SOURCES OF THE FINANCING HIERARCHY FOR BUSINESS INVESTMENT

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Abstract—What accounts for the apparent preference of firms to finance investment with internal funds? Recent theories stress information problems in capital markets, while older theories emphasize the transactions costs of external finance. To test these competing hypotheses, we estimate the sensitivity of investment spending to internal funds across firms likely to face varying degrees of information problems and transactions costs. Several attributes are used to differentiate these firms. The results provide some support for information asymmetries as a source of the financing hierarchy but indicate no significant role for transactions costs.

I. Introduction

IN the early postwar period, the liquidity of the firm figured prominently in research on capital investment. A financing hierarchy—with internal finance preferred to either outside debt or equity—was a standard feature of early descriptions of the investment decision (e.g., Kuh and Meyer (1963)). However, the early empirical studies were criticized by Jorgenson (1971) and others for failing to show that liquidity constraints *per se* caused investment to vary with internal funds; without adequate controls for investment opportunities, increased cash flow may drive investment merely because it signals an improvement in future profits. Such empirical problems, along with the growing influence of the Modigliani-Miller (1958) theorem on the irrelevance of financial decisions, led to a lull in empirical work on the relation between liquidity and investment.

Recently, interest in this relation has been rekindled, due partly to the development of theoretical models that imply a cost premium for external funds based on asymmetric information and agency costs (see, for example, Jensen and Meckling (1976) and Myers and Majluf (1984)). Perhaps the most influential paper from the recent empirical literature is Fazzari, Hubbard, and Petersen (1988), who used a panel of U.S. manufacturing firms to test for the existence of a financing hierarchy. They found that cash flow and investment were correlated even after controlling for Tobin's Q and that the correlation was strongest for low-dividend firms. For these firms, investment outlays are likely to exhaust cash flow, with external finance being the marginal source of funds. The strong correlation between cash flow and investment indicates that these firms do not regard internal and external finance as perfect substitutes.

Although the results of Fazzari, Hubbard, and Petersen (hereafter, FHP) support the *existence* of a financing hierarchy, they do not indicate the *source* of the hierarchy. In particular, it is not clear whether asymmetric information or agency costs—the theoretical explanations currently in vogue—are responsible for the apparent cost premium for external funds. An alternative, and older, explanation is that the financing hierarchy stems from the transactions costs incurred to obtain external finance.

In the current paper, we extend the work of FHP by attempting to determine the source of the hierarchy for a panel of U.S. firms. To test the competing hypotheses, we estimate the sensitivity of investment spending to internal funds across firms believed to differ with respect to both information problems and transactions costs. We proxy for the severity of a firm's information problems with data on its age, exchange listing, pattern of insider trading, and distribution of equity ownership. After controlling for these attributes, we use variations in firm size as a proxy for the magnitude of transactions costs. These indicators permit the most complete test to date with U.S. data of the source of the financing hierarchy.[1]

The next section reviews the alternative explanations for a financing hierarchy. In section III we discuss the rationale for our firm-level indica-

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[1] See Hoshi, Kashyap, and Scharfstein (1991) and Schaller (1991) for tests of the source of the financing hierarchy in Japan and Canada, respectively.

tors of information problems and transactions costs. Section IV describes our panel of 120 U.S. firms. Section V lays out the empirical tests and results, while section VI provides some concluding remarks and directions for future work.

II. The Financing Hierarchy: Theory

Several explanations have been proposed for a financing hierarchy in which internal funds are the cheapest source of finance.[2] Perhaps the most obvious explanation involves the transactions costs of issuing debt and equity. These costs include compensation for the dealer placing the issue; registration fees; legal, accounting, and printing costs; and state and federal taxes. Estimates of such costs are presented in Securities and Exchange Commission (1974). According to the SEC data, these costs consumed, on average, nearly 19% of the gross proceeds of small stock issues and about 14% of the proceeds of small debt issues (we define small issues as those grossing less than $2 million). Thus transactions costs could have created a significant financing hierarchy for relatively small firms. However, the SEC data show that these transactions costs became less burdensome with increases in issue size. Indeed, for debt and equity issues of $100 million or more, the share of gross proceeds consumed by transactions costs averaged only 1% and 3%, respectively.[3]

More recently, attention has shifted toward explanations that stress information problems in capital markets. This newer literature focuses on the potential asymmetry of information between the firm's managers and outside suppliers of finance. The fundamental insight comes from Akerlof's (1970) analysis of the "lemons" problem, in which the sellers of a product have more information about its quality than do buyers. Akerlof showed that this information asymmetry can hamper the functioning of markets and, in extreme situations, cause a complete breakdown of trading.

In the current context, the asymmetry of information concerns the quality of a firm's investment projects and the behavior of its managers. Myers and Majluf (1984) analyze the case in which the firm's management has information about project returns that is unavailable to investors.[4] Because investors cannot distinguish between good and bad projects, every issue is priced assuming the average project outcome, which implies that the securities backing good projects are undervalued. Given this undervaluation, the cost of financing such projects with external funds exceeds that of financing with internal funds. This difference in costs represents the "lemons premium" associated with external finance. When the premium becomes sufficiently high, firms will forego otherwise acceptable projects by refusing to issue stock or bonds.

Under asymmetric information, the firm's managers also have some scope to pursue their own interests at the expense of the firm's stockholders and bondholders. As shown in Jensen and Meckling (1976), the agency problems that arise from these conflicts of interest can boost the cost of obtaining external finance. Realizing that their interests may be jeopardized, outside shareholders attempt to control management behavior through the use of audits, budget restrictions, and compensation systems designed to align manager and shareholder interests (see Smith and Watts (1982)). These actions impart a cost premium to the use of outside equity finance, reflecting both the direct cost of monitoring management and the loss of profit opportunities due to reduced management flexibility. Although debt has a more senior claim to the firm's income than does equity, the interests of creditors also may be harmed by management actions that dissipate firm resources. Moreover, debtholders face the hazard that management may act on behalf of shareholders to erode the value of existing debt by undertaking excessively risky projects. To protect themselves from these risks, creditors usually demand covenants that restrict management behavior in various ways (see Smith and Warner (1979)).

[2] One explanation not considered in this paper relies on tax considerations (see, for example, Auerbach (1984)). We do not assess the role of taxes because we lack data on the marginal tax rates faced by firms and their suppliers of finance.

[3] See Oliner and Rudebusch (1989, table 1) for a more complete summary of the SEC data.

[4] For related work, see Stiglitz and Weiss (1981) and Greenwald, Stiglitz, and Weiss (1984).

These restrictions, and the monitoring required for enforcement, constitute the agency costs of debt.

III. The Financing Hierarchy: Empirical Implications

In our empirical work, we test whether the financing hierarchy can be linked to transactions costs or to information problems in capital markets. Our method examines the characteristics of firms for which investment and internal finance are most closely correlated. If these firms have traits that signal a high degree of asymmetric information or agency costs, we conclude that financing constraints likely reflect information problems in capital markets. Similarly, if investment is most sensitive to internal funds for firms believed to face high transactions costs, we regard that factor as a likely source of the financing hierarchy. To implement these tests, we use observable proxy variables for information asymmetries, agency costs, and transactions costs, which are described in this section.

To compare our results to those in FHP, we also test the sensitivity of investment to cash flow across firms with different ratios of common-stock dividends to net income (denoted *DIVY*). However, as noted in the introduction, we view dividend policy mainly as identifying those firms that may face liquidity constraints for *whatever* reason. Our own indicators appear better suited for examining the source of the financing hierarchy.[5]

Asymmetric Information

We employ three proxy variables for the degree of the information asymmetry facing a firm. The first is the firm's age, defined as the number of years since the firm's initial public offering of common stock; for our empirical work, we construct the variable *AGE*78, the firm's age in 1978. As suggested by Gertler (1988), information asymmetries are likely to be especially large for young firms. Creditors have not had much time to evaluate such firms, nor have the firms formed the long-term relations with suppliers of finance that can establish credibility. In essence, a young firm is a relatively unknown commodity, and the cost of outside finance will include a premium to cover the risk implied by this uncertainty.

The second proxy for asymmetric information is the firm's exchange listing. We define a dummy variable, *EXCH*, that equals zero for firms whose common stock traded over the counter (OTC) during all or part of 1978–83; *EXCH* is set to one for firms listed on the New York Stock Exchange (NYSE) over the entire period. When firms go public, their stock is issued over the counter, as they typically fail to meet the listing requirements of the major exchanges. If successful, the firm may eventually migrate to the NYSE. Thus, relative to the NYSE, the OTC market consists of less mature firms for whom we expect information asymmetries to be relatively severe.

Our third proxy for asymmetric information relates to the stock trading behavior of corporate insiders. When insiders possess more information than the market, they have an opportunity to earn windfall gains. Indeed, the finance literature has shown that insiders can identify mispricings in their own firms and can profitably trade on their special information (e.g., Jaffe (1974), Finnerty (1976), and Seyhun (1986)). This divergence between the insiders' valuation and the market's valuation of the firm lies at the heart of the asymmetric information problem. Insider trading is thus a natural indicator of the extent of asymmetric information.

The insider trading variable we employ measures whether the firm's insiders tend to trade on the same side of the market. Such a convergence of activity would suggest that insiders have information that is not publicly available. To define this measure, let BUY_t and $SELL_t$ denote the dollar value of insider stock purchases and sales, respectively, on the open market during year t; also, let $NET_t = BUY_t - SELL_t$. We measure the one-sidedness of insider trading for a firm by

$$INTR = \sum_{t=1978}^{1983} |NET_t| \Big/ \sum_{t=1978}^{1983} (BUY_t + SELL_t).$$

INTR can range in value between 0 and 1, with larger values indicating more one-sided trading

[5] In their sample, FHP found that liquidity constraints were smaller for higher-dividend firms. In general, however, a firm may be liquidity constrained and still pay considerable dividends because a dividend cut sends a negative signal to outsiders (see, for example, John and Williams (1985)).

and thus more substantial information asymmetries.[6]

Agency Costs

Although *AGE78*, *EXCH*, and *INTR* are our main proxies for information problems, we also constructed two indicators of the severity of agency costs. These indicators, both of which reflect the structure of shareholding, attempt to capture the degree of difficulty in controlling managerial behavior.

Agency costs will tend to be small when two conditions hold: (1) the interests of management and outsiders are reasonably well aligned and (2) the actions of managers can be monitored at relatively low cost. Based on this reasoning, our first proxy for the magnitude of agency costs is the share of outstanding common stock controlled by the firm's board of directors, denoted by *INHOLD*. When insiders have a large equity stake in the firm, their interests will be linked relatively closely to those of outside shareholders. This observation suggests that firms with large values for *INHOLD*, all else equal, face relatively low agency costs and thus a small premium for external equity finance. In addition, for any given split of stock ownership between insiders and outsiders, effective monitoring of management is more likely to occur when the outside holdings are highly concentrated. Shareholders with considerable funds at risk have strong incentives to devise an effective monitoring system. This argument motivates our second measure of agency costs, the percentage of outside shares controlled by the twenty largest outside shareholders (denoted by *OUTHOLD*). For firms with large values of *OUTHOLD*, the agency-cost premium for external equity finance should be relatively small.

Despite these arguments, *INHOLD* and *OUTHOLD* may be imperfect proxies for agency costs. Morck, Shleifer, and Vishny (1988) provide evidence that increases in inside stock ownership beyond a certain point can lead to the entrenchment of managers, who then have substantial latitude to deviate from the maximization of firm value. If so, large values of *INHOLD* could be associated with relatively high agency costs, contrary to our maintained hypothesis. In addition, large inside equity holdings may increase the conflict of interest between managers and debtholders by reinforcing the incentive to undertake risky projects. Similarly, powerful outside shareholders may be able to prod management into actions that are adverse to creditors, raising the agency costs of debt finance.[7] Thus, *INHOLD* and *OUTHOLD* may be ambiguous indicators of *total* agency costs.

Because our indicators of agency costs may be inadequate, the tests done in section V with these indicators are relatively weak ones. These tests cannot rule out agency problems as a source of the financing hierarchy. Yet they can establish the converse: if investment and internal funds are found to be tightly correlated for firms with low values of *INHOLD* and *OUTHOLD*, that result would suggest that agency problems help generate the hierarchy.

Transactions Costs

The SEC data discussed in section II indicate that transactions costs are especially high for small issues. Assuming that issue size and firm size are positively correlated, small firms would be expected to face relatively high transactions costs for external finance. Based on this reasoning, we employ firm size as a proxy for transactions costs. Our empirical measure of firm size is the replacement value of the firm's fixed capital stock at the beginning of the year, denoted $SIZE_t$. The use of *SIZE* as a proxy for transactions costs will be valid only if other firm characteristics that may vary with size—such as age and inside equity holdings—are held fixed. Without such controls, *SIZE* could be viewed just as easily as a proxy for information problems (as Gertler (1988), Barry and Brown (1984), and others have argued).

[6] We also experimented with two other measures of insider trading. The first one focused on insider purchases alone because insiders may sell their company's stock to raise cash or to diversify their portfolios—motives unrelated to asymmetric information. The other measure was based on the variability of *NET* over 1978–83, as major changes in trading patterns may suggest that insiders have learned something not perceived by outside investors. Neither of these measures performed as well as *INTR* in explaining the financing hierarchy.

[7] Presumably, such actions would be unlikely if outside holdings of debt also were concentrated. However, we cannot refine OUTHOLD to account for the concentration of debtholding because data on the ownership distribution of debt are not readily available.

IV. Description of the Data

This paper uses a firm-level data set formed from two parallel panels covering the period 1977–83.[8] The first panel, constructed from the 1984 volume of *Moody's Industrial Manual*, consists of 99 firms, virtually all of which were listed on the NYSE for the entire sample period.[9] We compiled a second panel of 21 OTC firms from the 1978 and 1984 volumes of *Moody's OTC Industrial Manual*. We set *EXCH* equal to zero for these firms and for five others from the first panel that traded in the OTC market over part of the sample period; for the remaining 94 firms, *EXCH* equals one.

Using data from the *Moody's* manuals, we constructed annual firm-level series on sales, Tobin's Q, cash flow, and investment in plant and equipment. Tobin's Q was defined as the market value of the firm's common stock, preferred stock, and debt, divided by the replacement value of capital stock and investories. We measured cash flow net of common and preferred dividends. *Moody's* also was used to construct the following indicators discussed in section III: *AGE*78, *SIZE*, and *DIVY*.[10]

Data for the remaining indicators—*INTR*, *INHOLD*, and *OUTHOLD*—had to be obtained from other sources. *INTR* was constructed from data in the SEC's *Official Summary of Security Transactions and Holdings*.[11] The *Official Summary* contains monthly information on insider stock trading for each publicly-traded firm, which we aggregated to annual totals at the firm level. The SEC defines each officer or director of the firm to be an insider, as well as any individual who owns 10% or more of any class of the firm's equity securities. For the data on *INHOLD* and *OUTHOLD*, we relied on the Corporate Data Exchange's (CDE) *Stock Ownership Directory*. Because the CDE *Directory* lists only Fortune 500 firms, values of *INHOLD* and *OUTHOLD* are missing for about one-third of our sample. Note also that the CDE data characterize ownership structure only at a single date during our sample period (December 31, 1980). However, for many of the firms in our sample, we were able to confirm a stable ownership structure over 1978–83 by constructing a time series on insider holdings from various issues of the *Value Line Investment Survey*.

Our data set has one advantage over commercial firm-level databases such as Value Line and Compustat: for many of the firms in our sample, the *replacement* values of capital stock and inventories and the *market* value of debt need not be imputed. *Moody's* reports the market prices for important debt issues, and we used these prices to value debt whenever they were available. Moreover, for most firms in the NYSE panel, *Moody's* includes estimates from the firms themselves of capital stock and inventories at replacement value.[12] However, our sample of 120 firms is small compared with ones obtainable from the commercial data bases, which may reduce the precision of our results.

Table 1 summarizes major characteristics of the full sample and the 84-firm subsample for which data are available on shareholding; figures for the subsample are shown in parentheses. For the full sample of firms, the median age as of 1978 was 49 years, and the median size was $328 million (measured by the average replacement value of capital stock during 1978–83). Further, the median firm in the full sample paid out 34% of net income as common-stock dividends over the years during 1978–83 in which it earned positive net income. Thus, the median firm was large, well-established, and paid substantial dividends —the type of firm probably not subject to serious financing constraints. However, the distribution around the median for these characteristics is quite wide. In particular, the bottom 10% of the

[8] Although the sample period for our empirical work begins in 1978, certain variables dated as of year-end 1977 (such as capital stock) are needed to provide beginning-of-year data for 1978. An appendix, available from the authors, details the criteria for including firms in the sample and the construction of individual variables.

[9] This panel was provided by Christopher Baum and Clifford Thies and is a continuation of the project described in Ciccolo and Baum (1985).

[10] Because two recessions occurred during 1978–83, many firms in our sample had negative net income in at least one year. To avoid negative values for the dividend–income ratio, we excluded such years from the calculation of *DIVY*. Thus, *DIVY* equals total common-stock dividends paid in sample years with positive income, divided by total net income in those years.

[11] Darrell Williams of the SEC kindly provided these source data.

[12] Between 1976 and 1986, large firms were required by the SEC and the Fair Accounting Standards Board to disclose the replacement value of their capital stock, inventories, depreciation, and cost of goods sold. See Thies and Sturrock (1987) for details.

TABLE 1.—SUMMARY STATISTICS

Variable	Percentile Value				
	10th	25th	Median	75th	90th
*AGE*78	9.0	22.0	49.0	65.0	80.0
(years)	(22.0)	(41.0)	(57.0)	(73.0)	(86.0)
Avg. *SIZE* over 1978–83	28.0	113.2	328.3	969.6	1879.4
(millions of $)	(161.4)	(313.0)	(677.8)	(1223.8)	(2696.8)
DIVY	0.02	0.23	0.34	0.44	0.52
(ratio)	(0.21)	(0.30)	(0.39)	(0.46)	(0.54)

Note: See text for definitions of variables. The figures shown without parentheses pertain to the full sample of 120 firms; the figures in parentheses pertain to the subsample of 84 firms with data on shareholding.

distribution contains firms much more likely to face a significant financing hierarchy; these firms were relatively new, were less than one-tenth the size of the median firm, and paid essentially no dividends. Much of this variation, unfortunately, is lost in the subsample of firms with data on shareholding; as a result, our tests for agency problems as a source of the financing hierarchy may be weak.

V. Empirical Results

As yet, there is no widely accepted structural model of investment spending. Thus, our empirical analysis of the financing hierarchy is conducted with reduced-form investment equations that include both Tobin's Q and sales as independent variables. The relationship between investment and Q has been carefully derived and moti-

TABLE 2.—INVESTMENT AND CASH FLOW: SINGLE INTERACTION TERMS
(t-statistics in parentheses)

		Definition of X						
	(1)	*AGE*78 (2)	*EXCH* (3)	*INTR* (4)	*SIZE* (5)	*INHOLD* (6)	*OUTHOLD* (7)	*DIVY* (8)
Q_{it}	0.003	0.024	0.003	−0.232	0.009	0.011	−0.164	0.004
	(0.2)	(1.1)	(0.1)	(1.8)	(0.6)	(0.4)	(2.3)	(0.2)
$(S/K)_{it}$	0.059	0.058	0.059	0.190	0.058	0.034	0.095	0.060
	(6.0)	(3.0)	(3.3)	(2.3)	(5.7)	(2.3)	(2.2)	(3.4)
$(CF/K)_{it}$	0.243	0.326	0.444	−0.935	0.271	0.280	0.142	0.329
	(2.7)	(2.0)	(2.9)	(1.2)	(2.9)	(1.9)	(0.4)	(2.3)
$X * Q_{it}$		−0.001	0.002	0.249	−0.042	−0.004	0.003	−0.022
		(1.4)	(0.1)	(1.8)	(1.8)	(2.0)	(2.1)	(0.3)
$X * (S/K)_{it}$		0.000	0.003	−0.145	−0.007	0.000	−0.001	−0.002
		(0.1)	(0.1)	(1.6)	(0.6)	(0.7)	(1.3)	(0.0)
$X * (CF/K)_{it}$		−0.004	−0.295	1.290	0.000	0.002	0.003	−0.557
		(0.9)	(1.6)	(1.5)	(0.0)	(0.3)	(0.4)	(1.1)
Expected sign on $X * (CF/K)_{it}$		(−)	(−)	(+)	(−)	(−)	(−)	(−)
Cash flow effect at								
$X(0.25)$		0.247	0.444	0.134	0.271	0.281	0.240	0.200
$X(0.75)$		0.093	0.149	0.317	0.271	0.301	0.291	0.083
$\bar{R}^2$	0.488	0.490	0.489	0.490	0.492	0.321	0.322	0.488
No. of firms	120	120	120	120	120	84	84	120

Note: The dependent variable is the investment-capital ratio (I/K). The regressions were estimated by OLS using fixed firm and year effects (not reported) from 1978 through 1983.

vated by many authors, notably Abel (1979) and Summers (1981). Empirically, however, Q theory does not appear to completely explain investment spending, and there remains an important role for accelerator effects from sales or production (see, e.g., Abel and Blanchard (1986)).

Our basic equation is

$$(I/K)_{it} = \alpha_i + \alpha_t + \beta Q_{it} + \theta(S/K)_{it} + \gamma(CF/K)_{it} + \epsilon_{it}. \quad (1)$$

Investment for the i^{th} firm in year t depends on (beginning-of-period) average Q, current sales (S), and current cash flow (CF). Each of these variables except Q is scaled by the firm's beginning-of-period capital stock measured at replacement value. The constants α_i and α_t capture firm-specific and year-specific fixed effects.

Single-Proxy Regressions

OLS estimates of equation (1) for the full sample are shown in the first column of table 2. As shown, cash flow has a significant positive influence on investment even after conditioning on sales, while Q has virtually no effect.[13] Given that sales and Q have been included as controls for profit opportunities, the significant coefficient on CF/K suggests that liquidity *per se* affects investment. This link between investment and internal funds is consistent with the existence of a financing hierarchy.

To explore the source of this hierarchy, we augment equation (1) to include multiplicative interactions of Q, S/K, and CF/K with the firm characteristics described in section III.[14] That is, we estimate

$$(I/K)_{it} = \alpha_i + \alpha_t + (\beta_1 + \beta_2 X)Q_{it} + (\theta_1 + \theta_2 X)(S/K)_{it} + (\gamma_1 + \gamma_2 X)(CF/K)_{it} + \epsilon_{it}, \quad (2)$$

where X denotes a single characteristic, such as *AGE*78 or *EXCH*. These baseline regressions are shown in columns (2) through (8) of table 2.[15]

Our main interest in table 2 centers on the estimate of γ_2, the coefficient of $X*(CF/K)$. Focus first on columns (2) through (4), in which cash flow is interacted with the firm characteristics that proxy for the asymmetry of information. If this asymmetry were an important source of the financing hierarchy, we would expect γ_2 to be negative in columns (2) and (3) and to be positive in column (4), showing that investment is most sensitive to cash flow in young firms, those traded OTC, and those with a one-sided pattern of insider trading. As shown, the estimates of γ_2 in columns (2) through (4) have the expected sign.

However, none of the estimates is significant at the usual 5% level, and the small t-statistics may reflect collinearities among $X*Q$, $X*(S/K)$, and $X*(CF/K)$. Because an F test showed $X*Q$ and $X*(S/K)$ to be jointly insignificant at even the 30% level in both columns (2) and (3), we reran those regressions after omitting $X*Q$ and $X*(S/K)$. This exclusion had little effect on the point estimates of γ_2 in columns (2) and (3) but raised their t-statistics to about 2.0. Overall, these results suggest that information asymmetries may impart a cost premium to external finance.

Given the point estimates of γ_2 in columns (2) through (4), we can assess whether changes in age, exchange listing, and the pattern of insider trading have an economically important effect on the relation between investment and cash flow. The third and fourth rows from the bottom of the

[13] To ensure that the coefficient on current cash flow does not reflect news about the firm's future profitability that arrives after the beginning of period t, we added end-of-period Q to the regression in column (1). Including this additional term reduced only slightly the size and significance of the coefficient on cash flow. Similarly, the cash flow coefficient was little affected when we added the beginning-of-period stock of cash and marketable securities to the regression.

[14] This procedure is broadly analogous to that in FHP; they split the sample based on the dividend–income ratio and estimate separate regressions for each subsample. See Oliner and Rudebusch (1989) for results based on sample splits of the data used in the current paper.

[15] Note that equation (2) does not include X as a regressor separate from the interaction terms. Apart from *SIZE*, all of the indicators described in section III take a single value for each firm over the entire sample period. In a model with fixed firm effects, the influence of such variables on I/K cannot be distinguished from the firm-specific constant. In contrast, *SIZE* does vary over time for each firm, and thus could be included as a separate regressor in equation (2). However, we found that this variable was insignificant when included as a separate regressor and that its inclusion had little effect on the results reported in column (5) of table 2.

TABLE 3.—CORRELATION COEFFICIENTS FOR VARIOUS FIRM CHARACTERISTICS

	EXCH (1)	*AGE*78 (2)	*INTR* (3)	*SIZE* (4)	*INHOLD* (5)	*OUTHOLD* (6)	*DIVY* (7)
I. Full sample (n = 120)							
EXCH	1.00	0.41	−0.09	0.21	*	*	0.31
*AGE*78	0.41	1.00	−0.20	0.16	*	*	0.50
INTR	−0.09	−0.20	1.00	−0.07	*	*	−0.10
SIZE	0.21	0.16	−0.07	1.00	*	*	0.16
INHOLD	*	*	*	*	*	*	*
OUTHOLD	*	*	*	*	*	*	*
DIVY	0.31	0.50	−0.10	0.16	*	*	1.00
II. Firms with data on shareholder concentration (n = 84)							
EXCH	*	*	*	*	*	*	*
*AGE*78	*	1.00	−0.12	0.04	−0.38	−0.18	0.30
INTR	*	−0.12	1.00	−0.05	0.23	0.14	−0.05
SIZE	*	0.04	−0.05	1.00	−0.03	−0.16	0.07
INHOLD	*	−0.38	0.23	−0.03	1.00	0.21	−0.37
OUTHOLD	*	−0.18	0.14	−0.16	0.21	1.00	−0.10
DIVY	*	0.30	−0.05	0.07	−0.37	−0.10	1.00

Note: See text for definitions of variables. To calculate the correlations with *SIZE*, we used the average value of *SIZE* for each firm over 1978–83.

table address this question by calculating $(\gamma_1 + \gamma_2 X)$, with X set first at the 25th percentile of its sample distribution and then at the 75th percentile.[16] As shown, such a change in value for *AGE*78, *EXCH*, or *INTR* substantially alters the sensitivity of investment to cash flow.

For the characteristics shown in columns (5) through (7)—size and the two measures of shareholding—the estimated coefficient on $X*(CF/K)$ is clearly insignificant. Moreover, using the point estimate for γ_2 in each column, the influence of these characteristics on the cash flow effect is small compared with those shown in columns (2) through (4). With regard to dividend behavior (column (8)), the estimate of γ_2 indicates that increases in the dividend payout rate reduce the sensitivity of investment to cash flow, consistent with the results of FHP. Although γ_2 is not significant at conventional levels, rerunning the regression without $X*Q$ and $X*(S/K)$ raises the t-statistic for γ_2 to nearly 2.0, with little effect on the point estimate of γ_2.

Multiple-Proxy Regressions

While suggestive, the single-proxy regressions in table 2 cannot definitively identify the source of the financing hierarchy because of correlations among the various firm characteristics. These correlations are presented in table 3.[17] For example, column (4) of the table displays the correlations of *SIZE* with the other characteristics. As shown in the top half of the table, large firms tend to trade on the NYSE, to be old, and to have relatively well-balanced insider trading (that is, to have small values of *INTR*). Thus, large firms may face relatively modest information asymmetries, implying that the regressions in table 2 must be refined to separate the effects of size and information problems on investment behavior. A similar situation arises for the agency cost proxies. As shown in the bottom panel of table 3 (columns (5) and (6)), both *INHOLD* and *OUTHOLD* are negatively correlated with *AGE*78 and *SIZE*, indicating that the structure of shareholding is more diffuse for larger, more mature firms. Accordingly, the estimates in columns (6) and (7) of table 2 do not capture the pure effect of the structure of shareholding on investment behavior.

The correlations presented in table 3 suggest that equation (2) should be augmented to include interactions of all relevant firm characteristics with cash flow, Q, and sales. Such an equation would be free from the omitted variable bias that may distort the results in table 2. However, the inclusion of several proxy variables in one regres-

[16] For exchange listing, the comparison shown is between $X = 0$ (OTC firms) and $X = 1$ (NYSE firms).

[17] In the bottom panel of the table, the correlations that involve *EXCH* are omitted because the subsample has only three OTC firms.

sion, with all the associated interaction terms, clearly would lead to problems of multicollinearity. To reduce the number of explanatory variables, we constructed a univariate measure of the degree of asymmetric information from *AGE*78, *EXCH*, and *INTR* and a univariate representation of shareholding from *INHOLD* and *OUTHOLD*.

Our univariate measure of information asymmetries, denoted by *INFO*, is the first principal component of *EXCH*, *AGE*78, and *INTR*.[18] *INFO* is constructed to be negative for firms with relatively high values for *EXCH* and *AGE*78 and relatively low values for *INTR*; such firms are expected to face a small asymmetry of information. In contrast, *INFO* is positive for the firms believed to face large asymmetries. A positive coefficient on $INFO*(CF/K)$ in equation (2) would signal that investment is more sensitive to cash flow for the firms with a substantial asymmetry of information. The first principal component of *INHOLD* and *OUTHOLD*, denoted by *STOCK*, is our univariate measure of stock ownership patterns. *STOCK* takes positive values for firms with large inside holdings and concentrated outside holdings; *STOCK* is negative for firms with a diffuse ownership structure. Because the latter firms are assumed to face relatively large agency costs, a negative coefficient on $STOCK*(CF/K)$ would suggest that these costs tighten the link between cash flow and investment.[19]

We now re-estimate equation (2), specifying X to include the univariate measures just described, along with *SIZE*. This equation allows us to separately identify each of the potential sources of the financing hierarchy. Estimates of this augmented version of equation (2) are presented in table 4 for the full sample and in table 5 for the subsample of firms with data on shareholding (interactions involving *STOCK* necessarily are omitted from table 4). As shown in column (1) of table 4, the coefficient on $INFO*(CF/K)$ is positive, indicating that cash flow and investment are more closely related for firms with relatively large information asymmetries. However, this coefficient's marginal significance level is only about 10% in a two-tailed t-test. In part, this imprecision is due to the inclusion of other interaction terms involving *INFO*. We dropped $INFO*Q$ and $INFO*(S/K)$ from the regression, along with the term in $SIZE*(S/K)$, as an F test showed these three terms to be jointly insignificant. As shown in column (2), these exclusions hardly affect the coefficient on $INFO*(CF/K)$, but increase its t-statistic to 2.3. Overall, the results in both columns provide evidence that information asymmetries induce a financing hierarchy.

Moreover, the effect of asymmetric information appears to be quantitatively important. The row labeled "*INFO*(.25)" and the following row show

TABLE 4.—INVESTMENT AND CASH FLOW: JOINT INTERACTION TERMS FOR FULL SAMPLE (t-statistics in parentheses)

	(1)	(2)
$SIZE_{it}$	0.003	0.004
	(0.3)	(0.4)
Q_{it}	0.003	0.011
	(0.1)	(0.6)
$(S/K)_{it}$	0.060	0.058
	(5.5)	(5.9)
$(CF/K)_{it}$	0.158	0.163
	(1.5)	(1.6)
$INFO*Q_{it}$	0.051	
	(0.4)	
$INFO*(S/K)_{it}$	0.002	
	(0.0)	
$INFO*(CF/K)_{it}$	1.365	1.429
	(1.6)	(2.3)
$SIZE*Q_{it}$	−0.44	−0.47
	(1.8)	(2.0)
$SIZE*(S/K)_{it}$	−0.009	
	(0.7)	
$SIZE*(CF/K)_{it}$	0.012	−0.012
	(0.3)	(0.4)
Cash flow effect at:		
INFO(0.25)	0.061	0.035
(0.75)	0.247	0.229
SIZE (0.25)	0.159	0.161
(0.75)	0.169	0.151
$\bar{R}^2$	0.494	0.496

Note: The dependent variable is the investment–capital ratio (I/K). The regressions were estimated by OLS using fixed firm and year effects (not reported) from 1978 through 1983. Each regression included 120 firms.

[18] Before computing the principal components, we standardized each variable by subtracting its sample mean and then dividing by $\sqrt{n}$ times its standard deviation. *INFO* equals a weighted average of the standardized variables, with the vector of weights equal to the unit eigenvector associated with the largest eigenvalue of the correlation matrix of *EXCH*, *AGE*78, and *INTR*.

[19] By definition, *INFO* and *STOCK* capture as much of the variation in their respective sets of standardized variables as is possible in a univariate measure. The proportion of variation captured is about 50% for *INFO* and 60% for *STOCK*.

TABLE 5.—INVESTMENT AND CASH FLOW: JOINT INTERACTION TERMS FOR FIRMS WITH DATA ON SHAREHOLDING
(t-statistics in parentheses)

	(1)	(2)	(3)	(4)
$SIZE_{it}$	0.002	0.003	0.005	0.005
	(0.3)	(0.4)	(0.6)	(0.6)
Q_{it}	−0.010	−0.005	−0.004	−0.003
	(0.3)	(0.2)	(0.1)	(0.1)
$(S/K)_{it}$	0.026	0.024	0.023	0.022
	(1.8)	(1.7)	(1.5)	(1.6)
$(CF/K)_{it}$	0.354	0.366	0.361	0.364
	(2.6)	(2.7)	(2.6)	(2.7)
$INFO * Q_{it}$	0.205		0.323	0.325
	(0.9)		(1.4)	(1.4)
$INFO * (S/K)_{it}$	0.145	0.152	0.158	0.150
	(1.7)	(1.8)	(1.8)	(1.8)
$INFO * (CF/K)_{it}$	−0.717	−0.345	−0.294	−0.238
	(0.7)	(0.4)	(0.3)	(0.2)
$STOCK * Q_{it}$			−0.338	−0.353
			(1.1)	(1.2)
$STOCK * (S/K)_{it}$			−0.36	
			(0.3)	
$STOCK * (CF/K)_{it}$			−0.120	−0.328
			(0.1)	(0.4)
$SIZE * Q_{it}$	−0.038	−0.39	−0.047	−0.048
	(1.7)	(1.8)	(2.0)	(2.1)
$SIZE * (S/K)_{it}$	−0.003		0.000	
	(0.3)		(0.0)	
$SIZE * (CF/K)_{it}$	−0.014	−0.024	−0.019	−0.020
	(0.3)	(0.9)	(0.5)	(0.7)
$\bar{R}^2$	0.328	0.330	0.327	0.330

Note: The dependent variable is the investment-capital ratio (I/K). The regressions were estimated by OLS using fixed firm and year effects (not reported) from 1978 through 1983. Each regression included 84 firms.

the effect of increasing the value of *INFO* from the 25th percentile of its distribution to the 75th percentile, while holding size fixed at the sample mean. In column (1), the sensitivity of investment to cash flow is about four times larger at the 75th percentile of the *INFO* distribution than at the 25th percentile; in column (2), the difference in the cash-flow effect is even more pronounced.

The results in table 4 also shed light on size *per se* as a source of the financing hierarchy. In both columns, the coefficient on $SIZE * (CF/K)$ is insignificant. In addition, an increase in *SIZE* from the 25th percentile to the 75th percentile of its distribution has little quantitative effect on the relation between cash flow and investment. This can be seen by comparing the row labelled "*SIZE*(.25)" with the following row, a comparison that holds *INFO* fixed at its mean value of zero. The absence of a pure size effect suggests that, for our sample, transactions costs are not a source of the financing hierarchy.

As yet, we have not assessed whether our proxies for agency costs are related to the financing hierarchy, after controlling for *INFO* and *SIZE*. Table 5 examines this question for the subsample of firms with data on shareholding. To begin, column (1) presents a baseline regression that leaves out terms in *STOCK* (this is the same regression presented in column (1) of table 4). As shown, the coefficients on $INFO * (CF/K)$ and $SIZE * (CF/K)$ are both insignificant. Further, this result is not affected by omitting other interaction terms that appear insignificant, as seen in column (2). The insignificance of $INFO * (CF/K)$ and $SIZE * (CF/K)$ is not really surprising, given that all the firms in this subsample are members of the Fortune 500. These large and well-established firms likely have matured beyond the point

at which transactions costs and information asymmetries seriously limit access to external finance.

Column (3) adds the interaction terms in *STOCK* to the baseline regression. The coefficient on $STOCK*(CF/K)$ is insignificant, and the estimates of the interaction effects involving *INFO* and *SIZE* are little changed from those in column (1). These results remain much the same if we drop apparently insignificant interaction terms in Q and S/K, as is done in column (4). There are two possible explanations for these negative results concerning the structure of shareholding. First, agency problems may indeed be minimal for the firms in this subsample. Alternatively, for the reasons discussed in section III, *STOCK* may not be an adequate proxy for agency costs. To discriminate between these hypotheses, the effects of shareholding must be examined in a more heterogeneous panel than our 84-firm subsample.

VI. Conclusion

Recent theoretical work has stressed information asymmetries and agency costs as the source of the financing hierarchy, rather than the traditional explanation based on transactions costs. This paper has attempted to distinguish among these competing theories with data for a panel of U.S. firms covering the late 1970s and early 1980s.

Our results suggest that information asymmetries are a source of the financing hierarchy. We found that investment was most closely correlated with cash flow for the firms expected to face relatively severe asymmetries of information. These firms tended to be young, to have their stock traded over the counter, and to have patterns of insider trading consistent with privately-held information. However, the statistical evidence supporting a role for information asymmetries was not overwhelming; the extra sensitivity of investment to cash flow for firms believed to face large asymmetries was, in most cases, marginally significant at only the 5% to 10% levels.

Transactions costs—as proxied by firm size—did not explain the financing hierarchy for the firms in our sample. In addition, we found no evidence that the structure of shareholding—which we used as a proxy for the severity of agency costs—was related to the financing hierarchy. However, as discussed above, this negative result may simply reflect the difficulty of constructing proxies for agency costs, along with the fact that we had data on shareholding only for relatively mature firms.

Fruitful extensions to our research can proceed in several directions. First, it would be useful to increase the representation of very young companies in the data panel. These firms are the ones expected to face a financing hierarchy, and their presence would enhance the power of the statistical tests. Second, new indicators of agency costs should be developed to supplement the measures used in this paper. Third, researchers should examine whether the importance of the financing hierarchy has changed in recent years given the development of the junk-bond market and other financial innovations.

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