Response to Patrick Minford

Willem H. Buiter and Anne C. Sibert

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We are grateful to Patrick Minford (PM) for his extensive, thoughtful comments on our paper. We agree that at times governments appear to engage in fiscal policy actions that appear to ignore the intertemporal budget constraint of the government.

An implication of the FTPL is that there is no risk of a fiscal/financial accident or disaster from implementing policies that ignore the IBC of the State. Non-Ricardian policies are fiscal, monetary issuance and interest rate policies that don't always – both *in equilibrium and out of equilibrium* - satisfy the intertemporal budget constraint of the State, with government bonds priced at their contractual values). The FTPL asserts that non-Ricardian policies will *in equilibrium* satisfy the IBC of the State (holding with equality and with government bonds priced at their equilibrium values), because the general price level takes on the value that ensures that the real value of the outstanding stock of nominal government bonds satisfies that IBC of the State.

The FTPL has nothing to do with the endogeneity or exogeneity of monetary issuance

Where we disagree with PM is that the FTPL versus conventional analysis amounts to the contrast between fiscal dominance vs. monetary dominance (or active fiscal policy/passive monetary policy vs. passive fiscal policy/active monetary policy). PM says *"…, we could describe the FTPL as one where the government chooses spending and tax and 'implies' money supply growth; Ricardian as one where the government chooses spending and monetary growth, and 'implies' tax."* and *"The difference between the Ricardian and the FTPL descriptions is a difference is what processes are 'exogenous'. Under the FTPL both fiscal variables – spending and tax – are exogenous stochastic processes, while money is endogenous; whereas under the 'Ricardian' description the monetary process is exogenous and only one fiscal variable, say spending, can be exogenous."* Minford (2017).

As stated above, the relevant meaning of 'Ricardian policies' is, fiscal (exhaustive public spending and taxes net of transfers), monetary issuance and interest rate policies that always – both in equilibrium and out of equilibrium, that is, for all possible values of the variables entering the IBC of the State - satisfy the intertemporal budget constraint of the State, with government bonds priced at their contractual values. So, our paper (in equation 4.44) has a simple non-Ricardian rule, in which the real value of the augmented primary surplus is constant: $\hat{s}_1(t) = \tau(t) - g(t) + \frac{\dot{M}(t) - i^M(t)M(t)}{P(t)} = \bar{\hat{s}}_1$. This is consistent with exogenous monetary growth, with $\dot{M}$ and one of the fiscal variables exogenous and the other fiscal variable endogenous (in addition to the exogenous augmented primary surplus. It is also consistent with endogenous monetary growth, if both fiscal variables and the augmented primary surplus are exogenous.

We consider a Ricardian set of rules in equations (5.20) and (5.21) of our paper, reproduced below:

$$i(t) = \delta + \pi^* + \beta_1\left(\pi(t) - \pi^*\right) + \beta_2\left(y(t) - \bar{y}\right)$$
$$\beta_1 > 1,\ \beta_2 > 0$$

$$\tau(t) - g(t) + \sigma_1(t) = r(t)l(t) + \zeta\left(l(t) - l^*\right)$$
$$\zeta > 0$$

Again, this is consistent with monetary issuance, σ_1, being endogenous or exogenous.

Our paper shows that the FTPL rests on a fundamental fallacy: the confusion of the intertemporal budget constraint of the State with a misspecified equilibrium nominal bond pricing equation and the double use of this IBC. This fundamental fallacy generates a number of internal inconsistencies and anomalies that makes the FTPL a logical nonsense.

The key point is that the FTPL is *not* about monetizing deficits (endogenously) to ensure that the PDV of current and anticipated future seigniorage satisfies the IBC of the State in equilibrium when taxes and public spending are exogenously determined. Instead the FTPL asserts that the general price level always assumes the value required to ensure that the real contractual value of the stock of nominal government debt satisfies the IBC of the State with equality.

It follows that the FTPL is a fallacy regardless of whether the model of the economy is deterministic or stochastic. It is a fallacy when expectations are forward-looking, forward-looking and rational or backward-looking.

The FTPL has been proposed for models where money does not exist except as the numeraire

That these are two different theories is clear from the fact that most of the original contributors to the FTPL have applied this theory explicitly to models in which money exists only as a numeraire, and not as an asset/store of value, that is, models without any seigniorage or monetary issuance. Sims's original FTPL contribution (Sims (1994, pp 396 - 399)) contains a Section IX titled "Equilibrium prices and interest rates without money"; Sims (2011) analyses cashless models in Sections III2 and III3; and despite its title ("Active fiscal, passive monetary equilibrium in a purely backward-looking model"), the Sims (2016) model does not contain money as a store of value but only uses something called money as the numeraire. Woodford (1998, 2001) considers price level determination in an FTPL world "in the cashless limit", when seigniorage becomes negligible and therefore incapable of satisfying the IBC of the State. Cochrane's "Frictionless View of U.S. Inflation" (Cochrane (1999)) is an FTPL approach to price level determination in a world in which money does not exist, except as the numeraire. One of our reasons for rejecting the FTPL is precisely that it permits the determination of the general price level (the reciprocal of the price of money) in a model in which there is no demand for or supply of money.

We do consider, in Section 4, whether sticky price level models of the kind studied by Sims (2011, 2016) can rehabilitate the FTPL and whether, even if they cannot do so, can be used to rationalize the use of non-Ricardian policies, including interest rate pegs (or financial repression). Not surprisingly, when we invoke the key FTPL assumption that the IBC of the State, holding with equality, is imposed *twice,* we get an overdetermined equilibrium in the sticky price model. When we impose the IBC of the State, only once, overdeterminacy disappears, but, as one would expect, non-Ricardian policies may or may not lead to explosive public debt trajectories, depending on the details of the policy rules and the other parameters of

the model. As regards the FTPL, our conclusion as economic theorists is: ignore it; this is logical nonsense. As regards the unconventional fiscal stimulus-cum-financial-repression policies advocated by Sims and analysed, using conventional New-Keynesian and Old-Keynesian models, in Section 4 of our paper, our conclusion as economic policy advisers is similar to that of Minford (2017): don't go there; this is risky and could lead to hyperinflation and/or sovereign default or a belated, painful fiscal correction.

Some more on fiscal dominance and endogenous monetary issuance: limits to (real) seigniorage

We noted that both Ricardian and non-Ricardian (FTPL) rules can have either monetary or fiscal dominance. This is clear from the famous 'Unpleasant Monetarist Arithmetic' paper by Sargent and Wallace (1981) shows. Before the public debt reaches the (exogenously given) upper bound, monetary policy is active - the growth rate of the nominal money stock is exogenous. Government borrowing is passive. Once the government bond debt ceiling is reached, monetary growth passively finances the public-sector deficit (real public spending and real taxes don't change). More generally, we can have a Ricardian policy rule for which the path of the nominal money stock is specified exogenously ('monetary dominance'), as well as the path of one of the fiscal policy instruments, real public spending, say, with the other fiscal policy instrument, real net taxes in this case, adjusting endogenously to ensure that the IBC of the State is always satisfied.

What we want to emphasize here is that even Minford's Minford's endogenous money supply rule (both real public spending and real net taxes are exogenous) may not actually be Ricardian, because it is not certain that the real value of the resulting government deficit (net of any government bond issuance that is consistent with solvency of the State) can be financed through an increase in the nominal money supply, however large, or that, if it can be financed through monetary issuance, this implies a permanent hyperinflationary 'equilibrium' - something we don't consider a sensible equilibrium. Whether this is possible depends on the interest rate rule. We provide a simple example.

Assume that there is only one government bond, a zero-duration nominal bond with instantaneous risk-free nominal interest rate i. The instantaneous budget constraint of the State is given by:

$$\frac{\dot{M}(t)+\dot{B}(t)}{P(t)} = g(t)-\tau(t)+\frac{i(t)B(t)+i^M(t)M(t)}{P(t)} \tag{1.1}$$

Assume that the State sets real public spending, real net taxes, and the own interest rate on money exogenously and, for simplicity, at constant values: $g(t)=\overline{g}$, $\tau(t)=\overline{\tau}$ and $i^M(t)=\overline{i}^M=0$. Assume also that the nominal stock of government bonds is kept constant: $B(t)=\overline{B}\geq 0$. The nominal interest rate on bonds is set to keep a constant real interest rate:

$$i(t)=\overline{\delta}+\pi(t) \tag{1.2}$$

where $\overline{\delta}>0$ can be interpreted as the constant pure rate of time preference.

The nominal money stock is endogenously determined. The instantaneous budget constraint of the State becomes:

$$\frac{\dot{M}(t)}{P(t)} = \overline{g} - \overline{\tau} + \frac{(\rho + \pi)\overline{B}}{P(t)} \tag{1.3}$$

Assume that, in the spirit of Minford's statement (one which we subscribe to) that "…, *sometimes governments do seem to act as if there is no binding intertemporal budget constraint"* (Minford (2017, p. 1)), the State runs a permanent primary (non-interest) deficit: $\overline{g} - \overline{\tau} > 0$. To keep the example as simple as possible, assume $\overline{B} = 0$. Assume the demand for real money balances depends negatively on the nominal interest rate and positively on the real value of some scale variable like the endowment (assumed constant). The instantaneous budget constraint of the State is:

$$\frac{\dot{M}(t)}{P(t)} = \frac{\dot{M}(t)}{M(t)}\frac{M(t)}{P(t)} = \overline{g} - \overline{\tau} > 0 \tag{1.4}$$

Can equation (1.4) be satisfied for any constant rate of inflation, $\pi = \overline{\pi}$? In that case the nominal interest rate is constant ($i = \overline{\rho} + \overline{\pi}$) and the demand for real money balances is constant, $\frac{M}{P} = m(\overline{\pi}, ...)$. The instantaneous budget constraint becomes:

$$\overline{\pi} m(\overline{\pi}, ...) = \overline{g} - \overline{\tau} \tag{1.5}$$

There may exist no constant inflation rate that solves equation (1.5). The maximum real seigniorage that can be extracted at a constant and fully anticipated rate of inflation may be capped. This will be the case of the semi-elasticity of long-run money demand with respect to the inflation rate is non-increasing with the rate of inflation (see Buiter (2007)). A familiar example is the long-run base money demand function, made popular by Cagan's studies (Cagan (1956)) of hyperinflations, which have a constant semi-elasticity of money demand with respect to the nominal interest rate (and therefore, in our simple example, the rate of inflation).

It is possible that, even if there is no constant rate of inflation that can generate the real seigniorage revenue required to finance the budget deficit of the State, there are solutions with a positive and rising growth rate of the nominal money stock and a positive and rising rate of inflation. Depending on the details of the money demand function, even hyperinflationary equilibria may not generate the necessary real seigniorage revenue required to finance the deficit of the State.

Woodford (1995) and Cochrane (1999) propose an alternative non-Ricardian policy rule in which the money supply is endogenous but is prevented by other features of the policy rules (rather than by money-demand-driven limits on seigniorage) from fully funding the State deficit and prevent sovereign default. A simple special case of their rule is the constant real augmented primary surplus we used before: $\hat{s}_1(t) = \tau(t) - g(t) + \frac{\dot{M}(t) - i^M(t)M(t)}{P(t)} = \overline{\hat{s}}_1$

From the budget constraint (1.1) this implies:

$$\frac{\dot{B}}{B} = i - \overline{\hat{\sigma}}_1 \frac{P}{B}$$

If there is a permanent augmented primary deficit ($\bar{\hat{\sigma}}_1 < 0$) and $B > 0$, the growth rate of the nominal stock of bonds is always greater than the nominal interest rate on the bonds. This means permanent Ponzi finance and sovereign default. With $\bar{\hat{\sigma}}_1$, τ and g exogenous, monetary issuance is endogenous.

The key message for policy makers is: if you want to ensure the State remains solvent (if you want a Ricardian budgetary rule), you cannot specify monetary policy (base money issuance, policy rates) and fiscal policy (public spending and taxes) independently. Either there is a cooperative solution, or there is fiscal dominance and monetary issuance becomes endogenously determined (the residual), or there is monetary dominance and public spending and/or taxation have to adjust (becomes the residual) to maintain sovereign solvency.

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