# Government spending and the "falling rate of profit"

*David Alan Aschauer*

Over the last decade, various authors have noted the apparent "productivity slowdown" in the United States. Specific reference has been made to a "falling rate of profit" or a "profits squeeze" as an indicator of a reduction in the productivity of capital. This paper looks at the recent behavior of the rate of return to private capital and then considers the extent to which its movements can be explained by public sector capital accumulation as well as the overall level of government expenditures on goods and services.

Discussion of fiscal policy issues usually centers on the public sector deficit, its relation to financial market rates of return, and thereby its impact on private investment and economic growth. Little or no importance is placed on the precise way in which the deficit is created, whether by tax or expenditure changes, nor on the possible distinctive impacts which the two types of deficits may have on economic variables of interest.

Public investment policy, for example, may affect the level of private investment by altering the marginal product of private capital. New highways, airports, and modern power plants—components of a general economic infrastructure—are likely to heighten the productivity of private capital and spur expenditure on new plant and equipment. This paper examines whether such effects are large enough to explain the widely discussed fall in the return on capital in the U.S. economy and thus whether the size of the decline in public investment can potentially be linked to the slowdown in U.S. productivity growth.

## Recent behavior of the return to private capital

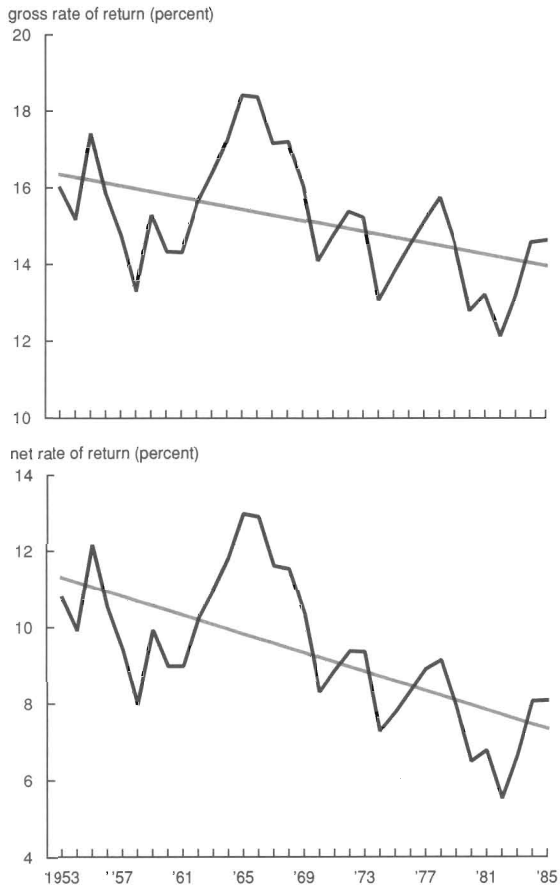
We begin by examining the behavior of the rate of return to private capital held by nonfinancial corporations in the United States during the period 1953 to 1985. Two specific average rates of return, gross and net of physical depreciation, are employed. These rates of return are calculated as the ratio of corporate profits (with inventory valuation adjustment and capital consumption adjustment) plus net interest to the net stock of fixed capital, land, and inventories. The net stock of fixed capital is computed along "perpetual inventory" lines by subtracting from the gross capital stock (cumulative investment minus discards) an estimate of cumulative depreciation. For private capital, the depreciation methodology is straight-line over 85 percent of the service lives as published in Bulletin F of the Treasury Department. The gross rate of return exceeds the net rate of return by the ratio of the capital consumption allowance to the net capital stock.

Note three aspects of these average rates of return. First, the rates of return are limited to the nonfinancial corporate sector since published data on capital consumption allowances are confined to this category. Second, both the gross and net rates of return are pre-tax, with the exception that state and local property taxes are treated by the Commerce Department as a cost of production. Third, capital losses on the net financial assets held by corporations arising from inflation are ignored. The basic rationale for the second and third characteristics of these profit rates is that the attempt is to capture underlying technological relationships between the government spending variables and capital's marginal product.

The behavior of these rates of return during the period 1953 to 1985 is shown in Figure 1. The average values of the gross and net rates were 15.2 and 9.4 percent, respectively, implying an average rate of physical depreciation of 5.8 percent per year. Both rates achieved their maximum values of 18.4 percent (gross) and 13.0 percent (net) in 1965 and their minimum values of 12.2 percent (gross) and 5.6 percent (net) in 1982. Evidently, both rates of return exhibit a downward trend during the sample period. As the regressions in Table 1 indicate, before accounting for serial corre-

David Alan Aschauer is a senior economist at the Federal Reserve Bank of Chicago.

Figure 1
**Rate of return to private capital**




lation and cyclical effects the trend lines are highly significant, with the gross rate of return falling, on average, by 7.5 basis points per year and the net rate declining by a more substantial 12.2 basis points.

In a recent article, Feldstein and Summers (1977) investigated the behavior of similar rates of return and presented evidence that the downward trend apparent in the raw data disappeared upon accounting for serial correlation and cyclical effects. But the results presented here in Table 1 indicate that while the estimates of the trend are reduced in both cases, only the trend estimate for the gross rate of return becomes insignificantly different from zero at conventional levels. Indeed, the trend estimate in the net return case still implies a strong negative movement in the rate of return on the order of 7.5 basis points per year. This difference in trend behavior shows up in a strong positive trend in the implied depreciation rate of capital of 4.6 basis points per year (associated t-statistic = 9.426). On the other hand, the similarity in the response of both rates of return to cyclical factors implies that the depreciation rate is not affected, to any significant degree, by movements in the capacity utilization rate. This last result points out dramatically a basic deficiency in the depreciation methodology utilized by the Department of Commerce because we would expect true economic depreciation to be positively related to intensity of use of the capital stock.

Thus, some evidence of a falling return to private capital over the sample period remains even after controlling for serial correlation and the cyclical variability of capacity utilization. In the next section we consider the possibility that the public capital stock may play a leading role in explaining this trend in the nation's rate of profit.

## Public capital, public spending, and the rate of return

We now focus on the importance of public sector capital accumulation to the rate of return to private capital. Consider, as a benchmark, a neoclassical production technology for aggregate output with employment ($n_t$), private capital ($k_t$), and public capital ($k_t^g$) as factor inputs.[1]

The fundamental hypothesis of interest is that the public capital stock is productive and complements the private capital stock in the sense that an increase in public sector capital—holding fixed private factors of production—raises the marginal product of private capital.[2]

We estimate the following rate-of-return equation:[3]

$$r_t\beta_0 + \beta_1 t + \beta_2 \ln(n_t/k_t) +$$

$$\beta_3 \ln(k_t^g/k_t) + \beta_4 cu_t + z_t \qquad (1)$$

where $r_t$ is the average rate of return to private capital (net or gross); $n_t$, $k_t$, $k_t^g$ are defined as above and $cu_t$ is defined as capacity utilization rate. The aggregate employment variable is total employment while the net public capital stock variable is obtained along perpetual inventory lines comparable to that of net private capital. The results of estimating equation (1)

## Table 1
## Rate of return to private capital

| dependent variable | const | time | cu | p | DW | $R^2$ | SSE |
|---|---|---|---|---|---|---|---|
| rg | .203<br>(11.301) | -.00075<br>(-2.901) | - | - | .696 | .214 | .006 |
| rn | .178<br>(9.639) | -.00122<br>(-4.623) | - | - | .634 | .408 | .007 |
| rg | .006<br>(.183) | -.00028<br>(-1.229) | .201<br>(6.053) | .389<br>(2.251) | - | .775 | .002 |
| rn | -.015<br>(-.424) | -.00075<br>(-2.976) | .196<br>(5.951) | .455<br>(2.755) | - | .843 | .002 |

rg = gross rate of return to private nonfinancial corporate capital
rn = net rate of return to private nonfinancial corporate capital
p = first order autocorrelation coefficient
DW = Durbin-Watson statistic
$R^2$ = adjusted coefficient of determination
SSF = sum of square residuals

by ordinary least squares, as well as by first order autoregressive and instrumental variables techniques, are shown in Table 2. In all regressions, the signs of the estimated coefficients are in accordance with the neoclassical argument that a higher private capital-labor ratio tends to depress the rate of return to capital as well as the hypothesis that a higher level of public capital, given the levels of employment and private capital, raises the rate of return. As a specific case, focus on the ordinary least squares results. Holding fixed the level of employment, a 1 percent increase in the private capital stock (and hence in the capital-labor ratio) would lower the gross and net rates of return by $-(\hat{\beta}_2 + \hat{\beta}_3)/r$ percent, or by 38.4 and 38.1 basis points, respectively. A 1 percent increase in the public capital stock, relative to its private counterpart, would raise the gross and net rates of return by $\hat{\beta}_3/\bar{r}$ percent, or by 19.1 and 21.4 basis points. Public capital appears to be of comparable importance to private capital in determining the profitability of the nation's private stock of plant and machinery.

The introduction of the capital-labor and public-private capital ratios only slightly diminishes the role of cyclical factors in the movement in the return to capital. A one percentage point increase in the capacity utilization rate from its sample average value of 81.9 percent raises the gross rate of return by 15.1 basis points and the net rate of return by 14.8 points. Cyclical factors clearly appear to affect the profitability of capital in a positive fashion.

As noted, the results in Table 1 suggest—at least for the case of the net rate of return—that even after taking into consideration serial correlation and cyclical effects there is a downward trend in the profitability of capital. The introduction of the additional variables in Table 2 to help explain the rate of return changes the previous picture in a dramatic fashion. There is now a tendency for the gross and net rates of return to rise on the order of 50 basis points per year. This would imply a neutral rate of technical change of $(\hat{\beta}_1/\bar{r})\times 100$ per year, or 3.29 percent for the gross rate of return and 5.43 percent for the net rate of return. These point estimates are clearly too high, given the average growth rate of real gross national product of 3.2 percent during this period. Nevertheless, the more reasonable value of 2 percent per year falls within the 95 percent confidence intervals for estimates of both rates of return.

The values of the Durbin-Watson statistic lie within the inconclusive range of the test at the 5 percent level. To account for the possibility of serial correlation, equation (1) was reestimated with a first order autocorrelation correction. The estimated value of the autocorrelation coefficient was relatively low and statistically insignificant at the 10 percent level for both rates of return. Furthermore, the

**Table 2**
**Rate of return to private capital and public capital**

| dependent variable | method | const | time | ln(n/k) | ln( kg/k) | cu | p | DW | $R^2$ | SSE |
|---|---|---|---|---|---|---|---|---|---|---|
| rg | OLS | 1.490 (2.569) | .005 (3.171) | .171 (2.643) | .191 (4.547) | .151 (4.381) | - | 1.551 | .840 | .0013 |
| rn | OLS | 1.455 (2.599) | .005 (3.125) | .170 (2.732) | .214 (5.273) | .148 (4.461) | - | 1.473 | .894 | .0012 |
| rg | FOAC | 1.465 (2.107) | .005 (2.650) | .167 (2.158) | .198 (3.947) | .141 (3.767) | .220 (1.169) | - | .849 | .0012 |
| rn | FOAC | 1.403 (2.044) | .005 (2.521) | .164 (2.142) | .219 (4.439) | .140 (3.839) | .254 (1.364) | - | .902 | .0011 |
| rg | IV | 1.705 (2.782) | .005 (3.350) | .195 (2.851) | .202 (4.668) | .143 (4.057) | - | - | .841 | .0013 |
| rn | IV | 1.762 (2.969) | .005 (3.461) | .205 (3.095) | .230 (5.481) | .137 (4.017) | - | - | .894 | .0012 |

OLS = ordinary least square
FOAC = first order autocorrelation correction
IV = instrumental variables
rg = gross rate of return to private nonfinancial corporate capital
rn = net rate of return to private nonfinancial corporate capital
p = first order autocorrelation coefficient
DW = Durbin-Watson statistic
$R^2$ = adjusted coefficient of determination
SSE = sum of squared residuals

estimated coefficients and standard errors remained nearly unaltered.

An apparently troubling aspect of the estimation, particularly for the coefficient of the employment – private capital variable, is the possible simultaneity bias arising from the joint determination of employment and the rates of return. Treating the employment-capital variable as potentially endogenous, the equation was again reestimated by instrumental variables, with the trend value of employment relative to the private capital stock and time taken as instruments. The results are shown in the last two rows of Table 2. This aspect of simultaneity evidently is not a matter of particular concern.

Thus, it seems clear that the rate of return to private capital is strongly and positively related to the public capital stock. This offers a clue to the mystery of the downward trend in the profit rate over the sample period. For as can be noted from Figure 2, the ratio of public to private net capital stocks has fallen persistently since 1964, from a peak of .840 in that year to .564 in 1985. Given the employment – private capital ratio, this implies that gross and net rates of return to private capital have been depressed, relative to the level which would have arisen if the public capital ratio had been steady.

Figure 2
**The declining ratio of public capital stock relative to private capital stock (1982 dollars)**

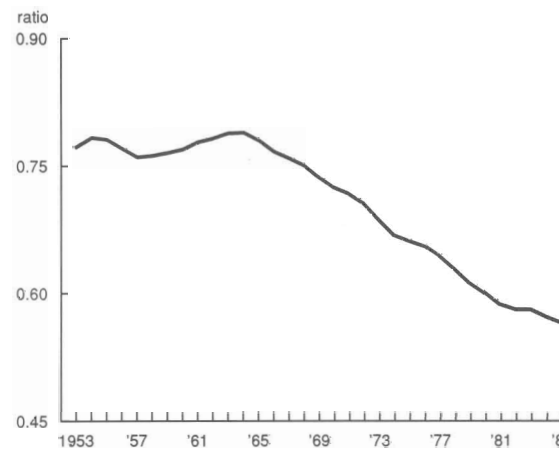



Table 3 contains estimates of expanded rate of return equations where the ratio of total government expenditure on goods and services to the private net capital stock has been added to the list of regressors. The introduction of this variable has no discernible impact on the estimated coefficients of the original variables, and its own estimated coefficient is of negligible statistical importance. Even taking the coefficient estimates as valid, the results suggest that a 1 percent increase in the level of government

**Table 3**
**Rate of return to private capital, public capital, and government spending**

| dependent variable | method | const | time | ln(n/k) | ln($k^g$/k) | ln(g/k) | cu | p | DW | $R^2$ | SSE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| rg | OLS | 1.429 | .005 | .163 | .178 | .012 | .149 | - | 1.568 | .842 | .0012 |
| | | (2.379) | (3.048) | (2.413) | (3.533) | (.497) | (4.242) | | | | |
| rn | OLS | 1.384 | .005 | .161 | .198 | .014 | .146 | - | 1.499 | .895 | .0012 |
| | | (2.392) | (2.997) | (2.479) | (4.093) | (.602) | (4.319) | | | | |
| rg | FOAC | 1.419 | .005 | .161 | .188 | .009 | .141 | .207 | - | .849 | .0012 |
| | | (1.988) | (2.586) | (2.014) | (3.253) | (.342) | (3.699) | (1.081) | | | |
| rn | FOAC | 1.354 | .005 | .158 | .208 | .011 | .139 | .237 | - | .902 | .0011 |
| | | (1.931) | (2.471) | (2.033) | (3.696) | (.398) | (3.778) | (1.245) | | | |
| rg | IV | 1.653 | .005 | .188 | .191 | .010 | .142 | - | - | .842 | .0013 |
| | | (2.594) | (3.224) | (2.626) | (3.679) | (.405) | (3.945) | | | | |
| rn | IV | 1.703 | .005 | .197 | .218 | .011 | .135 | - | - | .895 | .0012 |
| | | (2.768) | (3.332) | (2.850) | (4.333) | (.465) | (3.907) | | | | |

OLS = ordinary least square
FOAC = first order autocorrelation correction
IV = instrumental variables
rg = gross rate of return to private nonfinancial corporate capital
rn = net rate of return to private nonfinancial corporate capital
p = first order autocorrelation coefficient
DW = Durbin-Watson statistic
$R^2$ = adjusted coefficient of determination
SSE = Sum of squared residuals

expenditure relative to the capital stock would raise the gross rate of return by only 1.2 basis points and the net rate of return by 1.4 points.

The evidence presented here suggests the importance of distinguishing not only between the financial and real elements of fiscal policy, but between various sorts of government spending as well. Specifically, while public capital boosts the profitability of private plant and equipment, the overall flow of government spending has little or no such impact.

## Conclusion

The analysis of the effects of fiscal policies on aggregate economic variables may roughly be placed into financial and real categories. The new-classical or equilibrium approach to fiscal policy is often characterized, and criticized, as implying the "irrelevance" of budgetary policies on economic outcomes. Such characterization and criticism is inaccurate. While adherents to this approach typically claim such irrelevance for the particular lump sum financial policy pursued by the government, broad scope remains for fiscal policy effectiveness along real channels, including tax incentive and public expenditure policies.

Indeed, this paper has presented evidence which suggests that while the overall level of government spending on goods and services may not affect the marginal product of capital (more specifically, the return to capital) the accumulation of capital goods by the public sector does have such an effect. The elasticity of the rate of return to capital—gross or net of physical depreciation—with respect to public capital is strongly positive and of comparable magnitude to the corresponding elasticity with respect to private capital. Furthermore, the decline in the public capital stock, relative to that of private capital, accounts for much of the apparent downward trend in the profit rate in the United States over recent years.

[1] We may write the marginal product of capital as

$$r_t = \frac{\partial f}{\partial k}(n_t, k_t, k_t^g) \cdot g(u_t, t)$$

where $r_t \equiv$ marginal product of private capital, $n_t \equiv$ aggregate employment, $k_t \equiv$ private net capital stock, $k_t^g \equiv$ public net capital stock, and $u_t \equiv$ technological shock. Further, assuming that the primitive function $f(\cdot)$ is linearly homogenous in its arguments allows us to invoke Euler's theorem and write

$r_t \equiv h(n_t/k_t, k_t^g/k_t) \cdot g(u_t, t)$.

[2] Or $\partial h(\cdot)/\partial(k_t^g/k_t) > 0$.

[3] This is an approximation to the second equation in Footnote 1.

## Appendix

### Data used in this study

The raw data on the net fixed capital stocks are contained in Musgrave (1986 a, b), Tables 8 and 15. The year-end published data are converted to a mid-year average value for construction of rates of return.

The data on gross and net capital income are found in the *National Income and Product Accounts*, Table 1.16 (lines 20, 27, 35).

The land and inventory data are from *Balance Sheets for the U.S. Economy 1946-85*, pp. 21-25.

The capacity utilization rate, overall government spending (goods and services), and employment (total civilian labor force) are taken from the *Economic Report of the President* (1987).

| year | rg | rn | kg/k | g/k | k/n | cu |
|---|---|---|---|---|---|---|
| 53 | .160 | .108 | .773 | .362 | 17873.8 | .893 |
| 54 | .152 | .099 | .784 | .316 | 18877.2 | .801 |
| 55 | .174 | .122 | .782 | .291 | 18999.2 | .870 |
| 56 | .578 | .105 | .771 | .280 | 19317.6 | .861 |
| 57 | .148 | .095 | .761 | .282 | 20062.9 | .836 |
| 58 | .133 | .080 | .763 | .287 | 21024.7 | .750 |
| 59 | .153 | .100 | .766 | .281 | 21056.5 | .816 |
| 60 | .144 | .090 | .770 | .277 | 21263.3 | .801 |
| 61 | .143 | .090 | .778 | .286 | 21842.5 | .773 |
| 62 | .156 | .103 | .783 | .292 | 22069.0 | .814 |
| 63 | .164 | .110 | .789 | .289 | 22437.7 | .835 |
| 64 | .172 | .118 | .790 | .285 | 22743.3 | .856 |
| 65 | .184 | .130 | .780 | .280 | 23250.0 | .895 |
| 66 | .184 | .116 | .767 | .289 | 23892.7 | .911 |
| 67 | .172 | .115 | .759 | .298 | 24635.1 | .867 |
| 68 | .172 | .103 | .750 | .295 | 25294.1 | .870 |
| 69 | .160 | .083 | .736 | .278 | 25902.6 | .867 |
| 70 | .141 | .089 | .724 | .259 | 26841.0 | .792 |
| 71 | .154 | .094 | .716 | .248 | 27664.8 | .774 |
| 72 | .152 | .094 | .705 | .241 | 27716.1 | .828 |
| 73 | .131 | .073 | .686 | .227 | 27973.5 | .870 |
| 74 | .145 | .078 | .669 | .221 | 28696.6 | .826 |
| 75 | .151 | .094 | .661 | .219 | 29999.0 | .723 |
| 76 | .157 | .089 | .565 | .214 | 29694.1 | .774 |
| 77 | .146 | .092 | .643 | .210 | 29419.4 | .814 |
| 78 | .128 | .080 | .628 | .208 | 29213.9 | .842 |
| 79 | .132 | .065 | .611 | .201 | 29594.6 | .846 |
| 80 | .128 | .065 | .599 | .198 | 30579.8 | .793 |
| 81 | .132 | .068 | .585 | .194 | 31281.9 | .783 |
| 82 | .122 | .056 | .580 | .194 | 32366.1 | .703 |
| 83 | .132 | .067 | .579 | .193 | 32508.3 | .740 |
| 84 | .146 | .081 | .571 | .195 | 31937.7 | .805 |
| 85 | .146 | .081 | .564 | .202 | 32285.6 | .801 |

rg = gross rate of return to private nonfinancial corporate capital
rn = net rate of return to private nonfinancial corporate capital
kg/k = ratio of public to private net capital stock (1982$)
g/k = ratio of total government spending on goods and services to net private capital stock (1982$)
k/n = ratio of net private capital stock to total employment (1982$)
cu = manufacturing capacity utilization rate

## References


Aschauer, D.A. "Fiscal Policy and Aggregate Demand," *American Economic Review*, Vol. 75, March 1985, pp. 117-127.

_____. "Net Private Investment and Public Expenditure in the United States, 1953-84," *Staff Memoranda*, Federal Reserve Bank of Chicago, September 1984.

*Balance Sheets for the United States Economy 1946-85*, Board of Governors of the Federal Reserve System, 1986.

Barro, R. J. "Output Effects of Government Purchases," *Journal of Political Economy*, Vol. 89, December 1981, pp. 1086-1121.

_____. "Government Spending, Interest Rates, Prices, and Budget Deficits in the United Kingdom, 1707-1918," Vol. 20, September 1987, *Journal of Monetary Economics*, pp. 221-298.

*Economic Report of the President*. U.S. Government Printing Office, Washington, D.C., 1987.

Evans, P. "Do Large Budget Deficits Produce High Interest Rates?" *American Economic Review*, Vol. 75, March 1985, pp. 68-87.

Feldstein, M. "Government Deficits and Aggregate Demand," *Journal of Monetary Economics*, Vol. 9, January 1982, pp. 1-20.

Feldstein, Martin and Lawrence Summers "Is the rate of profit falling?" Brookings Papers on Economic Activity, Vol. 1, 1977, pp. 211-227.

Kormendi, R. C. "Government Debt, Government Spending, and Private Sector Behavior," *American Economic Review*, Vol. 73, December 1983, pp. 994-1010.

Modigliani, F., and A. Sterling "Government Debt, Government Spending and Private Sector Behavior: A Comment," *American Economic Review*, Vol. 76, December 1986.

Musgrave, J. "Fixed Reproducible Tangible Wealth in the United States: Revised Estimates," *Survey of Current Business*, January 1986, pp. 51-62.

_____. "Fixed Reproducible Tangible Wealth in the United States: 1982-85," *Survey of Current Business*, August 1986, pp. 36-89.

*National Income and Product Accounts of the United States, 1929-82*. U.S. Government Printing Office, Washington D.C., 1986.

Plosser, C. I. "Government Financing Decisions and Asset Returns," *Journal of Monetary Economics*, Vol. 9, May 1982, pp. 325-52.

Poterba, J. M., and L. M. Summers. "Finite Lifetimes and the Savings Effects of Budget Deficits," *Journal of Monetary Economics*, Vol. 20, September 1987, pp. 369-410.

Seater, J. J., and R. S. Mariano. "New Tests of the Life Cycle and Tax Discounting Hypotheses," *Journal of Monetary Economics*, Vol. 15, March 1985, pp. 195-215.