

The Fiscal Theory of the Price Level

1. Sargent and Wallace's (SW) article, "Some Unpleasant Monetarist Arithmetic"

This paper first put forth the idea of the *fiscal theory of the price level*, a radical departure from the conventional view on fiscal and monetary policy. It is considered an important classic in this area, but is a difficult paper to work out. The logic and the intuition are straightforward.

However, getting at the technical details can be challenging. Fortunately, much of what is in the paper is very similar to what we have been doing all semester long.

Essentially, we wish to make a connection between monetary policy and fiscal policy. In many discussions of the two policies the impression is given, and sometimes it is actually stated, that the two are independent. This is not so. They are connected by the government's budget constraint. Let G be government spending and T be taxes. Then we can define the government's deficit as $D = G - T$. Changes in spending or taxes will imply a change in the deficit. So, for example, it is argued that an expansionary policy increases G and reduces T , both of which make the deficit $G - T$ larger. Following SW, we will assume that deficits and hence fiscal policy are fixed and ask how this might constrain monetary policy.

If the government is running a deficit, it must somehow finance it. There are only a few ways of doing this. It can sell some assets, e.g., federal office buildings, but this won't work for very long since it will run out of assets. It can invade another country and try to take its resources, e.g., the Iraq invasion of Iran in the early 1980s, the Iraq invasion of Kuwait in 1990. It can also sell bonds and print money, which tend to be more reliable than selling assets or invading another country. If the government prints new money, the stock of money will grow according to $(M_t - M_{t-1})/p_t > 0$, which may cause inflation. Or it could issue bonds and allow the stock of bonds to grow, $B_t^g - (1+r)B_{t-1}^g > 0$. However, the credit markets may worry that the stock of bonds is growing too quickly for the government to pay off on its bonds and this may impose a constraint on government borrowing through the credit market. There have been cases where credit markets have rejected the government's bonds either because of the threat of government default, or an actual default like Mexico and Russia.

So we have to model the credit market and its connection to the government's financing of its deficit. We will assume there are rich savers and poor savers and there are legal restrictions on the assets people can own. So the rich will hold government bonds and the poor will hold money, and bonds will pay a higher rate of return.

First, let's figure out the savings functions. Agents only differ in their endowment of income, and have common preferences. SW assume the utility function is $U = c_1 c_2$, which is actually very similar to the log utility function we have been studying.¹ Recall the general decision problem: $\max \ln(c_1) + \beta \ln(c_2)$ subject to the endowment of (w_1, w_2) and the generic constraints $w_1 = c_1 + s$ and $w_2 + (1+r)s = c_2$. This will give us the general savings function,

$$s = \frac{\beta w_1}{1 + \beta} - \frac{w_2}{(1+r)(1 + \beta)}$$

We can specialize this to the Sargent and Wallace model. For the rich agent, $w_1 = w > 0$, $w_2 = 0$, and the discount factor is one, $\beta = 1$. So the savings function for the rich agent is

¹ Notice that $U = c_1 c_2$, so $\ln(U) = \ln(c_1) + \ln(c_2)$, which is the same as our utility function with the discount factor set to one. Or, suppose $U = c_1 c_2^\beta$. Now, $\log(U) = \log(c_1) + \beta \log(c_2)$.

$$S^r = w/2,$$

in our notation. For the poor agent, $w_1 = y_1$, $w_2 = y_2$, and the discount factor is one, $\beta = 1$. So savings for the poor agent is given by

$$S^p = \frac{\beta y_1}{2} - \frac{y_2}{2(1+r)}.$$

Notice something about the savings of the poor, namely, $y_1 > S^p$.² This will come in handy when imposing a legal restriction on the credit market.

Most governments impose restrictions on the asset markets and SW exploit this in their analysis. This is designed to capture certain realistic features of financial markets. They assume there is a private storage technology which captures the idea of investment. If k units of the good are stored or invested, $(1+x)k$ is returned next period in our notation. However, k has to be larger than some minimum \underline{k} in order for the investment to pay off, $k \geq \underline{k}$. If less than this is invested, the payoff is zero. In addition, they assume that $w/2 \geq \underline{k} \geq y_1$. Since $S^r = w/2$, the rich agent can afford to make the investment because $S^r \geq \underline{k}$. However, If $\underline{k} > y_1 > S^p$, then the poor agent will not have enough income in the first period to make the investment. The other assets available are fiat currency and government bonds. Bonds will have to pay competitive interest and so will pay $1+r = 1+x$, and in general $1+x > 1+r_m$, the return on money.

Ostensibly, the poor would like to pool their savings as a group, $N_1 S^p$, in order to make an investment in k to earn $1+x$, or buy a government bond and earn $1+r = 1+x$. One possible institutional arrangement would entail a finance company selling shares in an investment like storage or government bonds. Each poor agent would like to buy such shares using their savings and have the company invest on their behalf. They would then earn the return $1+x$ per share in the finance company. However, many governments severely restrict the private sector's ability to intermediate an investment like this. So SW assume there is a legal restriction that does not allow a group of agents, poor or rich, to get together and intermediate an investment and distribute the earnings to investors.

To close the model, it is assumed there is a two period structure, there are N_1 poor agents, N_2 rich agents, $N = N_1 + N_2$ is population, and population is constant. (SW assume population grows at rate $1+n$.) The government issues two assets, money and bonds, to finance its deficits. Bonds are in large denomination, which are too large for an individual poor agent to buy. The poor will hold money while the rich will hold bonds, and/or make an investment.

The equilibrium conditions are the following. For the money market involving the poor agents we have,

$$N_1 \left[\frac{\beta y_1}{2} - \frac{y_2}{2(1+r_m)} \right] = \frac{M}{p} \quad (1)$$

² To prove this conjecture, substitute for S^p and simplify,

$$y_1 > y_1/2 - y_2/2(1+r),$$

$$y_1/2 > -y_2/2(1+r),$$

which obviously holds. Therefore, $y_1 > S^p$.

Consider the special case where the poor agent only has income in the first period so equation (1) becomes,

$$N_1 y_1 / 2 = M / p. \quad (1^*)$$

Equilibrium in the credit market requires,

$$N_2 w / 2 = K + B^g. \quad (2)$$

SW's first result shows that a tight money policy now in the form of a reduction in the rate of growth of the money supply will lead to less inflation now but more inflation later. Getting at this requires another equation, the government's budget constraint. Since G is government spending and T is taxes, $G - T$ is the deficit, D . A deficit can be financed in one of two ways, printing more money, or issuing more bonds, or both. So, in period t ,

$$D_t = \frac{M_t - M_{t-1}}{p_t} + B_t^g - (1+r)B_{t-1}^g.$$

Note that rB_{t-1}^g is interest on the maturing debt. Divide through by N to put the variables in per capita magnitudes,

$$\frac{D_t}{N} = \frac{M_t - M_{t-1}}{N p_t} + \frac{B_t^g}{N} - (1+r) \frac{B_{t-1}^g}{N},$$

or,

$$d_t = \frac{M_t - M_{t-1}}{N p_t} + b_t^g - (1+r)b_{t-1}^g \quad (\text{gbc})$$

where $d = D/N$, $b^g = B^g/N$, and so on. This is the government's per capita budget constraint and it instructs us how the government can finance its deficit. There is also a money supply rule,

$$M_t = (1+z)M_{t-1}. \quad (\text{msr})$$

Substitute the (msr) into the (gbc) as we did in class, to get

$$d_t = \frac{z}{1+z} \frac{M_t}{N_t p_t} + b_t^g - (1+r)b_{t-1}^g. \quad (3)$$

This equation governs the government's spending behavior every period. So, for the first two periods it tells us the following

$$d_1 = \frac{z}{1+z} \frac{M_1}{N_1 p_1} + b_1^g - (1+r)b_0^g \text{ for period 1,}$$

and

$$d_2 = \frac{z}{1+z} \frac{M_2}{N_2 p_2} + b_2^s - (1+r)b_1^s \text{ for period 2,}$$

and so on.

Let's consider a special case of equation (3) to make things even easier to see. Suppose the deficit is constant over time, $d_t = d$, there is no debt initially, $b_0^s = 0$, and we focus on the first two periods,

$$d = \frac{z}{1+z} \frac{M_1}{N_1 p_1},$$

$$d = \frac{z}{1+z} \frac{M_2}{N_2 p_2}.$$

What is $(M_1/N_1 p_1)$? It will be given by equation (1*), $M/Np = N_1 y_1 / 2N$. Hence

$$d = \frac{z}{1+z} \frac{N_1 y_1}{2N}, \text{ for period 1,}$$

and similarly for period 2,

$$d = \frac{z}{1+z} \frac{N_1 y_1}{2N}, \text{ for period 2.}$$

So z , the rate of growth in money, has to satisfy this equilibrium condition each period or else people won't hold money.

Now suppose the government wants to fight inflation in the first period by running a tight money policy so it reduces z to z_1 in the first period. Since d is given by the assumption of fiscal policy being fixed, and $N_1 y_1 / 2N$ is also given, lower z in period 1 means the government will have to sell some bonds, b , in the first period to finance the deficit it is not financing through money issue (because of its tight money policy). But then it has to finance repayment and interest on the bonds next period so we get,

$$d = \frac{z_1}{1+z_1} \frac{N_1 y_1}{2N} + b, \text{ for period 1,}$$

and

$$d = \frac{z_2}{1+z_2} \frac{N_1 y_1}{2N} - (1+r)b, \text{ for period 2}$$

where $z_1 < z$, because the government is running a tight money policy. What is z_2 ? Since $N_1 y_1 / 2N$ and d are both given, $z_2 > z$ to finance part of the deficit and repayment of the bonds plus interest. But $z_2 > z$ is a loose money policy in period 2 which will cause inflation in the future!

Intuitively, if the government's fiscal policy is given, i.e., the deficit is fixed, and the government wants to fight inflation by reducing the rate of growth in the money supply, it has to sell bonds to finance its spending. This will require the government to *increase* the growth in money supply in the future!!!! How is inflation determined? By assuming the economy is in a stationary monetary equilibrium,

$$\frac{M}{Np} = \frac{M'}{N'p'}$$

which from our earlier work implies $1+r_m = 1/(1+z)$ so $1+\pi = 1+z$. So inflation increases as z increases and decreases as z decreases. So if fiscal policy is fixed, less inflation now (lower z_1) may mean higher inflation in the future (higher z_2)!³

SW also provide an example of a model where a tight money policy now causes greater inflation now! This is quite a startling result. The intuition is the following. A decrease in the growth in the money supply now (lower z_1), will cause the government to issue bonds now, which will eventually force the government to increase the rate of growth in the money supply in the future (higher z_2), as long as fiscal policy is fixed. This will cause greater inflation in the future. But greater inflation in the future will reduce the return to holding money now since $1+r_m = 1/(1+z)$. If $y_2 > 0$ for the poor agent so equation (1) holds, then the demand for money depends on the return to holding money hence inflation, and is given by

$$M/p = y_1/2 - y_2(1+\pi)/2, \text{ for period 1,}$$

since $1/(1+r_m) = 1+\pi$, where $\pi = z$. An increase in future inflation reduces the return to money now and reduces the demand for money now. This lowers the right side of the last equation. Given M , p must increase to reduce real money balances on the left side of the equation so there is greater inflation now in period 1!

The model is very monetarist in that the quantity theory holds; a one time increase in the stock of money causes inflation at the same rate, $dM/M = dp/p$. There are three elements of importance in our version of SW's model. GDP is not growing. The interest rate is positive and thus exceeds the growth rate of the economy. And the demand for money satisfies the Quantity Theory.⁴ This satisfies the model of Milton Friedman in his famous Presidential Address to the AEA in the late 1960s. However, the central bank is unable to control the money supply and hence inflation if fiscal policy is fixed, something that Friedman did not anticipate.

In a sense the two policies are linked; monetary policy cannot be made in a vacuum, nor can fiscal policy. However, if there are separate agencies in charge of its own policy, conflicts can arise. We have just examined one case where the fiscal authority chose to run deficits that must be financed. This severely constrains the central bank. The same is true going the other way. For example, if the central bank runs a contractionary policy, the fiscal authority cannot run deficits for long.

³ A clever argument to get around this might be to say: why doesn't the government just issue more bonds instead of printing more money after $t = 1$? Notice that in the gbc the stock of bonds will grow at rate $(1+r)$. The stock of bonds will grow without limit if $r > 0$, or if population is growing $r > n$. Bondholders will eventually refuse to hold the government's bonds and the government will be forced to inflate by increasing the growth in the stock of money. So eventually the government will have to inflate to pay off the bonds when $r > 0$, or $r > n$ if population grows. SW interpret $1+n$ as the growth in GDP. So if bonds grow faster than GDP, they will eventually have to be paid off. By 2013 the stock of bonds was growing faster than the economy!

⁴ In SW population grows at rate $1+n$. GDP is $N_1y_1 + N_2w$ and both N_1 and N_2 grow at rate $1+n$ so GDP grows at rate $1+n$. If bonds grow at rate $1+r > 1+n$, they will grow faster than the economy. This is not sustainable.

You might be asking: why do they call it the fiscal theory of the price level. Good question. There are two facets to the answer. The first is that we are taking into account the government's budget constraint, equation (gbc), which is not usual when discussing monetary policy. This was one of the most interesting aspects of SW's article. Second, consider equation (3) without bonds,

$$d = \frac{z}{1+z} \frac{M}{Np}.$$

Suppose the fiscal authority increases d . Then the central bank's hands are tied so to speak in its choice of z . It either must increase z , or increase M in a one shot policy move to finance the higher deficit. Monetary policy is subservient to fiscal policy when the fiscal authority the deficit, d .

2. Cashless economy

John Cochrane in several recent papers extended the fiscal theory of the price level to different economies including a cashless economy. Suppose there is no money and all savers accumulate private debt and government bonds. Let A represent nominal government debt denominated in dollars as a unit of account and let $1+i$ be the nominal interest rate. The government's budget constraint is

$$D = G - T = A_t/p_t - (1+i)A_{t-1}/p_t.$$

A/p is the stock of real debt. Note that $1+i = (1+r)(1+\pi)$, Fisher's equation. Also, dividing by population, we get

$$d_t = a_t/p_t - (1+i)a_{t-1}/p_t.$$

Notice, $(1+i)a_{t-1}/p_t = (1+r)(1+\pi)(a_{t-1}/p_{t-1})(p_{t-1}/p_t) = (1+r)(1+\pi)(a_{t-1}/p_{t-1})/(1+\pi) = (1+r)(a_{t-1}/p_{t-1})$ so we get

$$d_t = a_t/p_t - (1+r)a_{t-1}/p_{t-1}.$$

This is the government's budget constraint under bond financing. Suppose in the first period the government issues some new bonds a_1/p_1 that are repaid in the second period,

$$d_1 = a_1/p_1.$$

$$d_2 = -(1+r)a_1/p_1.$$

So $d_2 < 0$, i.e., surplus, to pay off the bonds. So the bonds have value because everyone believes they will be paid off next period by running a surplus. Suppose the government issues more bonds instead in period 2,

$$d_2 = a_2/p_2 - (1+r)(a_1/p_1),$$

the current deficit d_2 is equal to new bonds minus old bonds. We derive the following formula in the Appendix,

$$\frac{a_1}{p_1} = (T_2 - G_2) + \frac{(T_3 - G_3)}{1+r} + \frac{(T_4 - G_4)}{(1+r)^2} + \frac{(T_5 - G_5)}{(1+r)^3} \dots\dots\dots$$

where a_1 is given, and $N = 1$ for simplicity. This says that the value of the current stock of debt is equal to the present value of government surpluses, and it determines the current price level p_1 .

If private credit markets are convinced the government in the future will run surpluses, debt today will have value. Suppose the surpluses are expected to increase. This increases the right side. The only way to increase the left side is by **reducing** the current price level. So

increased future surpluses reduce prices. And falling surpluses will be inflationary now. This is true even if people are not using cash.

Appendix

Solve

$$d_2 = a_2/p_2 - (1+r)(a_1/p_1),$$

$a_1/p_1,$

$$d_2 = a_2/p_2 - (1+r)(a_1/p_1),$$

$$(1+r)(a_1/p_1) = a_2/p_2 - d_2$$

$$a_1/p_1 = (a_2/p_2 - d_2)/(1+r)$$

But next period we also have

$$a_2/p_2 = (a_3/p_3 - d_3)/(1+r).$$

Substitute this into the previous equation to get

$$a_1/p_1 = -d_2/(1+r) - d_3/(1+r)^2 + (a_3/p_3)/(1+r)^2.$$

If we continue substituting out a_3/p_3 we get the formula

$$\frac{a_1}{p_1} = -d_2 - \frac{d_3}{1+r} - \frac{d_4}{(1+r)^2} - \frac{d_5}{(1+r)^3} \dots\dots\dots$$

Replace $d = (T - G)$.

(You don't need to know derivations.)