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16

The Economics of Investment Behavior

Whatever cannot go on forever must come to an end.
—Herbert Stein

If consumers purchased only nondurable goods and services, the permanent-income and life-cycle hypotheses predict that consumer behavior would stabilize the economy. An offsetting factor is the procyclical movement of consumer durable purchases. Although consistent with the PIH and LCH, such movement tends to aggravate booms and recessions. In this chapter we find that business fixed investment also fluctuates procyclically. Thus both durable purchases by consumers and investment purchases by businesses introduce instability into the private economy, leading policy activists to claim that an activist stabilization policy is justified.

The instability of private investment gains new relevance after the wild oscillations of the past decade. Compared to its average annual growth rate over the period 1960–2007 of 4.8 percent, nonresidential private fixed investment grew at a much faster average rate of 9.8 percent during 1996–2000 and then *declined*, exhibiting an average growth rate of –7.0 percent during 2000–02, followed by a bounce-back annual growth rate of 4.9 percent during 2002–07.

16-1 Investment and Economic Stability

In Chapter 15 we found that the permanent-income and life-cycle hypotheses of individual consumption behavior explain the partial insulation of aggregate consumption spending from changes in other types of spending in the short run. But what are the sources of changes in these other types of spending? Nominal GDP in 2007 was divided among the major types of expenditures as follows:

Personal consumption expenditures	70.3%
Gross private domestic investment	15.4
Government purchases of goods and services	19.4
Net exports	−5.1
	100.0

Having already considered consumer expenditures in Chapter 15, government spending and other aspects of fiscal policy in Chapters 5 and 12, and net exports in Chapter 6, we concentrate here on private investment.

We will review a very simple theory that explains why investment spending is likely to exhibit more pronounced fluctuations than other types of spending. According to the permanent-income hypothesis, introduced in the last chapter to explain consumer expenditures, households try to maintain a constant ratio of their consumer durable stock to permanent income. This creates sudden bursts of durable purchases when an upward revision of permanent income causes the desired durable stock to increase. In this chapter we will see that investment spending on plant, equipment, inventories, and housing is driven by the same principle and therefore is also subject to sudden bursts of purchases.[1]

16-2 Case Study

The Historical Instability of Investment

Total Investment Rises and Falls Dramatically and Procyclically

We begin by examining the historical record of investment spending since 1960. Figure 16-1 clearly shows that investment spending is far more variable than consumption spending (compare with Figure 15-1 on p. 489). The top line in the figure shows total real gross private domestic investment (GPDI). By any standard, the fluctuations in total investment are huge.

The following table shows how real GPDI has fluctuated since 1960.

Quarters			Percentage change (in lags)	
Peak	Trough	Peak	Peak to trough	Trough to peak
1960:Q1	1961:Q1	1969:Q4	−22	+61
1969:Q4	1970:Q4	1973:Q4	−7	+39
1973:Q4	1975:Q1	1980:Q1	−31	+46
1980:Q1	1980:Q3	1981:Q3	−17	+21
1981:Q3	1982:Q4	1990:Q3	−26	+47
1990:Q3	1991:Q1	2001:Q1	−11	+73
2001:Q1	2001:Q4	—	−11	—

Shown in the left part of the table are the dates of each successive business cycle peak and trough. We can see, for instance, that in the 1973–75 recession,

[1] Examples of plant and equipment investment include:

Nonresidential Plant (Structures)	Equipment
Factories	Computers
Oil refineries	Jet airplanes
Office buildings	Trucks
Shopping centers	Bar-code scanners
Private hospitals	Internet switching equipment
Hotels	Tractors

The principles developed in this chapter apply also to residential investment, construction of both single-family homes and apartment buildings.

Thus in period 2 expected sales are $11 billion, as recorded on line 2. But then another mistake is made, because in period 2 actual sales turn out to be $12 billion again instead of the expected $11 billion. Once again, expectations for the next period are revised, and they continue to be revised as long as actual sales differ from expected sales.

The Level of Investment Depends on the Change in Output

The next step in the accelerator hypothesis is the assumption that the stock of physical capital—that is, plant and equipment—that a firm desires (K^*) is a multiple of its expected sales:

General Form	Numerical Example	
$K^* = v^*Y^e$	$K^* = 4.0Y^e$	(16.2)

For example, Mammoth Electric in Table 16-1 wants a capital stock that is always four times as large as its expected sales. Notice that the desired capital stock on line 3 of the table is always exactly 4.0 times the level of expected sales on line 2. What determines the multiple v^*, which relates desired capital to expected sales? As we will see, in calculating v^*, firms pay attention to the interest rate and tax rates. Their chosen value of the multiple v^* reflects all available knowledge about government policies and the likely profitability of investment.

Net investment (I^n) is the change in the capital stock (ΔK) that occurs each period.[3]

$$I^n = \Delta K = K - K_{-1} \tag{16.3}$$

In the example in Table 16-1, we assume that Mammoth Electric always manages to acquire new capital quickly enough to keep its actual capital stock (K) equal to its desired capital stock (K^*) in each period:

$$I^n = K - K_{-1} = K^* - K^*_{-1} \tag{16.4}$$

Equation (16.4) implies that net investment (I^n) is always equal to the change in the desired capital stock in each period, which from equation (16.2) is 4.0 times the change in expected sales:

$$\begin{aligned} I^n &= K^* - K^*_{-1} \\ &= v^*(Y^e - Y^e_{-1}) = v^*\Delta Y^e \end{aligned} \tag{16.5}$$

The accelerator hypothesis says that the *level* of net investment (I^n) depends on the *change* in expected output (ΔY^e). When there is an acceleration in business and expected output increases, net investment is positive. If expected output stops increasing, net investment falls to zero. And if expected output were ever to decline, net investment would become negative as businesses undertook less gross investment than the amount by which their capital stocks depreciated.

Adding replacement investment. Total business spending on plant and equipment includes not only net investment—purchases that add to the capital stock—but also replacement purchases, which simply replace plant and equipment that has become worn out or obsolete. Line 5 of Table 16-1 assumes that each year 10 percent of the previous year's capital stock needs to be replaced.

[3] This is an alternative but equivalent definition to the one we learned in Chapter 2, where net investment was defined as gross investment minus capital consumption allowances.

Thus, in the real world, net investment does not always close the whole gap between desired capital and last year's capital stock; more often it closes only a fraction of it.

Determinants of Gross Investment

To summarize, the relationship between economywide gross investment and output depends on at least four major factors.

1. *The fraction of the gap between desired capital and last period's actual capital that can be closed in a single period.* The higher this fraction, the more current investment responds to the change in last period's output.
2. *The response of expected output to last period's error in estimating actual output.* The higher this response, the more expected output and hence investment respond to any unexpected change in last period's actual output.
3. *The proportion of the capital stock that is replaced each year.* For long-lived types of capital, such as office buildings, only a small fraction of the stock is replaced each year. In contrast, because equipment depreciates more quickly, a larger amount of equipment investment is required annually per dollar of equipment capital to maintain the same size equipment capital stock. Firms are not forced to replace old capital on a fixed schedule. If firms delay replacement investment until expected sales are strong, total investment will respond even more than the simple accelerator model suggests.[8]
4. *The desired ratio of capital to expected output* (v^*). Investment responds more to changes in expected output in capital-intensive industries (those with a high v^*, such as electric utilities, oil refining, and chemicals) than in labor-intensive industries (those with a low v^*, such as textiles, apparel, and barber shops). Thus faster growth expected in more capital-intensive industries will spur more investment.

In the next section we investigate the determinants of the desired capital-output ratio and the policy instruments with which the government can affect the size of v^*.

16-6 The Neoclassical Theory of Investment Behavior

One of the most important contributions to the theory of investment behavior was made in the early 1960s by Dale Jorgenson of Harvard University.[9] Jorgenson's insight was to show that the user cost of capital could be derived from neoclassical microeconomic theory by examining the decision of a profit-maximizing firm. Jorgenson then demonstrated that tax policies affected how much firms invest.

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[8] A study that confirms the procyclical behavior of replacement investment is Martin S. Feldstein and David Foot, "The Other Half of Gross Investment: Replacement and Modernization Expenditures," *The Review of Economics and Statistics*, vol. 53, no. 1 (February 1971), pp. 49–58.

[9] Dale Jorgenson, "Capital Theory and Investment Behavior," *American Economic Review*, vol. 53 (May 1963), pp. 247–57. A comprehensive review of recent theories of investment is Ricardo Caballero, "Aggregate Investment," in J. B. Taylor and M. Woodford, eds., *Handbook of Macroeconomics* (North Holland, 1999), pp. 813–62.