A THEORY OF TAX DETERMINED INFLATION

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In the past decade, the average per capita state and local tax burden increased 112%, or about 8% per year.[1] Since taxes are clearly a critical component of the cost of living, such a rapid rise in tax costs ought to find its way into the price structure of the economy. In the Public Interest,[2] James Kuhn has argued that the recent inflationary upsurge may, in fact, be due to attempts by private sector workers to gain compensation for rising taxes by obtaining higher money wages. Yet at present, we lack a precise formulation for this probably critical relationship between taxes and prices.[3] The purpose of this paper is to develop such a formulation. Perhaps the central conclusion that emerges from our formulation is that above a given tax rate, the rate of taxation is associated with a given rate of inflation. Thus in an economy with a rising tax rate the rate of inflation will rise.

In order to develop our analysis we draw on a model developed some years ago by William Baumol.[4] Baumol shows that if wage rates between the services and goods sectors are equalized, and the rate of

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[1] Report of the Tax Foundation, as reported in the New York Times, Jan. 31, 1972, "Tax Bite Deeper; No Relief Sighted."

[2] "The Riddle of Inflation," James Kuhn, in Public Interest, Spring, 1972.

[3] Most attention has been focused on the way in which corporate taxes are passed on to consumers through various markup devices. This link is probably most relevant for federal taxes. At the local and state level corporations can often win tax concessions, or avoid payment altogether by shifting funds between state banks. For an interesting discussion of such tax avoidance, see, "Many Companies Work to Avoid Local Taxes -- With Great Success," Wall Street Journal, July 17, 1972.

[4] "The Macroeconomics of Unbalanced Growth; Anatomy of Urban Crisis," William Baumol, American Economic Review, June 1967.

productivity growth in the former is less than that of the latter, balanced growth of output between the two implies that an increasing flow of the economy's resources must flow to the service sector. Much the same argument can be made for the relationship between the public and private sector, implying that balanced growth between the two, i.e. equal rates of growth in public and private sector output, generates a rising tax rate on the economy.[5]

Thus in Section I we develop the rudiments of our transformed model, and in Section II we analyze the link between taxes and prices through the wage mechanism. Finally in Section III we develop some additional implications of our model.

Section I

Let GY(t) and PY(t) be public and private output respectively at time t. Then let us assume that as a condition of economic growth

(1) $GY(t)/PY(t) = V$, where V is a constant < 1.

In other words, a given level of private output must be sustained by a determinate level of public sector output, in the form of schools, hospitals, federal research outlays, and various other forms of infrastructure. We may call V the "social infrastructure ratio."

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[5] A somewhat different analysis of the relationship between the Baumol model and tax rates can be found in "Comment, Macroeconomics of Unbalanced Growth," Michael Keren, American Economic Review, March 1972.

Our assumption concerning government output differs from that made by both Baumol and Keren, since we assume that government output is constrained not by consumer demand but rather by private sector output. In other words, government output, though consumed by the population, functions ultimately as a factor input in the production of private sector output. Thus equation (1) is best thought of as a fixed coefficient production function.[5a]

Now let us write the production functions for private and public sector output. Letting GL(t) and PL(t) be the amount of public and private sector labor respectively, we can write

(2) $GY(t) = GL(t)ze^{dt}$ and $PY(t) = PL(t)ae^{rt}$ where, a and z are labor productivities at time zero, and r and d are the rates of growth of labor productivity. Then we assume:

[5a] A fixed coefficient production function is clearly a simplification of a more complex process. Since government output will often take "lumpy" forms, there will be times when government output will increase more rapidly or more slowly than private output. Thus an increase in economic activity will require an increase in transportation infrastructure, and, for example, large investments in highway building will be necessary. But after the initial large investment only annual service and maintenance investment will be required to service the higher transportation load. However, as the transportation load continues to rise, the highway will become congested and more large highway investment will be required. Our equation (1) can thus be thought of as a continuous approximation to this "discrete process."

(3) $r > d$

Then we assume that the wage rates in the two sectors are equal and are directly proportional to private sector productivity. In other words, private conditions -- the conditions of wages and productivity -- set the wage rate to be payed to public sector employees. (Labor mobility between the two sectors, the growing role of public sector unions, and the lack of productivity standards in much of the public sector will tend to make private sector wages the guideline for public sector employees. Letting GW and PW be public sector and private sector wage rates respectively, we have

(4) $GW = PW = fae^{rt} \quad f < 1$

Now if T is the tax rate, (on both public and private sector generated income) then the cost of public sector output net of taxes will be

(5) $GW\,[GL(t)]\,[1-T] = [1-T]fae^{rt}GL(t)$

But in combining equations (1) and (2) we can write GL(t) as

(6) $GL(t) = V(a/z)e^{(r-d)t}PL(t)$

Now since the tax rate on the private sector will be given as

(7) T = net cost of government output/private sector output

we have

(8) $T = (1-T)fae^{rt}V(a/z)e^{(r-d)t}PL(t)/PL(t)ae^{rt}$

Simplifying equation (8) gives us

(9) $T = (1-T)fe^{(r-d)t}V(a/z)$

Solving for T gives us

(10) $T = 1/(1/M + 1)$ where $M = fe^{(r-d)t}Va/z$

And since clearly $dM/dt > 0$, then $dT/dt > 0$ or the tax rate rises toward one.[6]

Section II

It might seem at first that a rising tax rate must in itself lower the real wage of labor. But this is not necessarily the case. Taxes may rise, but the amount of public sector goods produced and consumed may also rise. What counts is the net balance, i.e., the amount of taxes payed by the wage earner relative to the amount of public goods he gets in return.

To study this problem let us concentrate on the consumption and taxes of the wage earning group in the private sector, since this is the sector that can have a direct impact on private sector prices. We treat this group as a single unit or aggregate.

Let us rewrite equation (1) -- the balanced growth constraint -- as

(11) $GY(t) = VPY(t)$

Then let us assume that a certain fraction of government production supports private sector production because it functions as a consumption item for the wage earning population in the private sector. In other words, expenditures for health, education and transportation are essential to maintain private sector production but are also part of the

[6]Note our model assumes that all public sector output competes with private sector output. This will not be the case in the presence of unemployment. This is discussed in my forthcoming paper "A Model of Public Sector Growth," Working Paper No. 191, Institute of Urban and Regional Development, University of California, Berkeley.

consumption basket of the wage earner. In effect, they constitute part of the return that the wage earner gets for his taxes. Let that fraction be 'h.' Then we can say that the wage earning group in the private sector gets hPY(t) goods or output from the public sector. Because this group gets the fraction f of private sector income, it must presumably pay f of the taxes on the private sector. (The rest is paid out of profits.) Then we can say that the "terms of trade" between the public sector and private sector workers will turn against the latter if

(12) $hVPY(t) - fTPY(t) = (hV-fT)PY(t) < 0$

It might be thought that when workers in the private sector make this comparison they are behaving irrationally, since, however high the tax rate, the level of public sector output that it sustains is required to support their own growing standard of living from private sector activity. However, this assumes that such workers will of necessity take a full "social view" of production. That is, they will necessarily consider both the direct consumption and indirect production effects of government output.

In a market society where a more private and self-interested view is encouraged, such a social view of production may not be very likely. This will be particularly the case when the indirect effect of government production is difficult to trace out. Thus, federal grants to scientific research are clearly essential components of the technological process. But the exact connections and time lags between scientific research and productivity in any given instance, are difficult to determine. Thus, private sector workers may resent the seemingly "unfair" consumption privileges of research workers.

In effect (12) is a more precise expression for the notion that the wage earning group in the private sector does not get back enough consumption items in return for the taxes it pays. It represents their total loss of real income.

Let us now assume that condition (12) holds. Then let us take a cost push view of the world -- i.e., that workers push up wages in response to declining real income, that firms respond by raising prices so that real wages and the distribution of income between wages and profits remains unchanged, and that the monetary authorities ratify all increases in money values by increasing the money supply accordingly (keeping real interest rates constant). Now since (12) represents the total loss of real income for the entire wage earning group in the private sector, the loss of real income per worker, i.e., the decline in the real wage will be

$$(13)\quad (hV - fT)\frac{PY(t)}{PL(t)} = \frac{(hV - fT)}{f} \cdot \frac{fPY(t)}{PL(t)}$$

Thus presumably each wage earner will want to increase his real wage by

$$(14)\quad \frac{(fT-hV)}{f} \cdot \frac{fPY(t)}{PL(t)}$$

Note however, that the right hand expression of (14) is the real wage of workers in the private sector at time t. So we can then write our expression as

$$(15)\quad \Delta PW(t) = \frac{(fT-hV)}{f}\ PW(t) \quad \text{or} \quad \frac{\Delta PW(t)}{PW(t)} = \frac{(fT-hV)}{f}$$

In other words, wage earners will try to increase their real wages by the percentage amount (fT-hV)/f. Since the only way workers can try to increase their real wages is by increasing their money wage we can say that they will push up money wages by this percentage amount. This is, in effect, the first half of the cost-push cycle. If prices remain unchanged the workers will have been successful in raising their wages by the desired amount.

However, prices will not remain stable. Presumably, if the real wage is to be determined by productivity increases alone so that the distribution of income between wages and profits remains unchanged, prices will also have to rise by the same amount, or by (fT-hV)/f.

The net effect is that real wages of workers in the private sector rise only by the amount of productivity increase in the private sector. As a consequence they cannot make up for their loss in income due to the negative terms of trade between them and the public sector. This is perhaps an explanation for the sustained and recently appearing tax revolt.

These relationships are summarized in Table 1.

% increase in prices	% increase in money wages	% loss in real income due to tax effect
$\frac{(fT-hV)}{f}$	$r + \frac{(fT-hV)}{f}$	$\frac{(hV-fT)}{f}$

Table 1

Note, however, that the tax rate T is continuously rising. So from Table 1 we can conclude that once the terms of trade between the public sector and private sector workers turn against the latter, the rate of inflation in the economy will be rising.[7]

In Table 2 we present different values of possible rates of inflation for selected values of T and hV. We assume that f is about .75.[8]

f=.75 (numbers in decimals)

	hV		
T		.15	.10	.05
	.20	0	.06	.12
	.25	.05	.12	.18
	.30	.09	.16	.21

Table 2

[7] It might be thought that since money wages of government workers will now be rising faster than before (since GW=PW) this will put additional pressure on the tax rate. But a moment's reflection will show that the rise in prices in the private sector will cancel the effect of increasing money costs of government workers, so that the tax rate will rise only as a function of the basic productivity difference.

[8] According to the Statistical Abstract, 1971, p. 309, payments to capital (rent, interests, profits) come to 21% of income net of government wages and salaries. With proprietary income it comes to 31%. We compromised at the round figure of 25%.

The box (.25, .15) with a 5% rate of inflation comes perhaps closest to real values. A 5% rate of price inflation combined with a 3% rate of productivity increase implies an 8% rate of wage inflation. In addition, the real wages of private sector workers must fall by 2% since their real income due to productivity rises by r = 3%, but their loss due to taxes is given by $\frac{fT-hV}{f} = 5\%$ so 3% - 5% = -2%. This configuration of wage and price inflation resembles the recent experience that led to the establishment of wage and price controls. Thus it is possible that the recent inflationary history of the economy is due fundamentally to rising tax rates.

The relationship between the level of taxation and the rate of inflation is summarized in Figure 1.

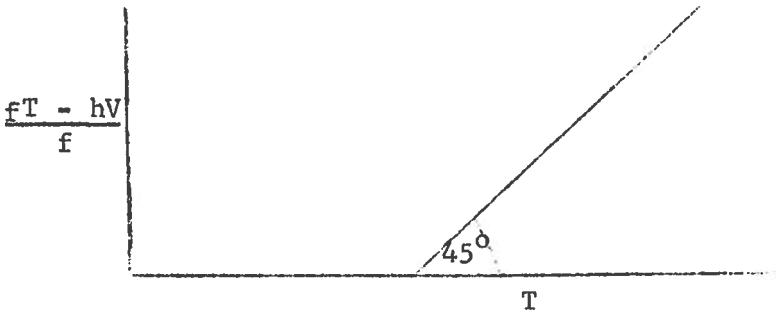

Figure 1

Section III

We can develop three further consequences of our model:

The Phillips Curve Shift

If we assume that some constant rate of unemployment is regarded as effective full employment (in the sense that the remaining workers are structurally unemployed and would find employment only under singular conditions), then maintaining that rate of employment

will require a higher and higher rate of inflation over time. This might be one factor behind the recently noticed rightward shift in the Phillips curve.

Determinants of 'h'

A critical factor in determining the terms of trade between the public sector and private sector workers will be the value 'h,' i.e., the fraction of public sector output consumed by the wage earning population in the private sector. Now 'h' will be given by both objective and subjective factors, though it is probably true that the latter predominates.

Thus imagine that government output is divided between social services and defense.[9] The quantity of social service available to the private sector is theoretically measurable. However, the amount of defense will depend much more on attitudes toward defense expenditures, i.e., does the population feel that it needs to be defended? If there is a reaction against defense but the fraction of defense output in total government output remains the same,[10] then there will be a devaluation of the value h and so a rise in the rate of inflation.

Similarly, 'h' will be determined by the attitudes of the wage earning labor force in the private sector to the structurally unemployed welfare population (e.g., the "welfare mother" on AFDC). Since a certain proportion of government output goes to this segment of the population, if the private sector labor force feels some "social responsibility" toward this sector, then the consumption of this sector will also add

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[9] Of course we must then argue that the political system enforces balanced growth between defense output and private sector growth, if equation (1) is to remain correct.

[10] The ratio of defense to social service output will be the same as the ratio of defense to social service expenditure, if labor productivity in the two are the same.

to the consumption utility of the private sector labor force. In other words, there will be positive consumption externalities. However, if a change in political attitudes results in negative consumption externalities, so that consumption of government output by the structurally unemployed population is resented by the private sector labor force, 'h' will be devalued, and once more the rate of inflation will rise.

Finally, even the amount of services available to the private sector labor force cannot be determined in a completely objective fashion. Rising expectations may lead to a feeling that the quality of these services has declined. As a consequence 'h' will once again fall and the rate of inflation will rise.

In effect, we see once again that there are powerful subjective and political elements that determine "real" economic variables such as inflation rates. (One of the most important subjective factors in general is probably expectations.)

The Measurement of Government Output

One assumption of the national income accounts is that government expenditure is not the real measure of government output or value added, since expenditure measures only income and not output. Thus it has been suggested that government income ought to be increased by the factor of labor productivity (if the latter can be measured) to arrive at a true measure of government output.[11] However, this analysis ignores the way in which government costs are in fact determined. Our model shows that government expenditure may very well overstate

[11] See, "The Push to Boost Government Productivity," Business Week, May 13, 1971.

government output, and that the increments to government spending must overstate the increments to government output.

Turning to equations (5) and (2) we can write

$$(16)\quad \frac{G(t)}{GY(t)} = \frac{(GW)GL(t)}{GY(t)} = \frac{fae^{rt}GL(t)}{ze^{dt}GL(t)} = f(a/z)e^{(r-d)t}$$

Since it is likely that $a > z$, beyond some value of t, $G(t) > GY(t)$ or government expenditure will be greater than government output. In other words, government expenditure must be deflated to arrive at a true measure of government output.

Let us assume that $a = z$ and $f = .75$. Then G(t) will begin to rise above GY(t) when $e^{(r-d)t} = 1/.75 = 1.33$. In Table 3 we show both the point where $G(t) = GY(t)$ for three different values of (r-d) and the respective rates of deflation of government expenditure beyond that point, required for the measurement of government output.

(numbers in decimals)

(r-d)	.01 (t=30)	.02 (t=15)	.03 (t=10)
(t)			
10			0
15		0	1.2
25		1.3	1.6
30	0	1.4	1.9

Table 3

Thus, according to Table 3 we see that, for a productivity difference of 2%, after twenty-five years, the level of government expenditure must be divided by 1.3 to arrive at the true level of government

output. In other words, government expenditure must be reduced by about 23% to arrive at government output.[12] Note now that whatever the values of f, a, and z, the increment to government output must be less than the increment to government spending, since

$$(17)\quad \frac{d[G(t)/GY(t)]}{dt} = \frac{d(fa/z)e^{(r-d)t}}{dt} = (r-d)t\,(fa/z)e^{(r-d)t} > 0$$

This might explain the recent seemingly contradictory impressions that while government expenditures have been increasing at a rapid rate, the amount of government output has not kept apace. According to (17) this is not a misperception or due only to rising expectations, but is rooted, in fact, in real productivity differentials.

[12] $(X - \frac{X}{1.3}) / X = \frac{X(1.3 - 1)}{1.3} = \frac{.3}{1.3} = .23$

APPENDIX

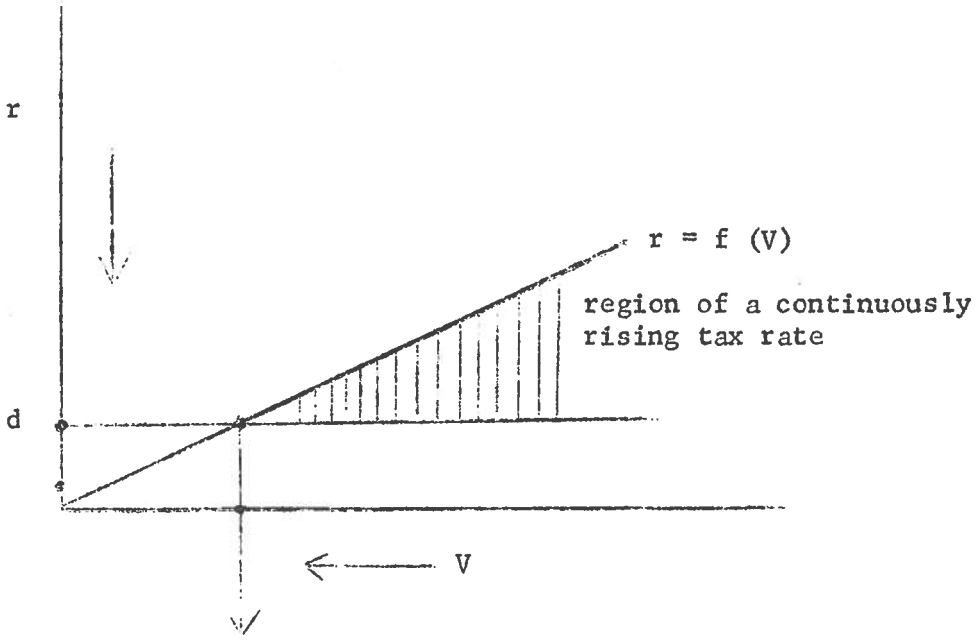
THE IMPACT OF THE "TAX REVOLT"

Let us assume that private sector workers, through the tax revolt, succeed in lowering their tax burden. What impact will this have on the processes outlined in this paper?

Assume that the tax burden is lowered through a forced reduction in the ratio V [see equation (2)]. In other words, taxpayers receive a "one shot" reduction in the tax rate by lowering the ratio of public to private sector production. However, since public sector output is an input into the private sector production process, a reduction in V, i.e., a reduction in the amount of highways, education, and research that supports a given unit of private sector output, should lead to a slower rate of productivity growth in the private sector. In other words, we write

(1') $r = f(V)$ $\qquad dr/dV > 0$

Now it should be clear that even though V falls, so long as $r > d$, the tax revolt will be frustrated. The taxpayers will receive a one shot decrease in the tax burden, only to once again experience future increases in the tax rate. Thus the tax revolt will be satisfied only when V falls sufficiently far so that $r=d$. In other words, the ultimate consequence of a sustained tax revolt is to lower the rate of growth of productivity of the private sector until it equals public sector productivity. This is summarized in the figure below.


r
r = f (V)
region of a continuously
rising tax rate
d
V
Point of
Stabilization

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