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A GENERAL MEASURE OF INFLATION TAX REVENUES *

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A general measure of the revenues from the inflation tax and seignorage is presented, which is correct across models. Previous measures, seemingly dependent on specific policy assumptions, can be seen as special cases of this unified measure.

A number of measures of the revenues arising from inflation acting like a tax on cash balances have appeared in the literature. These include the rate of inflation π multiplied by the real value of cash balances m [Friedman (1953), Bailey (1956)], the rate of monetary growth θ multiplied by m [Cagan (1956), Marty (1967), Friedman (1971)], measuring revenues actually collected by printing money, and, more recently, the nominal interest rate i multiplied by m [Phelps (1971,1972), Marty (1978)], reflecting the consumer's opportunity cost of holding money. Phelps and Marty have argued that there is no 'correct' measure, the revenue obtainable from money creation depending on the model or policy experiment being considered.

The purpose of this note is, first, to point out that some of the revenue measures used actually include two distinct revenue sources, and, second, to present a general measure of inflation tax revenues which separates these two sources and includes all previous measures as special cases.

To motivate this approach we begin by noting the importance of distinguishing the government's role as taxing authority from its role as monopolistic producer of money. This leads to a distinction of two revenue sources: revenue from expansion of the nominal money supply when individuals are already holding a given level of real balances, and profits earned by monopolistic issuers of money due to people's desire to hold a given level of balances. [1]

Revenue from current expansion of the money supply in real, per capita terms is

$$\dot{M}/PL = (\dot{M}/M)(M/PL) = \theta m = \dot{x}/L + \pi m, \tag{1}$$

where M is nominal balances, P the price level, L population, x total real balances, m real balances per capita, and θ the rate of monetary expansion. Dots denote time differentiation. θm is thought of

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[1] We ignore other changes in the budget position under inflation due to non-indexed non-monetary assets and liabilities (including, of course, an income tax system not adjusted for inflation). We follow this convention not because such effects are small (they are empirically quite important), but because the aim is to measure the tax-like effects of it being infeasible to pay interest on at least some components of the money supply.

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as the tax on cash balances, since it is the amount individuals must pay the government (via purchases of nominal balances) to continue consuming a given real amount per capita m. (Throughout the paper, we are looking at the components of the money supply controlled by the government.) More exactly, revenues from expansion of the money supply are the sum of πm, the tax arising from individuals keeping balances constant in the face of inflation, and $\dot{x}/L$, revenue arising from keeping m constant in the face of growth.

While θm represents revenues due to newly printed balances when a real quantity m is already outstanding, one may ask how the existence of an outstanding quantity m itself affects real revenues. We may write the government wealth constraint as

$$m + b = k^{g} + \Omega, \tag{2}$$

where b is the real value of interest-bearing debt the government issues, k^{g} is the real value of assets they hold, and Ω is an accounting term representing net government indebtedness (all expressed in per capita terms). Ω may be thought of as the sum of the discounted value of costs of running the monetary authority (denoted c) and indebtedness above this amount $\hat{\Omega}$ (that is, $\hat{\Omega} = \Omega - c$). If b and k bear the same interest rate, then we may write (2) in terms of net assets $a = k^{g} - b$. We may then write

$$m = a + \hat{\Omega} + c \quad \text{or} \quad a = m - \Omega, \tag{3}$$

where a is then the (per capita real) value of assets held by government by virtue of people holding real balances m.

The total interest earned on this amount is a, where i is the nominal interest rate. However, only part of this is net revenue, since the government must increase its nominal asset holdings to keep the per-capita real value of assets, a, constant in the face of inflation and population growth. Subtracting this amount $(\pi + n)a$ (where n is the population growth rate), net steady state revenue is then

$$ia - (\pi + n)a = ra - na, \tag{4}$$

where r is the real interest rate. This may be viewed as profits from having non-interest-bearing money outstanding.

Total revenues associated with money creation are then

$$\theta m + (r - n)a, \tag{5}$$

which is the basic measure we propose, combining both current flow revenue and revenue from assets purchased due to money issue, netting out that part of revenue used to keep a constant.

It is the second component one might naturally associate with profits from a monopoly on the right or ability to issue non-interest-bearing debt. The ability to issue money allows the issuer to sell non-interest-bearing assets and buy interest-bearing ones with the proceeds, the real profits being the net value of the assets purchased multiplied by the interest rate. Using rm (as is often done to measure the seignorage), rather than ra would measure not actual monopoly profits, but potential profits in the existence of a monetary authority, obtainable only if there are zero costs and if all proceeds from money issuance go to purchase of assets. In fact, that part of *previous* money issuance which was immediately spent on consumption (measured by Ω) yields no current monopoly profits.

To assess the usefulness of the measure presented here, we show that earlier measures arise as special cases, with the assumptions underlying them made explicit by this analysis. The early Friedman–Bailey measure, πm, concentrated on the tax on existing consumers. No explicit assumption was made about the proceeds of past issuance. If, in fact, past issuance went to current account expenditures ($a = 0$, any change in real money supply affecting indebtedness one-for-one), πm would represent total revenues from creation of non-interest-bearing money. The second measure, θm, also concentrated on current issuance, but included revenues due to growth of the economy.

The Phelps–Marty measure, im, arises in the context of a specific policy experiment where any change in the money supply is achieved via open-market operations. That is, the government is constrained to hold its net indebtedness constant, any issuance of money inducing an equivalent retirement of interest bearing debt. The government is further constrained to spend inflation tax revenues on (net) asset accumulation. Phelps concentrates on revenues from currently alive individuals [implying use of πm in (5)] and assumes $c = 0$. Our measure then yields

$$\pi m + r(m - \Omega) = im - r\Omega. \tag{6}$$

Therefore, if alternative inflation paths are constrained to keep Ω constant (and if r is unchanged), the change in inflation tax revenues when θ changes is measured by changes in im. (One may note that the revenue *at a point in time* is $im - r\Omega$, rather than simply im.) The Phelps–Marty approach indicates what monetary policy would lead to the change in revenue from money creation being simply the change in the consumer's opportunity cost of holding real balances. Under these assumptions, (5) yields the same result.

Burmeister and Phelps (1971) present a class of models where the government uses newly printed money to purchase a portion α of the total (per capita) capital stock k, so that government indebtedness (Ω in our framework) is constant. Constancy of the capital–labor ratio and the real interest rate then follows. Total revenue attributable to money creation is $\theta m + r\alpha k$, but the government is seen as collecting only πm. This arises, first, because the government transfers to consumers its profits from asset holding, namely $r\alpha k$, and, second, because revenue is seen as including only that from individuals currently alive and excluding supply of balances to newly-born consumers. Under these assumptions, net revenue from (5) would also be πm.

Cathcart (1974) and Auernheimer (1974) considered the revenue implications of changes in desired real balances when the price level jumps due to a change in expected inflation. The latter suggested that the government be constrained to expand or contract the nominal money supply by open-market operations to avoid such jumps. Starting from a given level of real balances, say m_0, we would include any revenue due to changes in the government asset position due to a change in the public's desired real balances, say, to m_1. Auernheimer calculated the present discounted value of revenues from monetary expansion over an infinite horizon. Including the change in the government asset position we obtain on a population aggregate basis

$$V(\theta = \theta_1) = \int_{t=0}^{\infty} (\theta_1 m_1)\, e^{-rt} dt + (m_1 - m_0) = \frac{\theta_1 m_1}{r} + m_1 - m_0, \tag{7}$$

where $m_1 - m_0$ is the initial purchase of or sale of money balances.[2] Implicit in the calculation of (7) are the assumptions that m_0 is net indebtedness of the government and that all current proceeds are invested in assets earning real return r (so that asset holding on a total, rather than per capita basis, is $m_1 - m_0$). Current flow of revenues, rV, would then be exactly as measured by (5).

One sees that the measures suggested in other models are all easily derivable from the general one presented here. Though this conclusion may appear like an exercise in accounting, it indicates, first,

[2] Compare eq. (3) in Auernheimer, where our eq. (7) is interpreted as population aggregated rather than per capita present value, consistent with Auernheimer's approach.

that contrary to what has been sometimes argued, there *is* a single measure of revenue from money creation which is generally applicable. Moreover, it clarifies the assumptions which lie behind derivation of other measures in specific models and the exact revenue sources.

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