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Incentive effects of the investment tax credit: Evidence from analysts' forecasts

Plummer, Catherine Elizabeth, Ph.D.

The University of Texas at Austin, 1994

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INCENTIVE EFFECTS OF THE INVESTMENT TAX CREDIT:

EVIDENCE FROM ANALYSTS' FORECASTS

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INCENTIVE EFFECTS OF THE INVESTMENT TAX CREDIT: EVIDENCE FROM ANALYSTS' FORECASTS

by

CATHERINE ELIZABETH PLUMMER, B.A., M.P.A.

DISSERTATION

Presented to the Faculty of the Graduate School of

The University of Texas at Austin

in Partial Fulfillment

of the Requirements

for the Degree of

DOCTOR OF PHILOSOPHY

THE UNIVERSITY OF TEXAS AT AUSTIN

December, 1994

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To Mom, Dad, and Christie

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ACKNOWLEDGEMENTS

I would like to express my appreciation to those who provided assistance with this dissertation. In particular, I wish to thank the members of my dissertation committee. Without John Robinson's insights and encouragement, the project would not have been started. The challenges and insights of Robert Freeman, Daniel Slesnick, and Laura Starks have made this dissertation more complete. I especially thank my chairman, Senyo Tse. His encouragement and guidance were essential to the completion of this research. His patience with me as I struggled through this project was incredible.

I also benefited from the comments of Bill Kinney and workshop participants at the Universities of Chicago, Georgia, Iowa, Pennsylvania (Wharton), Texas, and Washington.

I thank David Mest for generously sharing some of his *Value Line* data and Javier de la Rosa for meticulous data collection.

Financial support from the Deloitte & Touche Foundation, the Ernst & Young Foundation, and the Eugene and Dora Bonham Memorial Fund is gratefully acknowledged.

I thank Karen Smith for putting up with me for five long years. Her friendship provided both happiness and encouragement throughout the doctoral program, and I hope for many years through the future. I will miss all our yogurt trips.

Finally, I thank my family for their encouragement. Mom and Dad: You both love us kids unconditionally and raised us to never question our abilities. Thank you for your unwavering love and support.

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INCENTIVE EFFECTS OF THE INVESTMENT TAX CREDIT:

EVIDENCE FROM ANALYSTS' FORECASTS

Publication No. _________

Catherine Elizabeth Plummer, Ph.D.
The University of Texas at Austin, 1994

Supervisor: Senyo Y. Tse

This research addresses the issue of whether the investment tax credit is effective in stimulating firm-level capital investment. Although Congress has relied on the investment tax credit (ITC) as an investment incentive, prior research provides ambiguous results on the credit's success in encouraging capital investment, raising doubt about the ITC's usefulness as a policy tool. While prior research has relied on macroeconomic investment models and macroeconomic data, this study uses analysts' firm-specific forecasts of short- and long-term capital expenditures (available from *Value Line*) to proxy for firms' planned investment behavior. An advantage of these forecasts is that they are firm-specific, eliminating the need to specify a representative firm with a generalized investment model. The research design controls for other investment-related factors and estimates the increment in planned investment directly attributable to changes in the ITC tax provisions, i.e., that part of planned capital investment that would not have

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occurred without the credit. This estimate provides a firm-level quantitative measure of the ITC's stimulus effect. This study examines firms' capital investment responses to the ITC provision changes from three acts that were passed from 1971 through 1978. Results suggest that the ITC's reinstatement in 1971 increased firms' short-term planned capital expenditures. This result is robust across industries and firm-types. Firms in some industries also increased their long-term planned expenditures in response to the ITC's reinstatement. There is no evidence that firms increased planned capital expenditures in response to the 1975 ITC rate increase, while firms in some industries appear to have increased their anticipated long-term capital expenditures in response to the permanent rate increase in 1978. This study also examines the influence of two firm-specific factors, financing constraints and investment opportunities, on firms' sensitivity to the ITC's incentive effects. Results are consistent with those of the primary hypotheses.

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CHAPTER ONE: INTRODUCTION

This study tests whether the investment tax credit is effective in stimulating firm-level capital investment. Congress' primary purpose for enacting the investment tax credit (ITC) was to increase capital investment and thus economic growth. The ITC was repealed in 1986, but reenactment of the credit has recently been debated as a stimulus for investment.[1] Although Congress has relied on the ITC as an investment incentive, prior research provides ambiguous results on the credit's success in encouraging capital investment, raising doubt about the ITC's usefulness as a policy tool. The inconsistent evidence may be due both to the inability of macroeconomic investment models used in previous research to adequately model investment behavior and to a lack of relevant firm-level data. The data source and method presented in this study address many of the criticisms leveled at prior studies.

This study provides advantages over prior research by: (1) using firm-specific data to directly measure the ITC's influence on planned corporate investments of individual firms, as opposed to industry- or economy-wide investments, and (2) identifying factors that may interact with the ITC in affecting firms' investment behavior. The study estimates the increment in planned investment directly attributable to changes in the ITC tax provisions, i.e., that part

[1] Before being dropped from the economic package in May 1993, the credit had been a centerpiece of Clinton's economic stimulus package since the presidential campaign. In his campaign blueprint for economic policy, *Putting People First*, then President-elect Bill Clinton proposed a "targeted investment tax credit to encourage investment in the new plants and productive equipment here at home that we need to compete in the global economy." See *Tax Notes* (Tax Analysts and Advocates; January 11, 1993, p. 210).

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of planned capital investment that would not have occurred without the credit. This estimate provides a firm-level quantitative measure of the ITC's stimulus effect. Because this study measures the ITC's incentive effects at the firm level, the influence of firm-specific factors on the ITC's incentive effects can also be examined.[2] Moreover, the data source and method introduced in this study will be useful for examining the incentive effects of other tax provisions, such as accelerated depreciation.

This study examines firms' capital investment responses to the ITC provision changes from three tax acts that were passed from 1971 through 1978. The three acts are examined separately because the predicted effect of the legislation on planned investment varies for each act. Annual capital expenditure forecasts (available from *Value Line)* are used to proxy for firms' planned investment behavior. An advantage of these forecasts is that they are firm-specific, eliminating the need to specify a representative firm with a generalized investment model. Using analysts' forecasts as measures of firms' planned capital expenditures assumes that analysts' forecasts are relatively precise predictions of actual investment behavior. This study tests the validity of this assumption by comparing forecasted amounts with actual amounts. Tests indicate that analysts' forecasts are accurate estimates of investment behavior.

The ITC's effect on planned capital investment is estimated using changes in forecasted capital expenditure amounts published before and after relevant tax

[2] The analysis employs the framework developed by Scholes and Wolfson by jointly considering both tax and nontax factors in modeling firms' responses to tax incentives. Furthermore, Scholes and Wolfson argue for a microeconomic analysis of tax policy and issues. [See Scholes, Wilson, and Wolfson (1990) and Scholes and Wolfson (1989) and (1992).]

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legislation dates. The change in forecasted capital expenditures measures the change in a firm's short-term and long-term investment plans due to both ITC legislation and other investment-related factors.[3] Focusing on *changes* in forecasted capital expenditures rather than *levels* controls for firm-specific determinants of capital investment that do not change between time periods. To test whether the ITC increases planned capital investment, changes in firms' forecasted capital expenditures are modeled as a function of changes in investment-related variables (to control for nontax factors), ITC dummy variables (to measure the ITC's incentive effect on capital expenditures), and interaction terms (to test whether firms increased the capital intensity of their operations after the ITC's reinstatement).

The sample consists of 255 to 267 firms from five industries (building, chemical, electric utility, machinery, and metals & mining), depending on the time period examined. The overall results suggest that the estimation equations have significant explanatory power. However, the model's explanatory power differs significantly across acts and across industries. Results suggest that the ITC's reinstatement in 1971 increased firms' short-term planned capital expenditures. This result is robust across industries and firm-types. Firms in some industries (electric utility, machinery, and metals & mining) also increased their long-term

[3] The advantage of using investment forecasts made after the ITC provisions change rather than actual investment is that the forecasts are not influenced by confounding factors that occur in the period between the tax law change and the actual investment. This is especially important given that the ITC provisions may change again before long-term investment plans are implemented. Because confounding events are less likely to be a factor in the difference between short-term planned capital expenditures and actual expenditures, both the change in forecasted and actual capital expenditures will be used when examining firms' short-term investment responses. Even when actual capital expenditures are used, the *Value Line* data provide significant advantages because firm-specific observations of investment-related variables are available.

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planned expenditures in response to the ITC's reinstatement. The 1975 Tax Act temporarily increased the ITC's rate to 10% for all firms, while the 1978 Act made the 10% rate permanent. There is no evidence that firms increased planned capital expenditures in response to the 1975 ITC rate increase, while firms in some industries (building and chemical) appear to have increased their anticipated long-term capital expenditures in response to the permanent rate increase in 1978. In general, there is no evidence that firms increased the capital intensity of their operations in response to any of the ITC provision changes. Industries that may have been affected include the machinery (1971, $\Delta LTINV$), electric utility (1975 Act), and chemical (1978 Act) industries.

This study also examines the influence of two firm-specific factors, financing constraints and investment opportunities, on firms' sensitivity to the ITC's incentive effects. Firms facing financing constraints may respond less to the ITC's incentive effects because they are unable to obtain the necessary funds to finance new capital expenditures, while firms with few growth opportunities may respond less to tax incentives because they face a more limited set of potentially profitable investments. In general, the results provide little additional evidence regarding ITC incentive effects, but results are consistent with those of the primary hypotheses.

The remainder of this dissertation is structured as follows. Chapter 2 discusses the ITC's legislative history. Chapter 3 reviews economic investment theory and the empirical research that addresses the ITC's effects on firms' investment decisions. Chapter 4 develops the hypotheses, while Chapter 5 presents the methodology and research design. Sample selection and descriptive

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statistics are discussed in Chapter 6. Chapter 7 reports results of the empirical tests. Chapter 8 provides the conclusions of this study.

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CHAPTER TWO: LEGISLATIVE HISTORY OF THE INVESTMENT TAX CREDIT

2.1 THE INVESTMENT TAX CREDIT

Tax policy is in part designed to regulate the economy by influencing economic growth. Investment in fixed assets is an important source of economic growth because it stimulates productivity and job creation.[1] Using tax policy to encourage investment in fixed assets assumes tax incentives are an important factor in corporate decision-making. Proponents argue that tax incentives stimulate capital expenditures by: (1) reducing the cost of capital, and (2) increasing the flow of internal funds available for financing new asset purchases. Tax incentives may encourage business expansion because firms view additional capital investment projects as economically feasible. In addition to influencing the amount of capital a firm chooses to employ, investment incentives may also influence a firm's production technology choice. By reducing capital's cost relative to other input costs, a firm may choose to increase the capital intensity of its production technique. Investment incentives may therefore increase a firm's capital-labor ratio.[2]

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[1] U.S. Congress, House, Committee on Ways and Means (1977, p. 3-4). Whether or not the government should encourage capital formation is subject to economic and social debate. Harvard economist Dale Jorgenson argues that the economy pays for capital formation by reducing current living standards. The trade-off between current and future living standards is a social choice. Proponents of tax investment incentives argue that these incentives create jobs. However, Jorgenson argues that most job creation is due to development of new technologies that occurs primarily in newer, less capital intensive industries and firms which may be less responsive to tax incentives. Furthermore, much of the capital goods industry is located in foreign countries. Many of the new capital equipment orders may therefore create foreign jobs. [See Levinson (1986)].

[2] Investment incentives may also influence the desired durability of a firm's capital stock. The ITC may favor short-lived over long-lived capital. Short-lived assets can be replaced more

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The investment tax credit (ITC) is a form of tax subsidy to business investment designed to alter the level and composition of investment. The ITC has been enacted periodically since 1962 and was most recently repealed in 1986. Subject to certain limitations, the ITC provides a direct credit against taxes payable for firms that invest in qualified assets, primarily machinery and equipment.[3] Proponents argue that the ITC lowers the cost of qualified assets and thus stimulates investment to a level greater than would exist without the credit. However, some policymakers and economists have suggested that the ITC may not alter investment but may instead reward investment that would occur regardless of the tax credit, causing windfall gains and losses to shareholders based on previously determined investment behavior.[4] The ITC's repeal in 1986 was largely based on Congress' belief that the ITC distorted economic decisions and represented windfall subsidies.[5]

The ITC offers a rich legislative history for examining tax policy effects on

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frequently, thus permitting more frequent use of the credit. [See Bradford (1980) and Harberger (1980)].

[3] The ITC provisions generally allow a credit equal to a specified percentage of qualified investment in the year in which the property is placed in service. In general, qualified investment is tangible, personal property used in a trade or business or held for the production of income. Personal property does not include land, buildings, or other permanent structures. [See footnote 13 for a more complete definition.] The ITC amount is a function of three factors: (i) the taxpayer's basis in property eligible for the credit (i.e., the amount of I.R.C. Sec. 38 property); (ii) the percentage of basis deemed to qualify for the ITC; and (iii) the rate of the credit.

[4] Even though a particular incentive may have only a minor impact on investment decisions, a corporation can still use the tax rules to reduce their tax burden. In such situations, the provisions do not have the stimulus effect intended by the government and provide firms with a windfall benefit. Summers (1981) argues that good tax reform should minimize windfall gains and losses.

[5] See the *General Explanation of the Tax Reform Act of 1986* and Steuerle (1992).

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firms' investment behavior. Since its introduction in 1962, the ITC has been enacted, repealed, and its provisions changed numerous times.[6] In general, revisions to the ITC have been justified by the impact policymakers believe the ITC has on the economy. Although the ITC remained in existence until its repeal in 1986, this study is limited to ITC-related legislation from 1971 through 1978. The earlier legislation cannot be examined using this study's research design because *Value Line* only began disclosing capital expenditure forecasts in January 1970. The impact of changes in the ITC provisions subsequent to 1978 is more difficult to isolate and examine than the impact of earlier changes because the post-1978 changes are associated with major depreciation changes.[7] Although this study examines only the tax acts from 1971 through 1978, a discussion of the ITC's history from 1962 through 1986 is presented in order to show Congress' reliance on the ITC as an incentive for capital investment.

2.2 CHANGES IN THE INVESTMENT TAX CREDIT'S PROVISIONS

2.2.1 Prior to 1971

The ITC was first enacted in 1962[8] with the objective "... to encourage

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[6] ITC-related legislative acts over the period 1962 through 1978 include: (1) initial enactment of the ITC [1962], (2) repeal of the provision that required firms to deduct the amount of the credit from the depreciation base [1964], (3) suspension of the ITC [1966], (4) repeal of the suspension [1967], (5) repeal of the ITC [1969], (6) its reinstatement [1971], (7) a temporary increase in the tax credit rate [1975], (8) extension of the temporary rate increase [1976], and (9) a permanent increase in the rate [1978]. Seven of the nine law changes (1962, 1964, 1967, 1971, 1975, 1976, and 1978) involved enactment of a law that added the ITC or increased its benefits. The remaining two (1966 and 1969) involved the suspension and repeal of the ITC, respectively.

[7] The last major change in depreciation rules prior to 1981 was in 1954. The Accelerated Cost Recovery System (ACRS) of depreciation was introduced in 1981. Modified ACRS (MACRS) was introduced in 1986.

[8] Revenue Act of 1962, P.L. 87-834, Sec. 2(b).

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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."[9] President Kennedy introduced the ITC as part of his presidential tax message on April 20, 1961. The tax credit was part of a general tax reform package designed to stimulate investment in plant and equipment.[10] Businesses strongly opposed the tax credit when it was first introduced because it was seen as a poor substitute for the tax depreciation reform they desired.[11] In urging its enactment, the Administration promoted the credit as an incentive specifically designed to increase economic growth by reducing the after-tax cost of acquiring depreciable assets, increasing the cash flow available for investment, and reducing the payback period for particular assets.[12]

The ITC's enactment in 1962 followed lengthy legislative debate. The credit was equal to 7% of qualified investment property,[13] which included both

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[9] The ITC was also seen as providing "substantial help in alleviating our balance of payments problem ... by helping to improve the competitive position of American industry in markets at home and abroad ...." [S. Rep. No. 1881, 87th Cong., 2d Sess., 10-11 (1962)].

[10] The tax reform package also provided for the adoption of new guidelines for the determination of equipment lifetimes allowable for tax depreciation purposes.

[11] Harold Scaff, as representative for the National Association of Manufacturers, opposed the credit as a subsidy which would allow the Federal government to manipulate the economy (*Congressional Quarterly*, April 6, 1962, p. 551).

[12] S. Rep. No. 1881, 87th Cong., 2d Sess., 10-11 (1962).

[13] Qualified property was defined to include tangible personal property used in a trade or business or held for the production of income. Also included was other tangible property (but not buildings and their structural components) if the property was used (1) as an integral part of manufacturing, production, or extraction, or of furnishing transportation, communication, electrical energy, gas, water, or sewage disposal services, or (2) as a research or storage facility. [I.R.C. Sec. 48(a)(1)]. Tangible personal property was defined as any tangible property except

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new property and a limited amount of newly purchased used property.[14] The credit for public utility property was 3%. Property became eligible for the credit in the year it was placed in service. The investment credit was limited to the taxpayer's tax liability (if $25,000 or less), plus 25% of the liability in excess of $25,000. Excess credits were subject to carryforward and carryback rules.[15]

Unlike the 1962 enactment and 1986 repeal of the ITC, the series of presidential requests between 1966 and 1971 initiated fast congressional action leading to the suspension and reinstatement of the ITC. In 1966, the United States faced severe inflation, and an important objective of economic policy was to restrain investment. In November 1966, Congress enacted a coordinated anti-inflationary program requested by the Johnson administration.[16] A major feature of the Act was a 15-month suspension of the investment credit.[17] Both Congress

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land and improvements or other inherently permanent structure thereon. Buildings and structural components thereof were not eligible for the credit. Generally, property physically located outside the U.S. more than 50% of any single taxable year did not qualify for the ITC. (All Code and Regulation cites refer tc the *Internal Revenue Code of 1954*, as amended through 1986.)

[14] The amount of eligible used property was strictly limited to prevent existing assets from being resold to qualify for the ITC.

[15] The 1962 version of the credit required firms to reduce the depreciable base of an asset by the amount of the tax credit, thereby reducing the effective rate of the ITC. This feature was known as the Long Amendment and was repealed by the Revenue Act of 1964 [P.L. 88-272, Sec. 203]. The committee reports indicate that the basis reduction provision was repealed to remove recordkeeping and accounting problems associated with the provision, to avoid the situation in which basis reduction was required even where the investment credit was not used, and to increase the incentive effect of the investment credit [S. Rep. No. 830, 88th Cong., 2d Sess., 40-41 (1964)].

[16] P.L. 89-800, 89th Cong., 2d Sess. (1966).

[17] In general, the suspension was effective for property ordered, acquired, or whose construction was begun after October 9, 1966, and before January 1, 1968. In addition, accelerated depreciation for structures was replaced by 150% declining-balance depreciation.

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and the Administration believed the suspension would restrain inflationary forces, ease pressures in the money market, and promote a greater flow of capital into the home mortgage market.[18]

The suspension was originally intended to remain in effect until the end of 1967. However, by early 1967, equipment expenditures had decreased, and there was public concern that the economy was in a recession. In March 1967, after a little less than five months, President Johnson called for early repeal of the suspension. Consequently, Congress restored the ITC, effective March 1967 (in general). Congress said that the inflationary forces which the suspension was designed to moderate had faded and that restoration of the credit would encourage resumption of balanced, economic growth with high levels of employment and stable prices.[19]

The Tax Reform Act of 1969 generally terminated the ITC for property acquired after April 18, 1969.[20] Again, the stated rationale for repeal of the credit was concern that it directly contributed to inflationary pressures. Congress felt that outright repeal of the ITC was more appropriate than a second suspension.[21]

2.2.2 From 1971 through 1978

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[18] S. Rep. No. 1724, 89th Cong., 2d Sess., 1 (1966).

[19] S. Rep. No. 79, 90th Cong., 1st Sess., 2 (1967).

[20] Tax Reform Act of 1969, P.L. 91-172, Sec. 703(a). Certain exceptions were provided for property constructed or acquired under a binding contract entered into before April 19, 1969, and for other transitional property.

[21] *General Explanation of the Tax Reform Act of 1969*, H.R. 13270, 91st Cong., 1st Sess., 187-188 (1970).

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This study examines firms' capital investment responses to the ITC provision changes from three tax acts that occurred from 1971 through 1978. All three acts enhanced the ITC provisions. The 1971 Act reinstated the credit, while the latter acts increased the ITC's rate and extended its benefits.

Revenue Act of 1971: The ITC was reinstated in 1971 and referred to as the "job development credit."[22] Congress believed that lagging investment in machinery and equipment was a primary cause of the depressed economy[23] and that the credit could spur investment by decreasing capital's effective purchase price.[24] The Revenue Act of 1971 reinstated the ITC at a 7% rate (4% for regulated companies) and permitted the ITC to offset 50% of a firm's tax liability in excess of $25,000. The first $25,000 of tax liability could be fully offset. A 3-year carryback and 7-year carryforward were allowed for credits which could not be used in the current year because of the tax liability limitation. Little change was made in the types of property eligible for the credit.[25]

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[22] Revenue Act of 1971, P.L. 92-178, Sec. 101 *et. seq.*

[23] A McGraw Hill Publications Co. survey found that firms planned to increase capital expenditures by 4% in 1971 (relative to 1970 amounts). This would have been the smallest increase since 1968. [See "Firms to Lift Outlays 4% in 1971," *The Wall Street Journal*, April 30, 1971, p. A16]. Capital expenditures reached a six-year low when allocations for new plant and equipment in the second quarter of 1971 were 15.4% below 1970 levels. [See "Capital Appropriations Reached a Six-Year Low: Allocations for New Plant Equipment in Second Period Were 15.4% Below Year-Earlier Level," *The Wall Street Journal*, August 24, 1971, p. A8]. In a National Association of Purchasing Management survey, about 22% of respondents thought that the proposed ITC would result in higher capital spending than originally planned, while 78% said it would not change capital expenditure plans. [See "Majority Surveyed Say Proposed ITC Would Not Change Expenditures," *The Wall Street Journal*, October 4, 1971, p. A2].

[24] S. Rep. No. 437, 92d Cong., 1st Sess., 1, 6 (1971).

[25] As before, property used predominantly outside the U.S. did not qualify for the ITC. For about four months (August 15, 1971, through December 20, 1971), the credit was not available for foreign-produced property. Previously, the ITC had drawn no distinction between

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The credit was available for property acquired and placed in service after August 15, 1971 (the date President Nixon announced he would seek restoration of the credit).[26] The credit was also available for property for which construction was completed after August 15, 1971. As under prior law, the ITC was available only for that portion of the construction costs allocable to the period that the credit was in effect. There was some discussion in early 1971 indicating the credit might be restored. Because some taxpayers may have acquired property on the basis of these discussions, a special provision allowed property acquired before August 16, 1971 to be eligible for the credit if the order for the property was placed after March 31, 1971. Similarly for constructed property, if construction began before August 16, 1971, pursuant to an order placed after March 31, 1971, a credit was allowed for the entire project's cost.

To assure that regulated companies retained at least a portion of the investment credit, the 1971 Act provided that, in general, no credit was available when the benefit was passed on to customers in the form of rate reductions. The 1971 Act permitted regulated companies to elect one of the following options with respect to the credit's treatment for ratemaking purposes:[27]

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domestically produced and foreign-produced property.

[26] Using this acquisition date approach could provide some taxpayers with windfall benefits unintended by Congress. For example, if property was ordered in 1970 and acquired in September 1971, it would still be eligible for the ITC even though the credit was clearly not an incentive in the placement of the crder. (This scenario seems most applicable to property with a long manufacturing lead time.) Although this may create a windfall to some taxpayers, the possibility that contracts would simply be "renegotiated" to provide a later ordering date necessitated this approach.

[27] All regulated companies had to choose an option within 90 days of the law's enactment.

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(1) the credit was not available if any part of the credit was flowed through to income; however, the credit's tax benefits could reduce the rate base, provided the reduction was restored over the property's useful life; or

(2) the credit was not available if the credit was flowed through to income faster than ratably over the property's useful life; however, in this case there need not be any adjustment to reduce the rate base.[28]

In the early 1970's, businesses argued that depreciation reform was needed to reduce ambiguity and complexity. Therefore, the 1971 Act also introduced the Asset Depreciation Range System (ADR) of depreciation for property placed in service after December 31, 1970. The ADR system was expected to provide two benefits: (1) elimination or substantial reduction of the depreciation system's complexity and uncertainty, and (2) favorable financial and economic results through shorter depreciable lives. Therefore, any acceleration of depreciation allowances that arose from ADR may also have acted as an investment incentive.

Tax Reduction Act of 1975: From 1975 to 1982, significant changes and refinements to the ITC provisions were made. Under the Tax Reduction Act of 1975[29], Congress temporarily increased the ITC rate to 10% for all taxpayers, including public utilities.[30] The increased rate applied to property acquired and

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[28] S. Rep. No. 437, at 35. Also see I.R.C. Sec 46(f)(1).

[29] P.L. 94-12, 94th Cong., 1st Sess. (1975).

[30] A McGraw Hill survey indicated that U.S. industry had cut its planned 1975 capital spending severely since the fall of 1974. [See "Capital Budgets for 1975 Slashed Since Last Fall," *The Wall Street Journal*, February 28, 1975, p. A32]. Large firms' planned capital spending fell 24% in 1974's fourth quarter, and a Conference Board survey suggested that the decline was likely to continue through 1975. [See "Big Firms' Plans on Spending Fell 24% in Quarter: Survey by Conference Board says Decline is Likely to Continue Through 1975," *The Wall Street Journal*, March 7, 1975, p. A2]. A McGraw Hill survey indicated that major U.S. corporations planned to

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placed in service after January 21, 1975, and before January 1, 1977. The increased rate also applied to that portion of the property's basis attributable to construction between those dates. In the case of property acquired after December 31, 1976, the 7% credit (or 4% credit for public utility property) would apply even if the property was ordered before 1977.[31] For public utilities only, the 1975 Act increased the tax liability limitation from 50% to 100% for taxable years ending in 1975 and 1976. The percentage limitation was to be reduced 10% each year until the 50% limitation was again reached in 1981.

To compensate for long construction lead times, qualified progress expenditures were made eligible for the ITC.[32] Qualified progress expenditures were generally amounts paid during the construction period for property that had a normal construction period of at least two years and an estimated useful life of at least seven years. Without this provision, such payments were not eligible for the ITC until the year the property was ultimately placed in service.

Tax Reform Act of 1976:[33] The changes in the ITC provisions from the

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increase new plant and equipment spending only slightly in 1976. [See "Firms' 1976 Capital Outlays Seen Rising only Slightly," *The Wall Street Journal*, November 19, 1975, p. A19].

[31] For the same two-year period specified above, the ITC was increased to 11% to encourage investment in employee stock ownership plans (ESOPs). To qualify for the 11% rate, the corporate taxpayer was required to contribute its common stock to a qualified ESOP in an amount equal to 1% of its qualified investment for the year. The corporate taxpayer could also contribute securities convertible into common stock or cash for the acquisition of such common stock or securities. [P.L. 94-12, Sec. 301(d)].

[32] The credit for progress payments was available only if the taxpayer made an election to come under these rules. [P.L. 94-12, Sec. 302].

[33] This study's research design precludes examining the 1976 Act's incentive effects.

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Tax Reform Act (TRA) of 1976[34] were primarily extensions of benefits introduced by the Tax Reduction Act of 1975. The 10% rate, scheduled to revert to 7% (4% for public utilities) at the end of 1976, was extended through December 31, 1980.[35] This extension was made to further encourage investment in plant and equipment, which had declined substantially in 1975.[36] The Act also substantially modified the sequencing rules for absorbing investment credits to better facilitate the use of ITC carryforwards.[37]

<u>Revenue Act of 1978:</u> To stimulate the economy, the 1978 Act[38] significantly liberalized the existing ITC provisions.[39] The Act increased the tax liability limitation from 50% to 90%, phased in at 10% per year beginning with

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[34] P.L. 94-455, 94th Cong., 2d Sess. (1976).

[35] Also extended through 1980 was the provision giving employers an additional 1% investment credit if they contributed an equal amount to an ESOP. Employers could qualify for an additional 1/2% credit provided the employer's contribution was matched by an equal employee contribution.

[36] *General Explanation of the TRA of 1976*, H.R. Rep. 10612, 94th Cong., 2d Sess. (1976).

[37] As a further incentive to invest in pollution control facilities, 50% of the cost of eligible facilities placed in service after December 31, 1976, qualified for the ITC. The 1975 Act also increased the tax liability limitation for the railroad and airline industries.

[38] P.L. 95-600, 95th Cong., 2d Sess. (1978).

[39] The Commerce Department reported that business planned to increase spending on new plant and equipment by only 4.5% in 1978 (relative to 1977) after adjusting for inflation. The 1978 planned spending was $150.89 billion. [See "Business Outlays Expected to Raise Real Levels 4.5% in 1978- Commerce Agency's Survey Puts Figure Well Below Target Set by President," *The Wall Street Journal*, January 13, 1978, p. A2]. A McGraw Hill survey suggested U.S. firms planned only a modest increase in 1979's domestic capital spending [see "Firms' Real Outlays Will Rise Only 2% in 1979, Survey Finds," *The Wall Street Journal*, November 6, 1978, p. A2], while a Commerce Department survey showed businesses adopting a cautious attitude toward new plant and equipment spending in early 1979 [see "Business is Seen Spending Only Modestly- Survey Indicates Real Rise of 0.1% in 1979 First Half from Second Half of 1978," *The Wall Street Journal*, December 8, 1978, p. A2].

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years ending in 1979.[40] The Act permanently increased the ITC rate to 10%. The credit had been scheduled to return to 7% (4% for public utilities) in 1981.[41] The AICPA argued that making the increased rate permanent would provide certainty that is important to business planning. They said that repeated changes in the ITC provisions caused confusion and reduced the ITC's incentive effects.[42]

To enable businesses to rehabilitate and modernize existing older structures, the 1978 Act extended the ITC to qualified rehabilitation expenditures made in connection with existing buildings used in all types of businesses or production activities.[43] Qualified buildings included factories, warehouses, office buildings, and retail and wholesale stores.[44]

To encourage energy conservation and promote industrial and agricultural conversions from oil and gas to alternative energy forms, the Energy Tax Act of 1978[45] modified the ITC provisions to allow for an energy credit. For the period

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[40] The 1978 Act applied the phase-in of the 90% limitation to public utilities, railroads, and airlines. However, prior to the 1978 Act, special provisions provided a higher limitation for these properties. Therefore, the Act permitted these taxpayers to apply whichever limitation provided them the greater investment credit amount.

[41] In addition, the 1978 Act made 100% of pollution control facilities acquired after December 31, 1978, eligible for the ITC, rather than the 50% previously allowed. The ESOP credit provisions that were scheduled to expire in 1980 were extended for three additional years.

[42] See the testimony of Arthur J. Dixon, Chairman of the AICPA Federal Tax Division, on President Carter's 1978 tax program before the House Committee on Ways and Means, March 7, 1978. [Reprinted in *The Tax Adviser*, April 1978, pp. 246-247].

[43] I.R.C. Sec. 48 as amended by the 1978 Act, Sec. 315.

[44] To qualify for the credit, an expenditure must have been incurred after October 31, 1978, in connection with the rehabilitation or reconstruction of a building that had been in use for at least 20 years. The costs of acquiring or enlarging a building or for adding facilities did not qualify.

[45] P.L. 95-618, 95th Cong., 2d Sess. (1978). The Energy Bill was passed by Congress almost simultaneously with the 1978 Act.

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October 1, 1978 through December 31, 1982, businesses could add to the ITC a special 10% energy credit for investing in alternative energy property.[46] Thus, property qualifying as both energy property and ITC qualified investment property could benefit from both credits.[47] The energy credit could be used to offset 100% of tax liability.[48] Equipment purchased by public utilities did not qualify for the energy credit. The Windfall Profit Tax Act of 1980[49] expanded the definition of energy property, increased certain rates of the energy credit, and generally extended the period for which the energy credit was available through 1985.

2.2.3 Subsequent to 1978

Economic Recovery Tax Act of 1981: The Economic Recovery Tax Act of 1981 (ERTA)[50] contained a number of provisions designed to stimulate investment. Congress stated that the ADR and useful life systems of depreciation were overly complicated and were not providing the investment stimuli essential for economic expansion. Therefore, ERTA replaced the old system of depreciation with the Accelerated Cost Recovery System (ACRS) which

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[46] The energy property had to be new depreciable property with a useful life of at least 3 years. In general, energy property was defined to include: (1) boilers, burners, or similar items using something other than oil or natural gas as its fuel or feedstock, (2) solar and wind energy devices, and (3) certain heat recovery, solid waste recycling, shale oil, and natural gas producing equipment.

[47] Most property qualifying for the energy credit also qualified for the regular ITC. However, some energy property qualified for the energy credit but not the regular ITC because the property was a structural component of real property.

[48] The energy credit was not refundable, except in relation to solar and wind energy property.

[49] P.L. 96-223, 96th Cong., 2d Sess. (1980).

[50] P.L. 97-34, 97th Cong., 1st Sess. (1981).

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depreciated tangible property over much shorter periods of time than under the previous provisions. ERTA made a number of modifications to the ITC provisions in order to conform with the new ACRS rules. These modifications allowed for more generous ITC amounts.[51] By providing for easier, larger, and faster depreciation allowances and by liberalizing the ITC, Congress hoped firms would increase investment in fixed assets.[52]

Other ERTA provisions designed to stimulate firms' investment behavior include the introduction of the research and experimentation (R&D) credit,[53] enactment of the safe-harbor leasing laws,[54] increases in the credits available for

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[51] For example, under ERTA the investment credit was based on an asset's ACRS recovery period rather than its useful life. For eligible 5-year or 10-year property and for 15-year public utility property, 100% of the property's cost qualifies for the full 10% credit. Only 60% of the cost of 3-year property qualifies for the investment credit, making the effective ITC rate 6%. Under pre-'81 law, the ITC rate was 10% of cost for qualified property with a useful life of at least 7 years. If the useful life was less, only a partial credit was allowed. The 10% rate was applied against two-thirds of the basis if the useful life was 5 or 6 years, and against one-third of the basis if the useful life was 3 or 4 years. There was no credit for property with a useful life less than 3 years.

[52] Hulten and Wykoff (1981) and Gravelle (1982) found that the new depreciation rules would reduce substantially the effective tax rates on new investment.

[53] In the tax code, the credit is actually called the "research and experimentation" (R&E) credit. However, the common vernacular is "research and development" (R&D) credit. To promote R&D investment, the law introduced a 25% tax credit for incremental qualified R&D expenditures. The credit was designed to stimulate a higher rate of capital formation and to increase productivity by overcoming the resistance of "many businesses to bear the significant costs ... for uncertain rewards" associated with R&D investment. [U.S. Congress, House, Committee on Ways and Means (1981, p. 11).] Tillinger (1991) and Berger (1993) both provide evidence that the R&D credit increased R&D spending for some firms.

[54] Firms with tax losses or unused tax credits might not be able to utilize the additional tax benefits associated with ACRS. The Senate Finance Committee stated that the greatest stimulation to the economy would result if a method could be developed for transferring the tax depreciation benefits from these firms to firms that had greater use for the tax deductions. Special tax-leasing provisions were adopted to aid companies that could not otherwise take full advantage of ERTA's capital-formation incentives. The safe-harbor lease law permitted a firm to transfer tax benefits (such as depreciation deductions and ITC) to another firm (the lessor) by

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qualified rehabilitation expenditures, and extension of the net operating loss and ITC carryforward periods.

Tax Equity and Fiscal Responsibility Act of 1982: The Tax Equity and Fiscal Responsibility Act of 1982 (TEFRA)[55] made significant changes to the operation of the ITC provisions. These changes included (1) a reduction in the amount of tax that could be offset by the ITC, and (2) a requirement that an asset's depreciable base be reduced by one-half of the investment (and energy) credit taken.[56] Other TEFRA provisions that may have affected firms' capital investment behavior include the repeal of safe-harbor leasing and the elimination of scheduled increases in the ACRS rates.[57]

Tax Reform Act of 1984: Prior to enactment of the Tax Reform Act of 1984 (TRA)[58], the Internal Revenue Code (I.R.C.) contained five separate

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selling the property and immediately leasing it back. The advantages to the lessee from safe-harbor leasing included: (1) the receipt of payment from the lessor which provided the funds for down-payment on the equipment, and (2) the deferral of rental deductions for tax purposes to later years when the firm might have greater use for them. Shaw (1988) identifies 127 selling firms and 172 buying firms which disclosed safe-harbor leasing activity in their annual reports for the fiscal years ending between June 1981 and June 1983.

[55] P.L. 97-248, 97th Cong., 2d Sess. (1982).

[56] If the taxpayer did not expect to obtain the full benefit of the investment credit due to taxable income limitations, TEFRA provided that an election could be made to reduce the rate of the investment credit rather than the property's depreciable basis. When the ITC was originally enacted in 1962, the basis of investment credit property was reduced by the full amount of the credit. The basis adjustment provision was repealed by the Revenue Act of 1964.

[57] The safe-harbor leasing rules were substantially changed for transactions after July 1, 1982 and repealed for all transactions after December 31, 1983. ERTA had provided for more rapid write-offs under ACRS beginning in 1985 and 1986. TEFRA eliminated the scheduled increases and made the existing ACRS percentages permanent.

[58] P.L. 98-369, 98th Cong., 2d Sess. (1984).

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business-related credits. These credits had been added to the tax law on an ad hoc basis over the years and were generally applied against tax liability based on the chronological order in which they were added to the Code. To simplify the income tax credit provisions, the 1984 TRA combined the various business-related tax credits into a general business credit under one I.R.C. code section.[59] The 1984 TRA's rearrangement of the tax credit provisions was for simplification purposes only.

__Tax Reform Act of 1986:__ In general, the Tax Reform Act of 1986 (TRA)[60] repealed the ITC for property placed in service after 1985. According to the *General Explanation of the Tax Reform Act of 1986*[61], the reasons for terminating the ITC were to finance the substantial tax rate reductions introduced by the 1986 TRA and to eliminate the economic distortion caused by the ITC. In justifying the ITC's repeal, Congress argued that the ITC resulted in investment decisions being made more on the basis of the associated tax benefits than on the basis of economic merit. TRA 1986 also substantially modified the ACRS depreciation method, effective generally for property placed in service after 1986. Modified ACRS (MACRS) lengthened capital cost recovery periods. The U.S. Congress Joint Committee on Taxation estimated that the ITC's repeal would raise approximately $24 billion per year in revenues over the 1987 through 1991 period,

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[59] I.R.C. Sec. 38. The tax credit provisions combined included the investment tax credit (both the regular and energy credits), targeted jobs credit, alcohol fuels credit, and ESOP credit.

[60] P.L. 99-514, 99th Cong., 2d Sess. (1986).

[61] The "Bluebook" prepared by The Staff of the Joint Committee on Taxation, May 4, 1987, H.R. 3838, 99th Congress, p. 98.

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whereas the change in the depreciation schedule would raise about $2 billion per year.[62]

2.3 CONCLUSION

Reenactment of the ITC has recently been discussed as an investment stimulus. Before being dropped from the economic package in May 1993, the credit had been a centerpiece of Clinton's economic stimulus package since the presidential campaign.[63] In his campaign blueprint for economic policy, *Putting People First*, then President-elect Bill Clinton proposed a "targeted investment tax credit to encourage investment in the new plants and productive equipment here at home that we need to compete in the global economy."[64] Under President Clinton's proposal, small businesses would have been eligible for a 7% permanent

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[62] See the *General Explanation of the Tax Reform Act of 1986.*

[63] Machine tool orders slid 22% in November 1992 to $161.3 million from October levels as some big customers canceled orders and others waited for a proposed ITC. November marked the second month in a row that talk of the ITC caused customers to delay ordering. In December 1992, William G. Copeland, of Copeland Economics in Stamford, Conn., stated that Congress might base the tax credit on the increase in a firm's capital spending from 1992 to 1993, giving manufacturers an incentive to hold off capital expenditures for the rest of 1992. He estimated that companies were delaying $500 million to $1 billion in orders. Compared with November 1991, machine tool orders dropped 30.1%, and on a year-to-date basis they fell 1% to $2.28 billion according to the Association for Manufacturing Technology, an industry trade group. [See "Machine Tool Orders Declined 22% in November Due to Canceled Orders," *The Wall Street Journal*, December 28, 1992, p. A2].

Machine-tool orders declined 15% to $175.3 million in January 1993 from December 1992 levels as customers apparently fretted over the economy and the proposed ITC. Orders also fell 19.4% when compared with January 1992, according to the Association for Manufacturing Technology. Some machine-tool makers wondered whether an ITC would have much of an impact. Manufacturers "buy this stuff when they really have a need," said Edward Avildsen, president of Wallace Coast Machinery Company. [See "January Orders for Machine Tools Declined by 15%," *The Wall Street Journal*, March 1, 1993, p. A5].

[64] Senator William V. Roth., Jr., (R-Del.), introduced S. 2292 (the "Invest to Compete" Act) at the beginning of 1992. The bill provided for a permanent 10% incremental ITC. [See *Daily Tax Report*, The Bureau of National Affairs, Inc., February 28, 1992, p. G-8].

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ITC, while larger firms would have received a 3.5% temporary incremental ITC. An incremental credit only applies to purchases in excess of a threshold amount based on previous spending. The ITC would have cost the government approximately $30 billion per year in tax revenues.[65]

In a Grant Thornton Survey of American Manufacturers, 83% of respondents recommended tax investment incentives as a top priority of the Clinton administration.[66] Those surveyed saw two reasons for creating an ITC: (1) to provide an incentive for businesses to retool and equip themselves to be more efficient and competitive in the world marketplace, and (2) to provide an economic stimulus. Of these two purposes, the Clinton administration has focused almost exclusively on the economic stimulus factor.

The ITC is popular with some economists, including Clinton advisers Alan Blinder of the Council of Economic Advisers and Lawrence Summers, Treasury undersecretary. They insist it would stimulate the economy in the short-run, while also encouraging the investment needed to ensure long-term prosperity.[67] Leading economists Robert Solow and James Tobin testified to the Joint Economic Committee of Congress that an ITC should be reinstated because it would prompt additional business investment and thus boost the economy.[68] Solow stressed that

[65] See *Daily Tax Report*, The Bureau of National Affairs, Inc., February 12, 1993, p. G-4 and "The ITC May Be Dead. Long Live...What?", *Business Week*, April 26, 1993, p. 34.

[66] See *Manufacturing Issues*, Volume 4, No. 1, Winter 1993, published by Grant Thornton's National Manufacturing Committee.

[67] See "White House Mulls the Shape of Tax Credit," *The Wall Street Journal*, February 10, 1993, p. A2.

[68] Solow is an economics professor at MIT and a Nobel laureate. Tobin is a Princeton economist and also a Nobel laureate.

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the government should consider a temporary ITC because a permanent credit would not give firms an incentive to invest immediately.[69]

Leonard Podolin, immediate past chairman of the Tax Executive Committee of the Tax Division of the AICPA, testified at a hearing before the House Ways and Means Committee and warned that the proposed ITC would create "major definitional and computational complexities" and produce relatively little increase in investment. Both the U.S. Chamber of Commerce and the National Association of Manufacturers expressed concern about the incremental ITC, suggesting it would do little to increase capital investment while complicating the tax code.[70] Businesses argued that Clinton's proposed ITC was too narrow, too complicated, and too miserly to be effective and opposed the 2% corporate tax increase (to 36%) Clinton proposed to pay for the ITC. Many midsize firms that make heavy capital investment purchases want to replace the ITC proposal with an extra first-year depreciation deduction.[71] Bush proposed the idea of an additional first-year deduction the previous year, but Clinton opposes it.[72]

As evident from its legislative history and the current debate, the ITC has

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[69] See *Daily Tax Report*, The Bureau of National Affairs, Inc., February 12, 1993, p. G-3, G-4.

[70] See *Daily Tax Report*, The Bureau of National Affairs, Inc., March 18, 1993, p. G-4, G-5. Jane Gravelle, senior specialist in economic policy for the Congressional Research Service, argues that an incremental ITC might be impractical, ineffective, and unfair. [See *Daily Tax Report*, The Bureau of National Affairs, Inc., February 16, 1993, p. G-6, G-7].

[71] Proponents argue that the $30 billion ITC could be replaced by a temporary 40% write-off on capital purchases or a permanent 15% deduction. They hope this could be a first step toward a new system in which all capital purchases are fully expensed in the year they are made.

[72] See "The ITC May Be Dead. Long Live...What?", *Business Week*, April 26, 1993, p. 34.

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been relied upon to affect economic growth by influencing capital investment. In general, revisions to the ITC have been justified by the impact policymakers believe the ITC has on the economy. Proponents argue that the ITC lowers capital costs and stimulates investment to a level greater than would exist without the credit. However, economists and policymakers are divided as to the ITC's effectiveness as an investment stimulus. Prior research provides inconclusive evidence on the credit's success in encouraging capital investment. The next chapter reviews economic investment theory and the empirical research that addresses the ITC's effects on firms' investment decisions.

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CHAPTER THREE: CAPITAL INVESTMENT AND TAX POLICY: A REVIEW OF EXISTING MODELS AND EMPIRICAL RESULTS

3.1 OVERVIEW

Frequent manipulation of the ITC tax provisions suggests that policymakers believe the ITC is an effective mechanism for altering investment levels. Although Congress has relied on the ITC as an investment incentive, prior research provides ambiguous results on the credit's success in encouraging capital investment, raising doubt about the ITC's usefulness as a policy tool. The inconsistent evidence may be due both to the inability of macroeconomic investment models used in previous research to adequately model investment behavior and to a lack of relevant firm-level data. This study's data source and method, introduced in Chapter 5, address many of the criticisms directed at prior studies. However, the economic investment models discussed below are useful because they help identify investment factors that must be explicitly considered in developing this study's methodology.

This chapter reviews economic investment theory and the empirical literature that addresses the effects of tax policy, including the ITC, on firms' investment decisions. The two most prevalent investment models in empirical research are the neoclassical model and Tobin's *q* model.[1] The discussion below divides the research into sections according to investment models and methodology. First, studies based on neoclassical investment theory are discussed. The chapter then considers studies that use a *q* model framework to examine tax

[1] Discussion of the neoclassical and Tobin's *q* models is drawn primarily from Chirinko (1986) and Slemrod (1986).

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policy effects on investment. Empirical results from survey and other studies are reviewed last. Studies are presented in chronological order within each section.

3.2 NEOCLASSICAL INVESTMENT MODEL

3.2.1 The Model

The neoclassical model, developed by Hall and Jorgenson,[2] has been the model most frequently used to test tax policy's effectiveness as an investment stimulus. In the neoclassical model, the tax code's entire effect on capital expenditure decisions is summarized in a single measure known as the user cost of capital. The model assumes a profit maximizing firm with fixed factor prices, where profit (Π) can be expressed as:

$$\Pi = P^e_q f^e(K,L) - w^e * L^e - c^e * K^e,$$

where P^e_q = expected price of output
f^e = expected production function relating labor and capital inputs to output
w^e = expected wage rate
c^e = expected marginal cost of capital
L^e = expected units of labor
K^e = expected units of capital.

The profit-maximizing firm's decision rule will be to invest to the point where the expected marginal revenue product from an additional unit of capital ($P^e_q f^e_k$) equals the expected marginal cost of capital (c^e):

$$P^e_q f^e_k = c^e. \qquad (3.1)$$

c^e is the expected user cost (or rental price) of capital and is the firm's annual cost of using one unit of capital. Ignoring expectations, c can generally be expressed as:

[2] See Jorgenson (1963 and 1967) and Hall and Jorgenson (1967, 1969, and 1971).

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$$c \equiv q(\delta + r)[(1 - k - \tau z)/(1 - \tau)], \qquad (3.2)$$

where c = user cost of capital
q = purchase price of capital asset (per unit)
δ = the capital asset's rate of economic depreciation
r = the firm's annual discount rate
τ = income tax rate
z = present value of tax depreciation deductions per dollar of investment
k = rate of investment tax credit.

Part of the asset's cost ($q\delta$) is due to loss in value because of wear and tear or obsolescence. qr is the opportunity cost of tying up funds in the asset, since in alternative uses the funds could earn a rate of return equal to r. Tax parameters affect c directly (τ, z, k) and indirectly (r).[3] Revenue generated by the asset is taxed at the corporate tax rate (τ), and τz is the tax reduction from depreciation allowances per dollar of investment. Capital's acquisition price is reduced by any available ITC (k).

The neoclassical investment equation models a firm's optimal capital stock (K^*) as a function of the expected cost of capital (c^e), the expected price of output (P^e_q), and expected output (Y^e):

$$K^* = f(c^e, P^e_q, Y^e). \qquad (3.3)$$

The optimal (or desired) capital stock increases with P^e_q and Y^e, and declines with c^e. The model assumes that tax rate reductions increase investment by lowering c^e. The ITC is assumed to increase K^* through decreasing c^e. Given its forecasts of the variables in (3.3), the profit-maximizing firm will choose K^* so that (3.1) is met.

[3] The effect of personal taxes on capital investment is beyond the scope of this study and is therefore not discussed. See Auerbach (1983) and Poterba and Summers (1983) for such a discussion.

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Because firms' expectations of the variables in (3.3) are unobservable, researchers assume that firms base their expectations on historical data. Expectations are represented as a distributed lag of actual past values, and K^* is expressed as a function of these lagged variables:

$$K^*_t = f(c_{t-i}, P_{q,t-i}, Y_{t-i}), \qquad (3.4)$$

where the subscript t-i represents a distributed lag function. The researcher must determine the model's functional form, including the number of lags to include in the model.[4]

Capital expenditures are made either to replace existing capital (replacement investment) or to expand the existing capital stock (net investment). Gross (or total) capital expenditures therefore equal the sum of replacement investment and net investment. Researchers generally assume that replacement investment is a fixed proportion of the existing capital stock (δK_{t-1}).[5] Gross capital investment can thus be expressed as:

$$I^G_t = f(I^N_t, \delta K_{t-1}). \qquad (3.5)$$

If the capital stock could be instantaneously and costlessly adjusted to the desired level, the actual capital stock would always equal the optimal capital stock,

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[4] To specify a functional form for (3.3), researchers must make assumptions about a firm's production function. Most studies assume a Cobb-Douglas production function:

$$Y = f(K,L) = AK^{\alpha}L^{1-\alpha}$$

where Y, K, and L represent output, capital, and labor, respectively. It follows that:

$$f_k = \partial f/\partial K = \alpha AK^{\alpha-1}L^{1-\alpha} = \alpha Y/K.$$

The profit-maximizing firm will choose K^* such that:

$$P^e_q f^e_k = c^e$$
$$\alpha(Y^e/K^*) P^e_q = c^e$$
$$K^* = \alpha Y^e P^e_q / c^e$$

[5] This specification assumes that capital depreciates at a gecmetric rate.

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K^*. In practice however, delays in capital investment occur because of recognition and implementation lags. It may take time for management to recognize that an adjustment is necessary, and delivery and installation of capital require time. Furthermore, management may consider changes in (3.2) and (3.3)'s variables as temporary and therefore not requiring a change in investment behavior. Therefore, net current investment depends not only on the current desired capital stock but also on the backlog of uncompleted projects:

$$I^N_t = f(\Delta K^*_t, \Delta K^*_{t-i}), \qquad (3.6)$$

where the subscript t-i represents a distributed lag function and Δ represents a first difference. Again, the researcher must specify the functional form and the number of lags. Combining (3.5) and (3.6), gross capital expenditures can be expressed as:

$$I^G_t = f(\Delta K^*_t, \Delta K^*_{t-i}, \delta K^*_{t-1}), \qquad (3.7)$$

Finally, using equation (3.4), gross capital investment expenditures for period t can be expressed as a function of observable variables and fixed parameters that can be estimated empirically:

$$I^G_t = f(\Delta c_{t-i}, \Delta P_{q,t-i}, \Delta Y_{t-i}, \delta K^*_{t-1}). \qquad (3.8)$$

To examine the effect of a tax law change on investment, equation (3.8)'s parameters must first be estimated using pre-tax-change historical data. This estimates the historical relation between c, P_q, and Y and capital investment. The next step is to estimate the effect of the tax law change on the user cost of capital. For example, if a tax law changes τ, z, or k, the new parameter values are substituted into equation (3.2) to calculate a new level of c. The last step is to substitute the new (post tax change) cost of capital value into equation (3.8) to determine the capital investment that would follow a change in tax policy.

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3.2.2 Empirical Results

Economics and finance research has almost exclusively studied the incentive effects of the ITC and other tax policies at the industry-wide or economy-wide (macro) level using national accounts data.[6] These studies have been criticized on several grounds.[7] Researchers' ability to evaluate the efficacy of investment-oriented tax policies has been limited by the absence of satisfactory structural models of corporate investment behavior. There is disagreement about the determinants of investment and the correct specification of the investment model. Most studies have measured the effects of tax policy indirectly through the policy's effect on the variables contained in the investment equation (such as the cost of capital or firm value).[8] Such indirect tests of tax policy incentive effects may be especially weak given that studies have found only a weak empirical relation between either the cost of capital or firm value and capital investment.[9] The investment equations assume a representative firm with a generalized investment equation. However, a representative investment function may be

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[6] Almost all studies that conclude tax policy stimulates investment also conclude that the most important policy is the ITC. This is consistent with the ITC being the most effective tax medium for stimulating capital investment [see Shoven (1990)].

[7] For a review of these criticisms, see Fromm (1971), Chirinko (1986), Slemrod (1986), and Auerbach and Hassett (1992).

[8] This methodology requires three steps. The first step specifies the investment equation and estimates the parameters using historical data. Tax parameters do not directly enter into the investment model as explanatory variables. The second step estimates the effect of tax policy changes on the explanatory variables contained in the investment equation. The third step uses the parameter estimates from step one and the estimated variable changes from step two to determine the capital stock that would follow a change in tax policy.

[9] See Cummins and Hassett (1992) and Chirinko (1986).

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invalid if individual firms' production functions cannot be properly aggregated into a single equation. Firm-specific factors (including the discount rate, liquidity, tax status, capital structure, and capital investment mix) are ignored or generalizations are made for firms in the aggregate. Traditional investment models assume that firms make the necessary adjustments to obtain the optimal investment level as specified by the investment equation. Because of transactions costs and capital market imperfections, firms may be unable to make the required adjustments. Lastly, researchers have difficulty using traditional investment models to model dynamic investment behavior, behavior under uncertainty, and the effect of economic agents' expectations on capital expenditures. The different assumptions that researchers have made with respect to these issues have yielded substantially different results when examining tax policy's incentive effects. Chirinko and Eisner (1983) attribute the variations in results to critical differences in the specifications of the investment equations, concluding that, "one can get almost any answer one wants as to the effects of tax incentives for investment by making sure that the chosen model has specifications appropriate to one's purpose" (p. 163).

Prior research has also failed to identify and control for conditions that may affect firms' sensitivity to tax investment incentives. Failure to identify these factors may (1) lead to errors in policymakers' predictions of the efficiency, effectiveness, and equity of tax incentives, and (2) decrease the researcher's ability to isolate and measure the incentive effects of tax policy. These shortcomings may contribute to the inconsistent evidence.

Studies using a neoclassical framework to examine tax policy effects on investment are far too numerous to discuss each one. Consequently, this review is

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limited to the most important and frequently cited studies. The first four studies were presented in 1971 at the Brookings Conference on the Effects of Tax Policy on Investment. They remain the major work related to the effectiveness of tax policy, including the ITC, as an investment stimulus. The papers' primary purpose was to develop models of fixed investment behavior of U.S. business firms and to evaluate the impact on capital expenditures of federal tax incentives enacted since the 1940's. The studies' conclusions varied widely. The remaining three studies discussed in this section include more recent studies examining tax policy's incentive effects.

Hall and Jorgenson (1971): Hall and Jorgenson assess tax policy effects on investment behavior using a neoclassical model of investment behavior. They quantify the investment effects of adopting accelerated depreciation in 1954; adopting the ITC and shorter depreciable lives in 1962; reducing the corporate tax rate in 1964; and suspending the ITC and accelerated depreciation for structures in 1966. Their overall conclusion is that tax policy was highly effective in changing the level and timing of investment expenditures for the period studied.[10] Tax policy also affected the composition of expenditures. The ITC shifted investment away from structures and toward equipment, while accelerated depreciation had the opposite effect.

Their results suggest the individual tax measures had substantially different

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[10] This paper is similar to two of their earlier papers [see Hall and Jorgenson (1967) and (1969)], but they reestimated their econometric investment model, primarily by imposing further restrictions on the parameters, and expanded their data and analysis. Although their 1971 results suggest that tax policy's incentive effects are less than their original estimates, their overall conclusions are the same: tax policy has been effective in changing the level and timing of aggregate investment expenditures.

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impacts. The ITC had the greatest impact, especially after the repeal of the Long Amendment in 1964.[11] Accelerated depreciation methods and shortened depreciable lives were important determinants of investment expenditures from their introduction in 1954. Suspension of the ITC and accelerated depreciation for structures had an important restraining effect on investment. If the suspension had remained in effect for 15 months as originally intended rather than 5 months, the impact would have been substantially greater. Hall and Jorgenson conclude that only the corporate tax rate reduction in 1964 had little impact on investment expenditures.

Hall and Jorgenson assume a Cobb-Douglas production function where the elasticity of substitution between labor and capital is unity. The parameters of their investment model are estimated from annual data in 1965 dollars for investment in U.S. manufacturing and nonfarm nonmanufacturing industries for the period 1929-1965.[12] Separate investment functions are fitted for equipment and structures in each sector.

The authors evaluate the effects of the tax provision changes discussed above based on a partial equilibrium analysis of investment behavior. All determinants of investment expenditures except tax policy are held equal to their actual values. The tax parameters changed by the tax law are substituted into the

[11] The 1962 version of the ITC included the Long amendment. This provision required that an asset's depreciable base be decreased by the full amount of the ITC, thereby reducing the ITC's effective rate.

[12] The data are unpublished data collected by the U.S. Department of Commerce, Office of Business Economics. The data are derived by allocating commodity flow data on gross private domestic investment from the national product accounts among sectors of destination.

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investment equations, and the difference between investment resulting from actual tax policy and investment that would have resulted from alternative tax policies measures tax policy's impact. Although Hall and Jorgenson present quantitative estimates for the effects of changes in depreciation, tax credit, and corporate tax rate policy, only the details for the ITC provisions are discussed below since they are the most relevant for this study.

For each of the actual changes in tax policy, the authors calculate the user cost of capital based on the assumption that no policy change occurred. A 7% ITC for equipment was adopted in 1962. The authors estimate that the annual user cost of capital decreased by approximately 6% in 1963. Their results suggest that the peak response to the ITC occurred in 1965 when investment attributable to the ITC accounted for 28.4% of net investment in the manufacturing equipment sector. For the nonmanufacturing sector, the response peaked in 1964 when 36.8% of net investment was induced by the ITC. The earlier peak reflects the shorter lag in equipment investment in that sector.[13]

In 1964, the Long amendment was repealed, thereby increasing the ITC's effective rate. Hall and Jorgenson estimate that this decreased the cost of capital approximately 3%. Their results indicate the peak effect for manufacturing equipment took place in 1965 when 10.4% (or $365 million) of total net investment was attributable to the repeal. For the nonmanufacturing sector, results suggest the peak effect occurred in 1964, with over $1 billion and 16.6% of net

[13] The dollar amounts are $997 of $3,506 total net investment in manufacturing equipment (in millions of 1965 dollars) and $2,319 of $6,293 total net investment in nonfarm nonmanufacturing equipment (in millions of 1965 dollars).

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investment attributable to the ITC's change. (All dollar amounts are in 1965 dollars.)

The ITC was suspended in 1966. The suspension period was scheduled for 15 months, but the suspension was lifted after only 5 months. Results suggest the suspension increased the annual user cost of capital for equipment approximately 9.5%. For manufacturing equipment, results indicate the suspension restrained net investment from 1966 through 1968. The largest restraining effect was in 1967 when net investment was approximately 9% ($245 million) lower than it would have been without the suspension. For nonmanufacturing equipment, net investment was lower in 1966 and 1967 by approximately 10.5% and 8% ($762 and $452 million), respectively. If the ITC's suspension had continued for 15 months, results suggest the impact on investment would have been much more substantial. Correspondingly, the stimulus from the ITC's restoration would have increased.

Bischoff (1971): Bischoff's investment model is similar to Hall and Jorgenson's but less restrictive in some of its assumptions. Bischoff argues that tax incentives that alter the relative price of capital services should affect capital expenditures more gradually than changes in output. Therefore, Bischoff's investment model (unlike Hall and Jorgenson's model) provides separate lag distributions for output and relative prices.[14]

[14] Other relaxed assumptions include: (1) the Cobb-Douglas production function is replaced by an underlying production function with a constant but unspecified elasticity of substitution; (2) the assumption of static expectations is replaced by assuming that expected output and expected relative prices are generated via distributed lag functions; and (3) the constant before-tax cost of capital relevant to firms' investment decisions is replaced by an after-tax cost of capital that can be approximated by a linear function of the corporate bond yield, the corporate dividend-price ratio, the degree of corporate leverage, and the corporate tax rate.

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Bischoff's empirical results using quarterly aggregate data on investment in producers' durable equipment for the 1951-65 period indicate that allowing for separate lag distributions substantially improves the model's predictive power and that relative price changes affect equipment spending more slowly than do output changes. His results indicate that investment's response to price changes (including changes in equipment cost, interest rate, and taxes) is slow, starting with a small negative effect relative to the steady-state response and taking nine quarters to build up to 90% and 11 quarters to reach 100%. These results suggest that Hall and Jorgenson overestimated the effectiveness of tax incentives in stimulating investment.[15]

Bischoff's simulation results suggest that the ITC induced approximately $6.2 billion of gross investment over the period 1962 through 1966. The estimated percentage increase in actual capital expenditures for 1963 through 1966 was 0.6%, 3.9%, 5.0%, and 4.8%, respectively. This increased investment is smaller than the tax revenue losses for 1962 and 1963, approximately equal to the reductions in 1964, and considerably more than the reductions in 1965 and 1966. Accelerated depreciation policies are estimated to have had small effects, increasing expenditures by about 1% each year, with revenue losses being much larger than increased investment.

Coen (1968 and 1971): In both studies, Coen studies the impact of tax incentives (both accelerated depreciation and the ITC) on plant and equipment

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[15] Because Hall and Jorgenson constrain investment's response to changes in price and output to be equal, they probably overestimate (underestimate) the speed of reaction to price (output) changes.

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expenditures in the manufacturing sector during the 1954-66 period. His results indicate a much smaller effect for tax incentives than Bischoff's or Hall and Jorgenson's. Coen's approach is more general than both Bischoff's and Hall and Jorgenson's in that he: (1) does not specify an explicit form for the production function; (2) directly estimates separate coefficients for output and price variables;[16] and (3) introduces cash flow as a determinant of investment, whereas Bischoff and Hall and Jorgenson do not. Coen argues that cash flow variations do not influence the target capital stock (determined by price and output), but rather affect the *speed* with which that target level is approached.

The initial step in Coen's analysis is measurement of changes in the rental price of capital and in cash flow brought about by changes in tax policy. The next step is to determine investment's responsiveness to changes in the rental price of capital and in cash flow by statistically fitting an investment relation to quarterly data for 1950-1966. His relation models investment as the process by which firms adjust their actual capital stocks to desired levels, with the adjustment speed depending on the adequacy of cash flow to finance desired capital expenditures. Tax policy effects are calculated by combining the results of the two-step analysis. Based on his estimates, Coen concludes that the impact of tax incentives has been disappointing relative to their costs. Coen estimates that accelerated depreciation increased expenditures by 2% or $2 billion (1954 dollars) from 1954 to mid-1962, compared with tax savings to firms (revenues lost to the federal treasury) of $5.1

[16] The user cost (price) variable and output variable in Bischoff's and Hall and Jorgenson's estimated equations are multiplied together so that their separate influences are constrained to be equal.

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billion over the same period. From mid-1962 through 1966, both accelerated depreciation and the ITC increased expenditures by 4.19% or $2.8 billion, compared with tax savings of $8.6 billion. For the 1954-66 period, investment was 3.87% higher as a result of tax policy changes when cash flow does not enter into the investment model, and 2.02% higher when cash flow is included in the model.

Klein and Taubman (1971): Klein and Taubman estimate the incentive effects of the ITC and accelerated depreciation on (nonfarm) fixed investment. They focus on: (1) formulation of an investment function; (2) simulation of complete models containing endogenous investment reactions; and (3) responses to a questionnaire on the effects of investment incentives. The investment equations (estimated from quarterly data for the period 1948-1964) were taken from the then current version of the Wharton investment model. These investment equations were estimated separately for manufacturing, regulated industry, and a residual nonfarm sector (primarily commercial construction) and were of the general form:

$$I = a_0 + a_1 \text{ (real output)} + a_2 \text{ (long-term interest rate)} + a_3 \text{(capital stock)}_{t-1} + a_4 \text{ (cash flow variables)} + a_5 \text{(capacity utilization)}_{t-1}.$$

Every variable except capacity utilization is a weighted average of past values, where the weights are distributed over eight prior quarters.[17] Klein and Taubman's investment model is less restrictive than those of Bischoff, Coen, and Hall and Jorgenson. The authors argue that the ITC affects the expected rate of return but

[17] The weights are taken from Almon (1965).

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does not affect riskiness (i.e., the ITC shifts only the mean of the return distribution). The change in rate of return caused by the ITC is translated into a change in the long-term interest rate. Therefore, the investment equation estimates the ITC's effect on investment through its indirect effect on the long-term interest rate. The increase in the rate of return was computed for each of the three industry groups. In the empirical simulations, the ITC was assumed to add about 1% to a typical manufacturing firm's rate of return.

In contrast to Hall and Jorgenson, Klein and Taubman allow for the fact that a temporary tax credit suspension (as in 1966-1967) should have greater impact on investment than a permanent suspension. Assuming it had not been revoked in March 1967, results suggest that suspension of the ITC and accelerated depreciation would have reduced investment by an estimated $2.2 billion in 1967. About half this effect occurs because of feedbacks within the model. Without adjustment for the temporary nature of the suspension, the estimated impact was $1.6 billion (both amounts in 1958 dollars).

The authors also surveyed companies regarding their investment planning and any effect tax incentives might have on investment decisions. Twelve companies responded. Generally speaking, management of these firms did not feel sensitive to the temporary suspension of the ITC and accelerated depreciation during 1966-67. In most cases, the firms were involved in projects of sufficient length that they did not want to disrupt them because of temporary legislation. Respondents indicated they did not like the uncertainty caused by temporary changes in tax incentives. It also appeared that the ITC had a greater impact on investment behavior than accelerated depreciation.

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Chirinko and Eisner (1983): Disparities similar to those found in the four Brookings studies discussed above are consistent with the results in Chirinko and Eisner's study. Chirinko and Eisner analyze six major U.S. quarterly macroeconomic investment models: Bureau of Economic Analysis (BEA); Chase Econometrics; Data Resources, Inc. (DRI); University of Michigan; MIT-PENN-Social Science Research Council (MPS); and Wharton Econometrics. They examine the tax incentive effects of doubling the ITC from its historical rate and also of accelerated depreciation. They find that the predicted results of these incentives for capital investment vary widely among the models and attribute the differences in results to critical differences in the investment equation specifications. The authors conclude that the ITC has had only modest effects on investment and is not cost effective. Each dollar of direct tax loss yields considerably less than a dollar of increased investment.

Chirinko and Eisner ran simulations for the period 1973 through 1977. The historical ITC rate for equipment is doubled, and the original credit rate is applied to structures. (Structures are technically not eligible for the ITC.) Results are in terms of the investment equations alone and full model simulations that permit feedback effects.[18] The six models give vastly different results. In full model simulations of equipment investment, the ITC rate was doubled to 14% in 1973-1974 and to 20% from 1975 through 1979. This led to increases in investment, after five years, ranging from a low of 1.6% (Michigan model) to highs

[18] Chirinko and Eisner mitigate the problem of forecasting exogenous variables with a "residual feedback" technique. The errors in the baseline equations for each quarter are added to the endogenous variables. Thus, the baseline simulation paths are identical with history. Exogenous variables include, for example, GNP measures, rate of unemployment, and the wage rate.

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of 15.7% and 19.7% (DRI and MPS models, respectively). When no feedback is allowed, the results from doubling the ITC range from 1.5% to 15.1%. Structures were permitted a 7% ITC in 1973-1974 and 10% from 1975 through 1979. The corresponding increase in investment ranged from 0.2% to 15% allowing for feedback, and 0% to 5.7% not allowing for feedback.

Two major factors contribute to the results and differences in results among the six models. First, in a number of cases, elasticities of the response of desired capital or investment to changes in the rental price of capital (*c*) are preset or constrained. Second, the opportunity cost of capital, a critical component of *c*, is defined as a weighted average of interest costs and current earnings-price (E/P) ratios or dividend-price ratios. The authors argue that these latter ratios mismeasure the equity cost of capital, which should be the ratio of expected future earnings to current stock prices. A low current E/P ratio may be associated with higher investment not because the ratio reflects a lower cost of capital but because it reflects (via the stock price) high expected future earnings. To the extent parameters of *c* reflect earnings expectations, the models may incorrectly attribute positive investment effects to reductions in *c* brought on by tax changes (i.e., a confounding variable problem).

To quantify the extent to which the results are affected by critical assumptions and constraints, the authors reestimate the investment equations with more general specifications, including: (1) estimating the price elasticity of demand for capital without constraints, and (2) for most of the models, removing the current E/P or dividend-price ratios from the financial cost of capital to avoid the potential upward bias in the coefficients on *c*. The simulations were run with the

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same ITC rates applied to equipment and structures as before.[19]

Using the respecified equations sharply reduced the dispersion of results among the models and the estimated magnitude of the ITC's incentive effect on equipment investment. For four of the models on the basis of the investment equations alone (with no feedback), increases in equipment investment at the end of the fifth year fell within a range of 0.3%, from a low of 2.8% to a high of 3.1%. (The other two models indicated increases of 1.7% and 8.6%.) In general, the full model results closely followed those of the investment equations alone. Using the revised equations did not generally make much difference for predicted investment in structures.

In general, a 10% increase in the ITC rate brought about considerably less than 10% in added investment. Except for simulations with the original DRI and MPS equations, the increases in total fixed investment are considerably less than the static tax loss in all years in all models. The mean results from the original equations suggest that each federal tax dollar lost would result in about $.76 of added investment. The revised equations offer a comparable figure of only $.56. None of the revised models and none of the original models, except DRI and MPS, suggest that any of the tax incentives considered in the study are cost-effective. The authors acknowledge, however, that none of the six major macroeconomic models is well-equipped to analyze the effects of tax parameter changes on investment. They note the general limitations of using neoclassical investment models to analyze tax policy, including the fact that all results depend on the

[19] The authors also examined the incentive effects of accelerated depreciation (the Conable-Jones '10-5-3' depreciation).

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applicability of the investment equation coefficients, estimated from historical data, to the current situation with a modified tax code.

Auerbach and Hassett (1992): The authors' primary objective is to estimate the influence of tax policy on U.S. fixed nonresidential investment in equipment and structures over the period 1956 to 1988. They argue that past researchers' ability to evaluate the efficacy of investment-oriented tax policies has been limited by the absence of satisfactory models of investment behavior. To evaluate the investment effects of tax policy, an investment model is needed in which tax policy parameters appear as explanatory variables. The tax variables' coefficients are interpreted as the partial effects of such variables on investment.

The authors present a model of aggregate investment behavior derived from a model of optimizing behavior by firms with rational expectations. Similar to q investment models, their model is based on the assumption of forward-looking investment behavior by value-maximizing firms motivated by adjustment costs to smooth their capital expenditures over time. Unlike models that relate investment to q, their model relates investment to investment variables from neoclassical models, such as the cost of capital. Tax policy effects can be estimated directly, rather than by indirect inference, and can be compared with estimates from studies relating investment to the user cost of capital and effective tax rates.[20] Furthermore, most prior studies of investment tax incentives either assume static expectations or ignore the impact of anticipated future tax changes on the value of investment incentives. By assuming rational expectations, their study incorporates

[20] For example, see Hall and Jorgenson (1971) and Feldstein (1982), respectively.

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the effects of anticipated tax changes where firms are assumed to have perfect foresight.

Their investment model's assumptions are similar to those made by traditional neoclassical investment models. Some of the assumptions include (1) a Cobb-Douglas production function; (2) a quadratic adjustment cost function; and (3) future investment and tax variables are known with certainty. Like the neoclassical model, the investment equation contains a comprehensive measure of the user cost of capital, *c*. However, unlike traditional models, investment is a function of future rather than lagged values of the cost of capital. Tax parameters indirectly affect investment through the cost of capital term in the investment equation.

The model is estimated from annual aggregate data for the period 1953 to 1988.[21] Investment in producers' durable equipment and nonresidential structures are examined separately since their tax treatments are substantially different over the period. The authors find that the user cost of capital explains the investment level of both equipment and structures.[22] For example, the cost of capital's coefficient in the investment equation for equipment suggests that a permanent increase of one percentage point in the cost of capital (roughly the magnitude of change associated with a 10% investment tax credit) will initially reduce the ratio

[21] Investment, output, profits, and cash flow data come from the national income accounts, while the capital stock series for equipment and structures come from Musgrave (1989).

[22] The authors experiment with the number of leads and find that once the current and three subsequent annual values of the cost of capital are included in the investment equations, adding further future values does not alter the results. For equipment, each successive year's cost of capital is slightly more than half as important as the previous year's in explaining investment.

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of investment to capital by 0.253 percentage points, or roughly 1.5% of gross investment (based on the sample average investment-capital ratio of 0.170). Although this indicates that the cost of capital, based on both current and future conditions, significantly affects investment, it is not a particularly large response relative to prior studies relating investment to the cost of capital. Furthermore, it does not necessarily imply that the *tax* components of the cost of capital affect investment. To test this, the tax parameters are split out of the cost of capital term. Results indicate that taxes affect investment in machinery and equipment. Results also suggest that nontax determinants of the cost of capital have stronger effects than tax factors. Consistent with other studies, cash flow also seems to influence investment.[23]

Cummins and Hassett (1992): Cummins and Hassett (1992) is one of the few studies to use firm-level data to analyze the response of capital investment to changes in tax policy. In general, macroeconomic investment studies have found only a weak empirical relation between the cost of capital and investment. The authors attribute the weak correlation to model misspecification. They use Auerbach and Hassett's (1991) technique to analyze the response of firm-level investment to the 1986 Tax Reform Act (TRA86). TRA86 contained several tax provision changes that may have discouraged investment, including repeal of the ITC and lengthening of depreciation lifetimes.

They begin with an investment equation for the individual firm:

$$I_t/K_{t-1} = \alpha + \phi E_t \sum_{s=t}^{\infty} \rho^s C_s + \varepsilon_t \qquad \text{(CH1)}$$

[23] The authors measure the impact of tax policy on investment variability. The results suggest that tax policy has not stabilized investment.

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where I_t = gross investment during period t
K_{t-1} = capital stock at end of period t-1 (beginning of period t)
E = expectations operator
ρ = discount rate
C = user cost of capital
α, ϕ = parameters

C is a variation of the neoclassical user cost of capital and is subscripted to reflect the fact that its components may vary over time. The components of C include the price of capital goods relative to output (q), the real interest rate (r), the rate of economic depreciation, the inflation rate, the corporate tax rate, the investment tax credit, and the tax depreciation allowances.[24]

Because C is difficult to observe empirically, the authors treat C as "rarely" observable and develop an estimation strategy to identify the response of investment to changes in C (i.e., the elasticity of investment with respect to C). As evident from equation (CH1), investment depends on future expected costs of capital which the authors argue are difficult to predict in an uncertain tax policy environment. However, Cummins and Hassett argue that policymakers viewed the 1986 tax act as fundamental and long-lasting reform. Therefore, investors perceived the tax changes as permanent and anticipated no additional changes over the foreseeable future. If future tax policy is known with certainty, the tax components of C_s are constant through time. Assuming q and r are fixed, C can be factored out of the expectations term. Equation (CH1) reduces to the product of C and the sum of current and future expected weights, where the latter depends on future expected productivity.

Separating out the cost of capital which presumably includes all the tax

[24] The C term varies slightly depending on the specific production model chosen.

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parameters affecting investment, the authors express investment for firm i as:

$$I_{it}/K_{i,t-1} = X_{it}\beta + C_{it}\gamma + \varepsilon_{it}, \qquad \text{(CH2)}$$

where X_{it} is a vector of observable variables used to construct forecasts of future expected productivity. The X vector of explanatory variables includes lagged values of investment, a time trend, and cash flow. The coefficient γ is the elasticity of gross investment with respect to C. If C is unobservable, then the equation estimated empirically is:

$$I_{it}/K_{i,t-1} = X_{it}\beta + \omega_{it}. \qquad \text{(CH3)}$$

Because C is an omitted variable, $\hat{\beta}$ is a biased estimator of β and converges to $\beta + \Pi\gamma$, where Π is the vector of coefficients from the regression of C on X:

$$C_{it} = X\Pi + \zeta_{it}. \qquad \text{(CH4)}$$

Combining equations (CH2) and (CH4) yields:

$$I_{it}/K_{i,t-1} = X_{it}\beta + (X\Pi + \zeta)\gamma + \varepsilon_{it}.$$

$$I_{it}/K_{i,t-1} = X_{it}(\beta + \Pi\gamma) + \zeta\gamma + \varepsilon_{it}, \qquad \text{(CH5)}$$

where equation (CH5) is equivalent to the empirical estimation of equation (CH3). Therefore,

$$w_{it} = \zeta_{it}\gamma + \varepsilon_{it}. \qquad \text{(CH6)}$$

The coefficient γ can be estimated with a three-step process. First, $\hat{\beta}$ and $\hat{\Pi}$ are estimated with pre-1986 data using equations (CH3) and (CH4), respectively. The estimated coefficients are used to generate forecasts of I/K and C using equations (CH3) and (CH4) and post-1986 data. The estimated forecast errors ($\hat{\omega}$ and $\hat{\zeta}$) are then used in equation (CH6) to estimate γ.

Cummins and Hasset's sample consists of firms from *Compustat* which

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have data for the period 1970 through 1989.[25] The investment variable (I/K) and vector of X variables are firm-specific values taken from *Compustat*. The cost of capital measures are industry specific. The authors first estimate equations (CH3) and (CH4) for the period 1970-1985 and use these estimates to forecast investment for the post-TRA86 period. The forecast errors for both equipment and structures suggest that investment was on average lower than would have been predicted using the pre-TRA information set. They conclude that this finding is consistent with TRA86 decreasing capital investment. The authors find γ in equation (CH6) to be significant and conclude that cost of capital innovations contribute to investment forecast innovations (errors). They also find that a cash flow surprise variable is significant in explaining investment forecast errors. Adjusted R^2's are generally .01 to .02.

Chirinko (1992) argues that there are two major methodological concerns with this study. First, it is inconsistent to argue that TRA86 represented a major change in tax and investment policy and then use forecasting equations estimated with pre-1986 data to forecast after 1986. Second, the interpretation of the coefficients relies on the assumption that the 1986 tax changes were perceived as permanent. Given the history of tax policy changes and the tax changes that occurred subsequent to 1986, this assumption is not likely to hold. Chirinko also argues that the user cost of capital may not reflect all the complexities of the current tax code because the user cost formula contains only 3 or 4 statutory

[25] The authors do not give any specifics on their sample (for example, no descriptive information or information as to the number of firms). They do list the industries represented by the sample.

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parameters.

3.3 TOBIN'S Q INVESTMENT MODEL

3.3.1 The Model

As discussed above, a significant limitation of the neoclassical model is that it relies on backward-looking extrapolation from historical data to model expectations. An alternative investment model which does not require an historically-based estimate of expectations is Tobin's *q*.[26] Tobin's *q* theory specifies the investment decision rule with a value known as marginal *q*:

$$q_m = E(MB)/E(MC)$$

Expected marginal benefit [E(MB)] is the marginal increase in firm value from acquiring an additional unit of capital. Expected marginal cost [E(MC)] of a new unit of capital consists of the costs associated with planning for new capital investment, purchasing it, and installing it into the firm's production process.

q_m is the ratio of the increase in firm value from acquiring an additional unit of capital to its net-of-tax purchase cost. Firms with *q* greater (less) than one have (do not have) an incentive to invest in additional capital. *q* theory explains adjustments in capital assets based on marginal *q*, arguing that there is a causal relation between marginal *q* and capital investment. If marginal *q* exceeds one, a firm has an incentive to invest because the marginal value of new capital investment will exceed its cost. Firm value increases by more than a dollar for each dollar of investment. If all such investment opportunities are exploited, the marginal value of *q* should tend toward unity. If *q* is less than one, a firm has no

[26] The *q* concept was first developed by Tobin (1969). Also see Brainard and Tobin (1968) and Tobin and Brainard (1977).

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incentive to invest because firm value will increase by less than a dollar for each incremental dollar invested in capital. For firms with q equal to one, an incremental dollar of investment will yield exactly one dollar of market value.[27]

Because marginal q depends upon the marginal costs and benefits of *new* capital investment and is therefore unobservable, empirical studies use average q, defined as the ratio of the firm's market value (both debt and equity) to the replacement cost of its tangible and intangible assets:

$$q_a = MV/RC$$

Using q_a rather than q_m assumes that the market value of an additional unit of new capital investment is approximately equal to the market value of a unit of existing capital stock.[28]

The q investment equation models the rate of capital investment as an increasing function of q_a and assumes that the investment-q relation is stable through time:

$$I_t = I(q_{at}) * K_t$$

$$I_t/K_t = I(q_{at}) \qquad (3.1)$$

$$I(1) = 0 \text{ and } I' > 0$$

[27] This parallels the more familiar present value model which suggests firms should increase investment when the net present value of a project exceeds zero.

[28] Hayashi (1982) shows marginal q equals average q only under restrictive conditions. These conditions are: (1) the firm's production technology is homogeneous of degree one, (2) markets are perfectly competitive, and (3) capital depreciates at a geometric rate. Hayashi also shows that the numerator of q_a must be decreased by the present value of future tax depreciation allowances applicable to existing assets.

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where I_t = gross investment during period t (includes both net and replacement investment),
q_{at} = average q at time t, and
K_t = capital stock at time t.

The functional form of (3.1) is generally assumed to be some variation of:

$$I_t/K_t = \alpha + \beta q_{at} + \varepsilon_t \qquad (3.2)$$

where parameters are estimated using historical data. Lagged values of q are usually included in the investment equation to allow for capital expenditure lags. For example,

$$I_t/K_t = \alpha + \beta_1 q_{at} + \beta_2 q_{a,t-1} + \varepsilon_t.$$

In general, the major criticisms of the q equation pertain to (1) the relationship between average q used for empirical purposes and the theoretically correct q_m, and (2) the measurement of q_a.[29] The potential advantages of the q model are limited because of its critical assumptions.

Using q theory to examine investment responses to changes in tax policy requires three steps. The first step is to estimate the relationship between

[29] The numerator of q_a is equal to the financial value of the firm, including both common and preferred stock and debt. Short-term fluctuations in the firm's market value may not be related to its investment decisions and may add noise to the data. This measurement error will be more problematic for quarterly than for annual data. Furthermore, market values for preferred stock and debt are difficult to obtain, and the proxies used may not fully reflect investors' valuations and expectations.

The denominator of q_a is equal to the replacement cost of the firm's existing assets. Measurement error in this number may arise because of the difficulty in obtaining replacement cost values due to a lack of active markets for most old capital goods. Most studies use the book values as proxies for replacement cost. Measurement error in the denominator of q_a will also exist to the extent the firm has unrecorded intangible assets. This measurement error may result in systematic differences across industries and across firms. Regardless of how replacement cost is measured, the denominator of q_a reflects the replacement cost of existing assets. Technological change may make a portion of existing capital stock obsolete. Failure to adjust for technological changes or "real" depreciation will overstate the empirical measure of replacement cost in the denominator of q_a. This can result in additional measurement error and possible systematic bias in q_a.

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investment and q using historical data. The second step is to relate changes in tax parameters to changes in q. In effect, the response of firm value to changes in tax parameters must be quantified. The third step is to use the investment equation estimated in step one to determine the capital stock that would follow from the shift in q caused by tax changes, where the shift in q is estimated in step two. q theory assumes that rational expectations of future events for optimal capital investment are appropriately reflected in current market values. If changes in the value of q which occur around the time tax incentive legislation is passed could be reliably estimated, it might be possible to develop estimates of the changes in capital investment induced by tax legislation. Unlike the neoclassical model, the q model can be used to study the effects on capital investment of both temporary and announced, but not yet implemented, tax changes. Critics argue that it is inappropriate to use an extremely weak empirical correlation between the stock market and investment to infer tax policy's effects on investment. Furthermore, tests that constrain tax effects to work through q do not provide a powerful test because there are a variety of factors that could result in a correlation of q and investment without necessarily implying a causal role to tax policy.[30]

3.3.2 Empirical Results

There are far fewer studies that examine tax investment incentives using a q model approach than use a neoclassical framework. Most studies have focused on incorporating q into the investment equation to evaluate its significance in explaining actual investment activity rather than on using q models to estimate the

[30] See Bosworth's discussion and the general discussion in Summers (1981), pp. 128-132 and pp. 139-140, respectively.

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effects of alternative tax policies.[31] Studies based on aggregate data for the U.S., U.K., and Japan, have not found that q models are superior to user-cost models. Studies using cross-industry and cross-firm data have also generated mixed results.[32]

Summers (1981) is one of the few to analyze the effects of tax policy on capital investment using a *q*-theory investment model. He first estimates the effects a tax change will have on future profits and then discounts these to estimate their present value and corresponding change in firm market value. The estimated valuation effects are then used to estimate the expected impact on capital formation using a *q*-model investment equation that relates firm value (q) and capital investment. Summers' methodology is designed to maximize the estimated impact of taxes on investment.[33] Summers, using simulated data, concludes that immediately doubling the ITC from 0.056 to 0.112 would raise stock market values by 4.8% and the investment level by 5.5% in the first year. In the long-run, he estimates that the capital stock would be increased by 17.3%. He concludes that these estimates are fairly close to those obtained by studies using neoclassical (conventional) investment equations. However, his results imply the adjustment

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[31] See Chirinko (1986) for a discussion of empirical studies that examine the significance of q in the investment equation.

[32] Clark (1979) concludes that, relative to alternative investment equations estimated with U.S. data, q models have not performed well in terms of either within sample or out-of-sample statistics.

[33] Some of the more restrictive assumptions that influence Summers' study are: (1) the production and financing decision are completely dependent upon one another (i.e., investment requires the reduction of dividends); (2) adjustment costs are assumed to rise monotonically with the investment level; (3) the real rate of interest is constant; and (4) equipment, structures, and inventory are treated as a composite capital good.

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process is much slower than is usually assumed, with the half-life of the adjustment process being close to 20 years (i.e., the capital stock increases by 9.4% after 20 years). He also argues that the ITC's incentive effects depend critically on the timing of the provision change's announcement and enactment.

3.4 EMPIRICAL RESULTS FROM SURVEY AND OTHER STUDIES

3.4.1 Survey Studies

Most accounting studies that address tax policy's impact on investment behavior have used a survey methodology. Corporate executives are asked how tax provisions affect their investment decisions. In general, these studies have found respondents perceive the ITC and other tax incentives to have a negligible effect on capital investment decisions. There are significant limitations on the inferences and conclusions that can be drawn from survey data, including self-selection bias, omitted variables, and the difficulty in deriving quantitative measures.[34]

Eisner and Lawler (1975): The authors examine what business respondents in McGraw-Hill surveys said a number of tax measures would do or had done to their anticipated or actual capital expenditures. The responses are also compared with several econometric projections from prior studies. In general, the responses indicate only modest effects on investment from the tax measures.

The study uses capital expenditure surveys of firms in non-financial industries for the years 1963, 1964, 1965, 1966 (fall), and 1968, with the number

[34] Questionnaire terminology may not be precise enough to generate quantitative data. Another problem with surveys is that an individual may fill out the questionnaire without actually possessing the necessary information. Other potential problems include nonresponse bias and low response rates.

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of sample firms ranging from 272 to 339. McGraw-Hill provided individual firm responses, but firms were coded by numbers to preserve data confidentiality. Questions related to three different tax incentives: corporate tax rates, accelerated depreciation, and the ITC. The questions were of the following nature: "Of the total amount you now plan to invest in 19xx, roughly how much is due to tax incentive *y*?" or "Of the amount you invested in 19xx, roughly how much more did your company spend than it would have because of tax incentive *y*?" Questionnaires were not identical across the years.

The authors find respondents generally indicate little movement in the hypothesized directions. Respondents reported the effects from liberalized depreciation as being somewhat larger than from the ITC even though estimates indicated that the present value of tax advantages due to the credit was greater than for the depreciation changes. For example, the unweighted mean proportion of anticipated investment in 1963 attributed to the new depreciation schedule was 4.2% while that attributed to the ITC was 2.8%. In 1964, a similar question shows a greater amount of anticipated investment attributed to liberalized depreciation than to the tax credit but considerably smaller proportions for each, with 2.8% and 1.1% respectively.

There are wide variations in proportion means across industries. In general, the largest percentages are reported for railroads, and negligible ones for utilities. This is consistent with the utilities' credit being only 3% and with evidence that has shown the utility industry's capital expenditures to be dominated by demand and output factors.

The authors question both the internal consistency and accuracy of the

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responses. Responses regarding actual (ex post) proportions were substantially less than for anticipated (ex ante) measures. Inconsistency also arises from the fact that samples were not identical across years. The bulk of individual survey answers as to percentage effect was "zero."[35] There were also a number of relatively extreme observations, including amounts greater than 100 percent. Large percentage responses came primarily from small firms. Thus, the authors calculated weighted means of survey responses, measured as the estimated total change in expenditures divided by total expenditures. The weighted means result in universally more moderate estimated incentive effects. For example, the anticipated effect of depreciation (ITC) changes in 1963 were 1.9% (1.4%) versus simple means of 4.2% (2.8%).

Eisner and Lawler compare survey responses with ex post estimates derived from econometric estimates of Hall and Jorgenson, Bischoff, Klein and Taubman, and Coen [all studies found in Fromm (1971)]. Relative to the econometric studies, the survey responses generally indicate the various tax incentives to be considerably less effective. The largest discrepancies occur in estimates of ITC effects, with survey estimates being much lower than econometric estimates.[36] The authors conclude by noting that survey respondents may be

[35] There was no evidence that McGraw-Hill had translated nonresponses into zeroes. However, if nonresponses were coded as zero, this would bias the estimates toward zero and underestimate incentive effects.

[36] The survey responses were also included as independent variables in regressions which modeled capital expenditures as a function of sales changes, profits, and depreciation variables. If a particular tax measure has precisely the same effect on capital expenditures as reported in the survey, the coefficient on the survey response variable would be unity. The results were inconclusive.

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unaware of all the direct and indirect influences tax policies may have on capital investment.

Porcano (1984): Porcano uses a survey to examine the perceived impact and importance of various tax provisions on firms' decisions to acquire fixed assets. Questionnaires were mailed to the Vice-President of Finance of each of the 1981 *Fortune 1000* companies, with a usable response rate of 28%. Respondents were asked to rate and then rank the importance of thirteen factors in their firms' decisions to acquire fixed assets. The list of factors contained both tax and non-tax factors that may have some bearing on the investment decision.

The results indicate that respondents perceived tax provisions to have a very small overall effect on stimulating their firms' investment in fixed assets. All tax measures, including the ITC, were rated as being unimportant or indifferent. The ITC was rated as indifferent and ranked ninth and tenth in importance, by small and large firms respectively. Respondents considered the most important capital investment factors to be normal expansion and modernization plans and expected changes in the economy. Factors considered somewhat important included current economic conditions, interest rates, ability to raise funds via debt, and inflation. When asked to indicate whether provisions of the 1981 Economic Recovery Tax Act (ERTA) would affect fixed asset investment decisions, a majority of respondents said the provisions would not. The corporate decision-makers perceived ERTA to be ineffectual in stimulating firms' investment decisions.

Rose and O'Neil (1985): Rose and O'Neil surveyed top-level business

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executives of 102 Virginia firms via a mail questionnaire.[37] The executives were surveyed to obtain their perceptions of the importance of tax incentives in decisions to acquire new equipment. The tax incentives analyzed were the ITC and the Accelerated Cost Recovery System (ACRS) of depreciation. They hypothesized that executives in firms operating near full output capacity view investment tax incentives as more important than do executives from firms with high excess capacity. Firms approaching full output capacity are on the borderline for needing additional equipment and will be more sensitive to the incentive effects of tax provisions. Firms with large excess capacity have little need for additional equipment and will view tax incentives as unimportant.

Although they find a significant difference between firms operating close to full output capacity and firms with high excess capacity, the difference is only modest. Tax incentives are viewed as moderate, while other decision factors are perceived as more important at every level of excess capacity and across every industry. In order of importance, these other factors are: anticipated increase in sales; improvement of operating productivity and efficiency; replacement of worn-out equipment; and availability and cost of financing. The results have implications for the continued use of tax incentives as a means of stimulating a depressed economy. Tax investment incentives may have the lowest effect on investment decisions during periods of economic recession because firms experience increasing amounts of excess capacity during these times.

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[37] They chose a random sample of 169 firms from 684 Virginia firms listed in the publication *50,000 Leading U.S. Corporations (1980)*. Of the 169 firms contacted, 102 usable responses were received.

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Porcano (1987): Porcano mailed a questionnaire to the Vice-Presidents of Finance of companies from four different countries: France, West Germany, the United Kingdom, and the United States. From a list of large international corporations contained in *Moody's International Manual (1983)*, a random sample of 100 firms from each of the first three countries was chosen, with a usable response rate of 31%. The U.S. sample and data came from Porcano's 1984 study (see above). The questionnaire asked respondents to rate and then rank the importance of fourteen different items in their firms' decisions to acquire fixed assets. The items included both tax and non-tax factors which were expected to have an impact on firms' investment decisions.

The results indicate that government incentive provisions, including tax credits, are not perceived to have much of an impact on firms' investment decisions. In general, firms from all four countries considered tax credits as indifferent in influencing investment decisions and ranked them as ninth or tenth in importance (out of 14). Factors perceived as most important included normal modernization and expansion plans and expected changes in the economy.

3.4.2 Other Studies

Bathala and Carlson (1992): The Tax Reform Act of 1986 (TRA) generally repealed the 10% ITC available for qualified investments. Bathala and Carlson examine the effect this repeal had on firms' capital investment rates between the pre- and post-TRA periods. A firm's investment rate is defined as the change in gross property, plant, and equipment (GPPE) between periods, divided by the prior year's GPPE level. For the pre-TRA period the data are averaged for the years 1984 and 1985, and for the post-TRA period the data are averaged for

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the years 1988 and 1989. Averaging the data is done to help lessen the effects of any short-run variations. The years 1986 and 1987 are excluded because firms' investment policies may be confounded by the passage of the ITC during this period.

The authors use an ANCOVA model to test the null hypothesis that, after controlling for the ITC and other factors that may affect a firm's investment rate, investment rates did not change between the pre- and post-TRA periods. The model includes the firm's size, growth, and ITC amount as covariates:

$$IR_{it} = \mu + \beta_1(X_{1it} - X_1) + \beta_2(X_{2it} - X_2) + \beta_3(X_{3it} - X_3) + \varepsilon_{it},$$

where IR_{it} = investment rate for firm i, with t=0 for the pre-TRA period and t=1 for the post-TRA period,
μ = overall mean investment rate,
X_{1it} = log of ITC for firm i at period t,
X_{2it} = log of total assets for firm i at period t, and
X_{3it} = proxy for growth for firm i at period t (Tobin's q),

and X_1, X_2, and X_3 are mean values. The sample consists of approximately 300 NYSE firms from *Compustat*. (Financial institutions and firms in regulated industries are excluded.) For the sample, the investment rate decreased from 23.6% during the pre-TRA period to 11.65% during the post-TRA period, a significant difference at the 1% level. The overall ANCOVA model is significant (p=.011), but only the ITC covariate is significant (p=.0233) and positively related to the investment rate. Firm size and growth are not significant. After adjusting for the ITC's effects, mean investment decreased from a pre-TRA rate of 22.12% to a post-TRA rate of 13.65%. However, the decrease of 8.47% is not statistically significant (two-sided p=.156). The authors interpret this to indicate that if the ITC amount available to firms had remained constant across the two time periods,

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firms' investment rates would have remained relatively constant rather than decreasing significantly. The authors also divide the firms into groups based on relative investment rates and industry. Firms with higher rates of capital investment experienced larger declines in their investment rates during the post-TRA period.

There are several limitations to the interpretability of these results. First, in the ANCOVA model, only the ITC variable is significant in explaining the investment rate. This may indicate a misspecified investment model. Second, the 1986 TRA incorporated many tax changes which may have affected capital investment, including changes in corporate and personal tax rates and, perhaps most importantly, changes in the accelerated depreciation provisions. The accelerated depreciation rules were modified so that equipment and structures are depreciated over longer periods. Like the ITC's repeal, this would have a disincentive effect, and the ITC may be highly correlated with the change in depreciation deductions (an omitted variable). Therefore, it is difficult to attribute all of the decrease in capital investment to the ITC effects. Furthermore, the 8.47% decrease in the mean investment rate (adjusted for ITC effects) would be significant using a one-sided test (p=.0778) which may be the appropriate test to use when recognizing possible depreciation disincentive effects.

3.5 CONCLUSION

Although Congress has relied on the ITC as an investment incentive, the empirical evidence is inconclusive as to whether the ITC is effective at stimulating capital investment. Prior research has produced ambiguous results regarding the ITC's effects on investment decisions. The inconsistent evidence may be due both

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to the inability of macroeconomic investment models used in previous research to adequately model investment behavior and to a lack of relevant firm-level data. The data source and method presented in this study address many of the criticisms leveled at prior studies. The next chapter develops the hypotheses, while Chapter 5 describes the methodology and research design.

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CHAPTER FOUR: HYPOTHESES

This chapter develops the hypotheses. The primary hypotheses focus on the ITC's effectiveness in stimulating firm-level planned capital expenditures. Because the analysis is at the firm level, the influence of firm-specific factors on firms' sensitivity to the ITC's incentive effects can also be examined. Two factors that may impact the ITC's stimulus effect are identified: firms' debt constraints and firms' investment opportunities. Firms facing debt constraints may respond less to the ITC's incentive effects because they are unable to obtain the necessary funds to finance new capital expenditures. Firms with few growth opportunities may respond less to tax incentives because they face a more limited set of potentially profitable investments.

4.1 HYPOTHESIZED EFFECTS OF THE ITC ON FIRMS' INVESTMENT DECISIONS

This study tests whether the ITC is effective in stimulating firm-level capital investment. Specifically, this study examines the changes in firms' short-term and long-term investment plans due to ITC legislation that occurred from 1971 through 1978.[1] There were four tax acts during this period that changed the ITC's provisions. All four acts enhanced the ITC provisions. The 1971 Act reinstated the credit, while the latter acts increased the ITC's rate and extended its benefits. This study examines the incentive effects from three of these acts.[2] Congress' primary purpose for enacting the ITC and extending its benefits was to

[1] For purposes of this study, short-term refers to one year ahead, while long-term refers to the period three to five years ahead. This corresponds to the *Value Line* forecast periods.

[2] This study's research design precludes examining the 1976 Act's incentive effects.

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increase capital expenditures. This leads to the general hypothesis:[3]

HA1: Changes in the ITC's provisions changed firms' planned capital expenditures in predictable directions.

Although all three legislative acts examined in this study enhance the ITC provisions, the directional hypotheses differ for each act. For example, when the ITC is *reinstated*, firms may increase their capital expenditures in both the short- and long-run. Alternatively, when the ITC's rate is *temporarily* increased, firms may increase capital expenditures in the short-run by accelerating purchases to take advantage of the temporary increase in the ITC rate. Longer-term capital expenditures may remain unchanged or may decrease if the ITC does not stimulate capital investment but only alters its timing. The directional hypotheses in this study are consistent with the incentive effects anticipated by Congress.

Revenue Act of 1971: The Revenue Act of 1971 reinstated the ITC at a 7% rate (4% for regulated companies) and permitted the ITC to offset 50% of a firm's tax liability in excess of $25,000. The first $25,000 of tax liability could be fully offset. Congress stated that lagging investment in machinery and equipment was a primary cause of the depressed economy and that the ITC would increase capital investment by decreasing capital's effective purchase price. This leads to the following hypothesis.

$HA1_{1971}$: Reinstatement of the ITC increased planned capital expenditures in both the short- and long-run.

If the ITC is a capital investment stimulus, its reinstatement may cause

[3] All hypotheses are stated in alternative form.

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firms to increase their capital expenditures in both the short- and long-run. However, if firms cannot or do not react immediately, capital expenditures may change for the long-run but not the short-run. The ITC may be ineffective for stimulating short-term economic growth if firms respond slowly to changes in ITC provisions.

In the early 1970's, businesses argued that depreciation reform was needed to reduce ambiguity and complexity. Therefore, the 1971 Act also introduced the Asset Depreciation Range System (ADR) of depreciation for property placed in service after December 31, 1970. The ADR system was expected to provide two benefits: (1) elimination or substantial reduction of the depreciation system's complexity and uncertainty, and (2) favorable financial and economic results through shorter depreciable lives. Therefore, any acceleration of depreciation allowances that arose from ADR may also have acted as an investment incentive.

Tax Reduction Act of 1975: Under the Tax Reduction Act of 1975, Congress temporarily increased the ITC rate to 10% for all taxpayers, including public utilities. The increased rate applied to property acquired and placed in service during 1975 and 1976. In the case of property acquired after December 31, 1976, the 7% credit (4% for public utilities) would apply even if the property was ordered before 1977. In addition, public utilities were permitted to increase the amount of their income tax liability that could be offset by the ITC from 50% to 100% for taxable years ending in 1975 and 1976.[4] Congress hoped that firms would accelerate and/or increase their short-term capital expenditures in response

[4] The first $25,000 of tax liability could be fully offset. The percentage limitation was to be reduced 10% each year until the 50% limitation was again reached in 1981.

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to the temporary rate increase. This leads to the hypothesis:

$HA1_{1975}$: Temporarily increasing the ITC's rate increased planned capital expenditures in the short-run.

The increased ITC rate is expected to affect 1975 and 1976 capital expenditures.

Revenue Act of 1978: To stimulate the economy, the 1978 Act significantly liberalized the ITC provisions. The Act permanently increased the ITC rate to 10%. The rate had been scheduled to return to 7% (4% for public utilities) in 1981. The AICPA and other proponents argued that making the increased rate permanent would provide certainty that is important to business planning. They said that repeated changes in the ITC provisions caused confusion and reduced the ITC's incentive effects. The Act also increased the 50% tax liability limitation to 90%, phased in at 10% per year beginning in 1979.[5] These provision changes lead to the hypothesis:

$HA1_{1978}$: Permanently increasing the ITC's rate increased planned capital expenditures in the long-run.

Before the 1978 Act, the 10% rate was only effective through 1980. Therefore, any incentive effect from the 1978 Act would be expected after 1980.

To encourage energy conservation and promote industrial and agricultural conversions from oil and gas to alternative energy forms, the Energy Tax Act of 1978 modified the ITC provisions to allow for an energy credit. For the period

[5] To enable businesses to rehabilitate and modernize existing older structures, the 1978 Act extended the ITC to qualified rehabilitation expenditures made in connection with existing buildings used in all types of businesses or production activities. Qualified buildings included factories, warehouses, office buildings, and retail and wholesale stores. The costs of acquiring or enlarging a building or for adding facilities did not qualify.

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October 1, 1978 through December 31, 1982, businesses could add to the ITC a special 10% energy credit for investing in alternative energy property. Thus, property qualifying as both energy property and ITC qualified investment property could benefit from both credits.[6] The energy credit could be used to offset 100% of tax liability. Equipment purchased by public utilities did not qualify for the energy credit.[7]

4.2 ITC INCENTIVE EFFECTS AND FIRMS' DEBT CONSTRAINTS

In perfect capital markets, a firm's investment decisions are independent of its financial condition. However, firms face imperfect capital markets, and empirical evidence suggests that a firm's financial position affects its capital investment.[8] Whited (1992) finds that binding debt constraints affect firms' allocations of capital expenditures over time. Specifically, a firm facing such constraints may be unable to obtain the funds needed to finance new capital investment. Fazzari, Hubbard, and Petersen (1988b) hypothesize that investment expenditures by firms with external financing constraints will respond less to tax-induced changes in the cost of capital than investment by firms without such constraints. Firms with debt constraints may respond less to tax investment incentives, while firms not facing debt constraints may respond more strongly to

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[6] Most property qualifying for the energy credit also qualified for the regular ITC. However, some energy property qualified for the energy credit but not the regular ITC because the property was a structural component of real property.

[7] The Windfall Profit Tax Act of 1980 expanded the definition of energy property, increased certain rates of the energy credit, and generally extended through 1985 the period for which the energy credit was available.

[8] See Fazzari and Athey (1987) and Fazzari, Hubbard, and Petersen (1988a, 1988b).

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such incentives. This leads to hypothesis two.

HA2: The ITC's effect on planned capital expenditures was greater for those firms with less difficulty in obtaining debt financing.

Consistent with Whited (1992), I estimate firms' debt constraints using the firm's debt-equity ratio. A larger ratio implies a more binding debt constraint and greater difficulty in borrowing. Because average debt-equity ratios vary across industries, hypothesis two is tested separately by industry. Actual and forecasted (both short-term and long-term) debt-equity ratios are available from *Value Line*.

I focus on debt rather than equity financing because, for most firms, debt is a more important source of incremental funding than outside equity. According to the pecking order theory developed by Myers (1984), firms fund capital expenditures by first drawing down cash and other liquid assets, followed by issuing riskless debt, risky debt and hybrid securities, and lastly, common equity. A number of studies indicate that equity typically accounts for less than 5% of total new external finance.[9] If debt is the primary marginal source of external funds, debt constraints may be more likely to affect corporate investment decisions.

4.3 ITC INCENTIVE EFFECTS AND FIRMS' INVESTMENT OPPORTUNITIES

Tillinger (1991) hypothesizes that a firm's investment opportunities affect its responsiveness to a tax stimulus. She finds that the research and development (R&D) credit provided less of an incentive to increase R&D activity for firms with a smaller opportunity set than for firms with a larger one.[10] Tax incentives may be

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[9] For example, see Friedman (1982), Srini Vasan (1986), and Fazzari et al. (1988a and 1988b).

[10] Tillinger uses a firm's q ratio to estimate its investment opportunity set.

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ineffective for firms with fewer investment opportunities because these firms are less likely to have access to positive net present value projects. This leads to hypothesis three.

HA3: The ITC's effect on planned capital expenditures was greater for those firms with more investment opportunities.

I use the ratio of the market value of equity to the book value of equity[11] and the price/earnings ratio[12] to measure a firm's investment opportunity set. For both ratios, a larger value indicates a larger investment opportunity set. Because these measures differ across industries, hypothesis three is tested separately by industry.

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[11] See Chung and Charoenwong (1991), Collins and Kothari (1989), Lewellen, Loderer, and Martin (1987), and Gaver and Gaver (1993). Collins and Kothari argue that the difference between the market value and the book value of equity roughly represents the value of investment opportunities facing the firm.

[12] See Chung and Charoenwong (1991), Kester (1984), Gaver and Gaver (1993), and Smith and Watts (forthcoming). Chung and Charoenwong show that the larger the EP ratio, the larger the proportion of equity value attributable to earnings generated from existing assets, relative to growth opportunities.

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CHAPTER FIVE: USING ANALYSTS' FORECASTS TO EXAMINE CHANGES IN TAX POLICY

As discussed in Chapter 3, prior research provides inconsistent evidence of the ITC's effectiveness in stimulating capital investment. The inconsistent evidence may be due to the use of macroeconomic investment models rather than firm-level models and data. These studies assume a representative firm with a generalized investment function and test tax policy's effects indirectly. This study proposes a new data source and method to test the ITC's effectiveness in stimulating firm-level capital expenditures. The data source and method address many of the criticisms leveled at prior studies. This chapter first discusses the advantages of using analysts' forecasts to examine the ITC's incentive effects relative to using traditional investment models. The next section then presents the research design in detail. To test whether the ITC increases planned capital investment, changes in firms' forecasted capital expenditures are modeled as a function of changes in investment-related variables (to control for nontax factors) and ITC-related variables (to measure the ITC's incentive effects). The investment models discussed in Chapter 3 help identify the nontax factors included in the estimation equations. Using analysts' forecasts as measures of firms' planned capital expenditures assumes that analysts' forecasts are accurate estimates of investment behavior. The last section of this chapter discusses the validity of this assumption.

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5.1 ADVANTAGES OF USING ANALYSTS' FORECASTS

This study's methodology has several advantages over prior studies that examine tax policy incentive effects. The critical step in assessing the impact of tax investment incentives is specifying and estimating an acceptable investment function. Analysts' forecasts of capital expenditures are firm-specific, eliminating the need to specify a representative firm with a generalized investment model. Each forecast represents planned investment given a firm's characteristics and unique investment decision variables. Investment-related factors that vary across firms are specifically incorporated into firm-level investment forecasts. Such factors include actual and expected sales, income, discount rates, financing considerations, and modernization and expansion plans. Analysts' forecasts also reflect firm-specific information about firms' production functions, management's motivation in capital investment decisions,[1] and the timing of investment.[2] The assumptions traditional investment models must make with respect to these factors may have contributed to the inconclusive evidence regarding tax policy incentive effects.

The capital expenditure forecast made prior to anticipation of the ITC

[1] Both the Neoclassical and Tobin's *q* investment models use the general investment decision rule which states that a firm invests up to the point where expected marginal benefit equals expected marginal cost for the final unit of capital investment. This assumes managers act in shareholders' best interests to maximize firm value by, on average, undertaking positive net present value projects. Jensen (1986) suggests that managers of public corporations overinvest retained earnings by undertaking negative net present value projects and that this problem is widespread. Kallapur (1991) provides evidence consistent with Jensen's hypothesis.

[2] Traditional investment models must make explicit assumptions regarding adjustment costs and recognition and implementation lags which may prevent all economically desirable investments from being made immediately.

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legislation is the best approximation of a firm's planned investment in the absence of a tax law change. Forecasts made after the tax bill is signed into law proxy for the level of planned investment given the change in the tax provisions. The advantage of using investment forecasts made after the ITC provisions change rather than actual investment is that the forecasts are available soon after the tax law changes, and are not influenced by confounding factors that occur in the time period between the tax law change and the actual investment.[3] This is especially important given that the ITC provisions may change again before long-term investment plans are realized. Because confounding events are unlikely to affect the difference between short-term planned capital expenditures and actual expenditures, both the change in forecasted and actual capital expenditures will be used when examining firms' short-term investment responses.[4]

Another important advantage of the forecast data is that the forecasts directly incorporate *expectations* of future investment-related factors, including future tax changes.[5] Traditional investment models treat changes in tax provisions and other investment-related factors as though they were permanent. For example,

[3] Confounding factors include any unexpected changes in factors that affect a firm's capital investment decision, including unexpected changes in firm-specific, industry, and macroeconomic conditions.

[4] Even when actual capital expenditures are used, the *Value Line* data provides significant advantages because firm-specific observations of investment-related variables are available. Investment theory models investment as a function of *expected* sales and *expected* cost of capital, but empirical studies usually rely on an extrapolation from historical macro data to calculate expected values because expectations are unobservable. *Value Line* provides firm-specific observations of these forecasted amounts (for egs., forecasted sales and ROE).

[5] Lucus (1976) argues that, in formulating investment plans, economic agents necessarily look into the future. Thus the decision rules guiding their actions depend on parameters describing the expectations of future variables.

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in a traditional investment model, the 1975 temporary increase in the ITC rate would be estimated to have the same impact on investment as a permanent increase. In addition, preannounced changes in tax policy have no effect on investment expenditures in traditional models, even though firms might be expected to alter their plans to benefit from timely investment planning (for example, delaying investment to take advantage of phase-in provisions).

An advantage of using individual firm data is that it provides the heterogeneity necessary to examine factors that may affect firms' sensitivity to tax incentive effects. This should provide richer insights into firms' investment decisions, improve the ability to isolate and measure tax incentive effects, and provide policymakers with a better understanding of the efficiency, effectiveness, and equity of tax incentives. Furthermore, firm-level measures of capital investment and investment-related variables may be more accurate than macroeconomic measurements.

5.2 THE MODEL

Each quarter, *Value Line* forecasts annual *capital spending* for both one year ahead and an average for three to five years ahead. *Capital spending* is defined as the outlay for plant and equipment for the year, excluding funds spent for acquisitions. This study uses these capital expenditure forecasts to proxy for firms' planned investment behavior. I use forecasts published prior to discussions of the ITC provision changes to proxy for the level of planned investment without the ITC changes, and forecasts published after the final relevant tax legislation date to proxy for the level of planned investment given the change in the ITC provisions. If the ITC affects planned investment and analysts can forecast firms'

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capital expenditures, analysts will alter their forecasts to reflect their expectations of firm-specific capital expenditure responses. The differences in forecasts made before and after ITC-related legislation estimate the ITC's incentive effects on planned capital expenditures. Changes in both short-term (one year ahead) and longer-term forecasts (three to five years ahead) measure firms' short-run and long-run reactions to ITC changes.[6]

The discussion and enactment of tax legislation, however, can be a lengthy process. The legislative periods for the ITC provisions examined in this study range from approximately 3 months to 12 months. Therefore, *Value Line* forecasts are from 12 to 18 months apart. Since the forecasts are made at different times, they may differ not only because of the change in tax policy but also because of changes in other investment-related variables that occur between the forecast dates.[7] The forecast published after the ITC legislation represents firms' planned

[6] It is not possible to infer, from the ITC amount disclosed in a firm's financial statement, the amount of capital investment induced by the ITC. The ITC may be claimed on investment that would have occurred without the ITC. In such situations, the provisions do not have the stimulus effect intended by the government and may provide firms with a windfall benefit. It is also difficult to measure the ITC amount attributable to the current year's investment. Firms can use either the flow-through or deferral method of accounting for the ITC for financial statement purposes. If the deferral method is used, the full ITC amount attributable to current investment is not observable. Even if the full ITC amount claimed in a given year is known, the corresponding capital investment amount may be difficult to determine because of the qualified investment provisions. For example, the 1971 Act reinstated the ITC at a 7% rate for qualified investment. Qualified investment was equal to one-third, two-thirds, or 100% of an investment's cost depending on the asset's useful life. A $7 credit implies a $100 investment if 100% of the asset's cost is qualified investment but implies a $300 investment if only one-third of the investment's cost qualifies. In addition, firms may not disclose the ITC carryforward amount. If a firm cannot use the full ITC amount because of the ITC limitation provisions and does not disclose the amount carried forward, the ITC attributable to current investment cannot be determined. Alternatively, ITC amounts claimed in a given year may be carryforward amounts and not applicable to current investment.

[7] The years forecasted may also differ. Depending on the timing of the forecasts relative to the legislative period, the two forecasts compared may be for year t+1 and year (t+1)+1. For the

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expenditures given the changes in the ITC provisions *and* in other factors that may affect analysts' forecasts. If forecasted investment increases after controlling for changes in other investment-related factors, then it is likely that the ITC stimulated firms' planned capital expenditures.

The investment equations presented in this chapter test the prediction that the ITC provision changes increased firms' planned capital expenditures. The change in a firm's forecasted capital expenditures is modeled as a function of changes in investment-related variables (to control for nontax factors), dummy variables (to measure the ITC's incentive effect on capital expenditures), and interaction terms (to test whether firms increased the capital intensity of their operations after the ITC provision changes). Focusing on *changes* rather than *levels* controls for firm-specific determinants of capital investment that do not change between time periods.[8] Variables from investment theory that may potentially affect capital investment are identified and included in the investment equations. The next subsection discusses these variables, while the following subsections describe the estimation equations and the selection of forecast dates.

5.2.1 Explanatory Variables

Most investment and tax policy studies use some variant of Jorgenson's

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three-to-five year forecasts, the forecasts compared may be for year t+j and year (t+1)+j, where j is the three-to-five year period.

[8] Modeling changes rather than levels of forecasted investment may also be more tractable for empirical reasons. Levels of financial variables are often correlated, both across firms and through time. Under these circumstances, an omitted variable will be correlated with included variables and result in biased, inconsistent estimators. Time-differencing a misspecified cross-sectional levels model can generate a well-specified model in the differences, in contrast to time-series regressions where the differences are well specified if and only if the levels are well specified. [See Plosser, Schwert, and White (1982) and Christie (1987)].

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(1963) neoclassical investment model, which models investment (I) as a function of the expected user cost of capital (c^e), expected price of output (P^e_q), and expected output (Y^e):

$$I = f(c^e, P^e_q, Y^e) = g(c^e, S^e)$$

where S^e is expected sales and is equal to P^e_q multiplied by Y^e. Investment is increasing in S^e and decreasing in c^e. The variables described below are identified from this investment theory and are included in the estimation equations to control for changes in forecasted capital expenditures attributable to nontax factors.

(1) Sales: Studies of the determinants of business investment have typically emphasized output, sales, or profit variables [see Bernanke (1983)]. In a study of economic investment models, Clark (1979) concluded that output was clearly the primary determinant of nonresidential fixed investment.[9] Therefore, my investment equations include an independent variable to control for changes in forecasted capital expenditures due to changes in forecasted sales. Actual and forecasted sales are available from *Value Line*.

(2) Cost of Debt: The financial cost of capital, operating through c^e in the neoclassical investment model above, is inversely related to investment. Investment theory suggests that the cost of capital measure should reflect both the cost of debt and of equity. Much of the investment literature uses the real interest rate as a measure of the cost of debt. Real interest rates have been found to significantly affect capital investment [for example, see Bernanke (1983)]. The investment equations therefore include an independent variable to control for

[9] Allen Sinai, chief economist for Shearson Lehman Brothers, argues that "what drives investment are sales and expectations of sales relative to capacity utilization" [Levinson (1986)].

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changes in the real interest rate. To obtain a firm-specific bond measure, a firm's financial strength rating is collected from *Value Line*. For all industries except the electric utility industry, I use the average monthly yield on a comparably rated corporate bond for the month corresponding to the forecast date. For the electric utility industry, I use the average monthly yield on a comparably rated utility bond for the month corresponding to the forecast date. (These measures are collected from Standard and Poor's *The Outlook.*) Changes in the interest rate capture the impact on capital expenditures of changes in macroeconomic factors unrelated to the ITC, such as changes in the general economic environment. This is especially important if the ITC is proposed (repealed) during a recessionary (prosperous) period. Failure to incorporate interest rate changes could confound the impact on capital expenditures of changes in the general economy and changes in the ITC provisions.

(3) Cost of Equity: In addition to the cost of debt, the financial cost of capital includes the firm's expected cost of equity. Several studies have measured the cost of equity with various return on equity measures [see Chirinko (1986)]. I use the firm's forecasted return on equity to proxy for its equity costs. Actual and forecasted ROE values are available from *Value Line.*

(4) Internal Funds: Some investment studies have found that the amount of internal funds available for financing investment may be an important determinant of investment expenditures.[10] Changes in a firm's liquidity position between forecast dates could affect its capital expenditure forecasts. At the

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[10] For example, see Blundell, Bond, Devereux, and Schiantarelli (1992).

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forecast date, analysts estimate a firm's liquidity for the current year. To the extent that their estimate is incorrect, analysts may revise their capital expenditure forecasts. Therefore, the estimation equations incorporate a proxy for unexpected changes in a firm's liquidity during the forecast change period. Unexpected increases in internal funds may lead to increases in capital expenditures. Unexpected cash earnings (CASH) are used to proxy for unexpected liquidity changes. CASH is defined as a firm's annual cash earnings (announced between the two forecast dates) minus the annual cash earnings forecasted by *Value Line* at the beginning of the forecast period.[11]

(5) Capital Expenditure Forecast Error: To the extent the analyst's estimate of capital expenditures at the beginning of the forecast period is incorrect, the analyst may revise his/her capital expenditure forecast at the next forecast date. Therefore, the estimation equations include the capital expenditure forecast error that occurs during the forecast change period. The capital expenditure forecast error (CAP) is defined as a firm's annual capital expenditure (announced between the two forecast dates) minus the annual capital expenditure forecasted by *Value Line* at the beginning of the period.

5.2.2 The Estimation Equations

Equation (1) models changes in short-term capital expenditure forecasts (as a percentage of short-term forecasted sales), while equation (2) models changes in

[11] Motivation for including CASH is also provided by Greenwald and Stiglitz (1990). They propose an asymmetric information model of the firm where successful investment leads to a reduction in the cost of future investment. As a firm's financial strength increases, the risk premium associated with investment decreases, reducing the marginal cost of investment. A lower marginal cost allows higher continued investment.

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long-term forecasts (as a percentage of long-term forecasted sales):[12]

$$\Delta STINV_{it} = \beta_0 + \beta_1 \Delta STSAL_{it} + \beta_2 \Delta INT_{it} + \beta_3 \Delta STROE_{it} + \beta_4 CASH_{it} + \beta_5 CAP_{it} + \beta_6 DITC + \beta_7 CRED + \beta_8 \Delta STSAL_{it} {*} DITC + \beta_9 \Delta STSAL_{it} {*} CRED + \varepsilon_{it}, \qquad (1)$$

where $\Delta STINV_{it}$ = change in the short-term capital investment forecast for firm i for forecast change t divided by short-term forecasted sales at the beginning of the period;

$\Delta STSAL_{it}$ = change in the short-term sales forecast for firm i for forecast change t divided by short-term forecasted sales at the beginning of the period;

ΔINT_{it} = change in the real interest rate for firm i for forecast change t;

$\Delta STROE_{it}$ = change in the short-term return on equity forecast for firm i for forecast change t;

$CASH_{it}$ = unexpected cash earnings for firm i that occur during forecast change t divided by short-term (long-term) forecasted sales at the beginning of the period;

CAP_{it} = capital expenditure forecast error for firm i that occurs during forecast change t divided by short-term (long-term) forecasted sales at the beginning of the period;

DITC = 1 if period of ITC change (forecast change 0), equal to 0 otherwise;

CRED = 1 if period after ITC change (forecast change +1), equal to 0 otherwise;[13]

ε_{it} = error term for firm i for forecast change t;

i = 1,...,N; firm index (number of firms varies by industry); and

t = index indicating forecast change.

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[12] I deflated by sales (a size-related variable) to obtain greater uniformity in the data and ensure that a few observations (larger firms) do not exert excessive influence on the estimates [see Maddala (1977)]. In addition, because the regressions aggregate values from different calendar years, dividing the change in forecasted capital expenditures in specific years by forecasted sales in that same year may reduce the impact of inflation on the capital investment figure. Any reduction of inflation's impact assumes product prices (sales) and capital prices increase at the same rate.

[13] For the 1971 Act, *CRED* is equal to 1 for both forecast changes +1 and +2.

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$$\Delta LTINV_{it} = \gamma_0 + \gamma_1 \Delta LTSAL_{it} + \gamma_2 \Delta INT_{it} + \gamma_3 \Delta LTROE_{it} + \gamma_4 CASH_{it}$$

$$+ \gamma_5 CAP_{it} + \gamma_6 DITC + \gamma_7 CRED + \gamma_8 \Delta LTSAL_{it} {*} DITC$$

$$+ \gamma_9 \Delta LTSAL_{it} {*} CRED + \varepsilon_{it}, \qquad (2)$$

where $\Delta LTINV_{it}$ = change in the long-term capital investment forecast for firm i for forecast change t divided by long-term forecasted sales at the beginning of the period;

$\Delta LTSAL_{it}$ = change in the long-term sales forecast for firm i for forecast change t divided by long-term forecasted sales at the beginning of the period;

$\Delta LTROE_{it}$ = change in the long-term return on equity forecast for firm i for forecast change t;

and the other variables are as described above. Forecast change -1 occurs in the period immediately preceding the ITC legislation, while forecast change +1 occurs in the period immediately following the ITC legislation. Forecast change 0 includes the ITC legislative period.[14]

Investment equations (1) and (2) are estimated cross-sectionally for the complete sample and separately for each industry using the pooled forecast changes. The regressions are run separately for each act. The intercept represents the mean change (or growth) in forecasted investment not explained by the independent variables. If changes in the ITC's provisions immediately increased planned capital expenditures, then the intercept for forecast change 0 would be greater than for forecast changes -1 and +1.[15] This would imply that the ITC provided a one-time increase in the level of planned capital investment. Future capital expenditures will continue to be made at this higher level, but the growth

[14] For the 1971 Act, both forecast change +1 and +2 occur after the ITC legislation period.

[15] For the 1971 Act, forecast change 0's intercept would also be greater than forecast change +2's intercept.

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rate of capital investment in future periods will not change. This could reflect firms' ability to adjust short-term (long-term) capital expenditures to their new, higher levels within one year (three to five years) after the ITC's provisions change. Therefore, equations (1) and (2) include a dummy variable (DITC) set to 1 for forecast change 0 and set to zero for forecast changes -1 and +1. (For the 1971 Act, DITC also equals zero for forecast change +2). Figure 5.1, Panels A and B, illustrate what the level and changes in forecasted capital expenditures might look like under such a scenario (see the solid line).

Gravelle (1993) argues that one drawback of the ITC is that there is a great deal of uncertainty about how quickly any stimulus effect will occur. Even if the ITC does have a stimulus effect on investment, this effect may not occur immediately. She notes that most firms have significant planning horizons that result in a lag between a change in capital costs and increased capital expenditures. In large corporations with complex capital budgeting procedures, any response to the ITC may be substantially delayed. If this argument holds and firms respond slowly to the ITC's incentive effects, then the ITC will increase the mean change in forecasted investment in the period after its provisions change. The intercept for forecast change +1 (and forecast change +2 for the 1971 Act) would be greater than the intercepts for forecast changes -1 and 0. Therefore, both equations include the dummy variable CRED to test the ITC's effect on the mean change in planned capital investment in future periods. CRED takes on a value of one for forecast change +1 and a value of 0 otherwise. (For the 1971 Act, CRED is equal to 1 for both forecast changes +1 and +2). Figure 5.1 illustrates this graphically (see the dotted line).

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The ITC may also influence firms' operations. If capital becomes less expensive relative to labor, firms may become more capital intensive. If production becomes more capital intensive, the investment-sales relation will change. For a given increase in forecasted sales, forecasted capital expenditures will increase by a greater amount than they would without the ITC. Depending on the ability of firms to alter their production activities, this increase in capital intensity may be reflected immediately or in later periods. Therefore, both DITC and CRED are multiplied by the change in forecasted sales.

β_1 and γ_1 can be interpreted as the capital intensity coefficients. They represent the change in forecasted capital expenditures induced by a percentage change in forecasted sales. β_2 and γ_2 (β_3 and γ_3) are the change in forecasted capital expenditures induced by a 1% change in the real interest rate (forecasted ROE). β_4 and γ_4 can be interpreted as the change in forecasted capital expenditures attributable to unexpected cash earnings, while β_5 and γ_5 are the change attributable to the current capital expenditure forecast error. The coefficients on the forecasted sales, unexpected cash earnings, and capital expenditure forecast error variables (β_1, γ_1, β_4, γ_4, β_5, γ_5) are expected to be positive, while the coefficients on the interest rate and ROE variables (β_2, γ_2, β_3, and γ_3) are expected to be negative.

The prediction that the ITC increases planned capital investment is supported if the coefficients on the DITC dummy variables (β_6 and γ_6) are significantly positive. This would suggest that the ITC's incentive effects are immediately incorporated into planned capital investment and that firms respond relatively quickly to the ITC's stimulative effects. If the coefficients on the CRED

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dummy variables (β_7 and γ_7) are significantly positive, this would imply that the ITC changes increase the mean growth in planned capital expenditures in future periods. Significantly positive coefficients on the interaction terms (β_8, γ_8, β_9 and γ_9) would suggest that the planned capital intensity of firms' operations was affected by the ITC since this implies that, for a given increase in forecasted sales, forecasted capital expenditures increased by a greater amount when the ITC was available. If β_8 and γ_8 are significantly less than β_9 and γ_9, this suggests that it took time for firms to alter the capital intensity of their operations.

Equations (1) and (2) may bias *against* finding an ITC incentive effect because, if the ITC stimulates capital investment, the incremental capital investment induced by the ITC may increase forecasted sales revenue. Forecasted sales after the ITC's reinstatement may reflect higher expected sales revenue due to the ITC-related investment, biasing the sales forecasts upward. An increase in forecasted capital expenditures would be attributed to an increase in forecasted sales rather than the ITC. Therefore, equations (1) and (2) are also estimated including firm i's unexpected sales during forecast change t *(USAL)* as an explanatory variable instead of the change in forecasted sales. $USAL_{it}$ is defined as a firm's annual sales (announced between the two forecast dates) minus the annual sales forecasted by *Value Line* at the beginning of the forecast period, divided by short-term (long-term) forecasted sales at the beginning of the period. In the short-term model for example,

$$\Delta STINV_{it} = \beta_0 + \beta_1 USAL_{it} + \beta_2 \Delta INT_{it} + \beta_3 \Delta STROE_{it} + \beta_4 CASH_{it} + \beta_5 CAP_{it} + \beta_6 DITC + \beta_7 CRED + \beta_8 USAL_{it}{*}DITC + \beta_9 USAL_{it}{*}CRED + \varepsilon_{it}.$$

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$USAL_{it}$ is designed to capture changes in sales expectations due to non-ITC information that arrives between the forecast dates while minimizing the possible bias introduced by the forecasted sales amounts.

5.2.3 Selection of Forecast Dates

Revenue Act of 1971: The Tax Reform Act of 1969 repealed the ITC for property acquired after April 1969. On August 15, 1971, President Nixon announced he would seek restoration of the credit. I determined this date to be the first identifiable date at which expectations regarding ITC legislation changed.[16] Therefore, forecasts from a firm's *Value Line* report issued in the quarter prior to August 15, 1971 proxy for the level of planned investment without the ITC. These are forecasts from firms' 1971 second quarter *Value Line* reports and (for my sample of firms) are issued over the period May 7, 1971 through June 11, 1971. (These will be referred to as forecasts from 1971:2.) The Revenue Act of 1971 reinstating the ITC was signed into law on December 10, 1971. It may take analysts time to incorporate the effects of a tax change into their forecasts. Therefore, forecasts from firms' 1972 second quarter *Value Line* reports (1972:2) are used to proxy for the level of planned investment after the ITC's reinstatement. These reports are issued over the period May 5, 1972 through June 9, 1972. If forecasted capital expenditures are greater at 1972:2 than at 1971:2 after

[16] This date was chosen for several reasons. First, examination of *The Tax Adviser* and *Wall Street Journal Index* indicated that, prior to President Nixon's announcement, a majority of the investment community expected no additional legislation to liberalize business write-offs. Second, examination of *Value Line* reports issued prior to this date found no mention of an anticipated ITC, while *Value Line* reports subsequent to the President's announcement did discuss the effects of a tax credit. Lastly, in an ITC-legislation event study, Ayres (1987) found the earliest date at which a significant market value reaction could be detected was September 22, 1971, the date the House Ways and Means Committee agreed to a bill reinstating the ITC.

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controlling for changes in other investment-related factors, then this suggests the ITC had an incentive effect.

Value Line began disclosing capital investment forecasts in January 1970.[17] The investment equations' parameters are estimated using forecast data from the following *Value Line* editions: 1970:2, 1971:2, 1972:2, 1973:2, and 1974:2.[18] Forecasts from 1970:2 and 1971:2 are made before the ITC's reinstatement, while forecasts from 1972:2, 1973:2, and 1974:2 are made after the ITC's reinstatement. Year 0 is the ITC legislation and reinstatement year. Therefore, forecast change 0 is defined as a variable's forecasted value as of 1972:2 minus its forecasted value as of 1971:2. Forecast changes -1, +1, and +2 are defined similarly:

Forecast change	Forecast Dates
-1	1971:2 minus 1970:2
0	1972:2 minus 1971:2
+1	1973:2 minus 1972:2
+2	1974:2 minus 1973:2

Forecast change -1 occurs during a period when the ITC is not in effect, forecast change 0 includes the ITC legislative period, and forecast changes +1 and +2 both occur after the ITC has been reinstated. Figure 5.2 presents a timeline outlining the forecast changes for all the tax acts. Panel A corresponds to the 1971 Act.

Tax Reduction Act of 1975: President Ford proposed a temporary increase in the ITC rate on January 16, 1975.[19] I identified this date to be the first

[17] Prior to that time, forecasts were limited to sales, net income, and cash earnings.

[18] The 1971 Act's regression does not include subsequent forecast changes because of the ITC provision changes that occurred in 1975.

[19] President Ford originally proposed that the credit for nonutility firms be increased to 12% during 1975 only. Utilities would continue to receive the 4% credit.

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date at which expectations regarding ITC legislation changed.[20] Therefore, forecasts from firms' 1974 third quarter *Value Line* reports (1974:3) proxy for the level of planned capital expenditures without the ITC's rate increase. For my firm sample, these reports are issued over the period August 2, 1974 through September 6, 1974. The 1975 Act temporarily increasing the ITC rate to 10% was signed into law on March 29, 1975. To allow time for analysts to incorporate the effects of the increased rate into their forecasts, forecasts from firms' 1975 third quarter *Value Line* reports (1975:3) are used to proxy for the level of planned investment with the temporary rate increase. These reports are issued over the period August 1, 1975 through September 5, 1975. If forecasted capital expenditures are greater at 1975:3 than at 1974:3 after controlling for changes in other investment-related factors, then this suggests the rate increase had an incentive effect.

In a method similar to that above, the 1975 investment model is estimated using forecast data from the *Value Line* editions 1973:3, 1974:3, 1975:3, and 1976:3.[21] Forecasts from 1973:3 and 1974:3 are made before the ITC's rate

[20] This date was chosen for several reasons and in a method similar to that for the 1971 Act. First, examination of *The Tax Adviser* and *Wall Street Journal Index* indicated that, prior to President Ford's announcement, the investment community was not anticipating an ITC rate increase. Second, examination of *Value Line* reports issued prior to this date found no mention of a possible ITC rate increase, while reports subsequent to the announcement did refer to the increase. Third, Ayres (1987) found the earliest date at which a significant market value reaction could be detected was February 27, 1975, the date the House passed the tax credit bill temporarily increasing the ITC to 10%.

[21] The 1976:3 forecasts occur during the 1976 Act's legislative discussion period. Under the 1975 Act, the increased ITC rate applied only to 1975 and 1976, while the 1976 Act extended the increased rate through 1980. Therefore, the 1976:3 forecasts may be biased *downward* because extending the period for the temporary rate increase *decreases* the incentive for firms to accelerate capital expenditures into 1976.

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increase, while forecasts from 1975:3 and 1976:3 are made after the credit is increased to 10%. Again, forecast change 0 includes the ITC legislative period, and forecast changes -1, 0, and +1 are defined as follows:

Forecast Change	Forecast Dates
-1	1974:3 minus 1973:3
0	1975:3 minus 1974:3
+1	1976:3 minus 1975:3

Figure 5.2, Panel B, presents a timeline for the 1975 Act.

Revenue Act of 1978: On December 20, 1977, President Carter outlined his new tax bill, including the provision to make the ITC's 10% rate permanent for years after 1980. I determined this date to be the first at which expectations regarding ITC legislation were most likely to have changed. Long-term forecasts from firms' 1977 fourth quarter *Value Line* reports (1977:4) proxy for the level of planned investment assuming the 10% rate returned to 7% (4% for public utilities) in 1981. For my sample, these reports are issued over the period October 7, 1977 through December 16, 1977. The 1978 Act making the 10% rate permanent was signed into law on November 6, 1978. To allow analysts time to assimilate the effects of the permanent 10% rate, forecasts from firms' 1979 second quarter *Value Line* reports (1979:2) proxy for the level of long-term planned investment after the ITC's permanent rate increase. These reports are issued over the period April 6, 1979 through June 15, 1979.

The 1978 investment equations' parameters are estimated using forecast data from the following *Value Line* editions: 1976:3, 1977:4, 1979:2, and 1980:2. Forecasts from 1976:3 and 1977:4 are made before the ITC's rate is permanently increased to 10%, while forecasts from 1979:2 and 1980:2 are made afterwards.

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Forecast change 0 includes the ITC legislative period, and forecast changes -1, 0, and +1 are defined:

Forecast change	Forecast Dates
-1	1977:4 minus 1976:3
0	1979:2 minus 1977:4
+1	1980:2 minus 1979:2

See Panel C of Figure 5.2 for the timeline outlining the forecast changes.

5.3 MODEL VALIDATION

The analysis above assumes that analysts' forecasts are relatively precise estimates of investment behavior. This study tests the validity of this assumption by comparing forecasted amounts with actual amounts.[22]

[22] Mest (1992) finds that for 8625 *Value Line* firm-year observations covering the period 1971 through 1978 the mean error for one-year-ahead capital expenditure forecasts (scaled by forecasted sales) was .011 with a standard deviation of .116. For one-year-ahead (scaled) earnings forecasts, the mean error was -.020 with a standard deviation of .152.

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CHAPTER SIX: SAMPLE SELECTION AND DESCRIPTIVE STATISTICS

6.1 SAMPLE SELECTION

This study's sample of firms was selected from the firms regularly covered by *Value Line Investment Survey*. Coverage by *Value Line* is necessary because of the capital expenditure forecast data provided in a firm's *Value Line* report. This study uses these forecasts to model firm-specific investment behavior. For the period examined in this study (1970 through 1979), *Value Line* covered approximately 1,400 stocks classified into approximately 65 industries.[1] Each week, from 2 to 7 industries are covered on a preset sequential schedule.[2] All stocks and industries are covered once per quarter (a 13-week period). Firms covered by *Value Line* are those deemed to be of interest to *Value Line* subscribers and the financial community. These firms account for a substantial portion of the capital investment by publicly traded firms.

During the first quarter of 1970, the *Value Line* population consisted of 1,313 firms from 62 industries. To be included in the sample, a firm's *Value Line* report must provide annual capital expenditure information. *Value Line* does not generally provide this information for airlines, retailers, insurance companies, investment firms, banks, savings and loans, and other financial companies. This eliminates 194 firms from 11 industries. Because the parameters for the

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[1] The firms are not limited to a particular stock exchange. Currently, *Value Line* reports on about 1,700 stocks, classified into 91 industry groups. Value Line's 1,700 stocks account for about 96% of the trading volume on all stock exchanges.

[2] Approximately the same number of firms are covered each week, so the number of industries included in each edition varies depending on the industries' number of firms.

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investment equations in Chapter 5 are estimated across firms within an industry, I require that an industry have at least 30 firms. This eliminates 40 industries with a total of 541 firms. These two requirements leave 578 firms from 11 industries. Table 6.1 summarizes the sample selection criteria, while Table 6.3 lists the deleted industries.

Table 6.2 provides the average capital intensity ratios for the remaining 11 industries for the 1970 and 1971 fiscal years.[3] Consistent with Trezevant (1991), I define capital intensity as annual capital expenditures divided by sales, both as reported by *Value Line*. The average capital intensity for 1970 across all 11 industries is .127 (unweighted by relative industry size), ranging from a high of .437 for the electric utility industry to a low of .047 for the electrical equipment & electronics industry.[4] Six of the industries' capital intensity ratios are clustered from .047 to .069.

From the 11 industries in Table 6.2, I chose the following five industries for my sample: building, chemical, electric utility, machinery, and metals & mining. I chose these industries because of their diverse capital intensity ratios.[5] The building and machinery industries have relatively low capital intensity ratios (.069

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[3] I thank David Mest for providing the average ratio data. He collected these amounts from *Value Line*.

[4] The 1970 average capital intensity ratios for the 40 industries excluded above range from .01 to .50, with only six industries (63 firms total) having ratios greater than .10. Twenty-three of the industries (292 firms total) have ratios less than .05. Table 6.3 lists the *Value Line* industries deleted from this study's potential sample.

[5] I also measure capital intensity using capital expenditures divided by total assets. Although this measure changes the capital intensity values (for example, the electric utility measure decreases), the relative rankings of the five industries remain the same.

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and .056, respectively). The metals & mining and chemical industries both exhibit higher capital intensity ratios at .13 and .10, respectively.[6] I chose the electric utility industry for several reasons. First, its capital intensity ratio of .437 is the largest of all industries, .247 greater than the next highest ratio. Second, it is a regulated industry and may therefore exhibit different capital investment behavior and responses to tax incentives than other industries. Lastly, the ITC provisions differ for regulated industries. The 1971 Act provided regulated companies with a 4% credit, while other companies received a 7% credit. The incentive effects of the 1971 Act may therefore be less for regulated than for unregulated companies. The 1975 Act's ITC provisions were more generous for regulated than unregulated firms, so the ITC incentive effects may be more pronounced for the electric utility industry in 1975 relative to other firms.

Value Line classifies a company into the industry that accounts for the bulk of its business. The building industry consists primarily of commercial builders, homebuilders, cement companies, and other building materials suppliers.[7] The chemical industry is composed of firms that create the synthetic materials used in industries such as textiles, automobiles, construction, agriculture, and food. These materials include plastics, fibers, synthetics, and packaging materials.[8] Electric

[6] Although both the natural gas and petroleum industries have relatively high capital intensity ratios, I do not choose them because of the 1970's energy crisis that directly affected these industries. Inferences regarding ITC incentive effects may be more difficult to make because of the confounding events during this period.

[7] Examples include Boise Cascade Corporation, Kaiser Cement and Gypsum, and Owens-Corning Fiberglass.

[8] Examples include Dow Chemical and Du Pont.

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utilities include utility firms from across the United States that supply electricity to their respective regions.[9] Firms in the machinery industry sell machinery and equipment to a wide variety of markets such as construction firms, public utilities, industrial plants, and oil and gas producers. These machinery firms provide both heavy and light equipment.[10] The metals & mining industry includes firms which mine, produce, process, and market various minerals and metals, including aluminum, gold, silver, lead, zinc, copper, and nickel.[11]

Value Line industry definitions change periodically due to industries being dropped, added, split, or merged. The changes in *Value Line's* industry definitions for the sample firms during 1970 through 1979 included:

(i) Building: Fifteen firms were dropped to form the *Cement* industry [effective 8/15/75];

(ii) Chemical: Split into the *Basic Chemical* (34 firms) and *Specialty Chemical* (15 firms) industries [effective 1/31/75];

(iii) Electric Utility: Split into the *Central* (73 firms), *Eastern* (15 firms), and *Western* (15 firms) electric utility industries [effective 2/6/76];

(iv) Machinery: Thirteen firms were dropped to form the *Construction and Mining Machinery* industry [effective 7/9/76]; and

(v) Metals & Mining: Split into the *Lead, Zinc, and Minor Metals* (14 firms) and *Metals & Mining--General* (29 firms) industries [effective 2/28/75].

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[9] Examples include Houston Lighting and Power and Southern California Edison.

[10] Examples include Caterpillar Tractor and Fluor Corporation.

[11] Examples include Aluminum Company of America (ALCOA) and Reynolds Metals.

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For purposes of this study, a firm's 1970 industry assignment determines its industry classification. For example, the 15 cement firms are included in the building industry throughout the sample period. These changes in industry classifications were made by *Value Line* to narrow their industry definitions and do not reflect changes in industry or firm operations.

6.2 DESCRIPTIVE STATISTICS

To be included in the analyses, firms are required to have the data necessary to estimate investment equations (1) and (2) [see Chapter 5.2.2]. For the 1971 Act, this eliminates 49 of the 311 firms, leaving 262 firms for analysis.[12] Two hundred, sixty-seven (267) firms have data available for the 1975 Act, while only 255 firms have data available for the 1978 Act.[13]

Table 6.4 presents descriptive statistics for the sample firms for the period 1968 through 1979. The ITC was in effect for these years except from April 1969 through August 1971, with the increased rate available from 1975 through 1979. These values are presented for descriptive purposes only. No inferences regarding the ITC's incentive effects can be made until the controls in the investment equations are introduced. Although the mean capital intensity ratio increases every year through 1973, there is no jump in the rate of increase reflecting the ITC's reenactment in 1971. The mean ratio drops by 12% (from 22.3% to 19.6%) in 1975, the year the ITC's rate was increased. The mean ratio decreases to 18% in

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[12] By industry, the number of firms deleted were: building (10), chemical (5), electric utility (4), machinery (13), and metals & mining (17).

[13] The 267 firms are composed of building (56), chemical (38), electric utility (99), machinery (44), and metals & mining (30). The 255 firms are composed of building (50), chemical (34), electric utility (97), machinery (50), and metals & mining (24).

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1976 and remains there through 1979. The median ratio consistently declines from 1968 through 1972, increases in years 1973 through 1975, and then decreases in 1976 by 22% (from 11.6% to 9.1%). It generally remains there through 1979. To the extent capital expenditures tend to be directly proportional to sales, this decline appears to be inconsistent with changes in the ITC provisions encouraging firms to increase capital expenditures beyond what they otherwise would have spent. However, inferences about the ITC's effects must await more complete analyses.

Table 6.5 provides descriptive data for 1970 by industry, and shows the heterogeneity of the industry groups across several dimensions. The electric utility industry is clearly the most capital intensive. The electric utility industry also has the largest mean and median capital expenditure amounts (in dollar terms). The chemical firms have the largest sales, while the electric utility firms have the smallest revenues.

Table 6.6 presents Pearson and Spearman (rank-order) pairwise correlations of the scaled changes in forecasted short-term and long-term capital expenditures, sales, income, and cash earnings. All but 3 correlations are significant at the $p<.001$ level. When calculated by industry, the correlations remain highly significant, but their values differ across industries, suggesting that the investment equations should be run separately by industry.

Information regarding the accuracy and bias of analysts' forecasts for the sample firms over the 1970 through 1979 period is provided in Tables 6.7 through 6.9. The forecast errors are calculated by (1) subtracting the forecasted amount from the actual amount, and (2) dividing by the respective actual amount. For example, the capital expenditure forecast error equals actual capital expenditures

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minus short-term forecasted capital expenditures, divided by actual capital expenditures. Therefore, the forecast error measures can be thought of as percentage forecast errors. Table 6.7 shows the scaled forecast errors for the full sample for the 1970-1979 period combined. The mean error for short-term (one-year ahead) capital expenditure forecasts is -0.0486, while the mean error for net income forecasts is -0.0446. The scaled median forecast errors are -0.0015 and 0.0000, respectively. Both mean forecast errors are significantly different from zero at $p<.10$. The mean sales forecast error is not significantly different from zero. Both the mean capital expenditure and net income forecast errors are negative, suggesting that analysts, on average, overestimate capital expenditures and net income.

Tables 6.8 and 6.9 provide a more informative breakdown of analysts' forecast accuracy and bias. When the years are examined individually, only the mean capital expenditure forecast error for 1976 is significantly different from zero ($p<.05$). All other forecast errors are not significantly different from zero (see Table 6.8). Table 6.9 presents forecast errors by industry for each Tax Act. For all industries across all Acts, the mean capital expenditure forecast errors are not significantly different from zero except for the electric utility industry (1978 Act) where the mean forecast error is significantly negative ($p<.01$). Taken together, Table 6.7 through 6.9 indicate that analysts' capital expenditure forecasts are unbiased and that analysts have relatively good predictive ability.[14] For this sample, in general, analysts' short-term capital expenditure forecasts are similar in

[14] For more complete analysis, analysts' capital expenditure forecast accuracy should be compared with that of alternative models.

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bias and accuracy to their short-term net income forecasts.

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CHAPTER SEVEN: RESULTS AND DISCUSSION

7.1 TESTS OF HYPOTHESIS ONE: EFFECTS OF THE ITC ON FIRMS' INVESTMENT DECISIONS

Tables 7.1 through 7.8 present equation (1) and (2) regression results for the full sample and for each industry for all Acts. Results indicate that the estimation equations have significant explanatory power, with all equations except three significant at better than the 1% level. [Two of the three equations are significant at 1.4% and 2.2%. The remaining equation is not significant at conventional levels (p=.119).] The adjusted R^2's suggest a large diversity in the model's explanatory power across Acts and across industries:

Estimation Equation	Adjusted R^2's
1971 Act-*ΔSTINV* (Table 7.1)	9.7% to 37.5%
1971 Act-*ΔLTINV* (Table 7.2)	5.3% to 17.4%
1975 Act-*ΔSTINV* (Table 7.5)	17.2% to 76.4%
1978 Act-*ΔLTINV* (Table 7.7)	1.8% to 47.2%

The results also suggest there are factors not included in the model that help explain changes in short-term and long-term forecasted capital expenditures.

Coefficient estimates for the control variables are discussed next as a group. Results for each tax Act and the hypothesis variables are then discussed separately.

Control Variables: These variables are included in the estimation equations to control for changes in forecasted capital expenditures attributable to nontax factors. In general, coefficient estimates for the control variables are in their predicted directions, with varying degrees of significance. All regression t-statistics reported in the paper are based on White's (1980) covariance estimator. β_1 and γ_1 can be interpreted as the capital intensity coefficients and represent the

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change in forecasted capital expenditures induced by a percentage change in forecasted sales. For the 1971 Act (both $\Delta STINV_{it}$ and $\Delta LTINV_{it}$), β_1 and γ_1 are positive, as expected, in 13 of 14 equations, and significant in 9 of those equations. For the 1975 and 1978 Acts, β_1 and γ_1 vary in sign and are not significant in any of the estimation equations.

β_2 and γ_2 (β_3 and γ_3) are the change in forecasted capital expenditures induced by a 1% change in the real interest rate (forecasted ROE). The associated variables (ΔINT_{it}, $\Delta STROE_{it}$, and $\Delta LTROE_{it}$) control for changes in a firm's capital costs. Because capital expenditures decrease as capital costs increase, β_2, γ_2, β_3, and γ_3 are predicted to be negative. For the 1971 Act ($\Delta STINV$), β_2 varies in sign and is not significant in any of the estimations, while β_3 is in the predicted direction across most industries and is significant for the full sample ($p<.01$). For the 1971 Act ($\Delta LTINV$), γ_2 is negative in most of the regressions, but is significant only for the machinery ($p<.05$) and metals & mining ($p<.10$) industries. γ_3 is generally in the predicted direction and is significant for the full sample ($p<.01$), the electric utility firms ($p<.05$), machinery firms ($p<.01$), and metals & mining firms ($p<.10$). β_2 and β_3 are insignificant for the full sample and for each industry for the 1975 Act. For the 1978 Act, γ_2 is significantly *positive* for the non-utility subsample, and the chemical and metals & mining industries. γ_3 is in the predicted negative direction across industries, and is significant for the nonutility firms ($p<.01$), the building industry ($p<.05$), and the machinery and metals & mining industries (both p-values $< .01$).

Changes in a firm's liquidity position between forecast dates could affect its planned capital expenditures. Unexpected increases in internal funds may lead to

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increased capital expenditures. Unexpected cash earnings proxy for unexpected liquidity changes.[1] The equations also include the capital expenditure forecast error that occurs during the forecast change period. β_4 and γ_4 can be interpreted as the change in forecasted capital expenditures attributable to unexpected cash earnings, while β_5 and γ_5 are the change attributable to the current capital expenditure forecast error.

In general, β_4 is significantly positive across all equations for the 1971 Act ($\Delta STINV$) and the 1975 Act.[2] For the 1971 Act ($\Delta LTINV$), γ_4 is significant only for the building industry ($p<.05$). For the 1978 Act, γ_4 is significant at $p<.05$ for the full sample, the non-utility subsample, and the electric utility industry, and is significant for the metals & mining industries at $p<.01$. These results suggest that $CASH_{it}$ is an important explanatory variable, but relatively more important in explaining $\Delta STINV_{it}$ (versus $\Delta LTINV_{it}$). This is consistent with what one would expect since unexpected liquidity changes would be more important determinants of changes in short-term (versus long-term) capital expenditures.

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[1] For analysis of the 1971 Act only, operating margin times sales is used to proxy for cash earnings for all firms except those in the electric utility industry. Operating margin is defined as operating earnings before deduction of depreciation, depletion, amortization, interest, and income taxes, as a percentage of sales. For the 1971 Act, cash earnings amounts were only fully collected from the 1970 *Value Line* editions, while operating margins were collected from all editions (1970 through 1974). The Pearson correlations between cash earnings and the operating margin proxy for 1968 and 1969 actual values, 1970 and 1971 short-term forecasts, and the long-term forecasts from the 1970 editions are .99, .98, .99, .99, and .99, respectively. There are no significant differences among industries.

[2] For the 1971 Act ($\Delta STINV$), β_4 is in the predicted direction except for the electric utility firms and is significant in each industry and for the non-utility firms combined (p-values varying from .01 to .10). For the 1975 Act, β_4 is significant at $p<.01$ for the full sample, the non-utility subsample, and the electric utility and metals & mining industries, and is significant for the building and chemical industries ($p<.10$ and $p<.05$, respectively).

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The parameter estimate on CAP_{it} in the short-term equations (β_5) is highly significant in every equation. For both the 1971 ($\Delta STINV$) and 1975 Acts, β_5 is significantly positive for the full sample and for each industry at $p<.01$, except for the machinery industry (1978 Act) where $p<.10$. In contrast, γ_5, the parameter estimate on CAP_{it} in the long-term equations, varies in sign for the 1971 ($\Delta LTINV$) Act and is significant for the non-utility firms combined ($p<.10$) and the chemical and metals & mining industries (both p-values $< .05$). For the 1978 Act, γ_5 is generally in the predicted direction, but is significant only for the non-utility subsample ($p<.10$) and the chemical industry ($p<.05$). Similar to the $CASH_{it}$ variable, these results indicate that CAP_{it} is very important in explaining changes in short-term capital expenditure forecasts, but less so for long-term forecasts. Again, this is consistent with the idea that unexpected current capital expenditures are more important determinants of changes in short-term (versus long-term) capital expenditures.

Revenue Act of 1971 ($\Delta STINV$): The 1971 Tax Act reinstated the ITC at a 7% rate (4% for regulated companies). If the ITC is a capital investment stimulus and firms can respond relatively quickly, its reinstatement may cause firms to increase their capital expenditures in the short-run. Table 7.1 presents regression results for the full sample and for each industry for changes in short-term forecasted capital expenditures for the 1971 Tax Act. The coefficient on *DITC* (β_6) is positive for the full sample and for all industries and is significant for the full sample ($p<.01$), all non-electric utility firms combined ($p<.01$), the building industry ($p<.01$), and the chemical and machinery industries (both p-values$<.10$). The coefficient on *CRED* (β_7) is significantly positive for the full sample ($p<.01$),

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all non-electric utility firms combined ($p<.01$), the building industry ($p<.05$), and the chemical, electric utility, and machinery industries (all p-values$<.10$). F-statistics (not reported here) do not reject the equality of β_6 and β_7 for any of the estimations. Table 7.3 (Panel A) presents estimated parameter values for the intercept for each forecast change period. The intercepts represent the mean growth rate of forecasted capital expenditures for each period. These results combined indicate that the ITC's reinstatement in 1971 did have an incentive effect for the full sample and for the building, chemical, electric utility, and machinery industries. For the full sample and the non-utility industries, the ITC appears to have increased the mean growth rate in forecast change 0 and in forecast changes +1 and +2. For the electric utility industry, the increase only occurred in the periods after the ITC's reinstatement (forecast changes +1 and +2). There is no evidence that the metals & mining industry firms increased planned capital expenditures in response to the ITC's reinstatement.

The interaction terms $\Delta STSAL_{it}*DITC$ and $\Delta STSAL_{it}*CRED$ test whether, for a given forecasted sales increase, forecasted short-term capital expenditures increased by a greater amount after the ITC was reinstated. Table 7.3 (Panel B) presents the estimated parameter values for $\Delta STSAL$ for each forecast change period. None of the interaction terms are significant in the predicted direction, with several of them being significantly negative. There is no evidence that capital intensity increased in forecast changes 0, +1, or +2. The $\Delta STINV_{it}$ estimation equations were also run using the change in actual annual capital expenditures rather than the change in the forecasted amounts as the dependent variable. The results were qualitatively similar with no different inferences regarding the

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hypothesis variables.

Belsley, Kuh, and Welsch's (1980) diagnostic test for multicollinearity was employed for all estimation equations.[3] The results (not reported here in detail) indicate there is no evidence of multicollinearity. Most condition numbers are between 1 and 4, and all below 20, indicating that a multicollinearity problem does not exist.

Revenue Act of 1971 ($\Delta LTINV$): Table 7.2 presents regression results for the full sample and for each industry for changes in long-term forecasted capital expenditures for the 1971 Act, while Table 7.4 (Panels A and B) presents estimated parameter values for the intercept and $\Delta LTSAL$ coefficients for each forecast change period. The coefficients on *DITC* (γ_6) and *CRED* (γ_7) are generally in the predicted direction, but none are significant at the 10% level in any of the estimation equations. There is no evidence that the ITC's reinstatement had any incentive effect on firms' anticipated long-term capital expenditures.[4]

The estimated coefficients on the interaction terms $\Delta LTSAL_{it}*DITC$ and $\Delta LTSAL_{it}*CRED$ are insignificant for the full sample and for each industry except

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[3] Belsley et al. suggest the combined use of two diagnostic tools to detect which coefficients are most likely to be affected by collinearity. The two-step procedure they recommend is:

(1) Compute the condition indices of the data matrix. (A condition index is computed for each eigenvalue.) Various applications with experimental and actual data sets suggest that condition numbers in the range of 20 to 30 (and higher) probably indicate serious collinearity problems.

(2) For each condition index in excess of the "danger level," examine the proportion of the sampling variance of each coefficient associated with that eigenvalue. Coefficients with proportions in excess of .50 are likely to be adversely affected by the collinearity in the data matrix. [See Belsley, Kuh, and Welsch (1980), Johnston (1984), and Kennedy (1985).]

[4] As discussed in a later section, when *USAL* rather than $\Delta LTSAL$ is used as an explanatory variable, there is evidence that firms did increase their planned long-term capital expenditures when the ITC was reinstated.

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machinery, where both γ_8 and γ_9 are significantly positive ($p<.05$ and $p<.01$, respectively). γ_8 and γ_9 are not significantly different from each other. This suggests that firms in the machinery industry increased the planned long-term capital intensity of their operations and did so immediately in response to the ITC's reinstatement. The machinery industry is one of the least capital intensive industries examined in this study (see Table 6.5).

Belsley, Kuh, and Welsch's (1980) test indicates no multicollinearity for the 1971 Act's long-term estimation equations. All condition numbers are below 20, with most between 1 and 4.

Tax Reduction Act of 1975: Under the Tax Reduction Act of 1975, Congress temporarily increased the ITC rate to 10% for all taxpayers, including public utilities. (Recall that previously the rate was 7%, 4% for public utilities.) The increased rate applied to property acquired and placed in service during 1975 and 1976.[5] Congress hoped that firms would accelerate and/or increase their short-term capital expenditures in response to the temporary rate increase. Table 7.5 presents $\Delta STINV_{it}$ regression results for the 1975 Tax Act, for the full sample and separately for each industry. Table 7.6 (Panels A and B) presents estimated parameter values for the intercept and the $\Delta STINV_{it}$ coefficients for each forecast change period.

None of the coefficients on *DITC* or *CRED* are significant in the predicted direction. Furthermore, although not significantly different from zero, many of the estimated coefficients are of the wrong sign. There is no evidence that firms

[5] In addition, public utilities were permitted to increase the amount of their income tax liability that could be offset by the ITC from 50% to 100% for tax years ending in 1975 and 1976.

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increased their planned capital expenditures in response to the 1975 rate increase in the period of the rate increase (forecast change 0) or in the following period (forecast change +1).

The interaction terms $\Delta STSAL_{it}$*$DITC$ and $\Delta STSAL_{it}$*$CRED$ test whether, for a given forecasted sales increase, forecasted short-term capital expenditures increased by a greater amount after the ITC's rate increased. β_8 is not significantly positive for any of the estimation equations. The coefficient on the interaction term $\Delta STSAL_{it}$*$CRED$ (β_9) is significantly positive for the full sample ($p<.10$). However, when regressions are run separately by industry, it is significant only for the electric utility industry ($p<.05$). F-statistics comparing β_8 and β_9 indicate that $\beta_8<\beta_9$ for both the full sample and the electric utility firms ($p=.017$ and $p=.089$, respectively). This provides weak evidence that firms increased the capital intensity of their operations in the period after the ITC's rate increased (forecast change +1). However, the results are driven by the electric utility firms. The electric utility industry is the most capital intensive, and the 1975's rate increase was relatively more generous for utility firms. The $\Delta STINV_{it}$ estimation equations were also run using the change in actual annual capital expenditures rather than in the forecasted amounts. The inferences are similar.

The Belsley, Kuh, and Welsch (1980) diagnostic test indicates no multicollinearity for the 1975 Act's estimation equations. The results show that most condition numbers are between 1 and 4, and all numbers are below the critical value of 20.

Revenue Act of 1978: To stimulate the economy, the 1978 Act significantly liberalized the ITC provisions. The Act permanently increased the

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ITC rate to 10%. The rate had been scheduled to return to 7% (4% for public utilities) in 1981. Congress argued that making the increased rate permanent would provide certainty that is important to business planning. They said repeated changes in the ITC provisions caused confusion and reduced the ITC's incentive effects. Table 7.7 presents $\Delta LTINV_{it}$ regression results for the 1978 Act, while Table 7.8 (Panels A and B) presents estimated parameter values for the intercept and the $\Delta LTINV_{it}$ coefficients for each forecast change period.

None of the coefficients on *DITC* or *CRED* are significant in the predicted direction. Both *DITC* and *CRED* are significantly *negative* for the non-utility firms combined (both p-values <.05 using a two-tailed test). However, when tests are run separately by industry, *DITC* and *CRED* are significantly negative only for the metals & mining industry. Otherwise, the coefficients are all negative but not significantly different from zero. There is no evidence that firms increased their long-term planned capital expenditures when the ITC's increased 10% rate was made permanent for years after 1980.

Coefficient estimates on the interaction terms (γ_8 for $\Delta LTSAL_{it}*DITC$ and γ_9 for $\Delta LTSAL_{it}*CRED$) are generally in the predicted direction. However, γ_8 is significantly positive only for the chemical industry ($p<.10$). γ_9 is significantly positive for the non-utility subsample ($p<.10$), but industry regressions indicate that γ_9 is significant only for the chemical firms ($p<.01$). γ_8 and γ_9 are not significantly different from each other. This suggests that firms in the chemical industry immediately increased the anticipated capital intensity of their long-term operations. There is no evidence that other firms altered their planned capital intensity.

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Belsley, Kuh, and Welsch's (1980) diagnostic test indicates severe multicollinearity in the 1978 Act's estimation equations. Each equation has one condition number well above the critical value of 30. The sampling variances indicate that the coefficients affected by multicollinearity include the intercept and the coefficients on ΔINT, *DITC*, and *CRED*. One way of addressing this multicollinearity problem is to drop one of the collinear variables. If the true coefficient on the omitted variable is zero, this is appropriate. However, if the true coefficient on the omitted variable is not zero, a specification error is introduced. Omitting a relevant variable causes the parameter estimates of the remaining (correlated) variables to be biased. The variable ΔINT is not significantly different from zero in 19 of the 21 estimation equations for the 1971 and 1975 Acts (see Tables 7.1, 7.2, and 7.5). For the 1978 Act, ΔINT is not significantly different from zero in 3 of the 7 equations. Therefore, all estimation equations for the 1978 Act are reestimated after omitting the ΔINT variable.

As expected, there is no evidence of multicollinearity for the estimation equations after dropping ΔINT. All condition numbers are less than 10, with most between 1 and 4. The inferences with respect to all hypothesis variables remain the same except that *DITC* is significant for the nonutility subsample ($p<.05$), the building industry ($p<.05$), and the chemical industry ($p<.01$). This provides some (weak) evidence that the ITC's permanent rate increase may have caused the building and chemical firms to increase their anticipated long-term capital expenditures. However, inferences are tentative because of the interest rate volatility in 1979 and 1980.

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Hypothesis One: *USAL* (rather than $\Delta STSAL$ and $\Delta LTSAL$) as an explanatory variable: As discussed in Chapter 5, equations (1) and (2) may bias *against* finding an ITC incentive effect. If the ITC stimulates capital investment, the incremental capital investment induced by the ITC may increase forecasted sales revenue. Forecasted sales after the ITC's reinstatement may reflect higher expected sales revenue due to the ITC-related investment, biasing the sales forecasts upward. An increase in forecasted capital expenditures would be attributed to an increase in forecasted sales rather than the ITC. Therefore, equations (1) and (2) are also estimated with firm i's unexpected sales during forecast change t ($USAL_{it}$) included as an explanatory variable instead of the change in forecasted sales:

$$
\begin{aligned}
\Delta STINV_{it} = {} & \beta_0 + \beta_1 USAL_{it} + \beta_2 \Delta INT_{it} + \beta_3 \Delta STROE_{it} + \beta_4 CASH_{it} \\
& + \beta_5 CAP_{it} + \beta_6 DITC + \beta_7 CRED + \beta_8 USAL_{it} {*} DITC \\
& + \beta_9 USAL_{it} {*} CRED + \varepsilon_{it},
\end{aligned}
$$

$$
\begin{aligned}
\Delta LTINV_{it} = {} & \beta_0 + \beta_1 USAL_{it} + \beta_2 \Delta INT_{it} + \beta_3 \Delta LTROE_{it} + \beta_4 CASH_{it} \\
& + \beta_5 CAP_{it} + \beta_6 DITC + \beta_7 CRED + \beta_8 USAL_{it} {*} DITC \\
& + \beta_9 USAL_{it} {*} CRED + \varepsilon_{it},
\end{aligned}
$$

where $USAL_{it}$ is defined as a firm's actual annual sales (announced between the two forecast dates) minus the annual sales forecasted by *Value Line* at the beginning of the forecast period, divided by short-term (long-term) forecasted sales at the beginning of the period. $USAL_{it}$ is designed to capture changes in sales expectations due to non-ITC information that arrives between the forecast dates while minimizing the possible bias introduced by the forecasted sales amounts.

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Tables 7.9 through 7.12 present the regression results for the 1971 Act (Δ*STINV* and Δ*LTINV*), the 1975 Act (Δ*STINV*), and the 1978 Act (Δ*LTINV*), respectively. The *USAL* estimation equations in Tables 7.9 through 7.12 have explanatory power similar to the original *ΔSTSAL* (*ΔLTSAL*) equations in Tables 7.1, 7.2, 7.5, and 7.7. The significant instances of the control variables are consistent with the original estimation equations. The coefficient estimates on $CASH_{it}$ and CAP_{it} continue to be significant in many cases, while those on Δ*INT* and Δ*STROE* (Δ*LTROE*) are significant in some equations. The parameter estimates on *USAL* are not significantly different from zero except for three equations in Table 7.10 (i.e., the 1971 Act--Δ*LTINV*).

The *USAL* estimation equations do not provide any additional evidence supporting the ITC incentive effects for the 1971 Act (Δ*STINV*), 1975 Act (Δ*STINV*), or the 1978 Act (Δ*LTINV*). However, results in Table 7.10 (1971 Act, Δ*LTINV*) indicate the ITC did increase firms' long-term planned capital expenditures when it was reinstated in 1971. Recall that the original estimation equations provide no evidence that firms altered their long-term planned capital expenditures in response to the ITC's reinstatement. Coefficient estimates on *DITC* and *CRED* were not significantly different from zero in any equation (see Table 7.2). In the *USAL* equation (see Table 7.10), *DITC* is significant for the full sample ($p<.01$) and the electric utility industry ($p<.01$). *CRED* is significant for the full sample ($p<.05$), the nonutility firms combined ($p<.10$), the electric utility industry ($p<.05$), and the machinery and metals & mining industries ($p<.10$ and $p<.05$, respectively). This provides evidence that firms increased their long-term planned capital expenditures in response to the ITC's reinstatement. The ITC

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appears to have increased the mean growth rate of (anticipated) electric utility firm investments in forecast change 0 and in forecast changes +1 and +2. For the machinery and metals & mining industries, this increase came only in the periods after the ITC's reinstatement (forecast changes +1 and +2).

7.2 TESTS OF HYPOTHESIS TWO: ITC INCENTIVE EFFECTS AND FIRMS' DEBT CONSTRAINTS

Hypothesis two tests whether the ITC's incentive effect is influenced by a firm's ability to obtain debt financing, while hypothesis three tests whether the ITC's incentive effect is affected by a firm's investment opportunities. To test these hypotheses, sample firms are ranked within industries and partitioned into high and low groups based on their relative measures of debt constraints and investment opportunities. An indicator variable is included in the industry regressions and multiplied by DITC and CRED to test whether an incentive effect occurred among the subset of firms more likely to be affected.[6] For both hypotheses two and three, equations (1) and (2) become:

$$\begin{aligned} \Delta STINV_{it} = {} & \beta_0 + \beta_1 \Delta STSAL_{it} + \beta_2 \Delta INT_{it} + \beta_3 \Delta STROE_{it} + \beta_4 CASH_{it} \\ & + \beta_5 CAP_{it} + \beta_6 DITC + \beta_7 CRED + \beta_8 \Delta STSAL_{it} {*} DITC \\ & + \beta_9 \Delta STSAL_{it} {*} CRED + \beta_{10} D + \beta_{11} DITC {*} D \\ & + \beta_{12} CRED {*} D + \varepsilon_{it}, \qquad (3) \end{aligned}$$

[6] Initially, the investment equations used to test hypotheses two and three included a separate slope coefficient (capital intensity coefficient) for the D=0 and D=1 firms (for each forecast change period). However, the Belsley, Kuh, and Welsch diagnostic test indicated severe multicollinearity for these equations, with the variables affected being the capital intensity coefficients and none of the t-statistics being significant at conventional levels.

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$$\Delta LTINV_{it} = \gamma_0 + \gamma_1 \Delta LTSAL_{it} + \gamma_2 \Delta INT_{it} + \gamma_3 \Delta LTROE_{it} + \gamma_4 CASH_{it} + \gamma_5 CAP_{it} + \gamma_6 DITC + \gamma_7 CRED + \gamma_8 \Delta LTSAL_{it}{*}DITC + \gamma_9 \Delta LTSAL_{it}{*}CRED + \gamma_{10} D + \gamma_{11} DITC{*}D + \gamma_{12} CRED{*}D + \varepsilon_{it}, \qquad (4)$$

where D=1 for firms more likely to be affected, and D=0 for firms less likely to be affected by the ITC's incentive effects. Partitioning firms according to their debt financing ability and investment opportunities exploits the heterogeneity of the firm-level data and isolates those firms more likely to be affected by the ITC.

Parameters β_1 through β_5 (γ_1 through γ_5) are interpretable as before. The estimated intercept value for each forecast change period (for example, β_0, $\beta_0+\beta_6$, $\beta_0+\beta_7$) now represents the mean growth rate in forecasted capital expenditures for each period for those firms where D=0, the firms less likely to be affected by the ITC's incentive effects. $\beta_0+\beta_{10}$, $(\beta_0+\beta_{10})+\beta_6+\beta_{11}$, $(\beta_0+\beta_{10})+\beta_7+\beta_{12}$ are the intercept values for those firms more likely to be affected by ITC incentive effects (i.e., D=1 firms). In summary:

Forecast Change Period	Estimated Intercept D=0 Firms	Estimated Intercept D=1 Firms
-1	β_0	$\beta_0+\beta_{10}$
0	$\beta_0+\beta_6$	$(\beta_0+\beta_{10})+\beta_6+\beta_{11}$
+1	$\beta_0+\beta_7$	$(\beta_0+\beta_{10})+\beta_7+\beta_{12}$

Hypothesis two tests whether the ITC's effect on planned capital expenditures was greater for those firms with less difficulty in obtaining debt financing. Firms facing binding debt constraints may be unable to obtain the funds

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needed to finance new capital investment and therefore may respond less to the ITC's incentive effects. Firms not facing debt constraints may respond to the ITC's incentive effects in the way Congress anticipates. To estimate equations (3) and (4) for hypothesis 2, the debt-equity ratio distribution of each industry is used to identify as low-debt firms those in the lower 25% of their industry's debt-equity ratio distribution. These firms are less likely to have binding debt constraints, enabling them to respond more to the ITC's incentive effects. Therefore, D=1 for firms in the lower 25% of the debt distribution, while D=0 for firms in the upper 75% of the debt distribution. The debt-equity ratio is the book value of long-term debt divided by the book value of equity, both measured at forecast change zero.[7]

Tables 7.13 through 7.16 present the estimated parameter values for each forecast change period for both high- (D=0) and low- (D=1) debt firms. In general, the results do not provide additional insights into the ITC's incentive effects. For the 1971 Act ($\Delta STINV$), the incentive effects occur in both the low- and high-debt firms (see Table 7.13). For the chemical and metals & mining firms, the incentive effect appears to occur earlier for the low-debt firms (forecast change 0) than for the high-debt firms (forecast changes +1 and +2). For the electric utility and machinery industries, the incentive effect is significant only for the high-

[7] An alternative measure to estimate a firm's financing constraint is the interest coverage ratio. As discussed in Chapter 8, future work will rerun hypotheses two and three with the indicator variable equal to 1 for those firms least likely to be affected by the ITC. This may provide a more powerful test of hypotheses two and three. When these tests are run, interest coverage ratio will also be used to proxy for financing constraint.

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debt firms (*opposite* from what is predicted). For the 1971 Act ($\Delta LTINV$), see Table 7.14, an incentive effect does appear for the electric utility and metals & mining low-debt firms, as well as for the electric utility high-debt firms. This is consistent with hypothesis one results that found an incentive effect in these industries when *USAL* rather than $\Delta LTSAL$ was used as an explanatory variable.

Table 7.15 presents results for the 1975 Act which increased the ITC's rate to 10% for all taxpayers. Consistent with hypothesis one results, there is no evidence that low- or high-debt firms increased their planned capital expenditures in response to the 1975 rate increase. Results for the 1978 Act are presented in Table 7.16.[8] The results are consistent with hypothesis one results, indicating an incentive effect only in the building and chemical industries. For the building industry, the incentive effect is isolated in the low-debt firms, while the effect occurs in both low- and high-debt chemical firms.

7.3 TESTS OF HYPOTHESIS THREE: ITC INCENTIVE EFFECTS AND FIRMS' INVESTMENT OPPORTUNITIES

Hypothesis three tests whether the ITC's effect on planned capital expenditures was greater for those firms with more investment opportunities. Tax incentives may be ineffective for firms with fewer investment opportunities because these firms are less likely to have access to positive net present value projects. Conversely, firms with larger investment opportunity sets may respond more to the

[8] As before, the Belsley, Kuh, and Welsch diagnostic test indicates severe multicollinearity when ΔINT is included as an explanatory variable. Therefore, results for hypotheses two and three are reported for the estimation equation omitting the ΔINT variable.

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ITC's incentive effects. The price-earnings ratio, measured at forecast change zero, is used to measure a firm's investment opportunity set. A larger value indicates a larger investment opportunity set.[9] To estimate equations (3) and (4) for hypothesis 3, the price-earnings (PE) ratio distribution of each industry is used to identify as high-PE firms those in the upper 25% of their industry's PE ratio distribution. These firms are more likely to have greater investment opportunities, enabling them to respond more to the ITC's incentive effects. Therefore, D=1 for firms in the upper 25% of the PE distribution, while D=0 for firms in the lower 75% of the PE distribution.

Tables 7.17 through 7.20 present the estimated parameter values for each forecast change period for low- and high-PE firms (D=0 and D=1, respectively). As with hypothesis two's results, hypothesis three results provide little additional evidence regarding ITC incentive effects. For the 1971 Act ($\Delta STINV$), incentive effects occur in all industries for both low- and high-PE firms (see Table 7.17). For the electric utility industry, the effect is significant only for the high-PE firms. For the 1971 Act ($\Delta LTINV$), an incentive effect appears to occur in the electric utility industry (both low- and high-PE firms), and in the chemical and machinery high-PE firms (see Table 7.18). These are the first results to provide evidence that firms other than those in the electric utility and metals & mining industries may have altered their long-term planned capital expenditures in response to the ITC's

[9] I also partitioned firms according to their market-to-book value of equity. Results are consistent with those reported below.

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reinstatement.

Tables 7.19 and 7.20 present results for the 1975 and 1978 Acts, respectively. The 1975 results indicate that high-PE firms in the building and metals & mining industries may have increased their short-term planned capital expenditures in response to the 1975 ITC rate increase. This is the first evidence that in any way indicates firms may have responded to incentive effects of the 1975 Act. Results for the 1978 Act are consistent with hypotheses 1 and 2 results. Firms in the building (high-PE) and chemical (both low- and high-PE) industries appear to have increased their long-term planned capital expenditures. In addition, high-PE firms in the machinery industry may have also increased their planned long-term expenditures.

In general, the results for hypotheses two and three provide little additional evidence regarding the ITC's incentive effects. However, the results for the 1971 Act ($\Delta STINV$) indicate that the incentive effects hold for both low- and high-debt firms and low- and high-PE firms. The robustness of the results and the fact that they hold for firms less likely to be affected by the ITC's incentive effects indicates the strength of firms' short-term response to the 1971 ITC reinstatement.

Chapter 8 presents the overall conclusions of this research, discusses the study's limitations, and provides suggestions for future research.

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CHAPTER EIGHT: SUMMARY AND CONCLUSIONS

This study examines the ITC's effectiveness in stimulating firm-level, planned capital investment. The ITC has been used as an investment incentive, but prior research provides ambiguous results on the credit's success in encouraging capital investment. The inconsistent evidence may be attributable to the use of macroeconomic investment models and to a lack of relevant firm-level data. This study uses analysts' forecasts of firms' short- and long-term capital expenditures (available from *Value Line*) to proxy for firms' planned investment behavior. The ITC's effect on planned capital investment is estimated using changes in forecasted capital expenditure amounts published before and after relevant tax legislation dates. To test whether the ITC increases planned capital investment, changes in firms' forecasted capital expenditures are modeled as a function of changes in investment-related variables and ITC-related variables. The influence of firm-specific factors on firms' sensitivity to the ITC's incentive effects is also examined.

The overall results suggest that the estimation equations have significant explanatory power. However, the model's explanatory power differs significantly across acts and across industries. Results indicate that the ITC's reinstatement in 1971 increased the mean growth rate of forecasted short-term capital expenditures. Firms appear to have responded immediately to the ITC's reinstatement. The effect of the ITC's reinstatement on long-term forecasted capital expenditures is less clear. When $\Delta LTSAL$ is included as an explanatory variable, there is no evidence that firms increased their anticipated long-term capital expenditures. However, $\Delta LTSAL$ may introduce a bias against finding an ITC incentive effect.

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When the equations are estimated including *USAL* rather than $\Delta LTSAL$, results provide evidence that firms did increase their long-term planned capital expenditures in response to the ITC's reinstatement. The effect is concentrated in the electric utility, machinery, and metals & mining industries. The 1975 Tax Act temporarily increased the ITC's rate to 10% for all firms, while the 1978 Act made the 10% rate permanent. The results provide no evidence that firms increased their planned short-term capital expenditures in response to the 1975 temporary rate increase. For the 1978 Act, results provide some evidence that the ITC's permanent rate increase may have caused building and chemical firms to increase their anticipated long-term capital expenditures.

The interaction terms test whether, for a given forecasted sales increase, forecasted capital expenditures increased by a greater amount after the ITC's provisions changed. In general, there is no evidence that firms increased the capital intensity of their operations in response to any of the ITC provision changes. Industries that may have been affected include the machinery (1971, $\Delta LTINV$), electric utility (1975 Act), and chemical (1978 Act) industries.

This study also examines the influence of two firm-specific factors, financing constraints and investment opportunities, on firms' sensitivity to the ITC's incentive effects. Firms facing financing constraints may respond less to the ITC's incentive effects because they are unable to obtain the necessary funds to finance new capital expenditures, while firms with few growth opportunities may respond less to tax incentives because they face a more limited set of potentially profitable investments. In general, the results provide little additional evidence regarding ITC incentive effects but are consistent with those of the primary

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hypotheses.

Several limitations of this study should be mentioned. First, estimation of investment equations (1) and (2) constrain the coefficient estimates to be equal across firms. An alternative estimation method would be a fixed effects model that allows a firm-specific intercept. Second, the adjusted R^2's for the investment equations suggest a large diversity in the model's explanatory power across Acts and across industries. The results also suggest there are factors not included in the model that help explain changes in forecasted capital expenditures. To the extent these omitted factors are correlated with independent variables included in the model, there may be an omitted variables problem and coefficient estimates may be biased. Third, I have ignored any implicit tax effects. My model estimates the increase in capital *expenditures* (i.e., price times quantity). If capital assets become more tax-favored, capital asset prices may be bid up. Capital expenditures may increase because capital asset prices have increased, while quantity may increase, decrease, or remain unchanged. The implicit tax effects depend on the price elasticity of capital assets. Such estimations are beyond the scope of this study but provide an area for future research. Fourth, firms with net operating losses (NOLs) for tax purposes may not be affected by changes in ITC provisions because they are not in a position to utilize the tax credits. Future work should identify NOL firms and estimate ITC effects for them separately. Fifth, hypotheses two and three are estimated with the indicator variable equal to 1 for those firms most likely to be affected by the ITC. A more powerful test would set the indicator variable equal to 1 for those firms least likely to be affected by the ITC. Future work will examine hypotheses two and three with this modification, among

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others. Lastly, to more fully interpret this study's results, estimates of revenues lost due to the more generous ITC provisions will be gathered from the Congressional Committee Reports and drafts of the tax bills. These estimates of government revenues lost will be compared to this study's estimates of capital expenditure increases to assess the cost effectiveness of the ITC provision changes.

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FIGURES AND TABLES

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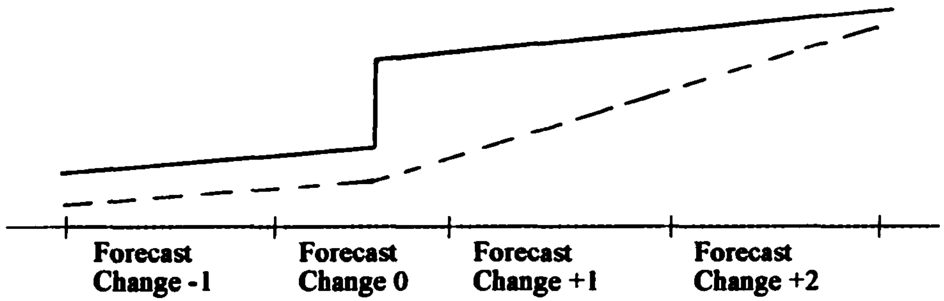
Figure 5.1
Expected Levels and Changes in Forecasted Capital Expenditures Under Different ITC Stimulus Scenarios

Panel A: Level of Forecasted Capital Expenditures



——— **if the ITC provides a one time increase in the level of planned capital investment**

--------- **if the ITC increases the growth rate of the level of planned capital investment in periods after the ITC's reinstatement**

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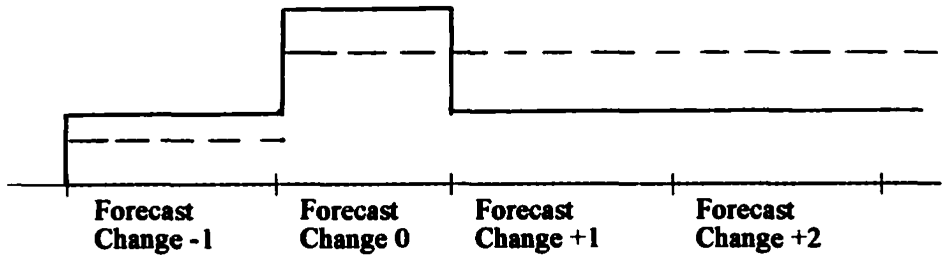
Figure 5.1 (continued)
Expected Levels and Changes in Forecasted Capital Expenditures Under Different ITC Stimulus Scenarios

Panel B: Change in the Level of Forecasted Expenditures[a]



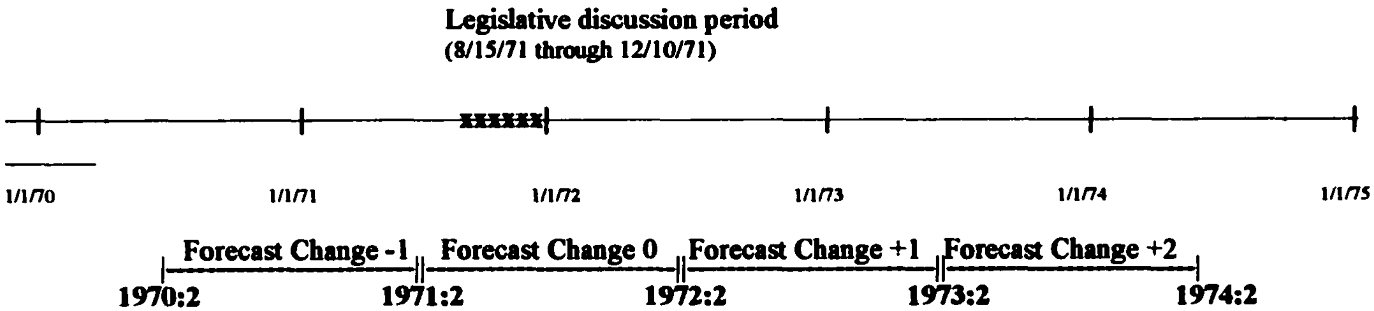
——— if the ITC provides a one time increase in the level of planned capital investment

--------- if the ITC increases the growth rate of the level of planned capital investment in periods after the ITC's reinstatement

[a] This represents the intercept and dummy variables in the investment equations. For example, γ_0 (the intercept term in equation 2) represents the mean change in forecasted capital expenditures for forecast change -1 not explained by the independent variables. $\gamma_0 + \gamma_6$ and $\gamma_0 + \gamma_7$ are the intercept terms for forecast change 0 and forecast change +1 and +2, respectively. (Forecast change +2 is relevant only for the 1971 Act.)

Figure 5.2
Timeline of Forecast Dates
(Forecast dates in bold)

Panel A: The 1971 Tax Act



Note:
The long-term forecasted values at 1970:2 correspond to the average values for a firm's 1972-1974 fiscal years.
The long-term forecasted values at 1971:2 correspond to the average values for a firm's 1973-1975 fiscal years.
The long-term forecasted values at 1972:2 correspond to the average values for a firm's 1974-1976 fiscal years.
The long-term forecasted values at 1973:2 correspond to the average values for a firm's 1975-1977 fiscal years.
The long-term forecasted values at 1974:2 correspond to the average values for a firm's 1976-1978 fiscal years.

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Figure 5.2 (continued)
Timeline of Forecast Dates
(Forecast dates in bold)

Panel B: The 1975 Tax Act

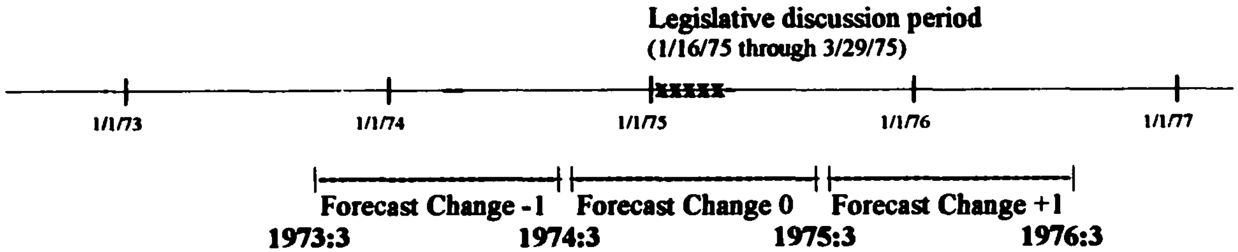

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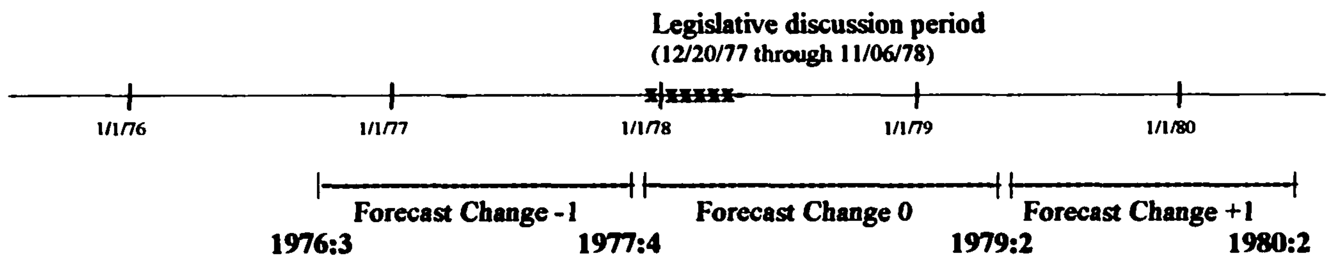
Figure 5.2 (continued)
Timeline of Forecast Dates
(Forecast dates in bold)

Panel C: The 1978 Tax Act



Note:
The long-term forecasted values at 1976:3 correspond to the average values for a firm's 1979-1981 fiscal years.
The long-term forecasted values at 1977:4 correspond to the average values for a firm's 1980-1982 fiscal years.
The long-term forecasted values at 1979:2 correspond to the average values for a firm's 1981-1983 fiscal years.
The long-term forecasted values at 1980:2 correspond to the average values for a firm's 1982-1984 fiscal years.

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Table 6.1
Summary of the Sample Selection Criteria

	# of Firms	# of Industries
Value Line population in 1970	1313	62
Less: Industries with no capital expenditure information provided by *Value Line*[1]	(194)	(11)
Industries with less than 30 firms[1]	(541)	(40)
Potential Sample Firms	578	11
Less: Industries not selected	(267)	(6)
Sample Firms	311	5

[1] Table 6.3 lists these deleted industries.

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Table 6.2
Average Capital Intensity of Sample Industries for the 1970 and 1971 Fiscal Years

Industry	Number of firms	Capital Intensity-1970	Capital Intensity-1971
Elec. Equip./Electronics	80	0.047	0.036
Machinery*	62	0.056	0.063
Auto Parts	30	0.057	0.041
Drug	32	0.061	0.054
Steel	35	0.062	0.048
Building*	61	0.069	0.059
Chemical*	45	0.101	0.087
Metals and Mining*	46	0.130	0.127
Petroleum	43	0.186	0.179
Natural Gas	47	0.190	0.190
Electric Utility*	97	0.437	0.465
All Industries[a]	578	0.127	0.123

* Chosen for inclusion in final sample

Note: Capital intensity is defined as annual capital expenditures divided by sales (both capital expenditures and sales are as reported by *Value Line*).

[a] Average capital intensity across all 11 industries, unweighted by relative industry size.

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Table 6.3
***Value Line* Industries Deleted from Potential Sample**

<u>Industries with no capital expenditure information provided by *Value Line*:</u>

Air Transport
Banking
Dual Fund
Finance
Fire-Casualty Insurance
Grocery Store
Investment Trust
Life Insurance
Retail Store
Savings and Loan
Variety Store

<u>Industries with fewer than 30 firms:</u>

Aerospace
Auto and Truck
Agricultural Equipment
Apparel
Baking
Brewing
Coal and Uranium
Conglomerates
Distilling
Fastener
Food Processing
Household Products
Leasing
Machine Tool
Meat Packing
Metal Fabricating
Milling and Vegetable Oil
Mobile Home
Office Equipment/Computer
Packaging and Container
Paper
Personal Service
Precision Instruments
Publishing and Advertising
Railroad
Railroad Equipment
Real Estate
Recreation
Retail-Special Lines
Shipping and Shipbuilding
Shoe
Soft Drink
Sugar
Textile
Telecommunications
Tire and Rubber
Toiletries and Cosmetics
Tobacco
Toys and School Supplies
Truck and Bus Lines

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Table 6.4
Descriptive Statistics for the Sample Firms for 1968-1979

Panel A: Capital Intensity[a]

Year	n	Mean	Median	StDev	Min	Max
1968	262	0.200	0.125	0.189	0.003	1.13
1969	262	0.205	0.118	0.197	0.014	0.84
1970	262	0.215	0.115	0.207	0.007	0.99
1971	262	0.221	0.104	0.229	0.010	1.02
1972	262	0.222	0.100	0.236	0.003	1.09
1973	262	0.229	0.103	0.244	0.005	1.27
1974	262	0.223	0.116	0.222	0.007	0.98
1975	262	0.196	0.116	0.197	0.011	1.04
1976	262	0.180	0.091	0.200	0.002	1.27
1977	255	0.179	0.083	0.189	0.006	1.05
1978	255	0.180	0.087	0.187	0.011	1.10
1979	255	0.178	0.091	0.187	0.005	1.26

Panel B: Capital Expenditures (in millions of dollars)

Year	n	Mean	Median	StDev	Min	Max
1968	262	49.06	19.94	68.94	0.160	367.2
1969	262	57.84	22.00	83.09	0.200	457.5
1970	262	66.62	26.90	98.72	0.160	498.4
1971	262	73.35	25.18	114.48	0.131	677.0
1972	262	77.18	32.12	120.73	0.392	859.6
1973	262	90.66	37.34	136.28	0.197	1002.6
1974	262	112.70	46.76	164.12	0.464	1211.7
1975	262	115.70	49.91	170.87	0.492	1031.7
1976	262	114.39	41.71	182.06	0.272	1186.8
1977	255	127.91	45.95	196.10	0.207	1217.3
1978	255	142.89	58.09	211.63	0.480	1477.5
1979	255	162.22	64.08	239.67	0.542	1431.6

[a] Capital intensity is defined as capital expenditures divided by sales.

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Table 6.4 (continued)
Descriptive Statistics for the Sample Firms for 1968-1979

Panel C: Sales (in millions of dollars)

Year	n	Mean	Median	StDev	Min	Max
1968	262	302.1	153.1	409.0	6.90	3481
1969	262	340.5	176.5	452.8	7.70	3655
1970	262	354.6	193.2	459.0	6.80	3618
1971	262	382.0	196.7	484.6	5.00	3848
1972	262	426.7	220.8	540.5	6.50	4366
1973	262	501.8	264.0	650.3	8.00	5275
1974	262	629.2	322.3	844.5	12.70	6910
1975	262	638.1	321.1	898.5	15.30	7222
1976	262	718.9	376.5	1006.9	11.70	8361
1977	255	823.1	424.7	1150.0	13.90	9435
1978	255	924.4	506.5	1280.0	9.00	10584
1979	255	1085.9	580.5	1523.9	23.60	12572

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Table 6.5
Descriptive Statistics for 1970, by Industry

Panel A: Capital Expenditures (millions of dollars)

Industry	n	Mean	Median	StDev	Min	Max
Building	51	31.03	11.02	54.82	0.485	282.0
Chemical	40	74.76	33.49	109.43	0.603	471.2
El. Utility	93	109.31	63.94	119.59	3.684	498.4
Machinery	49	14.47	7.49	17.40	0.843	72.3
M & M	29	59.48	22.38	79.44	0.160	285.0

Panel B: Capital Intensity[a]

Industry	n	Mean	Median	StDev	Min	Max
Building	51	0.072	0.055	0.049	0.007	0.230
Chemical	40	0.100	0.086	0.080	0.023	0.460
El. Utility	93	0.440	0.418	0.168	0.162	0.990
Machinery	49	0.059	0.039	0.066	0.007	0.410
M & M	29	0.129	0.104	0.090	0.015	0.400

Panel C: Sales (millions of dollars)

Industry	n	Mean	Median	StDev	Min	Max
Building	51	361.2	215.6	385.1	13.40	1717
Chemical	40	666.4	388.0	809.2	21.80	3618
El. Utility	93	226.6	136.8	226.6	16.70	1129
Machinery	49	283.8	194.9	289.6	33.40	1331
M & M	29	435.5	151.6	484.4	6.80	1522

Panel D: Net Income (millions of dollars)

Industry	n	Mean	Median	StDev	Min	Max
Building	51	13.92	8.30	21.02	-2.93	124.2
Chemical	40	37.78	15.45	62.13	-3.80	328.7
El. Utility	93	42.89	24.40	43.09	2.40	215.3
Machinery	49	11.75	6.25	14.40	-3.30	65.5
M & M	29	44.47	22.85	54.54	0.20	208.6

[a] Capital intensity is defined as capital expenditures divided by sales.

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Table 6.5 (continued)
Descriptive Statistics for 1970, by Industry

Panel E: Cash Earnings (millions of dollars)

Industry	n	Mean	Median	StDev	Min	Max
Building	51	41.4	25.07	52.78	4.085	275.1
Chemical	40	114.9	46.85	178.66	3.666	882.9
El. Utility	93	65.35	35.89	65.59	4.300	326.8
Machinery	49	32.3	21.13	35.27	3.168	163.9
M & M	29	89.5	29.47	115.69	0.015	382.2

Panel F: Return on Net Worth (percent)[b]

Industry	n	Mean	Median	StDev	Min	Max
Building	51	7.68	8.05	3.38	0.30	15.70
Chemical	40	9.25	8.80	4.33	1.50	20.10
El. Utility	93	11.79	11.55	2.14	7.20	16.90
Machinery	49	10.30	10.70	4.56	3.40	21.60
M & M	29	11.59	11.40	5.55	1.50	27.10

[b] Return on net worth is defined as net income divided by net worth, expressed as a percentage. Net worth is the sum of common plus preferred stockholders' equity, including intangibles.

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Table 6.6
Pearson and Spearman Correlations Among the Forecast Changes[a] (N=2614)
(Pearson correlations are above the diagonal, Spearman correlations are below the diagonal)

	$\Delta STINV_{it}$	$\Delta LTINV_{it}$	$\Delta STSAL_{it}$	$\Delta LTSAL_{it}$	$\Delta STINC_{it}$	$\Delta LTINC_{it}$	$\Delta STCASH_{it}$	$\Delta LTCASH_{it}$
$\Delta STINV_{it}$		.217	.147	.167	.110	.128	.249	.042[b]
$\Delta LTINV_{it}$	.223		.174	.305	.030[c]	.355	.143	.089
$\Delta STSAL_{it}$	.170	.140		.763	.204	.368	.461	.083
$\Delta LTSAL_{it}$	.222	.296	.588		.140	.536	.338	.100
$\Delta STINC_{it}$	.215	.110	.513	.298		.226	.267	.031[c]
$\Delta LTINC_{it}$	.238	.370	.355	.630	.448		.293	.133
$\Delta STCASH_{it}$	.187	.123	.566	.324	.819	.402		.066
$\Delta LTCASH_{it}$	:265	.380	.392	.658	.403	.825	.450	

[a] All correlations are significant at $p<.001$ unless otherwise indicated.
[b] Significant at $p<.05$.
[c] Not significant at $p<.10$.

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Table 6.6 (continued)
Pearson and Spearman Correlations Among the Forecast Changes

Variable definitions:

$\Delta STINV_{it}$ ($\Delta LTINV_{it}$) is the change in the short-term (long-term) capital investment forecast for firm i for forecast change t[d];
$\Delta STSAL_{it}$ ($\Delta LTSAL_{it}$) is the change in the short-term (long-term) sales forecast for firm i for forecast change t, divided by short-term (long-term) forecasted sales;
$\Delta STINC_{it}$ ($\Delta LTINC_{it}$) is the change in the short-term (long-term) net income forecast for firm i for forecast change t, divided by short-term (long-term) forecasted net income; and
$\Delta STCASH_{it}$ ($\Delta LTCASH_{it}$) is the change in the short-term (long-term) cash earnings forecast for firm i for forecast change t, divided by short-term (long-term) forecasted cash earnings.

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[d] $\Delta STINV'_{it}$ ($\Delta LTINV'_{it}$) is divided by the corresponding variable (i.e., either short-term or long-term forecasted sales, net income, or cash earnings).

Table 6.7
Short-term (Scaled) Forecast Errors for Sample Firms, 1970-1979[a]

Forecast Error	N	Mean	Median	St.Dev.
Capital Expenditures	2614	-0.0486*	-0.0015	1.5060
Net Income	2614	-0.0446*	0.0000	1.4051
Sales	2614	0.0030	0.0030	0.1050

[a] All forecast errors = (actual amount - short-term forecasted amount)/actual amount.
Note: Statistically significant t-statistics are denoted by * if significant at the 0.10 level, ** if significant at the 0.05 level, and *** if significant at the 0.01 level.

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Table 6.8
Short-term (Scaled) Forecast Errors for Sample Firms, 1970-1979
Full Sample By Year[a]

Capital Expenditure Forecast Error

Year	N	Mean	Median	St.Dev.
1970	262	-0.0396	0.0000	0.4898
1971	262	-0.0389	-0.0137	0.4156
1972	262	-0.0453	-0.0362	0.4871
1973	267	-0.0762	0.0214	0.7740
1974	267	-0.0020	0.0394	0.5168
1975	267	-0.0504	0.0010	0.5530
1976	255	-0.0472**	-0.0773	0.3520
1977	255	0.0293	-0.0199	0.5588
1978	255	0.0134	0.0230	0.4501
1979	255	0.0261	0.0298	0.2815

Net Income Forecast Error

Year	N	Mean	Median	St.Dev.
1970	262	-0.0021	-0.0053	1.5560
1971	262	-0.0206	0.0183	0.7069
1972	262	-0.0226	0.0179	0.4578
1973	267	0.0389	0.0208	0.3301
1974	267	-0.1222**	-0.0285	0.9497
1975	267	-0.1199	0.0000	1.5302
1976	255	-0.1672	-0.0072	3.5950
1977	255	-0.0459**	-0.0081	0.3457
1978	255	0.0040	-0.0002	0.0707
1979	255	0.0003	0.0000	0.9242

[a] All forecast errors = (actual amount - short-term forecasted amount)/actual amount.
Note: Statistically significant t-statistics are denoted by * if significant at the 0.10 level, ** if significant at the 0.05 level, and *** if significant at the 0.01 level.

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Table 6.8 (continued)
Short-term (Scaled) Forecast Errors for Sample Firms, 1970-1979
Full Sample By Year[a]

Sales Forecast Error

Year	N	Mean	Median	St.Dev.
1970	262	-0.0035	-0.0008	0.0357
1971	262	-0.0035	0.0011	0.0969
1972	262	0.0081	0.0154	0.0806
1973	267	0.0307***	0.0190	0.0839
1974	267	0.0237***	0.0182	0.0873
1975	267	-0.0227***	-0.0125	0.0855
1976	255	-0.0138***	-0.0070	0.0558
1977	255	-0.0048	-0.0029	0.0870
1978	255	0.0400	-0.0025	0.5980
1979	255	0.0071	0.0173	0.1831

[a] All forecast errors = (actual amount - short-term forecasted amount)/actual amount.
Note: Statistically significant t-statistics are denoted by * if significant at the 0.10 level, ** if significant at the 0.05 level, and *** if significant at the 0.01 level.

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Table 6.9
Short-term (Scaled) Mean Forecast Errors for Sample Firms For Each Industry By Tax Act Years[a]

Industry	N	Capital Expenditure	Net Income	Sales
1971 Tax Act				
Building	204	-0.0227	0.0359	0.0130**
Chemical	160	-0.0071	0.0016	0.0131**
Electric Utility	372	-0.0201	0.0033	0.0043**
Machinery	196	-0.0888	-0.0075	0.0034
Metals & Mining	116	-0.1589	-0.0558	0.0122
1975 Tax Act				
Building	168	-0.0307	-0.0794	0.0032
Chemical	114	0.0264	-0.0216	0.0164***
Electric Utility	297	0.0019	-0.0418***	0.0079***
Machinery	132	-0.0197	-0.2052	0.0042
Metals & Mining	90	-0.1396	-0.0662	-0.0355
1978 Tax Act				
Building	150	0.0382	-0.2816	-0.0017
Chemical	102	-0.0185	-0.1007	0.0057
Electric Utility	291	-0.0567***	-0.0329***	-0.0052
Machinery	150	0.0186	0.0464	-0.0036
Metals & Mining	72	0.6347	-0.0264	-0.0161

[a] All forecast errors = (actual amount - short-term forecasted amount)/actual amount.
Note: Statistically significant t-statistics are denoted by * if significant at the 0.10 level, ** if significant at the 0.05 level, and *** if significant at the 0.01 level.

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Table 7.1
The 1971 Tax Act
Regression Results for the Full Sample and for Each Industry for Changes in Short-term Capital Investment Forecasts

$$\Delta STINV_{it} = \beta_0 + \beta_1 \Delta STSAL_{it} + \beta_2 \Delta INT_{it} + \beta_3 \Delta STROE_{it} + \beta_4 CASH_{it} + \beta_5 CAP_{it} + \beta_6 DITC + \beta_7 CRED + \beta_8 \Delta STSAL_{it} {*} DITC + \beta_9 \Delta STSAL_{it} {*} CRED + \varepsilon_{it}$$

Industry	β_0	β_1 (+)	β_2 (-)	β_3 (-)	β_4 (+)	β_5 (+)	β_6 (+)	β_7 (+)	β_8 (+)	β_9 (+)	Adj. R^2 (F sig. level)
Full Sample	0.006	0.228	0.004c	-0.003	0.057	0.534	0.031	0.032	-0.219d	-0.198d	.104
N=1,048	(0.68)[b]	(4.53)***		(-2.56)***	(1.21)	(4.52)***	(3.04)***	(2.33)***			(<.001)
All firms but electric utilities	-0.010	0.087	-0.005	0.000	0.183	0.454	0.022	0.023	-0.110d	-0.051c	.182
N=676	(-1.57)	(2.89)***	(-0.68)	(-1.00)	(2.07)**	(6.94)***	(3.28)***	(2.56)***			(<.001)
Building	-0.012	0.033	-0.010	0.000	1.044	0.628	0.023	0.031	-0.043c	-0.043c	.243
N=204	(-1.08)	(0.59)	(-0.70)	(-0.14)	(2.43)***	(4.16)***	(2.36)***	(2.04)**			(<.001)
Chemical	-0.008	0.225	0.008c	0.000	0.096	0.492	0.014	0.014	-0.249d	-0.168d	.375
N=160	(-0.81)	(2.95)***			(1.29)*	(4.61)***	(1.39)*	(1.29)*			(<.001)

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Table 7.1 (continued)
The 1971 Tax Act
Regression Results for the Full Sample and for Each Industry for Changes in Short-term Capital Investment Forecasts

$$\Delta STINV_{it} = \beta_0 + \beta_1 \Delta STSAL_{it} + \beta_2 \Delta INT_{it} + \beta_3 \Delta STROE_{it} + \beta_4 CASH_{it} + \beta_5 CAP_{it} + \beta_6 DITC + \beta_7 CRED + \beta_8 \Delta STSAL_{it} {*} DITC + \beta_9 \Delta STSAL_{it} {*} CRED + \varepsilon_{it}$$

Industry	β_0	β_1 (+)	β_2 (-)	β_3 (-)	β_4 (+)	β_5 (+)	β_6 (+)	β_7 (+)	β_8 (+)	β_9 (+)	Adj. R^2 (F sig. level)
Electric Utility	0.029	0.363	0.007c	0.006c	-0.080d	0.605	0.035	0.062	-0.173c	-0.387c	.097
N=372	(0.81)	(1.49)*				(3.77)***	(0.83)	(1.30)*			(<.001)
Machinery	-0.010	0.112	0.002c	-0.003	0.264	0.504	0.014	0.024	-0.052c	-0.058c	.190
N=196	(-0.94)	(1.90)**		(-1.32)*	(1.78)**	(2.98)***	(1.46)*	(1.49)*			(<.001)
Metals & Mining	-0.013	0.036	-0.030	0.000	0.117	0.390	0.028	0.016	-0.107d	0.008	.163
N=116	(-0.77)	(0.59)	(-1.18)	(-0.07)	(1.43)*	(4.06)***	(1.14)	(0.64)		(0.14)	(<.001)

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Table 7.1 (continued)
The 1971 Tax Act
Regression Results for the Full Sample and for Each Industry for Changes in Short-term Capital Investment Forecasts

$\Delta STINV_{it}$	= change in the short-term capital investment forecast for firm i for forecast change t;
$\Delta STSAL_{it}$	= change in the short-term sales forecast for firm i for forecast change t;
ΔINT_{it}	= change in the real interest rate for firm i for forecast change t;
$\Delta STROE_{it}$	= change in the short-term return on equity forecast for firm i for forecast change t;
$CASH_{it}$	= unexpected cash earnings for firm i that occur during forecast change t;
CAP_{it}	= capital expenditure forecast error for firm i that occurs during forecast change t;
DITC	= dummy variable equal to 1 for forecast change 0 (equal to 0 otherwise);
CRED	= dummy variable equal to 1 for forecast changes +1 and +2 (equal to 0 otherwise);
ε_{it}	= error term for firm i; and
i	= 1,...,N; firm index (number of firms varies by industry).

The variables $\Delta STINV_{it}$, $\Delta STSAL_{it}$, $CASH_{it}$, and CAP_{it} are divided by short-term forecasted sales.

[b] White (1980) adjusted t-statistics are reported in parentheses. Probability values are based on two-tailed tests for the intercept and one-tailed tests for the other coefficients. Statistically significant t-statistics are denoted by * if significant at the 0.10 level, ** if significant at the 0.05 level, and *** if significant at the 0.01 level.

[c] Coefficient is not of the predicted sign and is not significant at the 10% level using a two-tailed test.

[d] Coefficient is not of the predicted sign and is significant at the 10% level using a two-tailed test.

Table 7.2
The 1971 Tax Act
Regression Results for the Full Sample and for Each Industry for Changes in Long-term Capital Investment Forecasts

$$\Delta LTINV_{it} = \gamma_0 + \gamma_1 \Delta LTSAL_{it} + \gamma_2 \Delta INT_{it} + \gamma_3 \Delta LTROE_{it} + \gamma_4 CASH_{it} + \gamma_5 CAP_{it} + \gamma_6 DITC + \gamma_7 CRED + \gamma_8 \Delta LTSAL_{it} {*} DITC + \gamma_9 \Delta LTSAL_{it} {*} CRED + \varepsilon_{it}$$

Industry	γ_0	γ_1 (+)	γ_2 (-)	γ_3 (-)	γ_4 (+)	γ_5 (+)	γ_6 (+)	γ_7 (+)	γ_8 (+)	γ_9 (+)	Adj. R^2 (F. sig. level)
Full Sample	0.002	0.200	-0.004	-0.007	-0.059c	-0.025c	0.011	0.012	-0.074c	-0.032c	.083
N=1,048	(-0.21)[b]	(2.74)***	(-0.34)	(-2.78)***			(1.26)	(0.90)			(<.001)
All firms but electric utilities	-0.002	0.042	-0.004	0.000	0.087	0.154	0.001	0.003	-0.024c	-0.003c	.105
N=676	(-0.63)	(1.29)*	(-0.97)	(-0.95)	(1.18)	(1.55)*	(0.30)	(0.69)			(<.001)
Building	0.005	0.063	0.004c	0.001c	0.186	-0.120d	0.003	-0.004c	-0.081c	-0.013c	.174
N=204	(1.40)	(1.46)*			(1.89)**		(0.69)				(<.001)
Chemical	0.003	0.037	0.002c	0.001c	0.118	0.156	-0.003c	-0.005c	0.012	-0.007c	.152
N=160	(0.55)	(0.50)			(1.18)	(1.97)**			(0.15)		(<.001)

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Table 7.2 (continued)
The 1971 Act
Regression Results for the Full Sample and for Each Industry for Changes in Long-term Capital Investment Forecasts

$$\Delta LTINV_{it} = \gamma_0 + \gamma_1 \Delta LTSAL_{it} + \gamma_2 \Delta INT_{it} + \gamma_3 \Delta LTROE_{it} + \gamma_4 CASH_{it} + \gamma_5 CAP_{it} + \gamma_6 DITC + \gamma_7 CRED$$
$$+ \gamma_8 \Delta LTSAL_{it} {*} DITC + \gamma_9 \Delta LTSAL_{it} {*} CRED + \varepsilon_{it}$$

Industry	γ_0	γ_1 (+)	γ_2 (-)	γ_3 (-)	γ_4 (+)	γ_5 (+)	γ_6 (+)	γ_7 (+)	γ_8 (+)	γ_9 (+)	Adj. R^2 (F. sig. level)
Electric Utility	-0.011	0.565	-0.025	-0.020	-0.006c	-0.030c	0.026	0.044	-0.199c	-0.207c	.159
N=372	(-0.40)	(4.03)***	(-0.65)	(-2.01)**			(1.21)	(1.07)			(<.001)
Machinery	-0.006	-0.030c	-0.008	-0.002	-0.003c	0.017	-0.002c	0.003	0.086	0.098	.053
N=196	(-1.79)*		(-1.68)**	(-2.43)***		(0.06)		(0.66)	(2.12)**	(2.89)***	(.022)
Metals & Mining	-0.014	0.026	-0.021	-0.002	0.076	0.226	0.005	0.020	-0.016c	0.027	.102
N=116	(-1.24)	(0.95)	(-1.31)*	(-1.55)*	(0.81)	(2.02)**	(0.60)	(1.16)		(0.80)	(.014)

Table 7.2 (continued)
The 1971 Act
Regression Results for the Full Sample and for Each Industry for Changes in Long-term Capital Investment Forecasts

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$\Delta LTINV_{it}$	=	change in the long-term capital investment forecast for firm i for forecast change t;
$\Delta LTSAL_{it}$	=	change in the long-term sales forecast for firm i for forecast change t;
ΔINT_{it}	=	change in the real interest rate for firm i for forecast change t;
$\Delta LTROE_{it}$	=	change in the long-term return on equity forecast for firm i for forecast change t;
$CASH_{it}$	=	unexpected cash earnings for firm i that occur during forecast change t;
CAP_{it}	=	capital expenditure forecast error for firm i that occurs during forecast change t;
DITC	=	dummy variable equal to 1 for forecast change 0 (equal to 0 otherwise);
CRED	=	dummy variable equal to 1 for forecast changes +1 and +2 (equal to 0 otherwise);
ε_{it}	=	error term for firm i; and
i	=	1,...,N; firm index (number of firms varies by industry).

The variables $\Delta LTINV_{it}$, $\Delta LTSAL_{it}$, $CASH_{it}$, and CAP_{it} are divided by long-term forecasted sales.

[b] White (1980) adjusted t-statistics are reported in parentheses. Probability values are based on two-tailed tests for the intercept and one-tailed tests for the other coefficients. Statistically significant t-statistics are denoted by * if significant at the 0.10 level, ** if significant at the 0.05 level, and *** if significant at the 0.01 level.

[c] Coefficient is not of the predicted sign and is not significant at the 10% level using a two-tailed test.

[d] Coefficient is not of the predicted sign and is significant at the 10% level using a two-tailed test.

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Table 7.3: Panel A
The 1971 Act ($\Delta STINV$)
Estimated Parameter Values for the Intercept
for Each Forecast Change Period

$$\Delta STINV_{it} = \beta_0 + \beta_1 \Delta STSAL_{it} + \beta_2 \Delta INT_{it} + \beta_3 \Delta STROE_{it} + \beta_4 CASH_{it} + \beta_5 CAP_{it}$$
$$+ \beta_6 DITC + \beta_7 CRED + \beta_8 \Delta STSAL_{it} {*} DITC + \beta_9 \Delta STSAL_{it} {*} CRED + \varepsilon_{it}$$

	Forecast Change -1 β_0	Forecast Change 0 $\beta_0 + \beta_6$	Forecast Change +1 and +2 $\beta_0 + \beta_7$
Full Sample (n=1048)	0.006	0.037***	0.038***
All firms but electric utilities (n=676)	-0.010	0.012***	0.013***
Building (n=204)	-0.012	0.011***	0.019**
Chemical (n=160)	-0.008	0.006*	0.006*
Electric Utility (n=372)	0.029	0.064	0.091*
Machinery (n=196)	-0.010	0.004*	0.014*
Metals & Mining (n=116)	-0.013	0.015	0.003

Note: Statistically significant t-statistics associated with the coefficient estimates are denoted by * if significant at the 0.10 level, ** if significant at the 0.05 level, and *** if significant at the 0.01 level.

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Table 7.3: Panel B
The 1971 Act ($\Delta STINV$)
Estimated Parameter Values for $\Delta STSAL$
for Each Forecast Change Period

$$\Delta STINV_{it} = \beta_0 + \beta_1 \Delta STSAL_{it} + \beta_2 \Delta INT_{it} + \beta_3 \Delta STROE_{it} + \beta_4 CASH_{it} + \beta_5 CAP_{it}$$
$$+ \beta_6 DITC + \beta_7 CRED + \beta_8 \Delta STSAL_{it} {*} DITC + \beta_9 \Delta STSAL_{it} {*} CRED + \varepsilon_{it}$$

	Forecast Change -1 β_1	Forecast Change 0 $\beta_1 + \beta_8$	Forecast Change +1 and +2 $\beta_1 + \beta_9$
Full Sample (n=1048)	0.228	0.009d	0.030d
All firms but electric utilities (n=676)	0.087	-0.023d	0.036c
Building (n=204)	0.033	-0.010c	-0.010c
Chemical (n=160)	0.225	-0.024d	0.057d
Electric Utility (n=372)	0.363	0.190c	-0.024c
Machinery (n=196)	0.112	0.060c	0.054c
Metals & Mining (n=116)	0.036	-0.071d	0.044

[c] Coefficient is not of the predicted sign and is <u>not</u> significant at the 10% level using a two-tailed test.
[d] Coefficient is not of the predicted sign and <u>is</u> significant at the 10% level using a two-tailed test.

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Table 7.4: Panel A
The 1971 Act ($\Delta LTINV$)
Estimated Parameter Values for the Intercept for Each Forecast Change Period

$$\Delta LTINV_{it} = \gamma_0 + \gamma_1 \Delta LTSAL_{it} + \gamma_2 \Delta INT_{it} + \gamma_3 \Delta LTROE_{it} + \gamma_4 CASH_{it} + \gamma_5 CAP_{it} + \gamma_6 DITC + \gamma_7 CRED + \gamma_8 \Delta LTSAL_{it} {*} DITC + \gamma_9 \Delta LTSAL_{it} {*} CRED + \varepsilon_{it}$$

	Forecast Change -1 γ_0	Forecast Change 0 $\gamma_0 + \gamma_6$	Forecast Change +1 and +2 $\gamma_0 + \gamma_7$
Full Sample (n=1048)	0.002	0.013	0.014
All firms but electric utilities (n=676)	-0.002	-0.001	0.001
Building (n=204)	0.005	0.008	0.001c
Chemical (n=160)	0.003	0.000c	-0.002c
Electric Utility (n=372)	-0.011	0.015	0.033
Machinery (n=196)	-0.006	-0.008c	-0.003
Metals & Mining (n=116)	-0.014	-0.009	0.006

[c] Coefficient is not of the predicted sign and is not significant at the 10% level using a two-tailed test.

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Table 7.4: Panel B
The 1971 Act ($\Delta LTINV$)
Estimated Parameter Values for $\Delta LTSAL$
for Each Forecast Change Period

$$\Delta LTINV_{it} = \gamma_0 + \gamma_1 \Delta LTSAL_{it} + \gamma_2 \Delta INT_{it} + \gamma_3 \Delta LTROE_{it} + \gamma_4 CASH_{it} + \gamma_5 CAP_{it}$$
$$+ \gamma_6 DITC + \gamma_7 CRED + \gamma_8 \Delta LTSAL_{it} {*} DITC + \gamma_9 \Delta LTSAL_{it} {*} CRED + \varepsilon_{it}$$

	Forecast Change -1 γ_1	Forecast Change 0 $\gamma_1 + \gamma_8$	Forecast Change +1 and +2 $\gamma_1 + \gamma_9$
Full Sample (n=1048)	0.200	0.126c	0.168c
All firms but electric utilities (n=676)	0.042	0.018c	0.039c
Building (n=204)	0.063	-0.018c	0.050c
Chemical (n=160)	0.037	0.049	0.030c
Electric Utility (n=372)	0.565	0.366c	0.358c
Machinery (n=196)	-0.030	0.056**	0.068***
Metals & Mining (n=116)	0.026	0.010c	0.053

Note: Statistically significant t-statistics associated with the coefficient estimates are denoted by * if significant at the 0.10 level, ** if significant at the 0.05 level, and *** if significant at the 0.01 level.
[c] Coefficient is not of the predicted sign and is <u>not</u> significant at the 10% level using a two-tailed test.

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Table 7.5
The 1975 Tax Act
Regression Results for the Full Sample and for Each Industry for Changes in Short-term Capital Investment Forecasts

$$\Delta STINV_{it} = \beta_0 + \beta_1 \Delta STSAL_{it} + \beta_2 \Delta INT_{it} + \beta_3 \Delta STROE_{it} + \beta_4 CASH_{it} + \beta_5 CAP_{it} + \beta_6 DITC + \beta_7 CRED$$
$$+ \beta_8 \Delta STSAL_{it}{*}DITC + \beta_9 \Delta STSAL_{it}{*}CRED + \varepsilon_{it}$$

Industry	β_0	β_1 (+)	β_2 (-)	β_3 (-)	β_4 (+)	β_5 (+)	β_6 (+)	β_7 (+)	β_8 (+)	β_9 (+)	Adj. R^2 (F. sig. level)
Full Sample	0.025	-0.035c	0.016c	0.000	(0.939)	0.589	-0.015c	0.012	-0.036c	0.057	.732
N=801	(1.65)[b]*			(-0.18)	(4.10)***	(7.53)***		(0.61)		(1.37)*	(<.001)
All firms but electric utilities	0.013	0.015	-0.005	0.000	0.404	0.459	-0.008c	-0.009c	0.015	-0.018c	.625
N=504	(1.21)	(0.60)	(-0.50)		(3.02)***	(5.07)***			(0.49)		(<.001)
Building	-0.003	0.024	0.001c	0.000	0.456	0.703	-0.004c	0.011	-0.026c	-0.036c	.255
N=168	(-0.16)	(0.81)			(1.56)*	(3.85)***		(0.48)			(<.001)
Chemical	0.022	0.015	-0.008	0.000	0.347	0.473	-0.012c	-0.016c	0.017	0.008	.174
N=114	(1.74)*	(0.55)	(-0.60)		(1.79)**	(3.82)***			(0.30)	(0.19)	(<.001)

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Table 7.5 (continued)
The 1975 Tax Act
Regression Results for the Full Sample and for Each Industry for Changes in Short-term Capital Investment Forecasts

$$\Delta STINV_{it} = \beta_0 + \beta_1 \Delta STSAL_{it} + \beta_2 \Delta INT_{it} + \beta_3 \Delta STROE_{it} + \beta_4 CASH_{it} + \beta_5 CAP_{it} + \beta_6 DITC + \beta_7 CRED + \beta_8 \Delta STSAL_{it} {*} DITC + \beta_9 \Delta STSAL_{it} {*} CRED + \varepsilon_{it}$$

Industry	β_0	β_1 (+)	β_2 (-)	β_3 (-)	β_4 (+)	β_5 (+)	β_6 (+)	β_7 (+)	β_8 (+)	β_9 (+)	Adj. R^2 (F. sig. level)
Electric Utility	0.132	-0.089c	-0.064	-0.005	1.28	0.496	-0.064c	-0.106c	0.008	0.352	.764
N=297	(1.92)*		(-0.92)	(-0.78)	(2.35)***	(2.93)***			(0.05)	(1.74)**	(<.001)
Machinery	0.003	0.047	0.000	0.000	-0.325c	0.230	-0.012c	-0.004c	0.026	-0.022c	.172
N=132	(0.31)	(1.25)	(-0.03)	(-0.92)		(1.31)*			(0.64)		(<.001)
Metals & Mining	0.010	-0.025c	-0.002	0.002c	0.545	0.434	0.039	0.004	0.033	-0.139d	.700
N=90	(0.23)		(-0.05)		(2.37)***	(4.09)***	(1.16)	(0.07)	(0.65)		(<.001)

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Table 7.5 (continued)
The 1975 Tax Act
***Regression Results for the Full Sample and for Each Industry for Changes* in Short-term Capital Investment Forecasts**

$\Delta STINV_{it}$	= change in the short-term capital investment forecast for firm i for forecast change t;
$\Delta STSAL_{it}$	= change in the short-term sales forecast for firm i for forecast change t;
ΔINT_{it}	= change in the real interest rate for firm i for forecast change t;
$\Delta STROE_{it}$	= change in the short-term return on equity forecast for firm i for forecast change t;
$CASH_{it}$	= unexpected cash earnings for firm i that occur during forecast change t;
CAP_{it}	= capital expenditure forecast error for firm i that occurs during forecast change t;
DITC	= dummy variable equal to 1 for forecast change 0 (equal to 0 otherwise);
CRED	= dummy variable equal to 1 for forecast change +1 (equal to 0 otherwise);
ε_{it}	= error term for firm i; and
i	= 1,....N; firm index (number of firms varies by industry).

The variables $\Delta STINV_{it}$, $\Delta STSAL_{it}$, $CASH_{it}$, and CAP_{it} are divided by short-term forecasted sales.

[b] White (1980) adjusted t-statistics are reported in parentheses. Probability values are based on two-tailed tests for the intercept and one-tailed tests for the other coefficients. Statistically significant t-statistics are denoted by * if significant at the 0.10 level, ** if significant at the 0.05 level, and *** if significant at the 0.01 level.

[c] Coefficient is not of the predicted sign and is not significant at the 10% level using a two-tailed test.

[d] Coefficient is not of the predicted sign and is significant at the 10% level using a two-tailed test.

Table 7.6: Panel A
The 1975 Act
Estimated Parameter Values for the Intercept
for Each Forecast Change Period

$$\Delta STINV_{it} = \beta_0 + \beta_1 \Delta STSAL_{it} + \beta_2 \Delta INT_{it} + \beta_3 \Delta STROE_{it} + \beta_4 CASH_{it} + \beta_5 CAP_{it}$$

$$+ \beta_6 DITC + \beta_7 CRED + \beta_8 \Delta STSAL_{it} {*} DITC + \beta_9 \Delta STSAL_{it} {*} CRED + \varepsilon_{it}$$

	Forecast Change -1 β_0	Forecast Change 0 $\beta_0 + \beta_6$	Forecast Change +1 $\beta_0 + \beta_7$
Full Sample (n=801)	0.025	0.010c	0.037
All firms but electric utilities (n=504)	0.013	0.005c	0.004c
Building (n=168)	-0.003	-0.007c	0.008
Chemical (n=114)	0.022	0.010c	0.006c
Electric Utility (n=297)	0.132	0.068c	0.026c
Machinery (n=132)	0.003	-0.009c	-0.001c
Metals & Mining (n=90)	0.010	0.049	0.014

[c] Coefficient is not of the predicted sign and is <u>not</u> significant at the 10% level using a two-tailed test.

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Table 7.6: Panel B
The 1975 Act
Estimated Parameter Values for *ΔSTSAL*
for Each Forecast Change Period

$$\Delta STINV_{it} = \beta_0 + \beta_1 \Delta STSAL_{it} + \beta_2 \Delta INT_{it} + \beta_3 \Delta STROE_{it} + \beta_4 CASH_{it} + \beta_5 CAP_{it}$$
$$+ \beta_6 DITC + \beta_7 CRED + \beta_8 \Delta STSAL_{it}{*}DITC + \beta_9 \Delta STSAL_{it}{*}CRED + \varepsilon_{it}$$

	Forecast Change -1 β_1	Forecast Change 0 $\beta_1 + \beta_8$	Forecast Change +1 $\beta_1 + \beta_9$
Full Sample (n=801)	-0.035	-0.071c	0.022*
All firms but electric utilities (n=504)	0.015	0.030	-0.003c
Building (n=168)	0.024	-0.002c	-0.012c
Chemical (n=114)	0.015	0.032	0.023
Electric Utility (n=297)	-0.089	-0.081	0.263**
Machinery (n=132)	0.047	0.073	0.025c
Metals & Mining (n=90)	-0.025	0.008	-0.164d

Note: Statistically significant t-statistics associated with the coefficient estimates are denoted by * if significant at the 0.10 level, ** if significant at the 0.05 level, and *** if significant at the 0.01 level.

[c] Coefficient is not of the predicted sign and is not significant at the 10% level using a two-tailed test.

[d] Coefficient is not of the predicted sign and is significant at the 10% level using a two-tailed test.

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Table 7.7
The 1978 Tax Act
Regression Results for the Full Sample and for Each Industry for Changes in Long-term Capital Investment Forecasts

$$\Delta LTINV_{it} = \gamma_0 + \gamma_1 \Delta LTSAL_{it} + \gamma_2 \Delta INT_{it} + \gamma_3 \Delta LTROE_{it} + \gamma_4 CASH_{it} + \gamma_5 CAP_{it} + \gamma_6 DITC + \gamma_7 CRED$$
$$+ \gamma_8 \Delta LTSAL_{it}{*}DITC + \gamma_9 \Delta LTSAL_{it}{*}CRED + \varepsilon_{it}$$

Industry	γ_0	γ_1 (+)	γ_2 (-)	γ_3 (-)	γ_4 (+)	γ_5 (+)	γ_6 (+)	γ_7 (+)	γ_8 (+)	γ_9 (+)	Adj. R^2 (F. sig. level)
Full Sample	0.025	0.020	0.023c	-0.002	0.288	0.110	-0.044c	-0.107c	0.028	0.017	.026
N=765	(1.88)[b]*	(0.79)		(-1.27)	(1.82)**	(0.76)			(0.83)	(0.57)	(<.001)
All firms but electric utilities	0.021	-0.007c	0.023d	-0.004	0.252	0.103	-0.042d	-0.106d	0.014	0.120	.263
N=474	(2.86)***			(-3.17)***	(1.77)**	(1.56)*			(0.83)	(1.30)*	(<.001)
Building	0.008	0.011	0.005c	-0.002	0.085	-0.028c	-0.003c	-0.027c	-0.009c	0.008	.101
N=150	(1.28)	(0.97)		(-2.20)**	(0.55)					(0.60)	(.004)
Chemical	0.013	-0.002c	0.021d	0.000	0.055	0.438	-0.021c	-0.101c	0.043	0.054	.417
N=102	(1.28)				(0.17)	(1.85)**			(1.37)*	(2.48)***	(<.001)

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Table 7.7 (continued)
The 1978 Tax Act
Regression Results for the Full Sample and for Each Industry for Changes in Long-term Capital Investment Forecasts

$$\Delta LTINV_{it} = \gamma_0 + \gamma_1 \Delta LTSAL_{it} + \gamma_2 \Delta INT_{it} + \gamma_3 \Delta LTROE_{it} + \gamma_4 CASH_{it} + \gamma_5 CAP_{it} + \gamma_6 DITC + \gamma_7 CRED$$
$$+ \gamma_8 \Delta LTSAL_{it}{*}DITC + \gamma_9 \Delta LTSAL_{it}{*}CRED + \varepsilon_{it}$$

Industry	γ_0	γ_1 (+)	γ_2 (-)	γ_3 (-)	γ_4 (+)	γ_5 (+)	γ_6 (+)	γ_7 (+)	γ_8 (+)	γ_9 (+)	Adj. R^2 (F. sig. level)
Electric Utility	0.136	0.037	0.179c	-0.004	1.08	0.231	-0.356c	-0.806c	0.141	0.102	.018
N=291	(1.38)	(0.41)		(-0.50)	(1.98)**	(0.88)			(1.13)	(0.91)	(.119)
Machinery	0.008	-0.001c	0.010c	-0.005	-0.339c	0.030	-0.016c	-0.057c	-0.015c	0.091	.100
N=150	(0.76)			(-2.59)***		(0.43)				(1.28)	(.004)
Metals & Mining	0.083	-0.008c	0.096d	-0.007	0.394	0.051	-0.221d	-0.430d	0.047	-0.022c	.472
N=72	(3.00)***			(-3.01)***	(3.41)***	(0.55)			(1.23)		(<.001)

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Table 7.7 (continued)
The 1978 Tax Act
Regression Results for the Full Sample and for Each Industry for Changes in Long-term Capital Investment Forecasts

$\Delta LTINV_{it}$	= change in the long-term capital investment forecast for firm i for forecast change t;
$\Delta LTSAL_{it}$	= change in the long-term sales forecast for firm i for forecast change t;
ΔINT_{it}	= change in the real interest rate for firm i for forecast change t;
$\Delta LTROE_{it}$	= change in the long-term return on equity forecast for firm i for forecast change t;
$CASH_{it}$	= unexpected cash earnings for firm i that occur during forecast change t;
CAP_{it}	= capital expenditure forecast error for firm i that occurs during forecast change t;
$DITC$	= dummy variable equal to 1 for forecast change 0 (equal to 0 otherwise);
$CRED$	= dummy variable equal to 1 for forecast change +1 (equal to 0 otherwise);
ε_{it}	= error term for firm i; and
i	= 1,...,N; firm index (number of firms varies by industry).

The variables $\Delta LTINV_{it}$, $\Delta LTSAL_{it}$, $CASH_{it}$, and CAP_{it} are divided by long-term forecasted sales.

[b] White (1980) adjusted t-statistics are reported in parentheses. Probability values are based on two-tailed tests for the intercept and one-tailed tests for the other coefficients. Statistically significant t-statistics are denoted by * if significant at the 0.10 level, ** if significant at the 0.05 level, and *** if significant at the 0.01 level.

[c] Coefficient is not of the predicted sign and is <u>not</u> significant at the 10% level using a two-tailed test.

[d] Coefficient is not of the predicted sign and <u>is</u> significant at the 10% level using a two-tailed test.

Table 7.8: Panel A
The 1978 Act
Estimated Parameter Values for the Intercept
for Each Forecast Change Period

$$\Delta LTINV_{it} = \gamma_0 + \gamma_1 \Delta LTSAL_{it} + \gamma_2 \Delta INT_{it} + \gamma_3 \Delta LTROE_{it} + \gamma_4 CASH_{it} + \gamma_5 CAP_{it}$$
$$+ \gamma_6 DITC + \gamma_7 CRED + \gamma_8 \Delta LTSAL_{it} {*} DITC + \gamma_9 \Delta LTSAL_{it} {*} CRED + \varepsilon_{it}$$

	Forecast Change -1 γ_0	Forecast Change 0 $\gamma_0 + \gamma_6$	Forecast Change +1 $\gamma_0 + \gamma_7$
Full Sample (n=765)	0.025	-0.019c	-0.082c
All firms but electric utilities (n=474)	0.021	-0.021d	-0.085d
Building (n=150)	0.008	0.005c	-0.019c
Chemical (n=102)	0.013	-0.008c	-0.088c
Electric Utility (n=291)	0.136	-0.220c	-0.670c
Machinery (n=150)	0.008	-0.008c	-0.049c
Metals & Mining (n=72)	0.083	-0.138d	-0.347d

[c] Coefficient is not of the predicted sign and is not significant at the 10% level using a two-tailed test.
[d] Coefficient is not of the predicted sign and is significant at the 10% level using a two-tailed test.

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Table 7.8: Panel B
The 1978 Act
Estimated Parameter Values for *ΔLTSAL*
for Each Forecast Change Period

$$\Delta LTINV_{it} = \gamma_0 + \gamma_1 \Delta LTSAL_{it} + \gamma_2 \Delta INT_{it} + \gamma_3 \Delta LTROE_{it} + \gamma_4 CASH_{it} + \gamma_5 CAP_{it}$$
$$+ \gamma_6 DITC + \gamma_7 CRED + \gamma_8 \Delta LTSAL_{it} {*} DITC + \gamma_9 \Delta LTSAL_{it} {*} CRED + \varepsilon_{it}$$

	Forecast Change -1 γ_1	Forecast Change 0 $\gamma_1 + \gamma_8$	Forecast Change +1 $\gamma_1 + \gamma_9$
Full Sample (n=765)	0.020	0.048	0.037
All firms but electric utilities (n=474)	-0.007	0.007	0.113*
Building (n=150)	0.011	0.002c	0.019
Chemical (n=102)	-0.002	0.041*	0.052***
Electric Utility (n=291)	0.037	0.178	0.139
Machinery (n=150)	-0.001	-0.016c	-0.090
Metals & Mining (n=72)	-0.008	0.039	-0.030c

Note: Statistically significant t-statistics associated with the coefficient estimates are denoted by * if significant at the 0.10 level, ** if significant at the 0.05 level, and *** if significant at the 0.01 level.
[c] Coefficient is not of the predicted sign and is <u>not</u> significant at the 10% level using a two-tailed test.

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Table 7.9
The 1971 Tax Act
Regression Results for the Full Sample and for Each Industry for Changes in Short-term Capital Investment Forecasts

$$\Delta STINV_{it} = \gamma_0 + \gamma_1 USAL_{it} + \gamma_2 \Delta INT_{it} + \gamma_3 \Delta STROE_{it} + \gamma_4 CASH_{it} + \gamma_5 CAP_{it} + \gamma_6 DITC + \gamma_7 CRED$$
$$+ \gamma_8 USAL_{it}{*}DITC + \gamma_9 USAL_{it}{*}CRED + \varepsilon_{it}$$

Industry	β_0	β_1 (+)	β_2 (-)	β_3 (-)	β_4 (+)	β_5 (+)	β_6 (+)	β_7 (+)	β_8 (+)	β_9 (+)	Adj. R^2 (F. sig. level)
Full Sample	0.025	0.069	0.004c	-0.002	0.047	0.526	0.014	0.016	-0.101c	-0.011c	.095
N=1,048	(2.53)[b]**	(0.83)		(-1.97)**	(1.08)	(4.38)***	(1.53)*	(1.18)			(<.001)
All firms but electric utilities	-0.005	0.032	-0.005	0.000	0.157	0.445	0.013	0.021	-0.081c	0.028	.178
N=676	(-0.77)	(0.48)	(-0.70)		(1.75)**	(6.68)***	(2.48)***	(2.60)***		(0.37)	(<.001)
Building	-0.008	-0.040c	-0.009	0.000	1.12	0.651	0.018	0.026	0.035	-0.013c	.245
N=204	(-0.83)		(-0.66)		(2.51)***	(4.55)***	(2.33)***	(1.77)**	(0.36)		(<.001)
Chemical	0.003	-0.039c	0.003c	0.002c	0.041	0.471	-0.002c	0.008	-0.003c	0.197	.366
N=160	(0.35)				(0.54)	(3.89)***		(0.95)		(1.78)**	(<.001)

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Table 7.9 (continued)
The 1971 Tax Act
Regression Results for the Full Sample and for Each Industry for Changes in Short-term Capital Investment Forecasts

$$\Delta STINV_{it} = \gamma_0 + \gamma_1 USAL_{it} + \gamma_2 \Delta INT_{it} + \gamma_3 \Delta STROE_{it} + \gamma_4 CASH_{it} + \gamma_5 CAP_{it} + \gamma_6 DITC + \gamma_7 CRED + \gamma_8 USAL_{it}{*}DITC + \gamma_9 USAL_{it}{*}CRED + \varepsilon_{it}$$

Industry	β_0	β_1 (+)	β_2 (-)	β_3 (-)	β_4 (+)	β_5 (+)	β_6 (+)	β_7 (+)	β_8 (+)	β_9 (+)	Adj. R^2 (F. sig. level)
Electric Utility	0.077	-1.42d	0.015c	0.007c	-0.077d	0.614	0.014	0.006	1.290	1.830	.103
N=372	(2.94)***					(3.85)***	(0.59)	(0.15)	(1.49)*	(2.04)**	(<.001)
Machinery	0.001	-0.087c	0.007c	-0.001	0.303	0.507	0.013	0.020	0.093	0.087	.164
N=196	(0.06)			(-0.63)	(2.25)**	(2.99)***	(1.80)**	(1.66)**	(1.29)*	(0.83)	(<.001)
Metals & Mining	-0.012	0.198	-0.033	0.000	0.070	0.379	0.014	0.020	-0.311c	-0.101c	.172
N=116	(-0.54)	(0.69)	(-1.19)		(0.74)	(3.90)***	(0.59)	(0.76)			(<.001)

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Table 7.9 (continued)
The 1971 Tax Act
Regression Results for the Full Sample and for Each Industry for Changes in Short-term Capital Investment Forecasts

$\Delta STINV_{it}$	=	change in the short-term capital investment forecast for firm i for forecast change t;
$USAL_{it}$	=	unexpected sales for firm i that occur during forecast change t;
ΔINT_{it}	=	change in the real interest rate for firm i for forecast change t;
$\Delta STROE_{it}$	=	change in the short-term return on equity forecast for firm i for forecast change t;
$CASH_{it}$	=	unexpected cash earnings for firm i that occur during forecast change t;
CAP_{it}	=	capital expenditure forecast error for firm i that occurs during forecast change t;
DITC	=	dummy variable equal to 1 for forecast change 0 (equal to 0 otherwise);
CRED	=	dummy variable equal to 1 for forecast changes +1 and +2 (equal to 0 otherwise);
ε_{it}	=	error term for firm i; and
i	=	1,...,N; firm index (number of firms varies by industry).

The variables $\Delta STINV_{it}$, $USAL_{it}$, $CASH_{it}$, and CAP_{it} are divided by short-term forecasted sales.
[b] White (1980) adjusted t-statistics are reported in parentheses. Probability values are based on two-tailed tests for the intercept and one-tailed tests for the other coefficients. Statistically significant t-statistics are denoted by * if significant at the 0.10 level, ** if significant at the 0.05 level, and *** if significant at the 0.01 level.
[c] Coefficient is not of the predicted sign and is not significant at the 10% level using a two-tailed test.
[d] *Coefficient is not of the predicted sign and is significant at the 10% level using a two-tailed test.*

Table 7.10
The 1971 Tax Act
Regression Results for the Full Sample and for Each Industry for Changes in Long-term Capital Investment Forecasts

$$\Delta LTINV_{it} = \gamma_0 + \gamma_1 USAL_{it} + \gamma_2 \Delta INT_{it} + \gamma_3 \Delta LTROE_{it} + \gamma_4 CASH_{it} + \gamma_5 CAP_{it} + \gamma_6 DITC + \gamma_7 CRED$$
$$+ \gamma_8 USAL_{it}{*}DITC + \gamma_9 USAL_{it}{*}CRED + \varepsilon_{it}$$

Industry	γ_0	γ_1 (+)	γ_2 (-)	γ_3 (-)	γ_4 (+)	γ_5 (+)	γ_6 (+)	γ_7 (+)	γ_8 (+)	γ_9 (+)	Adj. R^2 (F. sig. level)
Full Sample	0.013	0.179	0.009c	-0.004	0.047	-0.058c	0.019	0.028	-0.179d	-0.262d	.020
N=1,048	(1.46)[b]	(2.16)**		(-2.10)**	(0.82)		(2.78)***	(2.04)**			(<.001)
All firms but electric utilities	-0.001	0.098	-0.003	0.000	0.096	0.134	0.002	0.007	-0.100c	-0.053c	.067
N=676	(-0.37)	(1.53)*	(-0.88)		(1.37)*	(1.50)*	(0.76)	(1.60)*			(<.001)
Building	0.006	0.159	0.003c	-0.003	0.303	-0.087c	0.002	0.002	-0.250d	-0.205d	.141
N=204	(1.66)*	(1.55)*		(-2.17)**	(2.63)**		(0.58)	(0.31)			(<.001)
Chemical	0.003	-0.016c	0.001c	0.001c	0.158	0.188	0.002	-0.001c	0.035	0.061	.086
N=160	(0.50)				(1.19)	(2.16)**	(0.37)		(0.25)	(0.47)	(.006)

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Table 7.10 (continued)
The 1971 Tax Act
Regression Results for the Full Sample and for Each Industry for Changes in Long-term Capital Investment Forecasts

$$\Delta LTINV_{it} = \gamma_0 + \gamma_1 USAL_{it} + \gamma_2 \Delta INT_{it} + \gamma_3 \Delta LTROE_{it} + \gamma_4 CASH_{it} + \gamma_5 CAP_{it} + \gamma_6 DITC + \gamma_7 CRED + \gamma_8 USAL_{it}{*}DITC + \gamma_9 USAL_{it}{*}CRED + \varepsilon_{it}$$

Industry	γ_0	γ_1 (+)	γ_2 (-)	γ_3 (-)	γ_4 (+)	γ_5 (+)	γ_6 (+)	γ_7 (+)	γ_8 (+)	γ_9 (+)	Adj. R^2 (F. sig. level)
Electric Utility	0.013	0.549	-0.003	-0.023	-0.007c	-0.091c	0.063	0.093	-0.709c	-.954c	.064
N=372	(0.47)	(0.93)	(-0.08)	(-2.06)**			(3.19)***	(2.14)**			(<.001)
Machinery	-0.003	0.030	-0.004	-0.001	0.085	0.070	0.003	0.007	-0.052c	0.014	.000
N=196	(-1.03)	(1.14)	(-0.91)	(-1.20)	(0.78)	(0.26)	(0.69)	(1.35)*		(0.34)	(.652)
Metals & Mining	-0.018	0.024	-0.025	0.000	0.009	0.161	0.007	0.031	-0.009c	0.099	0.078
N=116	(-1.51)	(0.25)	(-1.49)*	(-0.29)	(0.11)	(1.60)*	(0.91)	(1.66)**		(0.79)	(.037)

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Table 7.10 (continued)
The 1971 Tax Act
Regression Results for the Full Sample and for Each Industry for Changes in Long-term Capital Investment Forecasts

$\Delta LTINV_{it}$	= change in the long-term capital investment forecast for firm i for forecast change t;
$USAL_{it}$	= unexpected sales for firm i that occur during forecast change t;
ΔINT_{it}	= change in the real interest rate for firm i for forecast change t;
$\Delta LTROE_{it}$	= change in the long-term return on equity forecast for firm i for forecast change t;
$CASH_{it}$	= unexpected cash earnings for firm i that occur during forecast change t;
CAP_{it}	= capital expenditure forecast error for firm i that occurs during forecast change t;
$DITC$	= dummy variable equal to 1 for forecast change 0 (equal to 0 otherwise);
$CRED$	= dummy variable equal to 1 for forecast changes +1 and +2 (equal to 0 otherwise);
ε_{it}	= error term for firm i; and
i	= 1,...,N; firm index (number of firms varies by industry).

The variables $\Delta LTINV_{it}$, $USAL_{it}$, $CASH_{it}$, and CAP_{it} are divided by long-term forecasted sales.

[b] White (1980) adjusted t-statistics are reported in parentheses. Probability values are based on two-tailed tests for the intercept and one-tailed tests for the other coefficients. Statistically significant t-statistics are denoted by * if significant at the 0.10 level, ** if significant at the 0.05 level, and *** if significant at the 0.01 level.

[c] Coefficient is not of the predicted sign and is not significant at the 10% level using a two-tailed test.

[d] Coefficient is not of the predicted sign and is significant at the 10% level using a two-tailed test.

Table 7.11
The 1975 Tax Act
Regression Results for the Full Sample and for Each Industry for Changes in Short-term Capital Investment Forecasts

$$\Delta STINV_{it} = \gamma_0 + \gamma_1 USAL_{it} + \gamma_2 \Delta INT_{it} + \gamma_3 \Delta STROE_{it} + \gamma_4 CASH_{it} + \gamma_5 CAP_{it} + \gamma_6 DITC + \gamma_7 CRED$$
$$+ \gamma_8 USAL_{it}*DITC + \gamma_9 USAL_{it}*CRED + \varepsilon_{it}$$

Industry	β_0	β_1 (+)	β_2 (-)	β_3 (-)	β_4 (+)	β_5 (+)	β_6 (+)	β_7 (+)	β_8 (+)	β_9 (+)	Adj. R^2 (F. sig. level)
Full Sample	0.020	-0.094c	0.014c	-0.001	1.118	0.544	-0.017c	0.020	-0.008c	0.062	.735
N=801	(1.50)b			(-1.50)	(4.03)***	(6.26)***		(1.01)		(0.77)	(<.001)
All firms but electric utilities	0.015	0.016	-0.005	0.000	0.382	0.451	-0.008c	-0.013c	0.020	-0.092d	.628
N=504	(1.45)	(0.38)	(-0.48)		(2.00)**	(5.13)***			(0.40)		(<.001)
Building	-0.002	0.083	0.004c	0.000	0.440	0.677	-0.007c	0.009	-0.047c	-0.169c	.274
N=168	(-0.10)	(0.83)			(2.04)**	(4.19)***		(0.40)			(<.001)
Chemical	0.027	-0.041c	-0.009	0.000	0.390	0.479	-0.010c	-0.018c	-0.013c	0.063	.174
N=114	(2.19)**		(-0.72)		(2.12)**	(4.40)***				(0.87)	(<.001)

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Table 7.11 (continued)
The 1975 Tax Act
Regression Results for the Full Sample and for Each Industry for Changes in Short-term Capital Investment Forecasts

$$\Delta STINV_{it} = \gamma_0 + \gamma_1 USAL_{it} + \gamma_2 \Delta INT_{it} + \gamma_3 \Delta STROE_{it} + \gamma_4 CASH_{it} + \gamma_5 CAP_{it} + \gamma_6 DITC + \gamma_7 CRED$$
$$+ \gamma_8 USAL_{it}{*}DITC + \gamma_9 USAL_{it}{*}CRED + \varepsilon_{it}$$

Industry	β_0	β_1 (+)	β_2 (-)	β_3 (-)	β_4 (+)	β_5 (+)	β_6 (+)	β_7 (+)	β_8 (+)	β_9 (+)	Adj. R^2 (F. sig. level)
Electric Utility	0.102	0.037	-0.050	-0.005	1.315	0.491	-0.043c	-0.030c	-0.574c	0.431	.766
N=297	(1.64)*	(0.07)	(-0.73)	(-0.81)	(2.41)***	(2.91)***				(0.71)	(<.001)
Machinery	0.013	0.009	-0.002	0.001c	-0.258c	0.278	-0.014d	-0.013c	0.086	-0.010c	.079
N=132	(1.78)*	(0.09)	(-0.21)			(1.50)*			(0.67)		(.024)
Metals & Mining	0.014	-0.013c	-0.006	0.001c	0.392	0.403	0.028	-0.025c	0.051	-0.139d	.696
N=90	(0.32)		(-0.14)		(1.75)**	(3.80)***	(0.80)		(1.17)		(<.001)

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Table 7.11 (continued)
The 1975 Tax Act
Regression Results for the Full Sample and for Each Industry for Changes in Short-term Capital Investment Forecasts

$\Delta STINV_{it}$	= change in the short-term capital investment forecast for firm i for forecast change t;
$USAL_{it}$	= unexpected sales for firm i that occur during forecast change t;
ΔINT_{it}	= change in the real interest rate for firm i for forecast change t;
$\Delta STROE_{it}$	= change in the short-term return on equity forecast for firm i for forecast change t;
$CASH_{it}$	= unexpected cash earnings for firm i that occur during forecast change t;
CAP_{it}	= capital expenditure forecast error for firm i that occurs during forecast change t;
DITC	= dummy variable equal to 1 for forecast change 0 (equal to 0 otherwise);
CRED	= dummy variable equal to 1 for forecast change +1 (equal to 0 otherwise);
ε_{it}	= error term for firm i; and
i	= 1,...,N; firm index (number of firms varies by industry).

The variables $\Delta STINV_{it}$, $USAL_{it}$, $CASH_{it}$, and CAP_{it} are divided by short-term forecasted sales.

[b] White (1980) adjusted t-statistics are reported in parentheses. Probability values are based on two-tailed tests for the intercept and one-tailed tests for the other coefficients. Statistically significant t-statistics are denoted by * if significant at the 0.10 level, ** if significant at the 0.05 level, and *** if significant at the 0.01 level.

[c] Coefficient is not of the predicted sign and is not significant at the 10% level using a two-tailed test.

[d] Coefficient is not of the predicted sign and is significant at the 10% level using a two-tailed test.

Table 7.12
The 1978 Tax Act
Regression Results for the Full Sample and for Each Industry for Changes
in Long-term Capital Investment Forecasts

$$\Delta LTINV_{it} = \gamma_0 + \gamma_1 USAL_{it} + \gamma_2 \Delta INT_{it} + \gamma_3 \Delta LTROE_{it} + \gamma_4 CASH_{it} + \gamma_5 CAP_{it} + \gamma_6 DITC + \gamma_7 CRED + \gamma_8 USAL_{it}{*}DITC + \gamma_9 USAL_{it}{*}CRED + \varepsilon_{it}$$

Industry	γ_0	γ_1 (+)	γ_2 (-)	γ_3 (-)	γ_4 (+)	γ_5 (+)	γ_6 (+)	γ_7 (+)	γ_8 (+)	γ_9 (+)	Adj. R^2 (F. sig. level)
Full Sample	0.024	0.049	0.016c	-0.003	0.485	0.144	-0.027c	-0.073c	-0.053c	-0.143c	.022
N=765	(1.84)[b]*	(0.30)		(-2.70)***	(3.04)***	(0.98)					(.002)
All firms but electric utilities	0.018	0.021	0.019d	-0.004	0.342	0.127	-0.031d	-0.084d	-0.023c	-0.069c	.266
N=474	(2.96)***	(0.34)		(-4.60)***	(2.25)**	(1.88)**					(<.001)
Building	0.007	0.010	0.003c	-0.003	0.127	-0.065c	0.001	-0.013c	-0.011c	0.026	.080
N=150	(1.17)	(0.24)		(-3.22)***	(0.78)		(0.04)			(0.46)	(.013)
Chemical	0.014	0.108	0.022c	0.001c	-0.057c	0.379	-0.018c	-0.095c	-0.330c	-0.047c	.379
N=102	(1.27)	(0.98)				(1.60)*					(<.001)

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Table 7.12 (continued)
The 1978 Tax Act
Regression Results for the Full Sample and for Each Industry for Changes in Long-term Capital Investment Forecasts

$$\Delta LTINV_{it} = \gamma_0 + \gamma_1 USAL_{it} + \gamma_2 \Delta INT_{it} + \gamma_3 \Delta LTROE_{it} + \gamma_4 CASH_{it} + \gamma_5 CAP_{it} + \gamma_6 DITC + \gamma_7 CRED$$
$$+ \gamma_8 USAL_{it}{*}DITC + \gamma_9 USAL_{it}{*}CRED + \varepsilon_{it}$$

Industry	γ_0	γ_1 (+)	γ_2 (-)	γ_3 (-)	γ_4 (+)	γ_5 (+)	γ_6 (+)	γ_7 (+)	γ_8 (+)	γ_9 (+)	Adj. R^2 (F. sig. level)
Electric Utility	0.165	0.080	0.209c	-0.004	1.310	0.310	-0.398c	-0.916c	-0.245c	-0.448c	.002
N=291	(1.62)	(0.11)		(-0.46)	(2.41)***	(1.13)					(.396)
Machinery	0.006	-0.084c	0.009c	-0.006	-0.221c	0.087	-0.016c	-0.039c	-0.157c	0.130	.066
N=150	(0.69)			(-2.77)***		(1.08)				(1.56)*	(.028)
Metals & Mining	0.071	0.042	0.079d	-0.005	0.413	0.078	-0.174d	-0.355d	0.188	-0.129c	.485
N=72	(2.98)***	(0.39)		(-3.72)***	(2.51)***	(1.00)			(1.05)		(<.001)

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Table 7.12 (continued)
The 1978 Tax Act
Regression Results for the Full Sample and for Each Industry for Changes in Long-term Capital Investment Forecasts

$\Delta LTINV_{it}$	=	change in the long-term capital investment forecast for firm i for forecast change t;
$USAL_{it}$	=	unexpected sales for firm i that occur during forecast change t;
ΔINT_{it}	=	change in the real interest rate for firm i for forecast change t;
$\Delta LTROE_{it}$	=	change in the long-term return on equity forecast for firm i for forecast change t;
$CASH_{it}$	=	unexpected cash earnings for firm i that occur during forecast change t;
CAP_{it}	=	capital expenditure forecast error for firm i that occurs during forecast change t;
DITC	=	dummy variable equal to 1 for forecast change 0 (equal to 0 otherwise);
CRED	=	dummy variable equal to 1 for forecast change +1 (equal to 0 otherwise);
ε_{it}	=	error term for firm i; and
i	=	1,...,N; firm index (number of firms varies by industry).

The variables $\Delta LTINV_{it}$, $USAL_{it}$, $CASH_{it}$, and CAP_{it} are divided by long-term forecasted sales.

[b] White (1980) adjusted t-statistics are reported in parentheses. Probability values are based on two-tailed tests for the intercept and one-tailed tests for the other coefficients. Statistically significant t-statistics are denoted by * if significant at the 0.10 level, ** if significant at the 0.05 level, and *** if significant at the 0.01 level.

[c] Coefficient is not of the predicted sign and is not significant at the 10% level using a two-tailed test.

[d] Coefficient is not of the predicted sign and is significant at the 10% level using a two-tailed test.

Table 7.13
The 1971 Act ($\Delta STINV$)
Hypothesis Two: Effect of Debt Constraints on ITC Incentive Effects:
Estimated Parameter Values for the Intercept for Each Forecast Change Period [a]

$$\Delta STINV_{it} = \beta_0 + \beta_1 \Delta STSAL_{it} + \beta_2 \Delta INT_{it} + \beta_3 \Delta STROE_{it} + \beta_4 CASH_{it} + \beta_5 CAP_{it}$$
$$+ \beta_6 DITC + \beta_7 CRED + \beta_8 \Delta STSAL_{it} {*} DITC + \beta_9 \Delta STSAL_{it} {*} CRED$$
$$+ \beta_{10} D + \beta_{11} DITC {*} D + \beta_{12} CRED {*} D + \varepsilon_{it}$$

	High-Debt Firms D = 0 Firms			Low-Debt Firms D = 1 Firms			
	β_0	$\beta_0+\beta_6$	$\beta_0+\beta_7$	$\beta_0+\beta_{10}$	$(\beta_0+\beta_{10})+\beta_6+\beta_{11}$	$(\beta_0+\beta_{10})+\beta_7+\beta_{12}$	Adj R^2 (F. sig. level)
Building (n=204)	-0.015	0.009***	0.017**	-0.006	0.014***	0.021**	.234 (<.001)
Chemical (n=160)	-0.009	0.002	0.008*	-0.008	0.013*	0.001	.371 (<.001)
Electric Utility (n=372)	0.016	0.075*	0.096*	0.052	0.020c	0.074	.097 (<.001)
Machinery (n=196)	-0.014	0.006**	0.017**	-0.005	0.003	0.005	.186 (<.001)
Metals & Mining (n=116)	-0.027	-0.023	0.015**	0.010	0.119***	-0.052c	.351 (<.001)

Note: Statistically significant t-statistics are denoted by * if significant at the 0.10 level, ** if significant at the 0.05 level, and *** if significant at the 0.01 level.
[a] The first, second, and third columns under D=0 and D=1 represent the intercept values for forecast changes -1, 0, and +1/+2, respectively.
[c] Parameter estimate is not in the predicted direction and is not significant at the 10% level using a two-tailed test.

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Table 7.14
The 1971 Act ($\Delta LTINV$)
Hypothesis Two: Effect of Debt Constraints on ITC Incentive Effects:
Estimated Parameter Values for the Intercept for Each Forecast Change Period [a]

$$\Delta LTINV_{it} = \gamma_0 + \gamma_1 \Delta LTSAL_{it} + \gamma_2 \Delta INT_{it} + \gamma_3 \Delta LTROE_{it} + \gamma_4 CASH_{it} + \gamma_5 CAP_{it}$$
$$+ \gamma_6 DITC + \gamma_7 CRED + \gamma_8 \Delta LTSAL_{it}{*}DITC + \gamma_9 \Delta LTSAL_{it}{*}CRED$$
$$+ \gamma_{10} D + \gamma_{11} DITC{*}D + \gamma_{12} CRED{*}D + \varepsilon_{it}$$

	High-Debt Firms D = 0 Firms			Low-Debt Firms D = 1 Firms			
	γ_0	$\gamma_0+\gamma_6$	$\gamma_0+\gamma_7$	$\gamma_0+\gamma_{10}$	$(\gamma_0+\gamma_{10})$ $+\gamma_6+\gamma_{11}$	$(\gamma_0+\gamma_{10})$ $+\gamma_7+\gamma_{12}$	Adj R^2 (F. sig. level)
Building (n=204)	0.005	0.007	0.000c	0.006	0.009	0.004c	.167 (<.001)
Chemical (n=160)	0.004	0.001c	-0.004c	0.002	-0.001c	0.002	.144 (<.001)
Electric Utility (n=372)	-0.011	0.023*	0.011	-0.007	0.004*	0.103***	.187 (<.001)
Machinery (n=196)	-0.006	-0.011c	-0.001	-0.006	-0.003	-0.006	.050 (.041)
Metals & Mining (n=116)	-0.013	-0.012	0.005	-0.020	-0.003*	0.007**	.079 (.055)

Note: Statistically significant t-statistics are denoted by * if significant at the 0.10 level, ** if significant at the 0.05 level, and *** if significant at the 0.01 level.
[a] The first, second, and third columns under D=0 and D=1 represent the intercept values for forecast changes -1, 0, and +1/+2, respectively.
[c] Parameter estimate is not in the predicted direction and is not significant at the 10% level using a two-tailed test.

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Table 7.15
The 1975 Act
Hypothesis Two: Effect of Debt Constraints on ITC Incentive Effects:
Estimated Parameter Values for the Intercept for Each Forecast Change Period[a]

$$\Delta STINV_{it} = \beta_0 + \beta_1 \Delta STSAL_{it} + \beta_2 \Delta INT_{it} + \beta_3 \Delta STROE_{it} + \beta_4 CASH_{it} + \beta_5 CAP_{it}$$
$$+ \beta_6 DITC + \beta_7 CRED + \beta_8 \Delta STSAL_{it}{*}DITC + \beta_9 \Delta STSAL_{it}{*}CRED$$
$$+ \beta_{10} D + \beta_{11} DITC{*}D + \beta_{12} CRED{*}D + \varepsilon_{it}$$

	High-Debt Firms D = 0 Firms			Low-Debt Firms D = 1 Firms			
	β_0	$\beta_0+\beta_6$	$\beta_0+\beta_7$	$\beta_0+\beta_{10}$	$(\beta_0+\beta_{10})$ $+\beta_6+\beta_{11}$	$(\beta_0+\beta_{10})$ $+\beta_7+\beta_{12}$	Adj R^2 (F. sig. level)
Building (n=168)	-0.002	-0.010c	0.009	-0.011	-0.001	0.009	.249 (<.001)
Chemical (n=114)	0.031	0.014c	0.008c	0.011	-0.014c	-0.001c	.239 (<.001)
Electric Utility (n=297)	0.131	0.066d	0.031d	0.127	0.068c	0.013c	.762 (<.001)
Machinery (n=132)	0.005	-0.006c	-0.001c	-0.009	-0.015c	-0.002	.190 (<.001)
Metals & Mining (n=90)	0.021	0.056	0.009c	-0.003	0.029	0.021	.701 (<.001)

Note: Statistically significant t-statistics are denoted by * if significant at the 0.10 level, ** if significant at the 0.05 level, and *** if significant at the 0.01 level.

[a] The first, second, and third columns under D=0 and D=1 represent the intercept values for forecast changes -1, 0, and +1 respectively.

[c] Parameter estimate is not in the predicted direction and is <u>not</u> significant at the 10% level using a two-tailed test.

[d] Parameter estimate is not in the predicted direction and <u>is</u> significant at the 10% level using a two-tailed test.

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Table 7.16
The 1978 Act
Hypothesis Two: Effect of Debt Constraints on ITC Incentive Effects:
Estimated Parameter Values for the Intercept for Each Forecast Change Period [a]

$$\Delta LTINV_{it} = \gamma_0 + \gamma_1 \Delta LTSAL_{it} + \gamma_2 \Delta INT_{it} + \gamma_3 \Delta LTROE_{it} + \gamma_4 CASH_{it} + \gamma_5 CAP_{it}$$
$$+ \gamma_6 DITC + \gamma_7 CRED + \gamma_8 \Delta LTSAL_{it}{*}DITC + \gamma_9 \Delta LTSAL_{it}{*}CRED$$
$$+ \gamma_{10} D + \gamma_{11} DITC{*}D + \gamma_{12} CRED{*}D + \varepsilon_{it}$$

	High-Debt Firms D = 0 Firms			Low-Debt Firms D = 1 Firms			
	γ_0	$\gamma_0+\gamma_6$	$\gamma_0+\gamma_7$	$\gamma_0+\gamma_{10}$	$(\gamma_0+\gamma_{10})+\gamma_6+\gamma_{11}$	$(\gamma_0+\gamma_{10})+\gamma_7+\gamma_{12}$	Adj R^2 (F. sig level)
Building (n=150)	0.005	0.011	0.002c	0.002	0.015**	0.004	.090 (.011)
Chemical (n=102)	-0.003	0.022***	-0.010c	0.004	0.027***	-0.005c	.402 (<.001)
Electric Utility (n=291)	0.028	0.006c	0.009c	-0.011	0.016	-0.036c	.021 (.111)
Machinery (n=150)	0.000	0.010	-0.011c	0.002	0.001c	-0.009c	.093 (.010)
Metals & Mining (n=72)	0.012	0.003c	0.014	0.017	0.000c	0.038	.374 (<.001)

Note: Statistically significant t-statistics are denoted by * if significant at the 0.10 level, ** if significant at the 0.05 level, and *** if significant at the 0.01 level.

[a] The first, second, and third columns under D=0 and D=1 represent the intercept values for forecast changes -1, 0, and +1 respectively.

[c] Parameter estimate is not in the predicted direction and is <u>not</u> significant at the 10% level using a two-tailed test.

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Table 7.17
The 1971 Act ($\Delta STINV$)
Hypothesis Three: Effect of Investment Opportunities on ITC Incentive Effects: Estimated Parameter Values for the Intercept for Each Forecast Change Period [a]

$$\Delta STINV_{it} = \beta_0 + \beta_1 \Delta STSAL_{it} + \beta_2 \Delta INT_{it} + \beta_3 \Delta STROE_{it} + \beta_4 CASH_{it} + \beta_5 CAP_{it}$$
$$+ \beta_6 DITC + \beta_7 CRED + \beta_8 \Delta STSAL_{it}{*}DITC + \beta_9 \Delta STSAL_{it}{*}CRED$$
$$+ \beta_{10} D + \beta_{11} DITC{*}D + \beta_{12} CRED{*}D + \varepsilon_{it}$$

	Low-PE Firms D = 0 Firms			High-PE Firms D = 1 Firms			
	β_0	$\beta_0+\beta_6$	$\beta_0+\beta_7$	$\beta_0+\beta_{10}$	$(\beta_0+\beta_{10})+\beta_6+\beta_{11}$	$(\beta_0+\beta_{10})+\beta_7+\beta_{12}$	Adj R^2 (F. sig. level)
Building (n=204)	-0.015	0.009**	0.018**	-0.004	0.014***	0.020***	.234 (<.001)
Chemical (n=160)	-0.010	0.004*	0.006*	-0.002	0.016***	0.008*	.370 (<.001)
Electric Utility (n=372)	0.022	0.046	0.080	0.022	0.099*	0.151***	.117 (<.001)
Machinery (n=196)	-0.009	0.005*	0.011*	-0.012	0.004	0.027**	.190 (<.001)
Metals & Mining (n=116)	-0.014	0.013*	0.003	-0.012	0.025*	0.001	.140 (<.001)

Note: Statistically significant t-statistics are denoted by * if significant at the 0.10 level, ** if significant at the 0.05 level, and *** if significant at the 0.01 level.
[a] The first, second, and third columns under D=0 and D=1 represent the intercept values for forecast changes -1, 0, and +1/+2, respectively.

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Table 7.18
The 1971 Act ($\Delta LTINV$)
Hypothesis Three: Effect of Investment Opportunities on ITC Incentive Effects: Estimated Parameter Values for the Intercept for Each Forecast Change Period [a]

$$\Delta LTINV_{it} = \gamma_0 + \gamma_1 \Delta LTSAL_{it} + \gamma_2 \Delta INT_{it} + \gamma_3 \Delta LTROE_{it} + \gamma_4 CASH_{it} + \gamma_5 CAP_{it}$$
$$+ \gamma_6 DITC + \gamma_7 CRED + \gamma_8 \Delta LTSAL_{it}{*}DITC + \gamma_9 \Delta LTSAL_{it}{*}CRED$$
$$+ \gamma_{10} D + \gamma_{11} DITC{*}D + \gamma_{12} CRED{*}D + \varepsilon_{it}$$

	Low-PE Firms D = 0 Firms			High-PE Firms D = 1 Firms			
	γ_0	$\gamma_0+\gamma_6$	$\gamma_0+\gamma_7$	$\gamma_0+\gamma_{10}$	$(\gamma_0+\gamma_{10})+\gamma_6+\gamma_{11}$	$(\gamma_0+\gamma_{10})+\gamma_7+\gamma_{12}$	Adj R^2 (F. sig. level)
Building (n=204)	0.005	0.009	0.002c	0.006	0.006	-0.002c	.168 (<.001)
Chemical (n=160)	0.006	0.001c	-0.005c	-0.004	-0.006c	0.005**	.171 (<.001)
Electric Utility (n=372)	-0.013	0.016*	0.023*	-0.008	0.014	0.076**	.164 (<.001)
Machinery (n=196)	-0.006	-0.003	-0.004	-0.006	-0.025d	0.002*	.086 (.004)
Metals & Mining (n=116)	-0.012	-0.008	0.008	-0.019	-0.013	-0.003	.085 (.047)

Note: Statistically significant t-statistics are denoted by * if significant at the 0.10 level, ** if significant at the 0.05 level, and *** if significant at the 0.01 level.

[a] The first, second, and third columns under D=0 and D=1 represent the intercept values for forecast changes -1, 0, and +1/+2, respectively.

[c] Parameter estimate is not in the predicted direction and is not significant at the 10% level using a two-tailed test.

[d] Parameter estimate is not in the predicted direction and is significant at the 10% level using a two-tailed test.

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Table 7.19
The 1975 Act
Hypothesis Three: Effect of Investment Opportunities on ITC Incentive Effects: Estimated Parameter Values for the Intercept for Each Forecast Change Period [a]

$$\Delta STINV_{it} = \beta_0 + \beta_1 \Delta STSAL_{it} + \beta_2 \Delta INT_{it} + \beta_3 \Delta STROE_{it} + \beta_4 CASH_{it} + \beta_5 CAP_{it}$$
$$+ \beta_6 DITC + \beta_7 CRED + \beta_8 \Delta STSAL_{it} {*} DITC + \beta_9 \Delta STSAL_{it} {*} CRED$$
$$+ \beta_{10} D + \beta_{11} DITC {*} D + \beta_{12} CRED {*} D + \varepsilon_{it}$$

	Low-PE Firms D = 0 Firms			High-PE Firms D = 1 Firms			
	β_0	$\beta_0+\beta_6$	$\beta_0+\beta_7$	$\beta_0+\beta_{10}$	$(\beta_0+\beta_{10}) +\beta_6+\beta_{11}$	$(\beta_0+\beta_{10}) +\beta_7+\beta_{12}$	Adj R^2 (F. sig. level)
Building (n=168)	-0.006	-0.012c	0.009	-0.022	0.004*	0.015**	.297 (<.001)
Chemical (n=114)	0.030	0.021c	0.002d	0.050	-0.017d	-0.009d	.257 (<.001)
Electric Utility (n=297)	0.119	0.053c	0.028c	0.135	0.094c	0.027c	.763 (<.001)
Machinery (n=132)	0.002	-0.008c	0.000c	0.012	-0.014d	-0.005c	.172 (<.001)
Metals & Mining (n=90)	0.034	0.048	0.016c	-0.030	0.038*	0.002	.692 (<.001)

Note: Statistically significant t-statistics are denoted by * if significant at the 0.10 level, ** if significant at the 0.05 level, and *** if significant at the 0.01 level.
[a] The first, second, and third columns under D=0 and D=1 represent the intercept values for forecast changes -1, 0, and +1 respectively.
[c] Parameter estimate is not in the predicted direction and is not significant at the 10% level using a two-tailed test.
[d] Parameter estimate is not in the predicted direction and is significant at the 10% level using a two-tailed test.

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Table 7.20
The 1978 Act
Hypothesis Three: Effect of Investment Opportunities on ITC Incentive Effects: Estimated Parameter Values for the Intercept for Each Forecast Change Period [a]

$$\Delta LTINV_{it} = \gamma_0 + \gamma_1 \Delta LTSAL_{it} + \quad + \gamma_3 \Delta LTROE_{it} + \gamma_4 CASH_{it} + \gamma_5 CAP_{it}$$
$$+ \gamma_6 DITC + \gamma_7 CRED + \gamma_8 \Delta LTSAL_{it} {*} DITC + \gamma_9 \Delta LTSAL_{it} {*} CRED$$
$$+ \gamma_{10} D + \gamma_{11} DITC{*}D + \gamma_{12} CRED{*}D + \varepsilon_{it}$$

	Low-PE Firms D = 0 Firms			High-PE Firms D = 1 Firms			
	γ_0	$\gamma_0+\gamma_6$	$\gamma_0+\gamma_7$	$\gamma_0+\gamma_{10}$	$(\gamma_0+\gamma_{10}) +\gamma_6+\gamma_{11}$	$(\gamma_0+\gamma_{10}) +\gamma_7+\gamma_{12}$	Adj R^2 (F. sig. level)
Building (n=150)	0.006	0.013	0.002c	0.005	0.012**	0.002c	.103 (.006)
Chemical (n=102)	-0.004	0.023***	-0.009c	0.004	0.028***	-0.007c	.402 (<.001)
Electric Utility (n=291)	-0.001	0.008	-0.003c	0.063	0.005c	-0.004c	.023 (.090)
Machinery (n=150)	-0.001	0.002	-0.006c	0.004	0.019*	-0.017d	.119 (.002)
Metals & Mining (n=72)	0.013	0.008c	0.016	0.016	-0.011c	0.019	.374 (<.001)

Note: Statistically significant t-statistics are denoted by * if significant at the 0.10 level, ** if significant at the 0.05 level, and *** if significant at the 0.01 level.
[a] The first, second, and third columns under D=0 and D=1 represent the intercept values for forecast changes -1, 0, and +1 respectively.
[c] Parameter estimate is not in the predicted direction and is not significant at the 10% level using a two-tailed test.
[d] Parameter estimate is not in the predicted direction and is significant at the 10% level using a two-tailed test.

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