Stabilization Policy and Capital Formation

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Every recession in the *U.S.* economy calls forth proposals for remedial stimulus. The government's own expenditures on goods and services can be increased, additional income can be provided to consumers in the hope that they will spend more, new incentives can be provided for investment, and the money stock can be increased. Conventional analysis does not distinguish among these policies with respect to the ratio of their effects on output and inflation. Each can push the economy out of recession, back to full employment, at the cost of worsening inflation. All operate along the same Phillips curve.

My purpose here is to reconsider the prevailing dogma by examining the possibility of differential effects of stabilization policies operating through capital formation. Expansionary policies either favor investment (monetary expansion and investment incentives) or discourage it (increased government expenditures or consumption). The paper begins with a bit of evidence to support the view that the Keynesian expenditure multiplier is positive but less than one, so that increases in other categories of aggregate demand depress investment. It also presents somewhat more conclusive evidence that monetary expansion stimulates investment. I conclude tentatively that the conventional instruments of expansionary policy do provide us with an important choice about the participation of capital formation in the resulting expansion.

The paper then asks what difference it makes for the economy whether a pro- or anti-investment strategy is pursued in response to a recession. Does the likely difference in the flow of investment over the course of the typical recession make enough difference in the capital stock so that changes in productive capacity are a matter of concern? I find that a pro-investment policy that actually restores full employment in the face of a recession will leave the economy with as much as 7 percent more capital by the end of three years than will an anti-investment policy that also restores full employment. Full-employment output is more than 2 percent higher after a pro-investment stimulus. The key hypothesis underlying this conclusion is the high marginal product of capital inferred from the earnings of capital in the current *U.S.* economy. Some reasons to think capital earnings exceed the marginal product of capital are mentioned as possible reasons for weakening the conclusion.

The conclusions also require modification when applied to stabilization policies of the magnitudes politically realistic in the United States. Antirecessionary policy has been timid and even perverse in the postwar decades. The principal source of foregone capital formation has been our failure to do anything about recessions, not our active use of anti-investment stimulative policies.

I. Evidence about the Effects of Expenditure and Monetary Policies on Investment

Though a number of large-scale econometric models of the *U.S.* economy were constructed or are used actively for exactly the purpose of predicting the effects of alternative stabilization policies, the results of these models are now greeted with extreme skepticism among macro economists. The models contain many purportedly

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structural equations whose actual function is primarily to express the autoregressive behavior of their dependent variables. The result, when the models are applied to issues of policy interventions, is to grossly overstate the sluggishness of the economy. Consequently, interest has turned to direct estimation of the reduced-form relations between the endogenous variables of the economy and the exogenous variables of policy. Robert Barro (1977, 1978) has been a leader in this line of research; he has studied unemployment, real output, and the price level. So far as I know, there have not been any studies of investment within the reduced-form approach. The results presented here are of course subject to the very basic criticism that they rest on the hypothesis of exogeneity (see, for example, Stephan Goldfeld and Alan Blinder). If monetary and expenditure policies have been motivated by something other than a desire to offset movements in the economy as they occur, then we can learn the effects of policies on investment simply by regressing investment on variables expressing the magnitudes of the policies. At the other extreme, if policies have been carefully tailored to eliminate all unwanted movements in investment, there may not be any regression relation, even though policy has profound effects on investment. Because policy has been far from perfect by any standard in the postwar period, because in any case it is clear that policy moves have been extremely timid when they were explicitly countercyclical, and because presumably it is output and employment, not investment, that is the principal target of policy, I think it is interesting to examine the reduced-form evidence for investment, even though I recognize that it is not fully convincing.

In the results below, expenditure policy is measured by total government expenditures (including state and local) in constant dollars of 1972 (G). Apart from trend, the largest movements in this variable occurred during the two military adventures of the postwar period. Expenditures are measured on the conceptual basis of the national income and product accounts, as government use of goods and services. Transfers, which are part of the budgets of governments, are not part of expenditures measured in this way. The other policy considered here, monetary policy, is measured by the aggregate amount of currency and demand deposits (M_1) deflated by the implicit deflator for *GNP*. The use of money in real terms is justified for this purpose by the findings of Barro (1978) and others that the influence of the money stock on the price level takes two years to be felt at all. Within that period, exogeneity of the nominal money stock and exogeneity of the real money stock amount to the same thing. Finally, other determinants of investment (in the reduced-form sense) are characterized by a constant, a linear time trend, and a stochastic residual. Obviously, the residual contains the effects of many other important economic mechanisms. The validity of the reduced-form approach does not rest on the inclusion of all relevant variables in the regression. Rather, what is important is the lack of correlation of the residual with the two policy variables, that is, their exogeneity.

As a measure of investment, I have used gross private domestic investment in constant dollars of 1972. It is important to note the inclusion of capital formation other than business fixed investment in this measure —inventories and residential housing are the most important of these. The regression results for quarterly data over the period 1954 to 1979: 2 are

$$(1)\quad I_t = \underset{(73)}{4} + \underset{(.40)}{1.59t} + a_0 G_t + \ldots + a_{15} G_{t-15} + b_0 M_t + \ldots + b_{15} M_{t-15}$$

$R^2 = .9785$; $s = 5.8$ *billion* 1972\$; *rho* $= .70$

The distributed lag coefficients are shown in Table 1. According to these results, government expenditures have a distinctly negative impact on investment for the first few quarters. Though investment responds slightly positively to expenditures of a year or two earlier, the negative response to the most recent expenditures is sufficiently strong that the net response to a sustained increase in expenditures is negative. The

TABLE 1—DISTRIBUTED LAG COEFFICIENTS OF G AND M IN EQUATION (1)

Years	a_i	Standard Error	b_i	Standard Error
0	−.31	.20	.69	.29
1	−.17	.08	.75	.11
2	−.05	.09	.61	.13
3	.03	.10	.37	.14
4	.08	.09	.10	.11
5	.09	.07	−.15	.08
6	.08	.07	−.34	.08
7	.04	.08	−.43	.10
8	−.01	.08	−.44	.10
9	−.07	.07	−.35	.09
10	−.12	.06	−.20	.08
11	−.14	.08	−.02	.11
12	−.13	.09	.12	.14
13	−.06	.09	.15	.13
14	.09	.07	−.01	.09
15	.34	.17	−.48	.27
Sum	−.31	.34	.37	.46

reduced-form evidence for the effect of government expenditures on total real *GNP* suggests it is somewhat positive, but the multiplier is less than one. The private components of *GNP*, especially investment, have a negative relation to government expenditure. Unfortunately, the sampling variability in these estimates is sufficiently large to preclude any strong conclusions about the exact magnitude and timing of the effects of expenditures on investment.

For monetary policy, the results are much stronger. The response of investment to an increase in the real money stock is vigorous and immediate. An increase of $1 billion in the money stock raises investment in the same quarter by $690 million. If the increase is sustained into a second quarter, investment is higher by $1.44 billion; the effect peaks at $2.52 billion for an increase sustained for five quarters (the sum of the first five lag coefficients). Thereafter, the influence lessens as the coefficients turn negative, reflecting the accelerator mechanism at work. A permanent increase in the real money supply, even if it could be achieved, would have little effect on the level of investment in the long run. Moreover, since prices eventually respond in proportion to an increase in the nominal money stock, simple monetary expansion is incapable of raising the real money stock permanently. But the evidence does support the hypothesis of a strong temporary effect of monetary expansion on capital formation.

I tentatively conclude from this evidence that government policy does have two instruments for expanding aggregate employment and output with very different implications for investment. Stimulus of aggregate demand through increased government expenditures appears to discourage investment, while stimulus through monetary expansion encourages investment. In fact, this is probably the major path by which money influences aggregate output. In the face of a negative shock on aggregate demand from some outside source, policy can restore full employment through either expenditure or monetary policy. The choice between the two should depend on, among other things, social views about capital formation.

II. Investment, Capital Stock, and Output

Now I want to assume that a suitably vigorous use of expansionary policy (or policies in tandem) has offset what otherwise would have been a typical recession set off by an adverse shock to demand. The economy faced an episode of diminished

investment as well as diminished output; in fact, investment as a ratio of *GNP* invariably falls sharply in a recession. The policy choices I wish to examine are:

1) *Pro-Investment.* Use monetary expansion or a policy with similar effects to restore investment to its normal relation to output. Specifically, investment is to be 15 percent of *GNP*, its postwar average in nonrecessionary years.

2) *Anti-Investment.* Use increases in government expenditures to restore full employment but depress investment even below its low level of a recession and early recovery. Specifically, investment is to be 10 percent of *GNP* in the first year, 11.7 percent in the second year, 13.3 percent in the third year, and its normal 15 percent in succeeding years. By comparison, investment was 13.6 percent in 1954, 12.9 percent in 1958, 13.7 percent in 1961, 14.4 percent in 1970, and 11.9 percent in 1975. It has never been as low as 10 percent during the postwar period, but similarly, vigorous expenditure policy has never been used to head off an incipient recession.

The full-employment growth economy described by Robert Solow provides a natural framework to compare these two full-employment policies. I will make use of the following assumptions and notations: 1) The labor force grows at a constant rate n; 2) Labor-augmenting technical progress occurs at rate v; 3) Capital depreciates at rate d; 4) In year t, gross investment is a fraction s_t of gross output; 5) Production is governed by a Cobb-Douglas production function and the elasticity of output with respect to capital is b; and 6) Capital per efficiency unit of labor in year t is k_t.

Then, according to Solow's model, the capital-labor ratio evolves in the following way over time:

$$(2) \quad k_{t+1} = (s_t k_t^b + (1-d)k_t)/(1+n+v)$$

A reduction in this year's rate of investment, s_t, reduces next year's capital stock and so reduces full-employment output next year, in an amount governed by the elasticity of output with respect to capital, b. In succeeding years, capital is also lower on account of diminished investment this year even if the investment rate returns to normal next year and later. The proportional effect of a reduction in the flow of investment on the stock of capital depends essentially on the sum of the rate of depreciation d, the rate of labor force growth n, and the rate of technical progress v. The higher is the sum, the more leverage current investment has on the capital stock in percentage terms.

Of the various parameters of this model, the most critical is the elasticity of output with respect to the capital stock b. Under competitive conditions, this parameter should equal the ratio of the gross earnings of capital to the gross value of output. In 1978, this ratio was 0.30, with gross earnings of capital estimated as the sum of capital consumption allowances, corporate profits before tax, net interest, and rental income plus one-half of indirect business taxes plus one-third of proprietors' income. An elasticity of 0.30 means that full-employment output is reasonably sensitive to changes in the capital stock, sensitive enough so that transitory stabilization policy may well influence output in a noticeable way. The reader should be cautioned, however, that direct examination of the data on output, capital stock, and other factor inputs has not confirmed an elasticity as high as 0.3—estimation of aggregate Cobb-Douglas production functions with postwar *U.S.* data has yielded elasticities around zero. Students of "potential *GNP*" have tended to omit capital and base their measures solely on labor input (for example, George Perry). Further, there is an unexplained gap between the apparent earnings of capital and the cost of capital in debt markets. In recent years, earnings, appropriately corrected for measurement biases due to inflation, have been robust, while interest rates, adjusted for inflation and taxation, have been zero or negative. Either businesses have failed to pursue investment to the point of equating the marginal earnings of capital to the cost of financing the capital (essentially the hypothesis of this paper), or measured capital earnings includes components other than the competitive return to capital. If profits,

proprietors' income, and rents include a large and growing element of returns to entrepreneurial talent, intangible investments, and monopoly income, then my estimate of the elasticity of output with respect to the capital stock is overstated.

For the other parameters, I have used the following estimates: 1) The rate of growth of labor productivity v is 1 percent per year, in line with the disappointing experience of the 1970's. 2) The rate of growth of the labor force is 1.5 percent per year. 3) The rate of depreciation of capital, averaged over equipment, structures (including residential), and inventories, is 10 percent per year.

With this preparation, it is possible to compare the evolution of the economy under a pro-investment response to its evolution under an anti-investment response. I will assume that the economy starts out at its steady-state capital-labor ratio with an investment rate of 15 percent of gross output. The pro-investment response maintains the investment rate at this level, so the economy continues on its growth path at 2.5 percent per year increase in output. The anti-investment response pushes the investment-*GNP* ratio to 10 percent in the year of the shock, 11.7 percent in the next year, 13.3 percent in the following year, and then it returns to 15 percent. The consequences of the anti-investment policy can be expressed in terms of the percentages by which its output and capital stock fall below those in the pro-investment, steady-state economy, as shown in Table 2.

TABLE 2—EFFECTS OF ANTI-INVESTMENT POLICY

Year	Investment Rate	Percent Shortfall in Output	Percent Shortfall in Capital
0	10.0	0.0	0.0
1	11.7	1.2	4.1
2	13.3	2.0	6.4
3	15.0	2.2	7.2
4	15.0	2.0	6.6

With a continuation of the investment rate at 15 percent in subsequent years, the shortfalls in output and capital will gradually decline to zero, though the perceptible effects of the temporary reduction in investment will continue for at least a decade. The adverse effect of the shock and the anti-investment response peaks in the third year, when the shortfall in output is 2.2 percent. The average growth rate of output from year 0 to year 3 in the economy with the anti-investment response is 1.9 percent per year, as against 2.5 percent per year with a pro-investment response. Over the period, the anti-investment policy deprives the economy of about a quarter of its potential growth over the three years.

An interesting implication of this finding is that the stimulus to capital formation from monetary expansion offsets part of the inflationary influence of the extra money. Consider, for example, the use of monetary stimulus to avoid a recession which would have depressed the investment rate to 12 percent from its normal level of 15 percent. The results presented in the previous section suggest that about a 2.5 percent increment in the money stock is needed to raise the investment *GNP* ratio by 1 percentage point. Closing the gap of 3 percentage points would require a 7.5 percent jump in the money stock. Eventually, this will make its way into higher prices, but the extra capital stock resulting from the pro-investment policy means that the long-run difference in the price level compared to the economy with no countercyclical policy will be almost 2 percentage points lower. To put it another way, toleration of a recession with its sharp reduction in capital formation is inflationary in the longer run, because the reduction in potential output calls forth a higher price level for any given money stock. Similarly, treatment of a recession with an anti-investment policy is also inflationary, again because the price level depends in the longer run on the ratio of the money stock to output.

The policy moves presupposed by this analysis are extremely aggressive by the standards of postwar experience in the United States. Raising the money stock by 7.5 percent to head off a recession is not a policy that would ever be considered seriously by the Federal Reserve. Year-to-year

variations in money growth rarely exceed 2 percentage points. Far from offsetting recessions, the Federal Reserve has permitted monetary growth to slacken during most postwar recessions, presumably because the pressure comes off interest rates at the trough of the business cycle. Government expenditures have been used only very cautiously to moderate recessions, in spite of the purported commitment of most of the postwar presidents to Keynesian principles. If the multiplier is 0.8 (a reasonable conclusion from reduced-form evidence), and a typical recession involves a shortfall of $60 billion 1979 dollars, then the necessary expansion of the government's use of goods and services is $75 billion, several times larger than anything proposed, much less enacted, in response to a recession.

A second interpretation of the findings is more relevant in the light of the generally noninterventionist policies actually adopted by the United States in the face of recent recessions. The decline in output in the full-employment analysis can also be considered as a decline in potential output of an economy operating at less than full employment. The decline is then interpreted as the cost of permitting a recession to occur as against either a vigorous pro-investment offsetting response or any other way of keeping the economy on a smooth growth path. A deep recession reduces potential output three years later by something over 2 percent, according to this interpretation (a deep recession is one that depresses investment to 10 percent of potential *GNP*). Further, according to the line of argument given above, there is a sense that a recession contributes to subsequent inflation—for the same money stock, the reduction in potential output raises prices.

III. Concluding Remarks and Cautionary Notes

The variations in the rate of capital formation that are associated with *U.S.* business cycles can affect the capital stock by around 7 percent. Correspondingly, full-employment output will vary by a little over 2 percent. For a given money stock, likely differences in price levels on account of the fluctuations are likewise around 2 percent. Though these numbers are fairly small relative to the levels of the corresponding variables, they could be quite important relative to the normal annual changes in the variables. In particular, 2 percent of output over a three-year period is about a quarter of normal growth in output. In this sense, there is an important interaction between the business cycle and the process of capital formation.

Up to this point I have avoided dealing with the welfare implications of the recessionary interruptions in capital formation that occur at random intervals and the related welfare implications of countercyclical policies that try to stabilize investment or output. Most economists will probably take it for granted that more investment is better, so recessions are undesirable, anti-investment policies are even more undesirable, and pro-investment policies are the way we should deal with recessions. There is one justification for this position that will command wide support—the earnings of capital are heavily taxed in the *U.S.* economy, so the social returns to capital formation substantially exceed the private returns, and any trick the government can use to encourage capital formation is to the good. I feel reasonably confident about another conclusion—large negative surprises in monetary policy are undesirable because of their interference with capital formation. But economists are virtually unanimous in their condemnation of sudden reversals in monetary policy, so there is nothing very novel in this conclusion.

The troublesome problem is what to do about an interruption in investment brought about by a nonmonetary shock. From time to time, businesses decide in unison that they need a lower level of inventories, and a classical inventory recession occurs. Further, two sudden increases in world oil prices seem to have contributed to recessions, one in 1974–75 and one apparently about to occur. It is not completely clear to me that fully offsetting the resulting pauses in capital formation is the optimal policy. When people decide to invest less in certain categories, the economy has a variety of ways to make use of the resources. They can be put to use producing other investment

goods (the essential idea of a pro-investment policy), they can be put in the hands of the government (an anti-investment policy), they can produce consumption goods, or they can withdraw from the market economy. Withdrawal seems to be an important part of what actually happens in the United States—recessions are periods of diminished employment and capacity utilization in durable goods industries with some movement of workers from durables to other sectors, but with a substantial increase in time spent away from work by those normally employed in durables. Whether the rather large amount of withdrawal that actually occurs in recessions is efficient is a question we have not really answered yet. Some caution in the use of vigorous pro-investment policies is in order until we understand more clearly exactly what is going on during a recession.

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