ECONOMIC GROWTH CENTER

YALE UNIVERSITY

Box 1987, Yale Station
New Haven, Connecticut

CENTER DISCUSSION PAPER NO. 287

PROGRESSIVE TAXES AND THE EFFECTIVENESS OF FISCAL POLICY

Louka T. Katseli-Papaefstratiou

June   1978

Abstract

In the Keynesian tradition expansionary fiscal policy increases employment and output. However, it will be shown here that in the absence of tax indexation, an increase in government expenditures might lead to stagflation since the aggregate supply curve of the economy can in fact be negatively sloped. In that case, a nominal tax reduction is a preferable expansionary fiscal policy tool but is inferior to tax indexation which reestablishes the overall effectiveness of fiscal policy.

Indexing taxes to the rate of inflation has been one of the latest and increasingly popular proposals to alleviate the fiscal drag caused by inflationary pressures (Giersch 1974, Dornbusch 1978). So long as a number of government outlays are fixed in nominal terms while taxes increase progressively with nominal income, inflation tends to reduce the budget deficit in real terms by reducing the real value of expenditures and increasing the real value of taxes paid to the government.

While the impact of inflation on the size of the budget deficit is by now well understood, the implications of tax progressivity for the exercise and effectiveness of fiscal policy itself have not yet been clearly expounded.

It is the objective of this paper to show that in the presence of nominal tax progressivity, expansionary fiscal policy can lead to stagflation; this is contrary to the widely held Keynesian or Classical views according to which expansionary policies will increase or at most leave unchanged the level of real output depending on the degree of money illusion present in the system. As a corollary to the above, it will also be shown that in the absence of tax indexation, tax reduction is preferable to increased expenditures when expansionary fiscal policy is required.

It has been shown elsewhere (Blinder 1973) that so long as workers are interested in their net-of-tax returns, a tax increase might be inflationary since it reduces aggregate supply at the same time that it constricts aggregate demand. This paper can be viewed as an extension of this earlier work in the sense that it retains the crucial assumption of a negative tax-rate elasticity of labor supply; the added assumption, however, of nominal

1

tax progressivity leads to substantially different conclusions by giving

rise to a negatively sloped aggregate supply curve for the economy. This

argument is developed fully in Section I of the paper while Section II

focuses on the implications of such a result for the effectiveness of

fiscal policy. Finally, the last section offers some empirical evidence on

tax progressivity and the tax burden created by inflation both in the

United States and the United Kingdom and concludes with some preliminary

discussion on the policy options available to the government authorities.

I. <u>Nominal Tax Progressivity and the Aggregate Supply Curve</u>

Let us assume that under inflationary circumstances workers attempt

to keep their real after-tax wage rate (w) constant.[1] If tax rates are

progressive so that $t = t(P)$ where $t' > 0$ then the real after-tax wage can

be expressed as:

$$w = \frac{W}{P} (1 - t(P))$$

It follows that for $dw = 0$, the percentage increase in nominal wages must

be higher than the percentage increase in prices or,

---

[1]One could assume a targeted increase in the real after-tax
wage but the conclusions will remain qualitatively the same.

$$\frac{dW}{W} = (1 + \frac{t'P}{1-t(P)}) \frac{dP}{P}$$

where $t(P)$ is the tax rate and t' is the marginal tax increase ($t' > 0$).

The implication of this result for the slope of the aggregate supply curve can be readily seen in Figures 1 (a) - 1 (b). If enterpreneurs equate the nominal wage (W) to the value of marginal product ($P_0 \cdot f(N)$), then an exogenous increase in prices will shift the demand for labor outwards. If workers desire to maintain their real after-tax wage constant, labor supply will be restricted, curtailing employment, till the equilibrium condition,

$$\frac{dW}{W} = \frac{dP}{P} (1 + \frac{t'P}{1-t(P)})$$

is satisfied. The resulting drop in employment will be associated with a drop in aggregate output through the aggregate production function, $y = f(N)$.

Thus, nominal tax progressivity coupled with the absence of money illusion gives rise to a negatively-sloped supply curve.[2] Its slope depends critically both on the marginal nominal tax increase, t', as well as the average tax rate $t(P)$.

---

[2] If workers are subject to money illusion so that they attempt to maintain their nominal after-tax returns constant, then the equilibrium labor-supply condition becomes $\frac{dW}{W} = \frac{t'p}{1-t(p)} \frac{dP}{P}$. If tax rates are highly progressive then the supply curve might still be negative. In the special case where $t(P) = tP$ then the supply curve will be negative if the average tax rate is higher than 50%.

Figure 1
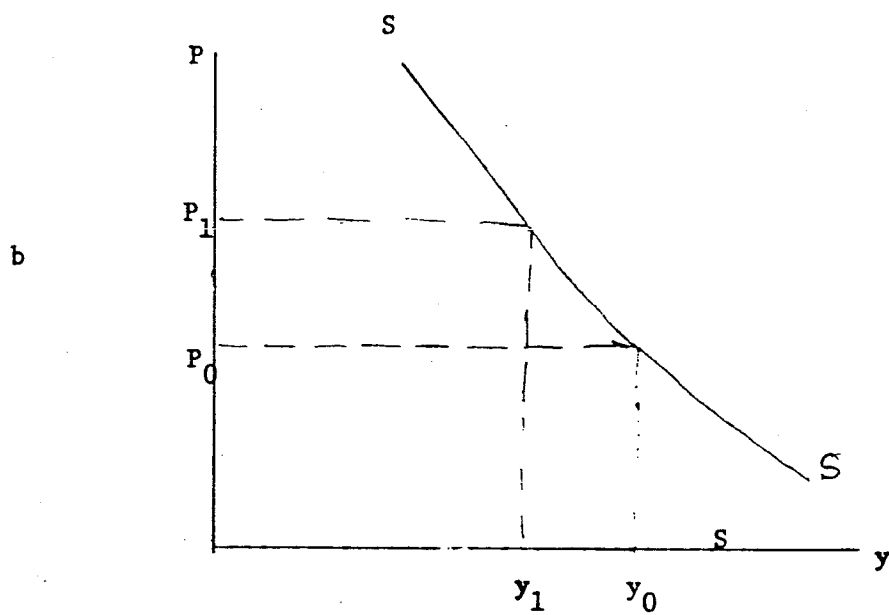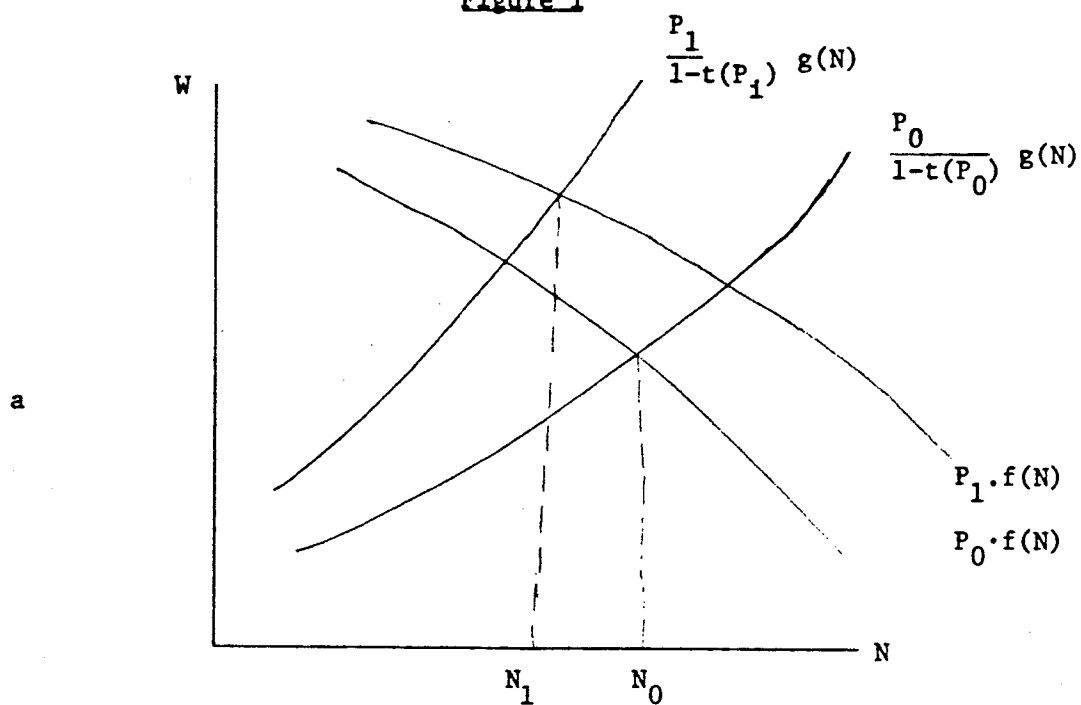
II. Effectiveness of Fiscal Policy Under Nominal Tax Progressivity

Having shown the implications of nominal tax progressivity for the slope of the aggregate supply function, we can now look at the effectiveness of expansionary fiscal policies in a simple model with no money illusion.

The aggregate equilibrium condition guarantees that output (y) will be equal to the sum of the aggregate demand components. In a closed economy,

$$y = c(y^d) + i(r) + g, \tag{1}$$

$$1 > c' > 0 \text{ and } i' < 0,$$

where in the simplest case consumption (c) is a function of disposable income (y^d), government expenditures (g) are exogenous and assumed fixed in real terms, and investment (i) is a negative function of the interest rate. Disposable income is defined as income net of taxes where taxes are assumed proportional to income while tax rates are progressive. Thus,

$$y^d = (1 - t(P)) y. \tag{2}$$

The tax rate, t(P), consists of an exogenous component (t_0) which can be identified as the average tax rate and an endogenous component sensitive to the price level. Thus,

$$t(P) = t_0 + t(P) \tag{3}$$

In the simplest Keynesian model, the equilibrium condition for the money market is given by:

$$\frac{M}{P} = 1(r) + k(y) \tag{4}$$

where desired money holdings are a function of the interest rate and real income and the central authorities are assumed to hold the nominal stock of money constant.[3]

On the supply side, output is assumed to be a function of employment (N):

$$y^s = f(N), \quad f' < 0, \quad f'' < 0 \tag{5}$$

In a competitive labor market entrepreneurs equate the nominal wage to the value of labor's marginal product so that,

$$\frac{W}{P} = f'(N) \tag{6}$$

while employees, as was argued before, attempt to maintain a constant after-tax real wage:

---

[3]It will be readily apparent below that if, at the time of expansionary fiscal policy, the central bank increases the nominal money stock in an effort to keep the real money stock or even interest rates constant then the aggregate demand curve will be shifted outwards even more, accentuating the stagflationary problems resulting from the initial policy.

$$\bar{w} = \frac{W}{P}(1-t(P)).$$ (7)

From equations (6) and (7) it follows that,

$$\bar{w} = f'(N)(1-t(P))$$ (8)

The model is similar to Blinder's (Blinder 1973) in all respects except for the treatment of taxes.

Equations (1), (2), (3), (4), (5) and (8) can be differentiated totally and the model can in turn be reduced to a system of three equations in three unknowns, namely dy, dP and dr. In matrix from:

$$
\begin{bmatrix}
1 - c'(1-t(p)) & c't'y & -i' \\
Pk' & M/P & P\ell' \\
f''\frac{1}{f'} & -f't' & 0
\end{bmatrix}
\begin{bmatrix}
dy \\
dP \\
dr
\end{bmatrix}
=
\begin{bmatrix}
dg & -c'ydt_0 & 0 \\
0 & 0 & dM \\
0 & f'dt_0 & 0
\end{bmatrix}
$$

The above can now be solved for the change in output as a result of increased government expenditures (dy/dg) or a reduction in taxes ($-dy/dt_0$).

As one would expect from the conclusions of the previous section, increasing g reduces output, and hence employment, at the same time that it increases prices. In other words, expansionary fiscal policy leads to stagflation since the demand curve of the economy is shifted outwards

along a negatively sloped supply curve. From the system described above, it can be seen that,

$$\frac{dy}{dg} = \frac{1}{1 - c'(1-t(P)) + \frac{k'i'}{\ell'} + \frac{1}{E_s}(c't'P + \frac{i'}{\ell'}\frac{m}{y})} \qquad (9)$$

where E_s is the price elasticity of supply ($E_s = \frac{dy^s}{dP} \cdot \frac{P}{y^s}$), and equal to

$$Es = \frac{f't'}{(1-t(P))f''\frac{1}{f'}} \frac{P}{y} . \quad \text{Since } f'' < 0 \text{ it follows that } E_s < 0. \text{ Hence the}$$

sign of dy/dg depends on the sign of the denominator which can be shown to be positive only if the system is inherently unstable that is if the demand curve is steeper than the supply curve.[4] Therefore, in an economy which is characterized by a highly progressive tax system and relatively inelastic demand expansionary fiscal policy might lead to lower prices and lower unemployment but any movement away from equilibrium will lead to further deviations away from it.

The effect of a tax reduction on output and employment can be similarly deduced from the system presented above. Lowering the average tax bracket changes output in the following way:

---

[4] The price elasticity of demand $E_d = \frac{dy^d}{dP} \frac{P}{y^d}$

$$\frac{-[c't'P + i'm/\ell y]}{1 - c'(1-t(P)) + \frac{k'i'}{\ell'}} .$$

Hence $\frac{dy}{dg} > 0$ only if $\frac{1}{E_s} > \frac{1}{E_d}$ or $/Es/ > /E_d/$.

$$\frac{dy}{(-dt_o)} = \frac{-f'i'm}{(1-c'(1-t(P)))\ (f't'P\ \ell') + Pk'f't'i' + (1-t(P))f''\frac{1}{f'}[c't'yP\ell'+i'm]} \tag{10}$$

The numerator of (10) is unambiguously positive since $i' < 0$ but the sign of the denominator is ambiguous since $f'' < 0$. Dividing both numerator and denominator by $f't'P\ell'$, which is negative, transforms expression (10) into:

$$\frac{dy}{(-dt_o)} = \frac{-i'm}{t'P\ell'}\ \frac{1}{[1-c'(1-t(P))] + \frac{k'i'}{\ell'} + \frac{1}{E_s}(c't'P + \frac{i'}{\ell'}\frac{m}{y})}\ . \tag{10'}$$

The tax rate multiplier is thus transformed into a multiple of the government expenditure multiplier which we have shown to be negative so long as the system is stable. It follows that under conditions of stability a reduction in taxes will increase output and employment as both the demand and supply curves of the economy shift to the right.

The effect on prices is ambiguous and will depend on the relative shift of the supply and demand curves. If, for example, tax reduction increases significantly the supply of labor offered for a given nominal wage but affects aggregate consumption only slightly, then the price level might indeed fall and employment and output increase. Thus, whereas tax policy in the absence of tax indexation works at least in the right direction, increases in government expenditures might contribute to stagflation and might affect the economy adversely.

III. Conclusions

In the previous two sections we have shown that the effectiveness of fiscal policy depends not only on the usual elasticity considerations but also on the fiscal tool used for that purpose. In the case of a nominally progressive tax system, increased government expenditures will probably lead to stagflation while a tax reduction will increase employment and output and might also reduce the aggregate price level.

It has been estimated (Roberts 1978) that in the United States a 10 percent rate of inflation implies a 16.5 percent increase in tax revenues i.e. that the price elasticity of the average tax rate is about 1.65. In terms of our model this would indicate that if prices rise by 10 percent and the tax rate is .50, nominal wages should rise by 26.5% to keep the real after tax wage rate constant. It is therefore probable that as a result of the recent inflationary pressures and in the absence of tax indexation the elasticity of the aggregate supply curve has rapidly diminished if not become negative.

There is some evidence that nominal tax progressivity has substantially aggravated the burden borne by people at the higher income tax brackets who face high average and marginal tax rates to begin with. In an article entitled "Britain's High Taxes on Income Seen as a Factor in Stagnation" (N.Y. Times, March 11, 1978), it is reported that in Britain, where the Treasury collects 83 percent of every extra pound in salary exceeding the equivalent of $41,000 and up to 98 percent of "unearned" investment income, "72 percent of senior executives would consider taking jobs abroad while 27 percent are actually likely to seek them out during

the next three year." In the same article it is reported that "one-third of these managers would refuse to move even for a pre-tax raise equivalent to almost $10,000."

Given the above it is important to realize that even though tax reduction seems to be a preferable short-term fiscal policy tool, a tax policy package which will benefit the lower-income tax brackets will also increase, in the absence of tax indexation, the nominal progressivity of the tax system and might significantly reduce work incentives. Thus unless inflation is drastically reduced, tax indexation seems increasingly necessary in order to reestablish the effectiveness of fiscal policy as well as to alleviate a random, inflation-induced burden carried by taxpayers.

References

1. A. Blinder, "Can Income Tax Increases be Inflationary? An Expository Note," _National Tax Journal_ XXVI (June 1973), pp. 295-301.

2. R. Dornbusch and S. Fischer, _Macroeconomics_, McGraw-Hill, 1978, pp. 450-452.

3. H. Giersch, et. al. (eds.), _Essays on Inflation and Indexation_, American Enterprise Institute, 1974.

4. P. C. Roberts, "Some Tax Myths: Who Pays What?", _National Review_ (April 28, 1978), pp. 524 ff.