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Interpreting the Reagan Deficits

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This paper describes two ways of rationalizing the large net-of-interest deficits experienced by the U.S. during the Reagan Administration. Both of these rationalizations imply that U.S. government expenditures are destined to fall relative to their pre-Reagan path.

Figures on government deficits are difficult to interpret because the economically relevant budget constraint is an intertemporal one. As such, it restricts the present value of a sequence of government deficits but not the size of deficits for particular years or even for long strings of years. For any observed string of government deficits, there always exists a string of prospective future surpluses that renders the budget in balance in the present value sense.

By alluding to prospects for future government surpluses, anyone can therefore assert that a record of observed deficits is consistent with maintaining sound government credit and a stable government currency. Several years of big deficits by themselves therefore fail to indicate that the entire sequence of government budgets is out of balance. This fact opens recent deficit figures for the United States to alternative interpretations, some hopeful, others foretelling doom.

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This paper tries to rationalize the large net-of-interest deficits in the federal budget of the United States that have marked the Reagan Administration. I take for granted that the recent deficits are temporary and that they foretell future government surpluses. I spend no time discussing the view that the deficits are simply a mistake, a failure of policy, or the result of shortsightedness or ignorance of the intertemporal government budget constraint. Instead I focus on alternative interpretations of recent events that are consistent with George Stigler's vision that all agents in a social system are rational and purposeful. I seek to explain the fiscal and monetary actions observed during the Reagan administration as reflecting the optimal decisions of government policymakers.

There will be one equation in the background of my discussion, one whose validity is granted by all competing theories of macroeconomics. This equation is the intertemporal government budget constraint. It states that, at any moment, the value of interest-bearing government debt is equal to the sum of two terms: the present value of future government surpluses net of interest, and the present value of future government revenues from printing currency (seignorage revenues).

Presumably, the government deficit net of interest and the revenues from currency creation are controlled by separate and independent agencies of the U.S. government. However, in a recurrent and strategic sense, independence is not feasible. Because revenues from printing currency are one component of the government budget constraint, the notion that there can be truly independent monetary and fiscal authorities is a myth.

Arithmetic makes the strategies of the monetary and fiscal authorities interdependent.¹ Classic recommendations for the conduct of monetary policy, such as Friedman's (1959) k -percent growth rule for currency or the gold standard, are well understood as coordination rules for monetary and fiscal policy. For these coordination rules to be feasible, the intertemporal government budget restraint must be respected. Throughout this paper, I will assume that a version of Friedman's k -percent coordination rule (one with a small value of k) is followed.

I seek to interpret the following observations about monetary and fiscal policy during the Reagan years: a string of large annual net-of-interest government deficits accompanied by a monetary policy

stance that has been tight, especially before February 1985, and even more so before August 1982. I take as indicators of tight monetary policy high real rates of interest on U.S. government debt and pre-tax yields that exceed the growth rate of the economy. (Real rates of this magnitude imply that the interest-bearing government debt is growing relative to the size of the economy unless the net-of-interest government budget is in sufficient surplus.) I take for granted that the string of net-of-interest government deficits and tight monetary policies (low rates of seignorage production) cannot both continue forever, simply because they would violate the intertemporal government budget constraint.²

I shall describe two rationalizations of recent observations on government policy, each of which is consistent with the government budget constraint, under the hypothesis of "rational expectations" and the presumption that the government as a whole is committed to a monetary regime with low inflation rates over the long haul. The last stipulation is equivalent to an assumption that the present value of seignorage in the government budget restraint is taken for granted to be small.

I. Barro Tax Smoothing

The first rationalization is constructed by applying the optimal tax smoothing model of Robert Barro (1979). I assume that the monetary authorities are committed to supplying little or no seignorage, and that this is beyond dispute. It follows therefore that the present value of seignorage is small. Because of the government budget constraint, the net-of-interest government budget must be in surplus in present value by an amount equal to the current value of interest-bearing government debt. How can this implication be reconciled with the string of large net-of-interest deficits observed during the Reagan administration? Barro's model supplies a possible answer.

Barro's model of tax smoothing can be thought of as a reinterpretation of Milton Friedman's (1956) model of permanent income as developed by Robert E. Hall (1978).³ The permanent income model of consumption confronts a consumer with an exogenous process for labor income and a constant real rate of return on savings. The consumer has

preferences over a long horizon that can be represented as a discounted sum of a current period utility function that depends on current consumption alone. That is, preferences are additively time-separable, and the utility function is concave in current consumption.

Hall shows that for a discount factor equalling the reciprocal of the gross interest rate on assets, the marginal utility of consumption follows a random walk. To the extent that the marginal utility of consumption is approximately linear in consumption, consumption itself may approximately follow a random walk. As Hall has stressed, for any income process, no matter how unsmooth, the model predicts that consumption is approximately a random walk. This means that at every point in time, future consumption is expected to be approximately constant.

Hall's model precisely represents the consumption-smoothing idea present in Friedman's original work on the consumption function. A possibly very

unsmooth labor income process is used to support a consumption process whose future is expected at each point in time to be perfectly smooth. Borrowing and lending are used to convert an unsmooth income path into a smooth consumption path. At any time, the mean of the consumption path is set so that the present value of consumption equals the present value of labor income plus initial nonhuman assets.

Barro can be regarded as having changed the names of the variables in Hall's model and applied them to government. In place of the household budget constraint, Barro uses the government budget constraint. What was the exogenous labor income process in the Friedman model becomes an exogenous process for government purchases. What was consumption in the household budget constraint becomes total tax collections in Barro's model. What were household assets become the stock of interest-bearing government debt. The interest rate confronting the household in Hall's model becomes the interest rate at which the government can borrow and lend in Barro's model.

The intertemporal version of the re-interpreted budget constraint is precisely the intertemporal government budget constraint described above, with seignorage assumed to have a present value of zero. In place of the preference function used by Hall, Barro uses an additively time-separable loss function measuring distortions from taxing. The current period loss function is convex in total tax collections.

Barro poses the problem of a government that faces an exogenous and given stochastic process for government purchases and that chooses a tax strategy to minimize the expected discounted value of losses from tax distortions. In mathematical terms, this model is equivalent to Hall's consumption model, with the change of variables described above. It follows that the model gives the result that optimally, total tax collections should follow a random walk. That is, in the face of an unsmooth government expenditure stream, tax collections should be smoothed. In this way, distortions are allocated over time in a way to minimize the present value of the distortion.

We note that this result depends critically on the feature of the loss function that the distortion at time t is assumed to depend only on total tax collections

at t , and not on future tax collections, as would occur in a model in which private agents are speculating about future government tax collections. In Barro's model, expected future tax collections are set equal to current tax collections, with current tax collections set to satisfy the intertemporal government budget constraint.

The Barro model can be used to rationalize the observed deficits of the Reagan Administration as part of an optimal tax smoothing response to an "innovation" about the present value of government expenditures that arrived coincidentally with Reagan's election.

Assume that the election of Reagan signalled a downward revision in the size of the U.S. government, as measured by the expected present value of federal expenditures. Assume further that the path of reductions, compared to the path that could have been expected prior to Reagan, was skewed toward the future or "back-loaded". That is, the election of Reagan meant reductions in the government expenditures could be expected to take place gradually over time, with larger reductions in the future than in the present.

Given such a change in the path of expected government expenditures at the start of the Reagan administration, Barro's tax smoothing model predicts that the (optimal) response of the government would be an immediate permanent reduction of tax collections, relative to the pre-Reagan path. The consequence of these immediate reductions would be a string of deficits while expenditures remained high, to be followed by a string of net-of-interest government surpluses after the reductions in expected government expenditures had been realized.

According to this scenario, there is nothing pathological about the large deficits we have observed. Instead, they are to be interpreted as the result of optimal tax smoothing by the federal government. Note that Barro's argument implies that the Reagan Administration should have tried for a 25 percent reduction in tax rates at one shot, rather than the 5-10-10 phasing in over three years embodied in the Kemp-Roth tax legislation.

Barro's model implies that the large deficits observed pose no inflationary threat because they pose no danger of being monetized subsequently. The fact that the interest-bearing U.S. government

debt has grown under Reagan is merely a signal that the budget will swing into surplus sometime in the future, and that government expenditures are destined to fall relative to their pre-Reagan path.

The scenario described depends critically on a controversial aspect of Barro's specification of the function measuring the current loss from distortion in the government's objective function. In particular, Barro specifies that the current distortion at time t depends only on current tax collections, and is not a function of the public's expectation of future taxes set by the government. This feature is critical in giving rise to the random walk characterization of taxes, which is at the heart of our interpretation of the Reagan deficits. It is also crucial in rendering Barro's solution of the optimal tax problem time-consistent.⁴

However, in models in which there is capital, either physical or human, the current distortion from taxation at time t typically depends in part on people's expectations about future taxes. In making investment decisions, people look and respond to the government's strategy for taxing in the future. Expectations about future taxes therefore distort private decisions.⁵ Such distortions would alter Barro's loss function in a way that would make it suboptimal if tax collections followed a random walk. It would also render the solution of the optimal tax problem time-inconsistent. Various administrations differing over time would therefore be unable to carry out any solution.

As it turns out, when optimal tax problems are solved for systems with physical or human capital, the optimal tax strategy usually is far from a random walk prescription. Usually high taxes are called for in the present, to be followed by lower taxes in the future. Since high taxes now are imposed on existing capital and existing capital is perfectly inelastic in supply, the taxes take on a lump sum character. As a result, such current taxes should be imposed heavily to minimize the present value of distortions. Anticipated future taxes, in contrast, do distort

investment decisions and therefore future values of capital. As a result, they should be used sparingly. The asymmetry in attitude toward current and future taxes on capital is at the heart of the time inconsistency of the solution, as well as of the suboptimality of tax smoothing.

In summary, by restricting the nature of the function that is assumed to measure the losses from the distortions that taxes impose, Barro was able to create a model calling for "tax-smoothing". By tax-smoothing, he meant that, even if government expenditures were expected to vary in the future, it would be optimal for consumers to expect taxes to remain unchanged. Applied to the current situation in the U.S. (supposing that the election of Ronald Reagan signalled that government expenditures would fall relative to their pre-Reagan path), the model rationalizes a string of deficits like the one we have experienced. Not only does the model "explain" those deficits, but it also implies that they are not signs of a "problem". Rather, the current deficits are simply a "signal" of future reductions in the path of government expenditures.

This application of Barro's model is attractive because it explains many aspects of the current situation and supports a sanguine interpretation of recent U.S. deficits. However, such an application is not beyond criticism for reasons alluded to above. In particular, the restrictions on the loss function measuring distortions in Barro's model are very strong ones. Indeed, the restrictions suppress any "supply side" effects flowing from expectations about future taxes to current decisions.

I now turn to an alternative interpretation, one due to Neil Wallace. Wallace's interpretation hinges on the observation that economic policymaking in the United States is decentralized over a variety of agencies, and that government expenditures cannot be reduced without a struggle among those agencies. Wallace's explanation makes the deficit an instrument in that struggle.

II. Wallace's Game of Chicken

Wallace's interpretation assumes that the "game" played by government policy authorities has a different structure from that assumed by Barro. In particular, Wallace has interpreted monetary and fiscal policy during the Reagan Administration as unfolding like a game of chicken among distinct branches of government with different preferences about the size of the U.S. federal government.⁶ In this game of chicken, reducing the present value of government expenditures is not a given, but instead is the objective of one of the participants in the game. This objective, in turn, is actually opposed by another player. The players' weapons consist of their separate authorities to set paths for government expenditures, tax collections, and currency creation. Using Wallace's analogy, the Reagan Administration plays the game for the purpose of reducing the present value of government expenditures — an objective whose attainment Barro's explanation took for granted.

The game of chicken is played among decentralized branches of government that control separate elements of the government budget constraint. There is a tax authority, whose role I shall assign to the Reagan Administration, and whose responsibility is to select a stochastic process for tax collections. There is a government expenditure authority, here assigned to Congress, that determines the stream of government expenditures. Finally, there is a central bank (the Federal Reserve System) that determines a time stream of currency and thereby controls the present value of seignorage that appears in the government budget constraint.

While these three players, the tax authority, the expenditure authority, and the monetary authority, must coordinate their strategies because of the arithmetic of the intertemporal government budget constraint, they are not forced to do so on a day-to-day basis by any formal legal or constitutional mechanism. The coordination of monetary and fiscal policy in the United States is not governed by a set of well-understood, recurrently applied, or explicit rules. Instead, policy actions seem to emerge from a process that is decentralized across institutions (Congress, President, and Federal Reserve) and spread over time through a succession of administrations and personalities. This decentralization

opens the way to the playing of what Neil Wallace has characterized as a game of chicken.

In the game of chicken being played under the Reagan Administration, the tax and monetary authorities jointly desire a reduction in the present value of government expenditures (something they do not control) as well as a stable price level. The expenditure authority is assumed to desire a larger government in the sense of a larger expected present value of government expenditures than does the tax authority.

To achieve its objective, suppose that the tax authority plays the game as follows. It achieves a once-and-for-all reduction in tax collections that reduces the present value of tax collections relative to its initial value. The tax authority (the President) then encourages the central bank to adhere to a k -percent rule for the monetary base for the indefinite future. Such a monetary policy implies that the central bank withholds seignorage revenues from the government. Given these "plays" by the President and the Federal Reserve, the only plays open to the government expenditure authority are ones that capitulate to the President's objective and that reduce the present value of government expenditures by an amount commensurate with the reduction in the present value of tax collections. As long as the President and the Federal Reserve adhere to their strategies, the stream of government expenditures must be reduced because of the arithmetic of the government budget restraint.

Congress may, however, reason as follows. It can simply refuse to reduce the present value of government expenditures despite the tax reduction engineered by the tax authority. Then, as long as the monetary authority refuses to monetize interest-bearing government debt, the arithmetic of the government budget constraint requires that the tax authority eventually reverse itself and raise taxes by an amount that makes the present value of taxes equal to the present value of expenditures plus whatever debt has accumulated. If the monetary authority and Congress both refuse to chicken out, then the arithmetic of the budget constraint asserts that the only feasible thing for the tax authority to do is to raise taxes.

Of course, it is feasible that neither the tax

authority nor the expenditure authority will chicken out. In that case, the central bank would be forced to chicken out by departing from its k -percent rule and generating substantial seignorage. By monetizing the debt, the central bank would permit government expenditures to exceed tax collections in present value terms, albeit at the cost of generating inflation.

While the authorities are playing this game of chicken, we would observe large net-of-interest government deficits, low rates of monetization of government debt (low growth rates for the monetary base), and maybe also high real interest rates on government debt. The result of high real interest rates on government debt and the net-of-interest government deficit is a growing real value of the stock of interest-bearing government debt. The rising stock of this debt would be a signal that the game is not yet over, in the sense that there has been insufficient capitulation. In the U.S. today, the real stock of interest-bearing federal debt continues to grow in relation to GNP.

The game of chicken interpretation has a number of merits as an explanation of these events. While it is tempting to criticize resorting to a game of chicken as an inferior way to run a government, such criticism ignores the extensive decentralization across time and institutions that exists under U.S. government. Given the limited power assigned to the Presidency for economic policy in general and government expenditures in particular, resorting to the game of chicken may be the best method available for achieving the preference, reflected in

Reagan's policies, for reducing the size of the U.S. government.

Several important macroeconomic policy events during the Reagan years bear interpretations in terms of one party or another in our game of chickening out. The Federal Reserve partly chickened out on two occasions, one in August 1982, and another at the start of 1985. Each time, the Fed was responding to outside pressures that were partly consequences of, and which in turn fed back upon, the original game of chicken.

In August 1982, the Fed substantially eased monetary policy, increasing the growth of narrow monetary aggregates and driving real interest rates downward. These actions were in large part responses to the international debt crisis that coincided with the high real interest rates associated with the game of chicken that dominated U.S. macropolicy. The Fed eased its monetary policy specifically in response to the Mexican crisis and the threat it posed for U.S. financial stability. Such concerns limit the Fed's ability to continue to play a tight monetary policy in the face of continued net-of-interest U.S. government budget deficits.

The second partial capitulation by the Fed was associated with a move starting in early 1985 to lower real interest rates in the U.S. as a device to drive down the value of the dollar. The Fed was responding to the increasing strength of protectionist pressures in the U.S. that were themselves responses to the U.S. trade deficit which was, in turn, one consequence of the string of government deficits associated with the game of chicken.

III. Conclusion

While they differ in a number of respects, our two alternative rationalizations of the Reagan deficits share the premise that, compared to the pre-Reagan path, U.S. federal expenditures are destined to fall. In Barro's model, the fall in the path of expenditures occurs exogenously, and precipitates the Reagan deficits via optimal tax smoothing. In Wallace's view, the fall in the path of federal expenditures relative to the pre-Reagan path is an outcome of (or "reward to") the game of "chicken", with an endless string of prospective budget deficits being the stick by which the President and Federal Reserve

persuade a reluctant Congress to reduce federal expenditures. According to both explanations, large net-of-interest deficits are signals of prospective surpluses to be achieved via reductions in expenditure.

Each rationalization relies on the looseness of the intertemporal government budget constraint to which I referred at the beginning of the paper. A long string of large deficits is consistent with budget balance provided that sufficient surpluses occur later. We have rationalized the large Reagan deficits by appealing to the idea that they are temporary and

bound to be replaced by surpluses long before they damage the economy.

Some readers may find the entire endeavor of rationalizing the large Reagan deficits to be misplaced. Perhaps it is farfetched to rationalize deficits in the ways that we have, and better to regard them

simply as reflecting shortsighted mistakes that the U.S. is bound to pay for in the future via more inflation, increased financial fragility, or higher taxes. Nevertheless, to reach the conclusion that the deficits of the last five years were mistakes, one must first understand the arguments that could rationalize them.

APPENDIX

We describe linear-quadratic versions of the models of Hall (1978) and Barro (1979). The exposition is designed to highlight parallels between the two models. For further details and implications of the models, see Sargent (1987).

Hall's Model

A representative consumer chooses a contingency plan for $(c_t)_{t=0}^{\infty}$ to maximize

$$(H1) \quad E_0 \sum_{t=0}^{\infty} \beta^t u(c_t), 0 < \beta < 1$$

where c_t is consumption at t , E_t is the mathematical expectation operator conditioned on information known to the consumer at t , and u is a one-period utility function given by

$$(H2) \quad u(c_t) = u_0 + u_1 c_t - \frac{u_2}{2} c_t^2$$

where $u_0, u_1, u_2 > 0$. The objective (H1) is maximized with respect to $(c_t, A_{t+1})_{t=0}^{\infty}$ subject to the sequence of budget constraints

$$(H3) \quad A_{t+1} = R[A_t + y_t - c_t], t = 0, 1, \dots$$

A_0 given

where $R \geq 1$ is the gross rate of return on savings between periods t and $t+1$, A_t is assets (indebtedness, if negative), and y_t is noncapital or labor income at t . We assume that y_t is a given stochastic process, outside the agent's control. We assume that $\beta R = 1$. We assume that (y_t) is a stochastic process that satisfies $\lim_{j \rightarrow \infty} E_t \beta^j y_{t+j} = 0$ for all t . We impose upon assets the condition

$$(H4) \quad E_0 A_t \geq M > -\infty \text{ for all } t$$

which rules out a strategy of larger and larger borrowing to support bliss consumption. Subject to H4, the solution of the difference equation H3 is the following intertemporal version of the budget constraint:

$$(H5) \quad \sum_{j=0}^{\infty} \left(\frac{1}{R}\right)^j E_t c_{t+j} = A_t + \sum_{j=0}^{\infty} \left(\frac{1}{R}\right)^j E_t y_{t+j}$$

Equation H5 states that the expected present value of consumption equals the expected present value of labor income plus the value of initial assets A_t .

Hall shows that a first order necessary condition associated with the problem of maximizing H1 subject to H5 is $E_t u'(c_{t+1}) = (\beta R)^{-1} u'(c_t)$. Since we have set $\beta R = 1$, this becomes $E_t u'(c_{t+1}) = u'(c_t)$. With utility given by H2, this in turn implies $E_t c_{t+1} = c_t$, so that consumption is a random walk.

Barro's Model

A government chooses a tax collection sequence $(\tau_t)_{t=0}^{\infty}$ to maximize

$$(B1) \quad -E \sum_{t=0}^{\infty} \beta^t L(\tau_t), 0 < \beta < 1$$

where τ_t are total tax revenues, and L is the loss function

$$(B2) \quad L(\tau_t) = v_1 \tau_t + \frac{v_2}{2} \tau_t^2$$

The maximization is carried out subject to the sequence of government budget constraints

$$(B3) \quad B_{t+1} = R[B_t + g_t - \tau_t], \quad t=0, 1, \dots$$

B_0 given

where B_t is the initial level of government interest bearing debt, $R \geq 1$ is the gross real rate of return on government debt, and g_t is government expenditures at t . Government expenditures are taken to be an exogenous stochastic process that satisfies $\lim_{j \rightarrow \infty} \beta^j E_t g_{t+j} = 0$ for all t .

We impose the boundary condition

$$(B4) \quad B_t \leq M < +\infty \text{ for all } t$$

which rules out a strategy of "never tax, always borrow more." Subject to B4, the solution of the difference equation B3 is the intertemporal government budget constraint

$$(B5) \quad E_t \sum_{j=0}^{\infty} R^{-j} \tau_{t+j} = B_t + E_t \sum_{j=0}^{\infty} R^{-j} g_{t+j}$$

Equation B5 states that the expected present value of tax collections equals the sum of the current value of debt plus the expected present value of government expenditures. The government is assumed to maximize B1 subject to B5 by choosing a strategy for setting $(\tau_t)_{t=0}^{\infty}$, taking B_0 and the stochastic process for g_t as given. Assume as in Hall's model that $\beta R = 1$.

Mathematically, Barro's model is equivalent to Hall's. Simply replace c_t in Hall's model with τ_t in Barro's, y_t in Hall's model with g_t in Barro's, A_t in Hall's with B_t in Barro's, (u_0, u_1, u_2) in Hall's model with $(0, -v_1, v_2)$ in Barro's. It immediately follows from Hall's results that the optimal tax collection strategy in Barro's model satisfies $E_t \tau_{t+1} = \tau_t$, so that tax collections are a random walk.

FOOTNOTES

1. Sargent and Wallace (1981) describe some of the implications of the interdependence between monetary and fiscal policy.
2. This is Sargent and Wallace's unpleasant monetarist arithmetic.
3. See the Appendix for a more formal presentation and comparison of Hall's and Barro's models.
4. See Kydland and Prescott (1977) for a discussion of the time-inconsistency problem in macroeconomics. See Lucas and Stokey [1983] for a study of dynamic inconsistency in the context of an optimal tax smoothing model that shares many features with Barro's model.
5. See Sargent's (1987) chapter on dynamic optimal taxation for an extended example exploring the time-inconsistency phenomenon created by the responsiveness of investment to anticipations of future taxes.
6. Wallace advanced his ideas orally in March 1981 during discussions that later led to our co-authoring "Unpleasant Monetarist Arithmetic" (1981).

REFERENCES

- Barro, Robert J. 1979, "On the Determination of the Public Debt," *Journal of Political Economy*, Vol. 87 (1979), pp. 940-951.
- Friedman, Milton. *A Theory of the Consumption Function*. Princeton: Princeton University Press, 1956.
- Friedman, Milton. *A Program For Monetary Stability*. New York: Fordham University Press, 1959.
- Hall, Robert E. "Stochastic Implications of the Life Cycle - Permanent Income Hypothesis: Theory and Evidence," *Journal of Political Economy*, Vol. 86, No. 6 (1978).
- Kydland, Finn E. and Edward C. Prescott. "Rules Rather than Discretion: The Inconsistency of Optimal Plans," *Journal of Political Economy*, Vol. 85, No. 3 (1977), pp. 473-491.
- Lucas, Robert E., Jr., and Nancy Stokey. "Optimal Monetary and Fiscal Policy in an Economy Without Capital," *Journal of Monetary Economics*, Vol. 12, No. 1 (1983), pp. 55-94.
- Sargent, Thomas J. *Macroeconomic Theory*. 2nd Ed. Academic Press, 1987.
- Sargent, Thomas J., and Neil Wallace. "Some Unpleasant Monetarist Arithmetic," *Quarterly Review*, Federal Reserve Bank of Minneapolis, Fall 1981.