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Briefing Paper

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INVESTMENT AND U.S. FISCAL POLICY IN THE 1990s

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Introduction

Investment is key to policy analysis for at least two reasons. First, it is the source of capital accumulation and is therefore a major determinant of the economy's long-run output capacity as well as the productivity and income of the labor force. Second, as a large and volatile component of aggregate demand, fluctuations of investment have a major influence on the short-run path of the business cycle.

For these reasons, investment has been the subject of much economic research over past decades, and has been the focus of significant policy debate. Of late, discussions linking policy and investment have been near the top of the policy agenda. This is largely because of the widely-held view that the federal budget deficit increases competition for the scarce pool of private saving, raising the real cost of capital faced by firms, and "crowding out" private investment. The predicted effect is stagnant growth in output and labor productivity.

For many economists, the "crowding out" problem is the primary reason for cutting the federal budget deficit. It follows that concerns about investment lie at the root of calls in some circles for tax increases and restraint on government spending. Also, the concern that higher deficits will weaken investment in the long run has derailed proposals which employ stimulative fiscal policy in response to the 1990s stagnation in the U.S.[2]

Furthermore, although the fervor behind the "supply-side" economics of the 1980s has quieted to some degree, the assumed sensitivity of investment to the after-tax cost of capital is still a cornerstone of tax policy in some circles. If taxes were cut on the returns from saving and investment, the argument goes, then the expansion of investment and of the capital stock would ultimately benefit the entire economy by increasing output and raising labor productivity and wages. The direct beneficiaries of such tax initiatives, however, would be largely wealthy taxpayers who have sub-

stantial savings or large claims on capital income. The Bush administration pushed for a capital gains tax cut on the basis of this kind of reasoning.[3]

While there is near consensus that U.S. fiscal policy affects private investment, the particular channels through which taxes and deficits influence investment have been the subject of decades of debate in both academic and policy circles. Since developing effective policy strategies hinges on determining which channels most clearly influence investment, this report analyzes the existing literature on investment, presents original research to assess the economic foundations of current policy debates, and explores the role policy can play in boosting investment. In particular, this report focuses on three broadly defined channels affecting investment.

- Channel 1 - Cost of Capital. This includes the effect of influences on the cost of capital such as direct tax incentives (e.g., the investment tax credit). The impact of budget deficits as well as policy initiatives designed to increase saving also fall into this category because they affect investment through interest rates.

- Channel 2 - Sales Growth. Tax and spending policies are widely thought to have a short-run impact on the strength of the economy. The theory is that insofar as stronger demand increases the growth rate of firms' sales, it may increase the motivation to invest. Through this channel, short-term sales growth may be translated into higher investment and long-term growth.

- Channel 3 - Financial Conditions of Firms. Recent research has resurrected earlier ideas that the availability of finance, either through firms' internal cash flow or from external debt, plays a fundamental role in determining the course of private investment. Fiscal policy can affect investment through this channel to the extent that it affects the cash that firms use to finance investment internally or the health of the financial sector that provides investment finance through debt.

This report presents new empirical research designed to measure the relative strength of these three channels of influence. This work is based on a panel of firm-level data larger than that used in any previous study of U.S. investment. The data are drawn from the mid- 1970s to 1990. The firms in the panel account for between 40 and 50 percent of all U.S. plant and equipment spending during this period. The empirical results show that:

- A change in real interest rates of two percentage points (which would be a very large policy-induced shift and an influence on the cost of capital (channel one)) is predicted to cause investment to change by:

  0 for high-growth firms;
  0 for moderate growth firms:
  2.5 percent for firms with stagnant growth; and,
  3.1 percent for firms with negative growth.

As a result of the recession-induced reduction in sales growth and corporate cash flow from the second quarter of 1989 to the fourth quarter of 199 1 (a change of the type described by channels two and three), investment declined:

13.1 percent for high-growth firms;
10.5 percent for moderate growth firms:
6.8 percent for firms with stagnant growth: and,
4.8 percent for firms with negative growth.

These findings suggest that the largely exclusive emphasis on the cost of capital in most current discussions is unjustified. The evidence shows that interest rates and the cost of capital play a very uncertain role in the determination of investment when compared with the strength of firms' financial conditions and the growth of their sales. Therefore, the impact of policy through the cost of capital channel may well have been overemphasized. Furthermore, the determinants of investment differ across firms. The fastest-growing firms appear to be the most sensitive to alternative sales and financial determinants of investment. It is useful to pay attention to this heterogeneity of firms when studying policy.

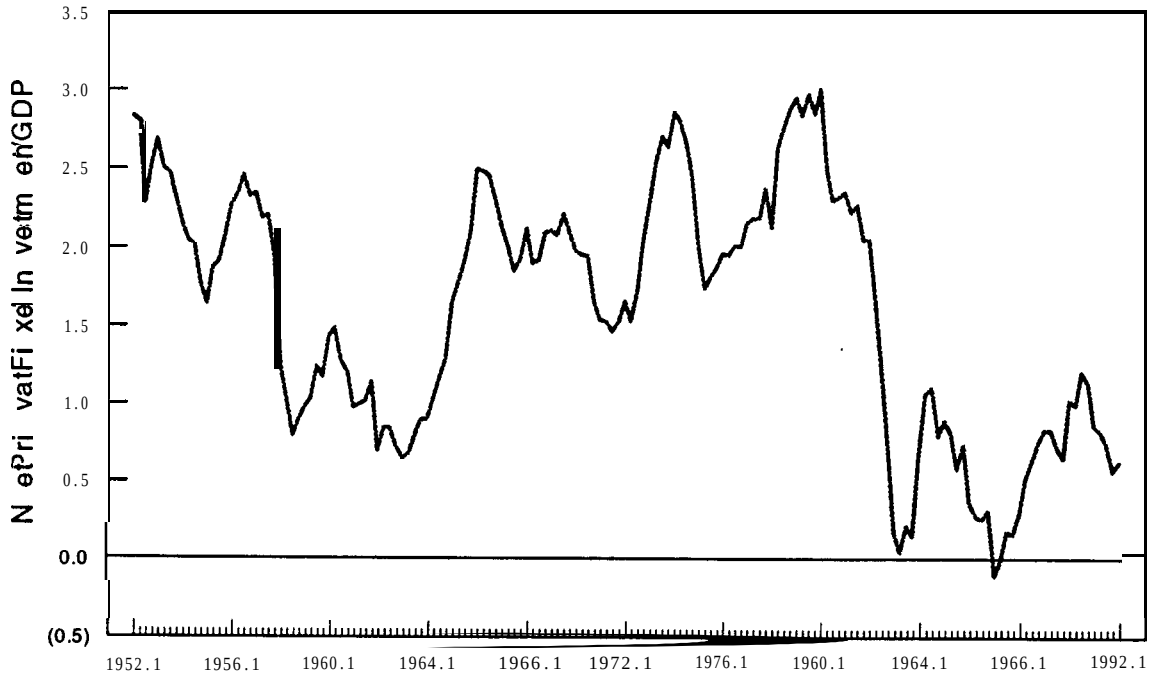
The policy implications of these findings are presented in the final section of this report. Briefly, the discussion focuses on the following points:

- The most important determinant of investment is the strength of the economy. The indirect impact of taxation and spending initiatives on overall economic activity is likely to have a greater effect on investment than the influence of taxes on the cost of capital.

- The negative ("crowding-out") effect of deficit spending on investment is likely to be small. Moreover, in the current weak economy, the stimulus to economic activity caused by deficit spending will probably overshadow any dampening of investment that occurs from rising interest rates. Therefore, at least in the current environment, fears of low private investment should not block progress on public investment, even if the consequence is a somewhat greater deficit.

Policy to stimulate investment directly should focus on "robust" policies, those designed to get cash into the hands of investing firms. The investment tax credit is such a policy: it not only reduces the cost of capital, but it also increases firms' cash flow. Cutting personal taxes, in particular a cut in the capital gains tax rate, is not a robust policy. Its impact on investment is hard to predict and could be quite weak, especially for the most dynamic sectors of the economy. Broader tax changes, which are designed to increase saving, face similar problems. Therefore, we could incur the distributional costs of regressive tax reform designed to raise saving without much benefit in terms of increased investment.

FIGURE 1
Net Non-Residential Investment, 1952-I 992



Source: National Income and Product Accounts, adjusted in Fair (1992).

Do We Need More Investment?

As this report examines the determinants of private investment and the impact of policy on investment, it is important to first address the background issue of whether policy should strive to stimulate investment in the U.S. during the 1990s.

Statistics show that investment has been particularly weak. Figure 1 plots net private fixed investment as a percentage of gross domestic product (GDP) for the last 40 years. This ratio varies widely with the business cycle. But recent experience still stands out as unusual. The investment-GDP ratio hit a postwar low in the 1982-83 recession and only bounced back slightly before turning down again in 1985, well in advance of the official beginning of the recession in mid-1990. During the recent slow growth and recession period, the investment percentage has shown a small upturn but it is still near its lowest levels in post-Depression experience. The percentage in late **1991** was below the trough reached following the 1973-74 recession, which was widely believed to be more severe than the current downturn.

There is surprising agreement from nearly every part of the political spectrum that policy should attempt to reverse the negative investment trend, in spite of sharp differences over the best way to pursue this goal. The Bush administration looked to increase investment and economic growth by lowering taxes (especially those on capital gains) and deregulation:

> *"A major suspect in the slowdown of U.S. productivity growth is thus to be found...in the capital markets. To raise the rate of productivity* growth, *the* national *rate of* investment should *be increased"* (Economic *Report of the* President 1992, p. 93, emphasis in the original).

Even Democrats Bill Clinton, Paul Tsongas, and Jerry Brown embraced capital gains tax cuts in some form to stimulate investment. Benjamin Friedman, a critic of the Reagan-Bush fiscal policies, argued that as a result of low investment in the 1980s, "productivity gains have continued to be disappointing and wages have lagged" (199 1, p. 150). Murray Weidenbaum, Ronald Reagan's first chair of the Council of Economic Advisors, called for a temporary investment tax credit on "productivity enhancing equipment for manufacturing companies" (Youngblood 1992).

Yet, in spite of this agreement on the need to increase private investment, there is some justification for questioning whether the pursuit of policies that stimulate investment will necessarily enhance social well-being. Suppose output is given at a constant level. Then, an increase of investment necessarily involves the sacrifice of some resources that could have been used for current consumption. It is not entirely obvious, therefore, that more investment is good. That is, the future benefits to society from higher investment may not be sufficient to justify the sacrifice of current consumption.

For several reasons, however, I believe that under current circumstances in the U.S., policy should strive to increase private investment. The most obvious of these is that the economy is far from fully employing its resources. To the extent that higher investment spending increases the sales of the businesses that supply investment goods, these businesses will increase production and employment. The incomes of their workers will rise, causing an increase in the demand for the things that workers buy, and more sales, production, and employment elsewhere in the system. This "ripple effect" in the economy, commonly referred to as the "multiplier," will propagate through the economic system. Therefore, in the current weak economic environment, the premise necessary to conclude that higher investment requires a sacrifice of current consumption is false. Output is not fixed at a "given level." There are good reasons supporting the theory that higher investment will increase output and employment, speed economic recovery, and increase the prospects for more consumption as well.[4]

A longer-term concern also supports the conclusion that the U.S. would benefit from higher private investment. The 1990 report of the Social Security Administration predicts that the ratio of social security beneficiaries to employed workers who pay social security taxes will rise from 0.3 in 1990 to 0.5 about 40 years later (see Carlson 1991, Figure 6). This widely-discussed change, caused by the aging of the baby-boom generation, will either greatly increase the burden borne by workers to support retirees or lead to substantial cuts in the benefits paid to retirees. Much has been written about the need to build up reserves in anticipation of this potentially serious intergenerational conflict in the next century.

The popular understanding of the social security problem, however, is clouded by what economists call a "fallacy of composition," that is, incorrectly concluding that what is true for an individual applies to the society as a whole. The obvious remedy for an individual who wants to provide for retirement is to save while working and then to use accumulated savings to finance consumption during retirement. Through their saving, people see themselves as transferring resources from the present to the future, and from their individual perspective this view is correct. But no such transfer of the actual goods that retirees want to consume occurs in the society taken as a whole. Baby-boom retirees will want to drive nice cars, eat good food, and consume high-quality medical care that will be the products of the future economy. No one accumulates stocks of such goods in massive warehouses planning to take them out for use when they retire in the second and third decades of the next century! The goods and services that the baby boomers will consume when they retire must come from the production of society at that time.

The best thing, therefore, we as a society can do today to provide for the retirement of the baby boomers is to enhance the ability of the economy to produce goods and services in the future. This objective requires higher investment now. With these demographic realities in mind, the downward trend of investment in recent years is particularly discouraging. Investment should be rising as a share of production. How economic policy can be used to boost investment is therefore the focus of the last section of this report.

What Do We Know About the Determinants of Investment?

To understand how policy interacts with investment, we must first explain how investment decisions are made. With some risk of oversimplification, the determinants of investment studied in the voluminous academic literature on the subject can

be divided into three broad categories: the cost of capital, output or sales growth variables, and measures of firms' financial conditions. We shall now consider each of these categories in some detail.

Channel One: The Cost of Capital and the Neoclassical Investment Model

Early empirical work emphasized all three categories of investment determinants (see for example, Meyer and Kuh 1957). In the 1960s, however, Dale Jorgenson developed what became the dominant view of investment in the economics mainstream: the neoclassical investment model (see Jorgenson's (197 1) survey for references). According to this theory, firms make employment, investment, and production decisions to maximize their profits (more precisely, the present value of profits over time). The only constraints on firms' choices arise from market prices (which they cannot affect under the perfectly competitive assumptions of the Jorgenson model) and technology (which determines the amount of output the firm can produce from its choice of employment and capital inputs). In this theoretical framework, then, investment is determined by technology and the full spectrum of prices. These prices include interest rates and other determinants of the cost of capital such as depreciation, expected inflation, and aspects of the tax code relevant to income from capital.

The direct role played by policy in this framework is clear, but narrow. To the extent that technology is exogenous, as most studies assume, policy affects investment because policy affects relative prices. In principle, such influences could occur through any prices (wages or other input prices, for example), but the vast majority of work has concentrated on the cost of capital. In economists' terms this concept represents the "opportunity cost" to firms' owners of sinking money into fixed capital investment, what they give up to make an investment. In a simple world without taxes on capital income (an assumption we shall drop momentarily), the two components of this sacrifice are reasonably clear.

Suppose a firm buys a new machine tool for $100,000 rather than paying out these funds to its shareholders. The cost of this decision to the equity owners will be the return they could have received by putting these funds into financial assets, which is usually measured by the interest rate adjusted for anticipated inflation. In addition, as the firm uses the machine tool over the year, its value is likely to fall as it wears out from use and becomes technically obsolete. This depreciation is also part of the sacrifice the firm owners make when the firm buys the machine. Assuming the firm acts to maximize the wealth of its shareholders, it will purchase the machine only if the new capital contributes enough to the firm's profits to compensate share-

holders for these opportunity costs. That is, the contribution of the machine to profits, determined by the firm's technology, must exceed the cost of capital. If the inflation-adjusted interest rate is 5 percent and the depreciation rate is 10 percent, a firm will buy a $100,000 machine if it adds $15,000 or more to annual profits.

In this simple environment, policy effects are limited. Policy can do nothing about depreciation rates or the productivity of capital, which both depend on the exogenous technology.[5] Policy may affect interest rates, however. If the government deficit forces heavy government borrowing, real (inflation-adjusted) interest rates can rise.[6] Therefore, the neoclassical framework predicts that deficits are bad for investment. Monetary policy also affects interest rates, but its most immediate impact is on short-term rates. Its effect on the longer term rates that are most relevant for investment is questionable.

This simple example, however, is only pedagogical because it ignores the complex array of taxes on capital income. On the one hand, corporate profits generated by capital investment are subject to the corporate income tax. On the other hand, capital investment creates depreciation deductions that reduce corporate taxes and, for most of the period from 1962 until the Tax Reform Act of 1986, investment further reduced corporate taxes through a special subsidy called the investment tax credit. In addition, nominal interest payments made by firms that finance their investment with debt are deductible, but the dividends paid to shareholders who provide equity finance for investment cannot be deducted. Even personal taxes can have an impact on the cost of capital if managers act in the interest of their tax-paying shareholders. For example, the literature has placed much emphasis on the differential tax treatment of capital gains and dividends.'

These complexities can be integrated into the cost of capital.[8] The simple investment theory presented above is modified to predict that firms will invest in a new factory or piece of machinery if the value of such a project exceeds the after-tax cost of capital. These tax effects introduce another lever for policy to affect investment. Changes in depreciation allowances or the personal taxation of capital gains, to name two examples that are widely discussed currently, change the cost of capital and potentially affect investment. Indeed, in most of the literature based on the mainstream neoclassical investment model, taxes constitute the primary channel through which government policy affects investment, and the effects are often assumed to be large.

This discussion of the neoclassical investment model and its policy implications summarizes a theory. While the theory is logically coherent, it is based on many strong and potentially unrealistic assumptions. For example, most versions

assume that firms can purchase all the inputs and sell all the output they want to at given prices (firms operate in "perfectly competitive*' markets). In addition, if firms do not have sufficient funds to finance a desirable investment project, they can obtain all the finance they need externally by issuing new shares at a fair market price or by borrowing at an economy-wide interest rate. There is little doubt that these strong assumptions do not match reality. The more important question for policy analysis, however, is whether the theory based on these assumptions nevertheless adequately describes the most important aspects of the way firms make investment decisions. This question must be answered by empirical tests of the theory.

Tests of the neoclassical investment model immediately run up against an important problem. The theoretical role played by technology is clear and very general in the model, but in practice the true structure of firms' technology and its impact on the demand for investment is unobservable. Researchers must make some additional assumptions about the nature of technology to test the theory. The character of these assumptions is important for policy purposes because they often introduce firms' sales or output as determinants of investment along with the cost of capital. Some of these models explain investment very well, but it is not clear that their explanatory power is driven by the cost of capital and therefore related to policy-driven changes in taxes and interest rates. The success of these empirical neoclassical models could be the result of including sales, which may have little to do with the neoclassical theory, an issue we shall soon take up.[9]

Thus, there is uncertainty about the standard influences of policy on investment through the cost of capital. We shall try to resolve some of this uncertainty with the new empirical research reported in the next section. First, however, we must consider some alternative perspectives on investment. While these views have not been subject to anything like the volume of research surrounding the neoclassical model, their relevance to current policy issues may be quite significant.

Channel Two: Sales and the Accelerator

In most versions of the neoclassical model, firms choose how much output they want to produce under the assumption that they can sell all they want to at the given market price. The only limitations they perceive on their production arise from their technology and market prices. This "perfectly competitive" environment, however, does not adequately describe the circumstances of firms in most U.S. industries. Typically, firms have at least some control over the price they charge, and the sales they can make at a given price are limited by the strength of demand for their products. In these conditions, one would expect that firms' expectations of future sales

would have an important impact on their investment spending. High sales, currently and in the recent past, will likely cause expectations of higher sales in the future and will give firms the incentive to invest in new productive capacity. Low sales will reduce the incentives to invest. This kind of intuition underlies one of the oldest and most empirically successful investment models: the accelerator. In its simplest form, the accelerator theory predicts that if a firm's sales growth increases, its investment will rise as well.[10]

Various versions of the accelerator have been used in empirical investment studies for decades with excellent results. As mentioned previously, strong accelerator effects have clouded the empirical evaluation of the neoclassical model because many versions of the neoclassical approach allow the cost of capital to affect investment only through variables that also include sales or output. Therefore, one cannot determine the separate impact of sales and the cost of capital from this research, and it is difficult to evaluate the independent importance of these channels for policy analysis.

Some studies, however, have compared the separate effects of sales and the cost of capital for explaining investment. In a recent survey, Robert Chirinko **(1991, p. 14)** writes, "although empirical results with versions of the Neoclassical Model differ widely, they suggest to this author that output (or sales) is clearly the dominant determinant of investment spending with the (cost of capital] having a modest effect." It is not clear that even the "modest effect" of the cost of capital is reliable for policy purposes; the new empirical work in this paper indicates that the cost of capital may not have any statistically significant impact. Therefore, there is doubt about the important implicit assumption, largely unquestioned in policy circles, that changes in the cost of capital of the magnitude likely to arise from deficits or tax reform will have an important effect on investment. New empirical evidence to address this problem is presented in the following section.

If sales dominate the cost of capital as a determinant of investment, and if sales are determined in part by macroeconomic conditions, then the links between fiscal policy and capital spending are significantly different from the policy implications of the neoclassical model summarized previously. The indirect effects of the tax system on investment, working through the influence of taxation on aggregate spending and firms' sales, may have a greater influence on investment than the direct effects of taxes on the cost of capital.

For example, let us compare the impact of a capital gains tax cut with an across-the-board tax cut of the variety often put forward as "middle-class tax relief." Cuts in the capital gains tax rate may reduce the cost of capital required by firms'

shareholders, since the tax bite will be smaller on the appreciation in firm value that results from investment. But, as indicated above, the empirical effect of the cost of capital on investment may be small. Moreover, the impact of cutting capital gains taxes on aggregate spending will likely be small. As is widely discussed, most capital gains income accrues to relatively wealthy individuals whose consumption spending is not likely to change much as the result of marginally lower taxes. In contrast, a middle-class tax cut has little direct influence on the cost of capital. However, this type of broad, consumer-oriented tax cut may stimulate spending and increase firms' sales, improving the investment climate through the accelerator effect. This channel of influence could well be more important empirically than the "cost of capital" effect that receives much more attention in policy debates.

Similar arguments can be made about the impact of government spending and the federal budget deficit. Theoretically, deficit spending hurts investment through the cost of capital channel as government borrowing increases interest rates and "crowds out" private investment. But, again, this effect may be weak empirically. Deficit spending also stimulates demand and sales, however, leading to more investment through the accelerator effect, which is strong empirically. Therefore, it is not clear that a public capital accumulation program designed to improve education and national infrastructure, for example, will crowd out private investment, even if it is financed by an increase in the deficit. Through the accelerator effect, such a policy may lead to ***more*** private investment.[11] These observations suggest the need for good information about the empirical strength of the cost of capital channel versus the accelerator channel in the determination of investment, an issue we shall examine in detail later in this report.

Many economists would qualify this discussion in an important way. On the one hand, the effects of the accelerator, though empirically strong, are widely viewed as temporary, applying to transient circumstances when the economy operates below full employment of its labor and capital resources. On the other hand, the cost of capital effects, although they are weaker empirically, are permanent in neoclassical theory, and they affect the desired stock of capital even at full employment. Some would argue, therefore, that policies designed to insure the long-run health of the economy should emphasize the cost-of-capital channel.

There are several important reasons, however, why such a focus could mislead policy design. At the time of this writing, the economy has suffered an extended period during which resources were far from fully utilized. The sacrifice imposed by the slack economy in terms of material standards of living and, perhaps more importantly, the national sense of well-being has been substantial. An important objective of investment policy over the short to medium horizon must be to invigorate the

economy by creating jobs, improving productivity, and increasing incomes. There is little doubt that the accelerator effect is much more important than the cost of capital in this regard. To be more specific, the economy's interest may be much better served by a tax policy that gives a strong and reliable boost to investment over a three- to five-year horizon (the typical operative period for the accelerator) than a policy that may have a more persistent effect, but one that is weaker and less certain (through the cost of capital).

Indeed, the argument for greater emphasis on the accelerator may go even deeper because it is not clear that its effects are necessarily short term. The view that investment stimulus through the accelerator is temporary relies on the assumption that the economy will eventually converge to a full employment equilibrium as a result of its own natural adjustment mechanisms. Moreover, the output and employment forthcoming in this long-run equilibrium are largely independent of how the economy has performed in the recent past. There are good reasons to question both of these critical assumptions.

The natural stabilizing forces in the economy that are usually assumed to restore full employment can be quite weak, and they may be dwarfed by destabilizing channels.[12] If this is the case, investment stimulus through the accelerator could have a prolonged effect by pushing the economy toward full employment when it otherwise might have continued to stagnate. These good results may not occur if policymakers ignore the need for explicit stabilization policy, benignly relying on the weak stabilizing forces of the market alone. Indeed, this perspective is consistent with current concerns about the anemic pace of economic recovery in the U.S. during 1992 (if the economy is recovering at all). Earlier in the recession, many forecasters discouraged the use of fiscal stimulus to fight slow-growth problems because of the deficit. Now, after over three years of stagnation, the group of "economic advisers still sticking to the 'just wait, things are about to get better' school is shrinking" (Wessel 1992, p. 1).

In addition, even if the economy would get to a long-run, full-employment equilibrium on its own, the short-run performance of the system may impact the character of its long-run equilibrium. Such effects arise because short-run performance affects the extent of technical progress (which is also tied to the level of investment), and the productivity of labor through "learning by doing" effects. As Frank Hahn recently wrote, "we do not have to settle for the historical determinism entailed by unique steady state growth rates" (1990, p. 35). Furthermore, in an open economy, short-run weak investment of a domestic industry relative to foreign competitors could cripple the industry permanently.[13] We must not, therefore, discount the importance of what are usually viewed as "short-term" fluctuations of investment

or employment because we believe that all will be well in some unchanging long-run steady state, the character of which is independent of shorter-term problems suffered by the economy. Short-run macroeconomic weakness can have long-run consequences.

Channel Three: Finance and Investment

Recent developments in research on the link between financial markets and investment also suggest a need to re-examine the economic foundations of investment policy debates. Much of the mainstream empirical research on investment is based on the assumption that firms can obtain financing for any investment project they believe is profitable (when the project is evaluated at a cost of capital based on market interest rates). New theoretical and empirical research, however, has made important advances in studying what are often called "financial constraints." The idea that the access to finance may pose a constraint on investment, independent of traditional determinants such as interest rates, taxes, and technology, now has wide (though not universal) support among economists.[14]

Suppose that a firm does not have sufficient internal cash to undertake a desirable investment project. It must then seek funds from external sources, either new borrowing or stock issues. External finance, however, may be more costly than internal funds for a variety of reasons.[15] Undoubtedly, there are transaction costs associated with external finance because of firms' need to work with financial intermediaries that must cover their own costs and make a profit on the deal. Estimates suggest these costs can be quite substantial. Therefore, an investment project that would be undertaken when the firm has sufficient internal cash to finance it may be postponed, or not undertaken at all, if the firm must rely on more costly external funds.

Recent literature has emphasized even deeper reasons why financial constraints on investment may arise. Many of the problems center on different ("asymmetric") information available to borrowers and lenders that can lead to many nontraditional results. For example, credit may be "rationed," meaning that interest rates do not equate the supply and demand for loans, leaving some firms without finance and constraining their investment. Furthermore, the ability of a firm to undertake an investment project may depend not only on the economic fundamentals of the project under consideration, but also on the firm's financial condition. Again, projects in which firms would invest if they had sufficient internal funds might not be undertaken if the firm must raise external funds to finance the project.

This research program has also spawned new empirical work examining the importance of finance. The results strongly support the idea that firms' financial condition matters. In particular, recent work has demonstrated the link between

investment and internal cash flow, variations of which are determined largely by profits. Moreover, this link is most important for relatively small, fast-growing firms that are likely concentrated in the most progressive sectors of the U.S. economy, but that also face the most severe information problems,

These developments have a direct impact on policy analysis. If firms face finance constraints, policies that affect the cost of capital in centralized securities markets (the deficit or saving initiatives, for example) may not be relevant to many firms that cannot borrow in such markets. Access to centralized securities markets is least likely for fast-growing firms in new, relatively high-technology industries. But presumably these firms are the most important in enhancing U.S. growth and international competitiveness, and therefore they deserve special attention in the policy discussion. Furthermore, tax policy may affect investment through very different channels than those emphasized by the mainstream view. The impact of taxes on the availability of low-cost internal finance for firms may be of greater importance than the tax effects on the cost of capital (see Fazzari, Hubbard, and Petersen 1988a and Petersen 199 1).

Finance constraints also set up another channel through which accelerator effects operate. Fluctuations of internal finance are driven by fluctuations of profits, which move strongly with the business cycle.[16] Therefore, recessions have an indirect but important effect on investment because they hamper firms' ability to finance investment from internal profits. The financial problems that often arise in recessions also probably raise the cost and limit the amount of external credit that firms can obtain. The recent "credit squeeze" is a case in point.[17] These observations imply again that the impact of fiscal policy on the course of the business cycle may be a much more important channel of influence for investment than effects that work through the cost of capital.

Financial effects on investment interact with the business cycle in another, more subtle way. Profit (or cash flow more broadly) is not the only source of internal finance for investment. Firms can also finance capital spending by reducing the amount of other assets they hold. For example, if firms face a downturn in cash flow but want to maintain investment spending without resorting to new borrowing or stock issues, they can sell off (or simply not replace) inventories, reduce their cash holdings, or tighten their policies on collecting accounts receivable. The funds released by these reductions in liquid assets can be used to temporarily "smooth" a firm's investment spending.[18]

The extent to which this kind of behavior can occur depends on how liquid firms are as they go into a recession. Firms' ability to cushion investment against downturns in cash flow will be lower if they hold fewer liquid assets or are more

heavily indebted going into the recession. Again, this point is particularly relevant to current conditions. Coming into the early 1990s, US. corporations had lower inventory stocks and much higher debt than in recent history. Thus, their liquidity was low. And, as shown in Figure 1, investment as a percentage of output fell to lower levels in the recent slow growth and recession period than it did at any time since the end of the Second World War. The debt overhang, therefore, and policies that contributed to it (the tax deductibility of interest and some kinds of financial deregulation, for example) have likely increased the sensitivity of investment to cyclical downturns by reducing firm liquidity. This metamorphosis of financial circumstances increases the importance of macroeconomic fluctuations for investment, and it correspondingly magnifies the role of policies that both create and contain the business cycle.

Empirical Evidence on the Determinants of Investment

Motivation and the Data

The theoretical analysis summarized in the previous section identifies a number of channels through which policy may have an impact on investment. Many of the papers cited above provide empirical evidence that can be used to sort through the relative effectiveness of the various channels and thus provide a quantitative basis for policy proposals. But this evidence tends to be fragmented and results are often inconclusive or contradictory.

Moreover, even though the analysis of investment determinants is fundamentally a microeconomic issue about the behavior of individual firms, the vast majority of the empirical studies on these issues are undertaken using aggregate data, often under the assumption that the entire economy behaves "as if" it could be described by a single "representative firm." Obviously, this approach precludes any evidence to support the view that heterogeneity among firms is important for policy purposes. While some studies do analyze firm-level data, they usually do not cover enough of the economy to support strong conclusions for macroeconomic policy.

For these reasons, this section presents some new empirical evidence on the determinants of investment to shed statistical light on the issues raised previously. The primary innovation in the approach taken here is in the data analyzed. The data sample is constructed from the "full coverage" files of the Standard and Poor's COMPUSTAT database. It provides information for over 5,000 U.S. manufacturing firms from 1971 to 1990 (about 53,000 observations). Over this period, the total capital spending by these firms accounts for 42 percent of total U.S. fixed-capital

investment.[19] Therefore, these data capture a large part of the economy. This extent of macro coverage is greater than any previous study of U.S. investment with firm-level data. More will be said later about how to generalize the results to the rest of the economy.

To measure the sensitivity of investment to the major determinants discussed previously, the investment regression includes three sets of variables: the cost of capital, sales growth, and firms' internal cash flow. The cost of capital variables, interest rates (adjusted for tax effects in some cases), reflect the conventional channels for policy influence on investment. The sales growth variables are suggested by the accelerator theory.[20] The effect of internal cash flow represents the importance of finance constraints: when firms have higher cash flow, they will have greater control over their investment spending because they depend less on external funds (new debt or stock issues) that may be excessively costly, or even impossible to obtain.[21]

The regression equations presented here are called "reduced forms" in the literature. That is, they simply relate the dependent variable, firm investment in this case, to various determinants suggested by theory without imposing any particular structure on the empirical relationship.[22] This approach has been criticized for purposes of policy analysis because new policies may change the empirical parameters estimated from data generated under the old policies. This problem is called the "Lucas critique" in the literature, after Robert Lucas whose work emphasized these issues. After obtaining results and considering their significance for policy, we must consider how proposed policy changes might affect the economic structure that generates the empirical results.[23] Also, one should not base judgements on small or highly uncertain effects. Most of the analysis pursued here emphasizes results which are extremely strong from a statistical perspective. In this sense, the use of a large sample of firm data helps to overcome the problems because the size of the database greatly increases the statistical significance of the results relative to studies based on aggregate data.

Firm Heterogeneity

To address the possibility that the importance of various determinants of investment will likely differ across firms, I have divided the sample into groups based on each firm's average real sales growth. This is only one of a number of interesting sample splits, but it is particularly appropriate for the purposes of this research. We are interested in the effects of fiscal policies on investment across firms with different potentials to contribute to the long-run growth of productivity, employment, and

TABLE 1
Characteristics of Sample Firms
by Sales Growth Class

Variable	Growth Class			
	Negative Class	Zero Class	Moderate Class	High Class
Percent of Observations	19.1%	21.0%	36.8%	23.1%
Percent of Investment	3.8%	19.1%	64.6	12.5%
Average Capital (millions of 1982 dollars)	$125	$420	$809	$175
Average Sales Growth	-4.3%	+0.6%	+4.3%	+11.2%
High Tech Percentage	34.3%	40.8%	45.5%	64.8%
Average Stock Price Growth	9.0%	9.2%	9.5%	11.6%
Average Employment Growth	0.6%	0.9%	4.5%	12.5%
Investment to Capital Ratio	0.117	0.153	0.196	0.319
R&D Spending to Capital Ratio	0.091	0.087	0.124	0.264
Share of R&D in Capital Spending	27.4%	25.0%	29.1%	37.0%

Source: Author's calculations from COMPUSTAT manufacturing firm database. See the econometric appendix for further details.

international competitiveness. Sales growth captures these characteristics. Fast-growing firms are the ones that have been successful at producing for changing markets. They are the ones that are most likely hiring new workers in the greatest numbers. They are the ones most likely to develop and adopt new technologies.

I split the sample into four groups. The details of the sales growth classification are given in the econometric appendix. The category of negative growth firms included all firms that contracted at an inflation-adjusted average rate of 1 percent or more over the sample period. **Table 1** shows that these firms accounted for approximately 19 percent of the observations, but under 4 percent of the total investment.

Real sales for zero-growth firms grew between negative 1 percent and positive 2 percent. The highest proportion of the observations, the majority of investment, and the biggest firms fell into the moderate growth class. These firms had real sales growth rates that averaged between 2 and 7 percent. The high-growth firms, with average growth rates above 7 percent were expanding very fast indeed (average sales growth above 11 percent).

Table **1** also provides statistics that highlight further differences between these groups of firms. Not only are the high-sales-growth firms expanding more quickly, they are also more concentrated in high-technology industries.[24] The higher growth classes provided much more employment growth over the sample period and their gross investment rate (plant and equipment spending divided by the capital stock) was much higher. The stock market value of firms in the highest growth class rose more quickly than for the other firms. Finally, research and development spending was much higher for the faster growing classes. Together these statistics show that the moderate growth firms, and especially the high-growth, represent the most progressive sectors of the U.S. economy. For this reason, their investment is likely crucial for productivity growth and international competitiveness and they deserve special attention in the policy analysis.

Regression Results

Summary results of the investment regressions appear in **Table 2.** The econometric appendix contains a discussion of the specifications used, the lag pattern, and standard errors. As found by other studies, the sales growth (accelerator effects) are

TABLE 2
Regression Estimates of Impact of Investment Determinants on the Investment-to-Capital Ratio by Sales Growth Class

Growth Class	Sales Growth	Cash Flow	Real Interest Rates
Negative	0.158	0.134	-0.002
Zero	0.179	0.204	-0.002
Moderate	0.287	0.248	0
High	0.361	0.329	0

Note: The depreciation rate was assumed to be 12 percent for all sales growth classes. This assumption is necessary to estimate the impact of profit changes on cash flow because cash flow includes depreciation as well as profits.

very strong. Also cash flow effects that capture the impact of financial constraints are quite important. Both the sales growth and cash flow effects are much stronger for the faster growing firms, a result that we shall discuss in more detail later in this study. One can overwhelmingly reject the hypothesis that these effects are in fact zero, with the positive estimated effect due simply to random variation (see the appendix for details). These results leave no doubt about the importance of sales growth and cash flow. In light of the Lucas critique, it is hard to imagine any policy change that would remove these effects.

The impact of real interest rates on investment, however, is much less certain. The evidence suggests that higher real rates cause investment to fall only for the negative and slow growth firms. Even weaker effects are obtained when one uses a cost of capital measure adjusted for taxation (see the results in the appendix). The interest rate estimates are also much less precise, meaning that the econometric analysis cannot pin down the size of these effects with a great deal of certainty. Further, although the regressions were also run with alternative interest rates, including the federal funds rate and the yields on treasury securities of different maturities, the results did not change materially. The econometric appendix contains more details about these tests. On the one hand, there is no strong evidence to reject the hypothesis that these cost of capital effects are zero. On the other hand, given the imprecise estimates, the effects could be negative and of a larger magnitude than those reported here, But we have no clear evidence of such effects, and it would be speculative to base policy on the assumption that interest rates drive investment to an important extent, especially for growing firms.

One possible reason for the imprecise estimates of the interest rate effects is that the regressions use rates determined in centralized securities markets (the Baa corporate bond yield adjusted for inflation, for the results in Table 2). The interest rates that individual firms face may well vary substantially from such centralized rates. For example, a firm that received a low credit rating will have to pay higher interest rates. If we could measure the actual rates paid by individual firms, we might be able to more accurately explain the effect of interest rates on investment. While this point is of interest for economic theory, it is not particularly important for policy purposes. If policy affects investment through interest rates, it certainly works through the interest rates set by the centralized securities markets (these centralized rates may then, in turn, drive firm-specific borrowing rates). If the deficit, for example, raises real interest rates and crowds out a substantial amount of private investment, then we should ultimately detect an impact of government bond rates on investment spending. Alternatively, policies designed to stimulate saving must work

through the aggregate cost of capital. One expects monetary policy to move federal funds rates and short-term treasury instrument yields, and these rates may affect long-term yields through various mechanisms of expectation. If these effects do not ultimately affect the investment of firms in this sample, or if such effects are weak, it is hard to see how they could be important for aggregate investment. Remember that the investment of firms in this sample accounts for over 40 percent of U.S. aggregate capital spending.

Furthermore, it is unlikely that the firms that are not included in the sample will be more affected by aggregate variables than the sample firms. COMPUSTAT tracks the firms with the most interest to the investment community. While the sample is extensive and contains much heterogeneity, the U.S. firms not included in the sample are probably smaller on average, with less access to centralized credit markets. Therefore, if any policy-induced effects of market interest rates or tax parameters on investment exist, they should show up in this sample.

Let us put these results into a more relevant perspective. First, consider the effect of the recent slow growth period in the U.S. How much variance of investment would these estimated equations predict as the result of disappointing recent economic performance? The long-term trend of real final sales growth for U.S. firms was 3.1 percent from 1970 to 1988. During the slow growth period from the second quarter of 1989 to the fourth quarter of 1991, final sales growth dropped to 0.3 percent. We can compute the predicted drop of investment from the estimated model as a result of the recent drop in sales growth alone. This calculation appears in the first column of **Table 3.** To estimate the effect of recent weakness on cash flow, note that after-tax real corporate profits through 1991 had dropped 30.3 percent from their

TABLE 3
Percentage Drop of Investment from Representative Changes in Investment Determinants

Growth Class	Sales Growth	Cash Flow	Real Interest Rates
Negative	3.4%	1.4%	3.1%
Zero	3.1	3.7	2.5
Moderate	4.0	6.5	0
High	3.0	10.1	0

1988 peak. The impact of this drop on predicted investment from our estimated model is in the second column of Table 3.

The statistics in Table 3 present a striking pattern. For reference purposes, aggregate non-residential investment fell by 7.5 percent in the 1982-1983 recession and it fell by 6.5 percent from 1990 to 1991 during the recent downturn. Thus, the simulated effects presented in Table 3 can easily explain investment fluctuations as large as those we have observed. (Note that the full effect of the recession is the *sum* of the sales growth and cash flow effects, which roughly equals or exceeds the drop of investment observed in recent downturns. However, this sum is merely an approximation of the effect of the recession due to the fact that the effects across firm classifications are not strictly additive since the recession would not affect the classifications equally). Perhaps more importantly, there is a substantial difference in the determinants of investment across firms with different growth characteristics. Sales growth is important at roughly the same magnitude for all firms. But cash flow is nearly eight times more important for the high-growth firms than the contracting class. The importance of heterogeneity in firm characteristics is clear in these results and such differences must not be ignored in policy discussions.

Now, let us consider interest rate effects. The major policy concern about interest rates and investment has been that the federal deficit or low private saving increased real interest rates, increased the cost of capital, and crowded out private investment. It is difficult to estimate how much high deficits or low saving caused real interest rates to change, since rates are determined by a wide variety of factors. Most analysts would probably agree, however, that a 200 basis point change in the real interest rate relevant for investment would be a very large policy-induced shift. Table 3 presents the impact of this change on investment as predicted by the estimated regression model. The effects are zero for the moderate and high-growth firms because the estimated coefficients on interest rates in their investment equations were zero. If we nonetheless assumed that these firms had the same interest rate coefficients that were estimated for the negative and zero growth classes, the percentage change of investment figures would be 2.0 and 1.2 percent for the moderate and high-growth firms, respectively.

Although the statistics in Tables 2 and 3 are not directly comparable, some broad conclusions can be drawn from them about the relative importance of sales growth, cash flow, and interest rates. Even for slow-growing firms, an estimate of possible policy influence on investment through large changes in the cost of capital is smaller than the impact of what has been described as a moderate recession. For the

growing firms, which undertake much more investment than the firms in the negative and zero growth classes, there is no statistically reliable impact of interest rates on investment, while the sales growth and cash flow effects are very large and very strong statistically. We now turn to the implications of these results for current fiscal policy debates.

Fiscal Policy and Investment

The research summarized in the previous section shows that the state of the business cycle and firms' access to finance strongly affect the path of fixed investment in the U.S. In contrast, the impact of the cost of capital, including tax incentives that modify firms' costs and returns from capital investments, is decidedly weaker, especially for fast-growing firms. What can we learn from these results that will help guide government fiscal policy in the coming years? Based on the findings of this study, the federal government should be guided by the following three broad lessons: (1) the importance of the business cycle for investment, (2) the likelihood that government deficits do not "crowd out" private investment to a substantial extent, especially in the current economic environment, and (3) the importance of designing "robust" policies to boost investment that will be effective through channels besides lowering the cost of capital, which is of questionable empirical strength.

The first lesson is that the path of investment *is* the path of the business cycle. Investment will be strong when firms perceive growing markets for their goods. A strong aggregate economy also supports profits and improves firms' ability to finance capital spending without relying on external funds. The empirical evidence summarized above provides strong evidence about the importance of these channels of influence on investment. If the economy stagnates because the Federal Reserve squeezes the economy in its zeal to reach zero inflation or if Congress and the President do not enact stimulative policy in a weak economy, one of the costs will be lower investment and, correspondingly, lower labor productivity and a weaker competitive position of U.S. firms in world markets.

Moreover, these costs are not necessarily temporary. Capital, by its nature is durable and takes time to build and install. Recession-induced downturns of investment may keep the capital stock below its long-run trend for many years, and the recession may even permanently affect the trend itself if economic weakness today reduces the rate of technical innovation and "learning by doing." The sacrifice of investment that inevitably follows a recession must be an important consideration in the debates over stabilization policy.

A realistic assessment of the determinants of investment also leads to a second lesson that changes the terms of what has become the dominant concern in post-Reagan fiscal policy: the huge and persistent federal deficit. In the minds of many analysts and policymakers, the chief problem with the deficit is that government borrowing "crowds out" private capital investment with obvious negative consequences for the economy. How might this happen? Government borrowing raises market interest rates, supposedly discouraging private capital spending. But if the sensitivity of investment to interest rates is weak, this effect is small. Furthermore, especially for an economy operating below full employment, the stimulative effects of the deficit on firm sales and profits probably outweigh the effect of rising interest rates.

Table 3 above roughly shows the effects of the recent recession on investment due to lower sales and cash flow. Table 3 also shows the (negative) effect of what would be a large deficit-induced rise in the real interest rate. For all groups of firms, the cyclical effects dominate the interest rate effects, but the difference is especially striking for the growing firms in the economy. If the recession could have been avoided by accepting a 200 basis point increase in the real interest rate as a result of enacting expansionary fiscal measures, the predicted impact on investment would have been favorable.

This analysis strongly suggests that concerns about investment should not stand in the way of policy initiatives that have important social value but that may also increase the deficit. Such policies include efforts to rebuild deteriorating American infrastructure and to invigorate education. As Robert Eisner (1992) argues, enhanced infrastructure and education will likely increase the productivity of private capital in the long run, which can only be good for investment.

Undoubtedly, there are virtues to reducing the deficit.[25] But, in spite of much current discussion, the results presented here suggest no reason to believe the deficit has had a large negative impact on investment. Policy discussions about the costs and benefits of deficit reduction need to be better informed about the relative importance of the various empirical channels through which the government's budget impacts private capital spending.

Further the results presented here show that certain kinds of policy initiatives designed to lower the cost of capital, especially those that exclusively focus on increasing saving, are an unreliable way to promote investment. Again, it is often taken for granted that more saving implies substantially more investment. Theoretically, this link occurs because higher saving lowers interest rates and reduces the cost of capital. For saving to have a large effect on investment, therefore, requires a

substantial sensitivity of investment to the cost of capital, which is not strongly supported by the data. Indeed, in our current economic condition, saving initiatives could well do more harm than good. From a macroeconomic perspective, more saving implies less consumption and weaker aggregate demand with lower sales growth and profits. As a result, policies that increase saving could, paradoxically, reduce investment, especially over a short to medium horizon.[26]

For example, the calls for a capital gains tax cut to stimulate investment rely on the view that lower taxes on the returns from capital will lower the price which savers require in order to make their funds available to investing firms.[27] But according to the results presented here, even a spectacularly successful saving initiative that lowered the real cost of capital by one or two percentage points would have a relatively small effect on investment for stagnant and contracting firms. For the progressive firms in the economy, there is no clear evidence that the lower cost of capital would have an important impact on investment.

On a more positive track, the third lesson suggests that because we cannot be certain about the relative strength of the determinants of investment, we should look for "robust" policy: initiatives which would be effective under a number of different views about how the investment process works. Cuts in the capital gains tax rate do not qualify as a robust policy. They will only be effective if investment is sensitive to the cost of capital.[28] More broadly, any attempt to increase investment by raising private or public saving, does not count as a robust policy because it relies exclusively on the questionable cost of a capital channel. Consider the investment tax credit, however. Re-establishing the ITC would reduce the cost of capital. But the ITC also puts cash in firms' hands that will increase cash flow and relax financial constraints.[29] This effect could well be more important for investment than the lower cost of capital, especially in new, high-technology firms that are most likely to face financial constraints (see Fazzari, Hubbard, and Petersen 1988a). Similar arguments can be made in favor of research and development credits (see Himmelberg and Petersen **1992).**[30] The fundamental question is this: why should we pursue policies to tinker only with the cost of capital, which have no strong empirical support for their effectiveness and usually have regressive distributional consequences, when we have the means to boost investment with policies that are effective under a number of different views of investment determinants?

Economic ideas matter for policy. But the particular ideas that dominate policy debates at any point in time are not necessarily those with the strongest empirical support. The view that the cost of capital constitutes the most important policy lever for the determination of private investment may be, unfortunately, an

example of a dominant hypothesis that underlies current policy positions even though it lacks strong empirical support. This report argues that in light of new evidence about the determinants of investment, the policy discussion should place greater weight on cyclical movements of the macroeconomy and financial conditions of the corporate sector and less emphasis on the questionable cost of capital channel. I believe such a shift of emphasis offers the best chance in the short run to restore healthy capital growth to the U.S. economy, with corresponding benefits for output, employment, productivity, and wages.

June 1993

Econometric Appendix

Definition of Sales Growth Classes

To limit the effect of extreme observations in the classification of firms, annual real sales growth figures in each year were capped between negative 20 and positive 20 percent. These limited sales growth data were then averaged for each firm. Firms were put into the negative growth class if their average was less than negative 1 percent. The zero growth class was based on averages from negative 1 percent to positive 2 percent. Moderate growth was designated by 2 to 7 percent growth, and high-growth firms had real sales growth that averaged over 7 percent.

Data Definitions

Investment (I) is capital spending on plant and equipment from the firms' sources and uses of funds statements. Sales (S) is total revenue from operations less discounts or returns. Cash flow (CF) includes after-tax profits, depreciation and amortization expense, extraordinary items, and deferred taxes. The sales data were deflated by the GNP deflator. Cash flow and investment were deflated by the implicit deflator for nonresidential fixed investment.

The capital stock (K) calculations used estimates of capital price inflation and economic depreciation to calculate a replacement value of capital. The method used was similar to that reported in Fazzari, Hubbard, and Petersen (1988b) with modifications to better account for acquisitions and divestitures and to measure depreciation more robustly.

The interest rate data used in the regressions reported in the text are the average yields on corporate bonds carrying Baa ratings taken from the 1991 ***Economic Report of the President.*** To estimate real interest rates (RBAA), the actual rate of change of the deflator for gross domestic product was subtracted from the nominal Baa interest rates. Additional tests were conducted using federal funds rates (real and nominal). The results for these alternative variables indicated weaker cost of capital effects than those for the real Baa rates, and there was virtually no effect of using the alternative cost of capital variables on the other results reported in the text.

Regression Sample Selection Criteria

All available annual data from COMPUSTAT for manufacturing firms (SIC codes 20 to 39) were put into the initial sample. The version of COMPUSTAT used to construct the sample included information from 1971 through 1990. The 1971 and 1972 data were used to construct lags and therefore the regression sample covers 1973-1990. Some observations were deleted because of major mergers or large inconsistencies in the accounting information. The regressions reported in the sample exclude outliers of the ratios used in the regressions defined as follows: Investment to Capital (I/K) exceeding 2.0; Real Sales Growth (SG) less than -75 percent or greater than 200 percent in a given year: Cash Flow to Capital (CF/K) less than -2.5 or greater than 2.5. These limitations reduced the sample by just over 5 percent. The regression results were much more robust after removing the outliers, especially for sales growth. The cash flow and cost of capital variables performed in similar ways in the full sample and limited samples. Tighter sample limits did not change the results materially.

Regression Specification and Estimation

The estimated regression equations had the form:

$$(I/K)_{jt} = a_j + (a_{10})\,SG_{jt} + (a_{11})\,SG_{jt-1} + (a_{12})\,SG_{jt-2} + (a_{20})\,(CF/K)_{jt} + (a_{21})\,(CF/K)_{jt-1} + (a_{22})\,(CF/K)_{jt-2} + (a_{30})\,RBAA_t + (a_{31})\,RBAA_{t-1} + (a_{32})\,RBAA_{t-2}$$

where the variables are defined as above. The a symbols represent estimated coefficients. Thej subscript indicates different firms: *t* indexes time periods. Because the intercept term was allowed to vary across firms, the estimator used captures time-series variation (the "within" fixed-effects estimator for panel data). The regression results reported in the text are the sum of the coefficients on the contemporaneous and two annual lags for each variable. The regression was estimated by ordinary least squares, although a two-stage least squares estimator (2SLS) was used to test whether endogeneity of the current interest rates affects the results, The 2SLS results did not indicate any substantial change in any of the reported statistics.

APPENDIX TABLE 1

Dependent Variable: (I/K),

Independent Variable	Negative Growth	Zero Growth	Moderate Growth	High Growth
SG_{jt}	0.070 (10.1)	0.092 (12.7)	0.151 (23.7)	0.203 (17.9)
SG_{jt-1}	0.057 (8.3)	0.068 (9.7)	0.090 (14.6)	0.111 (10.6)
SG_{jt-2}	0.03 1 (4.6)	0.019 (2.8)	0.046 (7.9)	0.047 (4.9)
CF/K_{jt}	0.033 (6.7)	0.061 (11.0)	0.068 (14.0)	0.110 (14.5)
CF/K_{jt-1}	0.060 (12.4)	0.087 (14.9)	0.110 (20.3)	0.158 (17.6)
CF/K_{jt-2}	0.041 (9.2)	0.056 (9.9)	0.070 (13.0)	0.061 (6.5)
RBAA,	-0.002 (2.2)	-0.001 (1.2)	0.002 (1.9)	0.005 (3.0)
$RBAA_{t-1}$	0.002 (1.1)	0.001 (0.9)	0.0003 (0.3)	0.003 (1.1)
$RBAA_{t-2}$	-0.002 (2.2)	-0.002 (1.8)	-0.002 (2.7)	-0.008 (4.7)
Adjusted R-Squared	0.127	0.165	0.181	0.228

Note: T-statistics are in parentheses.

Regression Results

Complete regression results for the specification analyzed in the text are as follows. The estimated t-statistics for the null hypothesis that the coefficient on each variable is zero are in parentheses below the parameter estimates. The adjusted R-squared figures do not include the explanatory power of the fixed effects. As mentioned in the text, it is clear that the statistical significance of the SG and CF/K variables is much stronger than the cost of capital variables. Specifications with different interest rates and different lag lengths led to quite similar results. The results

below are from a specification that uses a tax-adjusted cost of capital (COC), computed along the lines suggested by Jorgenson and Yun (1989), in place of the real interest rate variable. This variable corrects for the investment tax credit, tax deductions due to depreciation, corporate taxes, tax deductibility of interest, and the differential personal tax treatment of dividends and capital gains. Comparing the COC results with the Baa results presented above shows that tax adjustments weaken the empirical case for the view that higher capital costs significantly reduce investment.

APPENDIX TABLE 2

Dependent Variable: $(I/K)_{jt}$

Independent Variable	Negative Growth	Zero Growth	Moderate Growth	High Growth
SG_{jt}	**0.068** **(9.7)**	**0.089** **(12.2)**	**0.146** **(22.7)**	**0.193** **(16.9)**
SG_{jt-1}	**0.034** (8.7)	**0.070** **(9.9)**	**0.087** **(14.2)**	**0.105** **(10.0)**
SG_{jt-2}	**0.034** (5.1)	**0.022** (3.1)	0.048 (8.1)	**0.047** **(4.9)**
CF/K_{jt}	**0.035** (7.1)	**0.063** **(11.4)**	**0.069** **(14.2)**	**0.111** **(14.6)**
CF/K_{jt-1}	**0.061** **(12.6)**	**0.088** **(15.1)**	**0.111** (20.4)	**0.157** **(17.5)**
CF/K_{jt-2}	**0.043** (9.5)	**0.059** (10.4)	**0.07 1** **(13.2)**	**0.063** (6.7)
COC_{t}	**0.002** (2.8)	**0.002** (2.3)	**0.002** (3.4)	0.005 (3.9)
COC_{t-1}	**-0.001** (1.5)	**-0.0002** (0.2)	**0.001** (2.4)	0.002 (2.0)
COC_{t-2}	**-0.001** **(2.2)**	**0.0000** (0.1)	**0.001** (1.1)	**0.001** **(1.1)**
Adjusted R-Squared	**0.126**	**0.164**	**0.182**	**0.226**

Note: T-statistics are in parentheses.

Endnotes

1. The author thanks Eileen Appelbaum, Dean Baker, Robert Carpenter, John Caskey, Bruce Petersen, Mark Vaughan, and Murray Weidenbaum for helpful comments on earlier drafts of this paper. Andrew Meyer provided outstanding research assistance in reviewing the relevant literature and assembling the data used here.

2. Wessel (1992, p. 1) claims that President Clinton's challenge is to "find a way to stimulate the economy without frightening financial markets so much that they push up interest rates, retarding the economy just as Mr. Clinton is attempting to arouse it. This may prove impossible."

3. In principle, tax changes to stimulate saving need not be regressive. For example, a consumption tax with steeply increasing tax rates as consumption rises could increase the progressivity of federal taxes for many individuals. In practice, however, most proposals on the table designed to increase saving, the capital gains tax cut in particular, provide greater benefits to individuals with higher incomes.

4. As of this writing, the growth rate of U.S. real gross domestic product has not exceeded three percent for thirteen quarters (1989:2 through 1992:2) and has exceed two percent only twice in this period. This growth rate averaged only five-tenths of one percent over this period. Unemployment has been trending upward from mid-1990 to mid-1992.

5. Some government policies may affect technology, but this issue is outside the scope of this report.

6. This assumption is quite standard, but it can be questioned, especially if the economy is operating below full employment. I assume here that deficits do increase real interest rates and then I estimate the effect of this increase on investment. If deficits do not increase real interest rates substantially, the analysis presented here still applies, but the focus of the policy discussion will be somewhat different.

7. The Tax Reform Act of 1986 removed the personal tax exclusion for capital gains income. Nevertheless, capital gains income still enjoys a substantial tax advantage because shareholders can defer taxes on the increase in the value of assets until they sell these assets and heirs pay no capital gains taxes on assets held until death. The size of this benefit rises the longer one holds an appreciating asset. See Auerbach (1992) for further discussion.

8. See, for example, the treatment in Jorgenson and Yun (1989). A less technical explanation for many of these tax adjustments, and a discussion of how they were affected by the Tax Reform Act of 1986 can be found in Fazzari (1987).

9. More recently, much empirical work on investment has focused on the estimation of "Euler equations."

10. This concept goes back at least to Clark (19 17).

11. Further stimulus to private investment from infrastructure spending will arise if public capital enhances the productivity of private capital. For example, better water and sewer systems probably increase the productivity of manufacturing plants. Robert Eisner (1992) makes similar arguments.

12. The primary stabilizing factor is price adjustment. The relevant references are too numerous to include here. See Caskey and Fazzari (1987) and Tobin (1991) for more information.

13. This point is an application of the more general concept of "first-mover" advantages; its relevance for the link between investment and finance is discussed in Fazzari and Petersen (forthcoming 1993).

14. Although the resurgence of interest in this topic is relatively new in the economic mainstream, it is prominent in earlier ideas about investment, going back at least to Keynes (1936). See also Meyer and Kuh (1957) and Minsky (1975).

15. For a more extensive discussion of the ideas and results presented here, and for additional references, see Fazzari, Hubbard, and Petersen (1988b).

16. From 1971 through 1990, the correlation between real growth in corporate profits and GNP was 73 percent. Over the same period, a one percentage point change in GNP growth was associated with just under a five percentage point change in corporate profit growth.

17. See Bernanke and Lown (199 1) for a statistical analysis of the credit squeeze and some ideas about its causes.

18. This argument is discussed in detail and supported by empirical evidence in Fazzari and Petersen (forthcoming 1993).

19. Because of changes in the number of firms tracked over time, the proportion of aggregate fixed investment covered by the sample changes. It peaks at 49.2 percent in 198 1, the low point is 36.1 percent in 1973.

20. Most accelerator models relate the level of investment to the level or the difference in sales. At the firm level, however, this relation depends on the firm's capital-output ratio. This ratio can differ substantially across firms. Under the assumption that the capital-output ratio is constant for a particular firm, but not the same across firms, the relation between the investment-capital ratio and sales growth captures the accelerator effect.

21. See Fazzari, Hubbard, and Petersen (1988b) and Fazzari and Petersen (forthcoming 1993) for extensive discussion of how to interpret the cash flow-investment link. In particular, these papers analyze how to distinguish financial effects on investment from the possible role played by cash flow as a proxy for factors that shift investment demand.

22. One must assume a functional form for the regression equation. It is usually linear, which can be viewed as a general approximation to more complicated functions.

23. Another approach to address the Lucas critique employs economic theory to derive empirical specifications that allow estimation of parameters that do not vary with policy changes. But one can usually identify such specifications only under restrictive assumptions. The particular issues involved are beyond the scope of this paper. Briefly, to capture the effects of a variety of important issues (the importance of financial constraints or heterogeneity across different kinds of firms, for example), it would be difficult, if not impossible, to use an approach that solved the problems of the Lucas critique in all respects. Moreover, attempts to overcome some of the Lucas critique problems along these lines would necessarily impose very restrictive assumptions on the analysis, that have often been rejected in other empirical work on investment.

24. I considered an observation in a high-technology industry if the firm's primary standard industrial classification (SIC) 2-digit code was 28 (chemicals), 35 (machinery), 36 (electrical components), or 38 (instruments). See Himmelberg and Petersen (1992) for a further discussion of these industries and for additional references.

25. Two of the most obvious and substantive concerns about the deficit are the regressive distributional effect of broad-based taxes levied to pay interest on the national debt and the international distributional consequences of foreign holding of U.S. government assets. In addition, if reduced deficits do lower interest rates, this could reduce the exchange value of the dollar and bolster exports and international competitiveness.

26. In addition, to be effective, saving initiatives must be directed toward those who have the potential to save, which often means they benefit the relatively well-off groups of society disproportionately. Therefore, new saving stimuli would likely exacerbate the regressive distributional thrust of U.S. fiscal policy over the previous decade. See Blecker (1990) for an assessment of the link between saving and U.S. macroeconomic performance.

27. Another argument often made for cutting capital gains taxes is that the allocation of investment will be improved by lowering what is often called the "lock-in" effect. Because capital gains are taxed only when assets are sold, the capital gains tax creates an incentive to hold on to assets longer than might be optimal. But as Auerbach (1992) discusses, this problem could be solved by taxing capital gains at the time they are accrued rather than when they are realized by asset sales. The lock-in effect alone is not an effective justification for lower capital gains tax rates.

28. Some economists have suggested that the capital gains tax rate operates through an alternative channel by stimulating venture capital. A detailed analysis of this idea is beyond the scope of this paper. I note, however, that venture capital accounts form a very small proportion of investment finance in the U.S. Moreover, the benefits from an overall capital gains tax cut would accrue overwhelmingly to the owners of assets that do not qualify in any sense as venture capital.

29. William Vickrey (1992, p. 307) favors cutting or eliminating corporate taxes as opposed to capital gains initiatives for similar reasons. One way to understand this issue more formally is to recognize that in the conventional view, taxes matter for investment because they affect the effective price of new capital: that is, taxes on marginal investment are what matter. But if a tax cut is more important empirically for investment because lower taxes increase cash flow, rather than because lower taxes reduce the cost of capital, the average tax burden on firms is what matters. This point is made by Fazzari, Hubbard, and Petersen (1988a). Petersen (199 1) provides empirical evidence that the cash flow impact of tax cuts is indeed important for investment.

30. One could also argue that accelerated depreciation allowances qualify as a robust investment stimulus because they simultaneously lower the effective cost of capital and improve firms' after-tax cash flow. But depreciation rules can have complicated allocational effects on capital spending. The over-building of commercial real estate in the 1980s as the result of excessively generous depreciation allowances is a case in point. Because of its simplicity, therefore, I prefer a strong investment tax credit to accelerated depreciation. As DeLong and Summers **(1991)** argue, this incentive may be most effective if applied to equipment spending, which seems to have had the greatest historical effect on long-run growth.

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