A Review Sesssion for Monetary and Fiscal Policy*

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Abstract

In this paper, I use simple dynamic models to review several important lessons about monetary and fiscal policy. Regarding monetary policy, I will show, among other results, that 1) knowledge of the money supply is not enough to determine the equilibrium price path; 2) there is no real separation between fiscal and monetary policy; and 3) quantitative easing is unlikely to have much effect on the economy. The two main lesssons I want to review for fiscal policy are 1) all evaluations of increases in government consumption must be based on the way in which they are going to be financed and 2) different financing mechanisms will lead to very different outcomes.

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1. Introduction

On or about August 2007, economic policy character changed. Monetary policy, long regarded as an utterly serious yet terribly boring affair for middle-aged men in expensive suits, became the center of heated disputes, with some observers claiming that the actions of the Fed and the ECB were pushing us to the brink of a devastating hyperinflation, while others warned us about the imminent perils of a deflationary black hole. Simultaneously, fiscal policy, which during the 1980s had been discreetly pushed to an inconspicuous corner, was called on to play a key role in the recovery strategies of many governments.

None of this was an accident. Economic policy is the outcome of a delicate balance between ideas and particular interests. Both evolve over time in response to transformations in the economy and, in the case of ideas, by the development of new theoretical constructs and the accumulation (or reinterpretation) of empirical evidence. Thus, it is not surprising, and it was to be expected, that economic policy would be affected by the breathtaking course of events that the world economy has witnessed since the summer of 2007.

But while economic policy may have mutated rapidly, the tools of modern dynamic macroeconomics have not and probably should not. We can still successfully apply them to weigh the different economic policies proposed and to find them, often, wanting. I will argue that, for instance, some of the results in monetary theory from the 1980s, such as the work of Wallace (1981), speak directly to the questions at hand, and that should help us to work out a response to the situation. Furthermore, these lessons can be shown in relatively simple models that we can solve by paper and pencil and for which the intuition is straightforward.

This will be precisely my goal in this paper. I will present a benchmark model to think through many of the issues that fiscal and monetary policy face nowadays. I will perform this task in three steps. First, I will have a simple monetary model, with and without public debt. Then, I will switch gears and focus only on fiscal policy. Finally, I will integrate both aspects of the model into a coherent framework. While I could have started directly from this more complicated model, I hope that building the argument step by step will help the reader to understand better which elements are at play at each moment.

An interesting feature of the environment in which I will work is that I will not have any type of nominal rigidities. In that sense, this paper takes a clear neoclassical stand. This is, of course, not a statement regarding whether or not nominal rigidities are important for understanding the business cycle, a question well beyond the scope of this paper, but a recognition that to qualitatively understand the effects of many economic policies, one does not need to rely on these rigidities (a very different matter is to measure their quantitative effect). This point is made even more forcefully by Correia, Nicolini, and Teles (2008), who show how the optimal allocation in a monetary economy can be implemented independently of the type or degree of price stickiness. An exception to this equivalence would be policy under the zero lower bound of nominal interest rates, as the signs of some effects will actually change with and without nominal rigidities.

The three main lessons I want to illustrate for monetary policy are:

1. Knowledge of the money supply is not enough to determine the equilibrium price path. Therefore, fears that the current expansion of the money supply will inevitably lead to higher inflation are exaggerated. I will go as far as arguing that looking at monetary aggregates is not terribly interesting.

2. There is no real separation between fiscal and monetary policy. At a very fundamental level, monetary policy is always fiscal policy.

3. Quantitative easing is unlikely to have much effect on the economy. Up to a first-order approximation, the size and composition of the balance sheet of the central bank is irrelevant for equilibrium prices and allocations.

The two main lessons I want to illustrate for fiscal policy are:

1. All evaluations of increases in government consumption must be based on the way in which they are going to be financed.

2. Different financing mechanisms will lead to very different outcomes. In particular, changes in the timing of distortionary taxation may induce an expansionary effect of an increase in government consumption (for instance, with lump-sum taxes or future taxes) or no effect whatsoever (when the fiscal expansion is financed with current taxes).

The more careful reader could argue, at this moment, that I am not being particularly original and that most of these lessons are well known and understood. My reply would, first, accept the premise that what I am going to discuss in the next pages should be well understood to macroeconomists who have followed the literature. But I would also note that the recent public discussion of the consequences of many of these policies, discussion that has involved many prominent members of the profession, suggests that a reminder about these issues in a simple and coherent model may be due.

I organize the rest of the paper as follows. In section 2, I present a simple monetary model to introduce many of the main themes of the paper. In section 3, I enrich the model with public debt. The nice feature of the model is that the presence of public debt will allow me to derive many of the classic findings in monetary theory and discuss how they are relevant for policy at this moment, at the cost of minimum additional algebraic complication. Section 4 switches direction for a moment and concentrates on fiscal policy with and without distortionary taxation. Section 5 puts all of these elements together in a unified model to think about fiscal and monetary theory. Finally, I conclude with some speculative remarks in section 6.

2. A Simple Monetary Model

I start by fixing an environment that I will only slightly adapt in the rest of the paper. I will work with a simple three-period model, $t \in \{1, 2, 3\}$, with money. I choose a finite horizon environment to illustrate that most of the results in monetary theory that I find useful for analyzing our current predicaments do not depend on the subtle effects of infinite periods on dynamic choices. In particular, I do not need to deal with phenomena such as the multiplicity of equilibria that are pervasive in monetary models with infinite horizons. Besides, working with only three periods will let me derive many closed-form solutions that help in building our intuition. Finally, I consider three periods because I want to talk about short- and long-run interest rates.

There will be three agents in the model, a stand-in household that consumes, works, and saves, a perfectly competitive firm, and a government that conducts fiscal and monetary policy (the latter through a central bank). I will rig the model to deliver a classical dichotomy: real variables and nominal variables will be determined in separate blocks. This is not to be understood as a descriptive feature of reality, but simply as a convenient device to reduce the complexity of the analysis. None of the points I emphasize below rely on the presence or absence of nominal rigidities.

2.1. Environment

2.1.1. Households

There is a stand-in household that picks consumption c_t, labor supply l_t, and real money holdings to maximize

$$\log c_1 - \frac{l_1^2}{2} + \beta \left(\log c_2 - \frac{l_2^2}{2} \right) + \beta^2 \left(\log c_3 - \frac{l_3^2}{2} + \log \frac{m_3}{p_3} \right)$$

which implies a Frisch elasticity of labor supply of 1, in line, for instance, with the range of numbers suggested by Hall (2009a and 2009b). Note that since I have a three-period model, there is no restriction on β being smaller than 1. In particular, in one of my exercises below, I will pick $\beta > 1$ to induce a zero lower bound constraint on nominal interest rates. Also, real balances of money appear only in the last term of the utility function, $\log \frac{m_3}{p_3}$. This will allow me to pin down the price level and can be understood as a terminal condition that substitutes, somewhat imperfectly, for an infinite horizon model while avoiding its intrinsic complications and transversality conditions. Moreover, this last term will also let me derive several results that would be difficult to show in a pure cashless economy.

The budget constraints for the household are:

$$p_1 c_1 + m_1 + \frac{b_1}{R_1} = p_1 w_1 l_1 + p_1 T_1$$
$$p_2 c_2 + m_2 + \frac{b_2}{R_2} = p_2 w_2 l_2 + (1 + i_1)\, m_1 + b_1 + p_2 T_2$$
$$p_3 c_3 + m_3 = p_3 w_3 l_3 + (1 + i_2)\, m_2 + b_2 + p_3 T_3$$

where b_t is a one-period uncontingent bond with gross return R_t, i_t is the interest paid on money deposited at the central bank as reserves, w_t is the real wage, and T is real lump sum transfers of the final good. Here I am already imposing the condition that all money is deposited at the central bank (for instance, because it is a mere electronic annotation). Although this could be derived as an equilibrium result, it is substantially easier if we just consider it a property of our environment.

Prices are expressed in terms of one unit of account, which is the denomination of the money issued. Since there is no uncertainty, the one-period uncontingent bond is all that we require to have complete financial markets. Of course, in equilibrium the net holdings of this bond would be zero. I will not discuss much the additional constraint that money must be hold in positive amounts, that is

$$m_t \geq 0 \text{ for } t \in \{1, 2, 3\}.$$

Suffice it to say that this short-selling constraint will not change allocations because the short-sales can be replicated with the uncontingent bond (another way to think about it is that currency is a liability of the central bank and hence it cannot turn negative). Finally, at this moment I am not imposing the constraint that R_t or $1 + i_t$ is (weakly) bigger than one. Since all money is deposited at the central bank, we can easily think about negative net interest rates paid on those reserves (as the Swedish Riksbank effectively did in July 2009) or in holding fees. In other words, the absence of a "stuffing-in-your-matress" technology eliminates the traditional argument for the zero bound. We will come back to this point later when we explicitly impose this bound.

The Lagrangian of the household is then (dropping irrelevant constants):

$$
\begin{aligned}
&\log c_1 - \frac{l_1^2}{2} + \beta\left(\log c_2 - \frac{l_2^2}{2}\right) + \beta^2\left(\log c_3 - \frac{l_3^2}{2} + \log m_3\right) \\
&+\lambda_1\left(p_1 c_1 + m_1 + \frac{b_1}{R_1} - p_1 w_1 l_1 - p_1 T_1\right) \\
&+\beta\lambda_2\left(p_2 c_2 + m_2 + \frac{b_2}{R_2} - p_2 w_2 l_2 - (1+i_1)\, m_1 - b_1 - p_2 T_2\right) \\
&+\beta^2\lambda_3\left(p_3 c_3 + m_3 - p_3 w_3 l_3 - (1+i_2)\, m_2 - b_2 - p_3 T_3\right).
\end{aligned}
$$

The first-order conditions are for all t

$$
\begin{aligned}
\frac{1}{c_t} &= -\lambda_t p_t \\
l_t &= -\lambda_t p_t w_t
\end{aligned}
$$

for $t = 1$ and 2

$$
\begin{aligned}
\lambda_t &= \beta\,(1+i_t)\,\lambda_{t+1} \\
\frac{\lambda_t}{R_t} &= \beta\lambda_{t+1}
\end{aligned}
$$

and for $t = 3$

$$
\frac{1}{m_3} = -\lambda_3.
$$

We can start working on these conditions. First note that, for all t, we have an optimality condition for labor supply:

$$
c_t l_t = w_t
$$

for $t = 1$ and 2, we have an Euler equation and a non-arbitrage condition

$$
\begin{aligned}
R_t &= \frac{1}{\beta}\frac{c_{t+1}}{c_t}\frac{p_{t+1}}{p_t} \\
\frac{1}{p_t} &= \beta\,(1+i_t)\,\frac{1}{p_{t+1}}
\end{aligned}
$$

and for $t = 3$ we have a boundary constraint for prices:

$$
p_3 = \frac{m_3}{c_3}.
$$

The condition for the nominal interest rate embodies a simple Fisher equation between a real interest rate given by the pricing kernel of this economy

$$\frac{1}{\beta}\frac{c_{t+1}}{c_t}$$

and inflation $\frac{p_{t+1}}{p_t}$ that will hold in all equilibria. This should not be a surprise since Fisher equations appear as equilibrium conditions in a very wide set of environments.

2.1.2. Firms

The final good is produced by a competitive firm with a linear technology $y_t = l_t$. In this way, I do not need to keep track of physical capital or of the consequences for wages of changes in the labor supply (which combined with the unit Frisch elasticity will deliver the closed-form solutions that I will put to good use below). Thus, wage is given by marginal productivity, $w_t = 1$, and the resource constraints of the economy are:

$$c_t = l_t.$$

2.1.3. Government

The government issues currency in each period, buys the final good with it, and rebates the proceedings back to the household (or taxes them in case it wants to retire currency), that is

$$m_1 = p_1 T_1 \tag{1}$$

$$m_2 = p_2 T_2 + (1 + i_1) m_1 \tag{2}$$

$$m_3 = p_3 T_3 + (1 + i_2) m_2. \tag{3}$$

Then, it accepts reserve deposits at the central bank that pay gross interest $1+i_t$. I introduce payments on reserves to motivate a demand for money in periods 1 and 2. I could substitute them for money-in-the-utility function or cash-in-advance at the cost of much heavier algebra but little additional insight. In any case, the Fed's move in October 2008 to start paying interest rates on reserve balances has transformed this useful assumption into a description of actual behavior. That is why, in many of my examples below, I will keep the sequence $\{i_t\}_{t=1}^{2}$ unchanged and focus on other variations on policy.

I will call a policy sequence $\{m_t, T_t\}_{t=1}^{3}$ and $\{i_t\}_{t=1}^{2}$ that satisfies (1)-(3) a feasible policy sequence. This apparently innocuous definition overlooks, however, one important aspect. For which prices $\{p_1, p_2, p_3\}$ are (1)-(3) satisfied? For all price sequences that belong to an equilibrium? Or only for some particular price sequences that belong to an equilibrium? At the core of this question is the discussion about Ricardian policy regimes (where the government needs to satisfy its budget constraints for all equilibria) versus non-Ricardian policies (where the government only needs to satisfy its budget constraints along some equilibria, effectively empowering the government to reject any price sequence as equilibrium by guaranteeing that feasibility is not satisfied along such a path).

Fortunately, I have carefully made assumptions that allow me to sidetrack that discussion. As we will check later, given a policy, there is only one path of prices that is compatible with such a policy. Hence, in my model, all policies are trivially Ricardian. There is, however, one sense in which the insights of the fiscal theory of the price level still hold. We will revisit this issue below, but we can safely forget it for the moment.

2.2. Equilibrium

Now, we are ready to define an equilibrium in our economy.

Definition 1. *Given a feasible policy sequence $\{m_t, T_t\}_{t=1}^{3}$ and $\{i_t\}_{t=1}^{2}$, a competitive equilibrium is a sequence $\{y_t, c_t, l_t, w_t, p_t\}_{t=1}^{3}$ and $\{R_t\}_{t=1}^{2}$ such that:*

$$
\begin{aligned}
c_t l_t &= w_t \text{ for } t \in \{1,2,3\} \\
R_t &= \frac{1}{\beta}\frac{c_{t+1}}{c_t}\frac{p_{t+1}}{p_t} \text{ for } t \in \{1,2\} \\
\frac{1}{p_t} &= \beta\left(1+i_t\right)\frac{1}{p_{t+1}} \text{ for } t \in \{1,2\} \\
p_3 &= \frac{m_3}{c_3} \\
w_t &= 1 \text{ for } t \in \{1,2,3\} \\
c_t &= y_t \text{ for } t \in \{1,2,3\} \\
y_t &= l_t \text{ for } t \in \{1,2,3\}.
\end{aligned}
$$

To compute this equilibrium, first, I solve for the rather obvious:

$$c_t = y_t = l_t = w_t = 1 \text{ for } t \in \{1,2,3\}.$$

Next, and after imposing the previous findings, I solve for the sequence of prices and since:

$$p_3 = m_3$$

and:

$$\frac{1}{p_t} = \beta\left(1+i_t\right)\frac{1}{p_{t+1}} \Rightarrow p_t = \frac{1}{\beta\left(1+i_t\right)}p_{t+1} \text{ for } t \in \{1,2\}$$

we have:

$$
\begin{aligned}
p_1 &= \frac{1}{\beta^2 (1+i_1)(1+i_2)} m_3 \\
p_2 &= \frac{1}{\beta (1+i_2)} m_3 \\
p_3 &= m_3
\end{aligned}
$$

We can see in the previous equations how, as we ventured before, given m_3, i_1, and i_2, the equilibrium path for prices is unique. Note also that in our model, inflation between the second and first period is given by:

$$
\frac{p_2}{p_1} = \frac{\frac{1}{\beta(1+i_2)} m_3}{\frac{1}{\beta^2(1+i_1)(1+i_2)} m_3} = \beta (1+i_1)
$$

and between the third and second by:

$$
\frac{p_3}{p_2} = \frac{m_3}{\frac{1}{\beta(1+i_2)} m_3} = \beta (1+i_2)
$$

that is, a lower interest on reserves reduces inflation rate and a higher interest on reserves raises inflation. This is not as surprising as it may seem at first sight. In this model, the real interest rate is constant and just equal by the inverse of the discount factor β. Hence, an increase in the nominal interest rate can only be compatible with equilibrium if inflation increases.

The traditional reasoning of New Keynesian models is very different: increases in nominal interest rates, in environments where there are price rigidities, increase the real interest rate. This higher real rate lowers demand and with it output and inflation. However, both mechanisms are not incompatible if we analyze them carefully. In fact, a closer parallel can be found if we compare the behavior of our model with the behavior of a New Keynesian model with a Taylor rule when the monetary authority increases its long-run target for the interest rate. In that environment, we have an immediate jump in inflation and nominal rates; hence, in a well-defined casual sense, higher nominal rates cause higher inflation. What New Keynesian models are predicting is that temporarily high nominal interest rates (with respect to some target) lower inflation.

A peculiar feature of the equilibrium we just described is that the money supply in the first and second periods, m_1 and m_2, does not play any role in price determination. Here there is actually a deeper point at play: in environments where the central bank controls the interest rates on reserves, the money supply is not a terribly interesting quantity to look at, since there is no clear relation between it and the price level or inflation, some of the key targets of interest for monetary policy. Even the role of m_3 can be easily diminished: by extending our model sufficiently far into the future and taking the limit as t goes to infinity, an appropriate transversality condition will hold and the money supply at infinity will disappear as a relevant variable. Cochrane (2010) has recently emphasized that this is true only if we find it plausible to eliminate all equilibria where nominal quantities explode or collapse. He argues that, in contrast with more standard transversality conditions that are predicated on physical objects, such as capital, it is not obvious that we desire to impose this equilibrium selection mechanism, which Kockerlakota and Phelan (1999) called a *monetarist device*. Cochrane argues that this role of eliminating speculative equilibria can only be played by fiscal policy through the implementation of non-Ricardian policies. Again, my finite-horizon assumption lets me sail through this sea of dangers without further trouble.

Finally:

$$R_t = \frac{1}{\beta}\frac{p_{t+1}}{p_t} \text{ for } t = 1, 2$$

or $R_1 = 1 + i_1$ and $R_2 = 1 + i_2$. This is just a non-arbitrage condition that ensures that, in equilibrium, the household is indifferent between holding bonds or holding money. If we want to find the long-run interest rate R_{13}, we just need to multiply the two short-term rates:

$$R_{1,2} = (R_1 R_2)^{0.5} = ((1 + i_1)(1 + i_2))^{0.5} = \left(\frac{1}{\beta^2}\frac{p_3}{p_1}\right)^{0.5}.$$

Hence, the yield curve at time 1 in this economy can be increasing or decreasing depending on the relation between i_1 and i_2.

Since I am not imposing the condition R_t is (weakly) bigger than one, it is perfectly possible to have an equilibrium with negative net interest rates. As far as the money must be held at the central bank from one period to the other, there is no particular difficulty in implementing a negative i_t. Then, the financial markets will just ensure that R_t is whatever value we need to make net savings equal to zero.

2.3. Fixing Money or Fixing Transfers?

We can start now with an analysis of the policy implications of our model. Remember that the government is limited in its choices by the three budget constraints. Therefore, of the 8 policy variables, $\{m_t, T_t\}_{t=1}^{3}$ and $\{i_t\}_{t=1}^{2}$, it can pick only 5 independently. For instance, given the equilibrium, we can either think about the government fixing the currency supply and interest rates on reserves and then adjusting transfers or fixing the transfers and interest rates and financing them with seigniorage.

I explore first the case in which the government fixes the currency sequence $\{m_t\}_{t=1}^3$ and the interest on reserves $\{i_t\}_{t=1}^2$. We can call this policy a *monetarist policy* because it emphasizes the role of the money supply. In this case, we have that transfers must satisfy:

$$T_1 = \frac{m_1}{p_1} = \beta^2 (1+i_1)(1+i_2)\frac{m_1}{m_3}$$
$$T_2 = \frac{m_2 - (1+i_1)m_1}{p_2} = \beta(1+i_2)\frac{m_2-(1+i_1)m_1}{m_3}$$
$$T_3 = \frac{m_3 - (1+i_2)m_2}{p_3} = 1-(1+i_2)\frac{m_2}{m_3}.$$

An example of this policy is to fix money and interest at a constant rate, $m_t = x$ for all t and $i_t = i$, to get

$$T_1 = \beta^2 (1+i)^2,\ T_2 = \beta(-i_1)(1+i), \text{ and } T_3 = -i.$$

The intuition of this policy is that we issue money in the first period to pay for transfers, but that transfers must be negative from that moment on to pay the interest on reserves. Also, this policy implies that the price path is:

$$p_1 = \frac{1}{\beta^2(1+i)^2}x,\ p_2 = \frac{1}{\beta(1+i)}x, \text{ and } p_3 = x.$$

This result gives us a simple quantitative theory result: increases in x have a proportional effect on prices, but not on allocations or on real transfers by the government. This is another sense in which calling this policy monetarist is sensible.

At the same time, note that in this model, fixing only the currency sequence $\{m_t\}_{t=1}^3$ is not enough to pin down equilibrium: I must still select two more variables. In particular, the sequence of prices p_1 and p_2 is indeterminate and, with it, transfers. This is the first lesson for policy from our model: knowledge of the money supply is not enough to determine the equilibrium price path. And while the quantitative theory tradition has, as we just saw in the previous paragraphs, important insights, we should not be blind to its limitations either.[1] In particular, alarmist voices warning about hyperinflations around the corner triggered by the monetary policy of central banks over the last few years must be seriously discounted (this will be even clearer later on when I talk about quantitative easing).

[1] Sargent and Surico's (2010) study is another cautionary tale about the quantitative theory. The authors illustrate how, when we consider the full set of cross-equation restrictions implied by equilibrium, simple relations between long-run money growth and long-run inflation become weaker. Furthermore, the authors show how this accounts for the empirical departures that they document from the original evidence of Lucas (1980). Teles and Uhlig (2010) show that, indeed, in the data, for countries of moderate inflation, the relationship is tenuous at best or even non-existent.

I explore now the case in which the government fixes the transfer sequence $\{T_t\}_{t=1}^3$ and the interest on reserves $\{i_t\}_{t=1}^2$ and let money accommodate these choices. It is still the case that by the budget constraints:

$$T_1 = \beta^2 (1+i_1)(1+i_2) \frac{m_1}{m_3}$$
$$T_2 = \beta (1+i_2) \frac{m_2 - (1+i_1) m_1}{m_3}$$
$$T_3 = 1 - (1+i_2) \frac{m_2}{m_3}.$$

Working on these expressions:

$$T_3 = 1 - (1+i_2) \frac{m_2}{m_3} \Rightarrow$$
$$m_2 = \frac{1-T_3}{1+i_2} m_3. \tag{4}$$

Then:

$$\begin{aligned} T_2 &= \beta (1+i_2) \frac{m_2 - (1+i_1) m_1}{m_3} \\ &= \beta (1+i_2) \frac{\frac{1-T_3}{1+i_2} m_3 - (1+i_1) m_1}{m_3} \\ &= \beta (1-T_3) - \beta (1+i_1)(1+i_2) \frac{m_1}{m_3} \end{aligned}$$

gives us

$$m_1 = \frac{\beta (1-T_3) - T_2}{\beta (1+i_1)(1+i_2)} m_3. \tag{5}$$

Finally,

$$T_1 = \beta^2 (1+i_1)(1+i_2) \frac{m_1}{m_3} = \beta^2 (1-T_3) - \beta T_2 \tag{6}$$

That is, we can implement this policy with any choice of m_3 as long as (4), (5), and (6) are satisfied. Note that there is a linear relation between T_1, T_2, and T_3.

This constraint on government actions is not a surprise, but just a consequence of the neutrality of money. By doubling the supply of money we double prices, and hence the government cannot generate further real resources to transfer. That is, when the government is picking transfers, it can only select two of them. In that way, if I set $i_t = i$ and:

$$T_1 = \beta^2 (1+i)^2, \; T_2 = \beta (1+i)(-i), \text{ and } T_3 = -i$$

then any $m_t = x$ will implement that policy.

From this discussion, we obtain our second important lesson: there is no real separation between fiscal and monetary policy. As I emphasized in the introduction, at a very fundamental level, monetary policy is always fiscal policy (and conversely, fiscal policy is always a monetary policy). The intimate link between the two policies is given by the budget constraint of the government. Of course, as we learned from Sargent and Wallace (1981), different protocols about which policies are chosen first and which policies follow will give us different predictions for the model, but determining which of these protocols is the best framework for thinking about actual economic policy is a job for empirical evidence. Theory can only reiterate the intimate link between fiscal and monetary policy.

3. Enriching the Model: Public Debt

Now that we understand the basic behavior of the model, I will introduce real public debt, d_t. This will let us think about many classical results in monetary theory. Also, assuming that we are dealing with real debt instead of nominal debt is indifferent, as we have a model with complete financial markets and no uncertainty, which makes the set of allocations implementable in one situation equal to the set in the other one.

The model is unchanged except for the presence of public debt, which is sold at a price q_t. Therefore, the budget constraints of the household are now:

$$p_1 c_1 + m_1 + p_1 q_1 d_1 + \frac{b_1}{R_1} = p_1 w_1 l_1 + p_1 T_1$$
$$p_2 c_2 + m_2 + p_2 q_2 d_2 + \frac{b_2}{R_2} = p_2 w_2 l_2 + (1 + i_1) m_1 + p_2 d_1 + b_1 + p_2 T_2$$
$$p_3 c_3 + m_3 = p_3 w_3 l_3 + (1 + i_2) m_2 + p_3 d_2 + b_2 + p_3 T_3$$

and for the government:

$$m_1 + p_1 q_1 d_1 = p_1 T_1$$
$$m_2 + p_2 q_2 d_2 = p_2 T_2 + (1 + i_1) m_1 + p_2 d_1$$
$$m_3 = p_3 T_3 + (1 + i_2) m_2 + p_3 d_2.$$

The first-order conditions for the household are the same as before except that now:

$$\lambda_t p_t q_t = \beta \lambda_{t+1} p_{t+1}$$

for $t \in \{1, 2\}$. Since

$$\frac{1}{c_t} = -\lambda_t p_t$$

I get:

$$q_t = \beta \frac{c_t}{c_{t+1}}$$

and since

$$R_t = \frac{1}{\beta} \frac{c_{t+1}}{c_t} \frac{p_{t+1}}{p_t}$$

I have the non-arbitrage condition:

$$R_t = \frac{1}{q_t} \frac{p_{t+1}}{p_t}.$$

Also, note that, in equilibrium, it will still be the case that:

$$c_t = y_t = l_t = w_t = 1 \text{ for } t \in \{1, 2, 3\}$$

and, therefore,

$$q_t = \beta \text{ for } t \in \{1, 2\}$$

that is, the price of the debt is just equal to the discount factor (or equivalently, the return of the debt must be equal to the real interest rate). Prices will still be given by:

$$p_1 = \frac{1}{\beta^2 (1 + i_1)(1 + i_2)} m_3$$
$$p_2 = \frac{1}{\beta (1 + i_2)} m_3$$
$$p_3 = m_3.$$

In the interest of space, I will skip the definition of equilibrium. However, we can highlight how the presence of debt, by itself, does not change the equilibrium price path, which will still depend only on the sequence of money and interests on reserves. This invariance of the price path with respect to the presence of public debt is, at a fundamental level, the kernel of all our results below.

3.1. Fixing Money or Fixing Transfers (Revisited)?

I can now repeat the argument about the degrees of freedom of the government for picking policy. Given the equilibrium, the government fixes seven elements of the policy $\{m_t, T_t\}_{t=1}^3$ and $\{i_t, d_t\}_{t=1}^2$ and finds the other three through the budget constraints. That is, the government has 2 more degrees of freedom than in the model without public debt.

For example, if the government fixes the currency sequence $\{m_t\}_{t=1}^{3}$ and the debt and interest sequence $\{i_t, d_t\}_{t=1}^{2}$, then:

$$T_1 = \beta^2 (1+i_1)(1+i_2)\frac{m_1}{m_3} + \beta d_1$$
$$T_2 = \beta(1+i_2)\frac{m_2 - (1+i_1)m_1}{m_3} - d_1 + \beta d_2$$
$$T_3 = 1 - d_2 - (1+i_2)\frac{m_2}{m_3}$$

Now, given some currency sequence $\{m_t\}_{t=1}^{3}$ and the debt and interest sequence $\{i_t, d_t\}_{t=1}^{2}$, I get an allocation

$$c_t = y_t = l_t = w_t = 1 \text{ for } t \in \{1,2,3\}$$

with prices:

$$p_1 = \frac{1}{\beta^2(1+i_1)(1+i_2)} m_3$$
$$p_2 = \frac{1}{\beta(1+i_2)} m_3$$
$$p_3 = m_3$$

At the cost of some algebra, I can go in the opposite direction and show how we can find a currency sequence $\{m_t\}_{t=1}^{3}$ from $\{T_t\}_{t=1}^{3}$ and $\{i_t, d_t\}_{t=1}^{2}$. To see this, note that we will still have:

$$T_1 = \beta^2 (1+i_1)(1+i_2)\frac{m_1}{m_3} + \beta d_1$$
$$T_2 = \beta(1+i_2)\frac{m_2 - (1+i_1)m_1}{m_3} - d_1 + \beta d_2$$
$$T_3 = 1 - d_2 - (1+i_2)\frac{m_2}{m_3}.$$

Then, from the last equation:

$$m_2 = \frac{1 - T_3 - d_2}{1+i_2} m_3$$

and:

$$\begin{aligned} T_2 &= \beta(1+i_2)\frac{\frac{1-T_3-d_2}{1+i_2} m_3 - (1+i_1)m_1}{m_3} - d_1 + \beta d_2 \\ &= \beta(1 - T_3 - d_2) - \beta(1+i_1)(1+i_2)\frac{m_1}{m_3} - d_1 + \beta d_2 \end{aligned}$$

or:

$$m_1 = \frac{\beta(1-T_3) - T_2 - d_1}{\beta(1+i_1)(1+i_2)} m_3.$$

Finally:

$$T_1 = \beta^2 (1+i_1)(1+i_2) \frac{\beta(1-T_3) - T_2 - d_1}{\beta(1+i_1)(1+i_2)} + \beta d_1 = \beta^2 (1-T_3) - \beta T_2$$

which is the same restriction as in the case without public debt. That is, I can implement the same transfers by any policy that picks an arbitrary m_3 and then pins down:

$$\begin{aligned} m_1 &= \frac{\beta(1-T_3) - T_2 - d_1}{\beta(1+i_1)(1+i_2)} m_3 \\ m_2 &= \frac{1 - T_3 - d_2}{1+i_2} m_3 \\ T_1 &= \beta^2 (1-T_3) - \beta T_2 \end{aligned}$$

Equipped with this model, we can start evaluating some of the main issues of monetary policy that we referred to in the introduction.

3.2. Issue 1: Irrelevance of Open Market Operations

Wallace (1981) showed for the first time that a Modigliani-Miller theorem applies to open market operations. In a somewhat restrictive environment, he demonstrated that changes in the composition of the central bank's balance sheet did not have any effect on allocations. Later, the literature, in particular, Chamley and Polemarchakis (1984), extended the result to a much more general set-up. More recently, Eggertsson and Woodford (2003) found that the result still holds in models with nominal rigidities. Thanks to all of these contributions, nowadays, we have a class of irrelevance theorems of monetary policy with intimate links to Ricardian equivalence theorems (again, the link between fiscal and monetary policy resurfaces).

In our model we have one of these irrelevance theorems. The result tells us that we can change the money sequence $\{m_t\}_{t=1}^{3}$ and the debt and interest sequence $\{i_t, d_t\}_{t=1}^{2}$ in such a way that we keep the prices and allocations unchanged. That is, for an alternative sequence $\{\widehat{m}_t\}_{t=1}^{3}$ and $\left\{\widehat{i}_t, \widehat{d}_t\right\}_{t=1}^{2}$, the implied equilibrium will be the same.

Allocations are trivial in this model and independent of policy:

$$c_t = y_t = l_t = w_t = 1 \text{ for } t \in \{1, 2, 3\}$$

and the same for real prices

$$\begin{aligned} q_t &= \beta \text{ for } t \in \{1,2\} \\ w_t &= 1 \text{ for } t \in \{1,2,3\} \end{aligned}$$

or the nominal interest rate (conditional on a price level)

$$R_t = \frac{1}{\beta}\frac{c_{t+1}}{c_t}\frac{p_{t+1}}{p_t} \text{ for } t \in \{1,2\}$$

so I may as well forget about them. So, to prove our point, we only need to check prices and the budget constraint of the government. But if I set:

$$\begin{aligned} \widehat{m}_3 &= m_3 \\ \widehat{i}_t &= i_t \text{ for } t \in \{1,2\} \end{aligned}$$

a direct inspection of the price sequence shows that we are done.

Now, we can go to the budget constraints of the government:

$$\widehat{m}_1 + p_1\beta\widehat{d}_1 = p_1\widehat{T}_1$$
$$\widehat{m}_2 + p_2\beta\widehat{d}_2 = p_2\widehat{T}_2 + (1+i_1)\,\widehat{m}_1 + p_2\widehat{d}_1$$
$$m_3 = p_3\widehat{T}_3 + (1+i_2)\,\widehat{m}_2 + p_3\widehat{d}_2$$

and pick any alternative $\left\{\widehat{m}_t, \widehat{d}_t\right\}_{t=1}^{2}$ and $\left\{\widehat{T}_t\right\}_{t=1}^{3}$ that satisfy those equations.

For example, I can make

$$\widehat{m}_1 = \gamma m_1$$

for $\gamma > 1$ and $\widehat{T}_1 = T_1$, $\widehat{T}_3 = T_3$, $\widehat{d}_2 = d_2$, and $\widehat{m}_2 = m_2$. With these choices:

$$m_3 = p_3T_3 + (1+i_2)\,m_2 + p_3d_2$$

is automatically satisfied. Then, I pick

$$\widehat{d}_1 = \frac{1}{\beta}T_1 - \frac{\gamma}{\beta}\frac{m_1}{p_1} = \frac{1}{\beta}T_1 - \gamma\beta\,(1+i_1)\,(1+i_2)\,\frac{m_1}{m_3}$$

and:

$$\widehat{T}_2 = \beta\,(1+i_2)\,\frac{m_2 - (1+i_1)\,\gamma m_1}{m_3} + \beta d_2 - \frac{1}{\beta}T_1 + \gamma\beta\,(1+i_1)\,(1+i_2)\,\frac{m_1}{m_3}$$

and we complete our task.

Another interesting policy is to keep transfers unchanged and set $\widehat{m}_1 = \gamma m_1$ for $\gamma > 1$. Then, we still have

$$\widehat{d}_1 = \frac{1}{\beta}T_1 - \gamma\beta\left(1+i_1\right)\left(1+i_2\right)\frac{m_1}{m_3}$$

but now:

$$\begin{gathered}
\widehat{m}_2 + p_2\beta\widehat{d}_2 = p_2T_2 + \left(1+i_1\right)\gamma m_1 + p_2\left(\frac{1}{\beta}T_1 - \gamma\beta\left(1+i_1\right)\left(1+i_2\right)\frac{m_1}{m_3}\right) \Rightarrow \\
\frac{\beta\left(1+i_2\right)}{m_3}\widehat{m}_2 + \beta\widehat{d}_2 = T_2 + \gamma\beta\left(1+i_2\right)\left(1+i_1\right)\frac{m_1}{m_3} + \left(\frac{1}{\beta}T_1 - \gamma\beta\left(1+i_1\right)\left(1+i_2\right)\frac{m_1}{m_3}\right) \Rightarrow \\
\beta\frac{1+i_2}{m_3}\widehat{m}_2 + \beta\widehat{d}_2 = T_2 + \frac{1}{\beta}T_1
\end{gathered}$$

and

$$\begin{gathered}
\left(1+i_2\right)\widehat{m}_2 + p_3\widehat{d}_2 = m_3 - p_3T_3 \Rightarrow \\
\frac{1+i_2}{m_3}\widehat{m}_2 + \widehat{d}_2 = 1 - T_3
\end{gathered}$$

and we get:

$$\begin{aligned}
\frac{1+i_2}{m_3}\widehat{m}_2 + \widehat{d}_2 &= \frac{1}{\beta}T_2 + \frac{1}{\beta^2}T_1 \\
\frac{1+i_2}{m_3}\widehat{m}_2 + \widehat{d}_2 &= 1 - T_3
\end{aligned}$$

which clearly implies again:

$$T_1 = \beta^2\left(1 - T_3\right) - \beta T_2$$

that is, any combination of $\widehat{m}_2$ and $\widehat{d}_2$ that is feasible in the sense of satisfying the previous equation delivers the same sequences of allocations and prices. Note that this restriction defines an equivalence class of alternative policies with many members.

There is a well-defined sense in which we can think about these alternative policies as an open market operation: the government issues more currency and reduces its outstanding debt (or takes claims against the private sector if $\widehat{d}_1 < 0$). However, this operation does not have any impact, either real or nominal. All of the changes in the government's portfolio (either in size or in composition) are immediately undone by an equivalent contrary action by the household that leaves the equilibrium unchanged. However, the irrelevance of open market operations does not imply, as sometimes erroneously interpreted, that monetary policy is useless: the government is still determining the price level through the sequence of $\{i_t\}_{t=1}^{2}$ and m_3.

Also changes in the government's portfolio between currency and public debt do not have any impact on the yield curve. Remember the interest rate for the bond issued in period 1

$$R_1 = \frac{1}{\beta}\frac{p_2}{p_1}$$

and for the bond issued in period 2

$$R_2 = \frac{1}{\beta}\frac{p_3}{p_2}.$$

Then, the yield of a two-period bond issued at time 1 is:

$$R_{1,2} = (R_1 R_2)^{0.5} = ((1+i_1)(1+i_2))^{0.5}$$

and the yield spread $s_1 = R_{1,2} - R_1 = ((1+i_1)(1+i_2))^{0.5} - 1 + i_1$ is obviously unchanged.

The main result can be easily extended to the case in which we have long-lived debt and real debt instead of nominal debt (Peled, 1985). Some (boring) algebra will deliver the result that, again, prices, yields, and allocations are unchanged when we rebalance the central bank portfolio's.[2]

This finding delivers a very negative assessment of the prospects of quantitative easing as an instrument of monetary policy. As long as the central bank is exchanging one type of asset for another for which a well-working market exists, the prices of those assets (and the implied yields) cannot change. The explanation is simple. The price of an asset is given by the expectation of its return times the pricing kernel of the economy. Since asset returns do not change regardless of whether the asset is held in the private or the public sector, the only way in which the price of the asset can change is if the pricing kernel varies due to quantitative easing. In our model, the pricing kernel is independent of the central bank's action, so the whole point is moot. In richer models without our classical dichotomy, the pricing kernel will not be affected because the risk represented by the asset bought or sold by the central bank does not disappear from the economy, it is just moved from one agent to the other. But as long as the stand-in household needs to consider a consolidated view of its own balance sheet and the government's balance sheet (since this latter one will determine future net taxes), the transfer of risk within the economy will be cancelled out.

At this level of generality in the discussion, however, we cannot rule out models in which the transfer of risk could potentially induce changes in behavior and hence in the pricing kernel. Think, for instance, about models with financial constraints. The key is that one

[2]There is also a sense in which this result vindicates the old "Real Bills doctrine": as long as the monetary authority discounts at the right interest rate, it does not matter how many of the (sound) private bills it discounts. See Sargent and Wallace (1982).

needs to work hard to break the irrelevance of quantitative easing, and even when one can do so, (see Cúrdia and Woodford, 2010, for a recent example), the results are of second order. This result resembles the negative results in models with financial frictions, where even very tight constraints deliver disappointingly little bang for the buck in quantitative terms (Krueger and Lustig, 2006, is a good example of this literature).

We have, therefore, our third result: quantitative easing is unlikely to have much effect. Up to a first-order approximation, the size and composition of the central bank's balance sheet are irrelevant for equilibrium prices and allocations.

There is also a growing empirical literature that attempts to measure the possible effects of quantitative easing. See, for instance, Doh (2010), Greenwood and Vayanos (2010), or Hamilton and Wu (2010). While the authors of these papers usually take a more positive attitude toward quantitative easing than I do, my personal reading of their findings is that even very large purchase programs have rather limited effects. For example, Hamilton and Wu (2010) predict a 17-basis-point effect from moving $400 billion from short to long maturities of U.S. Treasuries.

However, this clear theoretical result and the somewhat disappointing empirical findings raise two questions. First, why did the Fed engage in purchasing $1.25 trillion of agency mortgage-backed securities (MBS) between January 5, 2009 and March 31, 2010? A quick answer is that the purchase of MBS was not quantitative easing in the traditional sense, but "credit easing," that is, engaging in a market in which, because of a number of asymmetric information problems, liquidity had disappeared. The Fed was not doing anything more than being the proverbial agent with "deep pockets" agent that we include in our standard papers in finance to ensure a lack of arbitrage opportunities. Here is not the place to analyze the impact of the MBS purchase program except to indicate that, as a response to unusually severe disruptions of credit markets, a monetary authority may be able to restore liquidity. But this is very different from the management of aggregate demand through changes in the interest rates defended by supporters of quantitative easing.

The second question is why did the Fed signal to the markets during the fall of 2010 that it may engage in a second round of quantitative easing? The explanation, I am afraid, goes beyond what we can examine with my model. A plausible explanation may be that even if the Fed is aware of the second-order effects of quantitative easing, such a program may shield the institution, at a relatively low cost, from further erosions of its independence at a time when populist sentiments are brewing. An alternative, and somewhat more optimistic, view is that by engaging in a cunning purchase program of U.S. Treasury debt, the Fed is trying to lock itself into a portfolio that will suffer large capital losses if inflation is not temporarily high during the next few years. This "commitment device" would signal to the market that the implicit promise of the Fed of allowing inflation to recover over time after several years of zero growth is credible and reducing, in that way, the real interest rates implied by the zero nominal bound with which we currently live.

3.3. Issue 2: Some Unpleasant Monetarist Arithmetic

Sargent and Wallace (1981) highlighted that, if we take fiscal policy as given, a choice for lower inflation today is also an implicit choice for higher inflation tomorrow. A similar type of result shows up in our environment. Remember that in our model, inflation is given by:

$$\frac{p_2}{p_1} = \beta \left(1 + i_1\right)$$

and

$$\frac{p_3}{p_2} = \beta \left(1 + i_2\right).$$

Now, we take as given the transfer sequence $\{T_t\}_{t=1}^3$ and the debt and interest sequence $\{i_t, d_t\}_{t=1}^2$ and we will construct a new sequence $\left\{\widehat{i}_t, \widehat{d}_t\right\}_{t=1}^2$ keeping fixed $\{T_t\}_{t=1}^3$ and with the same allocation, lower inflation between $t = 1$ and 2 and higher inflation between $t = 2$ and 3.

Using the same reasoning as before, we only need to check prices and the budget constraint of the government. I start by picking $\widehat{i}_1 < i_1$ and $\widehat{i}_2 > i_1$ such that

$$\left(1 + i_1\right)\left(1 + i_2\right) = \left(1 + \widehat{i}_1\right)\left(1 + \widehat{i}_2\right).$$

I also pick $\widehat{m}_3 = m_3$. These choices deliver the result that $\widehat{p}_1 = p_1$ and $\widehat{p}_3 = p_3$ and that there is less inflation in the alternative equilibrium in the first period and more in the second.

Finally, note that:

$$T_1 = \beta^2 \left(1 + \widehat{i}_1\right)\left(1 + \widehat{i}_2\right)\frac{\widehat{m}_1}{m_3} + \beta \widehat{d}_1$$

$$T_2 = \beta \left(1 + \widehat{i}_2\right)\frac{\widehat{m}_2 - \left(1 + \widehat{i}_1\right)\widehat{m}_1}{m_3} - \widehat{d}_1 + \beta \widehat{d}_2$$

$$T_3 = 1 - \widehat{d}_2 - \left(1 + \widehat{i}_2\right)\frac{\widehat{m}_2}{m_3}$$

which still leaves us with one degree of freedom: four variables to choose ($\widehat{m}_1$, $\widehat{m}_2$, $\widehat{d}_1$, and $\widehat{d}_2$) and three constraints. Again, we have our leitmotif of the interdependence of fiscal and monetary policy bounding the degrees of freedom of the government.

3.4. Issue 3: Fiscal Theory of the Price Level

We argued before that in our model, it is not possible to build non-Ricardian policies and that, therefore, strict versions of the fiscal theory of the price level do not hold. However, some of the insights of that literature are still valid.

Imagine that we want to ensure that the nominal value of T_1 is equal to d_0 (we can easily think about this case as some initial stock of public debt). We showed before that, once we have fixed T_2 and T_3, we must have

$$T_1 = \beta^2 (1 - T_3) - \beta T_2.$$

Therefore, given T_2 and T_3, the price level p_1 must satisfy:

$$\frac{d_0}{p_1} = \beta^2 (1 - T_3) - \beta T_2$$

or

$$p_1 = \frac{d_0}{\beta^2 (1 - T_3) - \beta T_2}$$

which determines the price level at $t = 1$. This is a version of the fiscal theory of the price level. Note that this determination of p_1 happens in an economy that satisfies the quantitative theory of money. Also, note that the government is "special": it only satisfies the initial condition for a particular p_1, which eliminates all possible equilibria that deliver different p_1. In comparison, the household needs to satisfy its budget constraint for all equilibria. In other words, we could force the government to satisfy its budget constraint given some nominal d_0 for all equilibria and we would eliminate this result (see Kocherlakota and Phelan, 1999, for a more careful development of this point).

At the same time, we have:

$$p_1 = \frac{1}{\beta^2 (1 + i_1)(1 + i_2)} m_3$$

Thus, we have the additional constraint on m_3 and p_3:

$$\frac{d_0}{\beta^2 (1 - T_3) - \beta T_2} = \frac{1}{\beta^2 (1 + i_1)(1 + i_2)} m_3 \Rightarrow$$

$$p_3 = m_3 = \frac{\beta (1 + i_1)(1 + i_2)}{\beta (1 - T_3) - T_2} d_0$$

Since we still have the three resource constraints, the government must pick

$$m_1 = \frac{\beta\left(1-T_3\right)-T_2-d_1}{\beta\left(1+i_1\right)\left(1+i_2\right)} m_3 = 1 - \frac{d_1}{\beta\left(1-T_3\right)-T_2} d_0$$
$$m_2 = \frac{1-T_3-d_2}{1+i_2} m_3 = \frac{\beta\left(1+i_1\right)\left(1-T_3-d_2\right)}{\beta\left(1-T_3\right)-T_2} d_0$$

(the third one is automatically satisfied by our definition of T_1). The government then selects $\{i_t, d_t\}_{t=1}^{2}$ and we have our complete equilibrium.

3.5. Issue 4: Zero Lower Bound on Nominal Interest Rates

I argued before that in this model, given our assumptions, there is no particular difficulty in thinking about $R_t < 1$. However, it is also instructive to eliminate that possibility and call back the "stuffing-in-your-matress" technology that allows households to hold their cash balances instead of depositing them at the central bank. If $R_t = 1$, then households are indifferent between both choices (I still assume that households do not face any storage cost, such as the installation of an alarm system at home to prevent their cash from being stolen).

The key to understanding what happens when we have a zero lower bound on nominal interest rates is to realize that the Euler equation for the household is still:

$$R_t = \frac{1}{\beta}\frac{c_{t+1}}{c_t}\frac{p_{t+1}}{p_t}$$

regardless of whether the zero bound binds because financial markets are complete and the household has access to them. Also, it will still be the case that $c_t = 1$ for all t (the classical dichotomy holds), and hence:

$$R_t = \frac{1}{\beta}\frac{p_{t+1}}{p_t}$$

If, for instance, $\beta > 1$ (think about it as a situation where we get a negative demand shock), and $R_t = 1$, the only way in which we can have an equilibrium is if $p_{t+1} > p_t$. Fortunately, this is what our other equilibrium conditions deliver. Remember that

$$p_1 = \frac{1}{\beta^2\left(1+i_1\right)\left(1+i_2\right)} m_3$$
$$p_2 = \frac{1}{\beta\left(1+i_2\right)} m_3$$
$$p_3 = m_3$$

and if $\beta > 1$, and $R_t = 1$ (and by non-arbitrage, $i_1 = i_2 = 0$):

$$p_1 = \frac{m_3}{\beta^2}$$
$$p_2 = \frac{m_3}{\beta}$$
$$p_3 = m_3$$

which is exactly what we need to get the Euler equation to hold. In other words, a discount factor bigger than 1 just generates an inflation exactly equal to it:

$$\frac{p_3}{p_2} = \frac{p_2}{p_1} = \beta$$

How can we reconcile this inflationary path created by the zero bound on the nominal interest rate with the usual argument that the zero bound may induce a deflationary black-hole? Here is a particular situation in which the presence of nominal rigidities makes a radical difference. When we have price rigidities, future prices cannot adjust as fast as we would need to clear the savings market (as it happens in our benchmark model). The only way in which we can clear markets is with a fall in output, which reduces the desired level of saving and with it, makes the Euler equation hold. In a world with nominal rigidities, where output is partially demand-determined, this is achieved with a fall in aggregate demand triggered by a deflationary path: deflation increases real interest rates, which reduces current demand and, with it, output and total savings, and ensures market clearing. It is not the zero lower bound that creates a problem. It is the interaction between the zero lower bound and nominal rigidities.

4. A Model with Government Consumption and Distortionary Taxation

I will now switch gears and analyze the effects of government consumption and distortionary taxation in an environment very similar to the one we just used. Again, this emphasizes the usefulness of modern dynamic macroeconomics in thinking through current policy debates.

I will proceed through the analysis in two steps. First, in this section, I will eliminate money (and the policy instruments associated with it), since the main issues I want to discuss do not depend on the presence of money. Second, I would have only two periods, $t \in \{1, 2\}$, since two periods are all I need to make my points.

I will still have a stand-in household that picks consumption c_t and labor supply l_t to maximize:

$$\log c_1 - \frac{l_1^2}{2} + \beta\left(\log c_2 - \frac{l_2^2}{2}\right)$$

The unitary Frisch elasticity of these preferences will be surprisingly useful below.

The budget constraints are now:

$$c_1 + \frac{b_1}{R_1} = (1 - \tau_1)\, w_1 l_1 + T_1$$
$$c_2 = (1 - \tau_2)\, w_2 l_2 + b_1 + T_2$$

where we introduce, as new notation, τ_t as the tax rate on labor income. I do not tax the returns on public debt because, in equilibrium, the returns would increase exactly by the quantity required to offset the tax. For fiscal policy, the tax on labor is the most important novelty of the model with respect to the framework of the previous sections. Since we do not have money, I have eliminated prices from the budget constraints and expressed all quantities, including public debt b_1, in real terms.

I will keep the technology constant and the final good is still produced by a competitive firm with a linear technology $y_t = l_t$. Again, this is just a simple way to fix wages over time without having to worry about physical capital or curvatures of labor supply.

The government uses its revenue from lump-sum transfers from the household and taxes on labor income to finance government consumption, g, in period 1. To simplify, the government does not consume in the second period and g is dumped into the sea (or, more palatably, it enters into the utility function of the representative household in a separable way). A simple way to think about this is that we are concerned only about the effects of increasing government consumption over some long-run average, and hence, we are normalizing all variables to get rid of the average level of public consumption (in section 5, I will let government consumption be positive in all periods at the cost of more algebra). Thus, the government budget constraints are:

$$g + T_1 = \tau_1 w_1 l_1 + \frac{b_1}{R_1}$$
$$b_1 + T_2 = \tau_2 w_2 l_2.$$

It will be more convenient below to use the consolidated budget constraint:

$$g = \tau_1 w_1 l_1 - T_1 + \frac{\tau_2 w_2 l_2 - T_2}{R_1}$$

Finally, the resource constraints of the economy are:

$$c_1 + g = l_1$$
$$c_2 = l_2.$$

Since the definition of equilibrium is standard and just a small modification of the definition in section 2, I skip it in the interest of space.

Also, it is straightforward to derive the equilibrium conditions of the model:

$$\frac{1}{c_1} = \beta R \frac{1}{c_2}$$
$$c_1 l_1 = (1 - \tau_1) w_1$$
$$c_2 l_2 = (1 - \tau_2) w_2$$
$$w_1 = 1$$
$$w_2 = 1$$
$$g = \tau_1 w_1 l_1 + tr_1 + \frac{\tau_2 w_2 l_2 + tr_2}{R}$$
$$c_1 + g = y_1 = l_1$$
$$c_2 = y_2 = l_2.$$

Eliminating w_1 and w_2, we get:

$$R = \frac{1}{\beta} \frac{c_2}{c_1}$$
$$c_1 l_1 = 1 - \tau_1$$
$$c_2 l_2 = 1 - \tau_2$$
$$g = \tau_1 w_1 l_1 + tr_1 + \frac{\tau_2 w_2 l_2 + tr_2}{R}$$
$$c_1 + g = l_1$$
$$c_2 = l_2,$$

a system of 6 equations on five unknowns, $\{c_1, c_2, l_1, l_2, R\}$ and a constraint on government behavior.

I start now analyzing different cases of fiscal policy. The goal is to derive the main lessons outlined in the introduction of the importance of specifying the way in which we finance government consumption expansions.

4.1. Case 1: No Government Consumption

We start with the simplest case of $g = 0$ to have a baseline case. Then, $\tau_1 = \tau_2 = tr_1 = tr_2 = d = 0$ and the equilibrium conditions simplify to

$$R = \frac{1}{\beta}\frac{c_2}{c_1}$$
$$c_1 l_1 = 1$$
$$c_2 l_2 = 1$$
$$c_1 = l_1$$
$$c_2 = l_2$$

or $l_1 = l_2 = c_1 = c_2 = 1$ and $R = \frac{1}{\beta}$.

This is pretty much the same equilibrium as the one in the model with money, consumption and labor are constant over time, and the real interest rate is the inverse of the discount factor.

4.2. Case 2: Government Expansion, Lump-sum Financed

We explore now the case $g > 0$, but all government consumption is financed through lump-sum taxes ($\tau_1 = \tau_2 = 0$). We can think about this exercise as exploring the case of an expansionary fiscal policy with respect to the baseline $g = 0$.

The equilibrium conditions are now:

$$R = \frac{1}{\beta}\frac{c_2}{c_1}$$
$$c_1 l_1 = 1$$
$$c_2 l_2 = 1$$
$$g = tr_1 + \frac{tr_2}{R}$$
$$c_1 + g = l_1$$
$$c_2 = l_2.$$

Then $c_1 = l_1 - g$ and

$$(l_1 - g)\, l_1 = 1 \Rightarrow l_1^2 - g l_1 - 1 = 0$$

which implies that:

$$
\begin{aligned}
l_1 &= \frac{g + \sqrt{g^2+4}}{2} \\
c_1 &= \frac{\sqrt{g^2+4} - g}{2} \\
l_2 &= 1 \\
c_2 &= 1 \\
R &= \frac{1}{\beta}\frac{2}{\sqrt{g^2+4} - g} \\
tr_1 + \beta\frac{\sqrt{g^2+4} - g}{2} tr_2 &= g
\end{aligned}
$$

(we have kept the positive root of l_1).

It is interesting to point out two remarks:

1. $g > 0$ expands output in period 1 with respect to the case $g = 0$. Note that

$$
y_1 = l_1 = \frac{g + \sqrt{g^2+4}}{2} > \frac{g + \sqrt{g^2+4-2g}}{2} = \frac{g + \sqrt{(2-g)^2}}{2} = 1
$$

   Also, since for small g

$$
\frac{\sqrt{g^2+4}}{2} \approx 1
$$

   the increase in output with respect to the baseline case is approximately half of the increase in g. Thus, by the resource constraint, c_1 falls. Output in period 2 is unchanged. It is quite remarkable that the size of this multiplier is the range of values obtained by more involved dynamic models (for example, if we had capital). The reason labor supply goes up is that there is a negative wealth effect triggered by higher taxes. The interest rate R increases to induce the representative household to consume less in period 1 to satisfy the resource constraint.

2. The timing of lump-sum transfers is irrelevant: d does not appear in the equilibrium conditions and we can pick any combination of tr_1 and tr_2 as long as it satisfies:

$$
tr_1 + \beta\frac{\sqrt{g^2+4} - g}{2} tr_2 = g.
$$

   In other words, it does not matter if we finance the government expansion with more taxes today and a balanced budget or with debt and deficit. This is, of course, just the

Ricardian equivalence. Note, however (and this should be clear), that the Ricardian equivalence does not say that an expansion of government expenditure does not have any effect when we have lump-sum taxes. We still have an increase in output. What the Ricardian equivalence says is that whether we finance that expansion with lump-sum taxes today or tomorrow is irrelevant.

Finally, an obvious point about welfare that is, however, often forgotten. The increase in output does not translate necessarily into an increase in welfare. In this economy g_t is useless and since the impact multiplier is smaller than 1, consumption and leisure fall and with them welfare. In a richer model, where g_t enters into the utility function, the net outcome will depend on the parameter weighting g_t in the preferences.

4.3. Case 3: Government Expansion, Distortionary Taxes Today

We explore the case $g > 0$ financed through distortionary taxes in the first period ($\tau_1 > 0$, $\tau_2 = 0$) and, to simplify the expressions, no lump-sum transfers.

The equilibrium conditions are now:

$$R = \frac{1}{\beta}\frac{c_2}{c_1}$$
$$c_1 l_1 = 1 - \tau_1$$
$$c_2 l_2 = 1$$
$$g = \tau_1 l_1$$
$$c_1 + g = l_1$$
$$c_2 = l_2.$$

Then:

$$1 - \tau_1 = 1 - \frac{g}{l_1} = 1 - \frac{l_1 - c_1}{l_1} = \frac{c_1}{l_1}$$

and:

$$c_1 l_1 = \frac{c_1}{l_1} \Rightarrow l_1 = 1$$

which implies that:

$$c_1 = 1 - g$$
$$\tau_1 = g$$
$$c_2 = l_2 = 1$$

and

$$R = \frac{1}{\beta}\frac{1}{1-g}$$

that is, output does not change in the first or second period. This result is, however, a consequence of having a unitary Frisch elasticity and a linear technology. The substitution effect of a lower after-tax wage is exactly counterbalanced by the negative wealth effect of higher taxes. The interest rate increases to induce the representative household to consume less in period 1.

4.4. Case 4: Government Expansion, Distortionary Taxes Tomorrow

We explore now the case $g > 0$ with some distortionary taxes in the second period ($\tau_2 > 0$, $\tau_1 = 0$) and, to simplify the expressions, no lump-sum transfers in the second period ($tr_2 = 0$). The equilibrium conditions are:

$$R = \frac{1}{\beta}\frac{c_2}{c_1}$$
$$c_1 l_1 = 1$$
$$c_2 l_2 = 1 - \tau_2$$
$$Rg = \tau_2 l_2$$
$$c_1 + g = l_1$$
$$c_2 = l_2$$

Then, as in case 1, we still have that

$$l_1 = \frac{g + \sqrt{g^2+4}}{2}$$
$$c_1 = \frac{\sqrt{g^2+4} - g}{2}$$

but now:

$$l_2 = \sqrt{1-\tau_2}$$
$$c_2 = \sqrt{1-\tau_2}$$
$$R = \frac{1}{\beta}\frac{2\sqrt{1-\tau_2}}{\sqrt{g^2+4} - g}$$
$$Rg = \tau_2 l_2.$$

Clearly, $l_2 < 1$. Also we have:

$$\frac{1}{\beta}\frac{2\sqrt{1-\tau_2}}{\sqrt{g^2+4}-g}g = \tau_2\sqrt{1-\tau_2} \Rightarrow \tau_2 = \frac{1}{\beta}\frac{2g}{\sqrt{4+g^2}-g}$$

and:

$$l_2 = c_2 = \sqrt{1-\frac{1}{\beta}\frac{2g}{\sqrt{4+g^2}-g}}$$

and:

$$R = \frac{1}{\beta}\frac{2\sqrt{1-\frac{1}{\beta}\frac{2g}{\sqrt{4+g^2}-g}}}{\sqrt{4+g^2}-g}.$$

This is an expression on the order of $\sqrt{g}$, that is, the effects on the second period allocation are a square root of the increase in government consumption. This is why, for small g, it does not really matter much to distinguish between debt-financed or lump-sum-transfer-financed fiscal expansions. Labor supply goes up in the first period because of the negative wealth effect and goes down in the second period because of the distortionary effect of taxes on wages.

4.5. Lessons

In summary:

1. When the increase in government consumption today is financed through lump-sum transfers (either today or tomorrow), output increases in the first period and stays the same in the second period. The increase in output in the first period is approximately half of the increase in government consumption.

2. When the increase in government consumption today is financed through lump-sum transfers, it is irrelevant if we tax today or tomorrow (Ricardian equivalence).

3. When the increase in government consumption today is financed through distortionary taxes today, output is unchanged in both periods.

4. When the increase in government consumption today is financed through distortionary taxes tomorrow, output increases today, approximately by half of the increase in government consumption, and falls in the second period, approximately by the square root of the increase in government consumption.

While some of the details of these lessons depend on our particular functional forms, the main thrust of the results will go through in a much wider set of environments. In particular, the idea that the effectiveness of expansionary fiscal policy depends crucially on the way it is financed appears clearly even in the most sophisticated DSGE models. Similarly, many of the orders of magnitude from 1 to 4 are a good indication of the results we should expect from medium-scale estimated models such as those described in Fernández-Villaverde (2010).

5. Putting it All Together

Now, as a capstone of the paper, I will put together monetary and fiscal policy in a coherent framework. For that, I return to a three-period model and reintroduce money but I keep the distortionary taxes and government consumption of the previous section in all three periods. For lack of a better name, I will call this environment the unified model.

5.1. Environment

There is a stand-in household that picks consumption c_t, labor supply l_t, and real money holdings to maximize

$$\log c_1 - \frac{l_1^2}{2} + \beta\left(\log c_2 - \frac{l_2^2}{2}\right) + \beta^2\left(\log c_3 - \frac{l_3^2}{2} + \log\frac{m_3}{p_3}\right)$$

subject to:

$$\begin{aligned} p_1c_1 + m_1 + p_1q_1d_1 + \frac{b_1}{R_1} &= (1-\tau_1)\, p_1w_1l_1 + p_1T_1 \\ p_2c_2 + m_2 + p_2q_2d_2 + \frac{b_2}{R_2} &= (1-\tau_2)\, p_2w_2l_2 + (1+i_1)\, m_1 + p_2d_1 + b_1 + p_2T_2 \\ p_3c_3 + m_3 &= (1-\tau_3)\, p_3w_3l_3 + (1+i_2)\, m_2 + p_3d_2 + b_2 + p_3T_3. \end{aligned}$$

The technology side stays as before, where the final good is produced by a competitive firm with a linear technology $y_t = l_t$.

The government budget constraints are:

$$\begin{aligned} m_1 + \tau_1p_1w_1l_1 + p_1q_1d_1 &= p_1g_1 + p_1T_1 \\ m_2 + \tau_2p_2w_2l_2 + p_2q_2d_2 &= p_2g_2 + p_2T_2 + (1+i_1)\, m_1 + p_2d_1 \\ m_3 + \tau_3p_3w_3l_3 &= p_3g_3 + p_3T_3 + (1+i_2)\, m_2 + p_3d_2 \end{aligned}$$

and the aggregate resource constraint $c_t + g_t = l_t$ for all $t \in \{1, 2, 3\}$. It is trivial to check that, by consolidating the budget constraints of the household and the government and imposing the market clearing conditions $b_1 = b_2 = 0$ and $w_1 = w_2 = w_3 = 1$, we recover the aggregate resource constraint. Again, the definition of equilibrium is straightforward and I omit it to save space. Also, to ease notation, I will already have applied the result $w_1 = w_2 = w_3 = 1$ in my next derivations.

5.2. Solving for the Equilibrium

The Lagrangian of the household is given by

$$\begin{aligned}
&\log c_1 - \frac{l_1^2}{2} + \beta \left(\log c_2 - \frac{l_2^2}{2} \right) + \beta^2 \left(\log c_3 - \frac{l_3^2}{2} + \log \frac{m_3}{p_3} \right) \\
&+\lambda_1 \left(p_1 c_1 + m_1 + p_1 q_1 d_1 + \frac{b_1}{R_1} - (1-\tau_1) p_1 l_1 - p_1 T_1 \right) \\
&+\beta \lambda_2 \left(p_2 c_2 + m_2 + p_2 q_2 d_2 + \frac{b_2}{R_2} - (1-\tau_2) p_2 w_2 l_2 - (1+i_1) m_1 - p_2 d_1 - b_1 - p_2 T_2 \right) \\
&+\beta^2 \lambda_3 \left(p_3 c_3 + m_3 - (1-\tau_3) p_3 w_3 l_3 - (1+i_2) m_2 - p_3 d_2 - b_2 - p_3 T_3 \right).
\end{aligned}$$

The first-order conditions for the household are for all t

$$\frac{1}{c_t} = -\lambda_t p_t$$
$$l_t = -\lambda_t (1-\tau_t) p_t$$

for $t \in \{1, 2\}$

$$\lambda_t = \beta (1+i_t) \lambda_{t+1}$$
$$\lambda_t p_t q_t = \beta \lambda_{t+1} p_{t+1}$$
$$\frac{\lambda_t}{R_t} = \beta \lambda_{t+1}$$

and for $t = 3$

$$\frac{1}{m_3} = -\lambda_3.$$

Using the resource constraint:

$$c_t + g_t = l_t$$

and the first two optimality conditions, we get $l_t (l_t - g_t) = 1 - \tau_t$ or:

$$y_t = l_t = \frac{g_t + \sqrt{g_t^2 + 4(1-\tau_t)}}{2}$$

and

$$c_t = \frac{\sqrt{g_t^2 + 4(1-\tau_t)} - g_t}{2}.$$

We can see from these two equations that output, consumption, and labor depend only on taxes and government consumption in the current period.

Now, for the price level, we get:

$$p_1 = \frac{1}{\beta^2(1+i_1)(1+i_2)} \frac{m_3}{c_1}$$
$$p_2 = \frac{1}{\beta(1+i_2)} \frac{m_3}{c_2}$$
$$p_3 = \frac{m_3}{c_3}$$

for the public debt in $t \in \{1, 2\}$:

$$q_t = \beta \frac{c_t}{c_{t+1}}$$

and for the nominal interest rate in $t \in \{1, 2\}$:

$$R_t = \frac{1}{\beta} \frac{c_{t+1}}{c_t} \frac{p_{t+1}}{p_t}.$$

We summarize the results

$$y_t = l_t = \frac{g_t + \sqrt{g_t^2 + 4(1-\tau_t)}}{2} \text{ for } t \in \{1, 2, 3\}$$
$$c_t = \frac{\sqrt{g_t^2 + 4(1-\tau_t)} - g_t}{2} \text{ for } t \in \{1, 2, 3\}$$
$$w_t = 1 \text{ for } t \in \{1, 2, 3\}$$
$$p_1 = \frac{1}{\beta^2(1+i_1)(1+i_2)} \frac{m_3}{c_1}$$
$$p_2 = \frac{1}{\beta(1+i_2)} \frac{m_3}{c_2}$$
$$p_3 = \frac{m_3}{c_3}$$
$$q_t = \beta \frac{c_t}{c_{t+1}} \text{ for } t \in \{1, 2\}$$
$$R_t = \frac{1}{\beta} \frac{c_{t+1}}{c_t} \frac{p_{t+1}}{p_t} \text{ for } t \in \{1, 2\}$$
$$b_t = 0 \text{ for } t \in \{1, 2\}.$$

As for the government constraints:

$$
\begin{aligned}
m_1 + \tau_1 p_1 l_1 + p_1 q_1 d_1 &= p_1 g_1 + p_1 T_1 \\
m_2 + \tau_2 p_2 l_2 + p_2 q_2 d_2 &= p_2 g_2 + p_2 T_2 + (1 + i_1)\, m_1 + p_2 d_1 \\
m_3 + \tau_3 p_3 l_3 &= p_3 g_3 + p_3 T_3 + (1 + i_2)\, m_2 + p_3 d_2
\end{aligned}
$$

where we see the 16 policy instruments, $\{m_t, \tau_t, T_t, g_t\}_{t=1}^{3}$ and $\{i_t, d_t\}_{t=1}^{2}$, and hence the presence of 13 degrees of freedom. This basically means that we have a large class of equivalent policies that implement the same allocations.

The clearest example of these equivalent policies is, naturally, that lump-sum transfers do not show up in the equilibrium conditions except in the three government constraints. This is a rather direct consequence of the result that in our unified model, Ricardian equivalence still holds. Hence, any changes in the timing of transfers will be irrelevant. At the cost of rather boring algebra, we could characterize all these equivalent policies and show, for instance, that quantitative easing will still be completely useless.

Also, we could explore the consequences of many different changes in government policy. In the interest of space, I will focus on just one experiment: an expansion in government consumption g_t. Imagine, first, that such an expansion is financed with lump-sum transfers. Then:

$$
\frac{\partial y_t}{\partial g_t} = \frac{1}{2}\left(1 + \frac{g_t}{\left(g_t^2 + 4\,(1 - \tau_t)\right)^{0.5}}\right)
$$

Clearly, this result nests our case 2 in section 4, where $\tau_t = 0$ and for g_t small, I found that

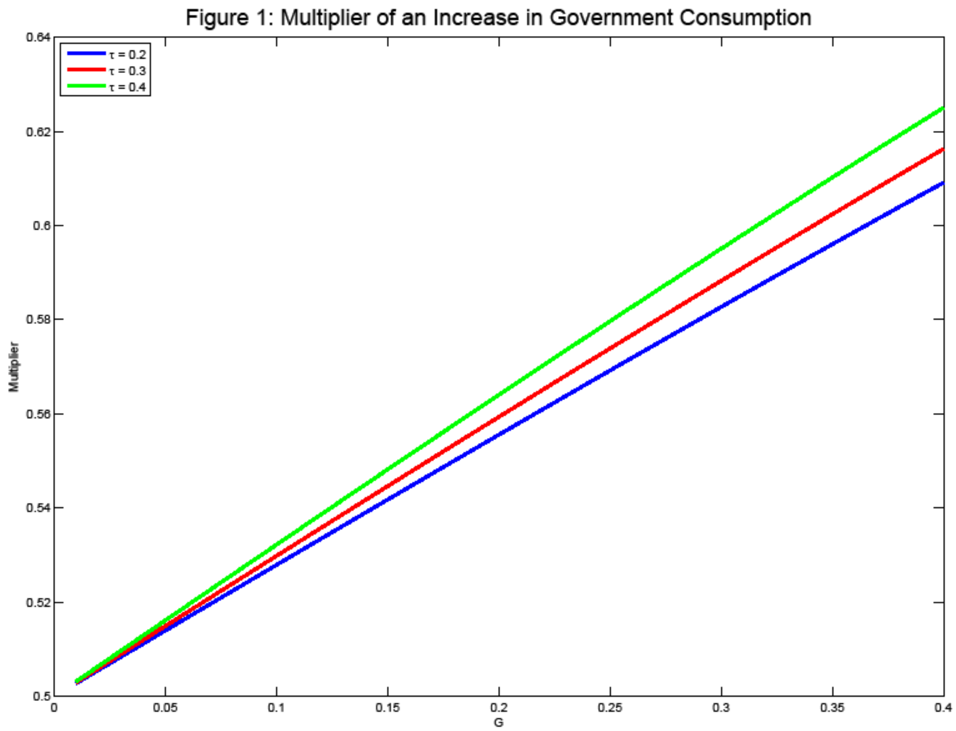
$$
\frac{\partial y_t}{\partial g_t} \approx \frac{1}{2}.
$$

Now the result with positive g_t and τ_t is a bit more complicated. To get an idea of the size of the multiplier, I plot in figure 1, the multiplier for different values of g_t (from 0 to 0.4) and for three values of τ_t (0.2, 0.3, and 0.4). While the value of the multiplier is not 0.5 any longer, it stays within reasonable values (up to 0.62), which are again similar to the ones reported in the empirical literature and the multipliers derived from richer DSGE models.

Interestingly, the multiplier never gets close to one, which implies, by the resource constraint of the economy, that c_t falls. Hence, given that the price level in each period is given by:

$$
p_t \propto \frac{m_3}{c_t}
$$

an increase in g_t increases p_t even if the money supply and the interest rates set up by monetary policy are unchanged.



Therefore, fiscal policy is the key to determining the price level and inflation even in a fully neoclassical world such as the one presented here. Also, the price of public debt

$$q_t = \beta \frac{c_t}{c_{t+1}}$$

would fall (we need to induce the households to consume less today and that is achieved with a higher real interest rate). However the nominal interest rate on bonds:

$$R_t = \frac{1}{\beta} \frac{c_{t+1}}{c_t} \frac{p_{t+1}}{p_t}$$

stays constant since the higher real interest rate is exactly balanced by the lower inflation rate between period t and $t+1$.

We can move now to the case where the expansion in government consumption g_t is financed with future distortionary taxes. The impact multiplier is still given by:

$$\frac{\partial y_t}{\partial g_t} = \frac{1}{2}\left(1 + \frac{g_t}{\left(g_t^2 + 4\left(1-\tau_t\right)\right)^{0.5}}\right)$$

while the effects on future output depend on when and how τ_t, T_t, and m_t are changed to restore the government's intertemporal budget constraint. The consequences for prices and interest rates will be the same as before except for the possible consequences for c_{t+1}.

Finally, in the case in which the expansion in government consumption g_t is financed with distortionary taxes today, some algebra will deliver that:

$$\frac{\partial y_t}{\partial g_t} = 0$$

and prices remain constant.

These derivations show us an important final lesson: we can use fiscal policy as a substitute for monetary policy. In fact, you can show in a much more general set-up that all of the changes in allocations that can be achieved with monetary policy can also be achieved with fiscal policy. Correia, Nicolini, and Teles (2008), in an important recent contribution, show that we can implement the same set of optimal allocations with fiscal instruments as with monetary policy and, moreover, that such optimal policy is independent of the degree or type of price stickiness.

6. Conclusion

In a learned and insightful book, Pincus (2009) has recently reminded us that the Glorious Revolution of 1688 in England, despite its faded role in the contemporary historiographical fashions genetically suspicious of Whiggish readings of events, was the initial milestone of modernity, the true start of contemporary economic growth, and of open, liberal societies. Among the many institutional changes brought about by the landing of the Prince of Orange at Torbay, the one that concern us the most is the chartering of the Bank of England on July 27 1694, which started us on the road toward monetary policy as we currently understand it. What is sometimes forgotten is that this first modern central bank (with the permission, of course, of the Swedish Riksbank) was created not so much as a tool for monetary policy, but as an instrument for fiscal policy. The position of William and Mary was tenuous. The War of the League of Augsburg had been dragging on for 5 long years without a clear path toward victory for the Grand Alliance, the menace of the return of James II from his French exile was ever present, and the Battle of Beachy Head had transparently demonstrated that England could lose control of the Channel. Money was needed and it was needed fast. A central bank, with many privileges such as the issuing of notes, was an expedient way to raise the required resources. As one pamphleteer of the time argued, such a bank could provide "ready money" in case of "a sudden emergency" to "equip Armadas, supply armies, levy soldiers," (cited by Pincus, 2009, p. 390).

This historical detour illustrates, better than any other I can think of, the deep interconnection between fiscal and monetary policy that has run through the paper. For a couple of decades, from 1985 to around 2007, that interconnection was partially hidden from the public debate. Monetary policy seemed to be just an issue of raising or lowering the nominal interest rate at appropriate moments to stabilize the economy and achieve low inflation. But this was the case only because fiscal policy did not impose tight constraints on what the monetary authority could do and because the economy did not require large policy interventions. Once the 2007-2009 recession broke those conditions, the intimate relation between different policies has resurfaced.

This has important political-economic implications. In a world in which monetary policy has a clear and rather limited set of tasks and goals, it is feasible to entertain the idea of an independent central bank. However, once fiscal and monetary policy start to interact with each other in dramatic ways, the pressure to achieve coordination between both of them will mount. One possibility, witnessed at least to some degree in the U.S., is that a populist impulse will subordinate central banks to Treasury directions, as was the case for a long time. A second possibility, which seems closer to the European experience, is that monetary authorities end up prevailing over those directing fiscal policy. Of course, the swing in one direction or the other will depend crucially on the relative strengths of each institution, and the weakness of the Fed with respect to Congress in the U.S. versus the strength of the ECB with respect to national authorities (at least those outside Germany and France) forecasts that these developments will become more acute over time.

But no matter what the final outcome of these political struggles is, we will still face the need to implement optimal policies. I have tried to argue in this paper that modern dynamic macroeconomics has uncovered some important lessons to address this challenge.

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