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HAS THE RATE OF INVESTMENT FALLEN?

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ABSTRACT

Although the ratio of gross fixed nonresidential investment to GNP has decreased very little since the late 1960's, the corresponding net investment ratio declined by nearly 40 percent between the second half of the 1960's and the second half of the 1970's. Four-fifths of this decline was due to the increased ratio of depreciation to GNP and only one-fifth to the decreased ratio of gross investment to GNP. The increased ratio of depreciation to GNP was in turn due in equal amounts to the higher ratio of capital to GNP and to the higher rate of depreciation. Nearly half of the higher depreciation rate was due to the increased rate of depreciation of equipment and nearly half to the increased share of equipment in the capital stock.

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## Has the Rate of Investment Fallen?

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There has been widespread concern in recent years about the decline in the rate of investment. Experts like Denison (1979) and Baily (1980) have pointed to the slow growth of the capital stock as one of the reasons for the slowdown in productivity growth. But, at the same time, the official Department of Commerce figures released in 1980 and 1981 indicate that the ratio of fixed nonresidential investment to gross national product has shown virtually no trend since the late 1960's and was actually higher in 1979 (0.110) than it had been in 1969 (0.107). More generally, the ratio of fixed nonresidential investment to GNP was virtually the same in the last half of the 1970's (0.103) as it had been in the last half of the 1960's (0.106).

The apparent conflict between these two views of investment is easily reconciled: the ratio of gross investment to GNP has been relatively stable while net investment has declined significantly. The fall in net nonresidential investment has been particularly sharp. The relevant figures are compared in the first four columns of Table 1.<sup>1</sup> Column 1 shows the stability of the ratio of gross private investment to GNP. This ratio declined by only seven percent from its average of 0.159 in the second half of the 1960's to 0.148 in the second half of the 1970's. The same picture of stability emerges if housing and

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<sup>1</sup>All of the figures used in this paper are from Department of Commerce sources. Specific references are given in the Appendix. The depreciation amounts and net investment figures are constant dollar amounts and are intended to reflect real economic depreciation; see below, page 7. They all reflect the upward revision of investment in the data released in late 1980.

TABLE 1

THE SHARE OF INVESTMENT IN GNP AND  
THE GROWTH OF THE CAPITAL STOCK 1948-1979

Year	Investment as Percent of Gross National Product						Net Fixed Non-residential Investment as Percent of Net Capital Stock
	Gross Private	Gross Fixed Nonresidential	Net Private	Net Fixed Nonresidential	Net Structures	Net Equipment	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1948	0.168	0.104	0.089	0.044	0.012	0.032	0.063
1949	0.133	0.093	0.050	0.030	0.010	0.020	0.041
1950	0.175	0.093	0.095	0.032	0.011	0.020	0.045
1951	0.162	0.091	0.084	0.031	0.012	0.018	0.045
1952	0.138	0.087	0.059	0.025	0.011	0.014	0.037
1953	0.137	0.090	0.057	0.028	0.014	0.014	0.041
1954	0.135	0.090	0.050	0.024	0.015	0.009	0.033
1955	0.158	0.093	0.075	0.029	0.016	0.013	0.041
1956	0.153	0.097	0.069	0.031	0.019	0.012	0.044
1957	0.142	0.091	0.056	0.030	0.018	0.012	0.041
1958	0.129	0.087	0.040	0.018	0.015	0.003	0.024
1959	0.150	0.088	0.064	0.021	0.014	0.007	0.029
1960	0.142	0.091	0.146	0.024	0.016	0.008	0.032
1961	0.137	0.088	0.051	0.019	0.016	0.006	0.029
1962	0.147	0.090	0.063	0.025	0.016	0.009	0.035
1963	0.150	0.090	0.067	0.026	0.015	0.011	0.036
1964	0.152	0.094	0.070	0.031	0.016	0.015	0.044
1965	0.163	0.105	0.083	0.042	0.021	0.021	0.059
1966	0.166	0.110	0.086	0.047	0.022	0.025	0.066
1967	0.153	0.104	0.071	0.040	0.019	0.021	0.055
1968	0.153	0.103	0.070	0.039	0.018	0.021	0.052
1969	0.158	0.107	0.073	0.041	0.019	0.022	0.054
1970	0.146	0.105	0.057	0.035	0.017	0.018	0.044
1971	0.155	0.100	0.066	0.029	0.015	0.014	0.037
1972	0.164	0.102	0.075	0.031	0.014	0.017	0.040
1973	0.173	0.110	0.085	0.040	0.015	0.025	0.052
1974	0.157	0.109	0.064	0.035	0.012	0.023	0.043
1975	0.125	0.097	0.028	0.019	0.007	0.012	0.022
1976	0.142	0.097	0.046	0.020	0.007	0.013	0.024
1977	0.156	0.103	0.061	0.026	0.007	0.019	0.033
1978	0.160	1.107	0.066	0.031	0.009	0.022	0.040
1979	0.157	0.110	0.061	0.033	0.011	0.023	0.042

inventories are ignored and attention is limited to gross fixed nonresidential investment. Column 2 shows that the ratio of gross fixed nonresidential investment to GNP averaged 0.106 in the peak years of the second half of the 1960's and then fell by less than three-percent of its value to 0.103 in the second half of the 1970's.

The decline in net investment was much sharper. The ratio of total net private investment to GNP (column 3) declined by more than 30 percent (from 0.077 in the late 1960's to 0.052 in the late 1970's) while the ratio of net fixed nonresidential investment to GNP (column 4) fell nearly 40 percent (from 0.042 to less than 0.026). The absolute declines in net investment were larger than the corresponding absolute declines in gross investment: 0.025 for net private investment versus 0.011 for gross private investment and 0.016 versus 0.003 for fixed nonresidential investment. Since net investment is generally less than one-half of gross-investment, the proportional declines are relatively larger.

The decline in net investment affected both structures and equipment. The figures in column 5 show that net investment in nonresidential structures fell from 2.0 percent of GNP in the second half of the 1960's to only 0.8 percent of GNP in the second half of the 1970's. During the same period, net investment in nonresidential equipment fell from 2.2 percent of GNP to 1.8 percent of GNP.

The sharp fall in net fixed nonresidential investment implied an even sharper fall in the rate of growth of the net stock of nonresidential fixed capital. Column 7 shows that this growth rate averaged 5.7 percent in the second half of the 1960's but only 3.2 percent in the second half of the 1970's.

Although the final years of the decade showed a slight improvement, the rate was still down substantially from the values for earlier decades.

Although the comparison of gross and net investment rates eliminates the apparent inconsistency between the two views of investment behavior, it raises the new puzzle of why net investment declined so sharply while gross investment declined so much less. Two factors account for this difference. First, since net investment is only a fraction of gross investment, any proportional fall in gross investment appears as a substantially greater proportional fall in net investment. Second, since the difference between gross investment and net investment is depreciation, the rapid fall in the net investment ratio reflects a corresponding rise in the ratio of depreciation to GNP.

1. Decomposing the Net Investment Decline

The decline in net investment can be decomposed more precisely into the fall in gross investment and the rise in depreciation. Let  $I^N/X$  be the ratio of net investment to GNP and let  $I^G/X$  and  $D/X$  be the corresponding ratios for gross investment and depreciation. The gross and net investment ratios for fixed nonresidential capital are shown in columns 2 and 4 of Table 1; the corresponding depreciation ratio is shown in column 1 of Table 2. The accounting identity

$$(1) \quad \frac{I^N}{X} = \frac{I^G}{X} - \frac{D}{X}$$

implies a first approximation for the rates of change

$$(2) \quad \frac{d(I^N/X)}{I^N/X} = \frac{d(I^G/X)}{I^G/X} \cdot \frac{I^G}{I^N} - \frac{d(D/X)}{D/X} \cdot \frac{D}{I^N}$$

TABLE 2

THE RELATION BETWEEN GROSS AND SET NONRESIDENTIAL  
AND THE NONRESIDENTIAL CAPITAL STOCK, 1948-1979

Year	Depreciation as Percent of GNP	Depreciation as Percent of Net Capital Stock			Net Capital Stock as Percent of GNP			Equipment as Percent of Net Capital Stock
	(1)	Total (2)	Equipment (3)	Structure (4)	Total (5)	Equipment (6)	Structure (7)	(8)
1948	0.060	0.086	0.117	0.064	0.697	0.293	0.403	0.421
1949	0.063	0.087	0.120	0.063	0.726	0.312	0.413	0.430
1950	0.062	0.088	0.121	0.062	0.701	0.308	0.393	0.439
1951	0.061	0.089	0.123	0.062	0.679	0.303	0.376	0.446
1952	0.062	0.090	0.127	0.061	0.681	0.306	0.375	0.449
1953	0.062	0.091	0.128	0.060	0.684	0.309	0.375	0.452
1954	0.066	0.092	0.132	0.060	0.716	0.321	0.395	0.449
1955	0.064	0.092	0.133	0.059	0.700	0.313	0.387	0.447
1956	0.066	0.092	0.135	0.058	0.715	0.317	0.399	0.443
1957	0.067	0.092	0.135	0.057	0.732	0.322	0.410	0.440
1958	0.069	0.092	0.138	0.057	0.752	0.325	0.427	0.432
1959	0.067	0.092	0.138	0.057	0.729	0.312	0.418	0.427
1960	0.067	0.091	0.138	0.056	0.737	0.312	0.425	0.423
1961	0.067	0.091	0.139	0.056	0.738	0.307	0.431	0.417
1962	0.065	0.090	0.139	0.055	0.722	0.298	0.424	0.413
1963	0.064	0.089	0.138	0.055	0.719	0.296	0.423	0.412
1964	0.063	0.089	0.136	0.055	0.713	0.295	0.418	0.414
1965	0.062	0.087	0.134	0.054	0.713	0.298	0.415	0.418
1966	0.062	0.087	0.131	0.053	0.718	0.305	0.413	0.425
1967	0.064	0.087	0.131	0.053	0.737	0.317	0.420	0.430
1968	0.065	0.087	0.132	0.053	0.741	0.322	0.419	0.434
1969	0.067	0.088	0.132	0.053	0.759	0.333	0.426	0.439
1970	0.070	0.088	0.134	0.053	0.792	0.350	0.442	0.442
1971	0.071	0.089	0.135	0.053	0.792	0.350	0.441	0.442
1972	0.071	0.091	0.137	0.054	0.779	0.347	0.431	0.446
1973	0.070	0.090	0.136	0.053	0.774	0.352	0.422	0.454
1974	0.074	0.091	0.136	0.053	0.811	0.375	0.436	0.462
1975	0.078	0.093	0.139	0.053	0.838	0.389	0.448	0.465
1976	0.077	0.095	0.141	0.054	0.813	0.381	0.432	0.469
1977	0.076	0.096	0.142	0.054	0.794	0.379	0.416	0.477
1978	0.075	0.096	0.140	0.054	0.786	0.381	0.405	0.485
1979	0.077	0.097	0.141	0.055	0.792	0.389	0.403	0.491

In the last half of the 1960's,  $I^G/X$  averaged 0.106,  $I^N/X$  averaged 0.042, and therefore  $D/X$  averaged 0.064. The  $I^G/X$  ratio declined over the next decade to 0.103 in the last half of the 1970's, a fall of 2.8 percent. The  $D/X$  ratio rose during this interval by 20 percent to 0.077. Substituting these values into the first term of equation (2) implies that the decline in gross investment contributed  $-0.028 (0.106/0.042) = -0.071$ ; i.e., if the depreciation-to-GNP ratio had remained constant, the decline in gross investment would have caused net investment to fall by 7.1 percent. Similarly, substituting the depreciation values into the second term of equation (2) implies that the increase in depreciation contributed  $-0.20 (0.064/0.042) = -0.305$  to the decline in net investment. Together these two terms imply a net investment fall of  $-0.376$ , slightly less than the observed fall of  $-0.381$ ; the difference reflects the first-order approximation nature of equation (2) as well as rounding errors in the original terms. The values of  $-0.071$  and  $-0.305$  imply that the fall in gross investment accounts for about 19 percent of the fall in net investment while the rise in the depreciation-to-GNP ratio accounts for about 81 percent of the fall. Adjusting the two components proportionately so that they sum to the actual change of  $-0.381$  implies values of  $-0.072$  and  $-0.309$ .

The rise in the depreciation-GNP ratio can itself be usefully decomposed into the change in the depreciation rate (i.e., the ratio of depreciation to the net capital stock,  $D/K$ ) and the change in the capital-GNP ratio ( $K/X$ ). Table 2 provides annual data disaggregated into equipment and structures on the depreciation rate (columns 2 through 4) and on the net capital stock as a percent of GNP (columns 5 through 7). The identity

$$(3) \quad \frac{D}{X} = \frac{D}{K} \cdot \frac{K}{X}$$



implies the first order approximation in rates of change

$$(4) \quad \frac{d(D/X)}{D/X} = \frac{d(D/K)}{D/K} + \frac{d(K/X)}{K/X}$$

In the second half of the 1960's, the depreciation rate for all fixed nonresidential capital averaged 8.7 percent. This rose to 9.5 percent by the second half of the 1970's. This implies  $d(D/K)/(D/K)=0.092$ . Over the same period, the ratio of capital to GNP rose from 0.734 to 0.805.<sup>1</sup> This 9.7 percent rise in the capital-GNP ratio thus contributed  $d(K/X)/(K/X)=0.097$  to the rise in the depreciation-GNP ratio. Taken together, the two terms account for a rise of 18.9 percent in the depreciation-GNP ratio.<sup>2</sup> Since the rise in the depreciation-GNP ratio contributed -0.309 to the decline in the ratio of net investment to GNP, the rise in the depreciation rate (D/K) contributed  $(0.092/0.189)(-0.309) = -0.150$  to the decline in the net investment ratio while the rise in the capital-GNP ratio contributed  $(0.097/0.189)(-0.309) = -0.159$  to the net investment decline. Thus the rise in the depreciation rate and the rise in the capital-GNP ratio contributed about equally to the higher ratio of depreciation to GNP.

The rise in the depreciation rate can itself be traced to the changing mix of equipment and structures as well as to the faster depreciation rate for equipment. Since equipment depreciates more rapidly than structures, a shift in the composition of the capital stock from structures to equipment increases the overall rate of depreciation. The relative importance of the changing composition

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<sup>1</sup>The ratio of net capital to GNP peaked at 0.838 in 1975 and then began to decline. The rise in K/X reflects the investment boom of the middle and late 1960's and the relatively low level of depreciation in those years.

<sup>2</sup>This falls short of the 20 percent rise in D/X because of rounding errors and the first-order nature of equation 4.

and changing depreciation rates can be calculated from the identity:

$$(5) \quad \frac{D}{K} = e \frac{D_e}{E} + (1-e) \frac{D_s}{S}$$

where  $D_e/E$  and  $D_s/S$  are the depreciation rates of equipment and structures, and  $e$  is the fraction of the net capital stock that is equipment. Column 8 of Table 2 shows annual values of  $e$ . Equation 5 implies that the proportional rise in  $D/K$  can be calculated as:

$$(8) \quad \frac{d(D/K)}{D/K} = \frac{e \, d(D_e/E)}{D/K} + \frac{(1-e) \, d(D_s/S)}{D/K} + \frac{\frac{D_e}{E} - \frac{D_s}{S}}{D/K} \, de.$$

Substituting the levels of the second half of the 1960's and the changes between them and the levels of the second half of the 1970's implies

$$(7) \quad \frac{d(D/K)}{D/K} = \frac{0.429 (0.009)}{.087} + \frac{0.571 (0.001)}{.087} + \frac{0.079 (0.048)}{.087}$$

$$= 0.044 + 0.007 + 0.044.$$

Thus, the change in the rate of equipment depreciation raised the overall depreciation rate by 0.044 and thus accounts for nearly half of its rise. By contrast, the depreciation rate for structures was largely unchanged while the increase in the relative importance of equipment in the capital stock also raised the total depreciation rate by 0.044. The linear decomposition is of course only approximate; the three terms sum to 0.095 while the actual proportional increase in the depreciation rate was 0.092.

Since the increase in the depreciation rate caused net investment to decline by 15.0 percent, the rise in the rate of equipment depreciation contributed  $(0.044/0.095) (0.150) = 0.0695$  of the 0.150. The small rise in the rate of depreciation of structures added an additional 0.011 while the changing composition of the capital stock added 0.0695.

Table 3 brings together all of the pieces of the overall decomposition of the decline in net investment into its several components. These figures indicate that the increased rate of depreciation and the higher capital-GNP ratio each accounted for about 40 percent.

## 2. Caveats and Implications

The depreciation rates for equipment and structures are calculated by the Department of Commerce on the basis of very detailed data on the distribution of gross investment in each year among different types of equipment and structures. For each type of asset, the Commerce Department uses straight line depreciation at a rate implied by 85 percent of the Bulletin F life for that type of asset. Unlike the procedure used for calculating depreciation for tax purposes, these depreciation calculations are adjusted for increases in the general price level for investment goods.

Although this procedure is supposed to measure economic depreciation, it may well be too conservative. First, the straight line depreciation schedule probably understates the rate of fall of the value (or remaining productive capacity) of capital assets. Even if the output of an investment good declines linearly, the resulting value of the asset would decline more rapidly.<sup>1</sup> Second, the use of 85 percent of Bulletin F lives probably overstates the useful lives for many types of equipment and may understate overall depreciation. Finally,

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<sup>1</sup>In particular, a linear decline in output implies a sum-of-the-years-output decline in the value of the asset.

TABLE 3

CONTRIBUTIONS TO THE DECREASED RATIO OF NET INVESTMENT TO GNP  
1965-69 to 1975-79

	Contributions	Percentage of Total
Decline in Ratio of Gross Investment to GNP	-0.072	18.9
Increase in Ratio of Depreciation to GNP	<u>-0.309</u>	<u>81.1</u>
Increase in Ratio of Capital to GNP	-0.159	41.7
Increase in Depreciation Rate	<u>-0.150</u>	<u>39.4</u>
Increased Equipment Depreciation Rate	-0.0695	18.3
Increased Structure Depreciation Rate	-0.0110	2.9
Increased Equipment Share in Capital Stock	-0.0695	18.3

Source: Calculations described in text.

Note: Components may not add exactly due to rounding error.

and perhaps most important for the second half of the 1970's, the jump in energy costs and other petroleum-related prices undoubtedly made many pieces of equipment economically obsolete sooner than they otherwise would have been. The conventional depreciation rates therefore probably understate the amount of depreciation in the late 1970's. Increasing the assumed rate of depreciation to reflect these three biases in the current procedure would of course reduce the implied rate of net investment and, because of the energy price change, would increase the relative decline in net investment between the late 1960's and the late 1970's. The increased rate of equipment depreciation would in turn account for a larger fraction of the greater relative decline in net investment.

The implication for future capital accumulation of the contrast between the sharp decline in net investment and the much milder decline in gross investment depends on the character of the firms' investment decision process. If firms make investment plans directly in terms of gross investment (e.g., because gross investment is governed by the available cash flow), the substantial slowdown in net investment will partly reverse itself over time as the ratio of the capital stock to GNP falls and thereby reduces the ratio of depreciation to GNP. But even in this case, net investment will nevertheless continue to be low relative to GNP if firms continue to devote a high share of gross investment to equipment.

However, the assumption that firms decide directly on the level of gross investment is less likely than the view that the rate of gross investment is a consequence of decisions made in terms of the desired capital stock and of the attractiveness of particular new investment opportunities. According to this view, a decline in the desired growth of the capital stock reduces net

investment directly; the change in gross investment then follows from this change in net investment in a way that depends on the existing capital stock and the depreciation rate. If this "net investment" interpretation is correct, the fall in the net investment rate is not just an unfortunate coincidence but the result of explicit decisions by firms to reduce the growth rate of the capital stock. Evidence presented elsewhere (Feldstein, 1980) suggests that the reduced real return on investment and the high real cost of capital have in fact reduced the incentive to invest and caused the recent decline in net investment.

Appendix

Sources of Data

Table 1, Columns 1 and 2

Gross national product, gross investment and the components thereof are presented in Table 1.2 of the National Income and Product Accounts. The data used in the paper incorporate the benchmark revisions released in late 1980 and early 1981. Data courtesy of Data Resources, Inc.

Table 1, Columns 3 through 6

Net investment figures are derived from the corresponding gross investment figures by subtracting depreciation. The depreciation amounts are Department of Commerce estimates of economic depreciation based on 85 percent of Bulletin F lives and straight line depreciation. These depreciation amounts as well as the net and gross investment figures are presented in Table 5.3 of the National Income and Product Accounts. Revised data were kindly provided by John C. Hinrichs of the Bureau of Economic Analysis, United States Department of Commerce.

Table 1, Column 7

The net capital stock is the Department of Commerce estimate of the net stock of nonresidential fixed capital that is consistent (except for several minor conceptual differences) with the net investment figures in column 4. These capital stock data are presented in Musgrave (1976) and subsequent issues of the Survey of Current Business. Revised data were kindly provided by John C. Musgrave of the Bureau of Economic Analysis, United States Department of Commerce.

Table 2, Column 1

Depreciation of nonresidential fixed capital is the same data used to derive column 4 of Table 1.

Table 2, Columns 2 through 4

The disaggregated depreciation figures are the same as those used to derive columns 5 and 6 of Table 1. The corresponding net capital stocks are also the Department of Commerce estimates provided by Musgrave and used for Table 1, column 7.

Table 2, Columns 5 through 8

These ratios use the capital stock and GNP data already described.

Note: All data used are in 1972 dollars.



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