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FEDERAL BUDGET DEFICIT FINANCING EFFECTS ON FIRM'S CHOICE OF DEBT AND EQUITY

by

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Federal Budget Deficit Financing Effects on Firm's Choice of Debt and Equity

Thesis directed by Professor Bárbara J. Robles

Does debt financing of the deficit make equity financing for firms more attractive? Benjamin M. Friedman (1986) argues that it does. The model in this paper examined whether the predicted nominal quantity side of the financing story corresponds with the pricing results Friedman found. Without delving into substitutability and risk measurement issues, the thesis revealed the impact of the link between the government financing decision and the corporate financing decision.

Government deficits, by themselves, crowd out all corporate financial instruments. Financing that deficit and debt with long term government bonds increases the severity of the crowding out effect. In contrast, however, short term financing can more than overcome the crowding out effects of budget deficits. Further, with the proper mix of long and short term instruments, the Treasury can exactly off set the crowding effects of deficits, rendering them portfolio neutral.

The graphical depiction of the data examined suggested that Friedman's model should have failed. Friedman's model did not fail, but as he recognizes, the financial markets have changed. These changes make his model appear to fail. Adjusting his model by accounting for the changes in the financial markets, as this study has done,

reconciles the model with the graphical analysis and adds a nominal quantity result for the implications of the theory.

These results are significant on two fronts. First, the analysis avoided the thorny issue of prices and still made the case for the government's role in debt and deficit management. Secondly, in contrast to proponents of the crowding out argument, high deficits have not diminished the corporate sector's ability to pursue either equity or debt financing. The corporate sector and the financial markets have demonstrated their versatility in the way they have adjusted to the size of government deficits and to the financing mix employed.

I gratefully acknowledge the encouragement and support I received from my family, thesis advisor, and committee. My wife Sandy and my boys, Matt and Tim, provided a constant reminder that my most important role is that of a husband and father. I agree with a popular notion that an individual's accomplishments partially define who they are and the standards by which they live. For me, however, an accomplishment means nothing if, in the process, I fail to devote time and energy to the people without whom I will surely lose my identity. I will have nothing if my children cease looking to me as their role model and my wife cannot find her best friend by simply casting her glance my way. My work, how I perform it, and what others make of it is important. It pales in comparison, however, to my first priorities. Only through the support of my family can I perform my work in such a manner that it merits recognition.

As for my work, I extend a heartfelt thanks to Professor Robles for her enthusiasm for my topic and for her seemingly boundless energy to review and criticize the countless revisions I submitted. Professor Zax and Professor Kaempfer, provided additional, insightful economic intuition that, together with the suggestions from Professor Robles, dramatically strengthened the model, arguments, and results.

Finally, I gratefully thank my parents and my brothers and sisters. My parents provided me with the thirst for seeking knowledge and the principles to proceed in a manner that dignifies the search. My brothers and sisters served as my own fan club, as we do for each other. We love to see each other succeed, but we also compete with each other enough to ensure that we push ourselves to our limits. Thanks!

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Introduction

Does debt financing of the deficit make equity financing for firms more attractive? Benjamin M. Friedman (1986) argues that it does. Based on the large increase in government deficits, the trend by corporations to use more debt financing, and the changing capital markets after 1979, more research must take place to better understand the relationship between the method the government uses to finance its deficits and the corresponding effect on firms' choice of debt and equity instruments to finance capital formation. This thesis examines the linkage between the borrowing activity of the federal government and the financing decision of the corporate sector. To do this, the study proposes a reduced form model to capture the linkage, without employing a microtheoretic optimizing model for the substitutability between the various instruments, *per se*. Instead, the linkages between government, the financial sector, and the corporate sector rely on the circular flow of the national income identity for the marcoeconomy.

The second question on which the paper focuses concerns an equally important issue: in financing federal budget deficits, do we experience portfolio crowding out, or any significant disruptions in the financial markets? One crowding out argument might proceed accordingly: since the government finances its large budget deficits primarily with debt instruments, this activity floods the financial market with bonds. The first thought is that this action by the government "dries up" the market for debt instruments. Corporations must respond by offering higher returns on their debt

instruments, or substitute into some other financial instrument to sustain their investment activity. The conclusion of this bond "portfolio crowding out" story rests on the assumption that investors must absorb all of the financial instruments to clear the market. As a result, corporations must pay a higher price to finance investment with debt versus equity.

This is only one such story. Other implications for the impact of government financing activity also exist. Because of the indeterminate conclusions of the crowding out argument, economists must obtain more concrete evidence before strongly advocating certain government policies with respect to the deficit and the method of financing that deficit? To entertain the questions raised in this introduction, the paper will focus on one specific government deficit financing issue: how do corporations respond to the method of financing the government chooses in financing its annual budget deficits?

The study will examine the annual level of new corporate debt issues relative to new corporate equity issues from 1947 through 1992. Based on the data and the model employed, this study finds evidence from a nominal quantity analysis that supports the price relationship Benjamin M. Friedman (1986) proposed. Friedman (1986) suggests that regardless of debt maturity, financing government budget deficits by issuing debt instruments (as opposed to printing new money), lowers the expected return on equity relative to the returns on long and short term corporate debt. This implies that during periods of debt financed deficits, financing corporate capital

formation should favor equity, including retained earnings, more than debt instruments. If this relationship holds, then how do we explain the increased reliance by corporations on debt versus equity financing during the 1980's? As Figure 1 shows, after 1980, corporations relied much more heavily on debt financing relative to equity financing, even when federal budget deficits exceeded $200 billion.[1]

The large deficits, according to Friedman's result, should have made equity financing far more attractive to corporations than debt instruments. From the graph in Figure 1, the budget surplus as a percentage of GDP has a rather obvious downward trend. In contrast to Friedman's model, however, since 1983, corporations have tended to favor debt relative to equity in their financing activity. Since 1947 the chart in Figure 1 shows that the annual budget deficits have grown as a percentage of GDP, from a surplus of 4.53% in 1948 to a 6.1% deficit in 1983 (Johnson, 1993). Financing this growth in annual deficits with debt instruments should have made equity an increasingly more attractive financing instrument for corporations. Therefore, some other market force must have motivated this conflicting result.

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[1] Data on the new issues of corporate debt and equity come from Historical Statistics of the United States, U.S. Department of Commerce, Bureau of the Census. Data on the Federal Budget Surplus come from David B. Johnson, Finding & Using Economic Information, pp. 380-82.

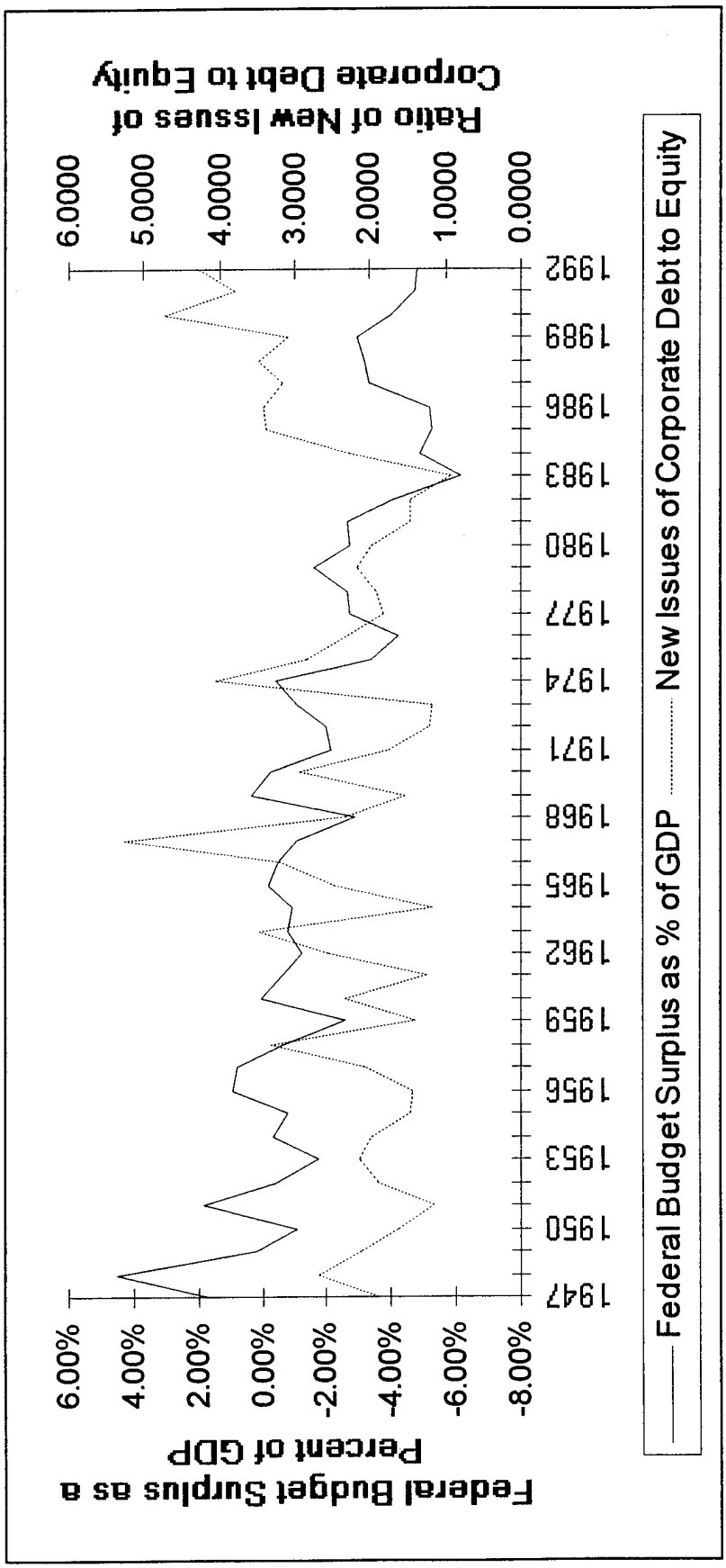

Figure 1: Federal budget surplus (deficit) and corporate financing mix.

To critically study the issues presented in the introduction, Chapter 1 first reviews the pertinent literature. The literature review focuses most heavily on the work of Friedman (1978, 1983, 1985, 1986, and 1993), along with some other literature offering alternative arguments to Friedman's conclusions. Chapter 2 presents a basic theory to predict the ratio of new corporate debt issues to new equity issues. Chapter 3 describes the data employed, it's source, and the collection method. Chapter 4 reports and critically interprets the empirical estimation of the theory. The thesis concludes with a summary of the results obtained and final comments on the direction in which future research should proceed.

Chapter 1: Literature Review

Crowding Out or Crowding In

Friedman introduced the issues confronting debt and deficit management in a seminal article published in 1978 in the Brookings Papers on Economic Activity. The motivation for his paper emanated from political rhetoric in the 1976 presidential race and in the prelude to the 1980 presidential campaign regarding large government deficits and a need for a balanced budget. In the paper, he looked for evidence of crowding out or crowding in resulting from annual government budget deficits from 1946 through 1977. His professed objective was to correct misunderstandings on how debt financed deficits affect the economy: "Debt-financed deficits need not crowd out any private investment, and may even crowd in some" (Friedman, 1978).

Friedman's focus is with the financial aspects of government spending. He agrees with the central, full employment theory of crowding out. If the supply of goods and services is fixed, with full employment, the government can crowd out real private sector activity by increasing its share of the total supply of goods and services. This is the widely accepted "forced savings" crowding out story (Friedman, 1978). Crowding out occurs when there is a "reduction in investment that results when expansionary fiscal policy raises the interest rate" (Mankiw, 1992). On the other hand, with less than full employment, if the government increases its supply of goods and services, this increase "can stimulate investment in productive capacity and thereby increase real private spending" (Friedman, 1978). He remarks that the Congressional

Budget Office refers to this stimulus effect as crowding in. Neither of these arguments for real activity, crowding out or crowding in, discusses the financing decision to issue interest bearing debt versus printing money. Friedman argues that possible "'financing crowding out' can take place independently of 'real crowding out,' and therefore can occur even if the economy is at less than full employment" (Friedman, 1978).

Presumably, when the government expands fiscal policy by deficit spending, it must finance that deficit in some manner. The financial crowding out story here is that when the government issues a certain maturity of bond, investors will first purchase these relatively less risky investment instruments. Any investment capital left over will be available to purchase corporate securities. A possible portfolio crowding in story would suggest that by issuing a certain type of debt instrument, the government could make corporate debt more attractive. The market would absorb both, and the government's debt issue actually encourages more corporate debt issue.

Friedman organizes his study into three sections. The first section focuses theoretically and empirically on the Hicks (1937) theory of transactions crowding out with familiar *IS-LM* analysis. In short, Friedman finds that with "unaccomodative monetary policy, transactions crowding out offsets some part of the effect of fiscal policy on income" (Friedman, 1978). If the interest elasticity of spending is perfectly inelastic, a vertical *IS* curve, then transactions crowding out will offset none of the effect of fiscal policy on income. Likewise, if the interest elasticity of money demand is perfectly inelastic, a vertical *LM* curve, then transactions crowding out offsets all of

the fiscal policy effect on income. In his empirical calculations, Friedman finds that the long run offset is greater than the short run, and that the offset is greater when monetary policy affects M_2 more than M_1. The long run versus short run results differ due to varying the different interest rates employed (*e.g.*, Treasury Bill versus Treasury Bond), and the crucial sensitivity of the *IS-LM* model to the interest rate employed.

In the second section, Friedman discusses the "portfolio crowding out" issue central to Milton Friedman's research. This is perhaps the most crucial section of the paper, both theoretically and empirically. His findings conclude that portfolio crowding out occurs when the "ratio of the substitution coefficient between bonds and money to the substitution coefficient between bonds and capital"(Friedman, 1978) is less than the ratio of the wealth coefficients of the demand for money and capital. In short, portfolio crowding out occurs when the motivation for individuals to hold money for portfolio purposes is stronger than holding money for transactions reasons. If, however, individuals hold money more for transactions purposes, then portfolio crowding in can occur. Empirical evidence provides little support for the notion that money has a zero wealth elasticity, and therefore eliminates the possibility of portfolio crowding out. Additionally, if bonds and capital are perfect substitutes, then portfolio crowding in cannot occur.

In the third and final section, Friedman examines portfolio substitutability measures. The aim of this analysis is to define the government's role in partially

determining crowding in or crowding out based on the duration of the debt instrument chosen to finance its deficits. This third section makes a theoretical argument to define the conditions under which the government can influence the occurrence of portfolio crowding out or crowding in. Friedman's theoretical conclusions find that:

> As long as there exists (or could be created) at least one government debt instrument (a short term bond) with a relative substitutability index greater than the key ratio of the respective wealth responses of money and capital and at least one (a long-term bond) less than the ratio, debt-management policy can determine which effect -- portfolio crowding out or crowding in -- results from financing deficits, and how much. Long term financing leads to crowding out, while short term financing leads to crowding in (Friedman, 1978, pp. 639-40).

Friedman recommends that the Treasury should "meet its financing requirements ... that it denies, not satisfies, the demands of investors for long-term securities, thereby stimulating the public to turn to the corporate business sector for more new [equity] issues" (Friedman, 1978). The object of a debt management policy should focus on "keeping the market hungry for long-term assets, not merely to avoid overfeeding it" (Friedman, 1978).

Many of his policy implications need updating, however, because the period Friedman examined witnessed its largest annual deficit of $70.6 billion (3.36% of GDP) in 1975, while during the 1980s, the federal government ran budget deficits in excess of $200 billion (Johnson, 1993). The largest deficit as a percentage of GDP was in 1983, 6.1% ($207.76 billion). The largest single annual budget deficit was in 1992 at $290.4 billion (4.81% of GDP) (Johnson, 1993).

Substitutability Measures

The empirical work for calculating the substitutability elasticity between debt and equity come from Friedman's 1985 paper. In this paper, Friedman empirically investigates the degree of substitutability between debt and equity securities in the United States. His primary concern focused on the stability of the elasticity measures over time. Friedman examined quarterly, after tax, nominal return data from 1960 through 1980 in a utility maximizing model. In his discrete-time, single-period model, Friedman proposes a representative investor that attempts to maximize expected utility. The investor derives utility exclusively from wealth accumulation, and wealth increases as the representative household "correctly" adjusts its portfolio in response to changes in asset returns. Friedman inferred the substitutability measures from the portfolio changes the representative household made.

The assets that composed the household's portfolio included stocks, long term debt, short term debt, and cash balances. The debt categories included government debt instruments, but Friedman did not attempt to measure the effects of government deficit financing. In short, he found that there is little evidence to draw any strong conclusions about the sign of the substitutability between short term debt and equity (Friedman, 1985, p.225). Long term debt and equity register as substitutes, although the magnitudes are extremely small relative to the implied measures suggested by the variance-covariance matrix (Friedman, 1985). He remarks that this paper did find "sharply changed optimal substitution responses of the demand for debt and equity to

their respective expected returns" between the 1960s and 1970s. Perhaps the most perplexing result this study produced was that expected asset returns and variance-covariance structure do not correspond to household perceptions. Investors consistently anticipated more favorable returns than were actually realized (Friedman, 1985).[2]

In a 1986 paper, Friedman considers how the government deficit financing choice affects the structure of expected returns. In this study, he relies on his 1985 empirical methodology to predict price effects (reflected in the rates of return) resulting from government deficit financing activity. The model in the 1986 study, however, examines the empirical results by using three different methods of incorporating risk perceptions as well as adding the effects of government deficit financing. The three methods of measuring risk perceptions are simple inspection of returns (technique employed in his 1985 paper), continually updated forecasting regressions, and survey expectations.

Although the magnitudes differ slightly, Friedman reports results that are consistent across the three various measures of risk perception. In short, he finds that regardless of debt maturity, financing government budget deficits by issuing debt instruments (as opposed to printing new money), lowers the expected return on equity

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2. The specific elasticity measures from this particular paper are not extremely important for Friedman's work and this paper's focus on how government deficits impact the structure of returns. Rather, the primary purpose for reviewing this paper is the methodology Friedman used to measure substitutability elasticity reported in this paper. He uses the same methodology in a subsequent paper that attempts to model the impact of government deficits, as well as employing different techniques for measuring risk and return perceptions.

relative to the returns on long and short term corporate debt.[3] Friedman's results suggest that by financing annual deficits by issuing short term debt lowers the return on long term corporate debt, but lowers the return on equity by even more. On the other hand, financing the deficits by issuing long term debt raises the return on long term corporate debt and lowers the return on equity. All of these relationships are relative to the return on short term corporate debt. As a result, with higher levels of government deficits, when the government issues debt to finance its deficits, the returns to equity fall in comparison to all other corporate financial instruments. This implies that debt financing of increasing annual budget deficits should influence corporations to use ever increasing amounts of equity relative to debt to finance their investment activity.

The results crucially depend on relative asset substitutability, which in turn depends on the perceived risk associated with the return on the various assets. Friedman readily admits that perceived risk is extremely difficult to measure, if not impossible. Nevertheless, he concludes that government deficit financing has a very definite effect on the market clearing expected returns to debt and equity. Debt financing of the deficit makes equity financing a more attractive instrument to corporations.

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[3] See Friedman (1986) for the parameter estimates. This paper is not so much concerned with the parameter values Friedman estimated, as it is with the statistical significance of the relationships that may, or may not exist, between the government's financing choice and how corporations' adjust their use of debt and equity in financing capital formation.

From the chart in Figure 2, it may not be so obvious, but the government has been financing its deficits with more short term than long term debt.[4] According to Friedman's calculations, this should have made equity even more attractive than if the government had used longer term financing. As demonstrated in Figure 1, and again here in Figure 2, corporations have been issuing more debt than equity in their financing activity.

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4. Data on the ratio of new issues of corporate debt and equity came from the Historical Statistics of the United States, U.S. Department of Commerce, Bureau of the Census. Data on the long and short term government debt came from the Treasury Bulletin, published by the U.S. Treasury Department.

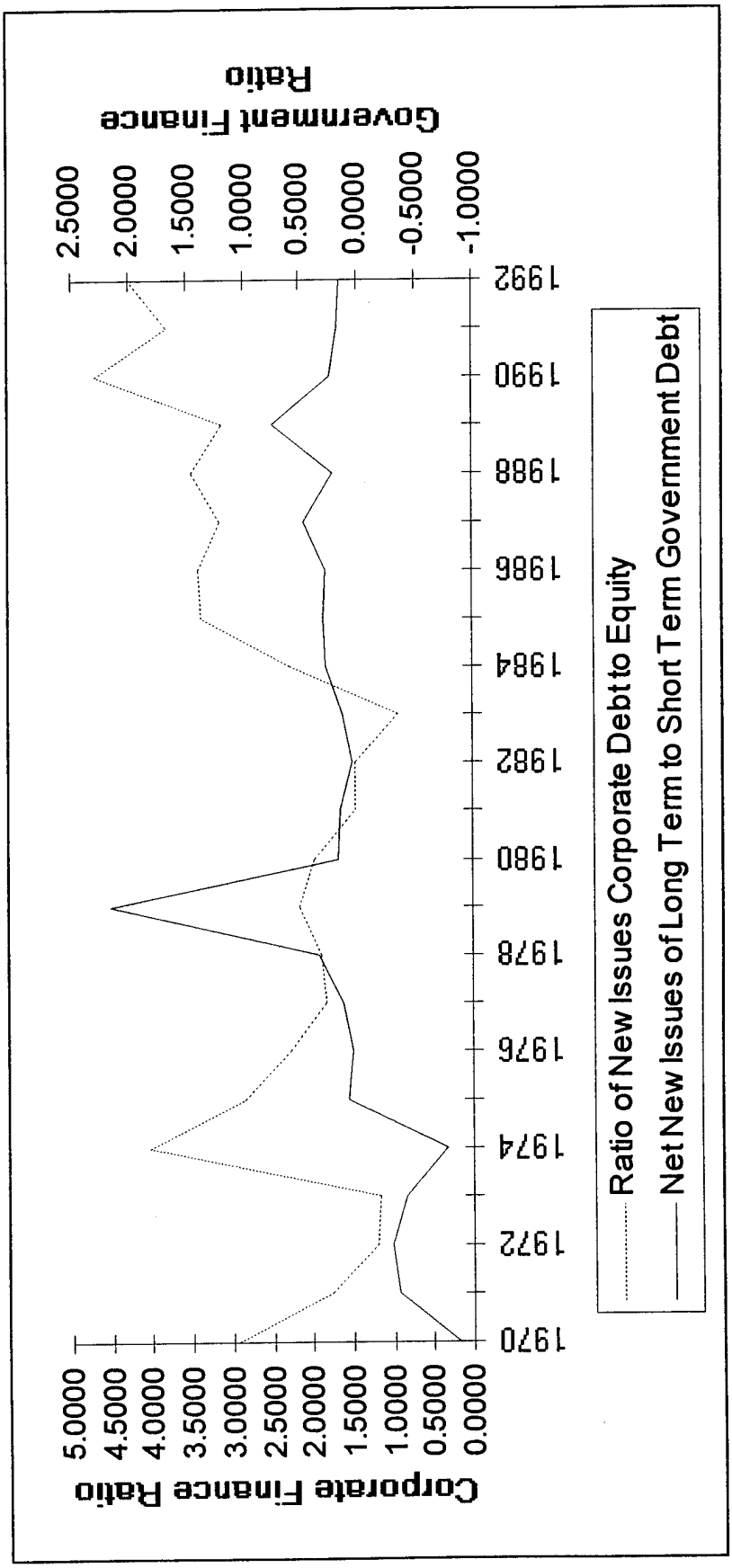

Figure 2: Government financing mix and corporate financing mix.

Additionally, based on his data, Friedman (1986) proposed a linear relationship between the deficit financing level and the impact on the structure of returns. For example, his data imply that financing a $100 billion deficit with long term bonds lowers the return on equity by .24% and raises the return on long term debt instruments by .1% relative to short term debt instrument returns. Friedman then argues that to obtain the predicted results from financing a $200 billion deficit, you need only double the results indicated above: equity returns fall by .48% and long term debt returns increase by .2% relative to short term rates.

The predicted drop in the return to equity (rents the firm faces for equity financing) is an extremely large number when multiplied by the size of the average annual rate of gross private domestic investment. Most economists believe that it is a significant event when the Federal Open Market Committee decides that they need to adjust the discount or funds rate by .5%. By incurring a deficit of $200 billion, financed with short term debt, the federal government has just lowered the relative price of equity for corporations by approximately .5%. This should cause a noticeable shift to equity, especially when gross private domestic investment has averaged 16.26% (variance .02%) of GDP over the sample period (1947 - 1992). However, during the 1980s, a period of extremely high annual deficits, we did not witness the predicted corresponding increase in the tendency for corporations to favor equity financing. More research must be done before feeling comfortable about the linear relationship Friedman suggests.

Specifically, does Friedman's predicted relationship between the size of the deficit financed and the effect on the term structure of interest rates hold in the face of the size of the deficits we witnessed after 1979? After 1979, we saw a major breakdown in the traditional relationship between monetary aggregates and real economic activity (Friedman, 1993). Economists use seemingly important monetary aggregates in their models to explain money demand, capital accumulation, government, corporate, and market behavior. Since 1979, however, many of these previous models that employ monetary aggregates failed to accurately predict the observations witnessed. In fact, credit aggregates have proved to be as important as monetary aggregates in predicting economic activity (Friedman, 1983). Moreover, the increased use of junk bond financing during the 1980s supports evidence of a discrepancy between the observations during the 1980s and Friedman's (1986) predictions.

An increase in both government and corporate debt

Robert A. Taggart, Jr. (1988) studied the level of junk bond financing and its importance to capital markets. He concluded that junk bonds emerged in response to the forces of "interest rate volatility, competition in financial services, and industrial restructuring ... allowing corporations to raise funds more quickly and on better terms than would otherwise have been available" (Taggart, 1988). This occurred during an episode of large annual deficits where, according to Friedman's hypothesis, equity financing should have been more attractive to corporations. In addition, Taggart

reveals evidence that indicates the corporate debt to equity ratio has increased steadily when measured in terms of book value.

By adjusting the measure of debt to equity in market terms, however, Taggart also finds evidence that tends to support Friedman's equity preference result. When accounting for inflation and a changed perception regarding an asset's ability to generate cash, the debt to equity ratio has decreased substantially since 1974 (Taggart, 1988). Taggart concludes his paper by demonstrating that junk bonds do not account for a major fraction of corporate debt, because some junk bond usage simply replaced "bank borrowing or private placements that corporations would otherwise have made" (Taggart, 1988). While the government's reliance on debt issues to finance the large budget deficits increased, corporations increased their reliance on short term debt issues to finance transactions, as opposed to bank borrowing. For the graphical representation of the period in the study, the new issues of corporate debt contains all forms of corporate debt issues. If corporations did replace a portion of their bank borrowing by relying more heavily on short term debt instruments, then this innovation provides on explanation of why new corporate debt issues increased at the same time as the budget deficits, especially when the government chose to finance the budget deficits by using shorter term debt instruments of its own. However, the relevant question for this paper still remains: how do corporations respond to the choice the government makes to finance its annual budget deficits?

Summary

The motivation for Friedman's research regarding federal budget deficits and the debt seem as valid today as he initially perceived these issues in 1978. Using various measures of risk perception, Friedman found evidence that the Treasury can influence the extent to which budget deficits crowd in or crowd out various private financial instruments. His models relied heavily on asset substitutability and rates of return. These rates of return depend on the perceived risk associated with the asset. Regardless of the risk measure used, however, when the government issues debt to finance its deficits, the returns to equity fall in comparison to all other corporate financial instruments. This implies that debt financing of increasing annual budget deficits should influence corporations to use ever increasing amounts of equity relative to long and short term debt to finance their investment activity. Friedman's research suggests a distinct role for the Treasury in debt and deficit management.

Graphical evidence reviewed in this chapter shows that the government has been using more short term than long term debt to finance its deficits. This should have made equity a more attractive financing vehicle to corporations than debt. However, graphical evidence suggests that, during the 1980s, corporations have been issuing more debt than equity in their financing activity. Taggart's explanation of the changed perception on the use of corporate debt may lend support to Friedman's equity preference result. If corporations replaced a portion of their bank borrowing by issuing debt, then this financial innovation may explain why new issues of corporate

debt increased during episodes when the government financed its large budget deficits with more short term debt than long term debt.

The study attempts to reconcile the disparity between the graphical evidence reviewed and Friedman's pricing conclusions. It will employ the use of a dummy variable to control for the tremendous financial market innovations that have occurred since 1980. By controlling for the vast financial market innovations that occurred after 1980, the thesis expects the model to resolve the apparent conflict between the graphical evidence and the theoretical predictions. In the following chapter, I will develop the theory of how the thesis will analyze the relationships among the variables.

Chapter 2: Theory and Model

Model Design

The theory and model proposed in this study differs from Friedman's work by using a nominal quantity analysis. The nominal quantity is the nominal dollar value of the financial instrument included in the study. By definition, the term "nominal quantity" implies the number of bonds, or shares, issued multiplied by the issued price. By using this approach, the analysis will examine whether the predicted quantity side of the financing story corresponds with the pricing results Friedman found.[5] The theory of this study expects to find that if the relationship Friedman postulates holds, then we should be able to model and explain a statistically significant portion of the variation in the ratio of new corporate debt issues relative to new corporate equity issues (measured in dollars), as well as explaining the amount of new issues of corporate debt and equity separately. The thesis will examine, then, three equations: (1) modeling the ratio of new issues of corporate debt to corporate equity; (2) modeling new issues of corporate debt, by itself; and (3) modeling new issues of corporate equity, by itself.

Using a nominal quantity approach avoids the odious problem of assigning perceived risk measures to the various asset returns. Additionally, because this approach avoids price measures categorically, it avoids the nagging problem all

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[5] From this point forward, when I mention that this is a "quantity" analysis, I mean "nominal quantities."

monetary economist face: the problem of selecting among various interest rates during each time period to assign to the various assets. In this way the study forces no *a priori* bounds on the parameters. It strictly observes the choices economic agents made with respect to available financial instruments in order to clear the markets. The nominal quantities include the price in the dollar value. However, by measuring the dollar value only, the analysis does not have to wade through information asymmetries or other market imperfections to specifically identify the rates of return (prices) in a given year for a set of financial instruments. With careful analysis, then, it is possible to infer the pricing relationship that must have existed to clear the market for the assets under consideration.

Specific Models Employed

To examine the relationship of how the ratio of new issues of corporate debt to corporate equity varies, the study will examine the following model in a generalized least squares formulation:

$$NICDTCE_t = f[STGD_t, LTGD_t, NNILTSTG_t, FBS_t, CHGFBS_t, SPRET_t, GPDI_t, GDP_t, REGDUMMY_t]$$

Dependent Variables:

1. $NICD_t$ = New issues of corporate debt in period t.
2. $NICE_t$ = New issues of corporate equity in period t.
3. $NICDTCE_t$ = Ratio of $\frac{NICD_t}{NICE_t}$ in period t.

Explanatory Variables:

1. $STGDt$ = Short term government debt outstanding in period t.

2. $LTGD_t$ = Long term government debt outstanding in period *t*.

3. $NNILTSTG_t$ = Net new issues of long term to short term government debt.

4. FBS_t = Federal budget surplus in period *t*.

5. $CNGFBS_t$ = Change in federal budget surplus between *(t-1)* and *(t)*.

6. $SPRET_t$ = Percentage Change in the S&P 500 Index between (t-1) and (t).

7. $GDPI_t$ = Gross Domestic Private Investment in period *t*.

8. GDP_t = Gross Domestic Product in period *t*.

9. *REGDUMMYt* = A dummy variable that changes to and stays at "1" beginning in 1980, the first year of the Reagan administration.

The same formulation of the model is used to regress *NICD* and *NICE* on the same collection of nine explanatory variables. To find evidence to support Friedman's conjectures, regression analysis should produce statistically significant parameter estimates with the following sign conventions:

$$NICDTCE_t = \alpha + \underset{(-)}{\beta_1} STGD_t + \underset{(-)}{\beta_2} LTGD_t + \underset{(+)}{\beta_3} NNILTSTG_t + \underset{(+)}{\beta_4} FBS_t +$$

$$(1)\quad \underset{(+)}{\beta_5} CNGFBS_t + \underset{(-)}{\beta_6} SPRET_t + \underset{(?)}{\beta_7} GPDI_t + \underset{(?)}{\beta_8} GDP_t + \underset{(+)}{\beta_9} REGDUMMY_t$$

Theoretical Predictions

According to Friedman's pricing story, the higher is short term government debt, then equity financing will be more attractive to corporations and drive down the ratio of new issues of corporate debt to corporate equity. Since Friedman's theory

postulates that increasing long term government debt raises the return on corporate debt and lowers the return on equity the theory proposed in this study expects long term government debt to have a negative effect on the ratio of new issues of corporate debt to corporate equity.

The study specifically chose stock measures of short and long term government debt. The theory presumes a specific economic capacity for short and long term financial instruments. Secondly, the economy must absorb all government financial instruments first. Government instruments represent the safest (least risk, lowest volatility) assets in their respective classes. Once the economy completely absorbs these instruments, then corporate financial instruments can flow into the economy's unused capacity. The short and long term government debt measures represent year end measures. Consequently, the flow of new government short and long term securities for the year have already found their way into the existing capacity. The only unmeasured parameter regarding the new stock of short and long term government securities is how the mix between the government instruments issued, on net, changed throughout the year. Composing a ratio of net new long term to short term government debt fills this void.

Determining the effect of the ratio of government financing is somewhat more difficult. From Friedman's work, we conjecture that more new issues of short term government debt will drive down equity returns more than new issues of long term government debt. As a result, when net new issues of long term to short term

government debt decreases, the government has issued more short term government debt, on net. This should cause new issues of corporate debt to corporate equity to decrease as well. Since the government chooses to finance deficits with debt, as the level of federal budget surplus gets more negative, then we should witness more equity financing by firms (*i.e.*, new issues of corporate debt to corporate equity should reduce). The same is true for the change in the federal budget surplus. The larger the change in the federal budget surplus in the direction of a deficit, the more corporations should favor equity, and new issues of corporate debt to corporate equity should fall.

Likewise, the more favorable is the market for equities, evidence by a high positive return on the S&P 500, the more corporations should favor equity financing and new issues of corporate debt to corporate equity should fall. Although the return on the S&P 500 represents a pseudo price, the variable serves as a proxy to indicate favorable equity market conditions. I could have used a dummy variable for this purpose, but since I had actual data that captures this condition, I thought that using the actual data would better serve the analysis than a dummy. Using a dummy would also have required the analysis to specify an *a priori* rate of return that suggests when the market is more favorable to new equity issues. Using actual data permits the model to identify how new equity and debt issues fluctuate with changes in equity market conditions.

Gross private domestic investment and gross domestic product are indeterminate. Both new issues of corporate debt and new issues of corporate equity

should increase as gross private domestic investment and gross domestic product rise, but which will rise faster is unknown. Unfortunately, we have no theory to help in signing these variables. The model should provide some evidence to sign the variables and perhaps help in revealing their contribution to explaining the dependent variables.

The Reagan dummy variable (REGDUMMY) is a special indicator. This is a dummy variable for the Reagan years and its legacy. Many dramatic financial market changes have occurred since 1979. These changes had a significant impact on the financial markets and the Reagan dummy indicates these changes by switching to a "1" in 1980 and remaining so through 1992. The change in Regulation Q (Reg Q), the tax changes in 1986, and the dramatically larger deficits are only a few of the changes that this dummy variable attempts to model. Eliminating Reg Q removed the price ceiling banks could pay to depositors. Banks then competed vigorously for deposits on a pricing basis, the rate they paid to depositors. To finance the higher rates, banks must increase their demand for some financial instrument that pays a sufficient return. The theory for this model is that since banks cannot own equity, they turned to the debt market. This increased the demand for bonds lowered the return that both corporations and the government must offer to sell their securities. This should influence higher new issues of corporate debt in the 1980s and suggest a positive coefficient on Reagan dummy.

In the tax change in 1986, the government eliminated the dividend exclusion. Tax payers could no longer exclude any portion of their dividend income, received by

holding corporate stocks in their portfolio, from their personal income tax filing. The result of this change favors more corporate debt demand. Since the government now taxes dividend and interest income equally, investors will opt for more debt. Creditors to corporations have a prior claim on profits and assets than do equity holders (Bodie, Kane and Marcus, 1989). Without the tax advantage, dividend income is less preferable than interest income received from holding bonds. This also influences more debt issue and implies a positive coefficient for Reagan dummy.

The increase in the size of the negative federal budget surplus and financing that negative federal budget surplus with shorter term debt implies corporations should prefer more equity to debt. This would influence the sign of the coefficient on Reagan dummy to be negative. Whether the two positive influences outweigh the one negative influence is uncertain, but the graphical evidence seems to suggest that the Reagan dummy coefficient should be positive, favoring new issues of corporate debt.

The Reagan dummy indicates more changes and innovations than the three changes previously reviewed. These three represent those changes with which I thought most people would have the greatest familiarity. In their paper entitled "The Integration of World Capital Markets" Michael Mussa and Morris Glodstein, from the World Bank, present a thorough review of the significant financial innovations that have occurred across all G7 nations since 1964. Of the seventeen they identified for the United States, twelve have occurred since 1979.

Summary

To find evidence that supports not only Friedman's conjectures, but also the graphical evidence presented earlier, regression analysis should produce statistically significant parameter estimates with the following sign conventions:

$$NICDTCE_t = \alpha + \underset{(-)}{\beta_1} STGD_t + \underset{(-)}{\beta_2} LTGD_t + \underset{(+)}{\beta_3} NNILTSTG_t + \underset{(+)}{\beta_4} FBS_t +$$

$$\underset{(+)}{\beta_5} CNGFBS_t + \underset{(-)}{\beta_6} SPRET_t + \underset{(?)}{\beta_7} GPDI_t + \underset{(?)}{\beta_8} GDP_t + \underset{(+)}{\beta_9} REGDUMMY_t \quad (1)$$

Finding empirical results that support the theoretical predictions are important for various reasons. Foremost, using the nominal quantity approach places no *a priori* bounds on the analysis. Producing results that align with theoretical predictions bolsters the theory Friedman developed independent of price specifications or restrictions. Secondly, it bolsters the theory while reconciling it with the graphical evidence from the 1980s, which seems to conflict with Friedman's theory.

To briefly recap the theoretical predictions, the higher is short term government debt, then equity financing will be more attractive to corporations and thus drives down the ratio of new issues of corporate debt to corporate equity. Increasing long term government debt raises the return on corporate debt and lowers the return on equity and this suggests that long term government debt should have a negative effect on the ratio of new issues of corporate debt to corporate equity.

When net new issues of long term to short term government debt decreases, more short term government debt is being issued. This should cause the ratio of new

issues of corporate debt to corporate equity to decrease. Since the government chooses to finance deficits with debt, as the level of federal budget surplus gets more negative, then we should witness more equity financing by firms. The same is true for the change in the federal budget surplus. The larger the change in the federal budget surplus in the direction of a deficit, the more corporations should favor equity, and new issues of corporate debt to corporate equity should fall.

Additionally, a high positive return on the S&P 500 should influence corporations to favor equity financing over new issues of corporate debt. Gross private domestic investment and gross domestic product are indeterminate. Both new issues of corporate debt and new issues of corporate equity should increase as gross private domestic investment and gross domestic product rise, but which will rise faster is unknown. The model should provide some evidence to sign the variables and perhaps help in revealing their contribution to explaining the dependent variables.

Eliminating Reg Q removed the price ceiling banks could pay to depositors; this should influence higher new issues of corporate debt and suggest a positive coefficient on Reagan dummy. In the tax change in 1986, the government eliminated the dividend exclusion. Since tax laws now treat dividend and interest income equally, investors will opt for more debt. Without the tax advantage, dividend income is less preferable than interest income received from holding bonds. This influence for more debt issues also implies a positive coefficient for Reagan dummy. The increase in the size of the negative federal budget surplus and financing that negative federal budget

surplus with shorter term debt implies corporations should prefer more equity than debt. This would influence the sign of the coefficient on Reagan dummy to be negative. Whether the two positive influences outweigh the one negative influence is uncertain, but the graphical evidence seems to suggest that the Reagan dummy coefficient should be positive, favoring new issues of corporate debt.

The quantity approach avoids the problem of assigning perceived risk measures to the various asset returns. Additionally, because this approach avoids price measures, it avoids the problem of selecting among various interest rates during each time period to assign to the various assets. In this way the study forces no *a priori* bounds on the parameters. It observes the choices made and infers the pricing relationship that must have existed to clear the market for the assets considered. This reduced form model permits an alternative method of investigation, not yet analyzed in the literature. Secondly, the use of a dummy to control for the changes in the financial markets, theoretically reconciles previous modeling results with the graphical evidence from the 1980s.

Chapter 3: Data Description

In order to facilitate a more complete understanding of the empirical results, reviewing the data gathering process will prove helpful. The paper analyzed annual data from the United States over the period from 1947 through 1992. The analysis did not seasonally adjust the data for business cycles. Lastly, all of the data collected and examined are in nominal terms. The analysis made no adjustments of the data for constant dollar or "real" dollar analysis.[6] Adjusting the data into real terms introduces pricing information. Typically, the real adjustment parameter is something like the consumer price index or an interest rate. For this thesis, I specifically intend to examine nominal quantity data, and intentionally exclude information that may place artificial bounds on the results.

Dependent Variables

The empirical analysis examined three dependent variables, all of which were constructed. The first relationship examined used the ratio of new issues of corporate debt to new issues of corporate equity (NICDTCE) as the dependent variable. In constructing this variable, the analysis divided new issues of corporate debt (NICD) by new issues of corporate equity (NICE). To decompose the variables further, new issues of corporate debt is the amount, in billions of dollars, of all bonds and notes

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6. Please reference Appendix A for a complete listing of the data analyzed, and statistical descriptions of the data. This section will focus exclusively on the source of the data and how the analysis constructed certain variables for empirical investigation.

offered publicly and domestically between 1947 and 1992. The new issues of corporate debt variable did not separate long term from short term corporate debt. The theory asserts that regardless of the term length of corporate debt, corporations prefer equity to all debt issues when the deficit increases. As a result, the model does not distinguish between long and short term corporate debt. It looks at the total level of all corporate debt combined in one variable. The data from 1947 through 1970 came from the Historical Statistics of the United States: Colonial Times to 1970, U.S. Department of Commerce, Bureau of the Census. The data from 1971 through 1992 came from the Federal Reserve Bulletin: Annual Statistical Digest, published by the Board of Governors of the Federal Reserve System. Careful cross checking of data taken from the Historical Statistics and the Federal Reserve Bulletin confirmed that the two sources produced identical data. By relying on the Historical Statistics source from 1947 through 1970, rather than pulling all of the Annual Statistical Digest for each year, the data gathering proceeded more quickly.

This analysis focuses on the nexus between the government financing decision and its corresponding effect on domestic, public, financial markets. For this reason, the composition of new issues of corporate debt did not include private placements of corporate debt, nor did it incorporate debt placed abroad. Corporations do not have to make the same kind of public disclosure on privately or foreign placed corporate debt as they do for domestically issued, publicly traded debt. As a result, domestic financial markets cannot accurately incorporate this partially disclosed financial

information into the term structure of interest rates. This term structure critically drives the results Friedman obtained. Additionally, the amount of debt placed both privately and abroad reflects only a small percentage of the new total debt issued in any given year.

The new issues of corporate equity variable was constructed by summing the new issues of both preferred and common stock for the period from 1947 through 1992. Once again, I used the Historical Statistics source for data between 1947 and 1970, and the Federal Reserve Bulletin: Annual Statistical Digest for the period 1971 through 1992. Like the new issues of corporate debt variable, the new issues of corporate equity variable omits that portion of equity placed privately. The reason for omitting this portion of new equity issues corresponds to the reasons given for the debt variable. The privately placed new equity issues reflects an even smaller percentage of the total new equity placed than the percentage of privately and foreign placed debt of the total new debt issued.

Independent Variables

Of the nine independent variables employed in the model, I constructed five of them by combining individual pieces of raw data. The variable labeled short term government debt (STGD) is constructed by summing the total, public issues of marketable bills, certificates and notes outstanding for each year under examination.

Treasury Bills are those government debt instruments with a maturity of one year or less. Treasury Notes are those government debt instruments with a maturity of

ten years or less. Finally, Treasury Certificates, which the Treasury ceased issuing in 1963, were short term debt instruments, like Treasury Bills, but the certificates paid interest (Bodie, Kane and Marcus, 1989).

Treasury bills are simply sold at a discount. The only gain lies in the difference between the price paid and the stated face value. Most instruments that act in this manner call the return a "capital gain." However, the government considers this return not as a short term capital gain, but rather as current interest income. As the tax code changes, this distinction can become important to the buyers of short term government debt.

Including all Treasury notes in the short term debt variable may seem inappropriate. Treasury notes include those debt instruments issued for one, three, five, seven and ten years. The analysis originally intended to characterize the short run as seven years or less. However, unless the analysis examined each individual bond issue during a particular year, no government publication this researcher reviewed itemized the Treasury notes issued annually at a summary level according to the issued duration. The most detailed level given was the general category of bill, note or bond.

The short term, regardless of the economic or financial study undertaken is always rather subjective. While the early years under consideration may have definitely classified ten years as the long run, certainly as we move through the 1980s and 1990s this perception changes. Ten years is no longer considered that far off that economists and corporations view ten years categorically as "the long run" for all

practical considerations. Therefore, the analysis determined the short run as ten years or less.

The source for the government debt data comes from the Treasury Bulletin. The United States Treasury Department issues these bulletins monthly. I gathered this data by pulling the October issue of every third year beginning in 1945 and recording the figures contained in the table entitled "Interest-Bearing Public Debt." Some overlap exists from one bulletin pulled to the next bulletin pulled. This ensured data integrity over time, such that any data reporting changes (of which none were cited) would be immediately recognized. This is a table the Treasury consistently reported.

The data composing the variable labeled long term government debt (LTGD) came from the same source, the Treasury Bulletin. The long term government debt variable is composed by summing the total outstanding publicly issued, marketable bonds. Treasury bonds are those government debt instruments issued with a maturity of more than ten years. For the data set examined in this paper, the long term government debt from 1947 through 1954 included both bank eligible and bank restricted bonds. After 1954, all bonds issued were bank eligible bonds. Bank restricted bonds were issues which commercial banks were prohibited from acquiring prior to a specified date.[7] The long term government debt variable does not include

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[7] Treasury Bulletin, United States Treasury Department, footnote 1 to "Table 3. - Interest - Bearing Public Debt." October 1951, p. 17.

bonds labeled as "Other" in the tables. The Treasury marketed this category of bond for specific projects, such as the Panama Canal during the 1950s.[8]

I constructed the variable net new issues of long term to short term government debt (NNILTSTG) by taking the first difference between the long term government debt and short term government debt outstanding from 1947 through 1992. To complete the construction of NNILTSTG, I divided the first difference of long term government debt by the first difference of short term government debt. The information that the ratio of the net new issues variable introduced to the model included not only how the maturity level of government debt issues changed, but also how the mix between long and short term government financing changed over time. The source for constructing this variable was the Treasury Bulletins, previously cited.

The data for the federal budget surplus (FBS) variable came from Finding & Using Economic Information: A Guide to Sources and Interpretation by David B. Johnson. Johnson's source, which I confirmed, was the President's Economic Report (annual). This report references the data appearing in the monthly Treasury Bulletin. The change in the federal budget surplus (CNGFBS) was constructed by taking the first difference of the FBS data from Johnson (1993) from 1947 through 1992.

The data for the annual return on the Standard & Poor (S&P) 500 index (SPRET) was constructed by calculating the percentage change in the S&P 500 composite index for each year. Standard & Poor's corporation reported the year

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8. Treasury Bulletin, United States Treasury Department, footnote 2 to "Table 2. - Interest - Bearing Public Debt." October 1954, p. 22.

ending values for their composite stock index. From this, I took the difference between the beginning year value (last year's ending value) and the current year's ending value and divided it by the beginning year value. Source for the S&P 500 data was the Economic Report of the President, 1993, "Table B-94. - Common stock prices and yields."

The data on the gross private domestic investment (GPDI) and the gross domestic product (GDP) come from various issues of the Survey of Current Business, published by the United States Department of Commerce in the national income and product accounts (NIPA).

Finally, I constructed a typical (0, 1) dummy variable for the Reagan years, labeled REGDUMMY. It reflects a change occurring in not only the Reagan years, but also in all of the years since 1979. The year 1979 marked the beginning of dramatic change in the financial markets of the United States. The elimination of Regulation Q marked the beginning of the changes that continue today in the financial markets of the United Stated and the financial markets around the world. The combined effect of these changes presumes that current financial markets adjust far more rapidly than any time in the past. In order to capture this effect, I constructed a dummy variable that switches from zero (0) to one (1) in 1980 and remains one through 1992. This variable captures the sweeping changes in the financial markets in the United States, as well as the dramatic increase in the federal budget deficits that began under President Reagan.

Summary

The study collected annual data from the United States over the period from 1947 through 1992. The relevant data included: new issues of corporate debt, new issues of corporate equity, the stock of short term government debt, the stock of long term government debt, the federal budget surplus, gross domestic product, gross private domestic investment, and the return on the Standard & Poor's 500 composite index. The analysis did not seasonally adjust the data for business cycles, and all of the data is expressed in nominal terms. The sources for the data included the Treasury Bulletin, Federal Reserve Bulletin: Annual Statistical Digest, Historical Statistics of the United States: Colonial Times to 1970, Survey of Current Business, Economic Report of the President and Finding & Using Economic Information: A Guide to Sources and Interpretation, by David B. Johnson.

I defined the short term government debt variable as government debt issued with a maturity of ten years or less. Debt with a duration of greater than ten years was classified as long term debt. The study used data from those corporate securities that were issued publicly in the United States.

The data collected for this thesis accurately represents the quantity information that pertains to the pricing variables contained in Friedman's work on this topic. The data selection and collection methodology remained as true to the principles of Friedman's theory as the data permitted. The results summarized in the next chapter reflect the integrity of the data and provide detailed information on the nature of the

relationship between the government's deficit financing policy and the economy's response.

Chapter 4: Estimation and Results

Investigation of the relationship between the government deficit financing mix and the mix of new corporate security issues begins with an ordinary least squares modeling technique. I followed a similar modeling approach that Friedman employs in his study of this topic. By employing this technique, the analysis assumes a linear relationship among the quantity variables employed. The nominal quantity approach avoids the problem of assigning perceived risk measures to the various asset returns. Additionally, because this approach avoids price measures, it avoids the problem of selecting among various interest rates during each time period to assign to the various assets. In this way the study forces no *a priori* bounds on the parameters. It observes the choices made and infers the pricing relationship that must have existed to clear the market for the assets considered.

The first model examines the ratio of new issues of corporate debt relative to new equity. The results will provide the most direct evidence of how the mix of corporate financial instruments changes in response to the financing mix the government chooses. The results of this modeling technique should produce statistically significant coefficients on the variables with the following sign conventions:

$$NICDTCE_t = \alpha + \underset{(-)}{\beta_1} STGD_t + \underset{(-)}{\beta_2} LTGD_t + \underset{(+)}{\beta_3} NNILTSTG_t + \underset{(+)}{\beta_4} FBS_t +$$

$$\text{(1)}\quad \underset{(+)}{\beta_5} CNGFBS_t + \underset{(-)}{\beta_6} SPRET_t + \underset{(?)}{\beta_7} GPDI_t + \underset{(?)}{\beta_8} GDP_t + \underset{(+)}{\beta_9} REGDUMMY_t$$

The higher is short term government debt, then equity financing will be more attractive to corporations and drive down the ratio of new issues of corporate debt to corporate equity. Increasing long term government debt raises the return on corporate debt and lowers the return on equity and this suggests that long term government debt should have a negative effect on the ratio of new issues of corporate debt to corporate equity.

When net new issues of long term to short term government debt decreases, more short term government debt is being issued. This should cause the ratio of new issues of corporate debt to corporate equity to decrease. Since the government tends to finance deficits with debt, as the level of federal budget surplus gets more negative, then we should witness more equity financing by firms. The same is true for the change in the federal budget surplus. The larger the change in the federal budget surplus in the direction of a deficit, the more corporations should favor equity, and new issues of corporate debt to corporate equity should fall.

Additionally, a high positive return on the S&P 500 should influence corporations to favor equity financing over new issues of corporate debt. Gross private domestic investment and gross domestic product are indeterminate. Both new issues of corporate debt and new issues of corporate equity should increase as gross private domestic investment and gross domestic product rise, but which will rise faster is unknown. The model should provide some evidence to sign the variables and perhaps help in revealing their contribution to explaining the dependent variables.

Eliminating Reg Q removed the price ceiling banks could pay to depositors; this should influence higher new issues of corporate debt and suggest a positive coefficient on Reagan dummy. In the tax change in 1986, the government eliminated the dividend exclusion. This influence also implies a positive coefficient for Reagan dummy. The increase in the size of the negative federal budget surplus and financing that negative federal budget surplus with shorter term debt implies corporations should prefer more equity than debt. This would influence the sign of the coefficient on Reagan dummy to be negative. Whether the two positive influences outweigh the one negative influence is uncertain, but the graphical evidence seems to suggest that the Reagan dummy coefficient should be positive, favoring new issues of corporate debt.

To uncover the empirical behavior of the separate variables composing the ratio, I designed two additional models to separately explain new issues of corporate debt and new issues of corporate equity. These separate models prove extremely informative. Simply modeling the ratio only explains how the mix changed relative to the explanatory variables. Examining each piece separately and calculating point elasticity measures tells us how fast each piece of the mix adjusted relative to the explanatory variables. Additionally, through the point elasticity measures, the analysis identifies how sensitive each piece of the ratio is to the various explanatory variables. Viewed in absolute terms, the results may appear surprising, but they do conform to the relationship Friedman identified in his price based model.

Initial Generalized Least Squares Estimation

In the estimation of equation (1), presented in chapter 2, the ordinary least squares (OLS) estimation reveals several data problems. The following table summarizes the results from the first least squares regression:[9]

$$NICDTCE_t = \alpha + \underset{(-)}{\beta_1} STGD_t + \underset{(-)}{\beta_2} LTGD_t + \underset{(+)}{\beta_3} NNILTSTG_t + \underset{(+)}{\beta_4} FBS_t +$$

$$(1)\quad \underset{(+)}{\beta_5} CNGFBS_t + \underset{(-)}{\beta_6} SPRET_t + \underset{(?)}{\beta_7} GPDI_t + \underset{(?)}{\beta_8} GDP_t + \underset{(+)}{\beta_9} REGDUMMY_t$$

Table 1: Regression results from NICDTCE on entire explanatory variable set.

Dependent Variable:	NICDTCE		R-Squared	0.47
Number of Observations:	45		D-W Stat	1.8907
			F-Stat	3.4493
Variable	Coefficient	T-Stat	Alpha Level	Significant
Constant	0.7563	1.0843	0.2856	
STGD	-0.0051	-1.0283	0.3108	
LTGD	0.0135	1.8115	0.0787	
NNILTSTG	-0.0904	2.0826	0.0447	*
FBS	-0.0059	-0.5483	0.5870	
CNGFBS	0.0223	0.2289	0.8203	
SPRET	-0.4305	-0.4965	0.6226	
GPDI	-0.0022	-0.0357	0.7235	
GDP	0.0017	0.9544	0.3464	
REGDUMMY	-1.3770	-1.7762	0.0844	

* significant at the $\alpha = 05$ level ** significant at the $\alpha = .01$

The explanatory power is extremely weak, and the model produced only one significant variable. Furthermore, the analysis uncovered several data problems. Aside from not being stationary, the most significant problems were heteroscedasticity and multicollinearity. The White test showed a near singular matrix and the

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[9] Appendix B presents the full regression results summarized in Chapter 4. The analysis utilized Micro TSP.

covariance matrix indicated a high degree of multicollinearity. In addition, unit root tests on each of the variables indicated that the data was not stationary. [10]

Weighted Least Squares Estimation

To correct for the data problems, I employ a weighted least squares technique for all subsequent regression calculations. Econometric theory suggests the weighted least squares technique as a method for correcting multicollinearity problems.[11] With this technique, the variable suspected of causing the multicollinearity problems is used as the weighting variable. Then, both the dependent variable and all the independent variables are weighted (multiplied) by the observation of the suspected variable divided by its mean, $\left(\frac{X_i}{\overline{X_i}}\right)$.[12] For this analysis the suspected variable is GDP. By making this modification to the regression analysis, the problems with multicollinearity and heteroscedasticity disappeared from the results.

Additionally, the unit root problem solved itself when the analysis employed the weighted least squares technique. Most time series data relating to economic information exhibit unit roots. To make time series data stationary, the typical solution lies in taking a first difference of the data, or by adjusting the data into real versus nominal terms. Using GDP as the weighting variable to correct for

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10. See Appendix B for unit root test results.

11 See Basic Econometrics by Damodar Gujarati, pp. 207, 217-218. and; Econometric Models & Economic Forecasts by Pindyck and Rubenfeld, pp. 142-144.

12 Micro TSP User's Manual. p. 14-18.

multicollinearity problems placed the data into a form of real, as opposed to nominal, terms. Hence, the weighting technique solved the unit root problems as well.[13]

The following equation and table summarize the results of this second regression analysis of NICDTCE in a weighted least squares format. The sign conventions beneath the parameters represent hypothesized signs that the theory suggests the model should produce.

$$NICDTCE_t = \alpha + \underset{(-)}{\beta_1} STGD_t + \underset{(-)}{\beta_2} LTGD_t + \underset{(+)}{\beta_3} NNILTSTG_t + \underset{(+)}{\beta_4} FBS_t +$$

$$\text{(1a)} \quad \underset{(+)}{\beta_5} CNGFBS_t + \underset{(-)}{\beta_6} SPRET_t + \underset{(?)}{\beta_7} GPDI_t + \underset{(+)}{\beta_8} REGDUMMY_t$$

Table 2: Regression results of NICDTCE using weighted least squares.

Dependent Variable:	NICDTCE		R-Squared	0.968
Number of Observations:	45		D-W Stat	1.9925
Weighting Series:	GDP		F-Stat	136.3126
Variable	Coefficient	T-Stat	Alpha Level	Significant
Constant	1.0558	2.6658	0.0114	*
STGD	-0.0052	-2.7629	0.0090	**
LTGD	0.0209	3.7009	0.0007	**
NNILTSTG	-0.0195	-0.0161	0.8728	
FBS	-0.0112	-2.4494	0.0193	*
CNGFBS	0.0020	0.6390	0.5268	
SPRET	-1.7653	-2.2349	0.0317	*
GPDI	0.0040	2.8644	0.0069	**
REGDUMMY	-1.2046	-2.4210	0.0206	*

* significant at the $\alpha = 05$ level ** significant at the $\alpha = .01$

As expected, the weighting technique produced not only stable data, but also eliminated indications of heteroscedasticity and multicollinearity problems. The sign on STGD agrees with the hypothesized direction. The theory asserts that as the level

[13] Unit root tests on the weighted variables indicates greater stability across all variables.

of STGD increases, it drives down the return on both corporate debt and corporate equity. If however, NICE increase faster relative to NICD when STGD increases, then the entire ratio would appear to decrease. This appears to be the case, and hence the negative sign.

In part, though, the results do not seem to agree with our theory. The sign on the long term government debt parameter is positive, where the theory predicts a negative sign. Friedman's research (1985) has shown that long term government debt is a weak substitute for corporate equity. As a result, this influence may have overshadowed other pricing effects and thus produced a positive parameter estimate where theory predicts a negative. Prior to examining each piece of the ratio separately, the analysis cannot draw a definite conclusion regarding this anomalous result.

The estimated parameter signs on FBS and the REGDUMMY seem to run counter to theoretical predictions as well. Although the separate pieces of the ratio may respond in the theoretically predicted direction, the speed of movement may have caused the sign reversals. Future regressions will attempt to disentangle this problem in order to make more definite conclusions for the perplexing results obtained.

The sign on NNILTSTG also runs counter to the theoretical predictions. However, since this parameter is not statistically significant, strong conclusions regarding the sign of the parameter estimate cannot be drawn. Overall, however, this model appears to support Friedman's pricing theory.

The explanatory power seems so strong, that examining the fitted values from the model with the actual data on the ratio may prove instructive. Figure 3 suggests that the model seems to have more prediction power during the 1980s. Inspecting the predictive power further reveals that during certain periods, the prediction seems incredibly erratic. The episodes where the predictions are the most erratic occur during periods around the specially drawn vertical lines. The vertical lines added for the years 1955, 1966, 1968, 1974, 1978, 1979, and 1988 represent the Romer dates and the credit crunch of 1966.[14] Except for the 1980s, the model does not adequately capture the effects, or over predicts the impact of the tight money episodes. The actual data, as witnessed by the ratio, does not react as dramatically as the model predicts during the tight money episodes.

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[14] Christina and David Romer (1993) reported episodes of post war tight money as inferred from published decisions from the Federal Open Market Committee and from the FOMC meeting minutes. They identified October 1947, September 1955, December 1968, April 1974, August 1978, October 1979, and December 1978.

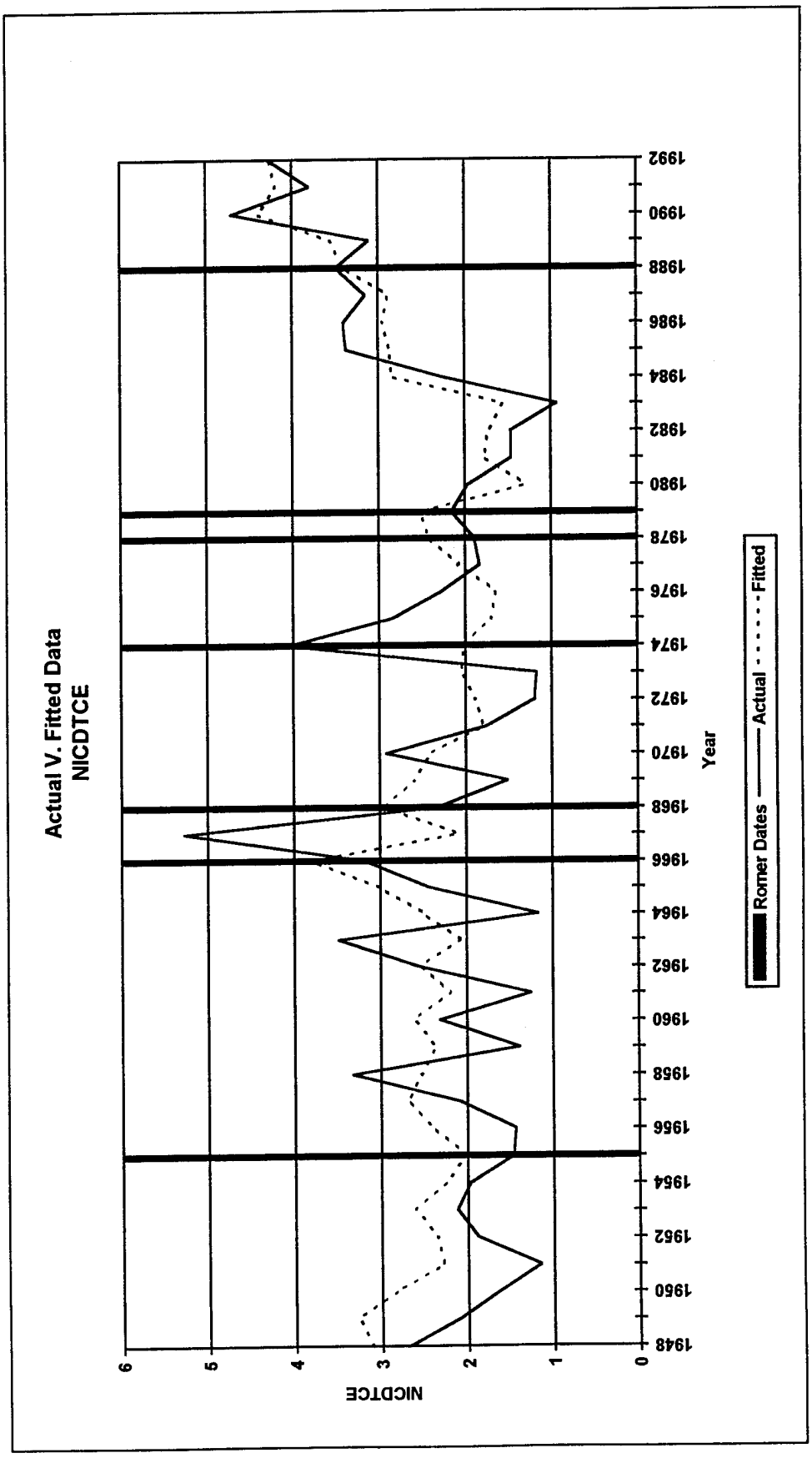

Figure 3: Actual versus Fitted NICDTCE.

In concluding this analysis of new issues of corporate debt to equity, it is interesting to note that in this regression neither the change in the size of the federal budget surplus (CNGFBS) nor the ratio of new issues of long to short term government debt (NNILTSTG) seem important in explaining the variation in the ratio of new issues of corporate debt to equity. Not surprisingly, the REGDUMMY is significant, but it is in the opposite direction from what the theory predicts. The empirical results suggest that the Reagan years favored new issues of corporate equity, whereas graphical evidence from the introduction and from Chapter 1 suggests the Reagan years favored new issues of corporate debt. Perhaps the significant deficits outweighed the effects of both Regulation Q and the tax change that eliminated the tax favored treatment of dividends for individuals. Corporations holding stock in another corporation, not their own subsidiary, still receive a dividend exclusion for the corporation's tax filing. Perhaps eliminating the dividend exclusion for individuals only was insufficient to cause a major demand shift for corporate bonds. To examine this relationship in more detail, and attempt to unravel some of the conflicting results, the analysis will examine each piece of the ratio separately.

Explaining NICD Observations

To uncover more information on this relationship, the analysis regressed each piece of the ratio of new issues of corporate debt to corporate equity on the same set of regressors in a weighted least squares estimation technique. The model and the results are summarized by the following equation and table. The sign conventions

beneath the parameters represent hypothesized signs the theory suggests the model should produce.

$$NICD_t = \alpha + \underset{(+)}{\beta_1} STGD_t + \underset{(-)}{\beta_2} LTGD_t + \underset{(-)}{\beta_3} NNILTSTG_t + \underset{(+)}{\beta_4} FBS_t +$$

$$(2)\quad \underset{(+)}{\beta_5} CNGFBS_t + \underset{(+)}{\beta_6} SPRET_t + \underset{(+)}{\beta_7} GPDI_t + \underset{(-)}{\beta_8} REGDUMMY_t$$

Table 3: Regression results from NICD using weighted least squares.

Dependent Variable:	NICD		R-Squared	0.96856
Number of Observations:	45		D-W Stat	2.0154
Weighting Series:	GDP		F-Stat	307.4115
Variable	Coefficient	T-Stat	Alpha Level	Significant
Constant	34.2809	1.7977	0.0806	
STGD	0.3926	4.3058	0.0001	**
LTGD	-0.4275	-1.5704	0.1251	
NNILTSTG	-1.1112	-0.0191	0.8495	
FBS	0.1944	0.8860	0.3815	
CNGFBS	0.5130	3.4129	0.0016	**
SPRET	51.7368	1.3604	0.1822	
GPDI	-0.3416	-5.0474	0.0000	**
REGDUMMY	3.0678	0.1281	0.8988	

* significant at the $\alpha = 05$ level ** significant at the $\alpha = .01$

The results seem robust in terms of the explanatory power, but there are only three significant variables. Where they are significant, however, they are significant at the $\alpha < .01$. Even more confounding is that for new issues of corporate debt, the change in the budget surplus has significant power. In the analysis of the ratio of new issues of corporate debt to corporate equity, however, this variable was insignificant. In this regression, it appears as though an increasing deficit (a negative value for CNGFBS) discourages new issues of corporate debt. This result tends to support a portfolio crowding out story. Considering the sign of STGD, however, it seems as though short term government debt does not crowd out, but in fact crowds in,

corporate debt issues. Therefore, if the government runs higher budget deficits from year to year, then financing the deficits with short term debt offsets some of the negative effects on NICD that the increasing deficit seems to have caused.

All of the parameter estimates align with the theoretically postulated signs, except for the investment parameter. The results obtained imply that higher levels of investment seem to favor lower levels of corporate debt. This problematic result will be the subject of a later section of this chapter.

The results for the regression on new issues of corporate debt are a little perplexing in light of what the regression for the ratio suggests. Perhaps using the same technique to analyze new issues of corporate equity would shed some more light on the relationship and the ratio. Before examining new issues of corporate equity, it may prove interesting to compare the fitted with the actual values for new issues of corporate debt, since the explanatory power for the regression on new issues of corporate debt is so high. Figure 4, on the following page, depicts this relationship. As in figure 3, the vertical lines represent the Romer dates and the credit crunch of 1966.

As with explaining new issues of corporate debt to corporate equity, the model seems to perform better during the 1980s. For all other periods, the model seems to fit values with the actual data better than the model for new issues of corporate debt to corporate equity. Like the model for new issues of corporate debt to corporate equity, the model for new issues of corporate debt has problems adequately modeling tight monetary episodes.

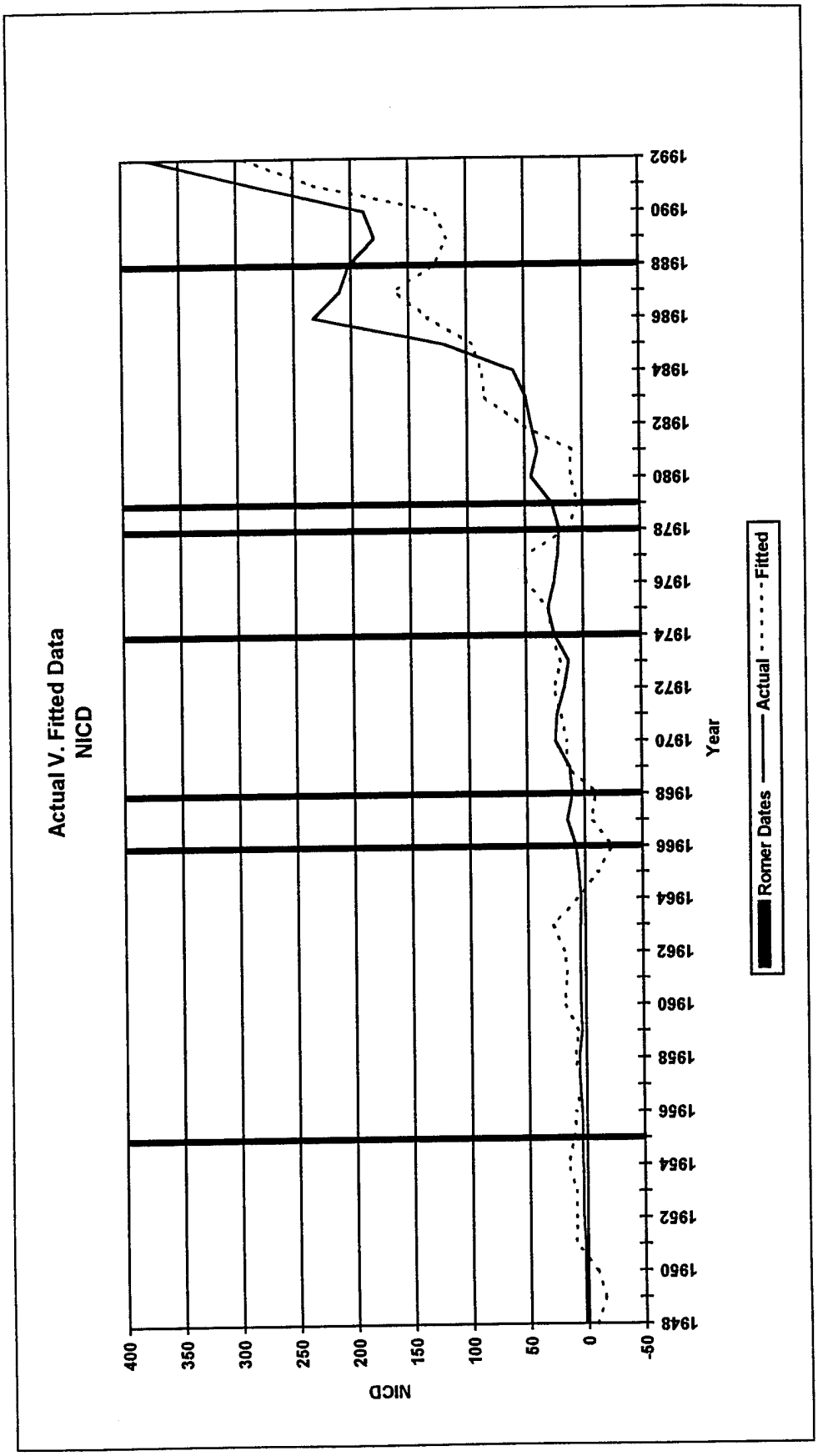

Figure 4: Actual versus Fitted NICD.

Explaining NICE Observations

The analysis next turned to the NICE part of the ratio. The following equation and table show the formulation and the results of a weighted least squares analysis of NICE on the set of explanatory variables. The sign conventions beneath the parameters represent hypothesized signs the theory suggests the model should produce.

$$NICE_t = \alpha + \underset{(+)}{\beta_1} STGD_t + \underset{(+)}{\beta_2} LTGD_t + \underset{(-)}{\beta_3} NNILTSTG_t + \underset{(+)}{\beta_4} FBS_t + \tag{3}$$
$$\underset{(+)}{\beta_5} CNGFBS_t + \underset{(+)}{\beta_6} SPRET_t + \underset{(+)}{\beta_7} GPDI_t + \underset{(+)}{\beta_8} REGDUMMY_t$$

Table 4: Regression results from NICE using weighted least squares.

Dependent Variable:	NICE		R-Squared	0.9870
Number of Observations:	45		D-W Stat	2.5718
Weighting Series:	GDP		F-Stat	342.6850
Variable	Coefficient	T-Stat	Alpha Level	Significant
Constant	20.5095	4.3625	0.0001	**
STGD	0.1609	7.1595	0.0000	**
LTGD	-0.3441	-5.1271	0.0000	**
NNILTSTG	0.0137	0.0095	0.9924	
FBS	0.2006	3.7090	0.0007	**
CNGFBS	0.0828	2.2334	0.0318	*
SPRET	53.5005	5.7060	0.0000	**
GPDI	-0.1135	-6.8050	0.0000	**
REGDUMMY	19.6139	3.3208	0.0021	**

* significant at the $\alpha = 05$ level ** significant at the $\alpha = .01$

Like the previously reviewed weighted least squares regressions, the model of new issues of corporate equity has an extremely high explanatory power. The D-W statistic looks a little suspicious, but the test places the statistic in the uncertain range;

it does not reject H_O.[15] Reexamining the model with an AR(1) process for the error terms produced estimation results with a lower R-squared, fewer significant variables, sign reversals, and an AR(1) coefficient that was extremely low and insignificant (α-level = .7642). It appears as though this is not an AR(1) process. An AR(2) and higher [AR(p) with p = 2, 3, and 4] estimation produced less informative results.

The results from the empirical analysis, summarized in Table 4, lead to the conclusion that short term government debt crowds in new issues of corporate equity while long term government debt crowds out new issues of corporate equity. The sign implication for long term government debt runs counter to Friedman's pricing model result (1985). The substitutability influences seem to overpower the relative pricing relationship. This result aligns with his 1978 gross substitute assessment of long term government debt and corporate equity (Friedman, 1978). If the model correctly predicts the sign of long term government debt, then the current trend of the government that favors financing the deficits with shorter term debt instruments supports the encouragement of new issues of corporate equity. However, the results also suggest, by the sign on federal budget surplus, that when the government runs a deficit, it tends to discourage the use of equity by corporations. In sum, the results suggest that although running budget deficits discourages the use of equity, financing the deficits with short term versus long term debt tends to abate, to a certain degree,

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15. The test range runs from 0 - 1.139, reject; 1.139 - 1.958, uncertain; 1.958 - 2.042, do not reject; 2.042 - 2.861, uncertain; and 2.861 - 4, reject. The D-W test statistic falls in the uncertain range. The null hypothesis is no autocorrelation.

the negative effects of the deficits on new issues of corporate equity. This result is strikingly similarly to the results obtained in the previous analysis of new issues of corporate debt. In sum, the results suggest that budget deficits may cause portfolio crowding out of any variety of private financial instrument, but financing that deficit with short term debt instruments tends to abate the crowding out effect.

The results suggesting that an increase in the return on the S&P 500 index encourages more issues of equity is no surprise. However, the implications regarding investment, once again, seem peculiar. The empirical estimate for the coefficient on gross private domestic investment indicates that as the investment level increases, firms tend to reduce the amount of new equity they issue. This was the same result exhibited in the regression for new issues of corporate debt. Equally perturbing is the result that while deficits tend to discourage equity issues, the Reagan years, as a group, seem to favor new equity issues. As previously mentioned, later sections of this chapter will focus exclusively on the confounding effects implied for investment and the Reagan dummy.

To conclude this section, looking at actual versus fitted values for new issues of corporate equity may prove helpful in better understanding and reconciling the results of the three models examined. Figure 5 compares the actual observations of new issues of corporate equity versus the values the model predicts for each observation. The model for new issues of corporate equity, like the others, seems more efficient during the 1980s. Like the other models, the model for corporate

equity also seems particularly inefficient during the early episodes of tight money. The model reacts more erratically than the actual observations during these periods.

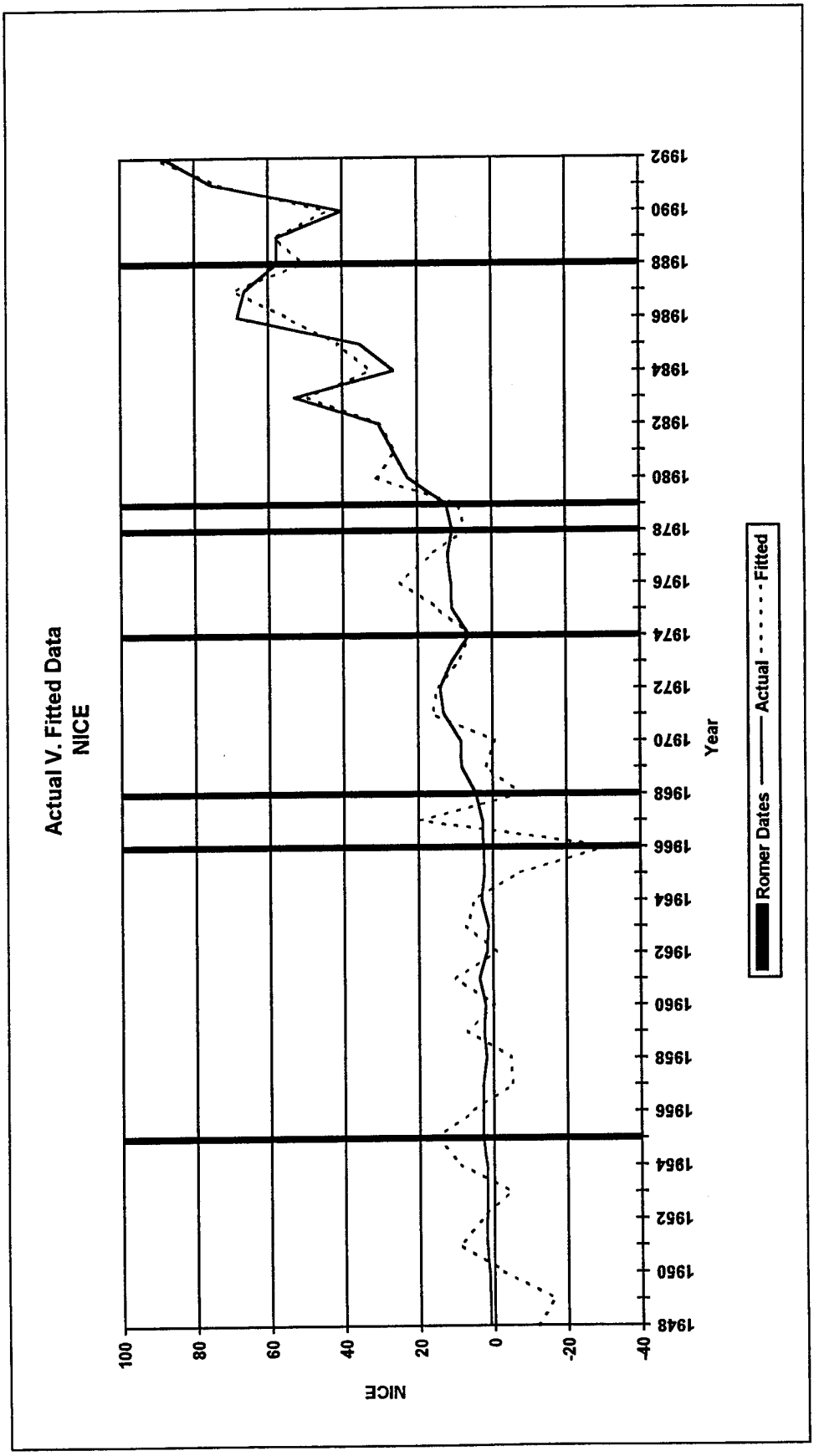

Figure 5: Actual versus Fitted NICE.

The models perform extremely well and correspond with the theory espoused by Friedman. However, the models do not seem to correspond too well with the graphical evidence from the 1980s. In an attempt to reconcile the theory and the graphical evidence I will refine the original model to control for the 1986 tax reform act. In this act, Congress eliminated the personal income tax dividend exclusion. The theory argues that this change in the tax law should have caused a significant shift to debt. By controlling for this effect apart from the Reagan dummy, I expect the results of the modeling to maintain its adherence to the theory, while improving its correspondence with the graphical analysis.

A Refinement of the Basic Model

To further investigate and reconcile the empirical results with the graphical analysis, I refined the basic model to include a second dummy variable. I will initially set this second dummy variable to zero and change it to a one beginning in 1986 through 1992. This marks the 1986 tax change that I argue should favor a significant switch to debt. Teasing this information from the REGDUMMY should help to produce a model that more closely aligns with the graphical analysis. The empirical results previously reviewed suggest that the large deficits witnessed since 1980 swamped the effects of other policy changes that would tend to favor new corporate debt issues. Controlling for the 1986 tax reform act should demonstrate that the tax change did favor new issues of corporate debt. Additionally, if this parameter has statistical significance, and the REGDUMMY has statistical significance, then the

analysis supports the argument that, in the previous models, the equity preference effect of the deficits swamped the other debt preference effects.

The estimation equations are extremely similar, with the exception of the additional dummy variable. The theoretical prediction suggests that the empirical calculations should produce positive parameter estimates for this dummy variable in the regression on the ratio of new issues of corporate debt to equity and for new issues of corporate debt. The theory does not permit definitive signing of the TAXDUMMY for the regression on new issues of corporate equity. Because the theory argues that the tax change favored new debt issues, it does not necessarily follow that it should simultaneously discourage new equity issues.

The following table summarizes the results from the three regressions:[16]

Table 5: Revised Model WLS Regression Results.

Dependent Variable:	NICDTCE		NICD		NICE	
Independent Variables	Parameter Estimate		Parameter Estimate		Parameter Estimate	
Constant	1.2854	**	55.8173	**	26.9214	**
STGD	-0.0055	**	0.3688	**	0.1538	**
LTGD	0.0189	**	-0.6175	*	-0.4007	**
NNILTSTG	0.0009		0.8016		0.5832	
FBS	-0.0138	**	-0.0548		0.1264	**
CNGFBS	0.0017		0.4859	**	0.0747	*
SPRET	-2.1576	*	14.9463		42.5470	**
GPDI	0.0036	*	-0.3813	**	-0.1254	**
REGDUMMY	-1.1688	*	6.4202		20.6120	**
TAXDUMMY	0.7302		68.4830	**	20.3892	**
Number of Observations	45		45		45	
Weighting Series	GDP		GDP		GDP	
R-Squared	0.9705		0.9897		0.9925	
D-W Stat	2.1731		1.6355		2.3631	
F-Stat	127.8256		375.0978		514.4035	

* significant at the $\alpha = 05$ level ** significant at the $\alpha = .01$

These results prove extremely valuable to the original model. By adding the tax dummy, the explanatory power, as evidenced by the R-Squared value, has increased across all three regressions. This is a reasonable result because we added another explanatory variable. However, the Adjusted R-squared also increased when using the revised model versus the original model.[17] Further, for the regression on new issues of corporate debt, the tax dummy is significant. In the prior model of new corporate debt issues, the regression produced only three significant variables (STGD,

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[16] Because the three regression equations are so similar to the previously estimated equations, I thought it would not prove extremely helpful to again write out the full equations. For a complete review of the regression analysis, please refer to Appendix B.

[17] The Adjusted R-squared measure, in theory, controls for the number of parameters in an estimation. Direct comparison of raw R-squared measures from equations with a different number of explanatory variables violates the theoretical use and meaning of the R-squared measurement.

CNGFBS, and GPDI), and the REGDUMMY was not one of those. In the revised new corporate debt issues regression, the results produced five significant variables, and the TAXDUMMY is highly significant. Perhaps even more informative is the long term government debt variable. In the original specification, this parameter estimate fell outside the bounds, albeit narrowly, of traditionally accepted measures of significance. In the revised model, this variable is of the correct sign, negative, and significant. This permits us to conclude that increasing the stock of outstanding long term government debt does reduce the corporate sector's ability to use either debt or equity to finance its activities. Financing the debt and deficits with long term debt crowds out the use of all corporate financial instruments. In contrast, financing the debt and deficits with short term instruments crowds in the use of both corporate debt and equity.

The tax dummy introduced no strange anomalies. All parameter estimates that proved significant in the original models, maintained their significance and the same sign convention. The introduction of the tax dummy cleared some of the fog surrounding how the level of long term government debt affects new issues of corporate debt. A deficit and an increasing deficit tend to discourage new issues of corporate equity and debt instruments. The analysis clearly demonstrates that the Treasury can exactly offset this effect with the proper mix of long and short term financing of the deficits. The Treasury can actually cause crowding in of all corporate financial instruments by exclusively financing the deficits with short term debt

instruments. Exclusive short term financing of the deficits more than compensates for the crowding out of the deficits.

The results of this revised model maintain all of the same inferences regarding the financing method the government chooses and the implications for corporations. Federal budget deficits tend to crowding out new corporate debt and equity issues, but short term financing of the deficits can more than offset this effect. Additionally, the tax change favored new corporate debt issues by more than three to one over new equity issues. When accounting for the constant in the estimation of the ratio of new issues of corporate debt to equity (approximately 1.2), this produces a ratio of new issues of corporate debt to equity of about 4.0. This is precisely the result witnessed in the earlier graphical analysis. Beginning in about 1986, corporations issued almost four times as much debt annually as they did equity. As a results, the revised model not only improves the performance of the original model and bolsters the inferences permitted by the original model, but also corresponds with the graphical analysis where the original model did not. To follow the format of the models previously reviewed, the following three figures graph the actual versus fitted data for the revised models. In each of the figures, the model demonstrates better performance after 1980.

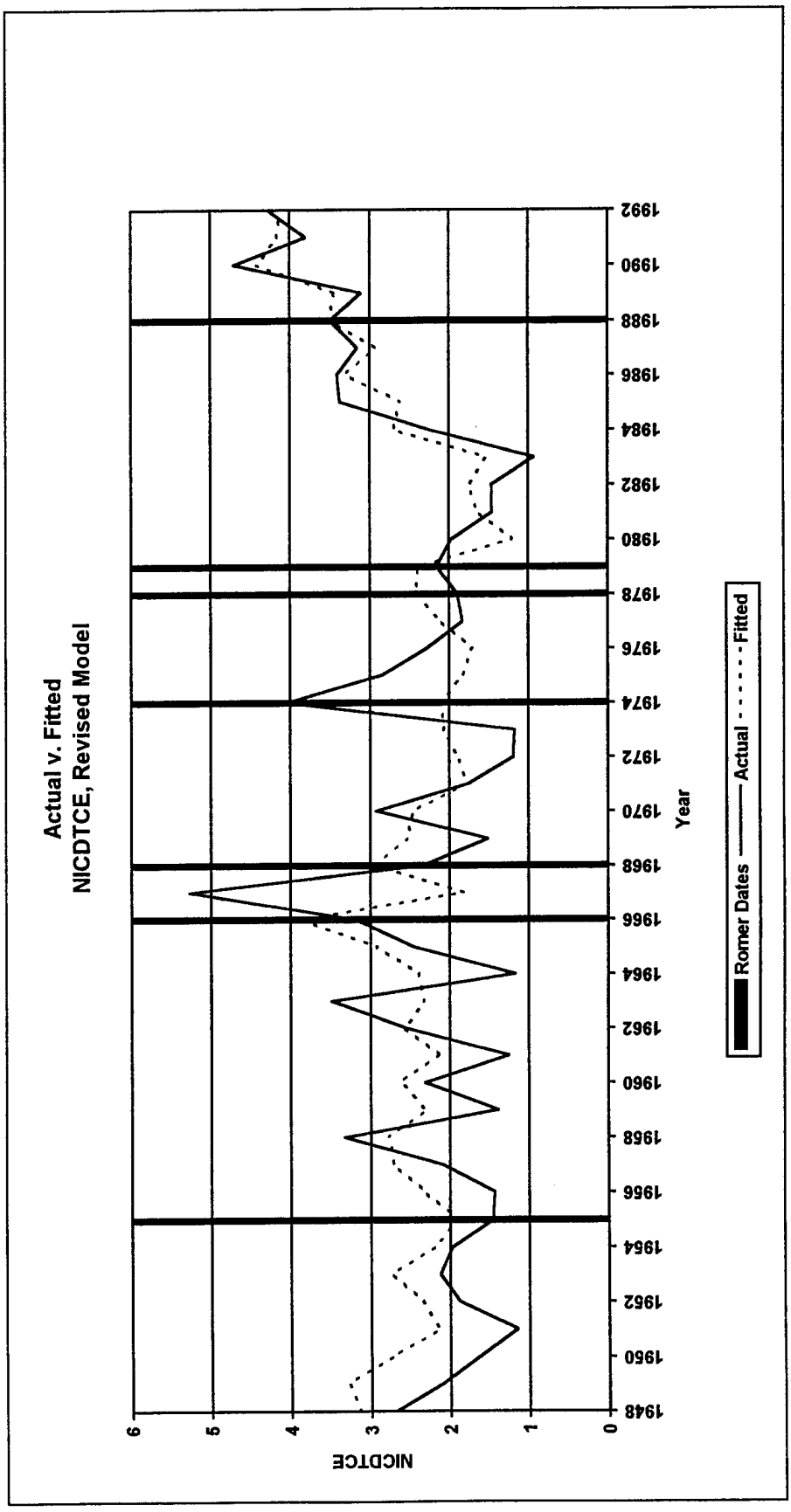

Figure 6: Actual versus Fitted; NICDTCE, Revised Model.

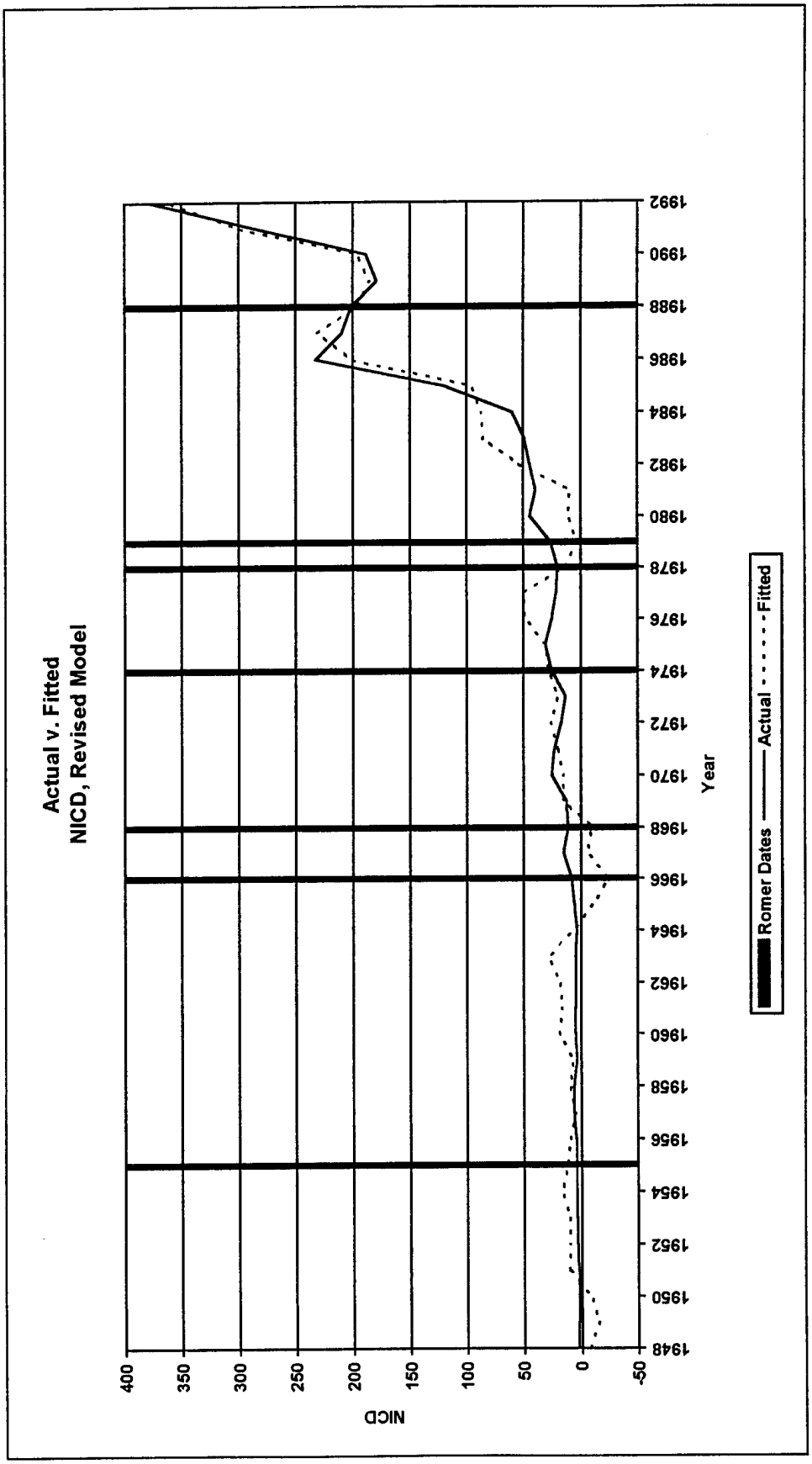

Figure 7: Actual versus Fitted; NICD, Revised Model.

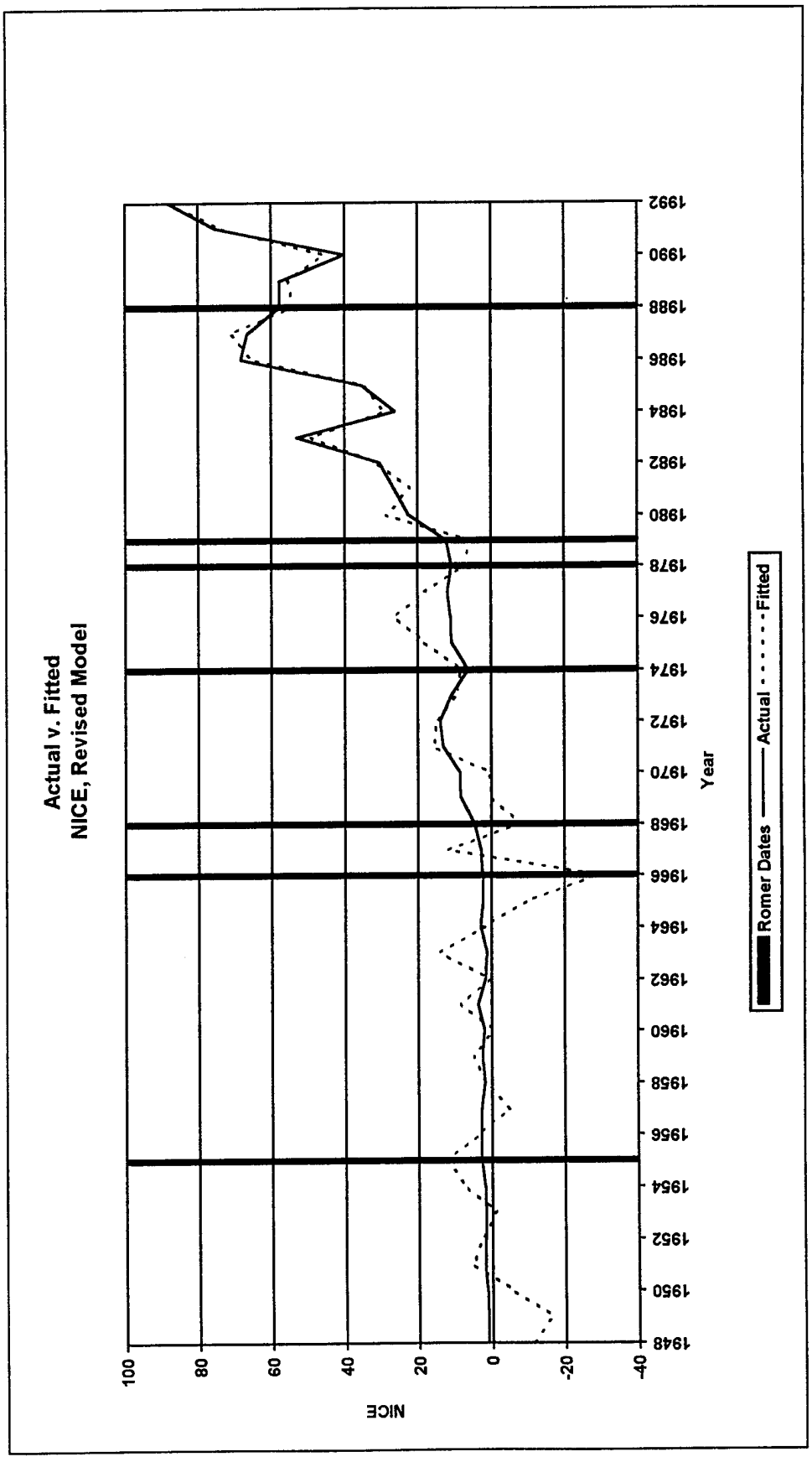

Figure 8: Actual versus Fitted; NICE, Revised Model.

Other Perturbations of the Basic Model

Following the successful modification of the original model by adding the tax dummy, I experimented with other modifications in an attempt to draw out even more information. The other modifications included:

a) using the federal budget surplus squared to capture any second order effects of this important variable;

b) separating the net new issues of long term to short term government debt parameter to identify any independent effects the ratio may not disclose; and

c) eliminating the REGDUMMY because if it only captured the effects of the large deficits, then the budget surplus parameter already directly captures this information.

The following tables provide a summary of the results:

Table 6: FBS Squared; WLS Regression Results.

Dependent Variable:	NICDTC		NICD		NICE	
Independent Variables	Parameter Estimate		Parameter Estimate		Parameter Estimate	
Constant	1.0591	*	30.2402		20.6452	**
STGD	-0.0052	*	0.3840	**	0.1612	**
LTGD	0.0210	**	-0.5169		-0.3411	**
NNILTSTG	-0.0188		-1.9070		0.0404	
FBS	-0.0119	•	1.0748	* °	0.1710	•
FBS^2	2.007E-06	x	0.0024	x	-8.166E-05	x
CNGFBS	0.0021		0.4336	**	0.0854	*
SPRET	-1.7775	*	66.5872		53.0019	**
GPDI	0.0039	•	-0.2102	*	-0.1179	**
REGDUMMY	-1.2162	*	17.1690		13.1405	**
Number of Observations	45		45		45	
Weighting Series	GDP		GDP		GDP	
R-Squared	0.9680		0.9868		0.9871	
D-W Stat	1.9953		2.0613		2.5866	
F-Stat	117.8179		291.9385		296.6426	

* significant at the $\alpha = 05$ level ** significant at the $\alpha = .01$

x = insignificant new parameter.

• = indicates insignificant in modified regression, when previously significant in the original model.

° = indicates significance in modified regression, when previously insignificant in the original model.

Table 7: Separated flow variables, with REGDUMMY, WLS Regression Results.

Dependent Variable:	NICDTC		NICD		NICE	
Independent Variables	Parameter Estimate		Parameter Estimate		Parameter Estimate	
Constant	1.8089		32.4236		20.9151	•
STGD	-0.0031	•	0.3842 *	•	0.1598 **	
LTGD	0.0154	•	-0.4022		-0.3388 **	
NNILTGD	0.0121	x	-0.1362	x	-0.0588	x
NNISTGD	-0.0068	x	-0.0093	x	-0.0221	x
FBS	-0.0134	•	0.1519		0.1686	•
CNGFBS	-0.0003		0.5211 *		0.0829	•
SPRET	-2.5322 *		52.5582		53.0190 **	
GPDI	0.0007	•	-0.3366	•	-0.1161 *	
REGDUMMY	-0.7722	•	3.3408		20.1869 *	
Number of Observations	45		45		45	
Weighting Series	GDP		GDP		GDP	
R-Squared	0.9689		0.9856		0.9871	
D-W Stat	2.0508		1.9926		2.5940	
F-Stat	121.0478		265.5237		297.3750	

* significant at the $\alpha = 05$ level ** significant at the $\alpha = .01$

x = insignificant new parameter.

• = indicates insignificant in modified regression, when previously significant in the original model.

° = indicates significance in modified regression, when previously insignificant in the original model.

Table 8: Separated flow variables, without REGDUMMY, WLS Regression Results.

Dependent Variable:	NICDTC		NICD		NICE	
Independent Variables	Parameter Estimate		Parameter Estimate		Parameter Estimate	
Constant	2.5520		29.2088		1.4896	
STGD	-0.0034	•	0.3766	**	0.1136	**
LTGD	0.0113	•	-0.3841		-0.2296	*
NNILTGD	0.0240	x	0.1876	x	-0.3698	x
NNISTGD	-0.0120	*	0.0132	x	0.1138	x
FBS	-0.0138		0.1541		0.1815	•
CNGFBS	-0.0017	•	0.5273	**	0.1200	* •
SPRET	-3.2630	**	55.7196		72.1214	**
GPDI	0.0028	•	-0.3216	**	-0.0256	•
Number of Observations	45		45		45	
Weighting Series	GDP		GDP		GDP	
R-Squared	0.9676		0.9856		0.9846	
D-W Stat	2.0783		1.9885		2.2664	
F-Stat	134.4786		307.1503		288.2434	

* significant at the $\alpha = 05$ level ** significant at the $\alpha = .01$

x = insignificant new parameter.

• = indicates insignificant in modified regression, when previously significant in the original model.

° = indicates significance in modified regression, when previously insignificant in the original model.

Table 9: Original Model, without REGDUMMY; WLS Regression Results.

Dependent Variable:	NICDTC		NICD		NICE	
Independent Variables	Parameter Estimate		Parameter Estimate		Parameter Estimate	
Constant	1.3879		33.4351		15.1022	
STGD	-0.0052	*	0.3926	**	0.1614	**
LTGD	0.0222	**	-0.4308		-0.3657	**
NNILTSTG	0.0374		-1.2562		-0.9125	
FBS	-0.0099	*	0.1912		0.1804	**
CNGFBS	0.0034		0.5095	**	0.0606	•
SPRET	-2.1207	*	52.6420		59.2881	**
GPDI	0.0019	•	-0.3362	**	-0.0789	**
Number of Observations	45		45		45	
Weighting Series	GDP		GDP		GDP	
R-Squared	0.9628		0.9856		0.9831	
D-W Stat	1.7227		2.0080		1.9612	
F-Stat	136.9545		360.9198		306.8894	

* significant at the $\alpha = 05$ level ** significant at the $\alpha = .01$

x = insignificant new parameter.

• = indicates insignificant in modified regression, when previously significant in the original model.

° = indicates significance in modified regression, when previously insignificant in the original model.

None of these modifications proved fruitful. Adding the square of the federal budget surplus weakened the significance of the federal budget surplus variable in all of the models. Separating the ratio of the net new issues of long term to short term government debt provided weaker results and the separate "flow" variables of government debt had no significance in any of the models. From this information, it appears as though the original specification of the model more closely corresponds to the actual relationships among the data. The important information regarding the government's participation in the financial markets is not its annual contribution to the

pool of financial instruments. Rather, the important information is how much of the economy's capacity for absorbing additions to the pool of long and short term financial instruments has the government already consumed by its existing stock of long and short term instruments. This information will then determine the extent to which new corporate financial instruments can flow into the economy's capacity. Finally, dropping the REGDUMMY caused alpha significance level for the budget surplus and investment parameters to increase (*i.e.* decrease in significance) across all three models and the explanatory power to decrease. This results lends support to the notion that the Reagan dummy does not specifically measure the effects of the increased budget deficits. Rather, it is a broad measure that indicates a significant change in the financial markets since 1980.

Analysis of Fitted Data

From the graphical analysis of the fitted to actual data, the fit seems far more accurate after 1979, than before 1979. In the following charts, I will decompose the actual versus fitted graphs for the revised model of new issues of corporate debt and new issues of corporate equity over the time period from 1980 through 1992. In the graphs, the solid, bold type lines represent the actual data and the dashed, bold type lines represent the fitted data. I identified the $\hat{\beta}_i X_i$ combinations with markers on solid, thin lines.

Since the REGDUMMY and TAXDUMMY coefficients are large and positive in both of these regressions, this graphical analysis will attempt to identify a statistically significant $\beta_i \hat{X}_i$ that is large and consistently negative during the same time period. This finding would provide evidence of a counteracting parameter and variable combination to balance the large positive influence of the REGDUMMY and TAXDUMMY. The empirical analysis immediately identifies the investment $\beta_i \hat{X}_i$ combination as a possibility for both the new issues of corporate debt and equity. Further, in the analysis of corporate equity, the budget surplus combination also appears suspect.

From the analysis of Figure 9, the investment $\beta_i \hat{X}_i$ combination does shift more negative close to the time when the tax law changed. Equally interesting is the graphical representation that short term government debt and long term government debt serve as upper and lower conical bounds to the data actual and fitted data. Their counter balancing effects alone could drive the tighter fit witnessed during the 1980s. asserting this argument implies that fiscal policy and the Treasury's financing decision have increased in importance to the financial markets since 1980. Perhaps the REGDUMMY implies that the combined effects of the policy changes and financial market innovations since 1980 have made the government's financing decision more important to the corporate financing choice.

In Figure 10, both the budget surplus and the investment $\hat{\beta_i X_i}$ combination have large negative influences on new corporate equity issues. Like the decomposition of new corporate debt issues, short term government debt and long term government debt serve as upper and lower conical bounds to the data actual and fitted data. The analysis of these figures leads to the conclusion that the increased size of the debt and how the mix of instruments change to finance that debt drive the better fit more than any one or more particular $\hat{\beta_i X_i}$ combinations. This decomposition analysis also lends support to the notion that the dummy indicators signify an increasing importance of fiscal and debt management policy to the financial markets. The financial market innovations have not caused this increase in importance. Rather, I posit a symbiotic relationship. When the government consumed a greater percent of the economy's capacity to absorb the various financial instruments, market innovations and pressures uncovered new methods to expand its capacity. At the same time, the government recognized its role and carefully monitored its debt and deficit financing choices to remain close to neutral as possible with respect to crowding out or crowding in of certain financial instruments. If anything, the evidence shows that the government has been to wary of the crowding out concern, and it has actually encouraged more new debt issues by the way it has pursued fiscal, tax and debt management policy.

From the graphical decomposition, only the investment $\hat{\beta_i X_i}$ combination meets the criteria for counter balancing the large positive effects of the dummy

variables. In the corporate equity analysis the budget surplus $\hat{\beta_i} X_i$ combination also meets the criteria. By the shape and boundary nature of the government debt $\hat{\beta_i} X_i$ combinations, the fit may simply reflect an increase in importance of government fiscal and debt management policies. The dummy variables may serve to identify the set of financial market innovations that occurred in order to accommodate the large debt and increased importance of government policies. In the next section of this chapter, the analysis turns to elasticity of substitution measures to identify more support for the conclusions reached thus far.

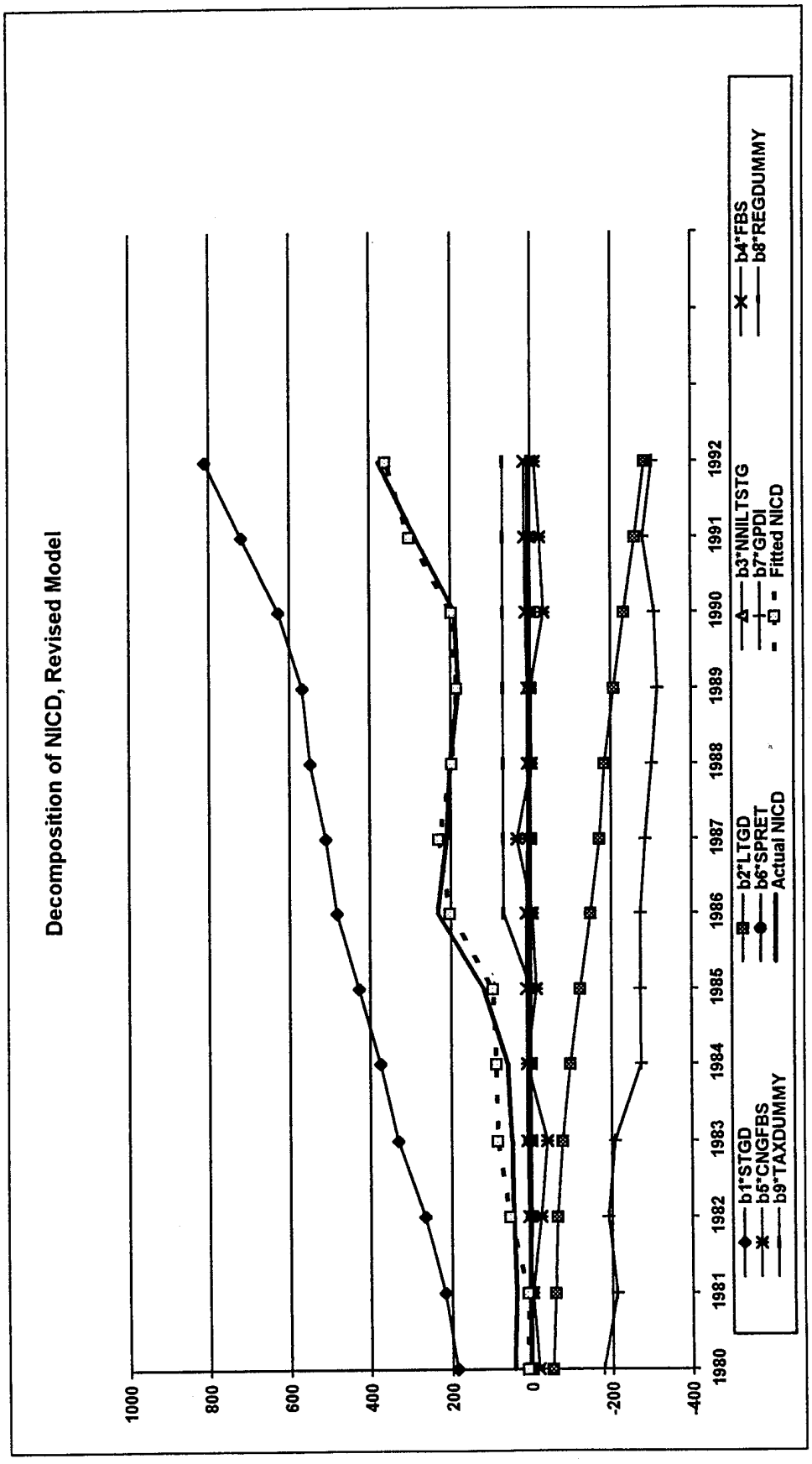

Figure 9: Decomposition of Fit; NICD, Revised Model.

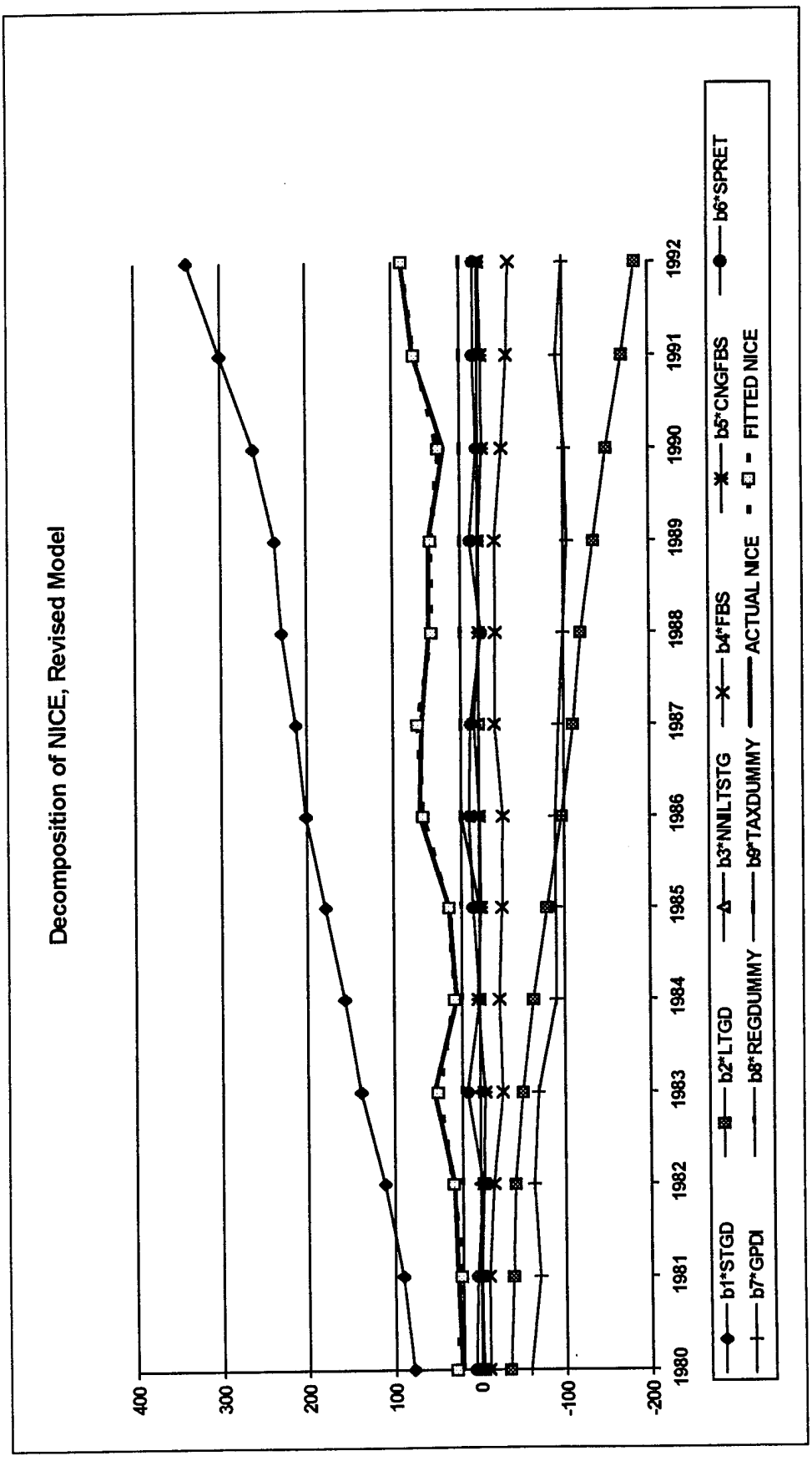

Figure 10: Decomposition of Fit; NICE, Revised Model.

Other Methods of Investigation

From the analysis of the original and revised model, the revised model yields the same information, but produces stronger results. The discussion that follows will focus on the results from the revised model. Both models suggest that when the level of short term government debt changes, then new issues of corporate debt changes more dramatically than new issues of corporate equity. The model of the separate pieces of the ratio suggests that for every one dollar increase in the level of short term government debt, new issues of corporate debt increase by thirty-six cents, while new issues of corporate equity increase by only fifteen cents. This would cause the ratio to increase, not decrease. However, the regression results on the ratio do not reflect this result.

Additionally, the point elasticity measures suggest that new issues of corporate debt adjusts faster to changes in short term government debt than does new issues of corporate equity. The following two tables depict the point elasticity of substitution between the dependent variable and selected independent variables $\left(\frac{\partial Y}{\partial X} \bullet \frac{X}{Y}\right)$. The years displayed represent the Romer dates and the credit crunch of 1966. Because graphical analysis indicated that the model was generally less efficient during these episodes of tight money, the analysis wanted to examine whether the elasticity

measures varied markedly during these episodes, relative to the mean and variance of the elasticity measure.[18]

Table 10: Selected Point Elasticity of Substitution; NICD, Revised Model.

	Dependent Variable			
Romer Dates	STGD	LTGD	FBS	CNGFBS
1955	7.0601	-8.4120	-0.1412	-0.2290
1966	5.2500	-5.4324	-0.0896	-0.1463
1968	4.9573	-3.6281	-0.4558	-0.7896
1974	3.6171	-0.5591	-0.0471	0.1776
1978	8.2241	-1.1769	-0.5619	-0.1378
1979	6.4609	-1.1478	-0.2949	0.3683
1988	2.8975	-0.6358	-0.1495	-0.0138
Mean	5.9516	-4.7910	-0.1971	-0.0803
Variance	6.4814	26.4176	0.0794	0.5521
Min	2.2050	-19.3691	-0.8197	-2.3609
Max	12.7882	-0.4438	0.7733	2.0009

Table 11: Selected Point Elasticity of Substitution; NICE, Revised Model.

	Dependent Variable			
Romer Dates	STGD	LTGD	FBS	CNGFBS
1955	4.2273	-9.8900	-0.2129	-0.0540
1966	6.8666	-13.9516	-0.2951	-0.0753
1968	4.7583	-6.8379	-1.1014	-0.2983
1974	6.0134	-1.8251	-0.1970	-0.1162
1978	6.4047	-1.7997	-1.1017	-0.0422
1979	5.7296	-1.9987	-0.6585	0.1286
1988	4.1501	-1.7882	-0.5392	-0.0078
Mean	5.2546	-8.0077	-0.4455	-0.0306
Variance	4.8703	71.8058	0.3532	0.0549
Min	2.3401	-34.9869	-1.4155	-0.7995
Max	14.4455	-0.8173	2.1396	0.5820

From the tables presenting elasticity measures, short term government debt and long term government debt are the only two variables that show consistent elasticity measures over time. Additionally, the elasticity measures for the tight money episodes

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[18] The full elasticity measures for each year, along with descriptive statistics, are provided in Appendix B.

do not widely differ from the mean of the measures. The separate elasticity of substitution results on new issues of corporate equity and new issues of corporate debt do not support the parameter estimates in the regression on the ratio of new issues of corporate debt to equity. The parameter estimate for long term government debt from the regression on new issues of corporate equity is negative and significant. The results from the regression on new issues of corporate debt indicate a larger, more negative parameter value for long term government debt. These results support a negative parameter value for long term government debt in the regression on the ratio of corporate securities. Actual regression results on the ratio of corporate securities produced a positive parameter value. As the level of long term government debt increased, new issues of corporate equity decreased while new issues of corporate debt decreased faster. This would influence the ratio to decrease, not increase. The elasticity measures support the inverse relationship, and compel a conclusion that the results from the analysis of the ratio are anomalous.

In comparing the results of the three regressions, most of the action in the regression on the ratio of corporate securities seems to come from the equity portion of the ratio. Short term government debt seems to crowd in both corporate debt and equity. Long term government debt seems to crowd out corporate equity, but it crowds out corporate debt to a greater extent This is an extremely important result for policy prescriptions. If the government insists on spending more than it receives in revenue, it can avoid crowding out the demand for all private financial instruments by

financing its deficits with short term debt instruments. Therefore, this study finds support for the notion that the Treasury can influence portfolio crowding in of certain private financial instruments by financing its deficits with shorter term government debt instruments.

Federal Budgets Deficits and Crowding-Out

The traditional crowding out argument which states that running a deficit crowds out private investment implies that debt financing should crowd out private debt issues. This study contributes more conclusive results. A deficit tends to crowd out all corporate financial instruments. However, financing that deficit with short term debt can more than compensate for this effect to cause portfolio crowding in of all corporate financial instruments. Additionally, reducing the budget deficit from one year to the next better enables corporations to use debt instruments to finance their investments. The results for new issues of corporate equity are even more informative. A positive level of budgetary surplus and a positive change in the surplus from one year to the next influences more corporate equity use.

From these results, it seems that an increase in the deficit causes new corporate equity issues to decrease. If new corporate equity issues decrease faster than new corporate debt issues decrease, then it would cause the ratio of the two to increase. Considering the size of the parameter coefficients, the model supports this conjecture, especially when the coefficient on the budget surplus for new issues of corporate debt is not statistically different from zero. Point elasticity of substitution measures further

emphasize this conclusion. Although the range of elasticity measures switches from negative to positive over the years examined, the mean elasticity of the budget surplus with respect to new corporate equity issues is more negative than the elasticity with respect to new corporate debt issues. It is hard to put much emphasis on the elasticity measure for corporate debt since the partial derivative piece of the calculation, the parameter estimate, is statistically insignificant, implying no response.

The normative policy question resulting from this analysis is whether crowding in corporate equity and corporate debt is welfare increasing for the economy. If it is, then is the increase in welfare worth the cost of repeatedly refinancing the outstanding debt by rolling over maturing short term instruments with new short term government debt? The motivation for Taggart's paper, reviewed in the literature section, considered the issue of whether corporations assumed too much debt during the 1980s and that the balance sheets were no longer "healthy." He found that by adjusting the analysis for the types of debt used, and the changing role of debt instruments, balance sheets have become more conservative (Taggart, 1986). By traditional measures of corporate healthiness, increasing the amount of corporate equity relative to debt improves the firm's healthiness rating or measure. To the extent that financing government deficits with short term debt instruments crowds in the use of equity by private firms, is this welfare increasing? Is it possible to crowd in too much use of equity, especially when you incorporate the cost of refinancing (rolling over) the short term debt? To examine this question in more detail, future research should develop a

representative agent, utility maximizing model. Research can then empirically examine the optimal level of short versus long term government debt financing of the deficit that yields the greatest "social" utility, incorporating refinancing costs and some measure of corporate healthiness into the model.

Confounding Investment Implications

The parameter estimate on gross private domestic investment (GPDI) is another extremely intriguing result. Overall, an increase in investment increases the ratio of new corporate debt to equity. The empirical evidence borne out by the data does support the notion that an increase in investment is financed more by debt than by equity. However, an increase in investment decreases both new issues of corporate debt and equity. These results imply that an increase in investment causes new corporate equity issues to fall faster than new corporate debt issues. The signs for the parameter estimates on investment from regressions on the separate pieces of the ratio do not support this notion. The results suggest that when investment increases, new corporate debt issues fall by more that new corporate equity issues fall. The results from the separate regressions imply that the parameter sign on investment in the regression on ratio of the corporate financial instruments should be negative. The results from the elasticity measures provide no better insight to reconcile the disparate results on how corporations finance investment. For further research on this inexplicable result, analysis should, perhaps, employ a less broad category for investment than gross private domestic investment.

What does the REGDUMMY Variable Imply?

Equally interesting is the sign on the REGDUMMY coefficient. The paper makes a logical argument for a positive parameter estimate for the REGDUMMY in the ratio of new issues of corporate debt to corporate equity regression. The empirical results, however, indicate a significant negative coefficient. The Reagan years actually favor new corporate equity issues evidenced by the positive coefficient in the regression on this model. The variable is insignificant for the regression on new corporate debt issues. This suggests that the power of the short term financed deficits, which make equity more attractive, is greater than other implications from financial market innovations which influence more debt issues. Unraveling the various financial market innovations that have occurred since 1980 will prove invaluable to policy makers. Future research should focus on the empirical implications of the financial innovations that have occurred since 1980 and that continue to rapidly change the ground rules of current financial markets.

Summary

In this chapter estimation results identified support for Friedman's pricing theory using a nominal quantity approach to the analysis. Furthermore, using the revised model produced results that not only support Friedman's theory, but also reconciled the theory with the graphical evidence from the 1980s. The empirical results suggest that the Reagan years favored new issues of corporate equity, whereas graphical evidence from the introduction and from Chapter 1 suggests the Reagan

years favored new issues of corporate debt. Including a tax dummy in the revised model produced results to explain the significant shift to debt in the 1980s. The 1986 tax change explained the dramatic shift towards new corporate debt issues, while the financial innovations since 1980 seemed to favor more new corporate equity issues.

The significance of the findings in this study lie in the modeling methodology employed. The analysis examined the government and corporate financing relationship using nominal quantity measures, thereby avoiding the problem of making *a priori* restrictions on prices. Considering the relationships found in this paper, the analysis confirms that the pricing relationship Friedman found must hold, otherwise the quantity results would have been drastically different. Additionally, through the use of dummy variables to identify important policy shifts, the model reconciles the disparate results from the pricing theory with the graphical analysis of the 1980s.

In sum, the modeling results suggest that although running budget deficits discourages the use of equity, financing the deficits with short term versus long term debt more than compensates for the crowding out effects of the deficits on new issues of corporate equity and debt. The results support the notion that budget deficits cause portfolio crowding out of private debt instruments. Financing the deficit with short term debt, however, can fully overcome the crowding out effect. If the government insists on spending more than it receives in revenue, it can avoid crowding out the demand for private financial instruments by financing its deficits with short term debt instruments. This study, therefore, supports the notion that the Treasury can influence

portfolio crowding in of certain private financial instruments by exclusively financing its deficits with short term government debt instruments.

The most important result from the analysis of new issues of corporate debt was that by reducing the budget deficit from one year to the next, then corporations are better able to use debt instruments to finance their investments. Adjusting the mix of long and short term government debt financing can neutralize the crowding out effects resulting from the government's debt and deficits.

Determining the effects on social welfare is the next important question, and the direction in which future research should proceed. If the Treasury can exactly undo the crowding out effects of deficits, could the Treasury increase social welfare by crowding in all corporate financial instruments? If it would increase social utility to crowd in corporate financial instruments, is it worth the expense of the refinancing costs involved in rolling over the short term debt?

Investment and how corporations finance their investment decision continues to elude definitive empirical conclusions. The results that show both new corporate debt issues and new corporate equity issues decreasing as the investment level increases seem perplexing, at best. One possible explanation for the result obtained may lie in the definition of the investment variable employed. Gross private domestic investment includes all investment (*i.e.* housing, plant, equipment, *etc.*). Perhaps an increase in the investment parameter identifies increases in housing purchases, which could serve as a substitute for "investing" in the financial instruments employed in this

model. Subsequent research will decomposing this investment variable into just corporate investment and redress the implications for investment.

The results for the REGDUMMY are equally perturbing. The analysis anticipated a finding that would support Friedman's theory. While supporting the theory, the analysis anticipated that the Reagan Presidency and its legacy caused such a shift in the financial markets that corporations now categorically favor debt instruments. The empirical results, however, show that the years since 1980 actually favor new corporate equity issues. Incorporating the tax dummy into the analysis reconciles the empirical results with the graphical representations. With that conflict ostensibly resolved, future research will review the cornucopia of financial market innovations since 1980 and endeavor to identify the important innovations that favored equity and those which favored debt financing by corporations.

The elasticity of substitution analysis and the analysis of the fit confirm the empirical analysis. Government deficits, by themselves, crowd out all private financial instruments. Financing that deficit and debt with long term government bonds increases the severity of the crowding out effect. In contrast, however, short term financing can more than overcome the crowding out effects of budget deficits. Further, with the proper mix of long and short term instruments, the Treasury can exactly off set the crowding effects of deficits, rendering them portfolio neutral.

Chapter 5: Conclusions and Final Comments

Does debt financing of the deficit make equity financing for firms more attractive? Benjamin M. Friedman (1986) argued that it does. The theory and model employed in this thesis provides evidence that supports the relationship Friedman proposed. Friedman (1986) suggested that regardless of debt maturity, financing government budget deficits by issuing debt instruments (as opposed to printing new money), lowers the expected return on equity relative to the returns on long and short term corporate debt. This implies that during periods of debt financed deficits, financing corporate capital formation should favor equity, including retained earnings, more than debt instruments.

The model in this thesis examined whether the predicted nominal quantity side of the financing story corresponds with the pricing results Friedman found. The thesis supported its conclusions with evidence from three separate estimations: (1) modeling the ratio of new issues of corporate debt to corporate equity; (2) modeling new issues of corporate debt, by itself; and (3) modeling new issues of corporate equity, by itself. Without delving into substitutability and risk measurement issues, the thesis revealed the impact of the link between the government financing decision and the corporate financing decision.

Government deficits, by themselves, crowd out all private financial instruments. Financing that deficit and debt with long term government bonds increases the severity of the crowding out effect. In contrast, however, short term

financing can more than overcome the crowding out effects of budget deficits. Further, with the proper mix of long and short term instruments, the Treasury can exactly off set the crowding effects of deficits, rendering them portfolio neutral.

The information gained from the coefficient estimates and elasticity measures provides even greater insight. Regardless of specific prices, when the government issues more short term debt, then corporations tend to issue more debt versus equity. This finding runs counter to the intuition provided by Friedman's pricing theory. His theory implies that when short term government debt increases, then the return corporations must pay to issue equity lowers, relative to the return on debt. This change in the return structure should influence more new issues of corporate equity than corporate debt.

This study enables researchers to draw some very definite conclusions about quantity relationships in public and private financing that supports the pricing relationship Friedman found. Additionally, the model in this paper can account for the significant increase in corporate debt since the 1980s, where Friedman's theory did not. The graphical depiction of the data suggested that Friedman's model should not only have failed, but that during the episodes of extremely "high" deficits (1980s), new corporate debt actually increased relative to new corporate equity issues. Friedman's model did not fail, but as he recognizes, the financial markets have changed. These changes make his model appear to fail. Adjusting his model by accounting for the changes in the financial markets, as this study has done, reconciles the model with the

graphical analysis and contributes a nominal quantity analysis that supports the implications of the pricing theory initially developed.

In sum, the quantity analysis reviewed in this thesis supports Friedman's pricing story. The federal debt and deficit do have a significant relationship with private sector financing variables, and the government can play a significant role in influencing private financing instruments. The crowding out story holds, somewhat, when the government issues longer term government debt. However, the most interesting result is that the government can actually crowd in both corporate debt and equity by financing the deficit and debt with shorter term debt instruments.

These results are significant on two fronts. First, the analysis avoided the thorny issue of prices and still made the case for the government's role in debt and deficit management. Secondly, in contrast to proponents of the crowding out argument, high deficits have not diminished the corporate sector's ability to pursue either equity or debt financing. The corporate sector and the financial markets have demonstrated their versatility in the way they adjust to the size of government deficits and to the financing mix employed.

Future research on this topic should attempt to address the normative questions of social utility, deficits and crowding in. In additions, future research should attempt to unravel the confounding investment implications and the REGDUMMY indicator. Since the impact of the investment variable seemed so perplexing, future research should attempt to separate and analyze the corporate

investment level from the aggregate investment numbers employed in this study. The model employed does not delve into which structural changes make the period since 1980 favor equity. Future research should review the profusion of financial market innovations since 1980 and identify the important innovations that favored equity and those which favored debt financing by corporations.

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Appendix A: Data Description

Table A-1: Data analyzed and used in model employed in Chapter 4.

Year	NICDTCE	NICD	NICE	STGD	LTGD	NNILTSTG	FBS	CNGFBS	SPRET	GPDI	GDP
1948	2.6808	2.9650	1.1060	47.7200	112.4620	4.5948	11.7960	7.7780	0.0237	48.1000	260.3000
1949	2.0991	2.4370	1.1610	44.5860	110.4250	0.6500	0.5800	-11.2160	-0.0193	36.7000	259.3000
1950	1.6366	2.3600	1.4420	52.3550	102.7950	-0.9821	-3.1190	-3.6990	0.2081	54.2000	287.0000
1951	1.1532	2.3640	2.0500	58.9290	78.8330	-3.6450	6.1020	9.2210	0.2141	60.3000	331.6000
1952	1.8857	3.6450	1.9330	64.6050	75.6600	-0.5590	-1.5190	-7.6210	0.0967	54.0000	349.7000
1953	2.1245	3.8560	1.8150	65.9860	81.2250	4.0297	-6.4930	-4.9740	0.0094	56.3000	370.0000
1954	1.9729	4.0030	2.0290	69.8800	80.3780	-0.2175	-1.1540	5.3390	0.2006	53.8000	370.9000
1955	1.4606	4.1190	2.8200	74.0790	81.0570	0.1617	-2.9930	-1.8390	0.3638	69.0000	404.3000
1956	1.4385	4.2250	2.9370	73.0630	81.8400	-0.7707	3.9470	6.9400	0.1514	72.2000	426.2000
1957	2.0902	6.1180	2.9270	74.8660	80.7890	-0.5829	3.4120	-0.5350	-0.0480	70.6000	448.6000
1958	3.3239	6.3320	1.9050	75.7420	90.9320	11.5788	-2.7690	-6.1810	0.0419	64.5000	454.7000
1959	1.3905	3.5570	2.5580	93.1740	84.8530	-0.3487	-12.8490	-10.0800	0.2409	78.8000	494.2000
1960	2.3184	4.8060	2.0730	102.5480	81.2970	-0.3793	0.3010	13.1500	-0.0267	78.7000	513.3000
1961	1.2553	4.7000	3.7440	106.3180	80.8300	-0.1239	-3.3350	-3.6360	0.1866	77.9000	531.8000
1962	2.5576	4.4400	1.7360	121.0470	75.0250	-0.3941	-7.1450	-3.8100	-0.0587	87.9000	571.6000
1963	3.4808	4.7130	1.3540	121.5440	81.9640	13.9618	-4.7560	2.3890	0.1201	93.4000	603.1000
1964	1.1721	3.6230	3.0910	118.0240	88.4640	-1.8466	-5.9150	-1.1590	0.1646	101.7000	648.0000
1965	2.4516	5.5700	2.2720	106.2140	102.4810	-1.1869	-1.4110	4.5040	0.0836	118.0000	702.7000
1966	3.1906	8.0180	2.5130	107.2300	101.8970	-0.5748	-3.6970	-2.2860	-0.3392	130.4000	769.8000
1967	5.2707	14.9900	2.8440	112.8030	97.4180	-0.8037	-8.6420	-4.9450	0.5779	128.0000	814.3000
1968	2.3415	10.7310	4.5830	135.5130	91.0790	-0.2791	-25.1610	-16.5190	0.0736	139.9000	889.3000
1969	1.5168	12.7350	8.3960	147.3020	78.8050	-1.0411	3.2420	28.4030	-0.0087	155.2000	959.5000
1970	2.9245	25.3850	8.6800	165.6430	62.9560	-0.8641	-2.8420	-6.0840	-0.1494	150.3000	1,010.7000
1971	1.7690	23.2940	13.1680	191.4840	53.9890	-0.3470	-23.0330	-20.1910	0.1811	175.5000	1,097.2000
1972	1.1976	16.8810	14.0960	208.0670	49.1350	-0.2927	-23.3720	-0.3390	0.1110	205.6000	1,207.0000

Year	NICDTCE	NICD	NICE	STGD	LTGD	NNILTSTG	FBS	CNGFBS	SPRET	GPDI	GDP
1973	1.1743	12.8990	10.9840	217.9010	45.0710	-0.4133	-14.9080	8.4640	-0.0162	243.1000	1,349.6000
1974	4.0555	25.3350	6.2470	233.4380	33.1370	-0.7681	-6.1350	8.7730	-0.2288	245.8000	1,458.6000
1975	2.8515	31.0240	10.8800	278.8260	36.7790	0.0802	-53.2420	-47.1070	0.0400	226.0000	1,585.9000
1976	2.2852	25.3860	11.1090	352.9560	39.6260	0.0384	-73.7190	-20.4770	0.1840	286.4000	1,768.4000
1977	1.8342	21.9390	11.9610	397.7830	45.7240	0.1360	-53.6710	20.0480	-0.0373	358.3000	1,974.1000
1978	1.8998	20.4680	10.7740	428.8010	56.3550	0.3427	-59.1680	-5.4970	-0.0222	434.0000	2,232.7000
1979	2.1633	26.4680	12.2350	435.6200	71.0730	2.1584	-40.1620	19.0060	0.0728	480.2000	2,488.6001
1980	1.9730	44.6500	22.6300	510.7350	83.7720	0.1691	-73.8080	-33.6460	0.1531	467.6000	2,708.0000
1981	1.4629	38.9650	26.6360	587.0310	96.1780	0.1626	-78.9370	-5.1290	0.0780	558.0000	3,030.6001
1982	1.4679	44.7710	30.5000	720.7900	103.6310	0.0557	-127.9400	-49.0030	-0.0651	503.4000	3,149.6001
1983	0.9307	49.2670	52.9370	898.2580	125.7420	0.1246	-207.7650	-79.8250	0.3400	546.7000	3,405.0000
1984	2.2697	59.6140	26.2650	1,018.4850	158.0700	0.2689	-185.3240	22.4410	0.0003	718.9000	3,777.2000
1985	3.3718	119.7000	35.5000	1,160.6689	199.5100	0.2915	-212.2590	-26.9350	0.1644	714.5000	4,038.7000
1986	3.4035	232.8000	68.4000	1,307.6140	241.7160	0.2872	-221.1670	-8.9080	0.2649	717.6000	4,268.6001
1987	3.1534	209.7000	66.5000	1,383.3900	277.5900	0.4734	-149.6870	71.4800	0.2136	749.3000	4,539.8999
1988	3.4939	201.6000	57.7000	1,488.0291	299.8750	0.2130	-155.0970	-5.4100	-0.0734	793.6000	4,900.3999
1989	3.1090	179.7000	57.8000	1,539.7900	337.9740	0.7361	-153.3780	1.7190	0.2146	832.3000	5,250.7998
1990	4.7082	188.8000	40.1000	1,700.5350	377.2240	0.2442	-220.3950	-67.0170	0.0364	808.9000	5,546.1001
1991	3.8050	286.9000	75.4000	1,952.3060	423.3540	0.1832	-269.4900	-49.0950	0.1243	736.9000	5,722.8999
1992	4.2775	377.7000	88.3000	2,200.6360	461.8400	0.1550	-290.4000	-20.9100	0.1052	796.5000	6,038.5000

Table A-2: Descriptive Statistics on primary data.

	NICDTCE	NICD	NICE	STGD	LTGD	NNILTSTG	FBS	CNGFBS	SPRET	GPDI	GDP
Mean	2.4087	52.9678	18.1354	474.4959	124.9073	0.5484	-61.2773	-6.5426	0.0877	301.7556	1,866.8733
Standard Error	0.1535	13.0592	3.5120	87.2669	15.5621	0.4404	12.8113	3.7433	0.0234	40.9048	263.3830
Median	2.1633	14.9900	8.3960	165.6430	83.7720	0.0557	-12.8490	-3.8100	0.0836	155.2000	1,010.7000
Standard Deviation	1.0294	87.6036	23.5594	585.4039	104.3934	2.9540	85.9409	25.1110	0.1572	274.3979	1,766.8269
Sample Variance	1.0597	7,674.3949	555.0455	342,697.7320	10,897.9842	8.7264	7,385.8424	630.5617	0.0247	75,294.2232	3,121,677.2637
Kurtosis	0.1798	4.3007	1.4328	1.2841	3.1588	13.1982	0.4543	2.8714	1.9103	-0.9286	-0.1793
Skewness	0.8065	2.1986	1.5817	1.5392	1.9960	3.4571	-1.3149	-0.4000	0.1926	0.8151	1.0614
Range	4.3401	375.3400	87.1940	2,156.0500	428.7030	17.6067	302.1960	151.3050	0.9172	795.6000	5,779.2000
Minimum	0.9307	2.3600	1.1060	44.5860	33.1370	-3.6450	-290.4000	-79.8250	-0.3392	36.7000	259.3000
Maximum	5.2707	377.7000	88.3000	2,200.6360	461.8400	13.9618	11.7960	71.4800	0.5779	832.3000	6,038.5000
Sum	108.3935	2,383.5530	816.0910	21,352.3150	5,620.8300	24.6761	-2,757.4770	-294.4180	3.9476	13,579.0000	84,009.2997
Count	45.0000	45.0000	45.0000	45.0000	45.0000	45.0000	45.0000	45.0000	45.0000	45.0000	45.0000

Appendix B: Regression Results

The following pages contain the full regression results; actual versus fitted data; residual measures; residual plots; and elasticity calculations. Chapter 4 presented summary information on this data in support of the thesis.

LS // Dependent Variable is NICDTCE
Date: 2-12-1995 / Time: 18:51
SMPL range: 1948 - 1992
Number of observations: 45

Table B-1: Regression Results, NICDTCE.

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	0.7563589	0.6975268	1.0843439	0.2856
STGD	-0.0051107	0.0049699	-1.0283388	0.3108
LTGD	0.0135248	0.0074661	1.8115052	0.0787
NNILTSTG	0.0904369	0.0434244	2.0826279	0.0447
FBS	-0.0058854	0.0107342	-0.5482842	0.5870
CNGFBS	0.0023391	0.0102174	0.2289344	0.8203
SPRET	-0.4304598	0.8669091	-0.4965455	0.6226
GPDI	-0.0021809	0.0061161	-0.3565774	0.7235
GDP	0.0016534	0.0017324	0.9544108	0.3464
REGDUMMY	-1.3769930	0.7752396	-1.7762161	0.0844

R-squared	0.470054	Mean of dependent var	2.408744
Adjusted R-squared	0.333783	S.D. of dependent var	1.029427
S.E. of regression	0.840240	Sum of squared resid	24.71014
Log likelihood	-50.36463	F-statistic	3.449389
Durbin-Watson stat	1.890661	Prob(F-statistic)	0.003885

Table B-2: Residual, Actual & Fitted: NICDTCE.

obs	RESIDUAL	ACTUAL	FITTED
1948	-0.03225	2.68083	2.71309
1949	-0.30906	2.09905	2.40812
1950	-0.43008	1.63662	2.06669
1951	-0.34884	1.15317	1.50201
1952	0.07682	1.88567	1.80885
1953	-0.26912	2.12452	2.39364
1954	0.07737	1.97289	1.89552
1955	-0.40277	1.46064	1.86340
1956	-0.45666	1.43854	1.89520
1957	0.08940	2.09019	2.00079
1958	0.08268	3.32388	3.24120
1959	-0.59933	1.39054	1.98987
1960	0.30335	2.31838	2.01503
1961	-0.67989	1.25534	1.93523
1962	0.62901	2.55760	1.92859
1963	0.19902	3.48080	3.28178
1964	-0.82141	1.17211	1.99352
1965	0.07196	2.45158	2.37963
1966	0.50525	3.19061	2.68536
1967	2.98825	5.27075	2.28250
1968	-0.17194	2.34148	2.51342
1969	-0.75753	1.51679	2.27432
1970	0.83125	2.92454	2.09329
1971	-0.14936	1.76899	1.91834
1972	-0.76978	1.19757	1.96736
1973	-0.85642	1.17434	2.03076
1974	2.08275	4.05555	1.97280
1975	0.70014	2.85147	2.15133
1976	0.18714	2.28517	2.09804
1977	-0.38141	1.83421	2.21562
1978	-0.54838	1.89976	2.44814
1979	-0.84017	2.16330	3.00347
1980	0.30807	1.97304	1.66497
1981	-0.44483	1.46287	1.90770
1982	-0.41057	1.46790	1.87847
1983	-0.89726	0.93067	1.82794
1984	0.11272	2.26971	2.15699
1985	0.96463	3.37183	2.40720
1986	0.75217	3.40351	2.65134
1987	0.21841	3.15338	2.93498
1988	0.34092	3.49393	3.15302
1989	-0.71963	3.10900	3.82862
1990	0.36510	4.70823	4.34313
1991	-0.61213	3.80504	4.41717
1992	0.02240	4.27746	4.25507

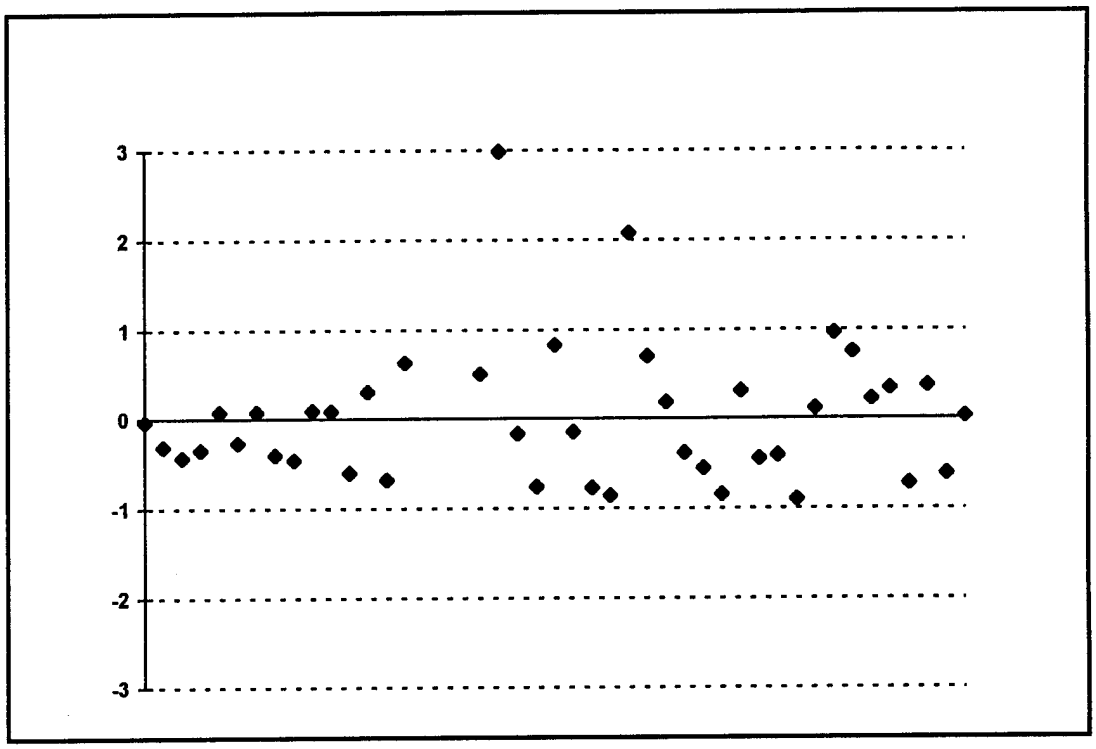

Figure B-1: Residual Plot: NICDTCE.

Augmented Dickey-Fuller Unit Root Test, With a Constant and One Lag Period

McKinnon Critical Values:	1%	-3.5850	*
	5%	-2.9286	**
	10%	-2.6021	***

Table B-3: Unit Root Tests.

Variable	T-Stat	Stable
NICDTCE	-3.1348	**
STGD	3.2266	**
LTGD	0.7881	Unstable
NNITLSTG	-5.7044	*
FBS	0.6237	Unstable
CNGFBS	-4.2950	*
SPRET	-6.4037	*
GPDI	0.8914	Unstable
GDP	3.3098	**

LS // Dependent Variable is NICDTCE
Date: 2-12-1995 / Time: 18:51
SMPL range: 1948 - 1992
Number of observations: 45
Weighting series: GDP

Table B-4: Weighted Least Squares (WLS) Regression Results: NICDTCE.

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	1.0557750	0.3960501	2.6657610	0.0114
STGD	-0.0052318	0.0018935	-2.7629944	0.0090
LTGD	0.0209230	0.0056534	3.7009491	0.0007
NNILTSTG	-0.0194699	0.1207857	-0.1611936	0.8728
FBS	-0.0111607	0.0045565	-2.4494033	0.0193
CNGFBS	0.0019948	0.0031216	0.6390288	0.5268
SPRET	-1.7652860	0.7898686	-2.2349109	0.0317
GPDI	0.0040261	0.0014055	2.8644909	0.0069
REGDUMMY	-1.2045982	0.4975626	-2.4209982	0.0206

Weighted Statistics			
R-squared	0.968043	Mean of dependent var	2.835614
Adjusted R-squared	0.960941	S.D. of dependent var	3.678733
S.E. of regression	0.727042	Sum of squared resid	19.02922
Log likelihood	-44.48678	F-statistic	136.3123
Durbin-Watson stat	1.992532	Prob(F-statistic)	0.000000

Unweighted Statistics			
R-squared	0.246293	Mean of dependent var	2.408744
Adjusted R-squared	0.078802	S.D. of dependent var	1.029427
S.E. of regression	0.988034	Sum of squared resid	35.14361
Durbin-Watson stat	1.867138		

Table B-5: WLS Residual, Actual & Fitted: NICDTCE.

obs	RESIDUAL	ACTUAL	FITTED
1948	-0.42449	2.68083	3.10532
1949	-1.17424	2.09905	3.27329
1950	-1.19337	1.63662	2.82998
1951	-1.12975	1.15317	2.28293
1952	-0.47450	1.88567	2.36017
1953	-0.47969	2.12452	2.60421
1954	-0.28935	1.97289	2.26224
1955	-0.56578	1.46064	2.02642
1956	-0.95555	1.43854	2.39409
1957	-0.60551	2.09019	2.69570
1958	0.78297	3.32388	2.54092
1959	-0.97520	1.39054	2.36574
1960	-0.29605	2.31838	2.61443
1961	-0.95207	1.25534	2.20741
1962	0.02804	2.55760	2.52956
1963	1.39589	3.48080	2.08491
1964	-1.33568	1.17211	2.50779
1965	-0.56811	2.45158	3.01969
1966	-0.60789	3.19061	3.79850
1967	3.16949	5.27075	2.10126
1968	-0.59751	2.34148	2.93899
1969	-1.09814	1.51679	2.61494
1970	0.51283	2.92454	2.41171
1971	-0.02505	1.76899	1.79404
1972	-0.69538	1.19757	1.89296
1973	-0.88311	1.17434	2.05746
1974	2.03330	4.05555	2.02224
1975	1.14687	2.85147	1.70460
1976	0.63740	2.28517	1.64778
1977	-0.24197	1.83421	2.07618
1978	-0.52097	1.89976	2.42073
1979	-0.34941	2.16330	2.51271
1980	0.67547	1.97304	1.29758
1981	-0.30581	1.46287	1.76868
1982	-0.25131	1.46790	1.71921
1983	-0.60996	0.93067	1.54063
1984	-0.56197	2.26971	2.83168
1985	0.52268	3.37183	2.84915
1986	0.46958	3.40351	2.93393
1987	0.28815	3.15338	2.86523
1988	0.11284	3.49393	3.38109
1989	-0.43070	3.10900	3.53970
1990	0.34741	4.70823	4.36082
1991	-0.34357	3.80504	4.14861
1992	0.05893	4.27746	4.21853

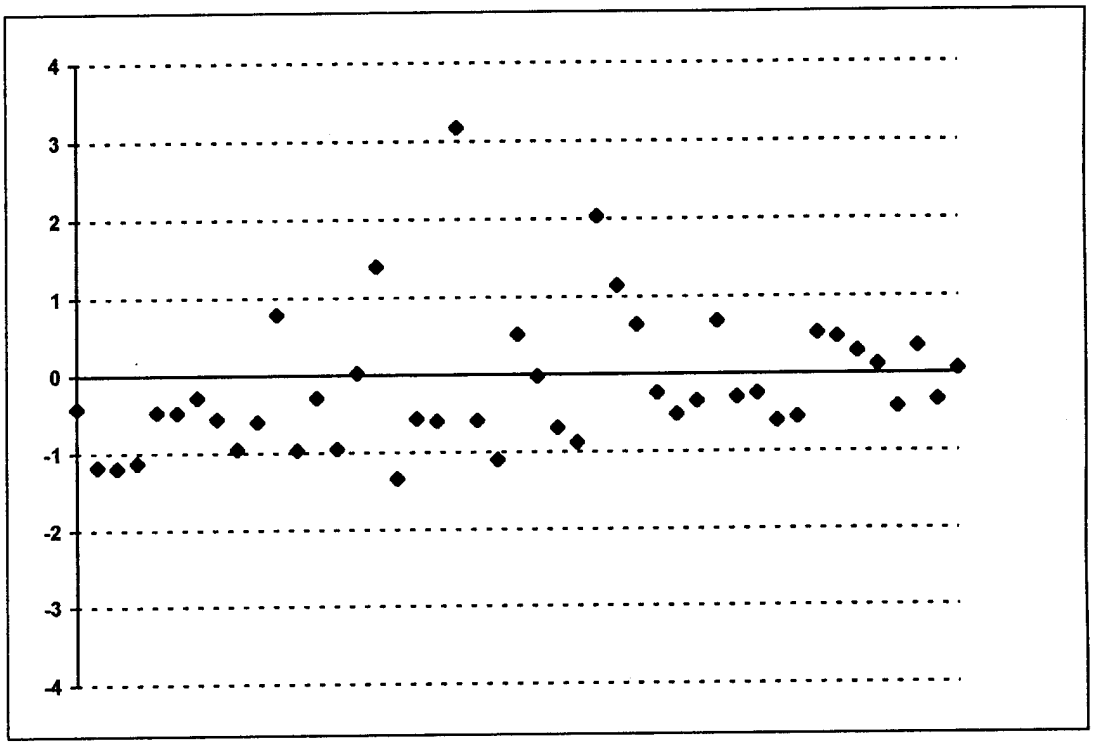

Figure B-2: WLS Residual Plot: NICDTCE.

LS // Dependent Variable is NICD
Date: 2-12-1995 / Time: 18:51
SMPL range: 1948 - 1992
Number of observations: 45
Weighting series: GDP

Table B-6: Weighted Least Squares Regression Results; NICD.

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	34.280870	19.069280	1.7977013	0.0806
STGD	0.3925621	0.0911699	4.3058323	0.0001
LTGD	-0.4274627	0.2722044	-1.5703741	0.1251
NNILTSTG	-1.1112879	5.8156698	-0.1910851	0.8495
FBS	0.1943750	0.2193894	0.8859819	0.3815
CNGFBS	0.5129631	0.1503030	3.4128592	0.0016
SPRET	51.736794	38.031110	1.3603809	0.1822
GPDI	-0.3415760	0.0676733	-5.0474247	0.0000
REGDUMMY	3.0678196	23.956970	0.1280554	0.8988

Weighted Statistics			
R-squared	0.985573	Mean of dependent var	125.6161
Adjusted R-squared	0.982367	S.D. of dependent var	263.6196
S.E. of regression	35.00607	Sum of squared resid	44115.30
Log likelihood	-218.8300	F-statistic	307.4115
Durbin-Watson stat	2.015448	Prob(F-statistic)	0.000000

Unweighted Statistics			
R-squared	0.953813	Mean of dependent var	52.96784
Adjusted R-squared	0.943549	S.D. of dependent var	87.60362
S.E. of regression	20.81407	Sum of squared resid	15596.12
Durbin-Watson stat	1.732710		

Table B-7: WLS Residual, Actual & Fitted; NICD.

obs	RESIDUAL	ACTUAL	FITTED
1948	12.0499	2.96500	-9.08485
1949	17.7541	2.43700	-15.3171
1950	0.62469	2.36000	1.73531
1951	-21.8001	2.36400	24.1641
1952	-6.62941	3.64500	10.2744
1953	5.42892	3.85600	-1.57292
1954	-18.1075	4.00300	22.1105
1955	-18.1398	4.11900	22.2588
1956	-12.1086	4.22500	16.3336
1957	2.54641	6.11800	3.57159
1958	17.6272	6.33200	-11.2952
1959	-9.29639	3.55700	12.8534
1960	-13.9439	4.80600	18.7499
1961	-17.4336	4.70000	22.1336
1962	-9.32229	4.44000	13.7623
1963	-1.33923	4.71300	6.05223
1964	-13.2596	3.62300	16.8826
1965	6.02764	5.57000	-0.45764
1966	38.5446	8.01800	-30.5266
1967	-4.78558	14.9900	19.7756
1968	19.2163	10.7310	-8.48527
1969	-8.57833	12.7350	21.3133
1970	14.7731	25.3850	10.6119
1971	1.94847	23.2940	21.3455
1972	-9.19883	16.8810	26.0798
1973	-5.68289	12.8990	18.5819
1974	5.21549	25.3350	20.1195
1975	12.7397	31.0240	18.2843
1976	-17.3278	25.3860	42.7138
1977	-24.3325	21.9390	46.2715
1978	6.03970	20.4680	14.4283
1979	12.2745	26.4680	14.1935
1980	26.2094	44.6500	18.4406
1981	16.9994	38.9650	21.9656
1982	-5.84815	44.7710	50.6191
1983	-36.3340	49.2670	85.6010
1984	-39.6317	59.6140	99.2457
1985	2.94850	119.700	116.751
1986	64.7423	232.800	168.058
1987	-14.2107	209.700	223.911
1988	16.3214	201.600	185.279
1989	-14.7029	179.700	194.403
1990	-2.95946	188.800	191.759
1991	-12.8360	286.900	299.736
1992	7.85361	377.700	369.846

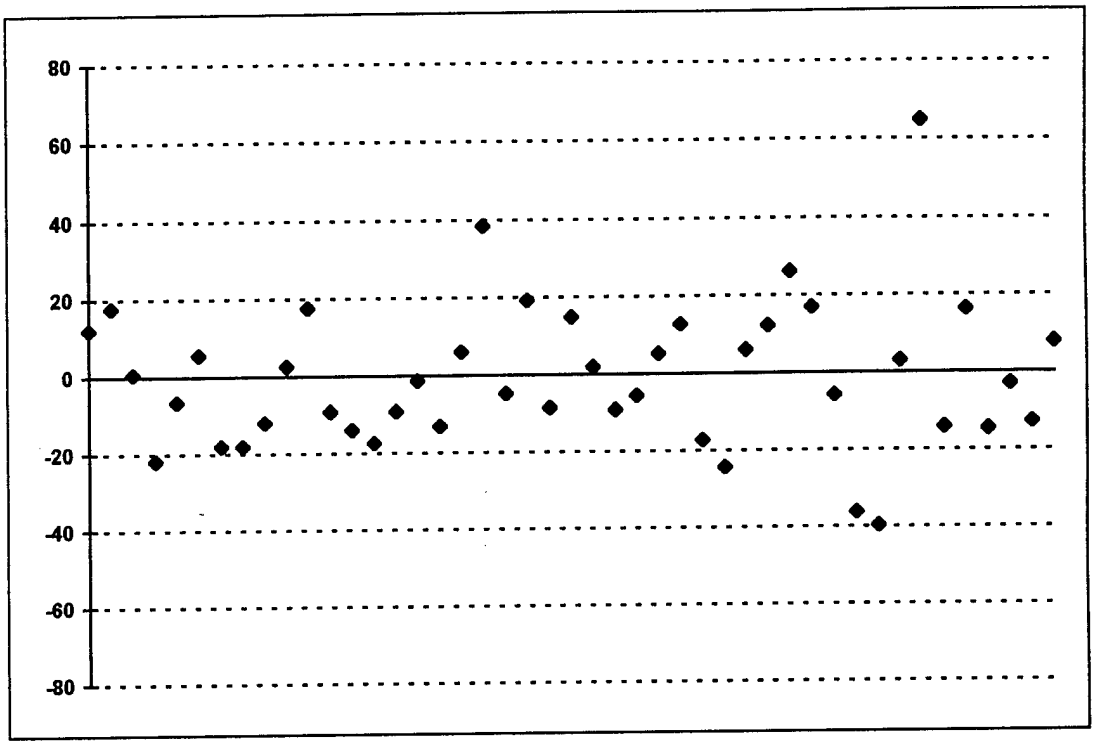

Figure B-3: WLS Residual Plot: NICD.

LS // Dependent Variable is NICE
Date: 2-12-1995 / Time: 18:50
SMPL range: 1948 - 1992
Number of observations: 45
Weighting series: GDP

Table B-8: Weighted Least Squares Regression Results; NICE.

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	20.509494	4.7013151	4.3625015	0.0001
STGD	0.1609230	0.0224769	7.1594854	0.0000
LTGD	-0.3440766	0.0671089	-5.1271385	0.0000
NNILTSTG	0.0136771	1.4337875	0.0095392	0.9924
FBS	0.200610	0.0540880	3.7089632	0.0007
CNGFBS	0.0827584	0.0370555	2.2333639	0.0318
SPRET	53.500490	9.3761394	5.7060255	0.0000
GPDI	-0.1135359	0.0166841	-6.8050385	0.0000
REGDUMMY	19.613940	5.9063197	3.3208396	0.0021

Weighted Statistics			
R-squared	0.987039	Mean of dependent var	38.58834
Adjusted R-squared	0.984158	S.D. of dependent var	68.56896
S.E. of regression	8.630350	Sum of squared resid	2681.386
Log likelihood	-155.8193	F-statistic	342.6850
Durbin-Watson stat	2.571774	Prob(F-statistic)	0.000000

Unweighted Statistics			
R-squared	0.859447	Mean of dependent var	18.13536
Adjusted R-squared	0.828213	S.D. of dependent var	23.55940
S.E. of regression	9.764707	Sum of squared resid	3432.582
Durbin-Watson stat	2.021891		

Table B-9: WLS Residual, Actual & Fitted; NICE.

obs	RESIDUAL	ACTUAL	FITTED
1948	12.7313	1.10600	-11.6253
1949	17.4745	1.16100	-16.3135
1950	3.83995	1.44200	-2.39795
1951	-7.36519	2.05000	9.41519
1952	-1.03891	1.93300	2.97191
1953	6.18337	1.81500	-4.36837
1954	-6.89913	2.02900	8.92813
1955	-12.5976	2.82000	15.4176
1956	-2.42883	2.93700	5.36583
1957	8.12145	2.92700	-5.19445
1958	6.48392	1.90500	-4.57892
1959	-4.27533	2.55800	6.83333
1960	2.25193	2.07300	-0.17893
1961	-6.22836	3.74400	9.97236
1962	2.43591	1.73600	-0.69991
1963	-5.76697	1.35400	7.12097
1964	-1.92422	3.09100	5.01522
1965	8.78436	2.27200	-6.51236
1966	33.7009	2.51300	-31.1879
1967	-16.5317	2.84400	19.3757
1968	11.9667	4.58300	-7.38369
1969	6.39739	8.39600	1.99861
1970	9.32078	8.68000	-0.64077
1971	-3.04560	13.1680	16.2136
1972	-0.86481	14.0960	14.9608
1973	1.68073	10.9840	9.30327
1974	0.23688	6.24700	6.01012
1975	-3.74425	10.8800	14.6242
1976	-13.4072	11.1090	24.5162
1977	-5.04431	11.9610	17.0053
1978	3.43320	10.7740	7.34080
1979	3.15850	12.2350	9.07650
1980	-8.37075	22.6300	31.0008
1981	0.57385	26.6360	26.0622
1982	0.40109	30.5000	30.0989
1983	3.69287	52.9370	49.2441
1984	-6.44660	26.2650	32.7116
1985	-5.62282	35.5000	41.1228
1986	13.4212	68.4000	54.9788
1987	-2.98083	66.5000	69.4808
1988	6.88381	57.7000	50.8162
1989	-0.19286	57.8000	57.9929
1990	-4.23633	40.1000	44.3363
1991	1.90920	75.4000	73.4908
1992	-2.25740	88.3000	90.5574

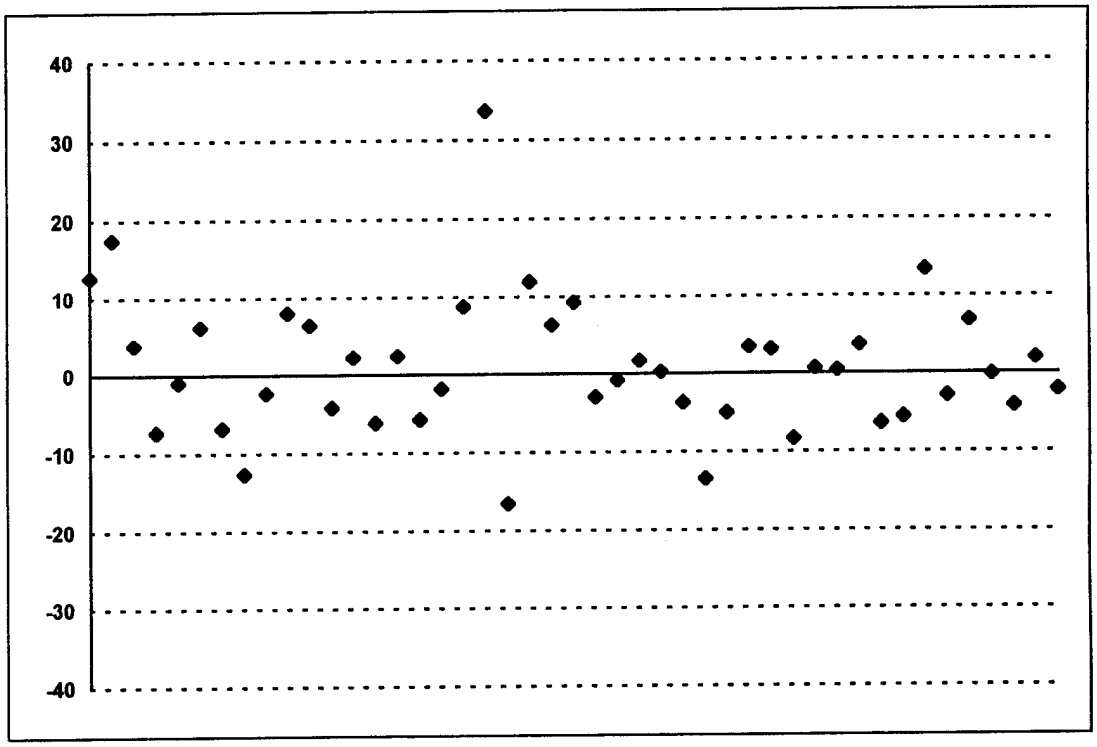

Figure B-4: WLS Residual Plot, NICE.

LS // Dependent Variable is NICDTCE
Date: 3-10-1995 / Time: 11:16
SMPL range: 1948 - 1992
Number of observations: 45
Weighting series: GDP

Table B-10: Regression Results; NICDTCE; Revised Model.

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	1.2854148	0.4090813	3.1421993	0.0034
STGD	-0.0054851	0.0018519	-2.9619431	0.0055
LTGD	0.0188964	0.0056389	3.3511068	0.0019
NNILTSTG	0.0009267	0.1183562	0.0078301	0.9938
FBS	-0.0138172	0.0047093	-2.9340535	0.0059
CNGFBS	0.0017060	0.0030478	0.5597296	0.5792
SPRET	-2.1575786	0.8038972	-2.6838988	0.0110
GPDI	0.0036020	0.0013927	2.5863309	0.0140
REGDUMMY	-1.1688528	0.4854938	-2.4075543	0.0215
TAXDUMMY	0.7302255	0.4300428	1.6980298	0.0984
		Weighted	Statistics	
R-squared	0.970475		Mean of dependent var	2.835614
Adjusted R-squared	0.962883		S.D. of dependent var	3.678733
S.E. of regression	0.708739		Sum of squared resid	17.58090
Log likelihood	-42.70562		F-statistic	127.8256
Durbin-Watson stat	2.173105		Prob(F-statistic)	0.000000
		Unweighted	Statistics	
R-squared	0.275784		Mean of dependent var	2.408744
Adjusted R-squared	0.089557		S.D. of dependent var	1.029427
S.E. of regression	0.982250		Sum of squared resid	33.76850
Durbin-Watson stat	1.936489			

Table B-11: Residual, Actual & Fitted; NICDTCE; Revised Model.

obs	RESIDUAL	ACTUAL	FITTED
1948	-0.44455	2.68083	3.12539
1949	-1.17576	2.09905	3.27482
1950	-1.08610	1.63662	2.72272
1951	-0.98191	1.15317	2.13508
1952	-0.46845	1.88567	2.35412
1953	-0.60132	2.12452	2.72584
1954	-0.23398	1.97289	2.20687
1955	-0.45220	1.46064	1.91284
1956	-0.88260	1.43854	2.32114
1957	-0.62056	2.09019	2.71076
1958	0.55529	3.32388	2.76860
1959	-0.91128	1.39054	2.30182
1960	-0.29970	2.31838	2.61808
1961	-0.89212	1.25534	2.14746
1962	-0.01668	2.55760	2.57428
1963	1.15315	3.48080	2.32765
1964	-1.22682	1.17211	2.39893
1965	-0.45856	2.45158	2.91015
1966	-0.68039	3.19061	3.87100
1967	3.43886	5.27075	1.83189
1968	-0.58594	2.34148	2.92742
1969	-1.03031	1.51679	2.54710
1970	0.46618	2.92454	2.45836
1971	-0.01124	1.76899	1.78023
1972	-0.69821	1.19757	1.89579
1973	-0.89820	1.17434	2.07254
1974	1.94635	4.05555	2.10920
1975	1.01724	2.85147	1.83423
1976	0.56858	2.28517	1.71660
1977	-0.28043	1.83421	2.11464
1978	-0.51818	1.89976	2.41794
1979	-0.23767	2.16330	2.40097
1980	0.75837	1.97304	1.21467
1981	-0.17480	1.46287	1.63767
1982	-0.29130	1.46790	1.75920
1983	-0.60524	0.93067	1.53592
1984	-0.43529	2.26971	2.70500
1985	0.74559	3.37183	2.62624
1986	0.10741	3.40351	3.29610
1987	0.22051	3.15338	2.93287
1988	-0.00819	3.49393	3.50212
1989	-0.33606	3.10900	3.44506
1990	0.29462	4.70823	4.41361
1991	-0.35913	3.80504	4.16417
1992	0.15522	4.27746	4.12225

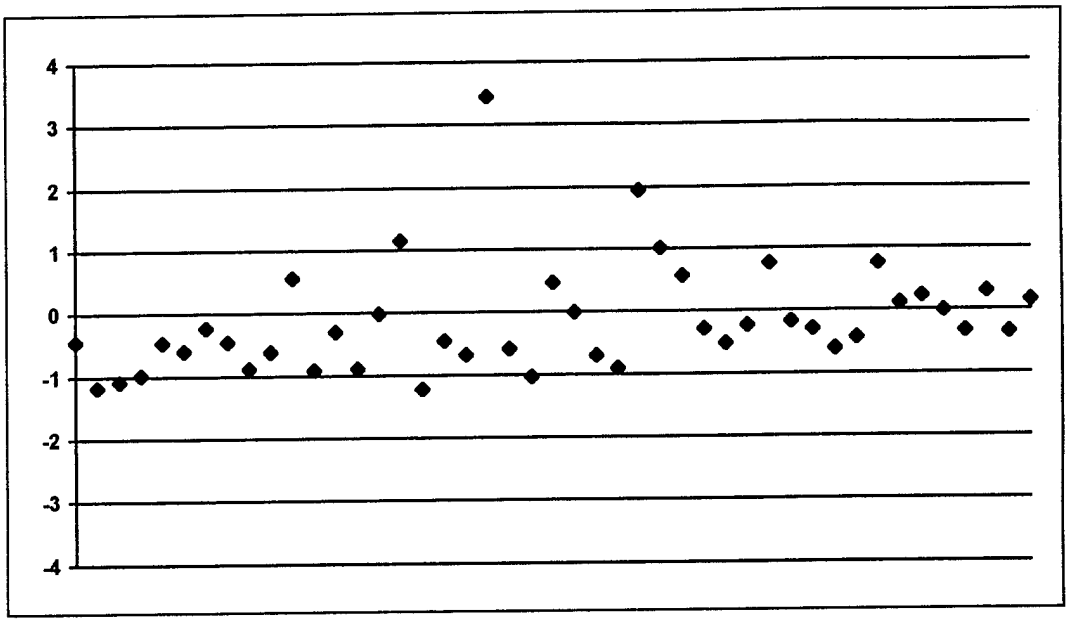

Figure B-5: Residual Plot; NICDTCE Revised Model.

LS // Dependent Variable is NICD
Date: 3-10-1995 / Time: 11:16
SMPL range: 1948 - 1992
Number of observations: 45
Weighting series: GDP

Table B-12: Regression Results; NICD; Revised Model.

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	55.817273	17.281995	3.2297934	0.0027
STGD	0.3688013	0.0782336	4.7141058	0.0000
LTGD	-0.6175245	0.2382183	-2.5922633	0.0138
NNILTSTG	0.8015761	5.0000628	0.1603132	0.8736
FBS	-0.0547615	0.1989467	-0.2752570	0.7847
CNGFBS	0.4858719	0.1287576	3.7735403	0.0006
SPRET	14.946261	33.961338	0.4400964	0.6626
GPDI	-0.3813473	0.0588359	-6.4815380	0.0000
REGDUMMY	6.4201525	20.510111	0.3130238	0.7561
TAXDUMMY	68.483030	18.167534	3.7695280	0.0006
		Weighted	Statistics	
R-squared	0.989739		Mean of dependent var	125.6161
Adjusted R-squared	0.987100		S.D. of dependent var	263.6196
S.E. of regression	29.94131		Sum of squared resid	31376.88
Log likelihood	-211.1634		F-statistic	375.0978
Durbin-Watson stat	1.635473		Prob(F-statistic)	0.000000
		Unweighted	Statistics	
R-squared	0.961353		Mean of dependent var	52.96784
Adjusted R-squared	0.951416		S.D. of dependent var	87.60362
S.E. of regression	19.30949		Sum of squared resid	13049.97
Durbin-Watson stat	1.114425			

Table B-13: Residual, Actual &Fitted; NICD; Revised Model.

obs	RESIDUAL	ACTUAL	FITTED
1948	10.1685	2.96500	-7.2034
1949	17.6110	2.43700	-15.174
1950	10.6843	2.36000	-8.3243
1951	-7.93461	2.36400	10.2986
1952	-6.06139	3.64500	9.70639
1953	-5.97796	3.85600	9.83396
1954	-12.9149	4.00300	16.9179
1955	-7.48789	4.11900	11.6069
1956	-5.26737	4.22500	9.49237
1957	1.13454	6.11800	4.98346
1958	-3.72551	6.33200	10.0575
1959	-3.30130	3.55700	6.85830
1960	-14.2863	4.80600	19.0923
1961	-11.8113	4.70000	16.5113
1962	-13.5162	4.44000	17.9562
1963	-24.1045	4.71300	28.8175
1964	-3.05060	3.62300	6.67359
1965	16.3011	5.57000	-10.731
1966	31.7450	8.01800	-23.727
1967	20.4771	14.9900	-5.4870
1968	20.3017	10.7310	-9.5706
1969	-2.21621	12.7350	14.9512
1970	10.3982	25.3850	14.9868
1971	3.24369	23.2940	20.0503
1972	-9.46412	16.8810	26.3451
1973	-7.09773	12.8990	19.9967
1974	-2.93953	25.3350	28.2745
1975	0.58269	31.0240	30.4413
1976	-23.7820	25.3860	49.1680
1977	-27.9394	21.9390	49.8784
1978	6.30150	20.4680	14.1665
1979	22.7539	26.4680	3.71413
1980	33.9843	44.6500	10.6657
1981	29.2864	38.9650	9.67858
1982	-9.59795	44.7710	54.3689
1983	-35.8920	49.2670	85.1590
1984	-27.7515	59.6140	87.3655
1985	23.8539	119.700	95.8461
1986	30.7770	232.800	202.023
1987	-20.5540	209.700	230.254
1988	4.97084	201.600	196.629
1989	-5.82688	179.700	185.527
1990	-7.91016	188.800	196.710
1991	-14.2955	286.900	301.196
1992	16.8838	377.700	360.816

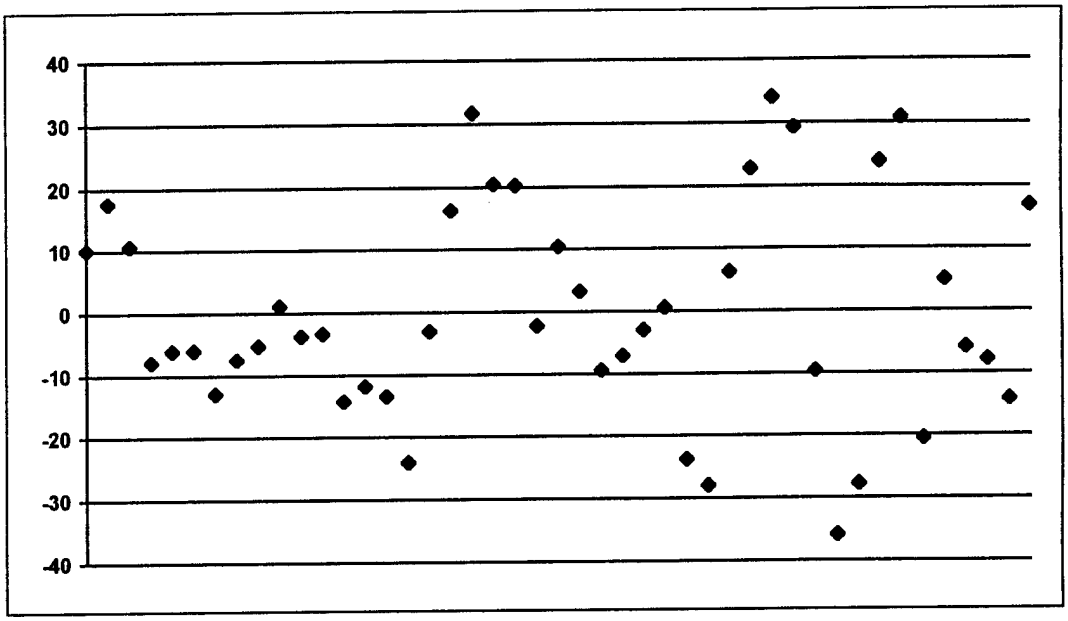

Figure B-6: Residual Plot; NICD; Revised Model.

LS // Dependent Variable is NICE
Date: 3-10-1995 / Time: 11:16
SMPL range: 1948 - 1992
Number of observations: 45
Weighting series: GDP

Table B-14: Revised Regression Results; NICE.

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	26.921452	3.8438661	7.0037433	0.0000
STGD	0.1538488	0.0174007	8.8415130	0.0000
LTGD	-0.4006631	0.0529846	-7.5618811	0.0000
NNILTSTG	0.5831874	1.1121154	0.5243947	0.6033
FBS	0.1264357	0.0442498	2.8573181	0.0071
CNGFBS	0.0746927	0.0286383	2.6081397	0.0133
SPRET	42.546973	7.5536903	5.6326076	0.0000
GPDI	-0.1253769	0.0130863	-9.5807692	0.0000
REGDUMMY	20.612019	4.5618647	4.5183319	0.0001
TAXDUMMY	20.389213	4.0408281	5.0458007	0.0000
		Weighted	Statistics	
R-squared	0.992497		Mean of dependent var	38.58834
Adjusted R-squared	0.990567		S.D. of dependent var	68.56896
S.E. of regression	6.659555		Sum of squared resid	1552.239
Log likelihood	-143.5200		F-statistic	514.4035
Durbin-Watson stat	2.363172		Prob(F-statistic)	0.000000
		Unweighted	Statistics	
R-squared	0.879026		Mean of dependent var	18.13536
Adjusted R-squared	0.847919		S.D.of dependent var	23.55940
S.E. of regression	9.187608		Sum of squared resid	2954.425
Durbin-Watson stat	1.589976			

Table B-15: Residual, Actual & Fitted; Revised Regression; NICE.

obs	RESIDUAL	ACTUAL	FITTED
1948	12.1712	1.10600	-11.0652
1949	17.4319	1.16100	-16.2709
1950	6.83497	1.44200	-5.39297
1951	-3.23706	2.05000	5.28706
1952	-0.86979	1.93300	2.80279
1953	2.78724	1.81500	-0.97224
1954	-5.35314	2.02900	7.38214
1955	-9.42622	2.82000	12.2462
1956	-0.39201	2.93700	3.32901
1957	7.70109	2.92700	-4.77409
1958	0.12665	1.90500	1.77835
1959	-2.49044	2.55800	5.04844
1960	2.14998	2.07300	-0.07698
1961	-4.55444	3.74400	8.29844
1962	1.18728	1.73600	0.54872
1963	-12.5448	1.35400	13.8988
1964	1.11526	3.09100	1.97574
1965	11.8430	2.27200	-9.57103
1966	31.6765	2.51300	-29.1635
1967	-9.01033	2.84400	11.8543
1968	12.2899	4.58300	-7.70685
1969	8.29156	8.39600	0.10444
1970	8.01827	8.68000	0.66173
1971	-2.65998	13.1680	15.8280
1972	-0.94379	14.0960	15.0398
1973	1.25950	10.9840	9.72450
1974	-2.19109	6.24700	8.43809
1975	-7.36371	10.8800	18.2437
1976	-15.3288	11.1090	26.4378
1977	-6.11817	11.9610	18.0792
1978	3.51115	10.7740	7.26285
1979	6.27850	12.2350	5.95650
1980	-6.05597	22.6300	28.6860
1981	4.23201	26.6360	22.4040
1982	-0.71532	30.5000	31.2153
1983	3.82448	52.9370	49.1125
1984	-2.90957	26.2650	29.1746
1985	0.60127	35.5000	34.8987
1986	3.30881	68.4000	65.0912
1987	-4.86937	66.5000	71.3694
1988	3.50445	57.7000	54.1956
1989	2.44976	57.8000	55.3502
1990	-5.71028	40.1000	45.8103
1991	1.47466	75.4000	73.9253
1992	0.43112	88.3000	87.8689

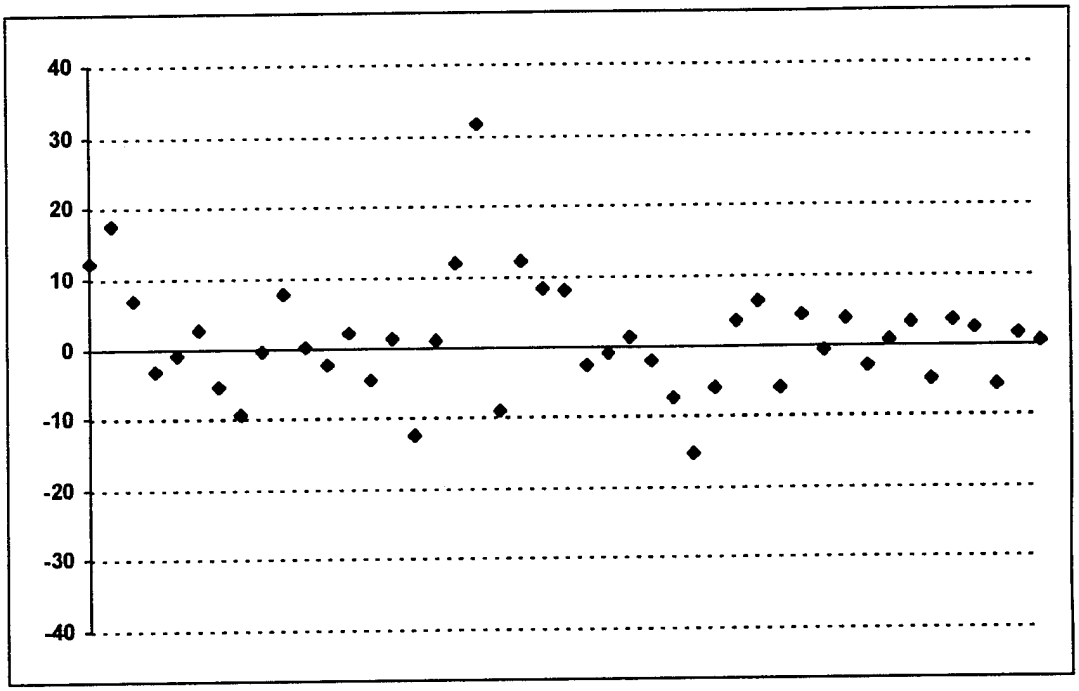

Figure B-7: Residual Plot; NICE Revised Model.

Table B-16: Elasticity of Substitution Measures, NICD; Revised Model.

Dependent Variable: NICD	STGD Point Elasticity of Substitution	LTGD Point Elasticity of Substitution	NNILTSTG Point Elasticity of Substitution	FBS Point Elasticity of Substitution	CNGFBS Point Elasticity of Substitution	SPRET Point Elasticity of Substitution	GPDI Point Elasticity of Substitution	REGDUMMY Point Elasticity of Substitution	TAXDUMMY Point Elasticity of Substitution
1948	5.9356	-23.4226	1.2422	-0.2179	1.2746	0.1196	-6.1864	0.0000	0.0000
1949	6.7474	-27.9812	0.2138	-0.0130	-2.2362	-0.1185	-5.7429	0.0000	0.0000
1950	8.1816	-26.8976	-0.3336	0.0724	-0.7615	1.3182	-8.7581	0.0000	0.0000
1951	9.1934	-20.5928	-1.2359	-0.1414	1.8952	1.3538	-9.7273	0.0000	0.0000
1952	6.5367	-12.8181	-0.1229	0.0228	-1.0159	0.3965	-5.6496	0.0000	0.0000
1953	6.3111	-13.0079	0.8377	0.0922	-0.6267	0.0364	-5.5679	0.0000	0.0000
1954	6.4381	-12.3995	-0.0436	0.0158	0.6480	0.7489	-5.1253	0.0000	0.0000
1955	6.6328	-12.1521	0.0315	0.0398	-0.2169	1.3199	-6.3882	0.0000	0.0000
1956	6.3777	-11.9617	-0.1462	-0.0512	0.7981	0.5356	-6.5168	0.0000	0.0000
1957	4.5130	-8.1545	-0.0764	-0.0305	-0.0425	-0.1174	-4.4006	0.0000	0.0000
1958	4.4115	-8.8681	1.4658	0.0239	-0.4743	0.0989	-3.8845	0.0000	0.0000
1959	9.6606	-14.7312	-0.0786	0.1978	-1.3769	1.0123	-8.4482	0.0000	0.0000
1960	7.8693	-10.4459	-0.0633	-0.0034	1.3294	-0.0829	-6.2447	0.0000	0.0000
1961	8.3426	-10.6201	-0.0211	0.0389	-0.3759	0.5933	-6.3206	0.0000	0.0000
1962	10.0546	-10.4346	-0.0712	0.0881	-0.4169	-0.1976	-7.5496	0.0000	0.0000
1963	9.5111	-10.7394	2.3746	0.0553	0.2463	0.3808	-7.5574	0.0000	0.0000
1964	12.0142	-15.0783	-0.4086	0.0894	-0.1554	0.6790	-10.7047	0.0000	0.0000
1965	7.0326	-11.3617	-0.1708	0.0139	0.3929	0.2242	-8.0788	0.0000	0.0000
1966	4.9322	-7.8478	-0.0575	0.0252	-0.1385	-0.6324	-6.2020	0.0000	0.0000
1967	2.7753	-4.0132	-0.0430	0.0316	-0.1603	0.5762	-3.2563	0.0000	0.0000
1968	4.6573	-5.2412	-0.0209	0.1284	-0.7479	0.1026	-4.9716	0.0000	0.0000
1969	4.2658	-3.8213	-0.0655	-0.0139	1.0836	-0.0102	-4.6474	0.0000	0.0000
1970	2.4065	-1.5315	-0.0273	0.0061	-0.1164	-0.0880	-2.2579	0.0000	0.0000
1971	3.0317	-1.4312	-0.0119	0.0541	-0.4211	0.1162	-2.8731	0.0000	0.0000

Dependent Variable: NICD	STGD Point Elasticity of Substitution	LTGD Point Elasticity of Substitution	NNILTSTG Point Elasticity of Substitution	FBS Point Elasticity of Substitution	CNGFBS Point Elasticity of Substitution	SPRET Point Elasticity of Substitution	GPDI Point Elasticity of Substitution	REGDUMMY Point Elasticity of Substitution	TAXDUMMY Point Elasticity of Substitution
1972	4.5457	-1.7974	-0.0139	0.0758	-0.0098	0.0983	-4.6446	0.0000	0.0000
1973	6.2301	-2.1577	-0.0257	0.0633	0.3188	-0.0188	-7.1870	0.0000	0.0000
1974	3.3982	-0.8077	-0.0243	0.0133	0.1682	-0.1350	-3.6998	0.0000	0.0000
1975	3.3146	-0.7321	0.0021	0.0940	-0.7378	0.0192	-2.7780	0.0000	0.0000
1976	5.1277	-0.9639	0.0012	0.1590	-0.3919	0.1083	-4.3023	0.0000	0.0000
1977	6.6869	-1.2870	0.0050	0.1340	0.4440	-0.0254	-6.2280	0.0000	0.0000
1978	7.7263	-1.7002	0.0134	0.1583	-0.1305	-0.0162	-8.0860	0.0000	0.0000
1979	6.0699	-1.6582	0.0654	0.0831	0.3489	0.0411	-6.9187	0.0000	0.0000
1980	4.2186	-1.1586	0.0030	0.0905	-0.3661	0.0512	-3.9937	0.1438	0.0000
1981	5.5562	-1.5242	0.0033	0.1109	-0.0640	0.0299	-5.4611	0.1648	0.0000
1982	5.9375	-1.4294	0.0010	0.1565	-0.5318	-0.0217	-4.2878	0.1434	0.0000
1983	6.7242	-1.5761	0.0020	0.2309	-0.7872	0.1031	-4.2317	0.1303	0.0000
1984	6.3008	-1.6374	0.0036	0.1702	0.1829	0.0001	-4.5988	0.1077	0.0000
1985	3.5761	-1.0293	0.0020	0.0971	-0.1093	0.0205	-2.2763	0.0536	0.0000
1986	2.0715	-0.6412	0.0010	0.0520	-0.0186	0.0170	-1.1755	0.0276	0.2942
1987	2.4330	-0.8174	0.0018	0.0391	0.1656	0.0152	-1.3626	0.0306	0.3266
1988	2.7222	-0.9186	0.0008	0.0421	-0.0130	-0.0054	-1.5012	0.0318	0.3397
1989	3.1601	-1.1614	0.0033	0.0467	0.0046	0.0179	-1.7663	0.0357	0.3811
1990	3.3218	-1.2338	0.0010	0.0639	-0.1725	0.0029	-1.6339	0.0340	0.3627
1991	2.5096	-0.9112	0.0005	0.0514	-0.0831	0.0065	-0.9795	0.0224	0.2387
1992	2.1488	-0.7551	0.0003	0.0421	-0.0269	0.0042	-0.8042	0.0170	0.1813

Table B-17: Summary Statistics, Elasticity Measures; NICD; Revised Model.

	STGD	*LTGD*	*NNILTSTG*	*FBS*	*CNGFBS*	*SPRET*	*GPDI*	*REGDUMMY*	*TAXDUMMY*
Mean	5.5914	-6.9211	0.0714	0.0555	-0.0761	0.1929	-4.9995	0.0209	0.0472
Standard Error	0.3565	1.1069	0.0771	0.0118	0.1049	0.0620	0.3653	0.0066	0.0170
Median	5.9356	-2.1577	0.0005	0.0520	-0.1093	0.0299	-4.9716	0.0000	0.0000
Standard Deviation	2.3918	7.4251	0.5170	0.0794	0.7038	0.4156	2.4505	0.0442	0.1143
Sample Variance	5.7205	55.1323	0.2673	0.0063	0.4953	0.1727	6.0049	0.0020	0.0131
Kurtosis	-0.1591	1.1013	10.3315	2.8765	2.2735	2.2461	-0.5121	4.1940	3.0886
Skewness	0.5085	-1.2918	2.4977	-0.8010	0.0747	1.5068	-0.1313	2.3037	2.1648
Range	9.9427	27.3400	3.6105	0.4488	4.1314	1.9862	9.9005	0.1648	0.3811
Minimum	2.0715	-27.9812	-1.2359	-0.2179	-2.2362	-0.6324	-10.7047	0.0000	0.0000
Maximum	12.0142	-0.6412	2.3746	0.2309	1.8952	1.3538	-0.8042	0.1648	0.3811
Sum	251.6124	-311.4516	3.2143	2.4989	-3.4247	8.6784	-224.9768	0.9427	2.1243
Count	45.0000	45.0000	45.0000	45.0000	45.0000	45.0000	45.0000	45.0000	45.0000

Table B-18: Elasticity of Substitution Measures, NICE; Revised Model.

Dependent Variable: NICE	STGD Point Elasticity of Substitution	LTGD Point Elasticity of Substitution	NNILTSTG Point Elasticity of Substitution	FBS Point Elasticity of Substitution	CNGFBS Point Elasticity of Substitution	SPRET Point Elasticity of Substitution	GPDI Point Elasticity of Substitution	REGDUMMY Point Elasticity of Substitution	TAXDUMMY Point Elasticity of Substitution
1948	6.6380	-40.7408	2.4228	1.3485	0.5253	0.9129	-5.4526	0.0000	0.0000
1949	5.9083	-38.1079	0.3265	0.0632	-0.7216	-0.7079	-3.9632	0.0000	0.0000
1950	5.5858	-28.5618	-0.3972	-0.2735	-0.1916	6.1413	-4.7125	0.0000	0.0000
1951	4.4225	-15.4075	-1.0369	0.3763	0.3360	4.4442	-3.6879	0.0000	0.0000
1952	5.1420	-15.6824	-0.1687	-0.0994	-0.2945	2.1282	-3.5025	0.0000	0.0000
1953	5.5933	-17.9305	1.2948	-0.4523	-0.2047	0.2201	-3.8891	0.0000	0.0000
1954	5.2986	-15.8721	-0.0625	-0.0719	0.1965	4.2058	-3.3244	0.0000	0.0000
1955	4.0415	-11.5165	0.0334	-0.1342	-0.0487	5.4882	-3.0677	0.0000	0.0000
1956	3.8273	-11.1645	-0.1530	0.1699	0.1765	2.1932	-3.0821	0.0000	0.0000
1957	3.9351	-11.0588	-0.1161	0.1474	-0.0137	-0.6984	-3.0241	0.0000	0.0000
1958	6.1170	-19.1250	3.5447	-0.1838	-0.2423	0.9361	-4.2450	0.0000	0.0000
1959	5.6039	-13.2906	-0.0795	-0.6351	-0.2943	4.0071	-3.8623	0.0000	0.0000
1960	7.6107	-15.7128	-0.1067	0.0184	0.4738	-0.5473	-4.7598	0.0000	0.0000
1961	4.3688	-8.6500	-0.0193	-0.1126	-0.0725	2.1202	-2.6087	0.0000	0.0000
1962	10.7275	-17.3155	-0.1324	-0.5204	-0.1639	-1.4386	-6.3483	0.0000	0.0000
1963	13.8105	-24.2540	6.0135	-0.4441	0.1318	3.7730	-8.6486	0.0000	0.0000
1964	5.8744	-11.4669	-0.3484	-0.2419	-0.0280	2.2656	-4.1251	0.0000	0.0000
1965	7.1923	-18.0723	-0.3047	-0.0785	0.1481	1.5650	-6.5117	0.0000	0.0000
1966	6.5647	-16.2461	-0.1334	-0.1860	-0.0679	-5.7434	-6.5058	0.0000	0.0000
1967	6.1022	-13.7243	-0.1648	-0.3842	-0.1299	8.6459	-5.6428	0.0000	0.0000
1968	4.5491	-7.9625	-0.0355	-0.6941	-0.2692	0.6837	-3.8272	0.0000	0.0000
1969	2.6992	-3.7606	-0.0723	0.0488	0.2527	-0.0442	-2.3176	0.0000	0.0000
1970	2.9359	-2.9060	-0.0581	-0.0414	-0.0524	-0.7325	-2.1710	0.0000	0.0000
1971	2.2372	-1.6427	-0.0154	-0.2212	-0.1145	0.5851	-1.6710	0.0000	0.0000

Dependent Variable: NICE	STGD Point Elasticity of Substitution	LTGD Point Elasticity of Substitution	NNILTSTG Point Elasticity of Substitution	FBS Point Elasticity of Substitution	CNGFBS Point Elasticity of Substitution	SPRET Point Elasticity of Substitution	GPDI Point Elasticity of Substitution	REGDUMMY Point Elasticity of Substitution	TAXDUMMY Point Elasticity of Substitution
1972	2.2709	-1.3966	-0.0121	-0.2096	-0.0018	0.3350	-1.8287	0.0000	0.0000
1973	3.0521	-1.6441	-0.0219	-0.1716	0.0576	-0.0628	-2.7749	0.0000	0.0000
1974	5.7490	-2.1253	-0.0717	-0.1242	0.1049	-1.5583	-4.9332	0.0000	0.0000
1975	3.9427	-1.3544	0.0043	-0.6187	-0.3234	0.1562	-2.6043	0.0000	0.0000
1976	4.8881	-1.4292	0.0020	-0.8390	-0.1377	0.7046	-3.2323	0.0000	0.0000
1977	5.1165	-1.5316	0.0066	-0.5673	0.1252	-0.1329	-3.7558	0.0000	0.0000
1978	6.1231	-2.0957	0.0186	-0.6944	-0.0381	-0.0877	-5.0505	0.0000	0.0000
1979	5.4777	-2.3274	0.1029	-0.4150	0.1160	0.2532	-4.9208	0.0000	0.0000
1980	3.4722	-1.4832	0.0044	-0.4124	-0.1111	0.2878	-2.5906	0.9108	0.0000
1981	3.3907	-1.4467	0.0036	-0.3747	-0.0144	0.1247	-2.6265	0.7738	0.0000
1982	3.6358	-1.3613	0.0011	-0.5304	-0.1200	-0.0909	-2.0693	0.6758	0.0000
1983	2.6106	-0.9517	0.0014	-0.4962	-0.1126	0.2733	-1.2948	0.3894	0.0000
1984	5.9658	-2.4113	0.0060	-0.8921	0.0638	0.0005	-3.4317	0.7848	0.0000
1985	5.0301	-2.2517	0.0048	-0.7560	-0.0567	0.1970	-2.5234	0.5806	0.0000
1986	2.9412	-1.4159	0.0024	-0.4088	-0.0097	0.1648	-1.3154	0.3013	0.2982
1987	3.2005	-1.6725	0.0042	-0.2846	0.0803	0.1367	-1.4127	0.3100	0.3067
1988	3.9676	-2.0823	0.0022	-0.3399	-0.0070	-0.0541	-1.7244	0.3572	0.3535
1989	4.0985	-2.3428	0.0074	-0.3355	0.0022	0.1580	-1.8054	0.3566	0.3529
1990	6.5243	-3.7691	0.0036	-0.6949	-0.1248	0.0386	-2.5291	0.5140	0.5087
1991	3.9836	-2.2496	0.0014	-0.4519	-0.0486	0.0701	-1.2253	0.2734	0.2705
1992	3.8343	-2.0956	0.0010	-0.4158	-0.0177	0.0507	-1.1309	0.2334	0.2310

Table B-19: Summary Statistics, Elasticity Measures; NICE; Revised Model.

	STGD	*LTGD*	*NNILTSTG*	*FBS*	*CNGFBS*	*SPRET*	*GPDI*	*REGDUMMY*	*TAXDUMMY*
Mean	5.0236	-9.3247	0.2289	-0.2808	-0.0276	0.9193	-3.4607	0.1436	0.0516
Standard Error	0.3145	1.4709	0.1676	0.0558	0.0315	0.3457	0.2469	0.0383	0.0188
Median	4.8881	-3.7606	0.0011	-0.3355	-0.0381	0.1970	-3.2323	0.0000	0.0000
Standard Deviation	2.1099	9.8674	1.1246	0.3746	0.2115	2.3190	1.6563	0.2566	0.1260
Sample Variance	4.4515	97.3661	1.2647	0.1403	0.0447	5.3777	2.7432	0.0658	0.0159
Kurtosis	6.4906	2.1539	17.4376	7.0767	2.5817	3.3224	0.8962	1.7833	4.2091
Skewness	1.9944	-1.4821	3.9867	1.8289	-0.0873	0.9274	-0.8950	1.6916	2.2976
Range	11.5733	39.7891	7.0505	2.2406	1.2469	14.3894	7.5177	0.9108	0.5087
Minimum	2.2372	-40.7408	-1.0369	-0.8921	-0.7216	-5.7434	-8.6486	0.0000	0.0000
Maximum	13.8105	-0.9517	6.0135	1.3485	0.5253	8.6459	-1.1309	0.9108	0.5087
Sum	226.0610	-419.6106	10.3027	-12.6352	-1.2428	41.3678	-155.7315	6.4612	2.3216
Count	45.0000	45.0000	45.0000	45.0000	45.0000	45.0000	45.0000	45.0000	45.0000