The Theory of Public Choice - II
James M. Buchanan and Robert D. Tollison, Editors
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Tax Rates and Tax Revenues in Political Equilibrium: Some Simple Analytics

James M. Buchanan and Dwight R. Lee

Our purpose here is to analyze the tax rate–tax revenue relationship that figured prominently in the supply-side economics discussion which dominated macropolicy argument in the early 1980s, and to use standard utility-maximization to define the conditions for both taxpayer and political equilibrium. In order to simplify our exposition, we ignore the serious complexities involved in conceptualizing a single rate-revenue relationship in a tax system that incorporates many separate bases for taxation, along with many rates, including progressive rates on important sources. What is *the* rate of tax in the United States? We simply assume that this question may be satisfactorily answered.

In order to bring the analysis to the simplest possible level, we shall assume that there is only one well-defined base for taxation, and, further, that there is a single uniform rate of tax imposed on the generation or use of this base. We shall use a demand-theory construction throughout the analysis. We consider the behavior of the potential taxpayer as a potential "demander" of the tax base. This construction is self-evident if we think of the base as an ordinary commodity, say, beer. It is less familiar, but nonetheless fully appropriate, to think of the taxpayer as demanding units of income when he supplies resource inputs. With an income base for tax, it is, of course, possible to examine the taxpayer's behavior in supplying labor or other resources to produce the base. Most of the analysis of taxpayer response has taken this supply-side approach.[1] The two constructions are reciprocals of each other; they describe the same behavior and yield identical results.[2] Our demand-side approach, however, will enable us to draw on familiar propositions in orthodox demand theory that tend more readily to be overlooked when the supply-side approach is taken.

The first objective is to examine carefully the possible relationships between tax rates and tax revenues. There will be a direct and proportionate relationship when the base is invariant with changes in rate. In terms of familiar Marshallian coordinates, the direct and proportional rate-revenue relationship exists when the elasticity of the demand for base is zero throughout the range of possible tax rates.

In all normal conditions, we should expect that the "demand curve" for the base would be downsloping throughout the range of possible rates, there-

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by generating nonlinear relationships between rates and revenues.[3] With a pretax price assumed constant over quantities, the rate-revenue curve becomes fully analogous to the price-revenue curve derived from the standard downward sloping demand curve. Commencing with a zero tax rate, and then allowing this rate to increase incrementally, we can trace a range over which total tax revenues increase, reach a maximum, and then a range over which revenues decrease, until at some rate, revenues fall to zero. For simplicity in exposition throughout, we shall use linear relationships between price (including tax) and quantities demanded.

The second objective is to analyze the behavior of those who make decisions on rates of tax with the purpose of predicting the "equilibrium" position or location along the rate-revenue function. In particular, we seek to determine whether or not rational rate-setting behavior could generate a location characterized by an inverse relationship between tax rate and tax revenue.

A Model of Government

For our purposes, we do not need to choose among alternative public choice models of governmental decision making (median voter, bureaucratic dominance, agenda setter, benevolent despot, monopolist surplus maximizer, etc.). We require only that government's utility function contain two arguments, expenditures (revenues), and tax rates with expenditures (revenues) considered as "goods," and tax rates as "bads." Clearly, this minimal requirement fits the objective function of all governments. The ideal position would be one of being able to make expenditures, either to finance public goods and services or to secure private-personal gains (or some combination) without, at the same time, having to levy taxes on a recalcitrant citizenry. The worst possible position, by contrast, would be that in which governments found it necessary to levy onerous taxes without securing the advantages of the revenue collections from which to make public expenditures.

The second characteristic of our model for governmental behavior is somewhat more restrictive than the first, although it is surely realistic. We postulate that governmental decisions are made on the basis of a limited time perspective.

If politicians in office could, at the end of their tenure, effectively realize the capital value generated as a consequence of their decisions, the necessary uncertainty of political tenure need not affect the time horizon. Without marketability of the capital value (generated, for example, by a record of fiscal prudence) politicians have little motivation to consider consequences that extend beyond the expected period of tenure. Furthermore, and somewhat paradoxically, expected tenure actually may be increased by focusing on short-run considerations. The rational ignorance of voters makes it unlikely that they will understand the long-term consequences of current decisions or be able to assign political responsibility for these consequences once they arrive. The politicians who push for policies that generate near-term benefits

probably increase their chances for reelection even if the long-run effects of these policies are decidedly negative. This short-sighted bias is intensified by the fact that the immediate advantages of policy often accrue to specific constituencies while the eventual costs are spread over an entire taxpaying public. When providing benefits for his constituency the politician is in much the same position as the exploiter of a common property resource. Not only will he and his constituents not pay all of the cost of exploiting the political process for their immediate gain, but if they refrain from this exploitation they cannot expect to gain a preferential claim on future benefits in exchange. The politician, much like the harpooner of blue whales, sees little advantage in taking a long-run perspective.

In the analysis to follow, we do not need to specify in any precise way what the time horizon of the political decision maker is. We require only that this horizon be shorter than that period of time that is necessary for taxpayers to make their full behavioral adjustments to changes in the rates of taxation.

The Rate-Revenue Analytics

We introduce a highly simplified geometrical construction, depicted in figure 1*A* and 1*B*. The abscissa is drawn at the level of the pretax price, which, for a money-income base is simply \$1. In figure 1*A*, the heavily drawn curve D_L is defined as the truncated long-run demand curve for the base with "long-run"

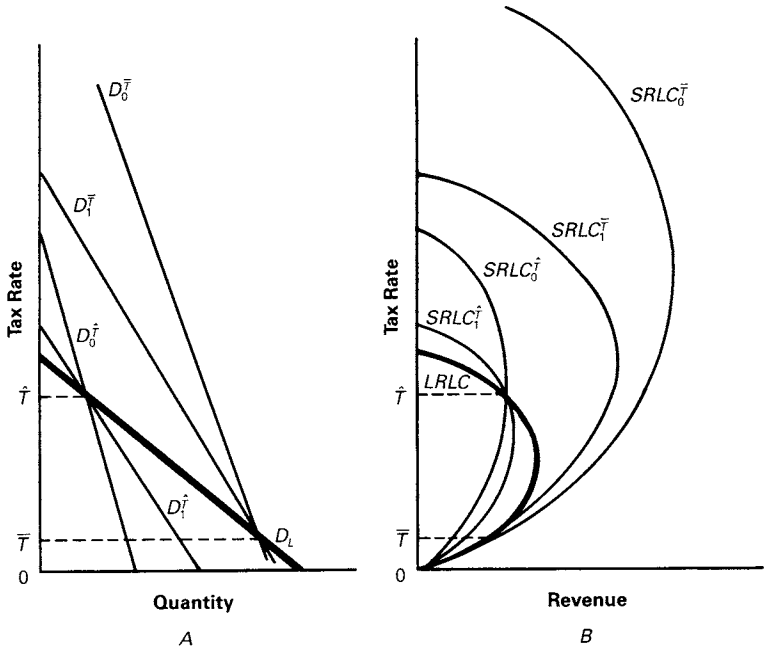

Fig. 1

being specifically defined to be a period sufficiently long to allow for full behavioral adjustment to each rate of tax on base, and for the attainment for the full institutional equilibrium subsequent to such behaviorial adjustment. In his work on the Swedish tax structure, Stuart (1979) has suggested that the calendar length of such a period, for Sweden at any rate, may be up to ten years. The short-run, long-run distinction clearly seems more important in the tax-adjustment context than it does when we are considering demands for ordinary commodities, in part at least because governments tend to levy taxes on those bases that are relatively immune to easy adjustment by potential taxpayers (as indeed they are advised to do by orthodox normative tax theorists).

The same relationship as that shown in the demand curve (heavily drawn) in figure 1*A* is traced out in figure 1*B* by the heavily drawn curve, *LRLC*, with total tax revenues being measured along the abscissa. The two end points of this curve correspond to the origin (at zero tax rate) and to the intercept of the demand curve in figure 1*A*, at which point the tax rate becomes sufficiently high so that, given time for complete adjustment, no base is demanded at all. If prices are converted to percentage rates, this intercept value may lie close to 100 percent, although it may readily fall below or even go above this level.

The heavily drawn demand curve in figure 1*A* and the heavily drawn rate-revenue curve (Laffer curve) in figure 1*B* depict taxpayer responses to alternative rates of tax after full adjustments have been made to each rate. In other words, these curves are necessarily long-run if taxpayer adjustments to rates are postulated to take time. Indeed, these curves define a unique relationship between rate and base, or rate and revenue, only if the full-adjustment stipulation is made. If we restrict taxpayer response to any period of time shorter than that required for full adjustment, it becomes necessary to date the functional relationship between rate and base, or rate and revenue, and, in addition, to fix the initial rate to which full adjustments are assumed to have been made.

On figures 1*A* and *B*, assume that taxpayers have fully adjusted their behavior to the rate shown by $\bar{T}$. There will be a whole family of demand curves (figure 1*A*) and Laffer curves (figure 1*B*) that may be drawn through the initial position of taxpayer equilibrium, each one of which will incorporate a different period of adjustment that must be specifically defined. In figure 1*A*, the demand curve labeled, $D_0^{\bar{T}}$, depicts the current-period adjustment to alternative rates of tax, given that taxpayers have fully adjusted to $\bar{T}$ before any change. The demand curve, $D_1^{\bar{T}}$, depicts the adjustment after a single period of time. The Laffer curves, $SRLC_0^{\bar{T}}$ and $SRLC_1^{\bar{T}}$, are, of course, alternative depictions of the same relationships. Only two short-run curves are drawn although any number could be included.

The same exercise could be carried out for any initial rate to which taxpayers might be assumed to have been fully adjusted. One additional rate, $\hat{T}$, is included in figure 1. Note that at all rates of tax above that for which

behavioral adjustments have been completed, more revenues will be generated in the short run than in the long run, whether revenues will increase in both cases, whether short-run revenues will increase and long-run revenues decrease, or whether both short-run and long-run revenues will decrease. Conversely, for all rates of tax below that for which behavioral adjustments have been completed, more revenues will be generated in the long run than in the short-run, whether short-run revenues will decrease and long-run revenues increase, or whether both short-run and long-run revenues increase, or whether both short-run and long-run revenues will increase.

Political Equilibrium

To derive the necessary conditions for political equilibrium, we must introduce the utility function for government itself, restricted by the stipulation that revenues are "goods" and taxes are "bads." This restriction allows us to depict government's preferences with ordinary indifference mapping on the same dimensions of figure 1. We do this in figure 2.

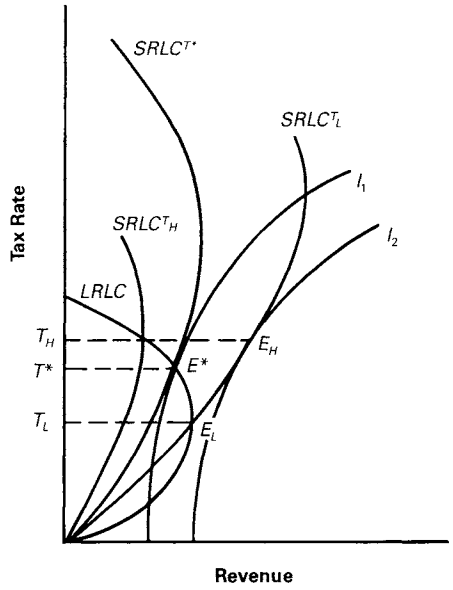

Fig. 2

The rate-revenue relationship defines the constraints within which governmental fiscal decisions are made. But it is necessary to specify carefully which particular rate-revenue relationship is relevant here. As noted earlier, the location of the rate-revenue function will depend on the initial tax-rate equilibrium to which taxpayers have adjusted and on the length of the time horizon incorporated in governmental decisions. The long-run or full-adjust-

ment rate-revenue or Laffer curve will become the relevant constraint only if political decision makers adopt the long-term perspective. In all other cases, this long-run curve is irrelevant to decision making by government, although it continues to describe the locus of equilibrium positions for taxpayers, and, through this means, to constrain the ultimate location of the position that defines equilibrium both for government and for taxpayers.

The equilibrium conditions for the politicians will be defined by the equality of the trade-offs between tax rate and tax revenue in the government's utility function on the one hand and in the appropriate rate-revenue function on the other. If this equilibrium is also to represent the long-run equilibrium adjustment for the taxpayer, it must lie on the long-run Laffer curve. One such equilibrium position is that shown at E^* in figure 2. At E^*, with tax rate, T^*, political decision makers are in the required tangency position; they have no incentive to increase or to decrease tax rates. Taxpayers, on the other hand, have fully adjusted to the tax rate, T^*; they will not modify their behavior further as time passes.

Note that government could, if it desired, increase revenues in the short run; the relevant short-run rate-revenue curve is upsloping at E^*. (It is assumed that only one short-run curve is relevant between a change in the tax rate and full adjustment to that tax rate.) If government should be strictly revenue maximizing, E^* would not, of course, be a position of political equilibrium. In this case, political equilibrium would be attained only where the relevant rate-revenue curve becomes vertical at its intersection with the long-run curve.[4]

As the geometrical construction in figure 2 indicates, the position of equilibrium may be located either on the upsloping or the downsloping portion of the long-run rate-revenue curve. Only by chance would the position be at the maximum revenue position on the long-run relationship, and there is no analytical reason to predict precisely where the equilibrium position will be located. Note, however, that the equilibrium will always be below the maximum-revenue point on the short-term rate-revenue curve, so long as taxes are "bads" in government's utility function.

Consider the case where the tax rate to which long-term adjustment has been made is T_L, the rate which does generate maximum revenues per period after all taxpayer adjustment has been completed. Finding itself at E_L government will seek to increase the tax rate to T_H in order to attain position, E_H, on the short-run curve, $SRLC^T_L$, that passes through E_L and which defines the appropriate adjustments over the period of the government's planning horizon. The position, E_H, cannot be attained for longer than the short period so defined because it is not consistent with long-term taxpayer equilibrium. As time passes, and as adjustments are made, both in taxpayer behavior and in tax rates, government will (assuming convergence) shift to the position of sustainable equilibrium, E^*, with tax rate, T^*.

With different configurations of the indifference curves or the rate-revenue curves, equilibrium could, of course, be located somewhere along the

upsloping portion of the long-run Laffer curve. We do not analyze this sort of equilibrium diagrammatically since the relevant necessary conditions are fully analogous to the position depicted in figure 2. We should note, however, that regardless of where sustainable equilibrium is located, the tax rate will be *above* that which would be chosen by a government whose time horizon is as long as the period required for taxpayers to make full adjustments to rate changes. It should also be evident that the longer the time horizon of government, even within the constraint that it remain shorter than the time for full adjustment, the closer will be the equilibrium tax rate to that which would characterize the rational behavior of the genuinely far-seeking government. We may summarize much of our analysis by stating that, so long as government is short-sighted, it will always seek to exploit to some degree the vulnerability of the taxpayer over the period between the change in tax rate and the attainment of full individual and institutional adjustment.

Convergence and Stability

The emphasis to this point has been to define the conditions for taxpayer and government equilibrium. We have simply presumed that the equilibrium will be attained, and we have neglected any analysis of the process through which the final position might be reached as well as the whole question as to whether convergence takes place at all. Without going into a detailed analysis of the dynamic features of the model and the stability conditions, some general observations can be made.

Assume that the government can adjust the tax rate once each period, and further that the government's concern is only with the current period while full private adjustment to a tax rate is not complete until the beginning of the period following its imposition. In this case it can be shown that the tax rate will oscillate around the political equilibrium rate, T^*, if the objective is simple revenue maximization (the indifference curves are vertical with respect to the horizontal axis).[5] When the tax rate enters the utility function as a bad, tax rates may oscillate around T^* early on, but will not necessarily continue to oscillate as T^* is approached. It is clear, for example, from the discussion of figure 2 that if the initial rate is below T^* at T_L, then the next period's rate will be above T^* at T_H. Once full adjustment to rate T_H has been made and the government is contemplating a new rate, $SRLC^{T_H}$ is the relevant short-run Laffer curve. It is reasonable to assume that the slope of $SRLC^{T_H}$ will be less positive (or more negative) at each tax rate than will the slope of any short-run Laffer curve to its right, and vice versa.[6] But one also expects that at each tax rate the indifference curves become steeper as we move left, reflecting a willingness to increase the tax rate more in return for a given increase in revenue when revenue is low than when it is high. Therefore the point of tangency between $SRLC^{T_H}$ and an indifference curve can occur either above or below T^*.[7] The possibilities for developing a general characterization of the tax rate time path appear limited and will not be attempted here.

Expectations

A more critical restriction on the analysis involves our neglect of expectations. We have implicitly assumed that taxpayers respond to rate changes in a passive sense; they expect any rate to be permanent. They do not, themselves, model the behavior of government in imposing these rates. The introduction of taxpayer expectations into the analysis has several interesting results that are apparently relevant to current tax policy debates.

If taxpayers model the tax-setting behavior of government correctly and if both taxpayers and government have available the same data on rate-revenue relationships, taxpayers will be able to predict the position of equilibrium and make their own behavioral adjustments accordingly. The possibly long sequence of adjustments through which response to rate changes take place will be foreshortened dramatically. Suppose, however, that in a rational expectations equilibrium, described by some position like E^* in figure 2, government should want to take on a longer time perspective than that which has characterized its previous behavior and which had been incorporated in the model of government held by taxpayers. Suppose government recognizes the additional revenue potential, in a long-run sense, available to it from tax-rate reduction, and that it seeks to exploit this. To government, this clearly should seem to be a net gain, since it should be able to secure additional revenues which will allow it to make additional outlays, while at the same time, rates of tax on the citizenry are reduced. Taxpayers should, seemingly, welcome this move toward rate reduction, since excess burdens would be lowered without any sacrifice in benefits available from public outlays.

The government may, however, find it difficult to move from E^* along the long-run Laffer curve in the manner that seems indicated. So long as taxpayers continue to model government as a short-run maximizer, they will not respond fully to a tax rate below T^*. Rather, they will incorporate only short-run considerations into their calculus and respond along curve $SRLC^T$ in figure 2. Taxpayers will reason that, if they respond fully to the rate cut below T^*, they will leave themselves again vulnerable to short-term exploitations as government returns to T^* or above. Therefore, a rate reduction will put the government on a lower indifference curve for a period that extends beyond the short run, and even a relatively far-sighted government will be unable to move down the long-run Laffer curve, LRLC in figure 2, from position E^*.

In order to generate shifts along the long-run Laffer curve, even in the long run, the government must convince taxpayers that tax rate reductions are permanent; in other words, they must, simultaneously with cuts in tax rates, get taxpayers to change their model of governmental behavior. If, however, taxpayers construct their model of governmental behavior on the basis of a developing historical record, there may be no readily available means of escape from the high tax dilemma. The straightforward shift in time perspective of government is not sufficient; government must, somehow, bind or

commit itself in such fashion that taxpayers become convinced that a "new deal" has, indeed, arrived. It is at this point that the argument for *constitutional* commitment on rates of tax, or on other forms of fiscal limits, comes into force. The promised results of "Reagonomics" might, indeed, become possible with constitutional rate reductions; they seem unlikely to emerge in the expectational setting of 1982 when taxpayers remain highly skeptical of the willingness of government, in future years, to keep real tax rates at promised levels.

Conclusions

Our purpose has been almost exclusively analytical rather than empirical. We have shown how equilibrium positions along the "wrong side" of the rate-revenue relationship may be attained, without any violation of rationality precepts on the part of governmental decision makers, and, further, we have indicated why escape from the genuine dilemma that such positions represent might prove difficult. The analysis is, however, helpful in assessing the attempts to locate empirically the position of the United States fiscal structure in the early 1980s. It seems clear that, in the debates of 1981, those supply-side economists who argued in terms of Laffer curve effects were implicitly adopting a long-time perspective, whereas those economists who argued that location along the downsloping portion of the Laffer curve was highly unlikely were, again implicitly, thinking in terms of some short-time Laffer relationship.

The empirical studies that have been attempted have been largely based on studies of the elasticity of input response to changes in net returns. Much of this work seems inconclusive in judging the long-run impact of a tax cut on revenues. For example, in an effort to address this impact, Fullerton (1980) makes use of thirteen empirical investigations of labor supply elasticities. Of the thirteen studies all were cross sectional except two, leaving inconclusive any means of assessment concerning the completeness of the adjustments. All thirteen studies generated estimates based on uncompensated responses to changes in the return to labor. This is reasonable when, as in the cases in most of the studies, the response of particular subsets of the labor force is being investigated. However, when the response of the aggregate labor force is to be estimated, as it necessarily must be when considering the results of a general tax change, the more reasonable assumption is that at least some compensation takes place. What workers gain (lose) from a tax reduction (increase) will be offset to some degree by a reduction (increase) in benefits from governmental service.[8] To ignore this offset is to understate labor supply elasticity when leisure is a normal good.

It is also true that input supply elasticities will generally be smaller than the output elasticities that are of ultimate concern. The positive effect of an increase in the return to labor may not come primarily from the motivation it provides to work more hours, but from the motivation to work more produc-

tively. Labor supply elasticities fail to pick up the output effects that flow from human capital increases induced by an additional return to labor. This output effect is further enhanced through the symbiotic interaction that exists between a growing stock of human and physical capital.

The definitive empirical work remains to be done. Not only does such work call for the estimation of long-run input elasticities (where the long run may extend to a decade or more), but also for the inclusion of these elasticities into a model that recognizes the dynamic interactions and feedbacks that exist between inputs in the generation of measured output. The simple analytics we have presented here offer the challenges to those who would either refute or corroborate the claims of the Lafferites.

The thrust of the analysis does not depend at all on the empirical findings concerning the location of the United States tax structure on the long-run Laffer curve. As we have noted, so long as government makes its fiscal decisions on the basis of a time horizon shorter than that period required for full taxpayer adjustment to tax rate changes, observed tax rates will be higher than those that a far-seeking or "enlightened" government would impose. The "high tax trap" is only one of several critically important policy dilemmas that arise when there is an obvious discrepancy between the government's rate of discount and that rate that would be "efficient" in some long-run sense. Fortunately, economists are rapidly coming to be aware of the central features of these dilemmas and are now shifting their attention to the analysis of *rules* that will restrict the operations of ordinary politics.[9]

NOTES

We are indebted to our colleagues, Geoffrey Brennan, Nicolaus Tideman, Robert Tollison, and Gordon Tullock, for helpful suggestions on an earlier draft.

1. Specifically related to the Laffer-curve relationship, see Fullerton (1980). By contrast, in their recent book, Buchanan and Brennan (1980) utilize a demand-theory construction throughout their analysis.
2. For a discussion of the reciprocal nature of the demand and supply relationship, see Buchanan (1971).
3. In our construction, we apply the rate of tax directly to the base, with base defined in units of ultimate consumable "goods," whether a single commodity like "beer" or the bundle of commodities and services that the taxpayer might purchase with posttax income units. This procedure allows us to convert the percentage rate of tax readily into an increment to pretax price, and to utilize orthodox demand analysis straightforwardly. Note, however, that this construction differs from the standard definition of a tax "rate" under income taxation, which involves applying a percentage rate to the generation of base, *inclusive* of tax. In terms of a simple numerical example, if the pretax price of a unit of consumable goods is $1, a 10 percent tax, in our construction, becomes equivalent to a 10 cent addition to pretax price. In order to generate $1's worth of final consumable goods, the taxpayer would have to generate $1.10's worth of income including tax, to which a "rate"

of 9.09 percent would be applied to secure the 10 cents. Hence, a rate of 10 percent, in our construction, is equivalent to the lower rate of 9.09 percent on the inclusive base.

The distinction here is important with respect to the dimension in which responses to changes in rate are measured. Invariance in the generation of base, net of tax, in our construction, necessarily implies a positive relationship between rate and generation of base, defined gross of tax. More generally, and as our analysis in the text indicates, any range of adjustment over which the demand for base, net of tax, is inelastic definitionally implies a positive relationship between rate and base, gross of tax.

4. In a forthcoming elliptical note, we develop the analysis of equilibrium in this limited revenue-maximizing case. See Buchanan and Lee, "Politics, Time, and the Laffer Curve," *Journal of Political Economy* (August, 1982): 816–19.
5. This has been established and the conditions for convergence worked out in Buchanan and Lee (1981).
6. This will be true of all short-run Laffer curves when the short-run demand curves are vertically parallel to each other.
7. It is possible that a tangency occurs at the point where $SRLC^{T_H}$ intersects *LRLC* and thus there will exist multiple political equilibria. This multiple equilibria possibility does not exist in a strict revenue-maximizing model.
8. For a theoretical investigation of this consideration see Lindbeck (1980).
9. The "high tax trap" analyzed in this article is closely analogous to the "inflationary trap" generated by discretionary monetary policy in a setting where there is a recognized short-run trade-off between unemployment and inflation. Governments that respond rationally in the face of this short-run trade-off are led to policies that generate inflation which is undesired within the long-term perspective. And the difficulties involved in any escape from this inflationary trap are in many respects identical to those analyzed here. On the inflationary trap, see Kydland and Prescott (1977) and Barro and Gordon (1981).

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