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DEBT, COLLATERAL, AND U.S. MANUFACTURING INVESTMENT: 1954-1980

by William P. Osterberg

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ABSTRACT

I perform an empirical analysis of Euler equations for the firm's choices of capital, labor, hours, and debt. Financial structure has real effects, since taxes favor debt. However, the cost of debt increases with the debt-to-collateral ratio, and capital is part of collateral. The data, for U.S. manufacturing investment from 1954 to 1980, show that the debt-to-collateral ratio moves opposite to the direction suggested by tax rates. However, excluding the Euler equation for debt implies the correct sign for the relation between investment and the debt-to-collateral ratio. I also find structural instability in the Euler equations for debt and capital.

I. Introduction

A growing body of literature examines the empirical impact of financial factors on fixed investment. Although cash-flow measures have long been known to have predictive power for investment (see Meyer and Kuh [1957]), until recently, neither the finance nor macroeconomics literature left any significant role for capital structure to influence fixed investment. In an early treatment of the subject, Modigliani and Miller (1958) provide a theoretical rationale for the view in finance that capital structure is irrelevant to investment. In macroeconomics, q came to be regarded as completely summarizing the relevance of financial markets for investment. q theory usually allows no role for capital structure to influence investment.[1]

A broad literature stimulated by the Modigliani and Miller paper has explored what Myers (1984) terms "the capital structure puzzle"; that is, how firms choose their financial structure. Harris and Raviv (1991) survey recent theories and evidence on the relevance of agency costs, asymmetric information, product/input market interactions, and corporate control considerations in the determination of capital structure. Perhaps the most familiar theory of optimal financial structure emphasizes a "static trade-off" (Myers [1984]) between tax advantages to debt and various debt-related costs. The empirical relevance of tax-based theories is widely acknowledged.[2] In this paper, I assume a trade-off between a tax advantage to debt and a cost of debt that is related to the ratio of debt to collateral, which I proxy with the book value of tangible assets.

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[1] For three efforts to embed financial structure in q frameworks, see Chirinko (1987b), Hayashi (1985), and Osterberg (1989).

[2] See Bradley, Jarrell, and Kim (1984) and Haugen and Senbet (1986).

Scott (1977), Myers and Majluf (1984), and others have suggested that asset type influences the cost of debt.[3] In Scott, the claims of secured creditors have priority; thus, issuance of secured debt reduces the probability that costs such as legal damages will be paid in the event of bankruptcy. In Myers and Majluf, it may be costly to issue securities implicitly backed by assets whose value is more easily measured by insiders than outsiders. In both cases, the availability of assets that can serve as collateral enhances the value of equity. This is similar to arguments made by Myers (1977) that reliance on "assets in place" rather than on growth opportunities increases equity value, since the former are less dependent on discretionary investment. One influence of collateral on debt cost is suggested by Barro (1976), who shows how the equilibrium interest rate can vary with the loan-to-collateral ratio.[4] Smith and Warner (1979) and Stulz and Johnson (1985) analyze the case relevant to my paper, where the assets of the borrower serve as collateral.

Stiglitz and Weiss's (1981) theory of credit rationing was one of the first asymmetric-information models of investment and finance to show how financial factors may influence investment decisions. Related work by Bernanke and Gertler (1989), Gertler and Hubbard (1988), Calomiris and Hubbard (1990), and Hubbard and Kashyap (1990) points to a role for internal net worth in influencing loan contracts for investment. Fazzari, Hubbard, and Peterson (1990) describe two types of tests that have been used to search for the influence of financial factors. Some have tested for a role for cash flow as a proxy for availability

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[3] See Boot, Thakor, and Udell (1991) for a recent review of the theoretical and empirical efforts to analyze the role of secured debt.

[4] A role for collateral in asymmetric information models of investment has been suggested by Bernanke and Gertler (1989).

of internal finance.[5] This factor is relevant if informational asymmetries imply that certain types of firms could have difficulty in raising external funds. Other studies have estimated Euler equations for the firm's investment decision in the presence of a binding debt constraint.[6] Overall, the results support a role for financial factors in the investment decision.

Unlike recent empirical analyses of the role of asymmetric information, this paper utilizes aggregate rather than cross-sectional data. However, I improve on the cited studies by allowing for corporate and personal taxes to influence the investment decision and by analyzing a simultaneous system in which the Euler equations for both debt and capital are forced to hold simultaneously. An interest in examining aggregate production relations is provided by Cochrane (1991), who demonstrates the ability of aggregate investment data to explain stock returns. Ferson and Merrick (1987) point to a role for nonstationarity in explaining aggregate-consumption-based asset pricing relations. In this paper, the debt-to-collateral ratio has a significant influence on investment, although of the "wrong" sign. I show that nonstationarity is partly responsible for this result.

The focus in this paper is on the influence of the debt-to-collateral ratio on investment in physical capital. I assume a trade-off between tax advantages to debt and a cost of debt that, as in Barro (1976), varies with the debt-to-collateral ratio. Because taxes may influence the firm's choices of all productive inputs, I estimate Euler equations for the levels of investment, employment, and hours. There are potential internal adjustment costs associated

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[5] See Fazzari and Athey (1987), Fazzari, Hubbard, and Petersen (1988), Gertler and Hubbard (1988), and Hoshi, Kashyap, and Scharfstein (1991).

[6] See Gertler, Hubbard, and Kashyap (1990) and Whited (1990).

with all inputs. My specifications of the production function and wage equation are similar those of Shapiro (1986), who finds that empirical tests of q theories in which adjustment costs were associated only with capital stock implied unreasonably high adjustment costs. Here, the estimated total cost of investment is also influenced by its impact on the debt cost.

I analyze quarterly data for the U.S. manufacturing sector from 1954 to 1980. The estimated parameters in the system describing the optimal choices of capital, production labor, production hours, nonproduction labor, and debt are reasonable other than for the incorrect sign on the debt-to-collateral ratio. However, I find structural instability in the Euler equations for both debt and capital. In addition, omitting the Euler equation for debt implies the correct influence for the debt-to-collateral ratio.

II. The Model

I analyze a partial-equilibrium model of a firm that maximizes the expected market value of its equity through its choices of capital, labor inputs, and debt. Shareholders discount future dividends at the required after-tax rate of return on equity. The firm's financial and investment decisions thus affect the debt cost by influencing the ratio of debt to collateral. Since my measure of collateral is the book value of tangible assets, investment in capital stock influences the debt cost, and investment and financial structure become intertwined. In appendix A, I present the equations describing the underlying behavioral relationships, and in appendix B, I discuss the conditions under which tax rates favor debt over retained earnings.

In order to understand the important aspects of the firm's decision problem, I briefly present three key relations. The first is that the before-tax cost of debt varies with the ratio of the book value of debt to collateral.[7]

$$s_t = [a + \nu(B_t/\xi(K_t))]B_t \tag{1}$$

Stulz and Johnson (1985) show how such a relationship can arise when the assets of the borrower serve as collateral. The theory implies that ν is positive. I assume that 1) all debt is rolled over at the end of each period, with interest paid on the entire stock of debt, and 2) the book value of physical capital, $\xi(K_t)$, is a function of the net stock of physical capital, K_t. $\xi(K_t)$ and K_t may differ simply because book depreciation is not necessarily equal to physical depreciation. Although $\Delta_t = \xi(K_t)/K_t$ varies through time, it is known to the firm; thus, by choosing K_t, the firm indirectly chooses $\xi(K_t)$.

Another key relation is that of the production function, the form of which follows Shapiro (1986) and is given by equation 2.

$$\begin{aligned}\log y_t = {} & a_0 + a_K\log K_t + a_L\log L_t + a_H\log H_t + a_N\log N_t \\ & - .5[g_{KK}(K_{t+1}-d_tK_t)^2 + g_{LL}(L_t-q_{t-1}L_{t-1})^2 + g_{HH}(H_t-H_{t-1})^2 + g_{NN}(N_t-N_{t-1})^2] \\ & + a_1t + \epsilon_t\end{aligned} \tag{2}$$

Gross adjustments in the levels of factors utilize productive resources. The assumption of adjustment costs for capital, K_t, production labor, L_t, weekly hours, H_t, and nonproduction labor, N_t, implies that current choices will be influenced by expected future choices. However, adjustment costs are not interrelated; the adjustment of an input does not affect the cost of adjusting another input. Neither Shapiro (1986) nor Kokklenberg (1984) finds strong evidence in favor of such interrelatedness. Equation 2 also incorporates a

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[7] Definitions of all variables are given in the glossary.

multiplicative productivity shock.

The wage bill implies that the variation in hours will be influenced by the response of the wage rate as overtime rises: $W_t{*}L_tH_t = W_tL_t[H_t + \omega_0 + \omega_1(H_t - H{*}_t)]$. Total labor expenditures also include fixed costs for both production and nonproduction employees:

$$W_t^{*}L_tH_t + f_t^{L}L_t + f_t^{N}N_t. \tag{3}$$

The discrete-time version of the market value of equity at time 0 is

$$V_0 = \sum_{t=0}^{\infty} \prod_{j=0}^{t} [\frac{1}{1 + \theta{*}_j}][\frac{1 - \tau_{yt}}{1 - \tau_{ct}}]DV_t, \text{ with } \theta{*} = (\rho + p)/(1 - \tau_{ct}), \tag{4}$$

and an expression for the dividend, DV_t, is given in appendix A.

III. Optimal Factor Demands and Optimal Financial Structure

At the beginning of period t=0,1,2,.., the firm maximizes the expected value of V_t conditional on information available at the start of period t and initial conditions: $K_t = \underline{K}_t$, $L_{t-1} = \underline{L}_{t-1}$, $N_{t-1} = \underline{N}_{t-1}$, $H_{t-1} = \underline{H}_{t-1}$, and $B_t = \underline{B}_t$. B_t and K_t are stocks given at the start of period t, while L_t, N_t, and H_t are averages over period t. The firm thus chooses B_{t+1} and K_{t+1} as well as L_t, N_t, and H_t.

The following first-order conditions hold for all t:

$$\frac{\partial E_{t-1}(V_t)}{\partial L_t} = 0;\ E_{t-1}\{(1-\tau_{pt})\frac{[1-\tau_{yt}]}{[1-\tau_{ct}]}[\alpha_t y_t(a_L/L_t - g_{LL}(L_t - q_{t-1}L_{t-1})$$

$$-W_t[H_t + \omega_0 + \omega_1(H_t - H_t^{*})]) - f_t^{L}]$$

$$+ [\frac{1}{1+\theta^{*}_{t+1}}][\frac{1-\tau_{yt+1}}{1-\tau_{ct+1}}](1-\tau_{pt+1})\alpha_{t+1}y_{t+1}g_{LL}q_t(L_{t+1} - q_tL_t)\} = 0, \tag{5}$$

$$\frac{\partial E_{t-1}(V_t)}{\partial H_t} = 0; E_{t-1}\{(1-\tau_{pt})[\frac{1-\tau_{yt}}{1-\tau_{ct}}][\alpha_t y_t(a_H/H_t - g_{HH}(H_t - H_{t-1}) - W_t L_t(1+\omega_1))]$$

$$+ [\frac{1}{1+\theta^*_{t+1}}][\frac{1-\tau_{yt+1}}{1-\tau_{ct+1}}](1-\tau_{pt+1})\alpha_{t+1}y_{t+1}g_{HH}(H_{t+1}-H_t)\} = 0, \qquad (6)$$

$$\frac{\partial E_{t-1}(V_t)}{\partial N_t} = 0; E_{t-1}\{(1-\tau_{pt})\frac{[1-\tau_{yt}]}{[1-\tau_{ct}]}[\alpha_t y_t(a_N/N_t - g_{NN}(N_t - q_{t-1}N_{t-1})) - f^N_t]$$

$$+ [\frac{1}{1+\theta^*_{t+1}}][\frac{1-\tau_{yt+1}}{1-\tau_{ct+1}}](1-\tau_{pt+1})\alpha_{t+1}y_{t+1}g_{NN}q_t(N_{t+1}-q_t N_t)\} = 0, \qquad (7)$$

$$\frac{\partial E_{t-1}(V_t)}{\partial B_{t+1}} = 0; \quad E_{t-1}\{\frac{[1-\tau_{yt}]}{[1-\tau_{ct}]} +$$

$$[\frac{1}{1+\theta^*_{t+1}}][\frac{1-\tau_{yt+1}}{1-\tau_{ct+1}}][-(1-\tau_{ct+1})(a+2v_1[B_{t+1}/\xi(K_{t+1})])-1+p_{t+1}]\} = 0, \qquad (8)$$

$$\frac{\partial E_{t-1}(V_t)}{\partial K_{t+1}} = 0; \quad E_{t-1}\llbracket(1-\tau_{pt})\frac{[1-\tau_{yt}]}{[1-\tau_{ct}]}[\alpha_t y_t(-g_{KK}(K_{t+1}-dK_t))]$$

$$+ \frac{[1-\tau_{yt}]}{[1-\tau_{ct}]}[\beta_t(\tau_{pt}D_t - 1 + ITC_t)]$$

$$+ [\frac{1}{1+\theta^*_{t+1}}]\frac{[1-\tau_{yt+1}]}{[1-\tau_{ct+1}]}\{\alpha_{t+1}y_{t+1}(1-\tau_{pt+1})(a_K/K_{t+1}+d(K_{t+2}-dK_{t+1})g_{KK})$$

$$+ (1-\tau_{pt+1})v_1[B^2_{t+1}/(K_{t+1}\xi(K_{t+1}))] + [\tau_{pt+1}D_{t+1}-1+ITC_{t+1}]\beta_{t+1}(-d_t)\}\rrbracket. \qquad (9)$$

The transversality conditions are of the form

$$\lim_{T\to\infty} \frac{\partial(E_{t-1}V_T)}{\partial \bullet_T} = 0, \qquad (10)$$

where • is replaced by L, H, N, K, and B. In equations 5 and 6, the choices of production labor and hours for period t each affect period t+1 adjustment costs. The choices of L_t and H_t also influence the wage bill. Equation 8 states that the expected cost of funds is equalized between retained earnings and debt issue.

The choices of debt and physical capital are linked through their joint impact on the cost of debt. An increase in K_{t+1} implies adjustment costs, but raises period t cash flow via depreciation deductions (D_t) and investment tax credits (ITC_t). While an increase in K_{t+1} raises period t+1 output, its overall impact on period t+1 cash flow is linked to the future choice of K_{t+2}. To ensure a unique solution path, I assume that $0 < 1/(1+\theta^*) < 1$ and that the production function is concave and twice continuously differentiable in K, L, N, and H.

IV. Estimation

Since θ^* varies over time, I cannot solve for the firm's decision rules and instead utilize the Euler equations and expression for the employment cost directly. The decision rule method, however, would use more information by imposing the cross-equation restrictions between the stochastic processes generating the forcing variables and the decision rules. While it appears that the Euler equation method avoids the need to specify the stochastic processes generating the forcing variables, Garber and King (1983) point out that Euler equation methodology does not negate the need to specify the details of the general equilibrium. In the analysis developed here, if there are shocks to preferences but not to production, I will be estimating preference parameters rather than production parameters. As discussed by Shapiro (1986, p. 527), however, utilization of actual production data through substitution of y for the production function given by equation 2 makes the production shock observable. In addition, to aid identification, I assume that the shock is additive in logs.

The form of the stochastic Euler equations suggests use of the generalized instrumental variables estimator of Hansen and Singleton (1982). They derive a weighting matrix that minimizes asymptotic standard errors even under conditional heteroscedasticity. Andrews (1991) discusses the issues involved in computing covariance matrices under autocorrelation and heteroscedasticity. I utilize the generalized method of moments (GMM) routine in Time Series Processor Version 4.2 (1991).

I consider the variables listed at the top of table 1 as instruments. This includes all variables dated t–1, B_t, and K_t. Other than B_t and K_t, all variables dated t are realized average values over period t. Values of future endogenous variables are not known at time t, but will be chosen at the beginning of the next period, after new information has been received by the firm. If the e_t's contain a serially correlated specification error component, instruments dated t are not valid. Besides contemporaneous instruments, I consider instruments lagged three and eight quarters, an approach supported by examination of residuals from estimates assuming no serial correlation. Autocorrelation of order three could be due to use of annual data in constructing quarterly observations for variables such as ${f^N}_t$. The data are described in appendix C.

V. Results

I first consider the choice of instruments. Shapiro uses 21 variables, raising the possibility of multicollinearity among the instruments.[8] In addition, if all instruments are used in each equation, there are 126 orthogonality conditions (# instruments x # equations). A greater number of these conditions increases the likelihood of numerical inaccuracy.

A second consideration is the treatment of autocorrelation and heteroscedasticity. If the model is correctly specified and agents in fact

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[8] Rotemberg (1984) suggests focusing on the range over which parameter estimates of interest vary with use of different instrument lists. This is the approach adopted in this paper.

possess information about the variables in the information sets used by the econometrician, there will be no serial correlation among the residuals. However, since some quarterly items are calculated from annual data and other items are constructed from ex post information (for example, the effective tax-rate series) it is not clear which forecast horizon is appropriate. Both considerations are important given the relatively small sample size.

In the actual estimation, I consider variation in 1) instruments, 2) forecast horizon, and 3) treatment of serial correlation and heteroscedasticity. An analysis of the full instrument list, following the suggestions of Belsley, Kuh, and Welsch (1980), revealed harmful collinearity, so I reduce the list to seven and consider the seven subsets of six of the seven instruments.[9] Later, I split the sample in half and need fewer instruments for the J statistic to have sufficient degrees of freedom. Thus, I again follow the suggestions of Belsley, Kuh, and Welsch, reducing the number of instruments to four and then using subsets of three of the four.

To determine if my results are sensitive to the choice of forecast horizon, I alternately consider that both the agents and econometrician know 1) current values, 2) values lagged one quarter, and 3) values lagged four quarters.[10] Variables included in the "large" and "small" instrument lists are indicated in table 1. The subsets are labeled as 6a - 6g and 3a - 3d. I report the results

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[9] For comparability with the results of Shapiro, I estimated the full six-equation system, but I do not report those results here. Belsley, Kuh, and Welsch (1980) suggest examination of the condition indexes and variance decomposition matrix in order to deal with collinearity. I deemed a condition index over 30 as too high. To reduce the condition number to under 30, only seven of 21 instruments could be retained. Examination of the decomposition matrix determined which seven.

[10] I also considered a lag of eight quarters. These results are qualitatively similar to those reported.

for each choice of instruments with each choice of forecast horizon and estimate the model with the assumption of either homoscedasticity or heteroscedasticity when the full sets of seven or four instruments are used. I examine the sensitivity of the results to moving-average corrections of one, three, and seven for the full sets of seven and four instruments as well.

In order to evaluate the overall adequacy of the model, I utilize the J statistic suggested by Hansen and Singleton (1982). It is calculated as NOBS x the value of the objective function and is distributed as a chi-squared with r-l degrees of freedom, where r is the number of orthogonality conditions and l is the number of parameters estimated. I use the same instruments for each equation.

A comparison of columns 1 and 2 in tables 2A, 2C, 2D, 2F, 2G, and 2I shows that a correction for heteroscedasticity reduces the J statistic, indicating that heteroscedasticity is present. The GMM routine in Time Series Processor Version 4.2 (1991) utilizes a White (1980) correction, a technique I maintain in the subsequent runs. Tables 2A, 2C, 2D, 2F, 2G, and 2I show that correcting for a moving-average process reduces the J statistic monotonically with the order of the process. Although with higher-order corrections the J statistic does not imply rejection of the overidentifying restrictions, the presence of serial correlation may imply misspecification. On the other hand, the sensitivity of the J statistic to the order of the moving-average correction may reflect a small sample problem.

In tables 2A - 2I, almost all of the parameters are significant and of the correct sign and reasonable magnitude. However, g_{kk}, the adjustment cost parameter for the capital stock, is consistently negative, while g_{hh} is also negative for some runs. More important, the estimate of ν_1 is significant but of the wrong sign. Tables 2D, 2E, and 2F consider the same variations, but with instruments lagged one period. J statistics are generally lower than with the current instruments, but the restrictions are still rejected unless I correct for serial correlation. Tables 2G, 2H, and 2I were obtained when instruments lagged four periods were employed. The range of values for ν_1 from tables 2A - 2I is -0.331 to -0.189.

In the subsequent tables, I consider two explanations for my findings that 1) the overidentifying restrictions are rejected, and 2) while significant, my estimates of ν_1 are of the wrong sign. I test to see if these results are due to either temporal instability or rejection of a particular subset of the six-equation model.

In tables 3A to 3D, I present the results of estimating the model when the sample is split in half. I consider instrument subsets 3a - 3d with forecast horizons of one and four quarters. These smaller instrument sets are chosen to account for the smaller sample size. The J statistics still imply rejection of the overidentifying restrictions for each subsample, and the estimate of ν_1 still tends to be negative and significant.[11]

In tables 4A to 4G, I investigate the possibility that subsets of equations perform better than the full system. My choice of subsets is motivated by several considerations. First, there are no cross-equation parameter restrictions from the subset of the W, L, H, and N Euler equations to the K and B Euler equation subset, although 1) all instrumental variables are used with each equation and 2) covariances between residuals from different equations are allowed to be nonzero. Second, my primary focus is on the interaction between the choices of debt and physical capital. Consequently, I estimate the full system without the

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[11] The split point is varied with the forecast horizon in order to divide the sample exactly in half.

equation for debt, the equations for debt and capital together, and the equations for debt and capital alone. I use six instrumental variables with forecast horizons of one and four quarters.[12]

Tables 4A and 4E show the coefficient estimates for the five-equation system that excludes the Euler equation for debt. Although the overidentifying restrictions are still rejected at the .10 level, the ν_1 coefficient estimate is positive and significant in 11 of 14 cases. Next, I see if the restrictions imposed by the Euler equation for debt are responsible for the sign of ν_1 in the full system. Tables 4B and 4F show the results from splitting off the equations for K and B. In all cases, the restrictions are rejected and estimated values for ν_1 are significant and negative, ranging from -0.210 to -0.306. I then estimate the K and B equations individually to see if the restrictions imposed by the B equation on the K equation are in fact responsible for the negative sign on ν_1. Tables 4C, 4D, 4F, and 4G show that while the Euler equation for debt clearly implies a negative sign for ν_1 (ranging from -0.230 to -0.300), the sign implied by the single equation for K is ambiguous, ranging from 0.208 to -4.3E-3.

Having determined that 1) temporal instability does not explain the rejection of the overidentifying restrictions for the full model or the sign of ν_1, and 2) subsets of equations still imply rejection, I now further refine my focus on the main equation of interest, the Euler equation for K. In tables 5A through 5D, I present the results of estimating equation 11 when the sample is split in half. Again, the split point changes with the choice of forecast horizon. Whereas for the entire sample period the estimate of ν_1 was negative, now it is more likely to be significantly positive than significantly negative.

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[12] I also estimated this system with all 21 instruments and with the subsets of three instruments. In each case, I obtained results qualitatively similar to those reported in this paper.

In addition, the restrictions on this equation were clearly rejected before, but here they are generally not rejected for the second half of the sample.[13]

Tables 6A to 6D present the estimates of ν_1 from the Euler equation for debt when the sample is split. I find that the restrictions for this equation are generally not rejected for the first subperiod, although ν_1 is usually negative. In addition, the magnitude of ν_1 is generally lower for the first half of the sample than for the second.

V. Conclusions

This paper analyzes a partial equilibrium model of a representative firm maximizing the expected value of its equity via its choice of production labor, nonproduction labor, hours of production labor, capital stock, and debt issue. Financial structure affects investment, since the cost of debt is influenced by the amount of collateral and the capital stock is included in collateral. I utilize a generalized method-of-moments procedure to estimate Euler equations for the inputs and an equation for the wage bill. This differs from previous empirical investigations by incorporating a role for taxes in the debt-investment relation and by restricting the movement of the debt variable to satisfy the Euler equation for debt as well as that for capital.

For a wide variety of instruments, choices of forecast horizons, and treatments of serial correlation and heteroscedasticity, the overidentifying restrictions are rejected. In addition, the estimated coefficient for the

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[13] Since it is hard to disentangle the effects of the chosen switch point from the choice of forecast horizon, I tried the opposite combinations from those used in tables 5 and 6: instruments lagged four periods with 67:2/67:3 and instruments lagged one period with 68:1/68:2. With the first combination, four of eight runs implied nonrejection. With the latter, all eight implied nonrejection.

response of the cost of debt to the debt-to-collateral ratio is negative and significant, rather than positive, as implied by my model. However, the estimates of the elasticities are significant and reasonable, although some of the estimated adjustment cost parameters were negative.

Temporal instability does not seem to explain these results for the full six-equation system. However, omitting the Euler equation for debt implies the theoretically correct sign for the response of the debt cost to the debt-to-collateral ratio. In addition, a close examination of the Euler equation for capital shows that there is a temporal instability implying that, for both halves of the sample, the correct sign for ν_1 obtains. Similarly, a close examination of the Euler equation for debt indicates that, while the sign of ν_1 is negative for both subsamples, the estimate is of a much higher magnitude for the second half.

Overall, then, the evidence in favor of my modeling approach in this paper is mixed. While there is clearly a significant relationship between capital and the debt-to-collateral ratio, the mechanism is not the one postulated here, since the debt-to-collateral ratio moves in the opposite direction from that suggested by a trade-off between a tax advantage to debt and a debt cost that is increasing in the debt-to-collateral ratio. Given the substantial evidence that taxes influence financial structure, this may be surprising. Perhaps of equal interest is the finding of temporal instability in the single-equation estimates for debt and capital.

One possible explanation for the instability may be that the complex interaction between inflation, the tax code, and financial structure needs to be more carefully handled. The importance of this interaction for investment in the 1970s is suggested by the work of Modigliani and Cohn (1979), among others.

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Glossary of Terms

θ^* = the "discount rate" applicable to quarter t cash flow

ρ = fixed real rate of return required by stockholders

p_t = rate of commodity price inflation

τ_{ct} = marginal personal rate of capital gains taxation

τ_{yt} = marginal personal rate of dividend income taxation

τ_{pt} = corporate profits tax rate

DV_t = the dividend

γ_t = cash flow

y_t = real output of manufacturing

K_t = physical capital stock at the start of period t

L_t = level of production employment in period t

H_t = weekly hours per production worker

N_t = level of nonproduction employment

d = one minus the rate of physical depreciation of capital

q_t = one minus the quit rate

$\xi(K_t)$= book value of the stock of tangible assets - collateral

B_t = book value of debt

H^*_t = level of weekly hours per employee at which overtime starts

W^*_t = hourly wage rate inclusive of overtime payments

W_t = hourly wage rate exclusive of overtime payments

$f^L{}_t$ = the fixed cost of a production worker

$f^N{}_t$ = the fixed cost of a nonproduction worker

α_t = manufacturing output price index

β_t = investment goods price index

D_t, ITC_t = present value of depreciation deductions; investment tax credit

Table 1

Instrument Lists

Full List (21 instruments):

τ_{yt-1}, τ_{pt-1}, θ^*_{t-1}, τ_{ct-1}, q_{t-1}, $H_{t-1}-H^*_{t-1}$, H_{t-1}, N_{t-1}, L_{t-1}, K_t, B_t, $\xi(K_t)$, D_{t-1}, ITC_{t-1}, β_{t-1}, time (trend), constant, W_{t-1}, y_{t-1}, f^N_{t-1}, and f^L_{t-1}.

"Large" List (7): θ^*_{t-1}, τ_{ct-1}, $H_{t-1}-H^*_{t-1}$, K_t, ITC_t, β_{t-1}, W_{t-1}.
6a: θ^*_{t-1}, τ_{ct-1}, $H_{t-1}-H^*_{t-1}$, K_t, ITC_t, β_{t-1}.
6b: θ^*_{t-1}, τ_{ct-1}, $H_{t-1}-H^*_{t-1}$, K_t, ITC_t, W_{t-1}.
6c: θ^*_{t-1}, τ_{ct-1}, $H_{t-1}-H^*_{t-1}$, K_t, β_{t-1}, W_{t-1}.
6d: θ^*_{t-1}, τ_{ct-1}, $H_{t-1}-H^*_{t-1}$, ITC_t, β_{t-1}, W_{t-1}.
6e: θ^*_{t-1}, τ_{ct-1}, K_t, ITC_t, β_{t-1}, W_{t-1}.
6f: θ^*_{t-1}, $H_{t-1}-H^*_{t-1}$, K_t, ITC_t, β_{t-1}, W_{t-1}.
6g: $H_{t-1}-H^*_{t-1}$, K_t, ITC_t, β_{t-1}, W_{t-1}.

"Small" List (4): θ^*_{t-1}, τ_{ct-1}, ITC_t, $H_{t-1}-H^*_{t-1}$.
3a: θ^*_{t-1}, τ_{ct-1}, ITC_t.
3b: θ^*_{t-1}, τ_{ct-1}, $H_{t-1}-H^*_{t-1}$.
3c: θ^*_{t-1}, ITC_t, $H_{t-1}-H^*_{t-1}$.
3d: τ_{ct-1}, ITC_t, $H_{t-1}-H^*_{t-1}$

Notes for Tables 2 - 6

IVs: The choice of instrumental variable list from those given in table 1.

MA: The order of the moving-average process used to correct for serial correlation. No entry implies that no correction was employed.

HC: A correction for heteroscedasticity was employed.

NOBS: The number of observations.

J(df): The value of the Hansen-Singleton J statistic, which is distributed as a chi-squared with df degrees of freedom.

* : The coefficient is significant at the 10 percent level for a two-tailed test.

Table 2A: Estimates of Equations 11-15 with Current "Large" IV Sets

IVs	7	7	7	7	7
MA			1	3	7
HC		Yes	Yes	Yes	Yes
ω_0	0.113*	0.122*	0.127*	0.125*	0.122*
	0.059	0.046	0.041	0.030	0.023
ω_1	0.470*	0.466*	0.465*	0.466*	0.467*
	0.018	0.014	0.013	9.2E-3	7.2E-3
a_1	0.141*	0.144*	0.143*	0.142*	0.141*
	0.002	1.2E-3	1.4E-3	1.3E-3	9.0E-4
g_{11}	1.5E-4	1.2E-3*	1.1E-3*	8.5E-4*	7.3E-4*
	5.5E-4	3.5E-4	3.1E-4	2.4E-4	1.8E-4
a_h	0.173*	0.177*	0.175*	0.173*	0.173*
	3.4E-3	2.8E-3	2.6E-3	2.1E-3	1.5E-3
g_{hh}	-1.0E-5	-3.0E-4	-3.3E-4	-4.6E-4*	-5.0E-4*
	4.2E-4	2.6E-4	2.4E-4	1.8E-4	1.2E-4
a_n	0.205*	0.209*	0.208*	0.207*	0.206*
	2.9E-3	1.9E-3	2.1E-3	2.0E-3	1.4E-3
g_{nn}	0.048*	0.095*	0.090*	0.085*	0.082*
	0.022	0.017	0.014	9.7E-3	7.8E-3
a_k	0.093*	0.096*	0.097*	0.097*	0.097*
	6.6E-3	2.9E-3	3.0E-3	2.4E-3	1.9E-3
g_{kk}	-4.9E-4*	-4.3E-4*	-4.4E-4*	-4.0E-4*	-3.8E-3*
	9.8E-5	7.1E-5	6.8E-5	5.5E-5	4.1E-5
ν_1	-0.240*	-0.243*	-0.250*	-0.251*	-0.251*
	0.017	0.012	0.012	9.6E-3	7.0E-3
a_ν	0.019*	0.023*	0.269*	0.027*	0.027*
	0.010	6.5E-3	6.5E-3	5.1E-3	3.7E-3
NOBS	105	105	105	105	105
J(df)	174.99(30)	89.87(30)	47.80(30)	25.67(30)	13.64(30)

Table 2B: Estimates of Equations 11-15 with Current "Large" IV Sets

IVs	6a	6b	6c	6d	6e	6f	6g
HC	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ω_0	-0.041	-0.087	0.133*	0.099*	0.232*	0.140*	0.114*
	0.064	0.064	0.050	0.052	0.071	0.044	0.048
ω_1	0.517*	0.531*	0.463*	0.474*	0.432*	0.461*	0.469*
	0.020	0.020	0.106	0.016	0.022	0.014	0.105
a_1	0.144*	0.144*	0.144*	0.144*	0.144*	0.144*	0.144*
	1.4E-3	1.4E-3	1.3E-3	1.4E-3	1.6E-3	1.3E-3	1.3E-3
g_{11}	1.1E-3*	1.5E-3*	1.9E-3*	2.1E-3*	2.9E-3*	9.9E-4*	5.0E-4
	6.4E-4	5.7E-4	4.4E-3	6.9E-4	6.1E-4	3.6E-4	4.8E-4
a_h	0.185*	0.187*	0.177*	0.178*	0.172*	0.177*	0.177*
	5.0E-3	4.2E-3	2.9E-3	4.6E-3	3.8E-3	2.8E-3	3.1E-3
g_{hh}	-2.2E-3*	-9.8E-4*	6.7E-5	-3.2E-3*	-1.4E-3	-1.6E-4	-5.7E-4*
	1.1E-3	5.4E-4	3.6E-4	1.1E-3	1.4E-3	2.2E-4	3.7E-4
a_n	0.209*	0.210*	0.212*	0.210*	0.210*	0.210*	0.209*
	2.1E-3	2.1E-3	2.3E-3	2.1E-3	2.4E-3	2.1E-3	2.0E-3
g_{nn}	0.094*	0.107*	0.199*	0.085*	0.105*	0.103*	0.085*
	0.020	0.021	0.055	0.021	0.021	0.021	0.020
a_k	0.094*	0.093*	0.093*	0.106*	0.100*	0.092*	0.093*
	3.2E-3	3.6E-3	3.3E-3	4.2E-3	4.5E-3	3.1E-3	3.1E-3
g_{kk}	-4.6E-3*	-4.9E-4*	-4.6E-4*	-2.7E-4*	-3.3E-4*	-5.4E-5*	-4.5E-4
	7.8E-5	8.2E-5	8.3E-5	8.2E-5	1.1E-4	8.7E-4	7.9E-5
ν_1	-0.229*	-0.225*	-0.236*	-0.269*	-0.254*	-0.246*	-0.235*
	0.014	0.015	0.013	0.103	0.013	0.013	0.014
a_ν	0.103*	0.011	0.020*	0.038*	0.031*	0.025*	0.019*
	7.7E-3	8.1E-3	6.9E-3	7.0E-3	7.0E-3	6.8E-3	7.4E-3
NOBS	105	105	105	105	105	105	105
J(df)	86.1(24)	86.2(24)	88.6(24)	87.5(24)	84.2(24)	89.2(24)	86.2(24)

Table 2C: Estimates of Equations 11-15 with Current "Small" IV Sets

IVs	4	4	4	4	4	3-a	3-b	3-c	3-d
MA			1	3	7				
HC	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ω_0	-0.090	-0.132*	-0.138*	-0.121	-0.089	-0.066*	-0.144*	0.120	-0.134*
	0.082	0.070	0.075	0.077	0.067	0.108	0.084	0.201	0.084
ω_1	0.533*	0.547*	0.549*	0.543*	0.534*	0.529*	0.551*	0.471*	0.548*
	0.025	0.022	0.023	0.023	0.021	0.034	0.026	0.062	0.026
a_1	0.142*	0.148*	0.147*	0.146*	0.144*	0.150*	0.157*	0.151*	0.152*
	1.8E-3	1.9E-3	2.4E-3	2.9E-3	2.8E-3	2.2E-3	2.6E-3	2.2E-3	8.7E-3
g_{11}	1.1E-3	1.7E-3	1.6E-3	1.8E-3	1.8E-3*	2.0E-3*	7.4E-3*	3.3E-3*	-3.9E-4*
	1.1E-3	1.0E-3	1.1E-3	1.2E-3	1.1E-3	1.4E-3	2.0E-3	1.9E-3	0.011
a_h	0.182*	0.192*	0.190*	0.189*	0.184*	0.195*	0.198*	-0.057	0.205*
	8.1E-3	7.1E-3	6.5E-3	7.0E-3	6.9E-3	0.011	9.7E-3	0.199	9.2E-3
g_{hh}	-3.0E-3*	-5.3E-3*	-4.7E-3*	-4.1E-3*	-4.1E-3*	0.013	-7.6E-3	-0.226*	-2.5E-3
	3.0E-3	1.7E-3	1.5E-3	1.2E-3	8.4E-4	0.011	2.1E-3	0.110	2.6E-3
a_n	0.206*	0.213*	0.212*	0.211*	0.209*	0.214*	0.224*	0.216*	0.202*
	3.0E-3	2.7E-3	3.5E-3	4.2E-3	4.0E-3	3.1E-3	4.1E-3	3.1E-3	0.043
g_{nn}	0.052	0.031	0.055	0.070*	0.079*	0.026	0.140*	0.028	-0.617
	0.033	0.037	0.037	0.037	0.033	0.049	0.122	0.058	1.372
a_k	0.114*	0.106*	0.109*	0.111*	0.110*	0.112*	0.108*	0.110*	0.098*
	7.6E-3	6.3E-3	7.2E-3	7.8E-3	8.4E-3	0.014	6.5E-3	7.1E-3	7.7E-3
g_{kk}	-2.5E-4*	-3.6E-4*	-3.1E-4*	-3.4E-4*	-3.3E-4*	1.3E-4	-4.3E-4*	-2.2E-4	-3.4E-4
	1.4E-4	1.1E-4	1.1E-4	1.1E-4	1.1E-4	2.8E-4	1.5E-4	1.1E-4	1.8E-4
ν_1	-0.305*	-0.285*	-0.297*	-0.306*	-0.305*	-0.240*	-0.331*	-0.289*	-0.271*
	0.023	0.021	0.026	0.028	0.029	0.025	0.027	0.023	0.025
a_ν	0.058*	0.048*	0.055*	0.060*	0.059*	0.022	0.076*	0.051*	0.039*
	0.014	0.012	0.014	0.016	0.016	0.015	0.016	0.013	0.014
NOBS	105	105	105	105	105	105	105	105	105
J(df)	100 (12)	72 (12)	40 (12)	22 (12)	13 (12)	53 (6)	23 (6)	61 (6)	25 (6)

Table 2D: Estimates of Equations 11-15: "Large" IV Sets Lagged One Period

IVs	7	7	7	7	7
MA			1	3	7
HC		Yes	Yes	Yes	Yes
ω_0	0.087	0.103*	0.107*	0.113*	0.110*
	0.064	0.050	0.045	0.036	0.028
ω_1	0.478*	0.474*	0.472*	0.471*	0.471*
	0.020	0.016	0.014	0.011	8.8E-3
a_l	0.143*	0.145*	0.144*	0.143*	0.143*
	2.0E-3	1.4E-3	1.4E-3	1.2E-3	8.7E-4
g_{ll}	2.4E-4*	3.6E-3*	3.5E-3*	3.4E-3*	3.3E-3*
	1.3E-4	8.8E-4	8.6E-4	6.7E-4	5.1E-4
a_h	0.176*	0.182*	0.179*	0.175*	0.174*
	0.019	0.012	9.6E-3	6.5E-3	4.8E-3
g_{hh}	-0.027	-0.013	-0.010	-0.011*	-0.011*
	0.017	8.9E-3	7.2E-4	5.4E-3	3.5E-3
a_n	0.205*	0.210*	0.208*	0.207*	0.206*
	2.8E-3	1.9E-3	2.0E-3	1.7E-3	1.3E-3
g_{nn}	0.040*	0.068*	0.066*	0.061*	0.059*
	0.020	0.013	0.013	0.010	8.4E-3
a_k	0.103*	0.102*	0.103*	0.104*	0.104*
	5.9E-3	3.5E-3	3.6E-3	3.3E-3	2.6E-3
g_{kk}	-1.1E-4	-1.4E-4*	-1.6E-4*	-1.6E-4*	-1.5E-4*
	8.6E-5	6.2E-5	6.2E-5	5.3E-5	3.5E-5
ν_1	-0.218*	-0.225*	-0.229*	-0.235*	-0.237*
	0.017	0.011	0.010	8.7E-3	5.9E-3
a_ν	5.2E-3	0.013*	0.014*	0.017*	0.018*
	0.010	5.8E-3	5.7E-3	4.7E-3	3.2E-3
NOBS	104	104	104	104	104
J(df)	169.5 (30)	85.9 (30)	47.6 (30)	25.7 (30)	13.6 (30)

Table 2E: Estimates of Equations 11-15: "Large" IV Sets Lagged One Period

IVs	6-a	6-b	6-c	6-d	6-e	6-f	6-g
HC	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ω_0	-1.5E-3	-0.076	0.100*	0.100*	0.316*	0.110*	0.127*
	0.066	0.066	0.051	0.053	0.068	0.051	0.054
ω_1	0.506*	0.529*	0.475*	0.475*	0.407*	0.472*	0.466*
	0.022	0.020	0.016	0.016	0.021	0.016	0.017
a_1	0.147*	0.147*	0.147*	0.146*	0.145*	0.146*	0.146*
	1.6E-3	1.7E-3	1.7E-3	1.7E-3	2.0E-3	1.5E-3	1.6E-3
g_{11}	4.5E-3*	4.2E-3*	4.4E-3*	4.6E-3*	5.8E-3*	2.7E-3*	3.4E-3*
	1.2E-3	1.5E-3	1.0E-3	1.2E-3	1.2E-3	1.0E-3	1.2E-3
a_h	0.193*	0.194*	0.181*	0.184*	0.172*	0.184*	0.181*
	0.036	0.029	0.014	0.030	4.5E-3	0.011	9.8E-3
g_{hh}	-0.028	-0.021	-0.025*	-0.036	-2.2E-3	-0.010	-0.016*
	0.024	0.020	0.012	0.023	3.0E-3	7.9E-3	9.0E-3
a_n	0.211*	0.212*	0.212*	0.210*	0.209*	0.211*	0.212*
	2.2E-3	2.1E-3	2.3E-3	2.1E-3	2.1E-3	2.1E-3	2.3E-3
g_{nn}	0.073*	0.070*	0.085*	0.073*	0.065*	0.061*	0.125*
	0.018	0.019	0.015	0.018	0.015	0.016	0.029
a_k	0.101*	0.100*	0.101*	0.113*	0.110*	0.102*	0.095*
	3.5E-3	3.6E-3	3.7E-3	4.9E-3	4.9E-3	3.5E-3	3.2E-3
g_{kk}	-6.0E-5	-5.2E-5	-1.2E-4*	-5.0E-5	-4.9E-5	-1.4E-4*	-3.6E-4
	5.6E-5	5.9E-5	7.4E-5	6.2E-5	7.2E-5	7.2E-5	8.9E-5
ν_1	-0.200*	-0.189*	-0.216*	-0.256*	-0.239*	-0.225*	-0.242*
	0.013	0.014	0.012	0.012	0.012	0.011	0.013
a_ν	-3.6E-3	-9.6E-3	8.1E-3	0.031*	0.022*	0.014*	0.023*
	7.4E-3	7.6E-3	6.5E-3	6.8E-3	6.6E-3	6.1E-3	7.4E-3
NOBS	104	104	104	104	104	104	104
J(df)	80.1 (24)	77.3 (24)	81.0 (24)	83.6 (24)	80.5 (24)	81.1 (24)	80.2 (24)

Table 2F: Estimates of Equations 11-15: "Small" IV Sets Lagged One Period

IVs	4	4	4	4	4	3-a	3-b	3-c	3-d
MA			1	3	7				
HC		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ω_0	-0.058	-0.126*	-0.123	-0.110	-0.087	0.053	-0.117	-0.069	-0.186*
	0.084	0.074	0.074	0.078	0.075	0.098	0.086	0.127	0.081
ω_1	0.523*	0.545*	0.545*	0.539*	0.532*	0.493*	0.543*	0.529*	0.564*
	0.026	0.023	0.023	0.023	0.023	0.031	0.027	0.039	0.025
a_1	0.144*	-0.150*	-0.148	0.147	0.146*	0.150*	0.157*	0.152*	0.144*
	2.4E-3	2.1E-3	2.5E-3	2.7E-3	2.6E-3	2.6E-3	3.1E-3	3.0E-3	7.0E-3
g_{11}	5.2E-3*	4.0E-3*	5.0E-3*	5.5E-3*	5.7E-3*	4.2E-3	9.5E-3*	2.0E-3	-0.013
	2.1E-3	2.0E-3	2.2E-3	2.4E-3	2.3E-3	2.6E-3	3.0E-3	6.5E-3	8.8E-3
a_h	0.181*	0.208*	0.198*	0.193*	0.182*	0.211	0.191*	0.153*	0.197*
	0.063	0.046	0.035	0.027	0.021	0.249	0.023	0.085	0.013
g_{hh}	-0.065	-0.027*	-0.025	-0.036	-0.037*	0.083	-1.2E-2*	-0.267	-0.011
	0.098	0.044	0.039	0.030	0.023	0.540	4.6E-3	0.236	0.014
a_n	0.207*	0.215*	0.213*	0.211*	0.209*	0.217*	0.222*	0.220*	0.201*
	3.0E-3	2.8E-3	3.5E-3	4.0E-3	3.7E-3	3.0E-3	3.3E-3	3.4E-3	8.8E-3
g_{nn}	0.067*	0.072*	0.074*	0.079*	0.075*	0.064*	0.139*	0.080*	-0.387*
	0.024	0.024	0.028	0.030	0.027	0.025	0.033	0.036	0.181
a_k	0.113*	0.112*	0.113*	0.115*	0.116*	0.107*	0.114*	0.110*	0.080*
	6.6E-3	6.1E-3	6.7E-3	7.1E-3	6.7E-3	7.9E-3	6.2E-3	6.3E-3	0.013
g_{kk}	-5.6E-6	1.5E-5	3.6E-5	1.5E-5	-2.3E-5	1.1E-4	-3.1E-5	-4.9E-5	-6.6E-4*
	9.5E-5	6.7E-5	7.2E-5	8.1E-5	7.6E-5	1.1E-4	1.0E-4	8.2E-5	3.6E-4
ν_1	-0.242*	-0.244*	-0.249*	-0.255*	-0.261*	-0.193*	-0.274*	-0.261*	-0.247*
	0.022	0.022	0.026	0.027	0.026	0.024	0.029	0.023	0.025
a_ν	0.020	0.023*	0.026*	0.029*	0.032*	-5.9E-3	0.041*	0.034*	0.025*
	0.013	0.012	0.014	0.015	0.014	0.013	0.017	0.013	0.015
NOBS	104	104	104	104	104	104	104	104	104
J(df)	86 (6)	67 (6)	37 (6)	21 (6)	12 (6)	50 (6)	30 (6)	56 (6)	49 (6)

Table 2G: Estimates of Equations 11-15: "Large" IV Sets Lagged 4 Periods

IVs	7	7	7	7	7
MA			1	3	7
HC		Yes	Yes	Yes	Yes
ω_0	0.147*	0.142*	0.170*	0.175*	0.178*
	0.070	0.047	0.040	0.031	0.020
ω_1	0.461*	0.462*	0.453*	0.452*	0.451*
	0.021	0.015	0.012	9.5E-3	6.4E-3
a_1	0.149*	0.152*	0.151*	0.149*	0.149*
	5.9E-3	3.5E-3	3.4E-3	2.5E-3	1.7E-3
g_{11}	0.015*	0.011*	0.105*	0.015*	0.015*
	6.9E-3	5.1E-3	4.6E-3	2.9E-3	2.0E-3
a_h	0.173*	0.176*	0.172*	0.171*	0.171*
	6.7E-3	4.6E-3	3.3E-3	2.7E-3	1.8E-3
g_{hh}	-4.0E-3	-5.1E-3*	-3.7E-3*	-3.3E-3*	-3.2E-3*
	2.6E-3	1.4E-3	1.0E-3	7.6E-4	5.3E-4
a_n	0.209*	0.212*	0.210*	0.208*	0.208*
	3.4E-3	1.9E-3	2.1E-3	1.7E-3	1.2E-3
g_{nn}	0.117*	0.099*	0.109*	0.111*	0.112*
	0.033	0.024	0.019	0.013	0.010
a_k	0.104*	0.103*	0.105*	0.107*	0.106*
	5.8E-3	3.8E-3	4.1E-3	3.4E-3	2.5E-3
g_{kk}	-5.7E-5	-5.4E-5	-5.4E-5	-6.8E-5*	-7.4E-5*
	7.0E-5	4.6E-5	4.7E-5	3.9E-5	3.0E-5
ν_1	-0.216*	-0.221*	-0.224*	-0.232*	-0.231*
	0.017	0.013	0.103	0.010	9.0E-3
a_ν	5.0E-3	0.010	0.011	0.015*	0.015*
	0.010	6.9E-3	7.2E-3	5.7E-3	4.8E-3
NOBS	101	101	101	101	101
J(df)	131.3 (30)	81.3 (30)	45.8 (30)	24.8 (30)	13.0 (30)

Table 2H: Estimates of Equations 11-15: "Large" IV Sets Lagged 4 Periods

IVs	6-a	6-b	6-c	6-d	6-e	6-f	6-g
HC	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ω_0	0.156*	0.111*	0.107*	0.181*	0.138*	0.138*	0.142*
	0.075	0.057	0.057	0.050	0.051	0.056	0.047
ω_1	0.458*	0.471*	0.472*	0.449*	0.463*	0.463*	0.462*
	0.023	0.108	0.018	0.015	0.016	0.018	0.015
a_1	0.152*	0.155*	0.157*	0.155*	0.152*	0.166*	0.152*
	3.9E-3	4.4E-3	4.5E-3	4.1E-3	3.8E-3	9.0E-3	3.5E-3
g_{11}	0.012*	0.015*	0.014*	0.013*	0.014*	0.023	0.011*
	5.8E-3	6.4E-3	6.0E-3	6.4E-3	5.8E-3	0.023	5.1E-3
a_h	0.176*	0.177*	0.178*	0.177*	0.176*	0.177*	0.176*
	4.7E-3	5.3E-3	5.4E-3	5.1E-3	4.3E-3	4.7E-3	4.6E-3
g_{hh}	-4.1E-3*	-5.4E-3*	-5.7E-3*	-5.5E-3*	-4.2E-3*	-4.2E-3*	-5.1E-3*
	1.8E-3	1.5E-3	1.6E-3	1.7E-3	1.1E-3	1.3E-3	1.4E-3
a_n	0.212*	0.212*	0.214*	0.214*	0.210*	0.213*	0.212*
	2.1E-3	2.0E-3	2.2E-3	2.1E-3	2.0E-3	2.3E-3	1.9E-3
g_{nn}	0.106*	0.116*	0.115*	0.102*	0.098*	0.163*	0.099*
	0.027	0.027	0.028	0.028	0.025	0.056	0.024
a_k	0.101*	0.099*	0.099*	0.106*	0.107*	0.105*	0.103*
	3.9E-3	3.8E-3	4.0E-3	4.3E-3	4.0E-3	3.8E-3	3.8E-3
g_{kk}	-1.6E-4*	-8.4E-5	-6.6E-5	-2.6E-5	-1.2E-4*	-1.4E-4*	-5.4E-5
	7.4E-5	5.1E-5	4.7E-5	5.4E-5	6.0E-5	5.7E-5	4.6E-5
ν_1	-0.231*	-0.200*	-0.198*	-0.220*	-0.244*	-0.237*	-0.221*
	0.104	0.013	0.014	0.013	0.014	0.014	0.013
a_ν	0.106*	-4.6E-3	-5.9E-3	9.1E-3	0.023*	0.021*	0.010
	7.4E-3	7.2E-3	7.3E-3	7.4E-3	7.7E-3	7.5E-3	6.9E-3
NOBS	101	101	101	101	101	101	101
J(df)	80.5 (24)	78.1 (24)	76.0 (24)	74.6 (24)	80.7 (24)	72.4 (24)	81.3 (24)

Table 2I: Estimates of Equations 11-15: "Small" IV Sets Lagged 4 Periods

IVs	4	4	4	4	4	3-a	3-b	3-c	3-d
MA			1	3	7				
HC		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ω_0	-0.013	-0.021	-0.032	-0.020	0.010	0.072	-0.321*	0.047	-0.134
	0.077	0.072	0.073	0.072	0.050	0.079	0.152	0.078	0.100
ω_1	0.511*	0.513*	0.516*	0.513*	0.503*	0.486*	0.609*	0.492*	0.549*
	0.024	0.022	0.023	0.022	0.016	0.025	0.048	0.025	0.031
a_1	0.148*	0.155*	0.154*	0.152*	0.150*	0.161*	0.156*	0.149*	0.148*
	6.9E-3	4.7E-3	4.7E-3	4.5E-3	4.0E-3	0.012	4.4E-3	0.039	3.5E-3
g_{11}	0.014	0.016*	0.019*	0.018*	0.017*	0.040*	0.012	0.010	2.3E-3
	0.011	6.7E-3	6.5E-3	6.0E-3	5.6E-3	0.028	8.5E-3	0.076	4.7E-3
a_h	0.180*	0.190*	0.187*	0.185*	0.180*	0.193*	0.199*	0.195*	0.186*
	7.0E-3	6.6E-3	6.6E-3	6.4E-3	5.4E-3	6.2E-3	0.025	6.0E-3	0.102
g_{hh}	-3.8E-3	-5.0E-3*	-3.9E-3*	-3.5E-3*	-3.3E-3	-4.2E-3*	-9.9E-3	-2.5E-3	-0.034
	2.6E-3	1.7E-3	1.4E-3	1.2E-3	9.9E-4	1.5E-3	9.8E-3	1.7E-3	0.108
a_n	0.208*	0.216*	0.214*	0.211*	0.209*	0.219*	0.220*	0.233*	0.213*
	3.2E-3	2.9E-3	3.6E-3	4.1E-3	4.3E-3	3.1E-3	3.3E-3	0.015	3.4E-3
g_{nn}	0.088*	0.104*	0.108*	0.097*	0.087*	0.153*	0.110*	0.621	0.010
	0.037	0.031	0.029	0.027	0.022	0.038	0.038	0.495	0.051
a_k	0.104*	0.104	0.106*	0.106*	0.107*	0.100*	0.104*	0.100*	0.130*
	6.3E-3	5.4E-3	5.9E-3	5.6E-3	5.3E-3	5.9E-3	5.5E-3	7.5E-3	0.013
g_{kk}	-1.1E-4	-9.0E-5	-9.1E-5	-1.1E-4*	-1.2E-4*	-4.7E-5	-8.2E-5	-4.1E-4*	4.1E-4
	7.5E-5	6.0E-5	6.5E-5	6.4E-5	5.8E-5	6.3E-5	8.1E-5	1.4E-4	2.9E-4
ν_1	-0.226*	-0.219	-0.229*	-0.237*	-0.242*	-0.184*	-0.232*	-0.260*	-0.250*
	0.023	0.021	0.025	0.026	0.027	0.023	0.028	0.023	0.025
a_ν	9.8E-3	7.9E-3	0.013	0.017	0.020	-0.011	0.014	0.034*	0.028*
	0.014	0.012	0.014	0.015	0.015	0.014	0.016	0.013	0.015
NOBS	101	101	101	101	101	101	101	101	101
J(df)	74 (12)	69 (12)	39 (12)	22 (12)	12 (12)	36 (6)	41 (6)	48 (6)	61 (6)

Table 3A: Split Sample, 54:3 - 67:2, One-Quarter Lag, "Small" IV Sets

IVs	4	3-a	3-b	3-c	3-d
ω_0	0.198*	0.145	0.196*	0.221*	0.113
	0.051	0.097	0.068	0.083	0.077
ω_1	0.467*	0.488*	0.467*	0.463*	0.496*
	0.016	0.032	0.022	0.029	0.025
a_1	0.175*	0.177*	0.178*	0.175*	0.176*
	7.8E-4	1.5E-3	1.7E-3	1.1E-3	1.4E-3
g_{11}	-5.2E-4	0.013	4.1E-3*	1.3E-3	2.6E-3
	3.2E-4	0.011	2.3E-3	1.3E-3	1.6E-3
a_h	0.228*	0.234*	0.232*	0.228*	0.235*
	1.5E-4	5.9E-3	4.2E-3	4.5E-3	7.3E-3
g_{hh}	-9.3E-5	4.2E-4	1.0E-3*	5.9E-4	5.0E-3
	1.5E-4	1.5E-3	4.5E-4	6.4E-4	8.5E-3
a_n	0.252*	0.254*	0.254*	0.250*	0.254*
	1.2E-3	1.4E-3	1.3E-3	3.1E-3	2.5E-3
g_{nn}	0.075*	0.027	-0.029*	-0.418*	0.142*
	0.018	0.041	0.033	0.222	0.066
a_k	0.081*	0.079*	0.070*	-0.017	0.075*
	4.8E-3	7.7E-3	6.9E-3	0.058	5.9E-3
g_{kk}	-2.7E-4*	-7.1E-5	4.5E-5	-6.8E-4*	-2.6E-4*
	1.0E45	1.3E-4	1.5E-4	3.8E-4	1.5E-4
ν_1	-0.216*	-0.166*	-0.079*	-0.776*	-0.143*
	0.040	0.0663	0.056	0.609	0.056
a_ν	0.013	-0.011	0.053*	0.456	-0.022*
	0.019	0.031	0.022	0.287	0.026
NOBS	52	52	52	52	52
J(df)	40 (12)	29 (6)	26 (6)	36 (6)	19 (6)

Table 3B: Split Sample, 67:3 - 80:2, One-Quarter Lag, "Small" IV Sets

IVs	4	3-a	3-b	3-c	3-d
ω_0	-0.171*	-0.675	-0.193*	-0.083	-0.260*
	0.088	0.539	0.095	0.177	0.109
ω_1	0.551*	0.705*	0.558	0.525*	0.578*
	0.027	0.164	0.029	0.053	0.033
a_l	0.139*	0.139*	0.144*	0.139*	0.135*
	1.7E-3	1.9E-3	2.6E-3	2.3E-3	7.0E-3
g_{ll}	2.6E-3	1.7E-3	4.9E-3*	3.4E-3	-0.015*
	1.6E-3	1.6E-3	2.0E-3	3.1E-3	7.2E-3
a_h	0.182*	0.201*	0.178*	0.145	0.188*
	0.013	0.029	0.018	0.193	0.016
g_{hh}	-8.5E-3	-2.1E-3	-6.5E-3*	-0.264	-0.015
	7.4E-3	0.029	2.4E-3	0.481	0.012
a_n	0.198*	0.199*	0.204*	0.199*	0.182*
	2.5E-3	2.7E-3	3.2E-3	3.0E-3	0.016
g_{nn}	0.035*	0.020	0.079*	0.051*	-0.414*
	0.018	0.019	0.021	0.024	0.213
a_k	0.119*	0.058	0.131*	0.137*	0.124*
	0.012	0.051	0.106	0.016	0.016
g_{kk}	1.7E-4*	3.1E-4*	3.2E-4*	1.3E-4	-3.3E-4
	9.1E-5	1.5E-4	1.1E-4	1.0E-4	2.2E-4
ν_1	-0.191*	-0.135*	-0.194*	-0.291*	-0.338*
	0.056	0.242	0.065	0.078	0.081
a_ν	-0.018	-0.245	0.016	0.052	0.085
	0.038	0.169	0.044	0.053	0.056
NOBS	52	52	52	52	52
J(df)	32 (12)	24 (6)	17 (6)	30 (6)	10 (6)

Table 3C: Split Sample, 55:2 - 68:1, Four-Quarter Lag, "Small" IV Sets

IVs	4	3-a	3-b	3-c	3-d
ω_0	0.181*	0.136	0.208*	0.095	0.206*
	0.072	0.088	0.085	0.085	0.075
ω_1	0.475*	0.493*	0.464*	0.504*	0.469*
	0.022	0.028	0.028	0.027	0.023
a_l	0.173*	0.175*	0.175*	0.172*	0.174*
	7.6E-4	0.011	1.6E-3	2.5E-3	9.7E-4
g_{ll}	-1.2E-3	-0.030	3.2E-3	-0.013*	-5.9E-3*
	1.1E-3	0.071	3.7E-3	4.5E-3	3.3E-3
a_h	0.226*	0.234*	0.243*	0.272*	0.228*
	3.9E-3	4.7E-3	0.019	0.093	4.2E-3
g_{hh}	-1.1E-3	3.0E-3*	-0.018*	0.121	9.9E-4
	7.6E-4	1.3E-3	0.016	0.103	9.3E-4
a_n	0.250*	0.251*	0.253*	0.249*	0.251*
	1.0E-3	1.3E-3	1.6E-3	2.2E-3	1.3E-3
g_{nn}	0.027*	-0.096*	0.123*	-0.151*	-2.9E-3
	0.015	0.054	0.048	0.066	0.023
a_k	0.078*	0.074*	0.076*	0.050*	0.082*
	4.0E-3	6.7E-3	4.5E-3	9.5E-3	4.4E-3
g_{kk}	-3.8E-4*	-2.3E-4*	-1.5E-4	-3.4E-4*	-3.5E-4*
	5.5E-5	9.9E-5	1.4E-4	2.3E-4	7.3E-5
ν_1	-0.190*	-0.099*	-0.115*	-0.097	-0.220*
	0.035	0.050	0.029	0.082	0.034
a_ν	2.1E-3	-0.043*	-0.036*	0.139*	-0.016
	0.017	0.024	0.014	0.038	0.016
NOBS	52	52	52	52	52
J(df)	40 (12)	34 (6)	20 (6)	12 (6)	38 (6)

Table 3D: Split Sample, 68:2 - 80:2, Four-Quarter Lag, "Small" IV Sets

IVs	4	3-a	3-b	3-c	3-d
ω_0	0.043	-0.176*	0.145	0.045	-0.543*
	0.073	0.102	0.096	0.080	0.255
ω_1	0.487*	0.447*	0.455*	0.487*	0.663*
	0.023	0.031	0.029	0.025	0.077
a_1	0.141*	0.142*	0.139*	0.138*	0.138*
	2.7E-3	3.3E-3	1.8E-3	3.2E-3	7.0E-3
g_{11}	6.3E-3*	7.9E-3	-1.6E-3	-3.8E-4	4.2E-4
	2.7E-3	5.3E-3	1.9E-3	4.3E-3	1.8E-3
a_h	0.170*	0.169*	0.169*	0.174*	0.191*
	6.7E-3	5.1E-3	5.9E-3	6.9E-3	0.012
g_{hh}	-3.6E-3*	-1.8E-3*	2.1E-3	-1.1E-3	-5.7E-4
	1.5E-3	9.3E-4	1.5E-3	2.0E-3	5.8E-3
a_n	0.197*	0.198*	0.197*	0.206*	0.196*
	2.5E-3	2.8E-3	3.0E-3	6.8E-3	3.0E-3
g_{nn}	0.060*	0.035	-0.033	0.252*	9.8E-3
	0.024	0.024	0.025	0.129	0.029
a_k	0.059*	-0.024	0.066*	0.082*	0.148*
	0.022	0.053	0.021	0.021	0.040
g_{kk}	1.2E-4*	2.4E-4*	7.2E-5	-2.0E-4	5.3E-4
	6.4E-5	8.3E-5	6.7E-5	1.3E-4	3.7E-4
ν_1	0.080	0.499*	0.041	-0.091	-0.248*
	0.108	0.257	0.103	0.116	0.129
a_ν	-0.213*	-0.505*	-0.186*	0.091	0.021
	0.077	0.181	0.073	0.082	0.091
NOBS	52	52	52	52	52
J(df)	30 (12)	204 (6)	18 (6)	29 (6)	27 (6)

Table 4A: Non-Debt Equations, One-Quarter Lag, "Large" IV Sets

IVs	6-a	6-b	6-c	6-d	6-e	6-f	6-g
ω_0	-0.011	-0.086	0.133*	0.129*	0.352*	0.132*	0.142*
	0.067	0.069	0.055	0.056	0.071	0.055	0.057
ω_1	0.509*	0.531*	0.463*	0.465*	0.396*	0.464*	0.462*
	0.021	0.021	0.017	0.018	0.022	0.017	0.018
a_1	0.147*	0.147*	0.147*	0.147*	0.145*	0.146*	0.146*
	1.9E-3	2.0E-3	1.7E-3	1.8E-3	2.0E-3	1.7E-3	1.9E-3
g_{11}	4.6E-3*	4.0E-3*	3.5E-3*	4.4E-3*	4.1E-3*	2.4E-3*	3.7E-3*
	1.6E-3	1.8E-3	1.3E-3	1.5E-3	1.6E-3	1.3E-3	1.5E-3
a_h	0.200*	0.199*	0.181*	0.184*	0.171*	0.181*	0.181*
	0.028	0.019	8.8E-3	0.031	4.2E-3	6.9E-3	8.2E-3
g_{hh}	-0.023	-0.015	-0.014*	-0.038*	-2.0E-3	-5.4E-3	-0.014*
	0.018	0.014	7.8E-3	0.023	2.2E-3	4.6E-3	6.9E-3
a_n	0.212*	0.213*	0.212*	0.210*	0.209*	0.211*	0.212*
	2.5E-3	2.6E-3	2.5E-3	2.3E-3	2.1E-3	2.5E-3	2.6E-3
g_{nn}	0.073*	0.070*	0.067*	0.066*	0.045*	0.053*	0.102*
	0.022	0.022	0.019	0.022	0.017	0.018	0.033
a_k	0.040*	0.033*	0.033*	0.045*	0.045*	0.040*	0.051*
	9.1E-3	0.010	9.8E-3	0.010	9.4E-3	8.7E-3	8.1E-3
g_{kk}	8.8E-5	1.4E-4	2.4E-4	1.1E-4	1.6E-4	1.5E-4	-1.8E-4
	1.0E-4	1.1E-4	1.0E-4	9.4E-5	1.0E-4	1.0E-4	1.1E-4
ν_1	0.176*	-0.233*	-0.263*	0.157*	0.174*	0.192*	0.058
	0.068	0.075	0.076	0.070	0.065	0.066	0.066
NOBS	104	104	104	104	104	104	104
J(df)	77.3 (19)	74.0 (19)	76.2 (19)	81.2 (19)	74.8 (19)	79.3 (19)	76.1 (19)

Table 4B: Capital and Debt Equations, One-Quarter Lag, "Large" IV Sets

IVs	6-a	6-b	6-c	6-d	6-e	6-f	6-g
a_k	0.092*	0.092*	0.090*	0.108*	0.103*	0.092*	0.087*
	4.1E-3	4.2E-3	4.3E-3	5.2E-3	6.1E-3	4.1E-3	3.8E-3
g_{kk}	-1.3E-4*	-1.3E-4*	-1.9E-4*	-9.0E-5	4.1E-5	-1.9E-4*	-3.4E-4*
	7.6E-5	7.8E-5	9.9E-5	7.9E-5	9.3E-5	9.1E-5	1.1E-4
ν_1	-0.221*	-0.218*	-0.229*	-0.270*	-0.232*	-0.236*	-0.237*
	0.017	0.017	0.016	0.018	0.018	0.016	0.016
a_ν	9.8E-3	8.1E-3	0.017*	0.038*	0.019*	-0.020*	0.021*
	8.7E-3	9.0E-3	8.7E-3	0.010	9.6E-3	8.5E-3	8.6E-3
NOBS	104	104	104	104	104	104	104
J(df)	40.7 (8)	41.9 (8)	45.7 (8)	25.2 (8)	43.9 (8)	39.1 (8)	35.1 (8)

Table 4C: Capital Equation, One-Quarter Lag, "Large" IV Sets

IVs	6-a	6-b	6-c	6-d	6-e	6-f	6-g
a_k	0.045*	0.038*	0.048*	0.066*	0.062*	0.051*	0.060*
	9.6E-3	0.011	0.010	0.011	9.8E-3	9.1E-3	8.8E-3
g_{kk}	1.2E-4	1.7E-4	5.1E-5	3.7E-5	1.6E-4	4.7E-5	-2.2E-4
	1.1E-4	1.2E-4	1.1E-4	9.8E-5	1.1E-4	1.2E-4	1.3E-4
ν_1	0.152*	0.208*	0.131*	0.022	0.063	0.112	-4.3E-3
	0.072	0.081	0.082	0.075	0.070	0.071	0.074
NOBS	104	104	104	104	104	104	104
J(df)	7.5 (3)	6.1 (3)	11.3 (3)	6.5 (3)	4.1 (3)	11.5 (3)	4.3 (3)

Table 4D: Debt Equation, One-Quarter Lag, "Large" IV Sets

IVs	6-a	6-b	6-c	6-d	6-e	6-f	6-g
a_ν	0.019*	0.014*	0.031*	0.055*	0.041*	0.032*	0.027*
	9.3E-3	9.7E-3	9.8E-3	0.011	9.9E-3	9.8E-3	9.8E-3
ν_1	-0.239*	-0.230*	-0.253*	-0.300*	-0.276*	-0.259*	-0.248*
	0.017	0.028	0.019	0.020	0.018	0.018	0.018
NOBS	104	104	104	104	104	104	104
J(df)	13.8 (3)	21.4 (3)	25.5 (3)	6.4 (3)	26.4 (3)	23.4 (3)	30.8 (3)

Table 4E: Non–Debt Equations, Four–Quarter Lag, "Large" IV Sets

IVs	6-a	6-b	6-c	6-d	6-e	6-f	6-g
ω_0	0.130*	0.101*	0.243*	0.179*	0.195*	0.181*	0.133*
	0.059	0.060	0.058	0.057	0.063	0.057	0.077
ω_1	0.466*	0.474*	0.430*	0.451*	0.446*	0.449*	0.464*
	0.018	0.019	0.018	0.018	0.020	0.018	0.024
a_l	0.153*	0.152*	0.155*	0.153*	0.169*	0.151*	0.152*
	4.3E-3	4.1E-3	4.0E-3	3.9E-3	9.0E-3	3.6E-3	4.0E-3
g_{ll}	0.014*	0.011*	0.015*	0.015*	0.034	9.8E-3*	0.012*
	5.5E-3	5.3E-3	5.4E-3	5.6E-3	0.021	5.1E-3	5.6E-3
a_h	0.177*	0.178*	0.176*	0.176*	0.176*	0.175*	0.179*
	5.6E-3	5.7E-3	5.3E-3	4.5E-3	4.9E-3	4.9E-3	5.4E-3
g_{hh}	-5.2E-3*	-5.6E-3*	-4.9E-3*	-3.8E-3*	-4.8E-3	-4.4E-3*	-4.8E-3*
	1.6E-3	1.8E-3	1.9E-3	1.3E-3	1.4E-3	1.6E-3	2.2E-3
a_n	0.212*	0.211*	0.214*	0.211*	0.214*	0.211*	0.212*
	2.6E-3	2.7E-3	2.7E-3	2.5E-3	3.0E-3	2.8E-3	2.7E-3
g_{nn}	0.107*	0.106*	0.105*	0.103*	0.179*	0.092*	0.090*
	0.030	0.031	0.032	0.028	0.047	0.033	0.032
a_k	0.040*	0.029*	0.044*	0.055*	0.050*	0.042*	0.042*
	9.5E-3	0.011	9.2E-3	9.4E-3	8.5E-3	9.4E-3	8.7E-3
g_{kk}	7.1E-5	9.0E-5	1.2E-4	4.2E-5	6.1E-5	1.4E-4*	-4.3E-5
	6.6E-5	6.6E-5	7.3E-5	7.6E-5	6.5E-5	7.8E-5	8.0E-5
ν_1	0.175*	0.234*	0.165*	0.087*	0.121*	0.172*	0.138*
	0.060	0.065	0.058	0.064	0.056	0.061	0.059
NOBS	101	101	101	101	101	101	101
J(df)	78.1 (19)	76.5 (19)	70.0 (19)	77.3 (19)	65.1 (19)	75.3 (19)	75.8 (19)

Table 4F: Capital and Debt Equations, Four-Quarter Lag, "Large" IV Sets

IVs	6-a	6-b	6-c	6-d	6-e	6-f	6-g
a_k	0.091*	0.092*	0.096*	0.100*	0.094*	0.100*	0.093*
	4.4E-3	4.5E-3	4.9E-3	4.7E-3	4.5E-3	4.9E-3	4.7E-3
g_{kk}	-1.7E-4*	-1.4E-4*	-7.1E-5*	-2.9E-4*	1.8E-4*	-4.0E-5*	-2.1E-4*
	6.5E-5	6.2E-5	6.7E-5	7.9E-5	7.3E-5	6.2E-5	9.5E-4
ν_1	-0.218*	-0.210*	-0.216*	-0.267*	-0.226*	-0.224*	-0.230*
	0.016	0.015	0.016	0.018	0.017	0.016	0.017
a_ν	8.4E-3	3.3E-3	9.8E-3	0.036*	0.015*	-0.013*	0.017*
	8.1E-3	8.1E-3	8.7E-3	9.9E-3	9.3E-3	8.4E-3	8.7E-3
NOBS	101	101	101	101	101	101	101
J(df)	39.1 (8)	40.3 (8)	44.3 (8)	23.0 (8)	37.8 (8)	38.9 (8)	45.4 (8)

Table 4G: Capital Equation, Four-Quarter Lag, "Large" IV Sets

IVs	6-a	6-b	6-c	6-d	6-e	6-f	6-g
a_k	0.054*	0.049*	0.055*	0.068*	0.062*	0.056*	0.055*
	9.9E-3	0.011	9.9E-3	0.011	9.5E-3	9.9E-3	9.3E-3
g_{kk}	1.0E-4	1.2E-4	1.3E-4	1.9E-5	8.2E-5	1.7E-4	9.6E-5
	7.5E-4	7.7E-5	8.3E-5	9.0E-5	7.6E-5	9.1E-5	1.1E-4
ν_1	0.111*	0.140*	0.114*	0.012	0.055	0.126*	0.100
	0.062	0.068	0.062	0.077	0.064	0.066	0.063
NOBS	101	101	101	101	101	101	101
J(df)	9.5 (3)	8.6 (3)	6.2 (3)	8.2 (3)	7.9 (3)	8.2 (3)	10.5 (3)

Table 4H: Debt Equation, Four-Quarter Lag, "Large" IV Sets

IVs	6-a	6-b	6-c	6-d	6-e	6-f	6-g
a_ν	0.029*	0.025*	0.036*	0.052*	0.036*	0.034*	0.032*
	9.2E-3	9.4E-3	9.9E-3	0.011	0.010	9.7E-3	9.6E-3
ν_1	-0.255*	-0.248*	-0.264*	-0.293*	-0.265*	-0.261*	-0.259*
	0.018	0.017	0.018	0.020	0.019	0.018	0.018
NOBS	101	101	101	101	101	101	101
J(df)	10.8 (3)	16.4 (3)	16.4 (3)	9.1 (3)	19.2 (3)	18.4 (3)	17.7 (3)

Table 5A: Split Sample, Capital Equation, One–Quarter Lag, "Large" IV Sets, 1954:3 - 1967:2

IVs	6-a	6-b	6-c	6-d	6-e	6-f	6-g
a_k	0.104*	0.082*	0.104*	0.107*	0.098*	0.095*	0.094*
	0.022	0.021	0.020	0.024	0.019	0.018	0.019
g_{kk}	-3.6E-4*	-3.1E-4	-3.5E-4	-6.8E-4*	-2.8E-4	-4.1E-4*	-3.3E-4
	1.6E-4	1.2E-4	1.2E-4	1.7E-4	1.7E-4	1.2E-4	1.2E-4
ν_1	-0.485*	0.277*	0.493*	-0.571*	-0.414	-0.428*	-0.387*
	0.243	0.218	0.216	0.266	0.223	0.199	0.204
NOBS	52	52	52	52	52	52	52
J(df)	11.9 (3)	7.4 (3)	10.3 (3)	6.6 (3)	11.0 (3)	5.3 (3)	9.0 (3)

Table 5B: Split Sample, Capital Equation, One–Quarter Lag, "Large" IV Sets, 1967:3 - 1980:2

IVs	6-a	6-b	6-c	6-d	6-e	6-f	6-g
a_k	-0.057	-0.069	-0.061	-0.060	-0.052	-0.037	-7,6E-3*
	0.071	0.074	0.078	0.078	0.084	0.068	0.063
g_{kk}	1.7E-3	1.6E-4	1.6E-4	1.1E-4	8.7E-5	8.8E-5	-1.3E-5
	1.3E-3	1.3E-4	1.4E-4	1.1E-4	1.1E-4	1.0E-4	1.4E-4
ν_1	0.667*	0.728*	0.691*	0.672*	0.625	0.553*	-0.380*
	0.344	0.359	0.384	0.378	0.409	0.325	0.311
NOBS	52	52	52	52	52	52	52
J(df)	2.3 (3)	2.4 (3)	3.4 (3)	3.9 (3)	4.3 (3)	4.3 (3)	3.5 (3)

Table 5C: Split Sample, Capital Equation, Four-Quarter Lag, "Large" IV Sets, 1955:2 - 1968:1

IVs	6-a	6-b	6-c	6-d	6-e	6-f	6-g
a_k	0.063*	0.065*	0.061*	0.064*	0.065*	0.075*	0.068*
	0.022	0.021	0.022	0.021	0.021	0.022	0.022
g_{kk}	-3.1E-4*	-3.7E-4*	-2.7E-4	-4.0E-4*	-3.3E-4	-4.2E-4*	-3.5E-4
	1.5E-4	1.5E-4	1.6E-4	1.6E-4	1.5E-4	1.6E-4	1.5E-4
ν_1	-0.040	-0.076	-6.1E-3	-0.061	-0.060	-0.188	-0.090
	0.240	0.240	0.242	0.237	0.239	0.248	0.244
NOBS	52	52	52	52	52	52	52
J(df)	10.7 (3)	7.3 (3)	10.2 (3)	9.6 (3)	10.9 (3)	5.7 (3)	9.9 (3)

Table 5D: Split Sample, Capital Equation, Four-Quarter Lag, "Large" IV Sets, 1968:2 - 1980:2

IVs	6-a	6-b	6-c	6-d	6-e	6-f	6-g
a_k	0.015	0.012	-0.015	1.5E-3	-2.3E-3	-0.019	0.024
	0.058	0.058	0.064	0.060	0.060	0.069	0.056
g_{kk}	1.2E-4	1.2E-4	1.2E-4	1.2E-4	1.2E-4	1.5E-4	1.6E-4
	8.4E-5	8.4E-5	8.1E-5	8.5E-5	8.4E-5	9.5E-5	1.3E-4
ν_1	0.313	0.323	0.309	0.371	0.386	0.478	0.278
	0.278	0.277	0.305	0.283	0.281	0.328	0.262
NOBS	49	49	49	49	49	49	49
J(df)	6.9 (3)	7.0 (3)	7.0 (3)	6.6 (3)	6.0 (3)	5.9 (3)	6.7 (3)

Table 6A: Split Sample, Debt Equation, One-Quarter Lag, "Large" IV Sets, 1954:3 - 1967:2

IVs	6-a	6-b	6-c	6-d	6-e	6-f	6-g
a_v	-0.077*	-0.062*	-0.067*	-0.087*	-0.061*	-0.063*	-0.062*
	0.025	0.021	0.022	0.032	0.021	0.022	0.021
ν_1	-0.030	-0.063	0.051	-7.1E-3	-0.063	-0.059	-0.062*
	0.052	0.044	0.047	0.067	0.045	0.046	0.021
NOBS	52	52	52	52	52	52	52
J(df)	4.7 (3)	5.8 (3)	5.5 (3)	5.0 (3)	6.1 (3)	6.3 (3)	6.0 (3)

Table 6B: Split Sample, Debt Equation, One-Quarter Lag, "Large" IV Sets, 1967:3 - 1980:2

IVs	6-a	6-b	6-c	6-d	6-e	6-f	6-g
a_v	0.202*	-0.217*	0.216*	-0.224*	0.246*	0.214*	0.221*
	0.041	0.038	0.035	0.036	0.037	0.035	0.036
ν_1	-0.505*	0.527*	0.524*	0.538*	0.571*	-0.524*	-0.533*
	0.061	0.057	0.053	0.054	0.056	0.053	0.054
NOBS	52	52	52	52	52	52	52
J(df)	16.7 (3)	16.3 (3)	15.4 (3)	13.9 (3)	11.6 (3)	14.8 (3)	13.5 (3)

Table 6C: Split Sample, Debt Equation, Four-Quarter Lag, "Large" IV Sets, 1955:2 - 1968:1

IVs	6-a	6-b	6-c	6-d	6-e	6-f	6-g
a_v	-0.050*	-0.052*	-0.048*	-0.059*	-0.049*	-0.056*	-0.047*
	0.014	0.012	0.011	0.017	0.011	0.013	0.012
ν_1	-0.087*	-0.083*	-0.090*	-0.069*	-0.089*	-0.075*	-0.093*
	0.028	0.024	0.024	0.034	0.023	0.026	0.024
NOBS	52	52	52	52	52	52	52
J(df)	6.6 (3)	5.9 (3)	6.7 (3)	6.0 (3)	6.6 (3)	5.0 (3)	5.9 (3)

Table 6D: Split Sample, Debt Equation, Four-Quarter Lag, "Large" IV Sets, 1968:2 - 1980:2

IVs	6-a	6-b	6-c	6-d	6-e	6-f	6-g
a_v	0.151*	0.192*	0.237*	0.233*	0.259*	0.231*	0.225*
	0.068	0.062	0.049	0.054	0.058	0.051	0.047
ν_1	-0.431*	-0.489*	-0.554*	-0.548*	-0.585*	-0.544*	-0.536*
	0.097	0.090	0.072	0.079	0.085	0.075	0.070
NOBS	49	49	49	49	49	49	49
J(df)	14.4 (3)	15.7 (3)	16.5 (3)	16.5 (3)	16.2 (3)	16.3 (3)	4.8 (3)

Appendix A

Here, I derive an expression for the value of equity, following Summers (1980). The return on the equity of the firm has two components: after-tax capital gains, $(1-\tau_c)V^\circ$ ($^\circ$ denotes time differentiation), and after-tax dividends, $(1-\tau_y)DV$. The total equals the return required by stockholders, p, adjusted for the rate of inflation. This implies

$$(\rho+p_t)V_t = (1-\tau_c)V_t^\circ + (1-\tau_{yt})DV_t \tag{A1}$$

To prevent the solution to (A1) from exploding, I assume

$$\lim V_s \; e^{-\int_t^s [(\rho+p_u)/(1-\tau_{cu})]du} = 0. \tag{A2}$$

Then, the value of the firm's equity at time t can be written as

$$V_t = \int_t^\infty \frac{[1-\tau_{ys}]}{[1-\tau_{cs}]} DV_s e^{-\int_t^s [(\rho+p_u)/(1-\tau_{cu})]du} ds, \tag{A3}$$

and

$$\max z_0 E_0 = \int_0^\infty e^{-\int_0^t \theta*(\tau)d\tau} \gamma(t)dt, \tag{A4}$$

where

$$\theta*_t = (\rho + p_t)/(1 - \tau_{ct}) \tag{A5}$$

$$\gamma_t = (1 - \tau_{yt})DV_t/(1 - \tau_{ct}). \tag{A6}$$

Next, note that revenues equal the sum of wages, nonwage payments to labor, taxes, interest, dividends, and retained earnings.

$$\alpha_t y_t = W_t L_t [H_t+\omega_0+\omega_1(H_t-H_t^*)] + f_t^L L_t + f_t^N N_t \tag{A7}$$

$$+ \tau_{pt}\{\alpha_t y_t-(W_t L_t [H_t+\omega_0+\omega_1(H_t-H_t^*)] + f_t^L L_t + f_t^N N_t)$$

$$- (a+v_1[B_t/\xi(K_t)])B_t\} + DV_t + RE_t + (a+v_1[B_t/\xi(K_t)])B_t.$$

The cost of production and nonproduction employment is expressed as

$$W_t^* L_t H_t + f_t^L L_t + f_t^N N_t, \tag{A8}$$

where W_t* is the wage rate for production workers inclusive of overtime, $f^L{}_t$ is the nonwage cost of a production worker, and $f^N{}_t$ is the cost of a nonproduction worker. $f^N{}_t$ includes salaries and fringe benefits, while $f^L{}_t$ includes only fringe benefits. I express the wage bill, or variable cost of production employment, as

$$W_t^* L_t H_t = W_t L_t [H_t + \omega_0 + \omega_1 (H_t - H_t^*)], \tag{A9}$$

where H_t^* is the level of hours at which overtime starts, H_t-H_t* is overtime hours per production employee, and W_t is the wage rate for production workers exclusive of overtime.

Gross investment, I_t, is financed through debt issue, retained earnings, or the decrease in the real debt burden due to inflation.

$$\beta_t I_t = RE_t + (B_{t+1} - B_t) + p_t B_t\ , \tag{A10}$$

where β_t is the relative price of investment goods.

The firm receives an investment tax credit, ITC_t, on each dollar of investment expenditure at time t and deducts allowable depreciation expenses. D_t is the present discounted value of all depreciation deductions due to one dollar of investment at time t.

Total revenue is $\alpha_t y_t$, where α_t is the relative price of manufacturing output at time t. Total revenue is the sum of wages, nonwage payments to labor, taxes, interest, dividends, and retained earnings. All investment is financed through retained earnings, new debt issue, or the decline in the real burden of debt due to inflation. The term p_tB_t is the revenue accruing to the firm because the bonds are assumed to be denominated in nominal terms. Substituting for RE and solving yields the following expression for the dividend:

$$\begin{aligned} \mathrm{DV}_t = {} & (1-\tau_{pt})[\alpha_t y_t - W_t^* L_t H_t + f_t^L L_t + f_t^N N_t] \\ & - (1-\tau_{pt}) s_t + (B_{t+1} - B_t) + p_t B_t + \tau_{pt} D_t \beta_t I_t - \beta_t I_t (1-ITC_t). \end{aligned} \tag{A11}$$

Here, inflation has complex effects on investment, as suggested by previous investigations (Feldstein [1987] and Chirinko [1987a]). First, the investment tax credit and depreciation deduction are based on historical cost. Second, inflation erodes the real debt burden.

Appendix B

Tax rates favor debt over retained earnings if

$$\frac{(1 - \tau_{y0})}{(1 - \tau_{c0})} > \frac{(1 - \tau_{y1})}{(1 - \tau_{c1} + \rho + p_1)} [1 - p_1 + \frac{\partial s_1}{\partial B_1} (1 - \tau_{p1})], \qquad \text{(B1)}$$

where s_1 = before-tax cost of debt issued at time 0 and paid in period 1.

The cost to stockholders of one dollar of retained earnings at time 0 is the forgone one dollar of dividends, the present value of which is the left side of equation 4. The cost of one dollar of debt issued at time 0 is the reduction in dividends paid at time 1. The present value of this cost is the right side of equation 4, which utilizes the definition of $\theta*$ and s_0 and takes account of the reduction in the real debt burden due to inflation.

Appendix C

All data are seasonally adjusted, measured at quarterly rates, and pertain to all manufacturing, except where noted.

K_t is the stock of physical capital (billions of 1967 dollars) at the start of period t. It is calculated by the perpetual inventory method:

$$K_t = K_{t-1} - dK_{t-1} + I_{t-1}/IMPDEF_{t-1}. \qquad (C1)$$

d is a fixed rate of physical deterioration for structures and equipment in all manufacturing, as estimated by Jorgenson and Stephenson (1967). I_t is investment on new plant and equipment in manufacturing, published by the Bureau of Economic Analysis (BEA), and IMPDEF is the investment price deflator for fixed nonresidential investment expenditures, published by BEA in the Survey of Current Business (SCB). The net additions to the capital stock are expressed in 1967 prices. The starting value for K is the net stock of structures and equipment in manufacturing at the end of 1953, in 1967 prices as published in SCB.

L_t is the average number of production workers (in millions) employed in a given quarter. It is obtained by averaging the monthly data published by the Bureau of Labor Statistics in Employment and Earnings (EE). For consistency within the Euler equations, L (and N) must be scaled by 0.001.

N_t is the average number of nonproduction employees (in millions) over the quarter. The monthly number is calculated as the difference between total employment and production-worker employment for the manufacturing sector. The quarterly level is the average of the levels for the three months in the quarter. The source is EE.

q_t is the quit rate for employment, which EE publishes on a monthly, nonseasonally adjusted basis. I seasonally adjust the arithmetic average of the three-month data in each quarter using an X-11 seasonal adjustment procedure.

H_t is the average number of hours per week for production employment. I use the average of weekly hours over the quarter. H, which includes overtime hours, is published in EE. For consistency within the Euler equations, H is scaled by the average number of weeks in a quarter.

$H_t - H^*_t$ is the number of overtime hours per production employee per week. This series is available in EE. As for H, this series is scaled up by the average number of weeks per quarter.

W_t is the average hourly wage rate for production workers, calculated as the average of the monthly data over the quarter. The monthly data are published in EE. W_t excludes overtime payments.

W^*_t is the average hourly wage rate for production workers including overtime. The quarterly average is calculated as an average of the monthly averages. The data, published in EE, are available only from 1956 onward, so I extrapolate back to 1954 by 1) regressing the available data on a constant and a trend and 2) using the estimated trend coefficient to extrapolate backwards from the estimated intercept. Since this series is available only on an unadjusted basis, the entire series from 1954 onward was seasonally adjusted using an X-11 procedure.

f^L_t is the fixed payment per production employee (billions of dollars per million employees). This is derived from quarterly National Income and Product Account data. I calculate the total fixed cost to the sum of production and nonproduction employees as the difference between total compensation and the sum of wages and salaries and employer contributions to social insurance. This total is then divided by total employment to yield f_t.

f^N_t is the fixed cost per nonproduction employee (billions of dollars per million employees). This is calculated as $f^L{}_t$ plus a salary component. The salary component is computed as wages and salaries minus wages paid to production employees, and is then divided by the average level of nonproduction employment. The wage bill for production employment is the product of average hourly wages, the number of production employees, and the average hours per production employee per quarter.

ρ is the quarterly real required rate of return. It is calculated from data on common stock returns published by Ibbotson and Sinquefeld (1982) and represents the difference between the quarterly total rate of return on common stocks and the quarterly rate of change in the Consumer Price Index (CPI). The quarterly total rate of return is k_T, where $(1 + k_T)^{27x4}$ = the ratio between the end-of-1980 index on total returns on common stocks and the end-of-1953 index on total returns. The quarterly rate of change in the CPI is calculated as k_P, where $(1 + k_P)^{27x4}$ = the ratio between the end-of-1980 CPI and the end-of-1953 CPI. Thus, ρ is constant from 1954 to 1980.

p_t is the rate of change in the CPI for urban workers over period t, available in SCB.

τ_y is the marginal personal dividend income-tax rate. This series is calculated by Estrella and Fuhrer (1983) from annual individual income tax returns. Thus, τ_t is available only on an annual basis. I assume that the rate for each quarter is equal to the rate for the entire year.

τ_c is the personal capital gains tax rate. I follow Summers' (1980) and Bailey's (1969) treatment of the effect of deferral and the lack of constructive realization at death on the effective tax rate. Bailey concludes that from 1932 to 1969, each of these factors halved the effective rate. Because the statutory tax rate on capital gains was half that on dividends during this period, I use

12.5 percent of the dividend tax rate from Estrella and Fuhrer as τ_c for 1954 to 1969. I follow Summers and cite the estimate of the NBER TAXSIM model that the 1969 capital gains reform made the rate 50 percent higher or 18.75 percent of the dividend rate.

τ_p is the corporate profits tax rate. I use the statutory corporate profits tax rate as published in Pechman (1983) and assume that quarterly rates are equal to the annual rate.

y_t is the output of the manufacturing sector (billions of dollars). I use the Federal Reserve Board's index of manufacturing production and inflate the product of y and α so that its average for 1967 equals actual 1967 manufacturing output, calculated as equal to the 1967 value of shipments plus the change in manufacturing inventories over the year. Both the shipments and inventory data are published by BEA in Business Statistics, with each series unadjusted for seasonal variation. The inventory data are on a book-value basis. I seasonally adjust y using an X-11 procedure. The production index is published monthly, and I use the average level of the index over the quarter.

α is the price of manufacturers' goods. I use the Producer Price Index for manufacturing, published monthly in Business Statistics, and employ the average index level for the quarter. Because this index is available only on an unadjusted basis, I adjust the quarterly data using an X-11 procedure.

ß is the price of investment goods. I use the implicit price deflator for fixed investment for the nonresidential sector. ß is based so that the product of ß and I is measured in 1967 dollars.

I is investment in plant and equipment, measured by BEA.

ITC_t is the investment tax credit at time t from one dollar of investment expenditure at time t. I use the series calculated by Jorgenson and Sullivan

(1981) for the entire corporate sector. It is published on an annual basis, and I assume the quarterly rates are equal to the annual rate.

D_t is the present value at time t of all current and future depreciation deductions from one dollar of investment at time t. Jorgenson and Sullivan publish this series on an annual basis. I assume that the quarterly rates equal the annual rate.

$\xi(K_t)$ is the book value of capital at time t (billions of dollars). I use the series on the book value of "depreciable and amortizable fixed assets, including construction in progress," published in the Quarterly Financial Report (QFR) by the Bureau of the Census. The data were supplied by Data Resources Inc. Below, I discuss how I compensated for several discontinuities within the series. After this adjustment, I seasonally adjust the data.

B_t is the book value of debt (billions of dollars). I use the series on short-term debt ("original maturity of one year or less"), "installments due in one year or less on long-term debt," and "long-term debt" (due in more than one year) published in the QFR. I adjust for discontinuities in these series and then seasonally adjust the total. Thus, B_t excludes "trade accounts," "deferred taxes," and other liabilities.

The QFR series on the book values of debt and the capital stock contain two breaks in continuity. In 1967, newspapers were added to the sample, and DRI did not continue the series forward. In 1974, the entire sampling procedure and questionnaire were changed. A visual examination of the series suggested that I make a level adjustment for the 1973:IVQ to 1974:IQ break. I accomplished this using the overlap data available for those two quarters.