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Predicting Stock Price Responses to Tax Policy Changes

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Events leading to stock price windfalls happen for a variety of reasons. Lately huge gains and losses have resulted from changes in federal tax policies. Alan Auerbach and Laurence Kotlikoff (1983) estimate the Economic Recovery Tax Act (ERTA) of 1981 induced a $200 to $300 billion capital loss. More recently, Lawrence Goulder and Lawrence Summers (1986) and Thomas Downs and Patric Hendershott (1987) estimate that the Tax Reform Act of 1986 provided corporate shareholders with a 12 or 13 percent windfall gain. The legislative granting of windfall gains or losses gives rise to an important question of public policy: What is the impact of major tax changes on corporate asset values?

The objective of this study is to introduce and test a model for estimating windfalls resulting from tax policy changes. The model describes fundamental equity value as a function of capital accumulation patterns, tax policy parameters, and the equilibrium between rental prices and the expected return on capital. The impact on fundamental equity value of the policy changes enacted with ERTA is simulated and those results are used as predictions about stock price windfalls. Such windfalls are computed for different aggregates and actual stock returns data are analyzed to see whether the predicted windfalls accrued.

Section I introduces the valuation model. Section II presents estimates of fundamental equity value for the U.S. nonfinancial corporate sector and three manufacturing industries. Section III simulates the change in fundamental equity value from ERTA, and Section IV analyzes stock returns data to determine whether predicted price adjustments occurred. Section V is the summary.

I. The Valuation Model

Fundamental equity value is the present value of the cash flows expected to accrue to shareholders discounted by the equity financing rate. Denote as $R^j_{s,t}$ the expectation formed at time s about the equity residual cash flow to be received at time t from productive factor j. The fundamental equity value of shareholder claims against productive factor j, denoted V^j_s, is

$$(1) \qquad V^j_s = \sum_{t=s+1}^{\infty} (1+e)^{-(t-s)} R^j_{s,t},$$

where e denotes the equity financing rate. Computing V^j_s requires specification of the equity financing rate and the equity cash flow stream for each factor of production.

The equity financing rate can be determined from a portfolio equilibrium. Letting τ^e denote the effective personal tax rate on equity returns and τ^i the effective tax rate on interest income, then

$$(2) \quad (1-\tau^e)e = (1-\tau^i)\rho + (1-\tau^e)\beta\gamma^e.$$

ρ is the pretax riskfree interest rate, γ^e is the pretax risk premium for interest in the market portfolio of corporate equities, and β is the proportion of premium paid by the producer. The equity financing rate can be determined from equation (2) given exogenous estimates for τ^e, τ^i, ρ, β, and γ^e.

Equity cash flows are generated by only capital factors of production because non-capital inputs do not pass cash flows to

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equity. Say capital type j is expected to provide a pretax return (earnings before tax depreciation, interest, and taxes) equal to NOI^j and promises tax depreciation deductions equal to $TAXD^j$. Given financing by debt and equity, the cash flow for equity equals after-tax NOIs plus the value of the depreciation tax shield less after-tax interest and debt repayments,

$$(3)\quad R^j_{s,t} = (1-\tau)NOI^j_t + \tau TAXD^j_t - (1-\tau)INT^j_t + \Delta DEBT^j_t.$$

τ is the corporate profits tax rate and INT^j and $\Delta DEBT^j$ are the interest and principal cost of debt services associated with financing capital type j. V^j_s is

$$(4)\quad V^j_s = \sum_{t=s+1}^{\infty} (1+e)^{-(t-s)} \times\left[(1-\tau)NOI^j_t + \tau TAXD^j_t - (1-\tau)INT^j_t + \Delta DEBT^j_t\right].$$

Later in this study fundamental equity value is estimated from equation (4). The remainder of Section I describes the modeling of INT, $\Delta DEBT$, NOI, and $TAXD$.

Capital market equilibrium imposes a restriction on the values of all financial claims (Franco Modigliani and Merton Miller, 1963). Total capital income is $(1-\tau)NOI + \tau TAXD$ and in equilibrium it equals the after-corporate-tax cost of financing. The fundamental value of financial claims on capital type j at time t, denoted W^j_t, is

$$(5)\quad W^j_t = \sum_{u=t+1}^{\infty} (1+r)^{-(u+t)} \times\left[(1-\tau)NOI^j_u + \tau TAXD^j_u\right].$$

r is the weighted average after-tax cost of financing, $\alpha(1-\tau)i+(1-\alpha)e$, where i is the pretax debt financing rate and α is the debt-to-market value ratio. The interest and principal cost of debt services are

$$(6)\quad INT^j_t = i\alpha W^j_{t-1}, \quad \text{and}$$

$$(7)\quad \Delta DEBT^j_t = \alpha\left(W^j_t - W^j_{t-1}\right).$$

V^j_s measures the discounted value of the cash flows expected from existing capital plus the net present value of future investments. Previous studies indicate that in aggregate measurements the net present value of future investments is very small. Daniel Holland and Stewart Myers (1981) provide estimates that in the nonfinancial corporate sector in 1978 the net present value of future investments is less than one-half of 1 percent of the capital stock's replacement cost. Estimates by William Brainard, John Shoven, and Laurence Weiss (1980), imply that in 1977 the net present value of future investments for 187 large industrial firms is -1.39 percent of market value and between 1968–77 the average is 1.59 percent. Because the net present value of future investments as a proportion of existing capital is relatively small, NOI_t and $TAXD_t$ are assumed to result solely from capital in-place at time s.

Insights about the NOI stream can be made by analyzing the marginal investment equilibrium of zero net present value. As discussed by Thomas Downs (1986), the replacement cost of a unit of new type j capital, denoted q^j_s, is at equilibrium with its discounted income stream when

$$q^j_s = \nu^j q^j_s + \sum_{t=s+1}^{\infty}(1+r-\pi)^{-(t-s)} \times(1-\tau)c^j_s\left[1-\sum_{u=1}^{t-s}h^j_u\right] + \tau q^j_s Z^j.$$

ν is the effective rate of the investment tax credit, π is the rate of expected inflation, c_s is the time s rental price of capital, and Z is the present value of depreciation deductions per dollar of investment. The percent of original productive capacity lost by capital u periods after its acquisition is h_u. For example, with geometric depreciation $h_u = \delta(1-\delta)^{u-1}$; with straight-line depreciation over a service life of L years, $h_u = 1/L$ for $u = 1,\dots, L$ and $h_u = 0$ for $u > L$. The term in square brackets $[\cdot]$ is the proportion of time s investments surviving until time t.

Isolating the rental price from the zero net present value equilibrium shows

$$(8) \qquad c_s^J = q_s^J(r-\pi)(1-\nu^J-\tau Z^J)/\left[(1-\tau)(1-H^J)\right].$$

H is a depreciation term, $0 \le H < 1$, computed as

$$(9) \qquad H^J = \sum_{u=1}^{\infty} (1+r-\pi)^{-u} h_u^J.$$

For nondepreciating, infinite life capital, H is zero, and for assets that depreciate rapidly, H is close to unity. When assets depreciate over an infinite life at the geometric rate δ, H computed from equation (9) is $\delta/(r+\delta-\pi)$ and the rental price computed from equation (8) is $q_s(r+\delta-\pi)(1-\nu-\tau Z)/(1-\tau)$, the formulation introduced by Robert Hall and Dale Jorgenson (1967).

The rental price is the NOI earned by a unit of capital. When adjustment costs are absent or equal for assets of different vintage the NOI on one unit of new capital is the same as that on old capital. In the presence of adjustment costs that vary across assets of different vintage the NOI for new and old capital differ. Herein, the assumption is maintained that adjustment costs are zero for all capital and they are unaffected by tax policy changes.[1]

Total NOI^J for the capital stock equals the product of rental price times real capital stock. Given exogenous economic depreciation,[2] the stock of real type j capital in-place at time s that survives until time t is

$$(10) \qquad K_t^J = \sum_{u=t-s}^{\infty} I_{t-u}^J \left[1 - \sum_{v=1}^{t-s} h_v^J\right].$$

I^J denotes real investment. Because the rental price rises with inflation, total NOI expected at time t is

$$(11) \qquad NOI_t^J = c_s^J(1+\pi)^{(t-s)} K_t^J.$$

Future tax deductions promised by the existing stock, $TAXD^J$, are predetermined by historic investment flows and the tax depreciation laws in effect at the time the capital was put in-place. Let $z_{s,u}^J$ be the proportion of time s gross investments deductible for tax purposes at time $s+u$. The tax depreciation deduction that the time s capital stock promises at t is

$$(12) \qquad TAXD_t^J = \sum_{u=t-s}^{\infty} q_{t-u}^J I_{t-u}^J z_{t-u,u}^J.$$

Equations (11) and (12) specify the construction of return streams spanning times $t = s,\dots,\infty$ that may be used to find the present value of the capital income stream.

II. Fundamental Equity Value Before ERTA

Estimation of fundamental equity value requires construction and substitution of equations (5) through (12) into (4) for each type of capital asset. According to the U.S. Federal Reserve Board (FRB, 1985) Current Cost Balance Sheets, the \$3,773 billion of total assets in the nonfinancial corporate sector (NFC) at year-end 1980 are comprised of fixed assets (47 percent), short-term assets (43 percent), and land (10 percent). For short-term assets and land fundamental val-

[1]Auerbach (1986) shows that in the presence of adjustment costs the windfall is accentuated because of the transient inequality between the return on capital and rental prices.

[2]Hall and Jorgenson (1967) assume exogenous depreciation along a geometric pattern, and Charles Hulten and Frank Wykoff (1981) provide supporting evidence. The geometric assumption has been challenged by Robert Eisner (1972) and Martin Feldstein and Michael Rothschild (1974). Capital stock estimates generated by the U.S. Bureau of Economic Analysis (1986) as do our estimates herein, assume depreciation is exogenous along a straight-line pattern.

ues are assumed equal to the FRB entries, but for fixed assets the valuation model introduced above is employed. Separate streams and values for plant and equipment are estimated because of differences in service lives and tax treatment but the discussion below usually refers to the sum or weighted average of the two streams. Discussion focuses first on the NFC exclusively; industry estimates are described toward the end of Section II.

Our estimate of the equity financing rate (e) is 0.1708 and is constructed in accordance to equation (2) with the following settings. Debt rates hovered in the 13 percent range during the period under study so ρ is set to 0.13 and the equity risk premium (γ^e) is set to 0.07, the mean annual premium on common stocks between 1948–83 (Roger Ibbotson, 1984). The tax rate on interest income (τ^i) is 0.366 and is computed by Joe Peek and James Wilcox (1983) as the average marginal tax rate on interest income. The tax rate on equity returns (τ^e) is 0.182 and is computed as a weighted average of tax rates on dividends and capital gains.[3] β for the NFC is set to unity.

The length of the cash flow streams equal the average service life of capital, 30 and 13 years for plant and equipment, respectively, based on data from the Bureau of Economic Analysis (BEA, 1986).[4] Column 1 of Table 1 lists the proportion of the year-end 1980 real capital stock remaining productive each year into the future. By the seventh year, 1987, the surviving stock is capable of producing less than half of its 1981 product. After the thirteenth year the stock of equipment is totally expired and after the thirtieth year, 2010, all remnants of the year-end 1980 real capital stock have expired.

The *NOI* equals the product of the real capital stock times the rental price. A dollar of equipment generates \$0.2347 of *NOI* whereas per dollar of plant it is \$0.1789.[5] The *NOI* stream for plant and equipment is listed in column 2. One-third of all *NOI*s during the first six years of the return stream are free from taxation because of the shield provided by depreciation deductions. Estimates of the tax shield that assets existing at year-end 1980 were expected to provide over their remaining lives are obtained by depreciating historic investments with the tax depreciation practices in effect at their time of acquisition, as specified in equation (12). The proportion of new investments (plant or equipment) depreciated by accelerated methods and tax lives are taken from the SSRC-MIT-PENN Quarterly Econometric Model (1983). Half of all investments depreciated by accelerated methods are depreciated by sum-of-year's digits and half by 200 percent declining balance (150 percent for plant after 1969) with an optimal switch to straight-line. Investments not depreciated by accelerated methods are depreciated by straight-line. The stream of tax depreciation deductions promised by the year-end 1980 capital stock is listed in column 3 of Table 1.

The fundamental value of debt and equity claims on plant and equipment, denoted W(P&E), can be computed by discounting the *NOI* and *TAXD* streams with the weighted average cost of financing. Discounted after-tax *NOI*s plus discounted depreciation tax savings yield a W(P&E) of \$1,218 billion (see equation (5) and col-

[3]Joe Peek supplied generous discussion and data about τ^i. For τ^e, the weight applied to the dividend tax rate is 0.40. Following Hendershott (1986) the dividend tax rate is $\tau^{\max}/2$ and the capital gains tax rate is $(1\text{-exclu})\tau^{\max}/4$, where $\tau^{\max}$ is the statutory maximum personal tax rate (70 percent pre-ERTA and 50 percent post-ERTA) and "exclu" is the capital gains exclusion of 0.60. The divisions by 2 and 4 reflect deferral and avoidance activities.

[4]John Musgrave and Kenneth Rogers at the Department of Commerce (Bureau of Economic Analysis and Office of Business Analysis, respectively) have provided generous discussion and data. Our estimate of NFC plant and equipment at year-end 1980 is \$1,640 billion and is comparable to the BEA estimate of \$1,697 billion.

[5]The rental price constructed according to equation (8) assumes: ν is 0.0610 for equipment and 0.0 for plant (N. Behravesh, 1985); τ is 0.4924 reflecting the marginal tax rate of 0.46 and a deductible state and local tax rate of 0.06; π is 0.08; Z is 0.5997 for equipment and 0.3182 for plant and is constructed from the depreciation schedules described in the text; r is 0.1362 based on an e of 0.1708, i of 0.1300, α of 0.33; H is 0.6964 for equipment and 0.4782 for plant.

TABLE 1—FUTURE SERVICES FROM THE 1981 CAPITAL STOCK

Year	Capital Surviving (1)	NOI_t (2)	$TAXD_t$ (3)	$(1-\tau)NOI + \tau TAXD$ (4)	$R_{1980,t}$ (5)
1981	100.0 percent	$338.5	$133.6	$237.7	$182.4
1982	89.9	328.4	128.6	230.0	175.5
1983	80.4	316.5	110.4	215.0	163.6
1984	71.3	303.0	91.3	198.8	151.1
1985	62.8	287.7	78.3	184.6	140.0
1986	54.9	270.7	68.2	171.0	129.4
1987	47.5	252.6	60.7	158.1	119.4
1988	40.9	234.0	53.3	145.0	109.3
1989	34.9	214.9	46.1	131.8	99.2
1990	29.5	195.5	38.4	118.1	89.0
1991	24.8	176.7	17.1	98.1	74.8
1992	20.8	159.9	16.2	89.2	68.1
1993	17.8	146.7	15.4	82.0	62.6
1994	15.5	138.3	14.6	77.4	58.9
1995	13.8	132.5	13.9	74.1	56.0
1996	12.1	125.8	13.1	70.3	52.8
1997	10.5	118.3	12.4	66.2	49.4
1998	9.1	110.2	11.7	61.7	45.7
1999	7.7	101.4	11.0	56.9	41.9
2000	6.5	92.0	10.2	51.8	37.9
2001	5.4	82.2	9.5	46.4	33.7
2002	4.4	72.0	8.8	40.9	29.5
2003	3.5	61.5	8.1	35.2	25.2
2004	2.6	50.9	7.5	29.5	20.9
2005	2.0	40.6	6.6	23.9	16.8
2006	1.4	30.8	5.8	18.5	12.9
2007	0.9	21.6	5.0	13.4	9.3
2008	0.5	13.3	4.3	8.9	6.1
2009	0.2	6.5	3.7	5.1	3.5
2010	0.1	1.8	3.0	2.4	1.6
Discounted Sum with $r = 13.62$ percent		$1,869	$548	$1,218	
Discounted Sum with $e = 17.08$ percent					$816

Notes: All dollars are in billions and refer to the stock of nonfinancial corporate plant and equipment in-place at the beginning of 1981. Estimates are constructed from formulas and data described in text.

umn 4)). Fundamental equity value, denoted V(P&E), is $(1-\alpha)$ times that or $816 billion. The identical V(P&E) can be obtained by constructing the *INT* and $\Delta DEBT$ streams and discounting the equity residual cash flow stream by the equity financing rate (see equation (4) and column 5)).

The fundamental value of total assets equals W(P&E) plus FRB short-term assets and land and is $3,294 billion. It exceeds the $2,683 billion value of debt and equity claims, meaning that either securities are "undervalued" or that the fundamental value estimate is too high. The ratio of total market value to total fundmental value, referred to herein as the "overvalue ratio," is 0.81 for the NFC.

In the same fashion estimates of V(P&E) are generated in the Food Products (SIC 20), Paper and Allied Products (SIC 26), and the Stone, Clay, and Glass (SIC 30) industries.[6]

[6]The BEA data and our fundamental value estimates are on an establishment definition. The *COMPUSTAT* and *CRSP* data are on an enterprise basis. Our fundamental value estimates are multiplied by the year-end 1980 ratio of "*COMPUSTAT* Industry Sample Total

TABLE 2—FUNDAMENTAL EQUITY VALUE OF FIXED ASSETS AND PREDICTED EQUITY WINDFALLS

Total Nonfinancial Corporate	Food Products SIC 20	Paper Products SIC 26	Stone, Clay, and Glass SIC 30
1 Before-ERTA			
\$816.3	\$13,533	\$11,714	\$2,571
2 Constant Personal Tax and Interest Rates but Full Adjustment to ACRS			
\$725.4	\$11,675	\$10,127	\$2,039
−6.98 percent	−4.88 percent	−6.50 percent	−9.90 percent
3 Constant Interest Rates but Full Adjustment to ACRS and Personal Taxes			
\$724.2	\$11,662	\$10,114	\$2,041
−7.07 percent	−4.92 percent	−6.56 percent	−9.86 percent
4 Full Adjustment to ACRS, Personal Tax, and Interest Rates			
\$737.2	\$11,908	\$10,278	\$2,108
−6.07 percent	−4.27 percent	−5.89 percent	−8 63 percent

Notes: Dollars are in billions for the NFC and millions for the industries. The percentages are the predicted excess rate of return to shareholders, computed as the change from Before-ERTA fundamental value relative to equity market values. Equity market value is 1,303 billion dollars in the NFC and in SICs 20, 26, and 30 they are 38,059, 24,399, and 5,372 million dollars, respectively. Estimates are constructed from formulas and data described in text.

The same interest and income tax rates are used in all industries but each industry has its unique equity beta (0.796, 0.760, and 0.992 in SICs 20, 26, and 30, respectively), debt ratio[7] (0.4920, 0.3943, and 0.6840, respectively), tax lives (Robert Coen, 1975), effective rate of the investment tax credit (N. Behravesh, 1985), asset service lives (equipment: 14, 16, and 15 years; plant: 28 years), and capital investment data (BEA). The fundamental equity value of plant and equipment is \$13.5, \$11.7, and \$2.6 billion in SICs 20, 26, and 30, respectively. The overvalue ratios are 0.98, 1.09, and 0.75.[8] The market values of debt and equity in Food and Paper Products are reconcilable to within 10 percent of their fundamental values, but Stone, Clay, and Glass appears undervalued by a quarter.

III. Fundamental Equity Value After ERTA

The Economic Recovery Tax Act of 1981 affected stock prices through several channels. First is the influence of changes in the treatment of tax depreciation deductions on new investments. Second is the influence of changes in personal tax rates and third is the influence of changing interest rates because of shifts in the demand for capital. These influences are considered separately and are empirically summarized in Table 2.

Net Fixed Assets" to "BEA 2-digit SIC Industry Historic Cost Replacement Cost," 0.8580, 0.8248, and 0.7120 for SICs 20, 26, and 30 so that all industry estimates in this study are stated on an enterprise basis.

[7] The calculation of the debt to market value ratios, α, follows the procedure used by George VonFurstenberg, Burton Malkiel, and Harry Watson (1980) and employs market to book value ratios for long-term debt of 0.6665, 0.7332, and 0.6337 in SICs 20, 26, and 30, respectively.

[8] In SIC 20 W(P&E) is \$26,640 million. The total fundamental value of all other assets is \$49,779 million and is computed from the *COMPUSTAT* (1984) industry sample as "Total Assets" less "Net Fixed Assets." The actual market value of debt (see fn. 7) and equity claims is \$74,919 million. The overvalue ratio is 0.98 [= \$74,919/(\$26,640 + \$49,779)]. The SIC 26 overvalue ratio is 1.09 [= \$40,284/(\$19,340 + \$17,758)] and the SIC 30 overvalue ratio is 0.75 [= \$17,000/(\$8,136 + \$14.441)].

TABLE 3—SENSITIVITY OF EQUITY WINDFALLS TO KEY PARAMETERS

	SIC 20	SIC 26	SIC 30
1 Parameters Restricted to Same Value:	None		
Parameters Varying Across Industries:	Beta, Debt Ratio, Rental Price		
Percentage Windfall	−4.88 percent	−6.50 percent	−9.90 percent
2 Parameters Restricted to Same Value:	Beta		
Parameters Varying Across Industries:	Debt Ratio, Rental Price		
Percentage Windfall	−4.88 percent	−6.56 percent	−9.77 percent
3 Parameters Restricted to Same Value:	Beta, Debt Ratio		
Parameters Varying Across Industries:	Rental Price		
Percentage Windfall	−4.88 percent	−6.15 percent	−11.48 percent
4 Parameters Restricted to Same Value:	Beta, Debt Ratio, Rental Price		
Parameters Varying Across Industries:	None		
Percentage Windfall	−4.88 percent	−6.18 percent	−11.98 percent

Notes: When parameters are restricted they are set to the value they have in SIC 20.

A. *Constant Personal Tax and Interest Rates but Full Adjustment to ACRS*

Implementation of the Accelerated Cost Recovery System (ACRS) allowed new investments to be depreciated more quickly than before resulting in an increase in the present value of marginal depreciation tax savings. Old capital is not entitled to the higher tax savings and a wedge is inserted between the values of new and old capital.

The present value of tax depreciation deductions rises from 32 to 47 cents per dollar of structures investment and from 60 to 75 cents for equipment. The response to this incentive effect is a decline in the marginal physical product of capital and an equilibrium where pretax returns may be smaller yet satisfy zero net present value conditions. The smaller rental price and *NOI* translate into a decline in fundamental equity value of \$81.7 billion, a 6.27 percent windfall loss relative to the \$1,303 billion market value of outstanding NFC equity.[9]

The reduction in fundamental equity value represents an "unlevered loss" and occurs regardless of capital structure. With debt financing there is an additional "levered loss." The levered loss can be found by noting that the debt ratio remains unchanged if there is an immediate debt repayment of \$30.8 billion. The retirement reduces future debt services thereby raising discounted equity cash flows by \$19.3 billion. The \$11.5 billion difference is the levered loss, and the proportion $(1-\alpha)/(1-\tau\alpha)$ falls on equity.[10] For the NFC the levered loss is \$9.2 billion, representing 0.71 percent of equity values.

The net impact of ACRS is a \$90.9 billion reduction in fundamental equity value representing 6.98 percent of the market value of outstanding NFC equity (see row 2, Table 2). At the industry level ACRS again inserts a wedge between the values of new and old capital. In SIC 20 the fundamental equity value decline of \$1,858 million represents a 4.88 percent windfall stock market loss. The loss in SIC 26 is \$1,587 million or 6.50 percent of industry stock market value and in SIC 30 the \$532 million loss is 9.90 percent of shareholder value.

The sensitivity of the predicted losses to key parameters is analyzed by reestimating with alternative pre- and post-ACRS parameters. Those results are in Table 3. First, the

[9]David Cutler (1988) examines stock price responses to the Tax Reform Act of 1986. He finds revaluation of share prices from changes in marginal tax depreciation schedules are empirically important.

[10]Given that $\Delta r = \alpha(1-\tau)\Delta i + (1-\alpha)\Delta e$ and the additional risk is shared equally be debt and equity (i.e., $\Delta i = \Delta e$), the proportion of Δr borne by equity is $(1-\alpha)/[\alpha(1-\tau)+(1-\alpha)]$, or $(1-\alpha)/(1-\tau\alpha)$. The proportion borne by debt, $\alpha(1-\tau)/(1-\tau\alpha)$, is an increasing function of the debt ratio.

equity betas in all industries are set to the value of beta in SIC 20. The reduction of beta in SIC 30 by one-fifth lessens the windfall from -9.90 to -9.77 percent (see row 2). In row 3 sensitivity to capital structure is shown by restricting the debt ratio to its value in SIC 20. The decline in debt ratio by one-quarter in SIC 30 increases the equity loss by one-fifth. Row 4 holds pre- and post-ACRS rental prices constant and shows the percentage loss is not sensitive to the level of rental price.

The impact of ACRS on share prices in Stone, Clay, and Glass is more than in either of the other two industries—5 percentage points more than in Food Products. The overvalue ratio at 0.75 acts as a leverage ratio in that it amplifies the response of security prices to a given change in fundamental value. The large negative windfall occurs in Stone, Clay, and Glass because the market correctly capitalizes the value loss but the undervalued equity base is relatively small.[11]

B. *Constant Interest Rates but Full Adjustment to ACRS and Personal Tax Rates*

The 1981 Tax Act reduced the maximum marginal personal tax rate from 0.70 to 0.50. This exerts an influence on fundamental equity value through τ^{i} and τ^{e}. Peek and Wilcox have computed that from 1981 to 1982 the average marginal personal tax rate on interest income falls from 0.366 to 0.333. τ^{i} is assumed to fall likewise. The computation of τ^{e} depends on the statutory maximum tax rate (see fn. 3) and is computed to fall from 0.182 to 0.130. There is a resulting fall in equity and average financing rates and rental prices. Row 3 of Table 2 shows there is a further 10-basis point predicted shareholder loss.

[11]The ratio of ΔV to sales is -0.69, -1.63, and -0.91 percent in SICs 20, 26, and 30, respectively. Thus, the value loss relative to sales in SIC 30 lies between the other industries. The ratio of sales to debt plus equity market value, though, is 3.79, 2.01, and 6.26, respectively. In SIC 30, an unusually small stock of value supports a proportionately large amount of sales.

C. *Full Adjustment to ACRS, Personal Tax, and Interest Rates*

The ACRS investment incentives shifted the demand schedule for capital and exerted upward pressure on the interest rate. The rising interest rate has two effects. The average financing rate increases and rental prices increase. These two contrary influences tend to reduce fundamental value due to a discounting effect but tend to increase fundamental value due to the *NOI*-rental price effect.

The net impact of a rising interest rate on fundamental equity value may be positive or negative and the direction of influence depends on the interest elasticity (duration) of the marginal return stream relative to the interest elasticity of the average return stream.[12] A stream with a long duration has a higher elasticity and responds more to an interest rate change than does a short duration stream. A rising financing rate reduces the marginal investment's net present value below zero and the producer responds by selecting an investment budget and production plan with an increased marginal product of capital. The duration of the marginal return stream measures the rise in marginal product and rental price that reestablishes zero net present value marginal equilibrium.

The increased rental price increases the total *NOI* stream. This rise offsets a portion of the total value loss brought on by the higher discounting effect. When average duration is less than marginal duration the rise in total fundamental value from a higher rental price is more than the total value loss

[12]The average duration of the total capital income stream (equation (5)) is 4.84 years. The duration of the marginal return stream at the zero net present value equilibrium (equation preceding (8)) is 5.62 years. The ratio of average to marginal duration is less than unity and $dV/di > 0$. The relationship between interest rates and duration is discussed by Eugen Bohm von Bawerk (1988, esp. pp. 342–49), wherein it is referred to as "average period." J. R. Hicks (1939, esp. pp. 186–88, 222–24) describes how value and interest rate changes are related to the relative duration of return streams. The computational formula for duration is introduced by Frederick Macaulay (1938).

induced by higher financing rates. A smaller change in rental price—a change proportional to average duration—would have left total value unchanged, but the lesser change would not have reestablished marginal equilibrium.

To deduce the impact of ERTA on interest rates an estimate is borrowed from Patric Hendershott (1986). The Hendershott model allocates a fixed capital stock among thirteen classes of residential and nonresidential capital and finds that a 106-basis point interest rate rise in response to ERTA maintains the aggregate demand for capital at its initial level. Comparison of rows 3 and 4 in Table 2 shows that the impact of a 1.06 percent interest rate rise is a 1.00 percent windfall equity gain in the NFC and in the different industries the gain ranges from 0.67 to 1.23 percent.

The total equity windfall induced by ERTA from ACRS, personal tax, and interest rate changes are $-79.1 billion, a loss equivalent to 6.07 percent of the market value of outstanding equities in the nonfinancial corporate sector. In SICs 20, 26, and 30, the equity windfalls equal −4.27, −5.89, and −8.63 percent of stock market values. Stock returns in two industries are predicted to outperform market; a third industry is predicted to underperform.

IV. A Comparison of Predicted and Actual Stock Price Movements

The ideas in the 1981 tax legislation originated with a bill introduced in 1977. The bill received little attention until President Reagan introduced to Congress on February 18, 1981, a tax proposal adopting some of the earlier provisions. Progress toward tax reform was slow and not until June 1981, did the president and Congress seem serious about compromise. The bill quickly came together and on August 14, President Reagan signed the Economic recovery Tax Act of 1981. This section measures the windfall stock returns accruing because of ERTA between February 18 and August 14, 1981. Our measurement excludes price adjustments prior to February 18 reflecting anticipations about the direction tax policy was taking, or adjustments after August 14 reflecting slow revisions in expectation.

The valuation model can be tested by comparing the predictions with the relative performance of each industry. Separate portfolios are constructed for common stocks in the Food Products (SIC 20), Paper and Allied Products (SIC 26), and Stone, Clay, and Glass (SIC 30) industries. Included securities are listed on the Center for Research in Security Prices (CRSP, 1985) Daily Returns File and in each portfolio there are 79, 42, and 32 securities, respectively. The NFC proxy is the CRSP equal weighted market index.

Standard "event-study" methodologies (see H. Tehranian, N. Travlos, and J. Waegelein, 1987) estimate the excess risk-adjusted return for security j in portfolio n, $ER^{j,n}$, as

$$ER_t^{j,n} = R_t^j - \left(\alpha^j + \beta^j R_t^m\right).$$

R^j and R^m are returns on security j and the market index, respectively, and α^j and β^j are the ordinary least squares estimates of R^j on R^m. Excess returns are estimated for each security in the portfolio for all trading days between February 18 and August 14, 1981.[13]

The cumulative average excess return between days t and u for N securities in industry n, $CAER_{t,u}^n$, is

$$CAER_{t,u}^n = (1/N) \sum_{s=t}^{u} \sum_{j=1}^{N} ER_s^j.$$

$CAER$ measures relative industry windfalls and its expected value is zero if industry returns equal market. The null hypothesis that industry and market perform the same

[13]The α and β estimated between August 4, 1980, and January 6, 1981 (106 trading days) is assumed constant until August 14, 1981. As a check for stationarity α and β are reestimated for the period September 8, 1981, to March 1, 1982 (106 trading days). The industry average β in the pre- and post-reform periods are 0.80 and 0.78 in SIC 20, 0.76 and 0.79 in SIC 26, and 0.99 and 0.94 in SIC 30.

TABLE 4—ACTUAL RISK-ADJUSTED EXCESS STOCK RETURNS

Row	SIC 20		SIC 26		SIC 30	
1 Predicted Excess Return						
	1.80 percent		0.18 percent		−2.56 percent	
2 Actual Cumulative Average Excess Return, February 18 to August 14						
	6.71 percent	(3.55)	4.09 percent	(1.30)	−3.82 percent	(−0.62)
3 Actual Cumulative Average Excess Return for Nine ERTA Events						
Total of All Events	2.25 percent	(2.75)	2.06 percent	(1.13)	−2.18 percent	(−1.26)
By Event						
1	0.314 percent	(1.378)	1.287 percent	(2.800)	0.425 percent	(0.354)
2	0.507	(1.665)	−0.141	(0.149)	−0.795	(−1.395)
3	0.263	(1.135)	0.439	(0.841)	0.254	(0.052)
4	0.283	(0.955)	−0.577	(−1.783)	−0.327	(−0.595)
5	−0.247	(−0.858)	0.579	(0.543)	−0.237	(−0.276)
6	0.932	(2.179)	1.242	(2.758)	−0.282	(−0.627)
7	0.415	(1.517)	−0.336	(−0.831)	−0.754	(−0.360)
8	−0.415	(−0.741)	0.083	(0.103)	−0.492	(−0.865)
9	0.203	(1.013)	−0.520	(−1.200)	0.022	(−0.071)

Notes: Predicted excess return equals the difference between the industry and NFC equity windfalls, as listed in row 4, Table 2. Event returns are the cumulative average excess industry stock returns for the day before and day of the event date listed in Table 5. Standard normal statistics testing for zero equality (see equation (13)) are in parentheses. Estimates are constructed from formulas and data described in Section IV.

is tested with the standard normal statistic

$$(13)\quad Z^n = [N(u-t+1)]^{-1/2} \times \sum_{s=t}^{u} \sum_{j=1}^{N} \left(ER_s^{j,n}/S_s^{j,n}\right).$$

$S^{j,n}$ is the estimated forecast error standard deviation.[14] The null hypothesis that the industry $CAER$ equals the prediction from the valuation model is tested with the standard normal statistic

$$Z^p = Z^n(1 - \%\Delta V/CAER^n),$$

where percentΔV is the prediction.

$CAER$s are listed in row 2 of Table 4. SIC 20 outperforms the market by 6.71 percent substantially more than the 1.80 percent prediction listed in row 1. Predicted and actual excess returns in SIC 26 are 0.18 and 4.09 percent, respectively, and in SIC 30 they are −2.56 and −3.82 percent. Performance relative to the market is in all industries the same sign as predicted but the variance of stock returns is large. Only in SIC 20 are excess returns significantly different from zero, as evidenced by the Z^{20} of 3.55 listed in the parentheses of Table 4.

The $CAER$s discussed above include excess returns attributable to non-ERTA information changes. That effect can be dampened by measuring excess returns on only those days when significant news about ERTA becomes available. A review of *The Congressional Quarterly Almanac* (1981) and *The Wall Street Journal Index* (1980, 1981) suggests there are nine releases of significant information. These are listed in Table 5.[15]

[14] S^j is computed from the forecast error standard deviation formula given in most econometncs books. This assumes independent and identically normally distributed stock returns. The biasedness introduced by cross-sectional dependence among securities is examined by John Binder (1985) and Paul Malatesta (1986).

[15] The event is the day of publication of announcement in *The Wall Street Journal* but the $CAER$ also includes returns on the trading day before the event. Sensitivity is examined by computing $CAER$s for the nine events including three days prior to the event. In SICs 20, 26, and 30 these $CAER$s (and Z statistics) are 3.19 percent (3.07), 1.86 percent (0.99), and −1.64 percent (−0.91), respectively.

TABLE 5—DATES OF IMPORTANT INFORMATION RELEASES ABOUT ERTA

Event	Date	Description
1	2-18-81	Reagan Formally Announces Tax Reform Proposal to Congress
2	6-8-81	Reagan Offers Revised Tax Reform Proposal
3	6-10-81	Compromise Plan on Tax Treatment of Depreciation is Worked Out Between Reagan and Business
4	6-19-81	House Ways & Means Committee Tentatively Approves New Depreciation Guidelines
5	6-25-81	Senate Finance Committee Tentatively Approves New Depreciation Guidelines
6	7-24-81	Reagan and House Ways & Means Committee Work Out a Compromise Bill
7	7-30-81	Senate and House Each Pass Their Own Version of Tax Reform; a Panel Is Set to Resolve Conflicts
8	8-5-81	House and Senate Pass Compromise Bill
9	8-14-81	Reagan Signs Economic Recovery Tax Act of 1981

Notes: The event is the day of announcement publication in *The Wall Street Journal.*

Row 3 of Table 4 presents for each industry the *CAER*s during the nine ERTA "event-windows." In all industries the *CAER*s decline in absolute value relative to the continuous February–August interval, implying excess returns outside the windows were generally the same sign as within. However, within the windows there is less noise as evidenced by the decline in all industries of the implied standard deviation of excess returns (the ratio $CAER/Z$). The lack of statistical significance is still evident in SICs 26 and 30 but in SIC 20 the *CAER* of 2.25 percent is statistically greater than zero ($Z^{20} = 2.75$) but not different from predicted ($Z^{p} = 0.5$).

The valuation model predicts differences between industries. The null hypothesis that the *CAER* in one industry equals the *CAER* in another is tested with the standard normal statistic

$$Z^{n-m}\left[\sum_{s=t}^{u}\left(\sum_{j=1}^{N} ER_s^{j,n}/NS_s^{j,n} - \sum_{j=1}^{M} ER_s^{j,m}/MS_s^{j,m}\right)\right]\Big/ [(u-t+1)(1/N+1/M)]^{1/2}.$$

N and M are the number of securities in industries n and m, respectively. The null hypothesis that the difference in *CAER*s between two industries equals the predicted difference is tested with the standard normal statistic

$$Z^{p,n-m} = \left[Z^{n}(1-\%\Delta V^{n}/CAER^{n}) - Z^{m}(1-\%\Delta V^{m}/CAER^{m})\right]/2^{0.5}.$$

Shareholders in SIC 20 outperform those in SIC 30 by 4.43 percent. That amount is statistically greater than zero ($Z^{20-30} = 2.5$) but indistinguishable from the predicted outperformance of 4.36 percent ($Z^{p,20-30} = 0.2$). Likewise, the actual difference of 4.24 percent between SICs 26 and 30 is significantly different from zero at the 10 percent level ($Z^{26-30} = 1.7$) but not significantly different from predicted ($Z^{p,26-30} = 0.6$). Between SICs 20 and 26 *CAER*s are indistinguishable.

The listings of *CAER*s by event are in Table 4. No single event has a statistically significant impact on all three industries. However, a preponderance of events have a positive impact in SIC 20 and negative impact in SIC 30. The results are not being fixed by a few key events.

The analysis of stock returns data provides moderate support for the predictions from the valuation model. During the continuous February–August interval the performance of each industry relative to the market has the same sign as predicted but they are statistically indistinguishable. When the analysis is restricted to dates of important legislative action the results strengthen. In two of three interindustry comparisons the relative shareholder performance is significantly greater than zero but insignificantly different than predicted.

V. Concluding Remark and Summary

Policymakers affect the allocation of wealth and unanticipated policy changes redistribute it. Sound public policy requires an awareness of who is receiving and who is paying for the free lunch ordered by the policymakers. This study presents and tests a fundamental valuation model for predicting the windfalls resulting from tax policy changes.

The model is applied to estimate fundamental values for the U.S. nonfinancial corporate sector and three manufacturing industries. The ratios of year-end 1980 financial market value to fundamental value equaled 0.81 for the NFC, 0.98 in the Food Products Industry, 1.09 in paper and Allied Products, and 0.75 in Stone, Clay, and Glass.

Fundamental value changed because of the enactment of the Economic Recovery Tax Act of 1981. The largest effect was from the Accelerated Cost Recovery System because new capital received preferential tax treatment and old capital lost value. A slight positive influence on fundamental value was the increasing demand for capital and rising interest rate—new capital was adversely affected and old capital benefited. On net, ERTA favored new capital and the fundamental value of existing capital declined. The stock market at-large is estimated to have suffered a 6.1 percent windfall loss and in the different industries predicted losses range from 1.8 percent less to 2.6 percent more than market.

Portfolios of common stocks were formed in the NFC and in separate industries and actual changes in shareholder wealth were measured. When the analysis is restricted to dates of important legislative action adjustments in shareholder wealth provide moderate support for predictions from the valuation model. In two of three cases interindustry differences in shareholder returns are significantly greater than zero but insignificantly different than predicted. In the third case results are inconclusive. This study suggests that because of the enactment of ERTA shareholders in the Food Products and Paper Products Industries did better than those in Stone, Clay, and Glass, and the relative performance may have been a predictable outcome.

REFERENCES

Auerbach, Alan, J., "Tax Reform and Adjustment Costs: The Impacts on Investment and Market Value," NBER Working Paper No. 2103, December 1986.

______ **and Kotlikoff, Laurence J.**, "Investment versus Savings Incentives: The Size of the Bang for the Buck and the Potential for Self-Financing Business Tax Cuts," in L. H. Meyer, ed., *The Economic Consequences of Government Deficits*, USA: Kluwer-Nijhoff, 1983, 121–49.

Behravesh, N., Hearings before the Subcommittee on Economic Stabilization of the Committee on Banking, Finance, and Urban Affairs, House of Representatives, 99th Congress, Serial No. 99-33, March 13, 1985.

Binder, John J., "Measuring the Effects of Regulations with Stock Price Data," *Rand Journal of Economics*, Summer 1985, *16*, 167–83.

Bohm von Bawerk, Eugen, William Smart, trans., *The Positive Theory of Capital*, New York: G. E. Stechert & Co., 1888.

Brainard, William, Shoven, John and Weiss, Laurence, "The Financial Valuation of the Return to Capital," *Brookings Papers on Economic Activity*, 1980:2, 453–502.

Coen, Robert M., "Investment Behavior: The Measurement of Depreciation, and Tax Policy," *American Economic Review*, March 1975, *65*, 59–74.

Cutler, David M., "Tax Reform and the Stock Market: An Asset Price Approach," *American Economic Review*, December 1988, *78*, 1107–17.

Downs, Thomas W., "Using the User Cost," *Journal of Economics and Business*, November 1986, *38*, 297–305.

______ **and Hendershott, Patric H.**, "Tax Policy and Stock Prices," *National Tax Journal*, June 1987, *40*, 183–90.

Eisner, Robert, "Components of Capital Expenditures: Replacement and Modernization vs. Expansion," *Review of Economics and Statistics*, August 1972, *54*, 297–305.

Feldstein, Martin S. and Rothschild, Michael, "Toward an Economic Theory of Replacement Investment," *Econometrica*, May 1974, *42*, 393–423.

Goulder, Lawrence H. and Summers, Lawrence H., "Tax Policy, Asset Prices, and Growth: A General Equilibrium Analysis," NBER Working Paper No. 2128, July 1986.

Hall, Robert, and Jorgenson, Dale W., "Tax Policy and Investment Behavior," *American Economic Review*, June 1967, *57*, 391–414.

Hendershott, Patric H., "Tax Changes and Capital Allocation in the 1980s," in M. Feldstein, ed., *The Effect of Taxation on Capital Formation*, Chicago: University of Chicago Press, 1986.

Hicks, John R., *Value and Capital*, London: Oxford University Press, 1939.

Holland, Daniel M. and Myers, Stewart C., "Profitability and Capital Costs for Manufacturing Corporations and All Nonfinancial Corporations," unpublished manuscript, MIT 1981.

Hulten, Charles R. and Wykoff, Frank C., "The Measurement of Economic Depreciation," in C. Hulten, ed., *Depreciation, Inflation, and the Taxation of Income from Capital*, Washington: Urban Institute Press, 1981, 81–125.

Ibbotson, Roger G., *Stocks, Bonds, Bills, and Inflation: 1984 Yearbook*, Chicago: R. G. Ibbotson Associates, 1984.

Macaulay, Frederick R., *Some Theoretical Problems Suggested by the Movement of Interest Rates, Bond Yields, and Stock Prices in the United States Since 1856*, New York: Columbia University Press for the NBER, 1938.

Malatesta, Paul, "Measuring Abnormal Performance: The Event Parameter Approach Using Joint Generalized Least Squares," *Journal of Financial and Quantitative Analysis*, March 1986, *21*, 27–38.

Modigliani, Franco and Miller, Merton, "Corporate Income Taxes and the Cost of Capital: A Correction," *American Economic Review*, June 1963, *53*, 433–43.

Peek, Joe and Wilcox, James A., "The Postwar Stability of the Fisher Effect," *Journal of Finance*, September 1983, *38*, 1111–24.

Tehranian, Hassan, Travlos, Nickolaos and Waegelein, James, "The Effect of Long-Term Performance Plans on Corporate Sell-Off-Induced Abnormal Returns," *Journal of Finance*, September 1987, *42*, 933–42.

VonFurstenberg, George M., Malkiel, Burton G. and Watson, Harry S., "The Distribution of Investment between Industries," in G. M. VonFurstenberg, ed., *Capital, Efficiency, and Growth*, Cambridge, MA: Ballinger, 1980.

Center for Research in Security Prices, Daily Stock Returns File, University of Chicago, 1985.

Congressional Quarterly Almanac, *Congressional Quarterly, Inc., Washington, D.C.*, 1981.

Moody's Investors Service, *Moody's Bond Record*, New York, NY, July 1981.

Standard & Poor's *COMPUSTAT* Services, Expanded Industrial Annual File, New York, NY, 1984.

U.S. Department of Commerce, Bureau of Economic Analysis, "Fixed Nonresidential Capital Stock Estimates," 1986.

U.S. Federal Reserve Board, SSRC-MIT-PENN Quarterly Econometric Model, Washington: USGPO, September 1983.

U.S. Federal Reserve Board of Governors, *Balance Sheets for the U.S. Economy, 1945–84*, Flow of Funds Section, October 1985.

Wall Street Journal Index, Dow Jones and Company, New York, 1980, 1981.