

Money and Public Finance

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In this anxious market environment, people lose their rationality with some even spreading false information to create trading opportunities. The tales about the source of some rumours sound almost as fanciful as the rumours themselves. Financial market analysts and economists pay a great deal of attention to quarterly GDP growth rates. For example, figures released over the past couple of weeks have shown that growth has slowed sharply in America and Europe in the second quarter, while Japan's economy has continued to contract². For citizens of the countries themselves however, the level of output (and hence income) relative to that before the crisis is what really matters, rather than the rate of growth. Most economies still have a lot of lost ground to regain, but comparing output now with its level before the crisis understates the true depth of their slump.

In Vanuatu, false information to explain persistent 'panicking' continue to play down public confidence seen in the current Government³ with Member of Parliaments' (MP) understanding of money and Public Finance highly subjective. Some MPs held the views that an unrealistic fiscal position of the state may lead to the collapse of the national currency, the Vatu. Few are concluding that the Reserve Bank of Vanuatu (RBV) will devalue the Vatu. Most readers/writers have limited and lack of fairly good financial and economic background (mainly because of the limited exposures to financial markets) they may have yet to be educated on the relationship between fiscal and monetary dominance and the Ricardian equivalence proportion. The theoretical setting and analysis appeal to the fiscal dominance approach - also referred to as 'non-Ricardian regime', (passive monetary policy and active fiscal policy) practice by the current Government. A situation in which the fiscal authority set its expenditure and taxes without regard to any requirement of inter-temporal solvency implying that seigniorage must adjust to ensure that the Government's inter-temporal budget constraint is satisfied.

To understand how the relationships work we review the following three models namely (1) the Unpleasant Monetarist Arithmetic (2) the Fiscal Theorist of the Price Level and (3) the Optimal Taxation and seigniorage.

Overview

The three models

- 1) Unpleasant Monetarist Arithmetic

¹ The Analysis represent those of the author and does not imply the views of the Department of Finance and Treasury

² Source: Haver Analytics; IMF, JPMorgan; The Economist

³ 6th Extraordinary Session of Parliament September 8, 2011

- 2) Fiscal Theory of the Price level
- 3) Optimal Taxation and Seigniorage

Unpleasant Monetarist Arithmetic

The relevant literature review of “Unpleasant Monetarist Arithmetic” is discussed by Sargent et al., (1981), Federal Reserve Bank of Minneapolis, Quarterly Review, Vol.5, No.3, Winter 1-17 and Wash C.,E., (2003), Monetary Theory and Policy, 2nd edition, Chapter 4, Cambridge: MIT Press.

The basic idea in these analyses suggested that the key to controlling inflation is controlling monetary growth. The question is whether such a pure Monetarist approach is enough. Sargent and Wallace (1981) in their celebrated paper argue that fiscal discipline is also necessary. We analyse the logic behind their claim using the following model of continuous time.

We begin setting up the model by considering a simple classical model with flexible prices.

$$\frac{\dot{M}}{P} = ky \quad (\text{Quantity theory of money}) \quad (1)$$

$$\hat{y} = \frac{\dot{y}}{y} = n \quad (\text{Supply with exogenous growth}) \quad (2)$$

$$r = i - \pi = \rho \quad (\text{Constant real interest rate}) \quad (3)$$

Now we introduce short-term bonds, the nominal value of which is given by β which pays a nominal interest i . The Government budget identity is

$$\frac{\dot{M} + \dot{\beta}}{P} = g + \frac{i\beta}{P} - \tau = d + ib \quad (4)$$

where τ are lump sum taxes and $b = \beta/P$. The term $d = g - \tau$ is the primary deficit. We assume that this primary deficit is determined exogenously as a given proportion of GDP:

$$\frac{d}{y} = \delta \quad (5)$$

We assume further that the money supply grows at the fixed rate:

$$\hat{M} = \frac{\dot{M}}{M} = \mu \quad (6)$$

Using equation (1), (2) and (6) to show that the inflation is determined by the rate of monetary growth:

$$\pi = \hat{P} = \hat{M} - \hat{y} = \mu - n$$

Now we let $\beta = B/Py$ be the debt-income ratio. Then:

$$\hat{\beta} = \frac{\dot{\beta}}{\beta} = \hat{B} - \hat{P} - \hat{y}$$

$$\begin{aligned}
\hat{\beta} &= \frac{P(d+ib)-\dot{M}}{B} - \hat{P} - n \\
\hat{\beta} &= \frac{\delta}{\beta} + i - \frac{\dot{M}}{M} \frac{M}{PY} \frac{PY}{B} - \hat{P} - n \\
\hat{\beta} &= \frac{\delta - \kappa\mu}{\beta} + (\rho - n)
\end{aligned} \tag{7}$$

Similarly, if we think of the equation in terms of the rate of change, we can rewrite the previous equation as

$$\dot{\beta} = (\delta - \kappa\mu) + (\rho - n)\beta \tag{8}$$

where $(\delta - \kappa\mu)$ - is the expected average debt-income ratio and $(\rho - n)$ relates to the variation in the magnitude of the debt-income ratio given a unit change in the stock of public debt, holding effects on Government expenses, revenues and income constant.

The results tell us that the system is only stable if $n > \rho$. For economists, we normally assumes that $\rho > n$, implying that the above system is explosive – in other words, the real interest rate is greater than the real economic growth rate. The unpleasant monetarist arithmetic discover that it is instead of arbitrary initial values, we choose μ such that $\dot{\beta} = 0$, then clearly $\dot{\beta}$ will remain constant and will not explode. But $\dot{\beta} = 0$ has the following implications

$$\begin{aligned}
\mu &= \frac{\delta + (\rho - n)\beta}{\kappa} \\
\text{or } \pi &= \hat{P} = \mu - n = \frac{\delta + (\rho - n)\beta}{\kappa} - n.
\end{aligned} \tag{9}$$

This is the non-Ricardian regime – which is also known as the fiscal dominance. This result says that the Government budget deficit determines the inflation rate. In other words, the deficit is been financed by printing money. However, what if the Government sets δ and μ such that $\dot{\beta} > 0$? Then the Government borrowing is being secured on its capacity to borrow even more in the future. Such behavior is not indefinitely without people losing faith in the Government's ability to honor its debt. When this happens the Government cannot issue any more bonds and is forced to finance its deficit entirely by printing money, thereby raising inflation. To understand this, suppose the Vanuatu Government adopt the IMF debt-to-income ratio limit of 40 per cent⁴ say $\bar{\beta}$. Then this limit is approach more quickly the lower is the monetary growth rate. Thus tight money lowers current inflation at the expense of bringing nearer the day when debt credibility collapses and more rapid inflation ensues.

Fiscal Theory of the Price Level (FTPL)

The relevant literature review of “Fiscal Theory of the Price Level” is discussed by Buiter, W., (2002), The Fiscal Theory of the Price level: A Critique, “Economic Journal, Vol.112, No.481, 459-80, Wash C.,E., (2003), Monetary Theory and Policy, 2nd edition, Chapter 4, Cambridge: MIT Press and Woodford, Michael (1995). “Price Level Determinacy without Control of a Monetary Aggregate,” Carnegie-Rochester Conference Series on Public Policy, No.43, 1-46.

⁴ This is the IMF best standard but may vary from country to country depending on economic fundamental

The idea in these analyses suggested that the money equilibrium condition does not suffice to pin down the price level; the Government's budget constraint is also needed.

We begin by setting up the model as in the previous section. Let's consider the Government's period budget constraint as shown below.

$$P_t g_t + (1 + i_{t-1})B_{t-1} = T_t + M_t - M_{t-1} + B_t \quad (10)$$

In real terms this can be written as

$$g_t + w_t = \tau_t + s_t + \left(\frac{1}{1+r_t}\right)w_{t+1} \quad (11)$$

where $w_{t+1} = \frac{W_{t+1}}{P_t} = \frac{(1+i_t)B_t}{P_t} + \frac{M_t}{P_t}$ equals the Government's beginning-of-period financial liabilities (which in turn equals the household's beginning-of-period financial wealth in a closed economy) and

$s_t = \left(\frac{i_t}{1+i_t}\right)m_t$ denotes the Government's real seigniorage revenue.

The inter-temporal government's budget constraint becomes:

$$w_t + \sum_{i=0}^{\infty} \lambda_{t,t+i} [g_{t+i} - \tau_{t+i} - s_{t+i}] - \lim_{T \rightarrow \infty} \lambda_{t,t+T} w_T = 0 \quad (12)$$

with the discount factor, λ , given by

$$\lambda_{t,t+1} = \prod_{j=1}^i \left(\frac{1}{1+r_{t+j}}\right); \lim_{T \rightarrow \infty} \lambda_{t,t+T} w_T \text{ is a transversality condition and } \lambda_{t,t+1} = 1.$$

The transversality condition is imposed so that the limit term in equation (12) equals zero. This in turn implies that the value of outstanding government liabilities must equal the present debt value of future surpluses. If this is not the case, then the inter-temporal budget constraint is violated. In other words, either g or τ or s or any combination of the above must adjust in order to ensure that the inter-temporal budget constraint holds under all circumstances.

The fundamental difference between the "Classical view" and the FTPL is that the classical view assumes the budget constraint holds for any price level, e.g. it is an identity. The FTPL assumes that the budget constraint must only hold for the equilibrium price level, e.g. it is an equilibrium condition. For example, suppose the Government chooses an exogenous path for g_{t+1} and τ_{t+1} and the monetary authority pegs the nominal rate of interest at $i = \bar{i}$. This determines the seigniorage. Suppose the money market condition is

$$\frac{M_t}{P_t} = f(1 + i_t) \quad (13)$$

If the interest rate is fixed by the RBV, then an infinite number of price levels may satisfy monetary equilibrium, assuming the money supply adjusts endogenously. So proponents of the FTPL argue that the Government's solvency constraint,

$$\frac{M_t}{P_t} = \sum_{i=0}^{\infty} \lambda_{t,t+1} [\tau_{t+1} + s_{t+1} - g_{t+1}], \quad (14)$$

determines the current price level, since everything else in the equation is exogenous – equation (14) is also an equilibrium condition. The upshots of this result suggest that the price level adjusts in such a way to ensure that the Government's solvency constraint is met in equilibrium.

Optimal Taxation and Seigniorage

The relevant literature review of “Optimal Taxation and Seigniorage” is discussed by Wash C., E., (2003), *Monetary Theory and Policy*, 2nd edition, Chapter 4, Cambridge: MIT Press. The basic question from this section is the optimal level of government revenue to be raised from using seigniorage. In other words, how much revenue should the Government raise from using seigniorage?

In setting up the model, we consider the Government's inter-temporal budget constraint as:

$$E_t \sum_{i=0}^{\infty} R^{-i} (\tau_{t+i} + s_{t+i}) = Rb_{t-1} + \left(\frac{R}{R-1}\right) g \quad (15)$$

where $R = (1 + r)$ is the gross interest rate and the other variables are defined as before. We also assume that the Government can commit to a planned path for future taxes and inflation. We further assume that the Government wishes to minimize the present value of tax distortions,

$$\frac{1}{2} E_t \sum_{i=0}^{\infty} R^{-i} [(\tau_{t+i} + \phi_{t+i})^2 + (s_{t+i} + \varepsilon_{t+i})^2], \quad (16)$$

subject to the inter-temporal budget constraint. ϕ and ε are stochastic terms and the quadratic terms capture the distortion costs from taxes and seigniorage respectively. Now the first order condition (FOC) to the above minimization problem⁵ is

$$E_t (\tau_{t+i} + \phi_{t+i}) = E_t (s_{t+i} + \varepsilon_{t+i}) \quad (17)$$

Equations (15-17) produce several key results. The intra-temporal optimality condition: τ and s move in the same direction. In other words, if the Government needs to increase its total revenue it will do so by increasing taxes and seigniorage. The inter-temporal optimality condition: the marginal costs of the taxes are equated across time, giving rise to a motive for tax smoothing. For seigniorage this does not fare well empirically. Often seigniorage does respond to temporary increases in government expenditure. This fact can be explained by nothing that the distortions from the inflation tax actually apply to anticipated inflation. If we think of the Government committing to an inflation rate consistent with the revenue needs based on average expenditures, sudden, unanticipated fluctuations in expenditures will be met with surprise inflation are *not* distortionary. Furthermore, we can apply the general problem of optimal taxation to the inflation tax – the Ramsey principle states that the larger the elasticity of the tax base with respect to the tax rate, the lower the tax rate should be. The Ramsey principle is derived from the Ramsey

⁵ Because of welfare foregone/losses

problem which involves setting taxes to maximize the utility of the representative agent, subject to the Government's revenue requirement.

Using the Ramsey principle in the Money-In-Utility (MIU) framework one can show that Friedman's Rule can only hold if money and consumption are complements for the representative agent because in this case an increase of the tax on money will not only reduce money holdings but also consumption.

The Practical Reality

Suppose a nominal interest rate of i^m is paid on money balances. These payments are financed by a combination of lump-sum taxes and printing money. Let a be the fraction financed by lump-sum taxes. The Government's budget constraint is $\tau_t + \vartheta_t = i^m m_t$ with $\tau_t = ai^m m_t$ and $\vartheta_t = \theta m_t$. Now using the above approaches we can show how the marginal cost of holding money is affected by the method used to finance the interest payments on money. Similarly, we will explain the economics behind these results.

The basic MIU model has a consumer who maximizes lifetime utility

$$U_t = \sum_{s=t}^{\infty} \beta^{s-t} u(c_s, m_s) \quad (1)$$

The consumer's budget constraint, however, must be amended to take into account the interest payments on money and the fact that net transfers consists of two components, the first being the lump-sum transfer ϑ and the second being the lump-sum tax τ . The (real) budget constraint therefore becomes

$$c_t + m_t + b_t = y_t - \tau_t - \vartheta_t + \frac{1+i_{t-1}^m}{1+\pi_t} m_{t-1} + \frac{1+i_{t-1}}{1+\pi_t} b_{t-1} \quad (2)$$

where $\pi_t = \frac{P_t}{P_{t-1}} - 1$ denotes the inflation rate in period t . Solving the budget constraint for c_t and substituting into the objective function (1) gives an unconstrained lifetime utility function:

$$c_t = y_t - \tau_t - \vartheta_t + \frac{1+i_{t-1}^m}{1+\pi_t} m_{t-1} + \frac{1+i_{t-1}}{1+\pi_t} b_{t-1} - m_t - b_t$$

$$U_t = \sum_{s=t}^{\infty} \beta^{s-t} u\left(y_t - \tau_t - \vartheta_t + \frac{1+i_{t-1}^m}{1+\pi_t} m_{t-1} + \frac{1+i_{t-1}}{1+\pi_t} b_{t-1} - m_t - b_t, m_s\right). \text{ Now the}$$

FOCs with respect to m_t and b_t are⁶:

$$u_m(c_t, m_t) - u_c(c_t, m_t) + \beta u_c(c_{t+1}, m_{t+1}) \left(\frac{1+i_{t+1}^m}{1+\pi_{t+1}}\right) = 0 \quad (3)$$

$$\beta u_c(c_{t+1}, m_{t+1}) \left(\frac{1+i_t}{1+\pi_{t+1}}\right) - u_c(c_t, m_t) = 0 \quad (4)$$

⁶ Note: We apply the Chain rule for differentiation

We rearrange the FOC to get

$$\frac{u_m(c_t, m_t)}{u_c(c_t, m_t)} = -\beta \frac{u_c(c_{t+1}, m_{t+1})}{u_c(c_t, m_t)} \left(\frac{1+i_t^m}{1+\pi_{t+1}} \right) + 1 \quad (5)$$

and the second FOC to get

$$\beta \frac{u_c(c_{t+1}, m_{t+1})}{u_c(c_t, m_t)} \left(\frac{1+i_t}{1+\pi_{t+1}} \right) = 1 \quad (6)$$

Substitute (6) into (5):

$$\frac{u_m(c_t, m_t)}{u_c(c_t, m_t)} = \beta \frac{u_c(c_{t+1}, m_{t+1})}{u_c(c_t, m_t)} \left(\frac{1-i_t^m}{1+\pi_{t+1}} \right) \quad (7)$$

Note that the standard consumption Euler equation in an optimizing model is $u_c(c_t, m_t) = (1+r_t)\beta u_c(c_{t+1}, m_{t+1})$. Thus (7) can be written as

$$\frac{u_m(c_t, m_t)}{u_c(c_t, m_t)} = \frac{1}{(1+r_t)} \left(\frac{1-i_t^m}{1+\pi_{t+1}} \right). \text{ By virtue of the Fisher equation, } (1+i_t) = (1+r_t)(1+\pi_{t+1}) \text{ the}$$

above can be rewritten as
$$\frac{u_m(c_t, m_t)}{u_c(c_t, m_t)} = \left(\frac{1-i_t^m}{1+\pi_{t+1}} \right).$$

In words, this says that the ratio of the marginal utility of money to consumption is set to the opportunity cost of money. Since money now pays a nominal rate of interest i^m , this opportunity cost is $i_t - i^m$, the difference between the nominal return on capital and the nominal return on money.

Furthermore, from the Government's budget constraint, interest payments not finance through lump-sum taxes must be financed by printing more money, equation (9). Hence, $\vartheta_t = \theta m_t = (1-a)i^m m$, or the rate of money growth will equal $\theta = (1-a)i^m$. In the steady-state, $\pi = \theta$. This means that $\pi = (1-a)i^m$. Hence, the opportunity cost of money is given by

$$i - i^m \approx r + \pi - i^m = r + (1-a)i^m - i^m = r - ai^m$$

Paying interest on money affects the opportunity cost of money only if $a > 0$. Printing money to finance interest payments on money only results in inflation; this raises the nominal interest rate i , thereby offsetting the effect of paying interest. If the transfer is viewed by the household as proportional to her own money holdings, then this is equivalent to the individual viewing money as paying a nominal rate of interest. If this is financed via lump-sum taxes, changes in inflation do not change the opportunity cost of holding money – a rise in inflation that depreciates the individual's money holdings is offset by the increase in the transfer the individual anticipates receiving.