Assessing the Relationship Between Income Smoothing and the Value of the Firm

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This study develops the theoretical basis for the relationship between smooth income and equity market valuation. The model yields two testable hypotheses: equity markets should pay a premium for smooth streams of income; and market valuation distinguishes earnings streams that are naturally smooth versus those that are managed. The paper's empirical analysis offers support for both aspects of market valuation.

INTRODUCTION

Earnings management, more aptly called *disclosure management* by Schipper (1989), has been the subject of much accounting research over the past three decades.[1] A significant portion of this work has examined income smoothing, a special case of disclosure management.[2] The initial phase of the smoothing literature focused on detecting smoothing. The empirical question was whether firms deliberately dampen fluctuations around some expected earnings trend. While the results of early studies were inconclusive, recent evidence generally has supported the hypothesis that many firms appear to smooth income.[3]

This finding has prompted a second genre in the literature investigating the motivation for smoothing. Some researchers have speculated that managers benefit from smoothing due to the structure of compensation incentives. Watts and Zimmerman (1978) and Ronen and Sadan (1981) provide the earliest theory of how income-related compensation schemes can induce smoothing behavior. Moses (1987) supports this theory empirically by linking smoothing behavior with the existence of bonus compensation plans. Other researchers have sought to explain the rationale for smoothing in an agency setting. Lambert (1984) applies agency theory to show that optimal compensation agreements offered by principals may cause agents (managers) to smooth income. Trueman and Titman

[1] Schipper views disclosure management as purposeful intervention in the external financial reporting process to achieve some private gain. The underlying assumption is that accounting numbers are information driving financial market valuation.

[2] The motivation to manage earnings has been variously ascribed and tested in the literature. Much attention has focused on the desire of firms with unfavorable earnings to increase reported income. For example, see Warfield and Linsmeier (1992), Sheikholeslami (1992), Collins and DeAngelo (1990), and Trueman (1990). Boynton *et al.* (1992) examine earnings management as a means of minimizing corporate tax liability. Several recent articles have investigated the relationship between earnings management and executive compensation and security.

[3] See Ronen and Sadan (1981) for a summary of income smoothing research through 1981. Recent research supporting the smoothing hypothesis includes Belkaoui and Picur (1984), Moses (1987), Ma (1988), and Brayshaw and Eldin (1989).

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(1988) also use an agency framework to demonstrate that managers have an incentive to present future debt holders with low variance income streams, thus lowering the required return of the debt holders and thereby reducing the firm's long-term cost of capital. This study expands upon the Trueman and Titman rationale, albeit in a non-agency setting, to suggest equity market valuation as a motivation for smoothing.

Market valuation is measured using Tobin's q value. A discussion of the theoretical basis for the relationship between smooth income and equity market valuation yields two testable hypotheses. First, do the equity markets pay a premium for smooth streams of income? Second, do market valuations distinguish between earnings streams that are naturally smooth versus those that are managed?

SMOOTH INCOME AND MARKET VALUATION

Tobin's q ratio is a measure of financial market valuation premiums. The q ratio is defined as the market value of the firm relative to the replacement cost of its physical assets.[4] The q ratio has a clear intuitive interpretation. A ratio greater than one implies that the firm is generating economic rents because the market value of the firm is greater than the cost of replacing the capital assets. If this is not true, it is cheaper to purchase existing assets in the financial markets than to build a comparable enterprise anew.

For purposes of theoretical exposition, consider a simplified form of Tobin's q:

$$(1)\ q = \frac{(P)(N) + D}{RPL}$$

where:

P = The security price;
N = The number of shares;
D = The value of outstanding debt, and
RPL = The replacement cost of the firm's assets.

In the general case, the security price P represents the present value of the firm's future cash flows. For an infinite time period with uncertainty, the equity component of q in equation (1) may be rewritten:

$$(2)\ (P)(N) = \sum_{t=1}^{\infty} \frac{E(CF_t)}{(1 + k_e)^t}$$

where:

$E(CF_t)$ = The expected cash flow in period t; and
k_e = The risk-adjusted discount rate applied to equity.

[4] The seminal article on Tobin's q value is Tobin and Brainard (1968). Several empirical applications have followed. (See footnote 9.)

The debt term, D, of equation (1) similarly can be expanded to reflect the present value of the debt service payments (DS) of varying maturities t, with the longest maturity represented by the N^{th} period. A simplified rendering of this term is written:[5]

$$(3)\ D = \sum_{t=1}^{N} \frac{E(DS_t)}{(1 + k_d)^t}$$

where:

$E(DS_t)$ = The expected debt service in period t; and
k_d = The risk-adjusted discount rate applied to debt.

Substituting the terms in equations (2) and (3) into equation (1) yields the following expanded expression for q:

$$(4)\ q = \frac{\sum_{t=1}^{\infty} \frac{E(CF_t)}{(1 + k_e)^t} + \sum_{t=1}^{N} \frac{E(DS_t)}{(1 + k_d)^t}}{RPL}$$

It is obvious from equation (4) that the value of q will vary inversely with the risk-adjusted discount rates that stakeholders apply to equity (k_e) and debt (k_d). The maintained hypothesis of this paper is that the smoothness of income streams may influence the risk-adjusted discount rate applied to the future cash flows and debt payments. Note that k_e and k_d are market-determined rates consistent with the firm's systematic risk.

Consider two separate securities offering future cash flows as characterized in Figure 1. Observe that while the expected value of the two earnings streams is identical, Security A reflects a tighter distribution around the mean than Security B. It is well-known that if the difference in the variance between securities A and B is entirely unsystematic risk, then this risk can be eliminated through diversification. One would expect the equity market to value these securities comparably. To the extent the difference in variances reflects systematic risk, however, the cash flow and debt payments associated with Security B should warrant a higher discount rate.[6]

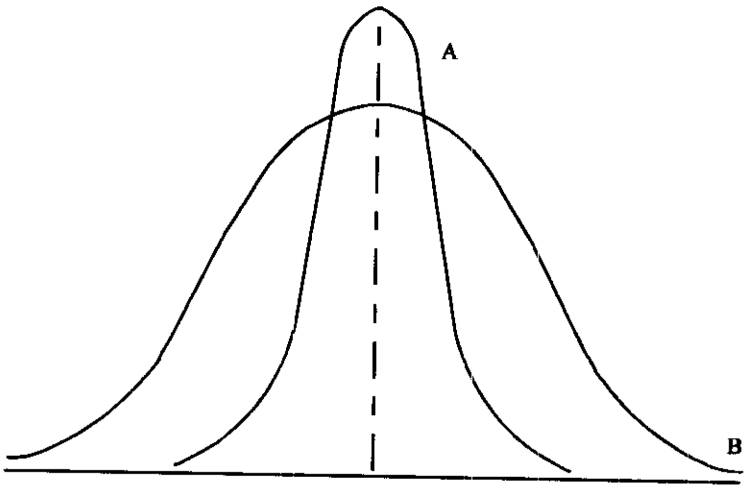
[5] Technically, one would distinguish the debt service from coupon payments versus face value redemptions. This distinction is unnecessary specificity for the testable hypothesis being developed.

[6] The link between income variability and systematic risk is key. Following Mandelker and Rhee (1984), the concept of an *accounting beta* (β_A) may be expressed as:

$$\beta_A = \frac{\%\Delta CF}{\%\Delta MKT} = \frac{\%\Delta CF}{\%\Delta EBIT}\ \frac{\%\Delta EBIT}{\%\Delta Sales}\ \frac{\%\Delta Sales}{\%\Delta MKT}$$

In this context, the term MKT refers to an economic measure of market activity (e.g., national income). If a firm's sales are correlated positively with economic activity, this expression details how the link between EBIT and sales can be softened by real or accounting decisions (timing of write-offs, accounting changes, spending on R&D). In turn, while the relationship between cash flows and EBIT remains tight, the firm can reduce the sensitivity between cash flows and market activity. In this respect, β_A can be lowered by smoothing actions.

Figure 1—Cash Flow Probability Distributions



Recasting Tobin's q in a risk-adjusted discount framework provides the basis for the first testable hypotheses. If smoother income streams lead investors to apply a lower risk-adjusted discount rate to the future cash flows of the firm, then firms with smoother incomes should have higher q values, all else equal.[7] Recognize, of course, that the theoretical basis for the hypothesis stated above implicitly pertains to valuation distinctions that would follow from differences in the degree of natural income smoothness. If natural smoothness earns a premium in the financial markets, however, a temptation exists to create the appearance of smooth income streams. This prospect poses a second empirical question. Does the financial market's valuation of equity distinguish between natural versus managed smoothness?[8] If sufficient information is available, managed smoothness

[7] This link between income smoothing, cash flows, and security valuation is consistent with the suggestion of Barnea *et al.* (1975) that one motivation for income smoothing is to enhance investors' ability to predict future cash flows. Ronen and Sadan (1981) cite a report of the American Institute of Certified Public Accountants that states, "An objective of financial statements is to provide information useful to investors and creditors in predicting, comparing, and evaluating potential cash flows ...". This application of Tobin's q is also consistent with Amit and Wernerfelt (1990) who demonstrate that lowering business risk increases firm q values. Note that although we do not employ an agency model, Tobin's q also captures the thrust of Trueman and Titman's rationale for smoothing. In terms of equation (1), if smooth income streams reduce the long-term cost of capital, the debt term (D) in the numerator rises.

[8] Early in the 1980s researchers began arguing for the need to distinguish natural and intentional smoothing (e.g., Imhoff, 1981 pp. 25-26; Moses, 1987 p. 358; and Ma, 1988 p. 489). Natural smoothness implies that a firm's income-generating process inherently produces a smooth stream of earnings without purposeful intervention by management. Natural smoothness could be attributed to the economic aspects of the product market such as income elasticity, price elasticity, significance of price versus nonprice competition, prospects for cooperative versus noncooperative behavior among firms, entry conditions, and the degree of product diversification. Intentional smoothing requires management to implement specific business and/or accounting decisions to achieve the desired effect.

would be detected and discounted in an efficient market. In this respect, our second empirical hypothesis can be interpreted as a semistrong form test of market efficiency.

EMPIRICAL TESTS OF THE SMOOTHING-VALUATION HYPOTHESIS

Tobin's q is an empirical measure of financial market valuation. Originally developed in 1968 for analysis of macroeconomic investment, Tobin's q received a renaissance of sorts in the work of Lindenberg and Ross (1981). Their study developed a methodology that blended financial and accounting data to obtain a time series of firm-specific q values. Their basic methodology for computing q has received wide application across business disciplines.[9]

The q values used in this study were constructed by Jose *et al.* (1986). While a detailed description of their assumptions and procedure for constructing q is relegated to Appendix A, a key conceptual aspect of q deserves emphasis. Recall from equation (1) that Tobin's q is the ratio of the value of the firm (equity + debt) to its replacement cost. As q is constructed using market prices of the firm's securities over time, q measures the capitalized value of the assets managed by the firm. In this respect, q may be thought of as a long-run equilibrium measure of economic rents. This is a desirable attribute for the valuation measure in light of the theoretical rationale for smoothing developed earlier. If, as we suggest, smooth income streams warrant lower risk-adjusted discount rates for future cash flows, then this basis for valuation differences is a phenomenon inherently long-run in its manifestation. Tobin's q ratio provides a continuous, times-series measure of the financial market's long-run valuation of the firm. These characteristics of q recommend it as an appropriate dependent variable in the empirical tests developed below.

Recall that the empirical thesis under investigation is twofold—does the equity market value smooth income; and, if so, does the market differentiate between income streams that are naturally smooth versus income streams that are manipulated in some fashion to appear smooth? This latter phenomenon shall be defined generally as *managed income* smoothing which in turn can be grouped into two subcategories: artificial smoothing and real smoothing.[10] Firms achieve artificial smoothing through discretionary accounting procedures that shift costs and/or revenues from one period to another.[11] And even a mandatory accounting change can be viewed as a smoothing vehicle

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[9] Smirlock, Gilligan, and Marshall (1984) use the Lindenberg and Ross methodology for constructing q values to examine the relationship between market valuation and industry concentration. Jose, Nichols, and Stevens (1986) apply q to analyze the contribution of diversification, advertising, and R&D to a firm's market value. Morck, Shleifer, and Vishny (1988) use q to assess the efficiency arguments for hostile corporate takeovers. Most recently, Jose and Stevens (1989) and Stevens and Jose (1991) use Tobin's q to study the effects of dividend policy on market valuation of the firm.

[10] The income smoothing literature identifies a third category as classificatory smoothing. This category, as introduced by Ronen and Sadan (1975), assumes management uses its discretion to classify certain income items as either ordinary or extraordinary to smooth ordinary income. Because this analysis produces nearly identical results using both ordinary and net income as smoothing objectives, we do not address this third category.

[11] The FASB exhorts a qualitative characteristic of neutrality with regard to financial reporting earnings. SFAC No. 2 (par. 100) states that economic activity must be reported "without coloring the image it communicates for the purpose of influencing behavior in some particular direction." Despite this promulgation, income management and smoothing is an accepted fact. It is noteworthy that SEC Chairman Richard Breeden acknowledges the presence of smoothing behavior. In a recent interview, when queried about whether

because implementation typically permits an adoption window.[12] Artificial smoothing decisions typically require changes in accounting estimates or procedures. Such changes might include changes in estimates relating to pension liabilities, investment tax credit treatment, or changes in amortization methods or estimates. As the effects of such changes are disclosed in the financial statements, these are detectable more readily than are real smoothing decisions. *Real smoothing* refers to timing the occurrence or recognition of actual transactions such as advertising or R&D costs. Because real smoothing decisions are not subject to disclosure rules, they are more difficult to capture empirically.[13] The difficulty of detecting real smoothing has constrained research on real forms of intentional smoothing, even though the practice may be pervasive.[14]

The variables used in the estimation procedure reflect several data transformations. These variable constructions will be described in detail shortly. The logic of the hypothesis tests, however, is straightforward. Consider a regression model of the form:

$$\text{(5)}\quad \text{VALUE}_i = f(\underset{(+)}{\text{SMOOTH}}, \underset{(+)}{\text{GROWTH}}, \underset{(+)}{\text{MARGIN}}, \underset{(-)}{\text{ACCOUNT}}, \underset{(-)}{\text{R\&D}}, \underset{(-)}{\text{LEVERAGE}}, \underset{(?)}{\text{ASSET SIZE}}, \underset{(?)}{\text{INDUSTRY}})_i$$

where:

VALUE_i = The q value for an individual firm.

The first term posits that the financial market's valuation of the firm will vary directly (+) with the smoothness of a reported income stream. The prediction that $\partial q/\partial \text{SMOOTH} > 0$ was developed explicitly in terms of equation (4) using a risk-adjusted discount rate concept. The sign and significance of the estimated SMOOTH coefficient constitutes the empirical test of our first hypothesis. Though secondary to our thesis, the prediction that $\partial q/\partial \text{GROWTH} > 0$ also follows from equation (4). All else equal, a higher growth firm will have higher E(CF) and thus a higher q. The MARGIN variable is a profitability measure. This variable is included to control for the influence of market power on a firm's q

investors should learn to accept volatility in financial results, he said, "...we should not use accounting devices to smooth it out" (*CFO*, January 1993, p. 17).

[12] For example, Gujarathi (1992) finds evidence that early adopters of SFAS 96 were motivated by the desire to manage earnings.

[13] As Schipper (1989, 92) states, "it might be difficult to distinguish empirically between investment decisions (such as choosing the level of expenditures on research and development or on advertising, adding or dropping a product line, or acquiring another firm) that are undertaken purely to maximize share values and those undertaken purely to manage earnings."

[14] For example, Lambert (1984) suggests that while only top management has the discretion to use accounting smoothing, managers at all levels can apply real smoothing techniques. The opportunities for real smoothing are considerably broader than for accounting smoothing. Further, studies by Lev and Kunitzky (1974) and Givoly and Ronen (1981) offer empirical evidence of real smoothing. In a laboratory setting, however, Koch (1981) finds that, given the choice between real and accounting variables, executives prefer to smooth income via accounting methods.

value. Because q is a measure of economic rent, it is important to control for differences in firm q values attributable to market power. We expect $\partial q/\partial MARGIN > 0$.

The next three terms of equation (5) are key to testing the second hypothesis of the study—whether the market distinguishes between income smoothness that is natural versus managed. In the regression format, the estimated coefficient for SMOOTH measures the influence of smoothness on q, other things equal. Firms with seemingly comparable smoothness of reported income, however, may have variations in their q values explained, not by SMOOTH, but by the degree to which an income stream would have been less smooth if the influence of accounting changes (ACCOUNT) or the discretionary timing of expenses (R&D) were permitted to enter the model. The inclusion of the ACCOUNT and R&D variables permits a distinction between the market's valuation of naturally smooth income versus income that is smoothed by purposeful managerial intervention. We hypothesize that in an efficient equity market, managed smoothness will be discounted; thus, the predicted signs for ACCOUNT and R&D coefficients are negative.

The last three terms of equation (5) are included to control for other factors that can influence a firm's q value. It is important to control for firms' relative LEVERAGE positions. Other factors equal, a higher degree of leverage by one firm implies lower free cash flows and therefore a lower q ($\partial q/\partial LEVERAGE < 0$). The ASSET SIZE variable is included to control for the possible influences of firm size on q. This variable has a potentially important role in the model because, for econometric reasons, the other variables listed in equation (5) take standardized values in the regression analysis. Thus, ASSET SIZE represents the only control for the possible influence of absolute firm size on q. We suggest, however, that the predicted sign of $\partial q/\partial ASSET\ SIZE$ is ambiguous. The INDUSTRY term in equation (5) represents a series of binary variables defined by four digit SIC codes. These binary variables test for the possibility that q values vary systematically by industry, other factors held constant. These industry binaries have clear conceptual appeal as control variables in light of the other independent variables in the model (e.g., GROWTH, MARGIN, LEVERAGE).

Equation (5) is estimated using data for the period 1976-1980. The dependent variable is the firms' five year average Tobin q value.[15] As noted above, due to substantial differences in the size of firms in the sample, explanatory variables generally are standardized to a mean of zero and a standard deviation of one. Table 1 presents a concise statistical and descriptive summary of the variables used in estimating equation (5).

Smoothness (SMOOTH) of the reported income stream is measured as the reciprocal of the sum of the squared residuals (SSQR) from the five year income trend. Accordingly, the largest values of SMOOTH represent firms with smallest values of SSQR; thus, if

[15] The q data were provided by Jose and Stevens (1986). Their description of the construction of q appears in Appendix A.

Table 1—Variables Within the Model

Variable	Mean and Standard Deviation	Max Min	Predicted Sign of the Coefficient	Variable Description
VALUE	0.851 0.308	2.168 0.255	Dependent Variable	Mean value of the firm's Tobin q value from 1976-1980. Tobin's q is the firm's ratio of the market value of debt plus equity to replacement cost. The q data are those used by Jose and Stevens (1989)
SMOOTH	7.418 23.191	207.943 0.250	+	Reciprocal of sum of squared residuals for the firm's standardized net income trend for 1976-1980. Income data are from Compustat
GROWTH	0.331 0.359	0.632 -0.607	+	OLS coefficient of the firm's standardized net income trend from 1976-1980
MARGIN	0.299 0.118	0.743 0.044	+	Average annual gross profit margin of the firm from 1976-1980. Margin is calculated as total revenue less cost of goods sold divided by total revenue. Revenue and cost figures are Compustat data
ACCOUNT	0.020 0.080	0.764 0.000	-	The difference between the sum of the squared residuals of the adjusted and unadjusted income streams (if 0, set = 0). Adjustments are based on footnotes from annual reports receiving qualified auditor opinions (38 percent of firms reported accounting changes for the period 1976-1980)
R&D	-6.520 12.139	-82.418 -0.251	-	Reciprocal of the sum of the squared residuals for the firm's standardized R&D spending trend from 1976-1980. To obtained the negative sign cited in equation (5), the observations are multiplied by -1. R&D spending is from Jose and Stevens (1989)
LEVERAGE	0.181 0.087	0.433 0.0	-	Mean of the long-term debt to asset ratio for the 1976-1980 period. Long-term debt and asset figures are Compustat data
LARGE ASSETS	0.201 0.402	1.00 0.0	?	Binary variable denoting firms in the top quintile when ranked by asset size (assets > $2.2 billion)
SMALL ASSETS	0.188 0.392	1.00 0.0	?	Binary variable denoting firms in the bottom quintile when ranked by asset size (assets < $150 million)
INDUSTRY BINARIES			?	Eleven industry binaries denoting the nonmanufacturing sectors and industries within manufacturing (food, textiles, paper, chemical, pharmaceutical, precision measuring equipment, oil, tires, primary metals, automotive). Jointly, these binaries include 92 firms, 42 percent of the sample

In the results section, the model is estimated separately using both net and ordinary income as the smoothing target. This influences the specific values that result when constructing the SMOOTH and GROWTH variables. The descriptive statistics presented above for these three variables are based on net income. Summary statistics for these three variables in the ordinary income model accompany the presentation of results in Table 2 the market values smoothness, $\partial q/\partial SMOOTH > 0$.[16] The growth variable (GROWTH) is defined as the firm's five year income trend. This variable is the OLS coefficient of standardized income regressed against time. Clearly, we expect $\partial q/\partial GROWTH > 0$. The MARGIN variable is the firm's gross profit margin calculated as sales minus cost of goods sold as a percent of sales.[17]

To capture the effect of accounting changes on reported income, after tax income figures are reconstructed using information obtained from the footnotes of financial statements flagged by qualified auditor opinions.[18] A second standardized income trend line is estimated for each firm using the reconstructed income figures to obtain a second set of sum of the squared residuals. The impact of accounting changes is measured as the difference between the sums of the squared residuals of the reported and reconstructed income streams. If the effect of a firm's accounting changes is to smooth income relative to trend, then the residuals from the reconstructed income trend line will be greater than the residuals from the reported income trend. The value of the ACCOUNT variable will be positive for instances where the effect of accounting changes works to smooth reported income. For a firm having no accounting adjustments over the period, ACCOUNT = 0; otherwise the ACCOUNT variable captures the incidence and magnitude of the smoothing effects of accounting adjustments. In an efficient market, specious smoothness would be detected and discounted; thus, we expect $\partial q/\partial ACCOUNT < 0$.

Regarding the real smoothing variable, it is implausible that a firm would let the goal of smooth income drive its longer-term R&D policy, because to do so likely would influence growth which is another key variable in determining market value.[19] Nonetheless, firms do have at least a one period leeway in charging such sizable expenses against

[16] Specification of this variable as the reciprocal of the sum of the squared residuals imposes a nonlinear functional form for which there is no strong theoretical justification. Our empirical analysis, however, produces compelling justification for this specification. We discuss this issue further in the next section.

[17] The relationship between a gross profit margin calculation and Lerner's conceptual index of monopoly power was developed early in the industrial organization literature in economics. Collins and Preston (1969) discuss this relationship in an influential econometric study of price-cost margins and market concentration. A large literature ensued which is summarized by Martin (1988, pp. 165-178). This literature later spawned an intense controversy led by Demsetz (1973). Demsetz questioned the ability of gross profit measures to distinguish market power effects versus economic efficiency, especially for analysis at the industry rather than firm level. This debate has rendered a compromise conclusion that profit measures such as gross profit margins reflect efficiency and market power. Given the focus of this paper, the distinction is inconsequential. The important point is that the MARGIN variable adequately controls for either influence, thus allowing a fair test of the marginal impacts on q of the smoothing variables that are the focus of our thesis.

[18] The most common types of accounting changes involve inventory valuation, investment tax credits, foreign currency translation, lease or interest capitalization, and depreciation methods. Financial statement footnotes state the after tax income effects of accounting changes implemented during that period. While the data are collected specifically for this study, there is some overlap between the period of our data coverage and accounting changes recorded by Lillien, Mellman, and Pastena (1988). This provides an independent source for verification of our accounting records.

We should acknowledge that many smoothing decisions have multiyear impacts. Once these decisions are implemented, the effects are imbedded into any number of future accounting periods and can not be changed willy nilly. No evidence exists, however, that smoothing decisions are made with a long-term view. Rather, a new set of smoothing decisions are made each period i. This set of decisions is made specifically to smooth income through period i and is certainty not guaranteed to have smoothing effects in periods i + 1, ..., i + n. These future periods will be subject to new smoothing decisions.

[19] Using 1977 data Hirschey and Weygandt (1985) find a positive relationship between firm q value and R&D expenditure. Also see Pound, Lehn, and Jarrell (1986).

income. In short, timing outlays for major R&D projects can shift expenses across reporting periods and thus smooth income. If so, a symptom of this conduct would be greater volatility around the longer-term R&D trend.[20] Therefore, we measure the potential impact of the real smoothing variable in terms of the sum of the squared residuals from the firm's spending trend on R&D.[21] Firms with the greatest volatility in this area are suspects that an efficient equity market could identify as real smoothers. This would prompt the market to discount the value of these firms vis-á-vis firms with smooth income streams that do not appear to be managed via the timing of real transactions. The predicted relationship for R&D trend residuals is negative ($\partial q/\partial R\&D < 0$).

The remaining variables in the model have no bearing on the issue of income smoothing but are of obvious importance as control variables. The LEVERAGE observation is a five year mean (1976-1980) of the firm's long-term debt-to-assets ratio. All other factors equal, more highly leveraged firms imply greater risk and, thus, a lower q value. Broad differences in firm size are considered with two binary variables, LARGE ASSETS and SMALL ASSETS. These variables denote firms in either the top or bottom quintile when ranked by asset size. Industry binaries are included to control for industry differences that may affect firm q values systematically. While the conceptual basis for including industry control variables is sound, the concept poses a somewhat vexing definitional problem. In short, there are few clear criteria to apply. Table 2 lists 11 industry classifications that emerged.[22]

EMPIRICAL RESULTS

Equation (5) is estimated for a sample of 218 firms.[23] The results appear in Table 2. Because there is some debate regarding the specific income target for smoothing, the model is estimated using both net and operating income in constructing the SMOOTH, GROWTH, and ACCOUNT variables.[24] In each case, three variations of the model are

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[20] This volatility may be a false symptom in some cases. As with all smoothing studies, one never can prove a decision is motivated by the desire to smooth. Smoothing behavior is always something that can be inferred only from circumstances. Volatility in R&D spending, while controlling for the actual reported income stream, is a plausible, albeit hardly exhaustive, scenario of such circumstances.

[21] The R&D variable is defined as the reciprocal of the sum of the residuals from trend. Because the reciprocal form reverses the sign, these observations are multiplied by -1 to retain the sign of the relationship identified in equation (5) (i.e., $\partial q/\partial R\&D < 0$). Also, as is the case of SMOOTH, the nonlinearity implied by the reciprocal form is justified only empirically and will be discussed presently.

[22] Because the sample is composed largely of manufacturing firms (202 of 218), a binary variable denotes firms in nonmanufacturing sectors. Beyond this distinction, the definition of industry binaries is somewhat ad hoc. We identify sufficient size clusters of firms within a particular four digit SIC code or across a combination of codes deemed closely aligned. The difficulty in identifying such clusters is evidenced by the fact that the 202 manufacturing firms span 97 unique four digit SIC codes. The industry binaries used and SIC codes represented are food manufacturing (2000, 2030, 2040); textile mill products (2211, 2221); paper mills (2621); chemical (2800, 2810, 2820, 2821); pharmaceutical (2834, 2840, 2844); petroleum refining (2911); tires (3011); primary metals (3312, 3330, 3334); motor vehicles (3711, 3713, 3714); and precision measurement instruments (3822, 3823, 3825, 3826). These binaries cover 92 firms or 42 percent of the sample.

[23] The sample size is constrained by availability of annual R&D data for each firm over the five year period. A list of the firms and their mean q values for the period appears in Appendix B.

[24] See Ronen and Sadan (1981, p. 16).

Table 2—Results for Smoothing Model Using Net and Ordinary Income

	Net Income			Ordinary Income			Mean/Standard Deviation	
	Q Value	Q Value	Q Value	Q Value	Q Value	Q Value		
Smooth	0.0036** (4.97)	0.0039** (5.28)	0.0039** (5.40)	0.0035** (4.93)	0.0039** (5.34)	0.0039** (5.44)	7.42 (23.19)	7.96 (23.26)
Growth	0.1137** (2.43)	0.1319** (2.65)	0.1108** (2.45)	0.1001* (2.18)	0.1171** (2.42)	0.0956* (2.16)	0.33 (0.36)	0.34 (0.37)
Account	-0.3799* (1.85)	-0.4528* (2.20)	-0.4076* (2.04)	-0.4353* (2.18)	-0.5142** (2.56)	-0.4731** (2.43)	0.02 (0.08)	
Margin	1.1406** (7.82)	1.2080** (7.36)	1.2122** (7.94)	1.1484** (7.80)	1.2276** (7.43)	1.2331** (8.04)	0.30 (0.12)	
R&D	-0.0027* (1.98)	-0.0024* (1.79)	-0.0025* (1.90)	-0.0027* (1.96)	-0.0024* (1.78)	-0.0025* (1.88)	-6.52 (12.14)	
Leverage	-0.4958** (2.64)	-0.4574** (2.39)	-0.5345** (2.92)	-0.5093** (2.70)	-0.4765** (2.49)	-0.5494** (3.00)	0.18 (0.09)	
Large Assets	-0.0535 (1.29)	-0.0802 (1.68)	-0.0533 (1.33)	-0.0569 (1.37)	-0.0875 (1.83)	-0.0568 (1.42)	0.20 (0.40)	
Small Assets	-0.0055 (0.13)	-0.0146 (0.34)		-0.0070 (0.17)	-0.0157 (0.37)		0.19 (0.39)	
NonMfg	-0.0146 (0.24)	-0.0019 (0.03)		-0.0082 (0.13)	0.0069 (0.11)		0.07 (0.26)	
Food Mfg		-0.0407 (0.63)			-0.0463 (0.71)		0.07 (0.26)	
Textile Mills		-0.0854 (0.87)			-0.0893 (0.91)		0.03 (0.16)	
Paper Mills		-0.1094 (1.24)			-0.1141 (1.29)		0.03 (0.18)	

Table 2—Results for Smoothing Model Using Net and Ordinary Income (continued)

	Net Income			Ordinary Income			
	Q Value	Q Value	Q Value	Q Value	Q Value	Q Value	Mean/Standard Deviation
Chemical		0.1240 (1.46)	0.1239 (1.49)		0.1172 (1.38)	0.1164 (1.40)	0.04 (0.19)
Pharmaceut		-0.1319† (1.99)	-0.1274† (1.96)		-0.1477† (2.21)	-0.1431† (2.18)	0.07 (0.26)
Precision Instruments		0.1515† (2.02)	0.1614† (2.19)		0.1479† (1.97)	0.1578† (2.14)	0.05 (0.21)
Petroleum Refining		0.0611 (0.64)			0.0703 (0.74)		0.03 (0.18)
Tires		-0.0075 (0.06)			-0.0114 (0.08)		0.01 (0.12)
Primary Metals		-0.0702 (0.74)			-0.0609 (0.64)		0.03 (0.18)
Passenger Vehicles		0.2046 (1.37)			0.2036 (1.36)		0.01 (0.12)
Constant		0.5161** (7.49)	0.5189** (8.48)	0.5421** (8.60)	0.5200** (7.56)	0.5217** (8.52)	
Mean/Std Dev of Q Value	0.5375** (8.53)	0.8514 0.3082	0.8514 0.3082	0.8514 0.3082	0.8514 0.3082	0.8514 0.3082	
Adjusted R Squared	0.8514 0.3082	0.4629	0.4715	0.4403	0.4621	0.4701	
F Value	0.4433	10.845	20.362	19.964	10.811	20.252	
	20.198						

* Significant at the 5 percent level, one-tailed test
** Significant at the 1 percent level, one-tailed test
† Significant at the 5 percent level, two-tailed test

presented in order to assess the role of industry effects more fully. The first model contains the core variables, while distinguishing only nonmanufacturing firms via a binary variable. The second model contains the full range of 11 industry binaries. The third model may be regarded as the most parsimonious version of the model—generally insignificant variables that appear in the first two models have been dropped.[25]

First observe that the sign and significance of key variables are similar regardless of whether net or ordinary income is used. Adjusted R^2s in the .44 to .47 range indicate a high level of explanatory power for cross sectional data.[26] Viewed broadly, the results generally conform to our earlier predictions. Note that a firm's q value is affected positively by income that is smooth and growing. Gross profit margin also is correlated strongly with the firm's q value, while the level of leverage reduces firm value in eyes of the equity market. Also note that the binaries for the pharmaceutical industry and precision measuring equipment are significant in the expanded model and in the parsimonious model.[27]

While the findings cited thus far are generally unsurprising, they are still reassuring. Having captured the influence of these core determinants in market valuation, the remaining variables can be interpreted as the marginal impacts of artificial and real smoothing. For example, consider the significant negative sign on the ACCOUNT variable. Strictly interpreted, this coefficient indicates that a firm, with otherwise equal smoothness and growth of reported income, suffers a lower q value to the extent that accounting changes contribute to smoothness. In short, this result suggests that the artificial smoothing effects of stated accounting changes are detected by the market.

If this it true, however, does it necessarily imply that firms that smooth income through management intervention are merely shadow boxing? Perhaps, but perhaps not. This conclusion is a qualitative one supported by interpretation of the sign, not the magnitude, of the estimated coefficients. An important question is whether the market rewards smooth income per se more than it discounts the methods by which it is attained. If so, managed smoothing is a rational corporate strategy from the standpoint of increasing market valuation of the firm. Unhappily, this quantitative inference cannot be gleaned readily by comparing the estimated coefficients of SMOOTH and ACCOUNT because the variables are measured in different units.[28]

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25 The third model reflects several experimental iterations based on the second model. This analysis focuses on alternative combinations of industry binaries. The results are available from the authors upon request.

26 If one is concerned about this aspect of the results, one can increase the R^2 substantially by changing the sample unit from the firm level to randomly determined portfolios of firms. While this will eliminate a significant amount of unexplained variance, it is a false objective given the focus on the study.

27 Recall an earlier discussion regarding the difficulty of adequately defining industry groups. The peril of going beyond four digit classifications is evidenced by the results for the chemical and pharmaceutical binaries. These binaries are both of borderline significance and yet bear opposite signs. While there is an apparent difference between these firms, they would be combined under a two digit classification scheme.

28 SMOOTH is the reciprocal of the sum of squared residuals of a reported trend income. ACCOUNT is the difference between two sums of squared residuals. Therefore, a given accounting change will not impose a comparable unit change in the two variables. A similar caution pertains to any precise comparative interpretation of the SMOOTH and GROWTH coefficients. From the standpoint of corporate policy, it is not intuitively meaningful to think of a one unit change in the firm's income trend coefficient versus a one unit change in the sums of the squared residuals from trend. Acknowledging this caveat, it is possible to calculate elasticities from the estimated coefficients. Based on the mean values of the dependent variables, the

The result for the R&D variable indicates a significant negative relationship between firm value and short-run volatility in R&D spending. Of course, any evidence of real smoothing should be received cautiously. Alternative explanations exist. For example, R&D policies, in and of themselves, may weigh in the market's valuation of the firm, and volatility in either area could reflect a lack of strategic planning or commitment. If so, these could be the considerations reducing the firm's q value, not the contrived impact on income smoothness implied by our hypotheses. Nonetheless, the results are consistent with the hypothesis that the market is sensitive to one possible vehicle of real smoothing—R&D charges that appear timed to smooth reported income.

Last, it is important to elaborate on the role of the inverse specification for the SMOOTH and R&D variables. This form was adopted on empirical rather than theoretical grounds. Using a levels specification, we obtain the surprising (and implausible) result that GROWTH is insignificant in explaining differences in the market's valuation of firms. This curious finding led us to investigate nonlinear functional forms such as the inverse. The performance of the GROWTH variable is altered dramatically by the inverse specification of SMOOTH and R&D; formerly insignificant, the GROWTH variable attains significance at the one percent level. Perhaps of even greater note, however, is the fact that the significance of SMOOTH and R&D—the variables key to the paper's thesis—are not sensitive to a levels versus inverse specification, despite the marked impact on GROWTH. Furthermore, a common statistical test for specification bias supports the inverse form of these variables over a pure linear as well as other nonlinear specifications.[29] In sum, while there is little theoretical basis of the inverse specification of SMOOTH and R&D, the empirical support is rather striking.

CONCLUSIONS

This study has suggested a theoretical link between income smoothness and market valuation as measured by Tobin's q. From this theoretical basis, we develop two testable hypotheses. Does the financial market show a preference for smooth income streams? And does it distinguish between naturally versus managed smoothness? The results indicate that, along with growth, the market does value smooth income. This finding is consistent with the predictions of a risk-adjusted rate of return framework. But the market also appears to be sensitive to how smoothing is achieved, thus supporting semistrong form market efficiency. The empirical results reveal that equity market valuations discount for

elasticities of VALUE with respect to SMOOTH, GROWTH, and ACCOUNT are .031, .044, and -.009, respectively. While these elasticities are suggestive of the relative importance one may attach to the variables, they still should be viewed cautiously in light of the unit-of-measure issue.

[29] A Ramsey RESET test for specification error was performed. The Ramsey RESET procedure re-runs the model with three additional variables constructed from the fitted values of the dependent variable. These values are raised to the second, third, and fourth power and inserted as right-hand regressors. A significant F-test indicates the presence of a specification error. This error can reflect either a functional form issue or an omitted variable bias. We examined four alternative functional forms of the SMOOTH and R&D variables: 1) levels; 2) inverse; 3) log; and 4) cubic. Only the inverse specification of the model yields an insignificant F test. Of course, the specification error could be an omitted variable bias, but if so, this does not explain why the omitted variable bias is less in the inverse form of the model. Also, GROWTH, MARGIN, and LEVERAGE are key theoretical concepts that are included in the model. A complete analysis of the sensitivity of these results to the inverse functional form is available from the authors.

both artificial and real smoothing. Further, these general conclusions apply whether the smoothing target is ordinary or net income.

These findings pose an obvious question. Why would firms practice income smoothing in a financial market that appears to discriminate? One possibility is that firms refuse to believe that the market cannot be fooled. This is consistent with the practice of establishing management compensation schemes that encourage managers to implement smoothing decisions. An explanation may also lie in the degree to which firms believe they can fool the market. Although the findings indicate that smoothing behavior is detected and discounted, they also suggest that the market does not fully discount to the no-smoothing level. More precise quantification of this dimension of the smoothing-valuation relationship is an obvious next step for future empirical investigation.

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APPENDIX A—CONSTRUCTION OF TOBIN'S q VALUES

Measurement of Tobin's q follows the basic methodology of Smirlock, Gilligan, and Marshall (1984) and Lindenberg and Ross (1981). One exception is that we estimate the average life for plant and equipment and use straight line depreciation to get the reduction in replacement costs of plant and equipment before inflation adjustment. In contrast, Smirlock, Gilligan, and Marshall use a simple 5 percent annual depreciation schedule.

The denominator of q is measured by valuing the firm's assets at estimated replacement costs. The firm's assets are categorized as plant and equipment, inventory, and other. For 1962 the book value of plant and equipment is assumed to be the replacement cost. For the following years the value of plant and equipment is reduced using straight line depreciation and the firm's average life for plant and equipment (estimated over the life of other study). The above values are adjusted to the new price level using the GNP implicit price deflator. One half year's depreciation and price level adjustment is made for new additions or sales, calculated as the change in gross plant book value.

Adjustments for various inventory accounting methods follow Lindenberg and Ross (1981). The primary method reported by Compustat is assumed to be the only method. Inventory average costs are adjusted for a half year's inflation. The Producer Price Index is used to adjust the excess of beginning over ending inventory for FIFO and changes in reported inventory are adjusted for a half year's inflation. The average of sales/costs of goods sold is used to deflate inventories under the retail accounting method, and inventories are maintained at book value for all other methods. Replacement cost is assumed to be equal to book value for all other assets.

The value of equity is taken at the year-end market price. Preferred stock is assumed to be a perpetuity discounted at the average yield for the year reported by Moody's. Current liabilities and portions of the debt maturing within one year are valued at book. For years after 1973 Compustat provided data on the debt maturing in two, three, four, and five years. For years prior to 1974, the maturity of outstanding debt is assumed to have been issued in equal amounts over the preceding 20 years and to have 20 year maturities at issue. Coupon rates are assumed to have been equal to the long-term corporate bond return from Ibbotson and Sinquefield (1982). For the years after 1973 the debt with more than five years to maturity is assumed to be issued in equal increments and is treated like the debt prior to 1974. Debt is valued each year by using the current year's issue coupon rate to calculate the price. The value of other liabilities is taken as the difference between the book value of total assets and the book values of common stock, preferred stock, current liabilities, and long-term debt.

APPENDIX B—q VALUES FOR SAMPLE FIRMS

Company	q Value	Company	q Value
Abbott Laboratories	1.6610	Del Laboratories Inc	0.7148
Air Products & Chemicals	0.9552	Dennison Mfg Co	0.6786
Akzona	0.5220	Dentsply International Inc	0.9536
Alberto-Culver Co	0.7058	Diebold Inc	1.0492
Allis-Chalmers Corp	0.6902	Dow Chemical	0.9856
Aluminum Co of America	0.5978	Dresser Industries Inc	1.0904
Am International Inc	0.6938	Du Pont (E.I.) De Nemours	0.8142
Amax Inc	0.7700	Echlin Inc	1.4204
American Brands Inc	0.7636	Edo Corp	0.7852
American Cyanamid Co	0.7896	Electronics Corp of America	1.0408
American Hospital Supply	1.3128	Emerson Electric Co	1.7056
American Seating Co	0.5440	Emhart Corp	0.7694
Ametek Inc	1.2036	Esmark Inc	0.6422
AMF Inc	0.7232	Ethyl Corp	0.6456
AMP Inc	1.8686	Exxon Corp	0.7500
Anderson, Clayton & Co	0.6700	Fedders Corp	0.6730
Armstrong World Inds Inc	0.6412	Ferro Corp	0.8000
Aro Corp	0.7876	Firestone Tire & Rubber Co	0.5290
Asarco Inc	0.5412	FMC Corp	0.6616
Ashland Oil Inc	0.7684	Ford Motor Co	0.5806
Avco Corp	0.6986	GAF Corp	0.5366
Bangor Punta Corp	0.6554	General Dynamics Corp	0.7978
Beckman Instruments Inc	1.5414	General Electric Co	1.0056
Becton, Dickinson & Co	1.2690	General Foods Corp	0.8008
Bell & Howell Co	0.6582	General Mills Inc	1.1134
Bemis Co	0.5294	General Motors Corp	0.7990
Bethlehem Steel Corp	0.4144	General Refractories Co	0.4776
Borden Inc	0.6588	General Signal Corp	1.1744
Braun Engineering	0.6914	Gillette Co	0.9782
Briggs & Stratton	1.5880	Glatfelter (P.H.) Co	0.6584
Brown & Sharpe Mfg Co	0.5298	Goodrich (B.F.) Co	0.4570
Brunswick Corp	0.6880	Gould Inc	0.8948
Burndy Corp	1.2488	Great Lakes Chemical Corp	2.1680
Burroughs Corp	1.2100	Gulf Resources & Chemical	0.7424
Campbell Soup Co	0.9074	Harris Corp	1.4606
Carlisle Corp	0.9744	Harsco Corp	0.7388
Carpenter Technology	0.7348	Heinz (H.J.) Co	0.7820
Carter-Wallace Inc	0.5126	Hercules Inc	0.6856
Caterpillar Tractor Co	1.0520	High Voltage Engineering	0.8506
CCI Corp	0.7998	Holly Sugar Corp	0.4918
Celanese Corp	0.5372	Ingersoll-Rand Co	0.8606
Central Soya Co	0.7374	Interpace Corp	0.5978
Champion Spark Plug	0.8782	Intl Business Machines Corp	1.8786
Chesebrough-Pond's Inc	1.4074	Intl Multifoods Corp	0.7114
Chrysler Corp	0.5700	Intl Paper Co	0.6736
Cincinnati Milacron Inc	0.7976	Itek Corp	0.7442
Coleman Co Inc	0.7526	Johnson & Johnson	2.0538
Colgate-Palmolive Co	0.9490	Kennametal Inc	1.1222
Collins & Aikman Corp	0.6234	Kerr-McGee Corp	0.9110
Conrac Corp	0.7914	Kimberly-Clark Corp	0.7212
Continental Group	0.6002	Koppers Co	0.8202
Cooper Tire & Rubber	0.6182	Lamson & Sessions Co	0.6158
CPC International Inc	0.8272	Lear Siegler Inc	0.9516
Crane Co	0.6602	Loews Corp	0.2550
Crompton & Knowles Corp	0.7148	Lowenstein (m.) Corp	0.4190
Crown Zellerbach	0.6936	LTV Corp	0.5952
CTS Corp	0.7802	Manville Corp	0.5860
Cummins Engine	0.6478	Marathon Oil Co	0.8794
Dan River Inc	0.4776	Masco Corp	1.3974
Dana Corp	0.9130	Masonite Corp	0.8792
De Soto Inc	0.6770	McNeil Corp	0.4584
Deere & Co	0.8582	Mead Corp	0.6578

APPENDIX B—q VALUES FOR SAMPLE FIRMS (CONTINUED)

Company	q Value	Company	q Value
Midland-Ross Corp	0.7894	Signal Cos	0.7148
Minnesota Mining & Mfg Co	1.6450	Signode Corp	0.8322
Mite Corp	0.8426	Simmonds Precision Prods Inc	0.9772
Mobil Corp	0.7468	Smith (A.O.) Corp	0.4580
Mohasco Corp	0.5132	Smith International Inc	1.4694
Mohawk Rubber Co	0.5854	SPS Technologies Inc	0.6302
Monsanto Co	0.6930	Square D Co	1.2124
Motorola Inc	1.1786	Standard Products Co	0.6882
Murray Ohio Mfg Co	0.8056	Stanley Works	0.9062
Nabisco Brands Inc	0.8436	Stauffer Chemical Co	0.8100
Nalco Chemical Co	1.9882	Stepan Chemical Co	0.6554
Narco Scientific Inc	0.7760	Sterling Drug Inc	1.1362
NCR Corp	0.8328	Stevens (J.P.) & Co	0.5536
Norton Co	0.7942	Sun Co Inc	0.6902
Norton Simon Inc	0.8344	Syntex Corp	1.3750
Oak Industries Inc	0.9532	Talley Industries Inc	0.6958
Occidental Petroleum Corp	0.7116	Tecumseh Products Co	1.0132
Olin Corp	0.5352	Tektronix Inc	1.3936
Outboard Marine Corp	0.5816	Teledyne Inc	1.0568
Owens-Corning Fiberglas Corp	0.9702	Telex Corp	0.9222
Parker-Hannifin Corp	0.9132	Textron Inc	0.8694
Peabody International Corp	1.1206	Thiokol Corp	0.8246
Pennwalt Corp	0.6966	Thomas Industries Inc	0.7050
Pfizer Inc	1.1478	Timken Co	0.7084
Phillips Petroleum Co	0.9618	Tokheim Corp	1.0098
Pillsbury Co	0.9178	Tonka Corp	0.6292
Polaroid Corp	1.0946	Trane Co	0.6794
Portec Inc	0.7726	TRW Inc	0.9438
Pratt & Lambert Inc	0.6220	Union Camp Corp	0.9700
Procter & Gamble Co	1.3816	Union Carbide Corp	0.5598
Products Research & Chemical	1.1190	Union Corp	0.6436
Purex Industries Inc	0.7760	United Industrial Corp	0.7542
Quaker Oats Co	0.7916	Varian Associates Inc	0.7134
R T E Corp	0.9678	Varo Inc	0.8882
Ralston Purina Co	0.9520	Vernitron Corp	1.0536
Ranco Inc	0.7516	Vulcan Materials Co	0.8194
Raymond	0.8268	Wallace-Murray Corp	0.6492
RCA Corp	0.7876	West Point-Pepperell	0.6082
Reynolds Metals Co	0.5096	Westinghouse Electric Corp	0.6372
Riegel Textile Corp	0.5968	Westvaco Corp	0.6474
Robertshaw Controls	0.5614	Weyerhaeuser Co	1.0538
Robins (A.H.) Co	1.0168	Whirlpool Corp	0.9096
Rogers Corp	0.9248	Witco Chemical Corp	0.7282
Rohm & Haas Co	0.6886	Wurlitzer Co	0.5920
Rubbermaid Inc	1.1434		
Savin Corp	1.0150		
Scovill Inc	0.6342	Mean	0.8514
Searle (G.D.) & Co	1.2396	Minimum	0.2550
Selas Corp of America	0.8080	Maximum	2.1680
Sheller-Globe	0.6762	No. of Firms	218