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nota

Inflation Adjusted Nominal Deficit: A Note on Robert Barro's Definition

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This note discusses the concept of 'inflation adjusted nominal deficit' proposed by Robert Barro in light of a stock-flow consistent real deficit. It is argued that the calculation proposed by the author violates the principle of stock-flow consistency and leads one to the erroneous interpretation that a rise in the rate of inflation decreases the government deficit in nominal terms.

1. INTRODUCTION

Robert Barro in his textbook "Macroeconomics" claims that the standard definition of the government's budget deficit used in the American National Accounts does not take proper account of inflation. Using the definition of the real budget deficit presented by Siegel (1979), Barro arrives at the 'inflation adjusted nominal deficit' by multiplying the real deficit by the current price level.

Although the author's objective when defining the inflation adjusted nominal deficit is to create a concept that can facilitate the calculation of the real deficit — one may simply divide the nominal deficit by the price level and obtain the right value for the real deficit—, I argue that Barro's definition of the nominal budget deficit can be misleading, as it implies that an increase in the inflation rate *reduces* the budget deficit *in nominal terms*, and that the problem arises from converting Siegel's definition of the real deficit (defined in continuous time) into the nominal deficit (defined by Barro in discrete time). Section 2 presents Siegel's "stock-flow" consistent calculation of the real deficit and section 3 discusses Barro's definition of the nominal deficit and its problems. Section 4 concludes.

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2. SIEGEL'S DEFINITION OF THE REAL DEFICIT

Jeremy Siegel in his "Inflation-Induced Distortions in Government and Private Saving Statistics" claims that real value accrual accounting must be employed in the government accounts for the definition of real deficit be "stock-flow consistent".

A pair of variables *x(t)* and *y(t)* are "stock-flow consistent" if *y* is the flow counterpart of the stock variable *x*, that is, $y(t) = x(t)$.

In terms of the government budget constraint, let B_t be the nominally denominated stock of bonds outstanding and assume that all discrepancies between taxes and receipts are financed by floating bonds[1]. In the absence of monetary finance, the nominal government deficit is:

$$G_t + R_{t-1} B_{t-1} - T_t = B_t - B_{t-1} \quad (1)$$

where,

G_t is the government spending in nominal terms;

$R_{t-1} B_{t-1}$ stands for nominal interest payments on the outstanding government debt;

T_t represents taxes revenue in nominal terms; and

B_t is the stock of government bonds issued at time t.

The nominal deficit, lets call it ND, is therefore defined as the change of the government's debt over time:

$$ND = B_t - B_{t-1} \quad (2)$$

Siegel uses continuous time and thus defines the nominal deficit as $ND = \frac{dB}{dt}$ or simply *B*. In order to arrive at the real deficit, the author argues that one can not simply divide the nominal deficit by the current price level *P* because $\frac{B}{P}$ will not be "stock-flow consistent" with the real value of the government debt.

To see this, remember that the real deficit is the change, in real terms, of the government's debt over time. The government's debt in real terms is $\frac{B}{P}$. Then, the real deficit is $\frac{d(B/P)}{dt}$ which differs fundamentally from $\frac{B}{P}$. That is, the real deficit (RD) is:

$$\frac{d\,(B/P)}{dt} = \frac{P(dB/dt) - B(dP/dt)}{p^2}$$

$$\frac{d\,(B/P)}{dt} = \frac{P(dB/dt)}{p^2} - \frac{B(dP/dt)}{p^2}$$

or

$$\text{RD} \equiv \frac{d\,(B/P)}{dt} = \frac{\dot{B}}{P} - \frac{\dot{P}}{P}\left(\frac{B}{P}\right) \quad (3)$$

The real deficit is then $\frac{d\,(B/P)}{dt}$ and not simply $\frac{\dot{B}}{P}$.

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[1] The author assumes for simplicity that the money supply is held constant.

3. BARRO'S INFLATION ADJUSTED NOMINAL DEFICIT

In his textbook "Macroeconomics", Robert Barro claims that the standard definition of the government nominal deficit as used in the American National Accounts does not take proper account of inflation. He argues that for the real deficit (calculated by dividing the nominal deficit by the price level) to correspond to the change of the government's real obligations, it is necessary to subtract from the nominal deficit the effect of inflation on the real value of the government's obligations.

Barro uses discrete time. The variable $y = \frac{dx}{dt}$ can be written in discrete time as $y = x_t - x_{t-1}$. By analogy, the real deficit written in discrete time is:

$\frac{d\,(B/P)}{dt} = \left(\frac{B}{P}\right)_t - \left(\frac{B}{P}\right)_{t-1}$ or $RD = \frac{B_t}{P_t} - \frac{B_{t-1}}{P_{t-1}}$, which represents the discrete time version of the real deficit that is stock-flow consistent.

Accordingly, if money creation is introduced as part of the government's budget constraint, we have the stock-flow consistent real deficit:

$$RD = \frac{(M_t + B_t)}{P_t} - \frac{(M_{t-1} + B_{t-1})}{P_{t-1}} \qquad (4)$$

In the National Accounts, the nominal deficit (ND) is reported as:

$$ND = (M_t + B_t) - (M_{t-1} + B_{t-1}) \qquad (5)$$

Barro argues that this definition of the nominal deficit is not appropriate when prices are not stable. The author arrives at the concept of an 'inflation adjusted nominal deficit', lets call it NDA, by multiplying the stock-flow consistent real deficit (equation 4 above) by the price level P_t:

$$NDA = M_t + B_t - (1 + \pi_{t-1})(M_{t-1} + B_{t-1}) \qquad (6)$$

where $\pi_{t-1} = \frac{P_t - P_{t-1}}{P_{t-1}}$ is the inflation rate.

When the price level is relatively stable and therefore the inflation rate is low, the two definitions of the nominal deficit tend to coincide, but the higher the inflation rate, the greater is the discrepancy between the two definitions.

As discussed in section 2, calculating the real deficit by simply dividing the nominal deficit by the price level, although a common practice, is not an appropriate one. Barro's inflation adjusted nominal deficit allows one to use this common practice and still arrive at the proper definition of the real deficit, that is, the change in the government's real obligations. Barro's definition may be misleading, however, as it implies that the nominal deficit is reduced when the inflation rate increases. How would price increases bring about a reduction in the *nominal* budget deficit? If anything, inflation should increase the deficit in nominal terms.

An example may help to illustrate this point.

Assume that the government has an outstanding debt *B* that yields a constant real rate r_0. If the government has a balanced budget, its primary surplus will be just enough to meet interest payments on its outstanding debt and its nominal deficit will be zero:

$ND_1 = G + R_1B - T = 0$

where R_1 is the nominal rate of interest at period 1.

The nominal rate of interest can be defined as the sum of the real rate of interest and the inflation rate:

$R_1 = r_1 + \pi_1$

Suppose that prices are stable. With a zero inflation rate, the nominal rate of interest will equal the real rate, $R_1 = r_1$, and the nominal deficit can be written as $ND_1 = G + r_1B - T$.

Now suppose that prices start rising at a rate π. In order to keep the real return on government bonds constant, the interest payments on the debt in nominal terms will have to rise.

The nominal deficit at time 2 will be:

$ND_2 = G + R_2B - T$, where $R_2 = r_1 + \pi$

Substituting R_2, the nominal deficit will be $ND_2 = G + (r_1 + \pi)\ B - T$ and the government will experience a nominal deficit of πB at time 2. If real taxes revenue and real spending are constant, the deficit will remain at πB and, in the absence of monetary finance, the government will have to issue bonds at the rate πB to finance itself. By doing so, the government will be simply adding bonds at the rate which inflation is depreciating them, leaving the real value of its outstanding debt intact. In other words, the real deficit will remain unchanged and the nominal deficit will *increase* with inflation[2].

By subtracting the reduction in the real value of government's obligations due to inflation, Robert Barro offers a way of simplifying the calculation of the real deficit but leads one to interpret the reduction of the inflation adjusted nominal deficit as a reduction of the government's nominal obligations. Although this interpretation does not follow directly from the author's arguments, it is certainly a plausible one, mainly in the context of a textbook.

The same reasoning that lead us to the definition of the real deficit should take us to the definition of the nominal deficit. The real deficit is the change, in real terms, of the government debt over time; the nominal deficit is the change, in nominal terms, of the government debt over time. In order to arrive at the definition of the nominal deficit starting from the real deficit, one has to transform the government debt into nominal terms *first* and then proceed calculating its change over time. That is:

$$RD = \frac{d\ (B/P)}{dt}$$

Starting from the real deficit, RD, the nominal deficit is obtained:

$$ND = \frac{d\left(\frac{B}{P}.P\right)}{dt}$$, which gives $ND = \frac{dB}{dt}$ or the nominal deficit as presented in the National Accounts.

[2] This result assumes that rise in inflation was foreseen by the government and by the public. If inflation were unexpected, the nominal interest rate would not rise and the nominal deficit would remain *the same* at least for one period and, in this case, the real deficit would be *reduced* by π(B/P).

In discrete time, the procedure is the same. Starting with the real deficit $RD = \frac{B_t}{P_t} - \frac{B_{t-1}}{P_{t-1}}$, the nominal deficit is obtained by multiplying the real debt by the price level prevailing at its issuing period:

$ND = \frac{B_t}{P_t}.P_t - \frac{B_{t-1}}{P_{t-1}}.P_{t-1}$, which gives $ND = B_t - B_{t-1}$, as presented in the National Accounts.

In other words, the nominal deficit as reported by the National Accounts can be used without a problem, as long as one uses first principals to calculate the real value of the government's obligations. By arriving at a concept of nominal deficit by means of multiplying the properly defined real deficit by the price level, Robert Barro's definition obscures Siegel's contribution on stock-flow consistent accounting and does not help students consolidate important concepts government finance.

4. CONCLUDING REMARKS

This note has discussed Robert Barro's concept of the 'inflation adjusted nominal deficit' and argued that it may induce erroneous interpretations about the effects of inflation on the government's budget deficit. The concept implies that an increase in the inflation rate will reduce the government's budget deficit in nominal terms. An analytical example is introduced to illustrate the problem of how the concept can be misleading.

The effects of inflation in the American government budget deficit and the proper way of assessing its real value from an accounting point of view has been discussed at length by Eisner and Pieper (1984), Hamilton and Flavin (1986) and, more recently, Bohn (1991). Although Robert Barro's calculation of the 'inflation adjusted nominal deficit' dialogues with this literature, it departs from a "stock-flow" consistent accounting of the real deficit, which is fundamental for understanding the concept of real budget deficit. In the context of a textbook, the author's definition of the 'inflation adjusted nominal deficit', I believe, may mislead students as to the effects of inflation on the government accounts.

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