Business Tax Incentives and Investments

by

Thomas Karier*

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*The Jerome Levy Economics Institute and Eastern Washington University

Abstract: For more than twenty years, U.S. tax policy offered businesses a credit based on a percentage of investment in equipment. The stated purpose of the investment tax credit was to encourage investment as a means to further modernization, job growth, and competitiveness. The results of this study, however, indicate that investments were not significantly higher when the credit was in force than during periods when it was not. While the credit may have increased the rate of return on equipment investments, additional tests fail to find an increase in investment spending due to this particular incentive. The results also suggest that only a small fraction of additional corporate income generated by the credit was likely to have been spent on investment.

Given the need to encourage investment spending, especially during recessions, alternatives to investment tax credits should be pursued. A logical alternative is a broader program of public investment in education, infrastructure, and research.

> The purpose of the investment tax credit is "to encourage modernization and expansion of the Nation's productive facilities and thereby improve the economic potential of the country, with a resultant increase in job opportunities and betterment of our competitive position in the world economy." The Revenue Act of 1962.

There are few macroeconomic disorders for which a large injection of investment spending is not considered a suitable remedy. Keynesians well understand that a surge of investment spending can bolster aggregate demand and revive a stagnating economy. Supply side economists hold the additional view that inflation is best prevented by the production of abundant goods and services, for which investment is an obvious prerequisite. Investment is also essential to ensure long-run growth and higher productivity. Finally, there is the widely heard argument that high levels of investment are necessary to ensure the competitiveness of U.S. corporations as they engage foreign rivals in the contest for world market shares. It would be difficult to exaggerate the range of benefits commonly attributed to investment spending.

Given the goal of expanding investment, how does one ensure that it will be forthcoming in sufficient quantity? Only government investment, including education, infrastructure, and research is amenable to direct and immediate manipulation. Most of the remaining investment in the private sector is determined by the disparate actions of hundreds of large firms and, to a lesser degree, hundreds of thousands of smaller ones. Efforts to promote investment in the private sector, have by necessity, resorted to indirect measures such as tax incentives.

The purpose of this research is to determine the effectiveness of one of these efforts, the investment tax credit. The implementation of this credit from 1962 to 1986 constitutes an important experiment in economic policy. During this period, firms were permitted a credit against their income tax liability equivalent to a percentage of their investment in machinery, equipment or furniture. Excluded from the tax credit were buildings, structural components, and intangible property.

The most difficult policy to assess is one that never changes over time. Fortunately this is not the case for the investment tax credit. After being introduced in 1962, the credit was suspended from October 1966 to March 1967, terminated from April 1969 to August 1971, and finally eliminated in 1986. What began as a 7 percent credit in 1962 was increased to 10 percent in 1975. In addition, the original law in 1962 required a reduction in the depreciable or basis value of the investment equivalent to the size of the credit. This requirement was dropped in 1964 and partially reinstated in 1982 with a required reduction in basis value equivalent to half the credit. Additional restrictions were applied to certain industries as well as to short-lived assets and investments outside the United States. All of these changes and qualifications may have created headaches for tax accountants but they enrich the quality of the experiment by increasing the variation in the credits over time.

How Credits Work

There are three primary ways in which the investment tax credit is believed to stimulate investment. The first occurs in response to a change in the cost of capital, or what is generally referred to as a price effect. By effectively reducing the price of additional capital and raising the rate of return, the tax credit is expected to stimulate additional investment. The actual response may still be insignificant if either the change in the cost of capital is small or demand is relatively unresponsive to price changes.

Statistical studies conducted in the late 1960s were likely to find a strong price effect for credits, largely due to the growth of investments following the introduction of the investment tax credit in 1962. But this evidence is at least partially suspect since the credit was introduced in the wake of the 1960-61 recession, a time when investments were far more likely to rise than fall.

A second possible means by which an investment credit can affect investment is through cash flow. By this mechanism, a firm qualifying for the tax credit reduces its tax liability, thus raising its after-tax profit. This income is then available for capital investment. But it can also be used for other purposes, including paying higher dividends, making financial investments, buying back outstanding stock or bonds, or financing acquisitions. The question concerning the income effect is: how much of additional corporate income is spent on capital investment?

A third link between capital expenditures and tax credits is based on the general Keynesian multiplier effect. Any expansion in the government deficit may create a short-run stimulus sufficient to boost aggregate demand and spark higher levels of investment spending. The effectiveness of such a deficit depends primarily on the state of the economy, such as the level of unemployment. It also matters whether the credits are absorbed by the corporation, distributed to stockholders or passed through to consumers in lower prices. While some of these issues are investigated later, it is presumed that the multiplier effect of an investment tax credit will resemble that of any other corporate tax cut. The focus, therefore, is on whether the investment tax credit provides an additional incentive to invest, above and beyond the conventional fiscal stimulus induced by a corporate tax cut.

There are two related measures of equipment investment spending that could be affected by tax credits. It is conceivable that a tax credit could increase the share of the nation's output dedicated to producer's equipment or it could raise the annual rate of growth in investment spending. Both of these variables, equipment shares and equipment growth, are considered in this study.

There is also a question of whether equipment and GDP should be adjusted separately for relative prices when calculating investment shares. This matters only because equipment prices have diverged from GDP prices over the course of the past forty-five years. In theory, the tests could be conducted using either nominal values or real values as long as relative prices are included in the model.[1]

Equipment Shares

The historical pattern between equipment investment and the investment tax credit (ITC) is presented in Figure 1. Equipment investment is measured as a share of GDP and both are adjusted using appropriate price indices. The investment tax credit is essentially a rate: the value of credits claimed by corporations divided by expenditures on producer's durable equipment.[2] The pattern for the ITC in the figure captures several important events: the suspension from 1969 to 1971, the increase from 7 percent to 10 percent in 1975, and the final repeal in 1986. The figure also shows that real equipment spending climbed erratically from 4.4 percent in 1961 to 7.6 percent in 1992. While the beginning of this ascent corresponds with the passage of the investment tax credit in 1962, the trend continued even after the credit was repealed in 1986.[3]

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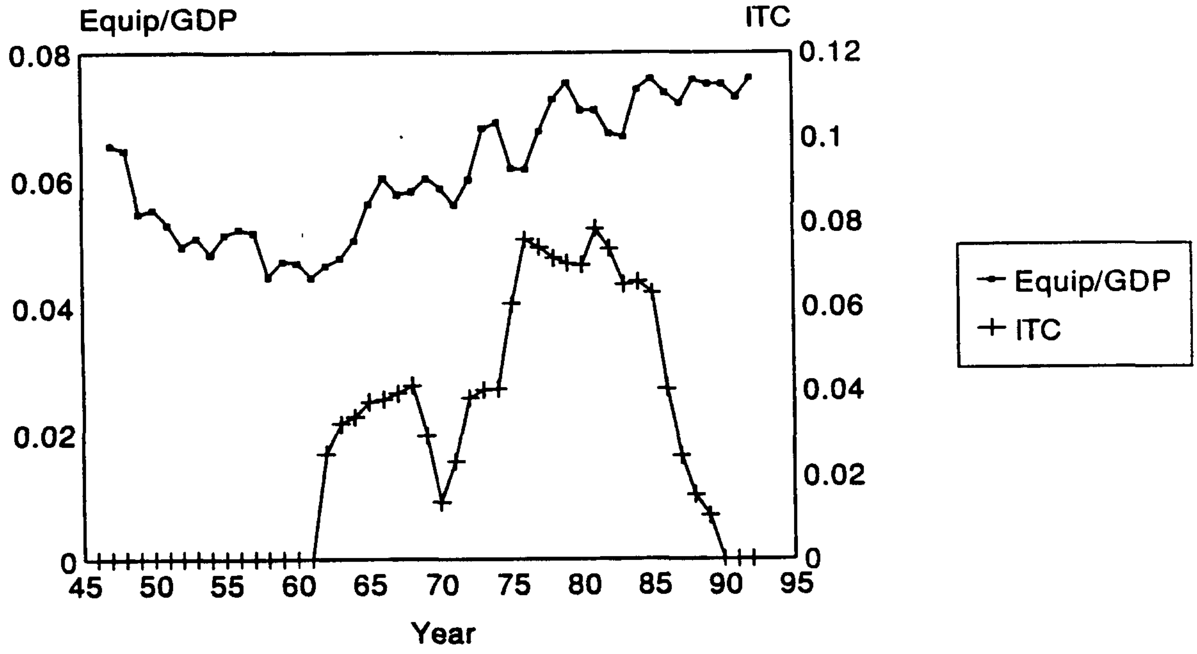
[1] In nominal terms, the ratio of equipment investment to gross domestic product is written as (E/Y) and in real terms (E'/Y'). The two ratios are related in the following form,

$E/Y = (E'/Y')(P_E/P_Y)$ where P is price.

Therefore it shouldn't matter which ratio is used as long as the relative price (P_E/P_Y) is also accounted for.

[2] After 1983, the investment tax credit, reported by the U.S. Internal Revenue Service, was combined with other business credits. This is one of the reasons why it doesn't fall to zero in 1986.

Figure 1
Equipment Shares of GDP and Investment Tax Credits



Note: Equip/GDP is equal to producer's durable equipment divided by GDP, both adjusted for inflation. ITC is equal to total corporate investment tax credits divided by equipment investment. Sources: National Income Product Accounts (NIPA) and Corporation Income Tax Returns, IRS.

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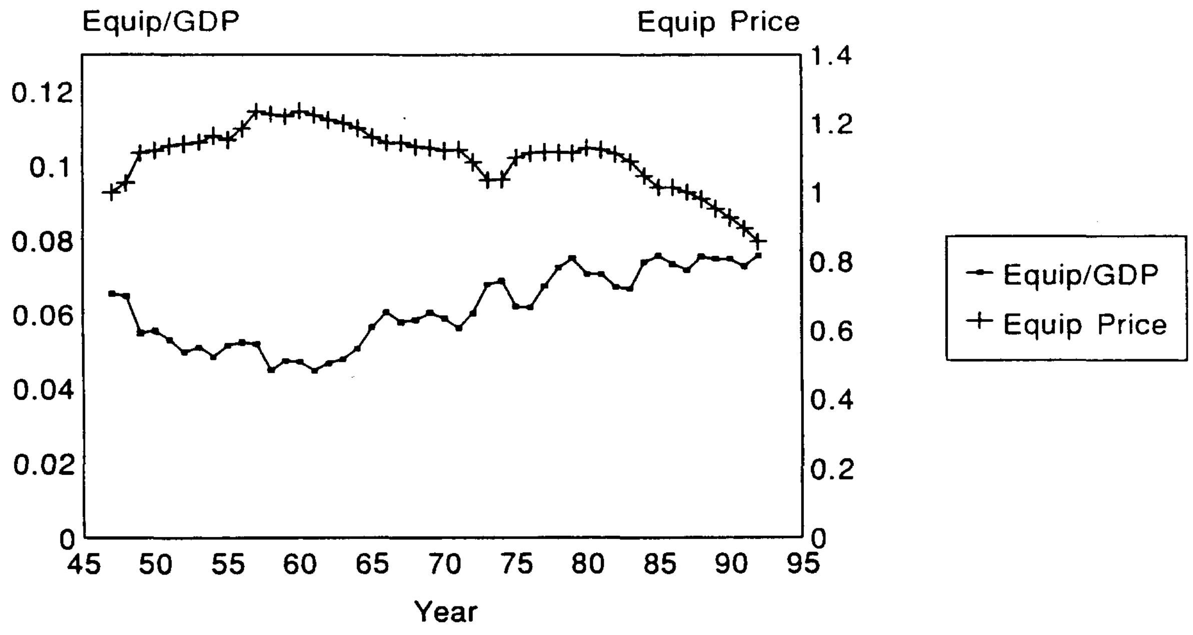
[3] The correlation coefficient between the two variables is (.51).

In order to properly assess the impact of the ITC on equipment spending, other factors must be accounted for. A particularly important one is equipment prices.[1] As can be seen in Figure 2, the upward trend in real equipment investment from 1962 to 1992 coincides with a downward trend in equipment prices. This is one of the competing variables to explain equipment investments.

Figure 2
Equipment Shares of GDP and Prices



Note: Equip/GDP defined in Figure 1. Equip price is equal to the price deflator for producer's durable equipment divided by the price deflator for GDP.
Source: NIPA.

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[1] This is equal to the ratio of the price deflator for producer's durable equipment divided by the GDP deflator.

Equipment prices and the investment tax credit fall into the category of cost of capital variables along with real interest rates and marginal tax rates. Capital is relatively cheaper when tax rates, interest rates, and equipment prices are lower. Other variables that could influence equipment investment are corporate cash flow, which captures the income effect, and capacity utilization. It is anticipated that firms will be more likely to invest after excess capacity has been exhausted.

For the most part, these variables and analysis, described in Appendix A, follow conventional lines. There is, however, one innovation that warrants an explanation. Most studies of investment behavior rely on a single measure of capital costs. This has the unfortunate characteristic of combining current variables which should have a direct effect on investment--like equipment prices--with current variables that serve as proxies for future variables--like marginal tax rates and real interest rates. Instead, I chose to measure the effects of several of the most prominent components of the cost of capital as separate entities. This approach places the least restrictions on how firms actually process current information in developing future expectations.

The results of this statistical analysis demonstrate that investment levels are significantly higher when capacity utilization is high or equipment prices are low. Tax credits, whether included separately or in the full model, do not appear to have a significant effect on levels of equipment investment. The coefficient on investment tax credits was not significantly different from zero in either case. The coefficients on cash flow, real interest rates, and marginal tax rates were neither significant nor always the expected sign. There is no compelling evidence here of a strong impact of investment tax credits on levels of investment spending. Other results are discussed in more detail in Appendix A.

The absence of a strong positive effect of tax credits on equipment investment is an important result. However, it is equally important to consider the specific channels in which the credit is expected to work. To this end, we must investigate the price and income effects.

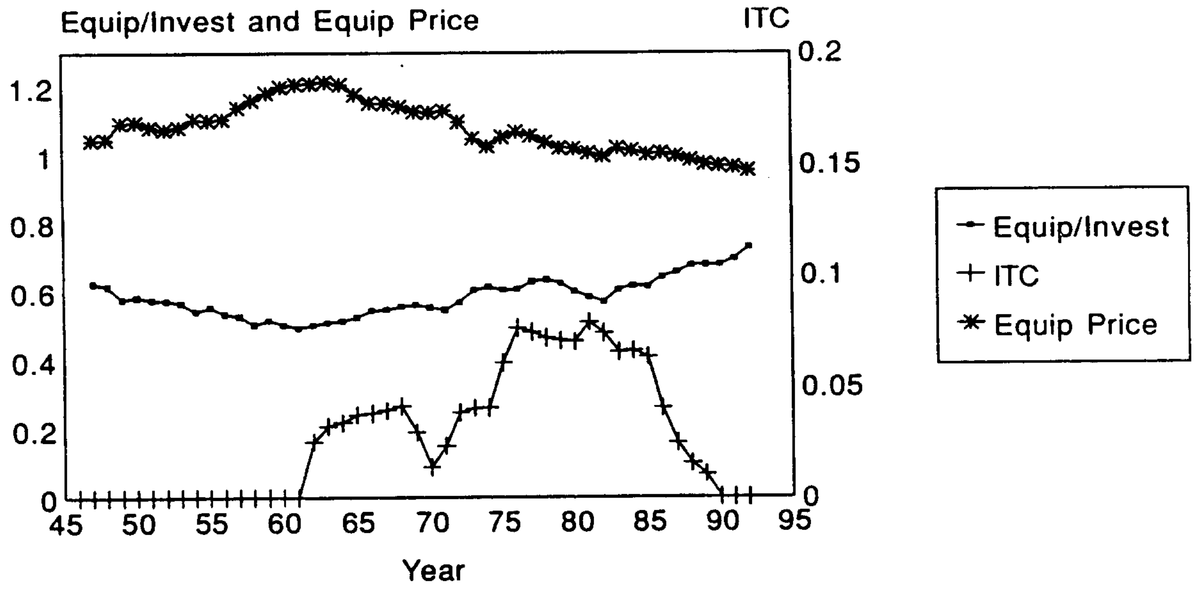
The Price Effect

In an early article investigating price effects and investment behavior, Hall and Jorgenson (1967) concluded that, "the investment tax credit has been a potent stimulus to the level of investment; it also shifted the composition of investment toward equipment." This highlights an important point: if the tax credit has a distinct price effect, the composition of investment should shift in favor of equipment. Figure 3 shows producer's durable equipment as a share of nonresidential investment, both corrected separately for inflation. The ratio rose from 49 percent in 1961 to 73 percent in 1992. The investment tax credit from

Figure 1 is also reproduced here. It should be evident from the figure that the composition of investment shifted towards equipment when the investment tax credit was in effect. But investment became even more equipment intensive after the credit was repealed in 1986.

Figure 3

Equipment Share of Nonresidential Investment Relative Prices and the ITC



Note: ITC defined in Figure 1. Equip/Invest is equal to producer's durable equipment divided by nonresidential fixed investment. Equip price is equal to the ratio of price deflators for equipment and nonresidential fixed investment. Source: NIPA and Corporate Income Tax Returns, IRS.

A second possible explanation for the changing composition of investment is also included in the Figure 3. Equipment prices relative to nonresidential investment fell gradually from the early 1960s to the present. Separate statistical analysis shows that relative prices are statistically significant in a model that explains 93 percent of the variation in equipment composition. The investment tax credit, however, had the wrong sign and was insignificant.[1] It doesn't appear that the presence of the investment tax credit steers firms towards equipment investment as one would expect under the price effect.

What is the possibility that equipment and structures are complements rather that substitutes, allowing tax credits to actually stimulate both forms of investment? This seems unlikely because equipment investment succeeded in rising relative to structures in the late 1980s, without the benefit of the investment tax credit. It is also worth remembering that even if a fixed proportion between structures and equipment characterized every single business in the United States, it would not necessarily apply to the country as a whole. The reason is that some businesses are relatively more equipment intensive while others are

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[1] The ratio of real equipment spending (E') to real nonresidential investment (N') is regressed on the investment tax credit and the ratio of price indices for E and N. An adjustment was made for autocorrelation. The result, with standard errors in parentheses was,

$$\begin{array}{llllll} E'/N' = & 1.16 & - .20\ ITC & - .52\ P_E/P_N & R^2 = .93 & DW = 1.67 \\ & (.122) & (.25) & (.11) & & \end{array}$$

structure intensive. If the tax credit shifted investment towards equipment intensive businesses, the relative share of equipment investment for the United States would rise.

While the absence of a verifiable price effect is insufficient to discredit the investment tax credit, it certainly limits its potential effectiveness. Only a strong price effect permits a small tax credit to produce a large increase in investment. We now turn to the other possible mechanism, the income effect.

Income Effect

According to the income effect, if a firm is given a tax refund, it is likely to spend some part of it on additional investment. The fact that it is given to firms that make relatively high investments should further increase this likelihood. But even in the best of circumstances, some portion of the credit is likely to be diverted to other purposes. The goal of the tax credit could be entirely frustrated if the additional cash flow is simply used to pay higher dividends, buy back outstanding stock or debt, or replace more conventional sources of investment funds. Each of these possibilities are considered in turn.

Tax Incidence

At the very first stage, tax credits could be distributed to either consumers or employees in the form of lower prices or higher salaries. It is curious that some analysts would dismiss this response as unrealistic, but readily accept the companion view, that tax increases are passed on to consumers or employees in the form of higher prices or lower salaries. If the burden of the corporate profit tax is shifted to consumers or employees then it is at least conceivable that tax credits provide relief to the same parties. The point is that whatever portion of a tax credit is shifted in this manner will not be available for additional investment; a dollar of tax credit will raise corporate profits after-taxes by something less than a dollar.

There are many reasons to suspect that corporations pay for most of the corporate income tax, not the least of which is their staunch opposition to it. In my own work, I've observed that the size of the price increase necessary to pass on the corporate profit tax varies widely among different companies in the same industry and for the same company over time.[2] This fact alone makes it very difficult to pass on the corporate income tax without disproportionately benefiting some firms.

No amount of hypothesizing, of course, will settle this issue. The test is whether a reduction in average tax rates is associated with constant profits before-taxes (no shifting) or falling profits (shifting). The relationship between corporate profit shares before taxes and average tax rates is presented in Figure 4.[3]

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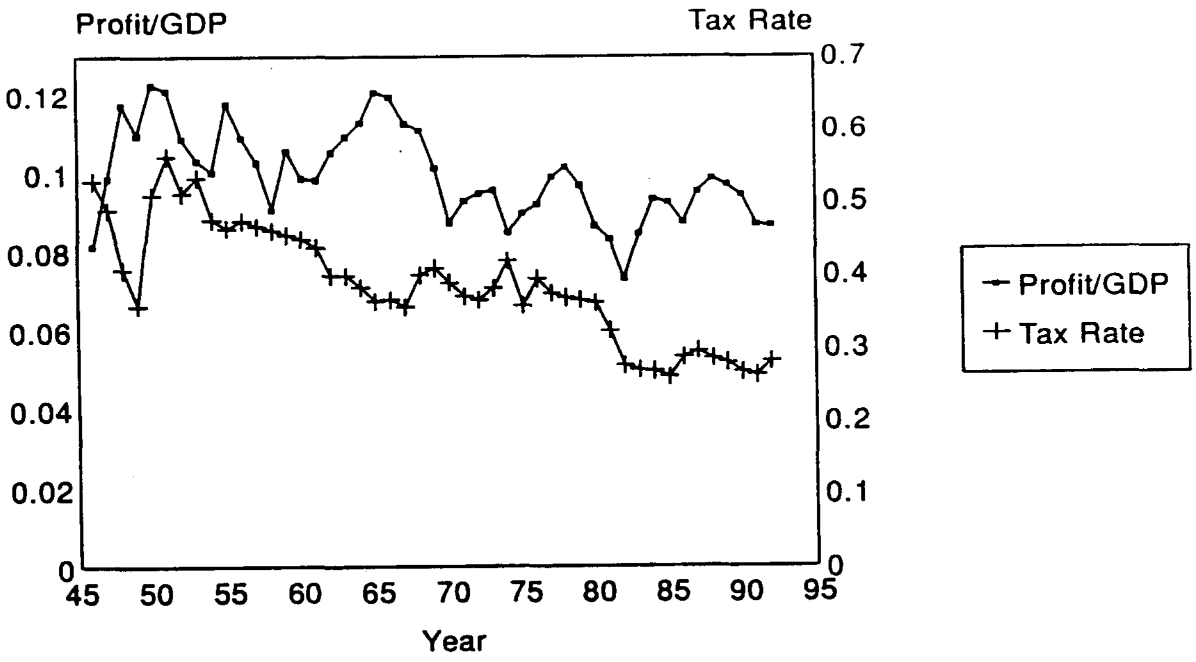
[2] See Karier (1990)

Figure 4

Average Tax Rates and Corporate Profit Shares (Before-Taxes)



Note: Profit is defined as corporate profits, including inventory valuation adjustments, capital consumption adjustment, and corporate net interest. Average tax rate is equal to corporate profit tax liability divided by profit. Source: NIPA.

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[3] Profits, equal to total corporate profits with inventory and capital consumption adjustments plus net interest paid by the corporate sector, are divided by gross domestic product to obtain a share. Average corporate tax rates are equal to total corporate tax liabilities divided by the same profit measure. Data is from the national income product accounts.

As illustrated by the figure, profit shares mirror the business cycle and experienced a one-time drop around 1970. After averaging approximately 11 percent from 1946 to 1970, the profit share slid to about 9 percent from 1970 to 1992. Average tax rates also declined during the period. They fell from over 50 percent in 1951 to less than 30 percent in 1992. The question is: did corporations distribute the tax savings to consumers and employees, thus reducing their profits before-taxes?

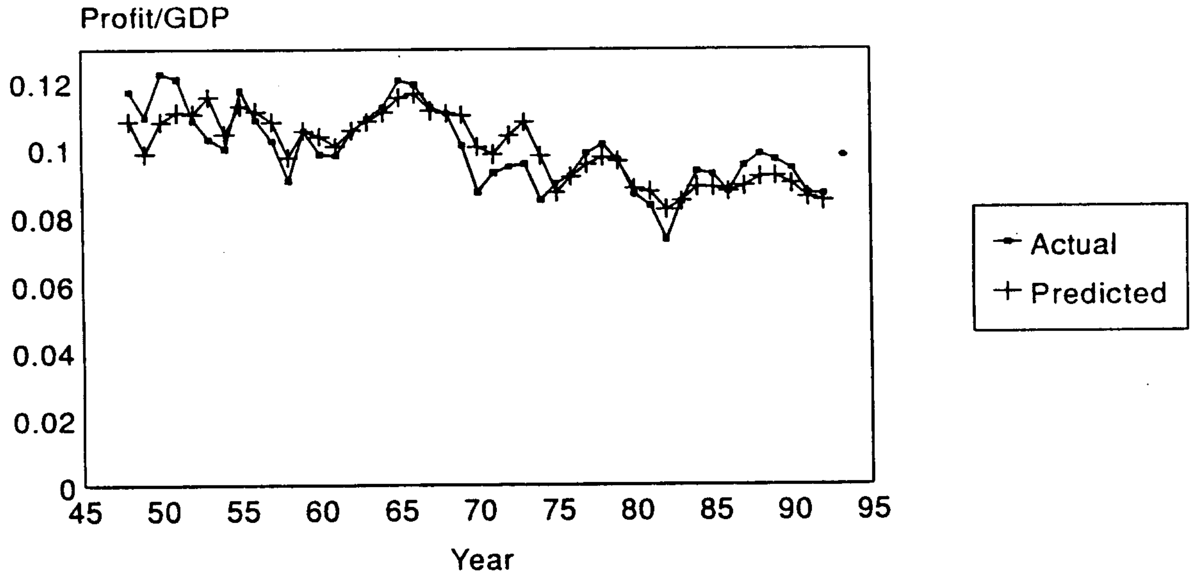
There are two reasons to believe this was not the case. First, the pattern of decline in profit shares does not match the pattern of decline in tax rates. Whereas profit shares appear to shift to a new, lower average around 1970, the decline in tax rates is concentrated in three distinct periods: 1951 to 1954, 1960 to 1965, and 1980 to 1983.

A second objection is that most of the variation in profit shares can easily be accounted for by other factors. Changes in capacity utilization directly affects profit shares and explains much of its movement over the business cycle. Profit shares are also affected by the level of price competition in the United States, which can be stimulated by the growth of imports.

A statistical test shows that these two variables, capacity utilization and import shares of gross domestic product, can account for approximately 81 percent of the variation in profit shares over this period. The predicted values of this simple model are compared to the actual values in Figure 5.

Figure 5

Corporate Profit Shares (Before-Taxes)
Actual and Predicted



Note: Actual profit shares are defined in Figure 4. Predicted values are based on the regression in Appendix B, Table 3, column 2.
Source: NIPA and author's calculations.

This illustrates that there is very little variation for tax rates to explain once these other variables are accounted for. The details of this statistical test are presented in Appendix B, but it should be noted that once capacity utilization and imports are included in the model, the effect of tax rates on profits is not in the direction one would expect for shifting nor is it statistically significant.

All of this evidence points to the conclusion that reductions in the corporate tax rate, including investment tax credits, are not, for the most part, passed on to consumers and employees. Instead, firms are left with relatively higher after-tax income which is, at the very least, available to finance additional investment. This brings us to the next potential leakage, dividends.

The fraction of profits after-taxes actually distributed as dividends from 1946 to 1992 is reported in Figure 6. In the 1980s and 1990s, approximately 60 percent of after-tax income was paid out in dividends compared to approximately 45 percent during the 1950s, 1960s, and 1970s. In addition to this general increase, dividend shares tend to move counter-cyclically, rising in recessions and falling in expansions. A simple statistical analysis covering 1946 to 1992 shows that for every dollar increase in after-tax profits, dividends increased by 56 cents.[1]

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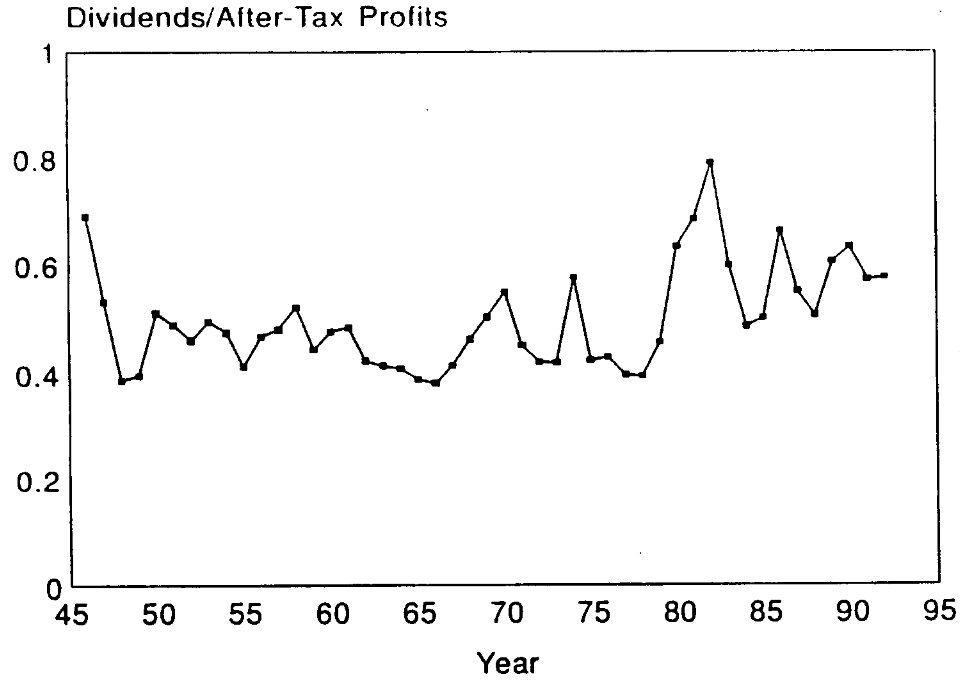
[1] In this case, dividends (D) paid by U.S. corporations from 1946 to 1992 were regressed on corporate after-tax income (I). Estimates were adjusted for autocorrelation. The results were,

$$\underset{(2.87)}{D = -2.53} + \underset{(.025)}{.564\, I} \qquad \text{Adj.}R^2 = .97 \qquad DW = 1.7$$

Figure 6

Dividends as a Share of After-Tax Profits



Source: NIPA.

This doesn't necessarily mean that 56 percent of the savings from an investment tax credit will be distributed as dividends. The actual amount could be more or less but this provides a useful benchmark. There is also no assurance that the remainder, retained earnings, will be devoted exclusively to additional real investment. The funds made available from tax credits could be used by a company to buy stocks and bonds of other companies, to purchase its own stocks or bonds, or to finance a merger or take-over. It is equally possible that these funds would simply supplant other sources of investment funds such as the sale of debt or equity. Each of these diversions tends to dilute the amount of the tax credit ultimately spent on new investment.

How much of after-tax profits are diverted and how much spent on real property, plant, and equipment. Another way to investigate this question is to look at the behavior of a large number of firms. For this purpose, a sample was drawn of 1,837 companies from Compustat Database for the most recent year, 1991.[1] Income was measured after taxes but before extraordinary items and investment was equal to capital expenditure on property, plant and equipment. Appendix C describes this model and the test which includes several additional variables representing sources of investment funds. The results show that a firm with a dollar more of income after-taxes spends only twelve cents more on property, plant, and equipment. The same firm, however, spends approximately 40 cents more on dividends, and reduces its sale of stock (less repurchases) by as much as 21 cents and its sale of debt by 17 cents. The conclusion is that firms with relatively higher after-tax income distribute more dividends and sell relatively less value of stocks and bonds. The amount that trickles down into additional investment is not large.

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[1] Companies with sales of less than ten million dollars or income losses greater than a billion dollars were excluded. Companies were also excluded if these or other cash flow variables were missing in either 1990 or 1991.

Investment and Economic Growth

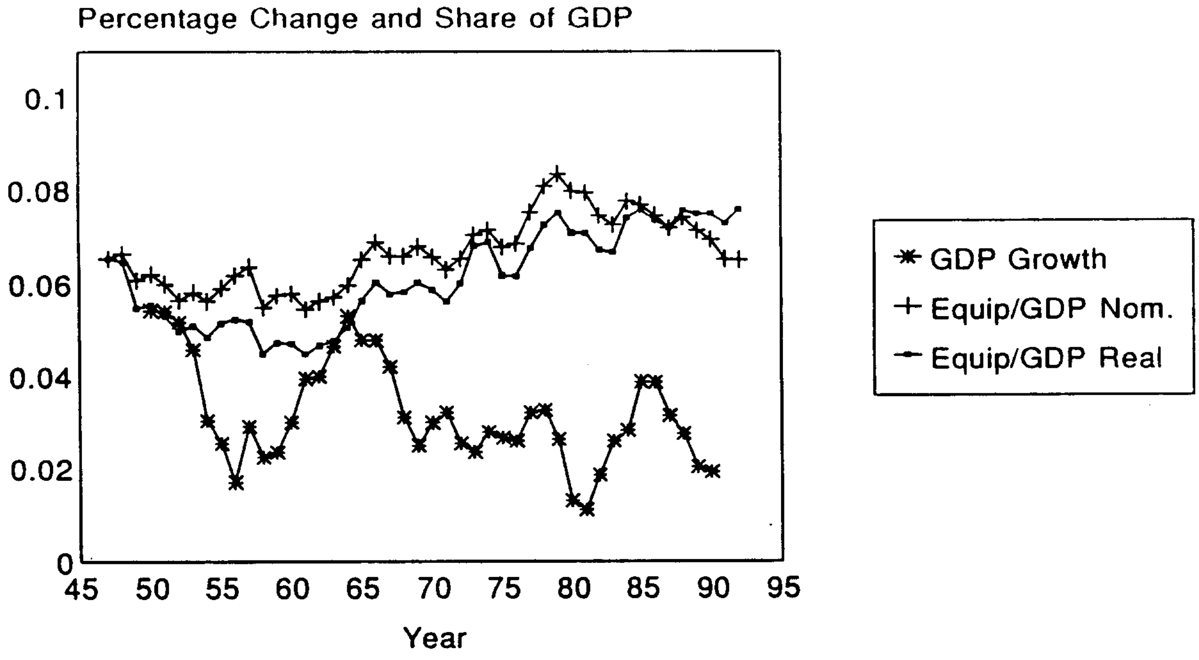
The popular image of equipment investment was reinforced in a recent article by Lawrence Summers and J. De Long (1991). The authors claimed that countries with a relatively high level of equipment investment also experienced relatively high growth rates. The surprising result was that this relationship held only for equipment investment and not for related investments in structures.

The beneficial effect of high levels of equipment investment spending is unfortunately not as readily apparent for the United States from 1950 to 1992. Figure 7 shows the ratio of spending for durable equipment to GDP and the growth rates of real GDP, calculated as five year moving averages. There is little evidence in this figure that high levels of private investment in equipment are associated with strong economic growth.

One possible explanation for this result is related to energy efficiency. Rising energy prices in the 1970s created a strong demand for more energy efficient equipment and structures. It is conceivable that in the process of becoming more energy efficient, U.S. capital investments contributed less to real advances in output. An indication of how profound the change in energy efficiency actually was

Figure 7

Real GDP Growth and Equipment Shares of GDP



Note: GDP growth is calculated as a five year moving average.
Source: NIPA.

is illustrated in Figure 8. This shows the relative output of the industrial sector per unit of energy.[1] By this measure, energy efficiency climbed 56 percent between 1972 and 1991. There is one problem with this explanation, however. Energy prices leveled off in the 1980s, energy efficiency stabilized and yet high levels of equipment investment still failed to boost economic growth.

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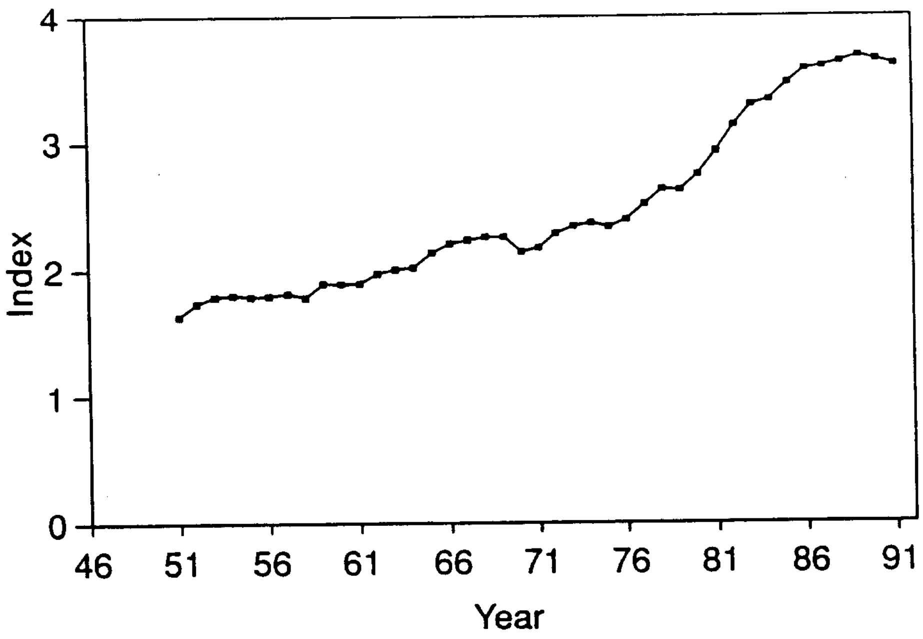
[1] The measure is equal to the industrial production index reported in the *Economic Report of the President*, 1993, divided by industrial energy consumed in British thermal units, reported in the *Annual Energy Review*, U.S. Department of Energy.

Figure 8
Industrial Energy Efficiency

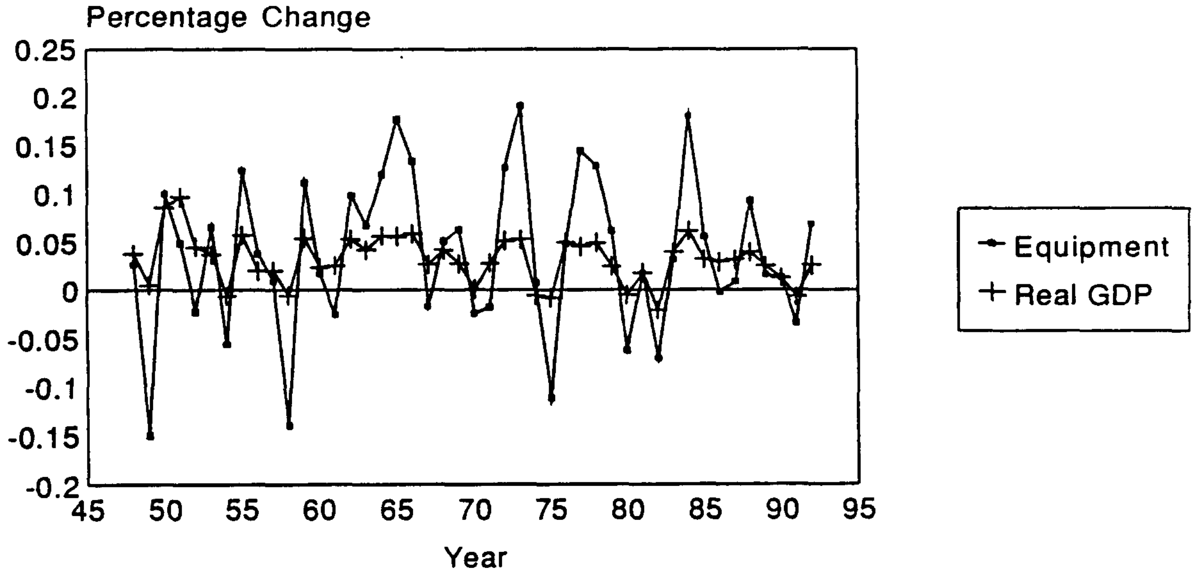


Note: Index is equal to industrial production index divided by total energy consumed by industry measured in Btu.
Source: Economic Report to the President, 1993 and Annual Energy Review, Dept. of Energy.

Most likely other factors are at the root of the slowdown in economic growth, but Figure 7 serves as a useful reminder that boosting the share of national output dedicated to equipment investment does not guarantee economic growth.

This fact should not be construed to mean that investment spending is not important. There is still the very familiar fact, presented in Figure 9, that annual changes in real investment spending are closely related to annual changes in real GDP. It may be difficult to sort out the causality in this relationship but at least some part of it can be attributed to the fact that rapid changes in investment spending can alter the trajectory of economic growth. In this lies a paramount need for public policy: to ameliorate or compensate for the volatility of private sector investment.

Figure 9
GDP and Equipment Investment Annual Real Growth Rates



Note: GDP and producer's durable equipment investment are both corrected for inflation and then calculated as annual growth rates.
Source: NIPA.

Does the historical record have anything to say about the effectiveness of an investment tax credit as a counter-cyclical tool? In its first few years of existence, the investment tax credit was actually used to counter the business cycle. It was initially deployed when investment was relatively low and then revoked twice: in 1966 and 1969, when investment showed signs of recovering.[1] But between reinstatement in 1971 and repeal in 1986, the credit was offered in good times and bad. The end of the credit as a counter-cyclical policy after 1971 marked a victory for the business sector which had from the start insisted on a permanent tax cut.

The relationship between the investment tax credit and real growth in equipment investment was analyzed in more detail and described in Appendix A. In general, there was no evidence that the existence of the tax credit had any significant effect on this growth rate. Only conventional business cycle variables, capacity utilization and real GDP growth, had a positive and significant impact on the growth of equipment investment.[2] There is reason to suspect from this evidence, that the investment tax credit would not have made an effective counter-cyclical tool.

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[1] Another reason offered to repeal the investment tax credit in 1966 by Senator Al Gore, was because of its quality as a special subsidy to capital. See King (1993) page 287.

[2] At least part of this significance can be attributed to the reverse causality, that higher investment contributes to higher GDP growth and capacity utilization.

Marginal Tax Credits

A revised form of the investment tax credit was recently proposed by President Clinton's advisor's and tested in an economic model by Meyer, Prakken and Varvares (1993). The basic Clinton plan included some aspects of the investment tax credit as it existed in 1985 except that it limited credits to investments exceeding some fraction (70 to 80 percent) of historic levels. The purpose of the threshold was to preserve the strong incentive for additional investment without rewarding all investments, thus saving the government some tax revenue.

It is less widely appreciated that the original proposal for the investment tax credit in the Kennedy administration included a similar marginal criteria. The Treasury's initial proposal in 1961 offered a credit of "15 percent of expenditures for new and tangible plants and equipment in excess of 100 percent depreciation" and "a credit equal to 6 percent of capital outlays greater than 50 percent of depreciation and an automatic 10-percent credit on the first $5,000 of new investment. . ."[3]

It was this graduated aspect of the investment credit which incited much of the business opposition to the original proposal. Businesses where much less interested in the incentive aspect of the credit than they were in the income-enhancing aspects which were sharply curtailed by a graduated tax. Lobbyists for businesses thought they could do better and they did by pressuring the Kennedy administration to adopt a flat 7 percent rate which became law in 1962.

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[3] King (1993), page 175.

Only if the investment tax credit works through the price effect does a marginal or graduated rate make any sense. This is because it preserves the price incentives while reducing the income effect. The problem with this logic is not theoretical but empirical. As we have seen, 7 percent and 10 percent tax credits in the past were not sufficient incentives to spark a discernible growth in equipment investment relative to structures. A marginal tax credit has the advantage of a smaller impact on the government budget but its reliance on price effects, does not promise any significant growth in investment.

Conclusion

For more than twenty years, the federal government provided corporations with billions of dollars worth of tax credits in the hope of raising the level of investment in equipment. According to the evidence presented here, these credits did not have a perceptible impact on either the growth in real equipment expenditures or the proportion of national output dedicated to equipment investment.

These observations were reinforced by more detailed investigations into how tax credits are supposed to work. Although the tax credit was supposed to increase the importance of equipment in total nonresidential investment, the evidence is lacking. The tax credit did not appear to have any perceptible impact on the composition of investment. Furthermore, while some of the credit may be spent directly on additional investment, that amount may be miniscule. The estimate in this study found that 12 cents of every every additional dollar of after-tax income was spent on property plant and equipment. The remainder is typically used to pay higher dividends, buy stocks or bonds, or release firms from the need to sell as much debt or equity.

Much of the evidence presented here in regard to the investment tax credit has a direct relevance to the effectiveness of other corporate tax breaks. Marginal tax rates on corporate income have declined steadily over the past forty years and yet the evidence in this research does not show any perceptible response in higher equipment investment. Generous depreciation rates have increased corporate cash flow, but only a small fraction of this is likely to see its way into new investment.

While investment tax credits may not contribute much to economic growth, there is no reason to abandon the effort to stimulate investment, both for its value in countering the business cycle and for creating new job opportunities. The failure of tax incentives to stimulate private sector investment only means that future efforts may be more successful if they concentrate on raising public sector investment. It is important, if not obvious, that a dollar spent on public investment will produce a dollar of public investment. There are more than a few promising opportunities for public investment in education, infrastructure, and research and development.

Appendix A
Investment and the Tax Credit

This section describes the statistical tests used to investigate the relationship between investment tax credits and equipment investment. These tests utilized aggregate annual data for the United States from 1946 to 1992. The hypothesis is that equipment investment should be a function of three sets of variables: cost of capital, cash flow, and capacity utilization.

Conventional estimates of capital costs typically combine several parameters, such as capital prices, tax rates, real interest rates, and tax credits into a single annual value. In fact, this method produces a single value that is equivalent to an annual rent payment whose present value over the lifetime of the equipment--properly discounted for time, depreciation, and future taxes--is equal to the current price (Hall and Jorgenson, 1967). It is easy to forget that at any moment in time, a firm only knows the purchase price and tax credit for certain, all other variables, such as real interest and tax rates apply to the future and are unknown. Consequently, my approach is to include each variable separately, under the presumption that unknown variables may have less influence on investment decisions.

One of the cost of capital variables is the real interest rate which is represented by the prime rate of interest less the rate of inflation (GDP deflator). Another cost of capital variable is the corporate tax rate which is equal to the statutory tax rate on corporate income. Equipment prices are represented by the ratio of the price deflator for producer's durable equipment to the deflator for GDP. In addition, the investment tax credit is included as the ratio of total corporate investment tax credits divided by producer's durable equipment.

Other variables include capacity utilization for manufacturing and cash flow, equivalent to the sum of consumption of fixed capital for corporations and undistributed corporate profits. The dependent variable, equipment investment, was adjusted for inflation and then divided by GDP, similarly adjusted. All of the variables were obtained from the national income product accounts except for the prime interest rate and capacity utilization which were obtained from the *Economic Report to the President*, 1993.

Not surprisingly, the model using ordinary least squares demonstrated a high degree of first order serial correlation. Therefore, the results presented in Table 1 are based on a correction for autocorrelation.

In the first column, the cash flow variable alone is tested and found to have an insignificant effect on equipment investment. This conclusion is not changed in the

Table 1
Dependent Variable: Real Equipment Investment/Real GDP
Single: Annual Observations, 1950-1992

	1	2	3
Cash Flow/GDP	.028 (.103)		-.019 (.082)
Real Interest			.019 (.024)
Tax Rate			-.013 (.015)
Equipment Prices			-.050** (.016)
Investment Tax Credit		.011 (.062)	.032 (.049)
Capacity Utilization [a]			.049** .009
Constant	.061** (.012)	.063** (.009)	.081 (.022)
Adjusted R^2	.89	.89	.95
Distribution	1.55	1.54	1.55

Note: Standard errors in parentheses
** Significantly different from zero at the 1% level. (2.70)
* Significantly different from zero at the 5% level. (2.03)
[a] Coefficient and standard error multiplied by 100.

full model in column 3. The effect of the investment tax credit alone is tested in column 2 and for the full model in column 3. In neither case is the investment tax credit found to have a significant impact on equipment investment. Equipment investments do respond significantly to two variables, equipment prices and capacity utilization. Low equipment prices or high capacity utilization appears to stimulate equipment investment.

It should be emphasized that according to these results, equipment prices have a negative effect on real equipment investment. Because the elasticity implied by the coefficient on equipment prices is very nearly one, changes in equipment prices will have almost no effect on the nominal amount of equipment investment.[1] This may simply be a characteristic of the demand for equipment goods, but there is another possibility. If firms make decisions about how much to spend on investment, independent of prices for investment goods, the regression results would not be any different. In this case, firms simply allocate a certain amount for investment based on their current level of capacity utilization. If equipment prices are unusually low, firms would spend the same nominal amount but get more for their money. It is beyond the capacity of this model to confirm or deny this possibility.

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[1] The actual elasticity, calculated at the means, is .91.

An additional set of tests were conducted using the annual growth of real equipment investment as the dependent variable. The results are reported in Table 2. The investment tax credit continues to have an insignificant effect when tested alone or in the full model. Cash flow has a significant positive effect on equipment growth when estimated alone but not in the full model. Only capacity utilization and the growth of real GDP have a significant effect on equipment growth, which in both cases, is positive. The coefficients on these two variables are likely to overstate the actual effects since the variables themselves are likely to be influenced by equipment growth.

Table 2
Dependent Variable: Growth in Real Equipment Expenditures
Sample: Annual Observations, 1951-1992

	1	2	3
Cash Flow	3.80* (1.67)		1.91 (1.30
Real Interest			.380 (.299
Tax Rate			.284 (.239)
Equipment Prices			-.317 (.160)
Investment Tax Credit		.543 (.439)	.200 (.421)
Capacity Utilization^a			.856** (.195)
Growth-Real/GDP			2.00** (.31)
Constant	-.276 (.139)	.022 (.017)	-.682** (.243)
Adjusted R^2	.09	.01	.78
Durbin Watson	2.01	1.98	1.95

Note: Standard errors in parentheses
** Significantly different from zero at the 1% level. (2.70)
* Significantly different from zero at the 5% level. (2.03)
^{a} Coefficient and standard error multiplied by 100.

In this study, cash flow is not found to make a significant contribution to equipment investment. Although a small percentage of additional income is likely to be spent on new investment, the result is not large enough to show up in this analysis. There are, however, many opportunities to overstate this relationship.

It should be remembered that cash flow is comprised of two distinct components, undistributed profits and capital consumption allowances. Capital consumption allowances are likely to be correlated with current investment levels for the simple fact that both are correlated with past investment. I found this relationship to hold for both annual aggregate data described in this Appendix as well as for company observations described in Appendix C. Because of this fact, there is a tendency to overstate the effect of cash flow on investment. The problem is largely eliminated in this model by correcting for autocorrelation. Once the correlation between current investment levels and past investment levels is reduced, the correspondence between cash flow (depreciation) and current investment also diminishes.[2]

The other component of cash flow is undistributed profits. This term is less likely to be related to past *levels* of investment spending but is more likely to be correlated with other business cycle variables, including *growth* of real investment spending. To some extent this is due to the fact that an increase in undistributed profits will increase investments but there is also the fact that both profits and investments are independently related to the business cycle. This may be the reason why cash flow is no longer significant when business cycle variables are included in the statistical tests (column 3, Table 2).

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[2] This is apparent because cash flow is statistically significant when ordinary least squares is used but not when the estimates are adjusted for first order serial correlation.

Appendix B
Tax Incidence

This section explains the statistical model and test of the relationship between profits before-taxes and tax rates. To the extent that corporate taxes (and tax reductions) are passed through to consumers and employees, average tax rates should be positively related to profits before-taxes. This is tested using a profit model based on my previous work (Karier 1993).

The model uses the following variables: profits before taxes (π), output (q), price (p), revenue (R), marginal cost (mc), and average cost (ac). By definition,

1) $\pi = pq-(ac)q = q(p-mc+mc-ac) = q(p-mc)+ q(mc-ac)$

Dividing both sides by revenue produces the result,

2) $\pi/R = (p-mc)/p + q(mc-ac)/R$

The first term on the right-hand-side of equation 2 is defined as the markup over marginal costs. When firms maximize profits, this term is equal to the inverse of the elasticity of demand, defined as monopoly power. The second term, including the difference between marginal and average cost, is related to capacity utilization. Presuming conventional short-run cost curves, marginal cost is likely to exceed average cost when capacity is tight, a relationship which is reversed when capacity is underutilized.

To the extent that higher taxes are passed through to consumers, firms must increase their markups resulting in higher profits before-taxes. Or, if higher taxes are passed back to employees, who are forced to accept lower wages, then marginal costs decrease and markups still rise. Tax rates should therefore be positively related to profits before-taxes if taxes are passed through to either consumers or employees.

Another factor that is likely to affect monopoly power is the level of foreign competition represented by imports. The greater the competition from imports, the lower the level of monopoly power and markups.

This model was estimated using annual data from 1948 to 1992. Profit shares were equal to corporate profits with inventory and capital consumption adjustments plus net interest paid by the corporate sector, divided by gross domestic product. The tax rate was equal to corporate profit tax liability divided by the same profit measure. Imports were simply divided by gross domestic product, and like each of the preceding variables, were obtained from the national income product accounts. Finally, capacity utilization was obtained for manufacturing from the 1993 *Economic Report to the President.*

Estimation of this model is presented in Table 3, with corrections for first order serial correlation.

Table 3
Dependent Variable: Corporate Profits (Before-Taxes)/GDP
Sample: Annual Observations, 1948-1992.

	1	2	3	4
Tax Rate	.063 (.028)		-.021 (.028)	-.029 (.024)
Capacity Utilization^a		.125** (.019)	.126** (.023)	.137** (.022)
Imports/GDP		-.247** (.065)		-.290** (.075)
Constant	.076** (.011)	.015 (.017)	.005 (.017)	.019 (.017
Adjusted R^2	.63	.64	.83	.81
Durbin Watson	1.70	1.61	1.64	1.59

Note: Standard errors in parentheses
** Significantly different from zero at the 1% level. (2.70)
** Significantly different from zero at the 5% level. (2.03)
^{a} Coefficient and standard error multiplied by 100.

The first column shows the results of regressing only tax rates on profit shares. The coefficient on tax rates is positive and nearly significant at the 5 percent level. This result captures the fact that both series have been declining over the past 45 years as illustrated in Figure 4. This correlation is suspect, however, since the timing for the declines in profit shares and tax rates are visibly different.

As the third column in Table 3 illustrates, the coefficient on tax rates changes signs and is far from significant once capacity utilization is added to the model. This result is also evident in column 3 which includes the import variable. Profits are significantly higher when capacity utilization is higher and imports are lower. This simple model captures 81 percent of the variance in profit shares. The lack of significance for the tax rate coefficient, or even the correct sign, provides little evidence that the cash generated from tax reductions are passed through to consumers or employees. The conclusion is that tax reductions during this period contributed to relatively higher profits after-taxes.

Appendix C
Company Data

A second series of tests were conducted to investigate the relationship between after-tax income and investment. The tests were applied to a sample of 1,837 firms drawn from Compustat database for the most recent year of available data, 1991. Since it is a cross-section, the cost of capital variables were dropped but additional cash flow variables were added. The dependent variable is based on net capital expenditures for property, plant, and equipment. Cash flow is separated into depreciation and amortization, income before extraordinary income (ordinary income), and extraordinary income. Other variables were included to control for other sources (and when negative, uses) of funds. These included the cash obtained from: the net sales of financial investments, the net sales of the company's own stock, and the net sales of the company's debt. All of these variables are divided by company net sales to obtain a share.

The results of estimating this model using ordinary least squares are presented in the first two columns of Table 4. It should be noted that the coefficients on three of the additional variables--net investment, net debt, and net stock--are all positive as expected and significant at the one percent level. Also significant is the cash flow term and its components, depreciation and ordinary income. Only extraordinary income appears to be unrelated to the level of investment spending. The coefficient on ordinary income in column 2 indicates that firms with an additional dollar of income, spend 12 cents more on investment.

A second test looked at the change in investment spending from 1990 to 1991 for the same firms. The numerator for each variable was recalculated to equal the difference from 1990 to 1991 and divided by net sales in 1991. The results of this regression are reported in column 3 of the same table. The results for depreciation, net investment, net debt, and net stock remain positive and highly significant. The coefficient on ordinary income, however, reverses signs and continues to be significant. At least for this one year, firms that experienced an increase in income were more likely to reduce their level of investment spending. Increases in all other sources of funds had the expected effect of raising investment.

If only a small fraction of higher income is spent on real investment, what happens to the rest? Other tests explored the relationship between dividend payments and company income (including extraordinary income). The results of these regressions indicate that firms with an additional dollar of income in 1991 distributed approximately 40 cents more in dividends. This is comparable to the estimate of 56 cents obtained from an analysis of annual data for the United States from 1946 to 1992.[1]

Table 4
Dependent Variable: Investment/Sales
Sample: 1,837 Firms

	(1)	(2)	(3) Change from 1990 to 1991[a]
	All values in 1991		
Cash Flow/Sales	.184** (.014)		
Depreciation/Sales		.907** (.025)	.847** (.035)
Ordinary Income/Sales		.122** (.011)	-.058** (.015)
Extraordinary Income/Sales		-.017 (.074)	-.123 (.122)
Cash Flow/Sales (-1)	.006 (.011)		
Net Stock/Sales	.166** (.012)	.141** (.010)	.145** (.014)
Net Debt/Sales	.429** (.020)	.359** (.017)	.175** (.015)
Net Invest/Sales	.232** (.039)	.228** (.031)	.084** (.040)
Constant	.052** (.003)	.009** (.003)	-.007 (.004)
Adjusted R^2	.29	.54	.38
Durbin-Watson	2.04	1.98	1.99

Note: Standard errors in parentheses.
**Significant at the 1% level.
*Significant at the 5% level.
[a] A change in dependent and all independent variables from 1990 to 1991 divided by 1991 sales.

Additional tests were conducted to investigate the relationship between income and other sources of cash flow. It is expected that higher levels of income will substitute for these other sources. This is, in fact, what the results in Table 5 suggest. In the first two columns, the coefficient on income is -.211 and -.165. This means that

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[1] Dividends (D) were regressed on company income after taxes (I) for the same sample of 1,837 firms in 1991. The result, with standard errors in parentheses, was,

$$D = \underset{(1.65)}{5.49} + \underset{(.007)}{.395}\, I \qquad \text{Adj } R^2 = .61 \qquad DW = 2.00$$

firms with a dollar more of income were likely to have 16 to 21 cents less in cash from the sale of stock. Recall that the stock variable is equal to the amount of cash raised from the sale of a company's own stock, less cash used to buy back its own stock. It is possible that firms with higher income either sold less new stock or bought more outstanding stock. In either case, the result means less available for investments. The second two columns estimate the same effect for net debt. It appears that firms with a dollar more income receive 8 to 17 cents less from the sale of debt. In conclusion, it appears that only a small fraction of additional income is spent on investment. There is some evidence that the difference is either allocated to dividends or used in lieu of additional equity or debt.

Table 5
Sample: 1,837 Firms

	Dependent Variable			
	Net Stock/Sales		Net Debt/Sales	
	1	2	3	4
Depreciation/Sales	.034 (.061)	.051 (.060)	.078* (.040)	.120** (.035)
Ordinary Income/Sales	-.211** (.257)	-.165** (.027)	-.173** (.017)	-.076** (.016)
Extraordinary Income/Sales		.420* (.178)		-.223* (.105)
Net Stock/Sales				.004 (.014)
Net Debt/Sales		.010 (.039)		
Net Investment/Sales		-.389** (.074)		-.823** (.040)
Constant	.044** (.007)	.041** (.007)	-.0003 (.004	-.006 (.004)
Adjusted R^2	.039	.058	.066	.248
Durbin Watson	2.01	2.00	1.95	1.95

Note: Standard errors in parentheses
** Significantly different from zero at the 1% level. (2.70)
** Significantly different from zero at the 5% level (2.03)
[a] Coefficient and standard error multiplied by 100.

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