$, which corresponds to a relatively high fixed cost (a = 1). The direction of the effect of changes in n is now reversed. High levels of n are now associated with high levels of inflation. For example, $\pi^*_{n=.5} = 57\%$, while $\pi^*_{n=2} = 84\%$. Some intuition for the reason of this result is provided by figure 5. Here we plot the utility costs as a function of inflation for different values of n. Because of the exponential form of the cost function, they all intersect at $\pi = 100\%$. Consider the case in which, under the linear specification (n = 1), $\pi^*_{n=1} > 100\%$. From figure 5 we see that in the region in which $\pi > 100$, higher levels of n correspond to higher level of cost. However, if $\pi^*_{n=1} < 100\%$, higher levels of n actually decrease the utility cost.

4. INTERPRETATION

The simulation results confirm our intuition that high inflation may be socially optimal as a means to induce policy change. Since the model is highly stylized, one may ask how much more they can tell us. We highlight two results which we view as important and general.

First, and especially striking, we notice from table 1 that though changes in b and n affect the optimal rate of inflation and the expected date of stabilization, they do not affect expected utility. This result is in contrast to the implications of Fischer and Summers (1989) or Ball and Cecchetti (1989). Our result is due to inflation affecting social welfare only through its effect on the utility of the groups engaged in the war of attrition. Our interpretation is as follows. Consider the cost function in (4) as a function only of θ, namely

$$(4') \qquad \hat{w}(\theta) = a + \hat{b}\theta ,$$

where choice of π affects the parameters of (4′). Under this specification, the maximization of social welfare in (15) may be dichotomized into two stages. First, choose the $\hat{w}(\theta)$ function which maximizes (15), that is, optimal parameters in (4′). For given a this means choosing optimal $\hat{b}$. Second, given optimal parameters in (4′), choose optimal π to hit these values for given b and n in (4).

This argument makes clear why maximized expected social welfare is independent of b and n for given a. There is an optimal $\hat{b}$ and different values of n, for example, induce changes in inflation in the appropriate direction.

The general message is that there is an optimal level of utility loss or suffering. If all the effects of inflation are internalized by the agents involved in choice of policy, then structural changes will not affect this optimal level of utility loss and expected social welfare will be invariant to structural changes. This suggests that the invariance result will <u>not</u> hold if inflation affects social welfare in ways which agents involved in policy making do not internalize (as would be the case if we had explicitly considered political parties with narrow constituencies). We further expect that in such a case, decreases in the cost of inflation to agents involved in the war of attrition which are not shared by other (i.e. noninvolved) groups will decrease maximized social welfare, as higher inflation will be needed to induce agreement. Conversely, a decrease in the cost of inflation which disproportionately benefits groups not involved in the war of attrition will raise expected social welfare in a dynamic model, in contrast to the basic Fischer and Summers result. We are currently checking this conjecture.

Turning to the optimal rate of inflation itself, a second key result is on the effect of nonlinearity in the costs of inflation on optimal π. The loss from inflation is no doubt not linear. One would intuitively think that the more convex this relation, that is, the more the loss to inflation rises for a given increase in the rate of inflation, the lower would be the optimal rate of inflation in this sort of model. Our simulation results show this need not be the case, and the argument in the previous paragraphs explain why not. Suppose in (4′) that the optimal level of $\hat{b}$ is low, meaning a low optimal level of utility loss and a low value of π in the linear ($n = 1$) case. Increased convexity of the cost function (increases in n) will then require <u>increases</u> in the level of inflation to generate the optimal $\hat{b}$. (Refer back to Figure 5.)

More generally, our results imply that how changes in the costs associated with inflation will affect equilibrium inflation in a model of endogenous policy depend crucially on how both the policy making process and the costs of inflation are specified. Basic intuition, though attractive, may be misleading.

5. CONCLUSIONS

Our analysis may be seen as a formalization of the view that policies which reduce (but do not eliminate) either inflation or the costs associated with inflation may be counterproductive since they make it more difficult to gain agreement on undertaking painful policy steps to eliminate inflation. Our results suggest that countries may have to suffer some significant inflation if they are to adopt fiscal policies consistent with a long–run low inflation path.

More generally, our analysis suggests that endogenizing the choice of tax policy may lead to a novel application of the Theory of the Second–Best, whereby distortionary taxation is preferred to non–distortionary taxation.

An interesting aspect of inflation as a way to induce stabilization, is that it does not need to be a deliberate action of the policy maker. In fact, it is often the case that when there exists lack of social consensus, monetization, and thus inflation, are used as the last resort to avoid public bankruptcy. In this case, the mechanism described above operates without an explicit decision to do so. In a sense, inflation could serve the role of an automatic social stabilizer.

While in the model above we assumed that the government equally weighted the welfare of the two interest groups, in reality this may not be the case. If the policy maker is biased in favor of one of the two groups, it could use distortionary taxes not just to induce agreement, but also to produce an outcome in favor of its constituency. The social desirability of crises, in this case, becomes questionable.

APPENDIX

To derive (8) we begin with the individual's expected utility (6). Differentiating with respect to T_i and θ, one can show that dEU/dT_i is decreasing in θ, which implies that optimal concession time $T(\theta)$ is monotonically decreasing in θ: a group with a higher cost will concede earlier. 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 $T_i = T(\hat{\theta}_i)$. Expected utility can then be written

$$\text{(A1)} \qquad EU(\hat{\theta}_i,\theta_i) = F(\hat{\theta}_i)\Big[\int_{\hat{\theta}_i}^{\overline{\theta}} -u^P(x)e^{-\rho T(x)}T'(x)dx + e^{-\rho T(\hat{\theta}_i)}V^H(T(\hat{\theta}_i))\Big]$$

$$+ \int_{x=\hat{\theta}_i}^{x=\overline{\theta}} \Big[\int_x^{\overline{\theta}} -u^P(z)e^{-\rho T(z)}T'(z)dz + e^{-\rho T(x)}V^N(T(x))\Big] f(x)dx \,.$$

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

$$\text{(A2)} \qquad \frac{dEU}{d\hat{\theta}} = f(\hat{\theta})\Big[(V^H(T(\hat{\theta})) - V^N(T(\hat{\theta}))\Big] +$$

$$F(\hat{\theta})(u^P(\theta,\hat{\theta}) - \rho V^H + \frac{dV^H}{dT})T'(\hat{\theta}) = 0.$$

which becomes after substitutions

$$\text{(A3)} \qquad \frac{dEU}{d\hat{\theta}} = -f(\hat{\theta}) - F(\hat{\theta})\gamma\pi(w - g/2)T'(\hat{\theta}) = 0.$$

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 (A3) evaluated at $\hat{\theta} = \theta$ implies (8). (Substituting $T'(\theta)$ evaluated at $\hat{\theta}$ from (8) into (A3) one sees that the second order condition is satisfied, since (A3) then implies that sign $dEU/d\hat{\theta} =$ sign $(\theta - \hat{\theta})$.)

To derive the initial boundary condition note first that for any value of $\theta \leq \overline{\theta}$, 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 $T(\overline{\theta}) = 0$.

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TABLE 1

	a	b	n	gamma	inflation	expected utility
	0	1	1	5.8	133	14.37
	0.1	1	1	5.7	124	14.37
changing a	0.3	1	1	5.6	115	14.37
	0.5	1	1	5.5	107	14.37
	0	1	1	5.8	133	14.37
changing b	0	3	1	4.4	46	14.37
	0	5	1	3.6	26	14.37
	0	1	0.5	6.2	172	14.37
changing n	0	1	1	5.8	133	14.37
when n(1)>100	0	1	2	5.6	115	14.37
	0	2	1	4.88	64	14.37
changing n	0	2	2	5.14	81	14.37
when n(1)<100	0	2	3	5.23	87	14.37

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Figure 1: a=0 b=1 n=1

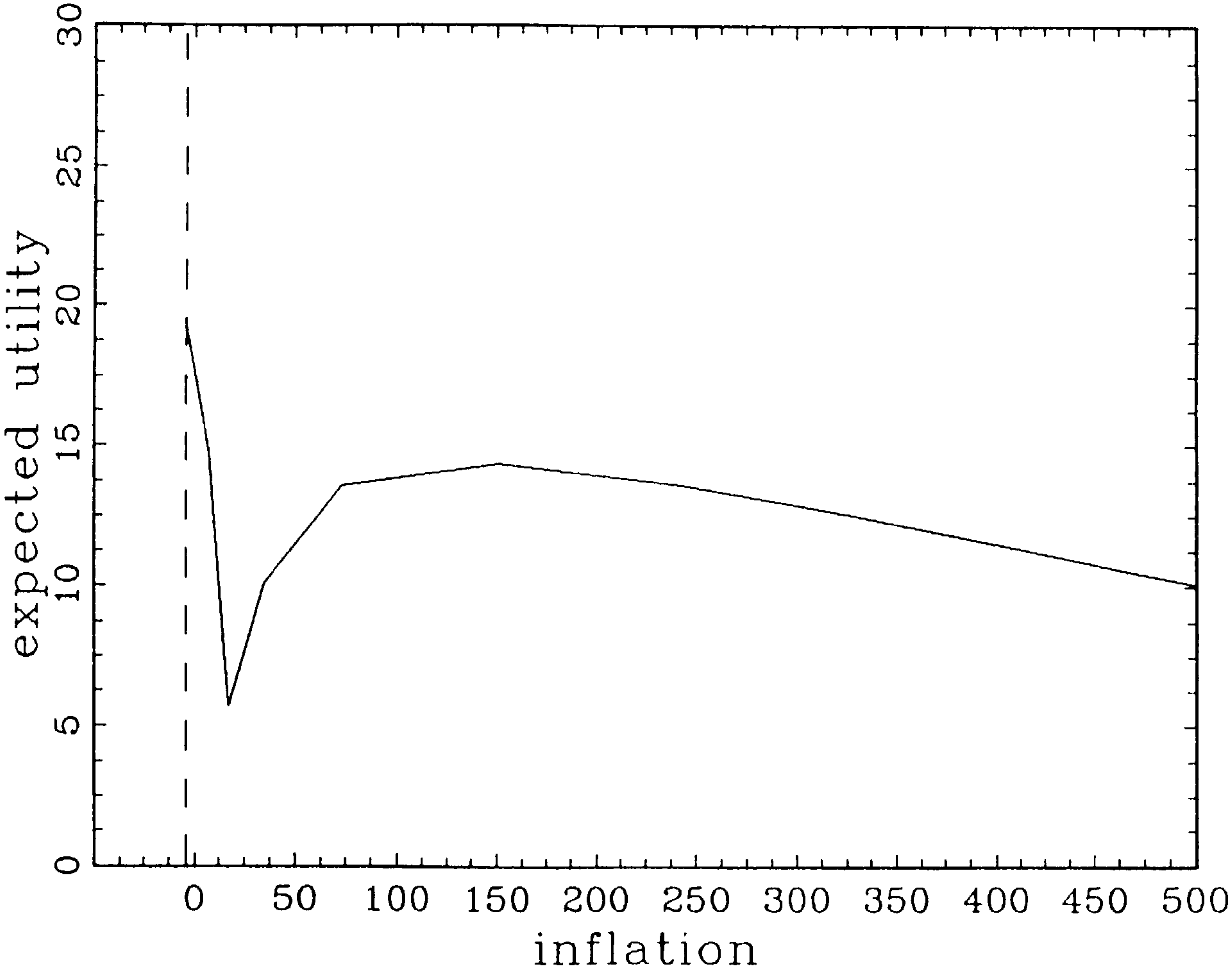

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Figure 2: a=0 b=1 n=1

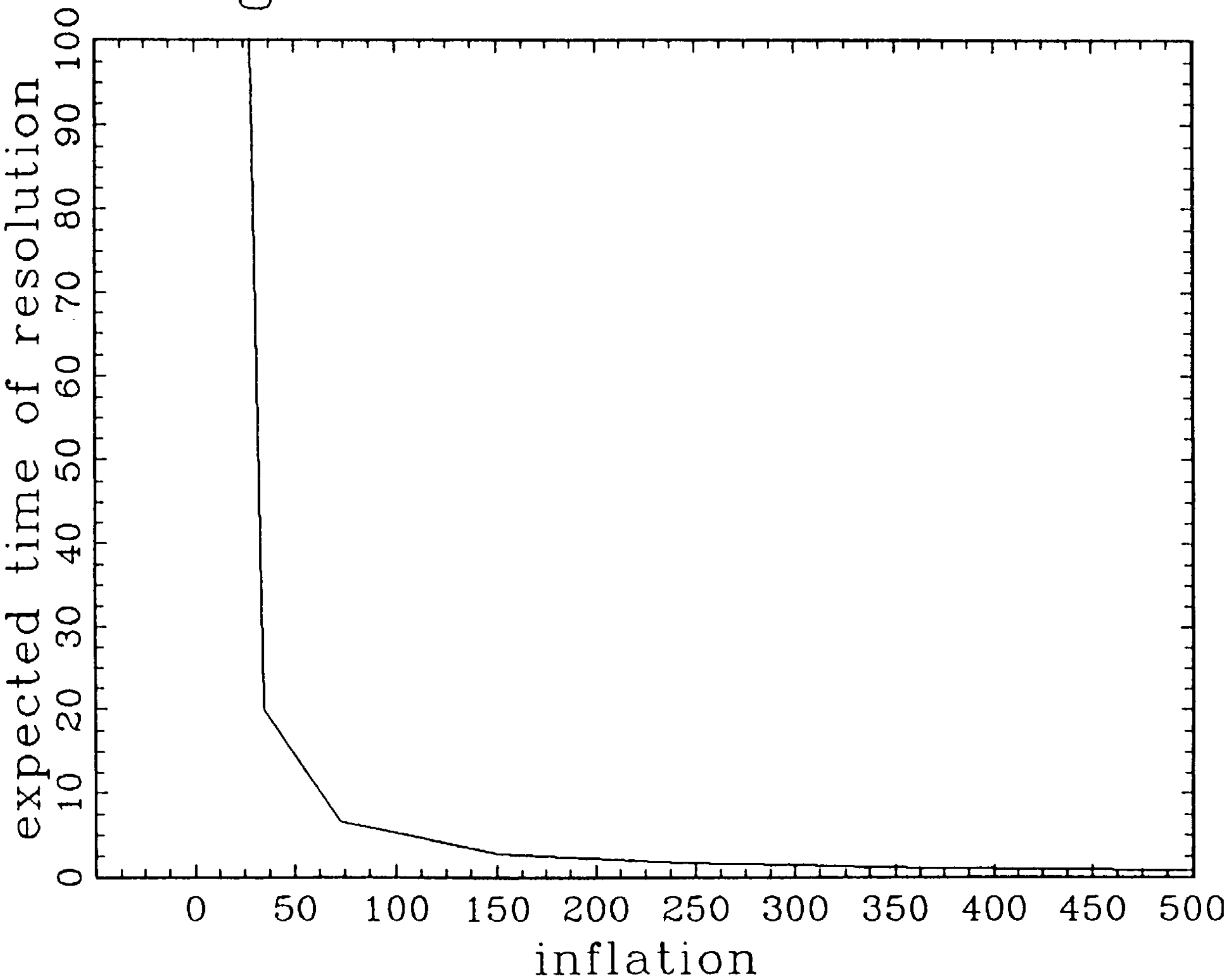

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Figure 3: a=0 b=1,3,5 n=1

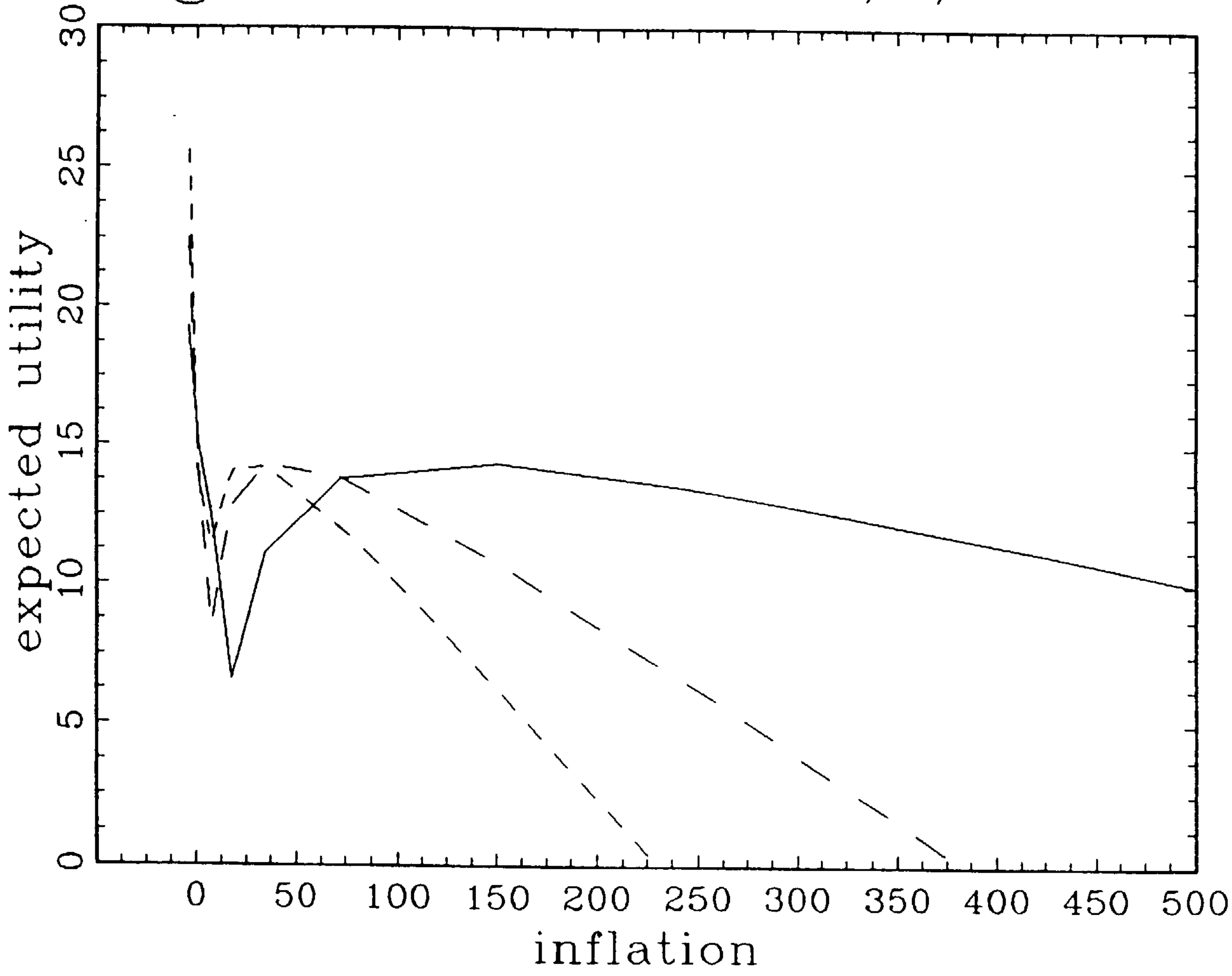

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Figure 4: a=0 b=1,3,5 n=1

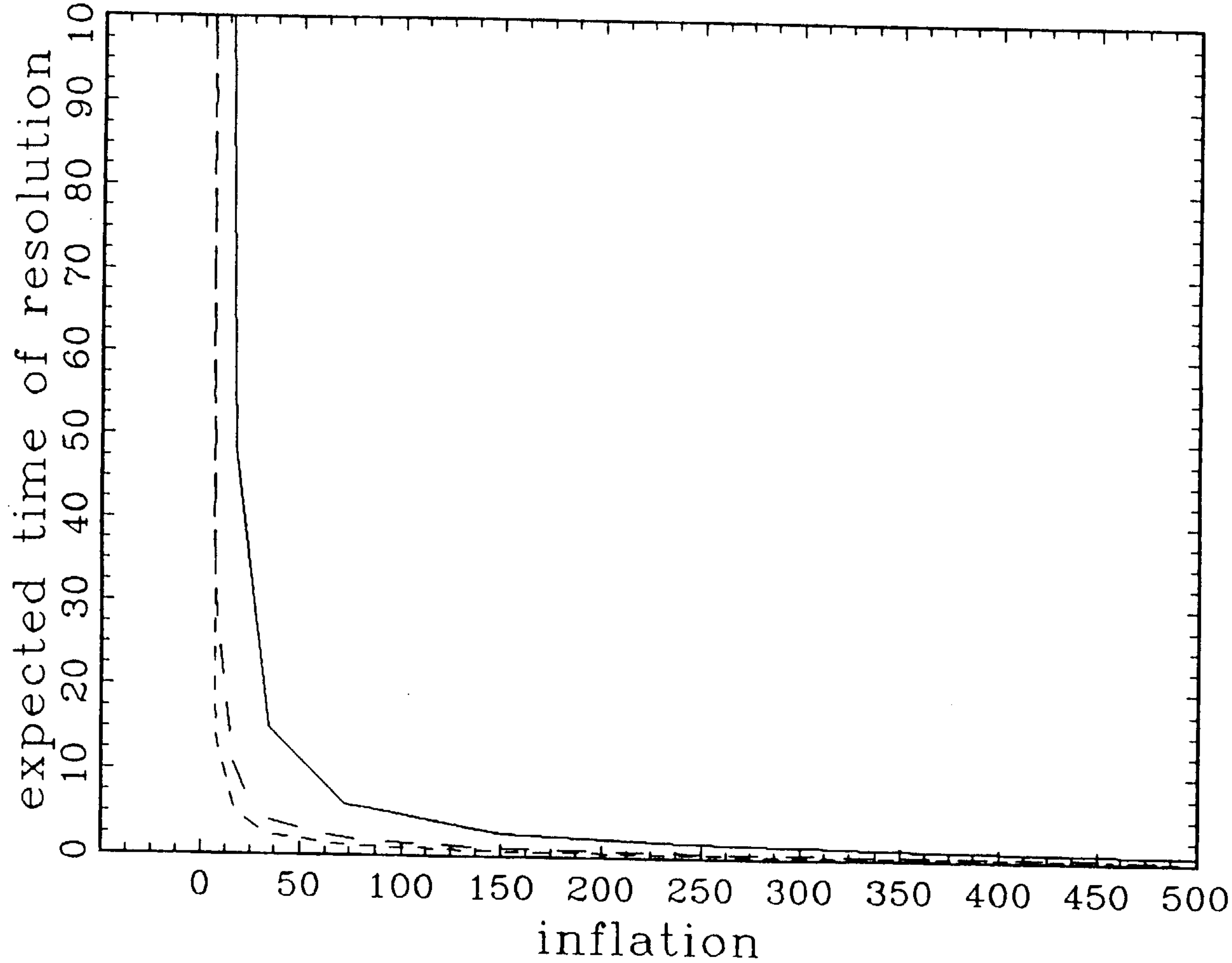

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Figure 5: Cost of Inflation