ELSEVIER

Journal of Financial Economics 67 (2003) 217–248

JOURNAL OF Financial ECONOMICS

www.elsevier.com/locate/econbase

Testing the pecking order theory of capital structure ☆

Murray Z. Frank[a,*], Vidhan K. Goyal[b]

[a] *Faculty of Commerce, University of British Columbia, Vancouver, BC Canada, V6 T 1Z2*
[b] *Department of Finance, Hong Kong University of Science and Technology, Kowloon, Hong Kong*

Received 22 March 2001; accepted 9 January 2002

Abstract

We test the pecking order theory of corporate leverage on a broad cross-section of publicly traded American firms for 1971 to 1998. Contrary to the pecking order theory, net equity issues track the financing deficit more closely than do net debt issues. While large firms exhibit some aspects of pecking order behavior, the evidence is not robust to the inclusion of conventional leverage factors, nor to the analysis of evidence from the 1990s. Financing deficit is less important in explaining net debt issues over time for firms of all sizes.

JEL classification: G32

Keywords: Pecking order theory; Capital structure; Financing deficit

☆We would like to thank Mike Barclay (the referee), Ken Bechmann, Robert Chirinko, Sudipto Dasgupta, Charles Hadlock, Keith Head, Vojislav Maksimovic, Sheridan Titman, and Karen Wruck, for helpful comments. Feedback from the seminar participants at the 2000 European Finance Association meetings, the 2000 Financial Management Association meetings, the 11th Annual Financial Economics and Accounting Conference (2000) at the University of Michigan, 2001 American Finance Association meetings, the 2001 Rutgers Conference on Corporate Finance, the University of Hong Kong, the University of Victoria, and the Hong Kong University of Science and Technology are appreciated. Murray Frank thanks the B.I. Ghert Family Foundation for financial support. We alone are responsible for the contents and any errors.

*Corresponding author. Tel.: +1-604-822-8480; fax: +1-604-822-8477.
E-mail addresses: murray.frank@commerce.ubc.ca (M.Z. Frank), goyal@ust.hk (V.K. Goyal).

0304-405X/02/$ - see front matter
PII: S0304-405X(02)00252-0

1. Introduction

The pecking order theory of capital structure is among the most influential theories of corporate leverage. According to Myers (1984), due to adverse selection, firms prefer internal to external finance. When outside funds are necessary, firms prefer debt to equity because of lower information costs associated with debt issues. Equity is rarely issued. These ideas were refined into a key testable prediction by Shyam-Sunder and Myers (1999). The financing deficit should normally be matched dollar-for-dollar by a change in corporate debt. As a result, if firms follow the pecking order, then in a regression of net debt issues on the financing deficit, a slope coefficient of one is observed.

Shyam-Sunder and Myers (1999) find strong support for this prediction in a sample of 157 firms that had traded continuously over the period 1971 to 1989. This is an attractive and influential result. The pecking order is offered as a highly parsimonious empirical model of corporate leverage that is descriptively reasonable. Of course, 157 firms is a relatively small sample from the set of all publicly traded American firms. It is therefore important to understand whether the pecking order theory is broadly applicable.

In this paper, we study the extent to which the pecking order theory of capital structure provides a satisfactory account of the financing behavior of publicly traded American firms over the 1971 to 1998 period. Our analysis has three elements. First, we provide evidence about the broad patterns of financing activity. This provides the empirical context for the more formal regression tests. It also serves as a check on the significance of external finance and equity issues. Second, we examine a number of implications of the pecking order in the context of Shyam-Sunder and Myers' (1999) regression tests. Finally, we check to see whether the pecking order theory receives greater support among firms that face particularly severe adverse selection problems.

The pecking order theory derives much of its influence from a view that it fits naturally with a number of facts about how companies use external finance.[1] Myers (2001) reports that external finance covers only a small proportion of capital formation and that equity issues are minor, with the bulk of external finance being debt. These key claims do not match the evidence for publicly traded American firms, particularly during the 1980s and 1990s. External finance is much more significant than is usually recognized in that it often exceeds investments. Equity finance is a significant component of external finance. On average, net equity issues commonly exceed net debt issues. Particularly striking is the fact that net equity issues track the financing deficit much more closely than do net debt issues.

Shyam-Sunder and Myers (1999) focus on a regression test of the pecking order. In this test one needs to construct the financing deficit from information in the corporate accounts. The financing deficit is constructed from an aggregation of

[1] The pecking order theory also derives support from indirect sources of evidence. Eckbo (1986) and Asquith and Mullins (1986) provide event study evidence that adverse selection is more significant for equity issues than for debt issues. Cadsby et al. (1990) provide experimental evidence of adverse selection in company financing.

dividends, investment, change in working capital and internal cash flows. If the pecking order theory is correct, then the construction of the financing deficit variable is a justified aggregation. Under the pecking order, each component of financing deficit should have the predicted dollar-for-dollar impact on corporate debt. The evidence does not support this hypothesis.

Even if a theory is not strictly correct, when compared to other theories it might still do a better job of organizing the available evidence. The pecking order is a competitor to other mainstream empirical models of corporate leverage. Major empirical alternatives such as the model tested by Rajan and Zingales (1995) use a different information set to account for corporate leverage. It is therefore of interest to see how the financing deficit performs in a nested model that also includes conventional factors. The pecking order theory implies that the financing deficit ought to wipe out the effects of other variables. If the financing deficit is simply one factor among many that firms tradeoff, then what is left is a generalized version of the tradeoff theory.

We find that the financing deficit does not wipe out the effects of conventional variables. The information in the financing deficit appears to be factored in along with many other things that firms take into account. This is true across firm sizes and across time periods.

Since the pecking order does not explain broad patterns of corporate finance, it is natural to examine narrower sets of firms. According to the pecking order theory, financing behavior is driven by adverse selection costs. The theory should perform best among firms that face particularly severe adverse selection problems. Small high-growth firms are often thought of as firms with large information asymmetries.

Contrary to this hypothesis, small high-growth firms do not behave according to the pecking order theory. In fact, the pecking order works best in samples of large firms that continuously existed during the 1970s and the 1980s. Large firms with long uninterrupted trading records are not usually considered to be firms that suffer the most acute adverse selection problems.

To understand the evidence it is important to recognize the changing population of public firms. Compared to the 1970s and 1980s, many more small and unprofitable firms became publicly traded during the 1990s. Since small firms generally do not behave according to the pecking order, this accounts for part of the reason that the pecking order theory is rejected. But the time period has a stronger effect than just this. For firms of all sizes, the financing deficit plays a declining role over time.

Previous literature provides other evidence pertinent to a general assessment of the pecking order theory. The pecking order theory predicts that high-growth firms, typically with large financing needs, will end up with high debt ratios because of a manager's reluctance to issue equity. Smith and Watts (1992) and Barclay et al. (2001) suggest precisely the opposite. High-growth firms consistently use less debt in their capital structure.

The pecking order theory makes predictions about the maturity and priority structure of debt. Securities with the lowest information costs should be issued first, before the firm issues securities with higher information costs. This suggests that

short-term debt should be exhausted before the firm issues long-term debt. Capitalized leases and secured debt should be issued before any unsecured debt is issued. Barclay and Smith (1995a, b) find that 50% of their firm-year observations have no debt issued with less than one-year maturity, 23% have no secured debt, and 54% have no capital leases. It seems difficult to understand this evidence within a pure pecking order point of view.

Chirinko and Singha (2000) question the interpretation of the Shyam-Sunder and Myers (1999) regression test. Chirinko and Singha show that equity issues can create a degree of negative bias in the Shyam-Sunder and Myers test. Suppose that firms actually follow the pecking order theory, but that these firms issue an empirically observed amount of equity. In that case, they show that the predicted regression coefficient is actually 0.74 rather than one. This amount of bias is not trivial, but it still leaves the coefficient very far from the magnitudes of slope coefficients that are observed. Chirinko and Singha also point out that if, contrary to the pecking order, firms follow a policy of using debt and equity in fixed proportions, then the Shyam-Sunder and Myers regression will identify this ratio. As a result, finding a coefficient near one would not disprove the tradeoff theory. Chirinko and Singha's cautionary note reinforces an important methodological point. Most empirical tests have various weaknesses. It is therefore important to examine the predictions of a theory from a number of points of view rather than relying solely on a single test.

The structure of the rest of this paper is as follows. Section 2 presents the pecking order theory and the associated empirical hypotheses. The data are described in Section 3. Section 4 presents the empirical results. Conclusions are presented in Section 5.

2. Theory

The pecking order theory is from Myers (1984) and Myers and Majluf (1984). Since it is well known, we can be brief. Suppose that there are three sources of funding available to firms: retained earnings, debt, and equity. Retained earnings have no adverse selection problem. Equity is subject to serious adverse selection problems while debt has only a minor adverse selection problem. From the point of view of an outside investor, equity is strictly riskier than debt. Both have an adverse selection risk premium, but that premium is large on equity. Therefore, an outside investor will demand a higher rate of return on equity than on debt. From the perspective of those inside the firm, retained earnings are a better source of funds than is debt, and debt is a better deal than equity financing. Accordingly, the firm will fund all projects using retained earnings if possible. If there is an inadequate amount of retained earnings, then debt financing will be used. Thus, for a firm in normal operations, equity will not be used and the financing deficit will match the net debt issues.

In reality, company operations and the associated accounting structures are more complex than the standard pecking order representation. This implies that in order to test the pecking order, some form of aggregation must be used.

We define notation as follows:

DIV_t cash dividends in year t;
I_t net investment in year t (i.e., I_t =capital expenditures + increase in investments + acquisitions + other use of funds − sale of PPE − sale of investment);
ΔW_t change in working capital in year t (i.e., ΔW_t =change in operating working capital + change in cash and cash equivalents + change in current debt);
C_t cash flow after interest and taxes (i.e., C_t =income before extraordinary items + depreciation and amortization + extraordinary items and discontinued operations + deferred taxes + equity in net loss − earnings + other funds from operations + gain (loss) from sales of PPE and other investments);
R_t current portion of the long-term debt in year t;
ΔD_t net debt issued in year t, (i.e., ΔD_t = long-term debt issuance − long-term debt reduction);
ΔE_t Net equity issued in year t (i.e., ΔE_t =sale of common stock minus stock repurchases).

Using this notation, we can use the flow of funds data to provide a partially aggregated form of the accounting cash flow identity as,

$$\mathrm{DEF}_t = \mathrm{DIV}_t + I_t + \Delta W_t - C_t = \Delta D_t + \Delta E_t. \quad (1)$$

Shyam-Sunder and Myers (1999) argue that under the pecking order hypothesis, after an Initial Public Offering (IPO), equity issues are only used in extreme circumstances. The empirical specification is thus given as

$$\Delta D_{it} = a + b_{PO}\mathrm{DEF}_{it} + e_{it}, \quad (2)$$

where e_{it} is a well-behaved error term. In Eq. (2), the pecking order hypothesis is that $a = 0$ and $b_{PO} = 1$. Shyam-Sunder and Myers (1999) find that the pecking order model is statistically rejected. However it does provide a good first-order approximation of their data.

In contrast to the accounting definition, Shyam-Sunder and Myers (1999) include the current portion of long-term debt as part of the financing deficit beyond its role in the change in working capital. Following their argument, the relevant flow of funds deficit (DEF_t^{SSM}) is defined as

$$\mathrm{DEF}_t^{SSM} = \mathrm{DIV}_t + I_t + \Delta W_t + R_t - C_t. \quad (3)$$

If their alternative version of the financing deficit is to be used, then replace DEF_{it} with DEF_t^{SSM} in Eq. (2). We try both approaches and find that empirically the current portion of long-term debt does not appear to belong in the definition of DEF_{it}. With the exception of column (7) of Table 5, we report only the results for which the current portion of long-term debt is not included as a separate component of the financing deficit. This choice favors the pecking order, but it does not affect our conclusions.

How is cash to be treated in the financing deficit? Changes in cash and cash equivalents are included with changes in working capital. Cash could be correlated with the amount of debt issued. This could arise in the presence of lumpy debt and

equity issues, with excess proceeds parked for some period of time in excess cash balances. If this takes place over a number of years, a more complex dynamic theory of leverage is needed. We report results in which the change in cash and cash equivalents are included. This choice favors the pecking order, but the conclusions are not affected.

In a panel regression, one can treat all year-firm combinations as equally important independent observations. If that is done, then a simple regression can be run. If one is willing to accept the classical error term assumptions, then standard fixed-effects or random-effects panel estimators may be used. Yet another possibility is to downplay the differences across time and focus on the cross-sectional differences. One could follow Fama and MacBeth (1973) and use the average of a series of annual cross-sectional regressions as the point estimate and use the time series of these estimates to construct standard errors. This is the approach taken by Fama and French (2002). We have tried these alternatives and our conclusions are not sensitive to the choice of approach.

According to theory, the specification in Eq. (2) is defined in levels. When actually estimating Eq. (2), it is conventional to scale the variables by assets or by sales. The pecking order theory does not require such scaling. Of course, in an algebraic equality if the right-hand side and the left-hand side are divided by the same value, the equality remains intact. However, in a regression the estimated coefficient can be seriously affected if the scaling is by a variable that is correlated with the variables in the equation. Scaling is most often justified as a method of controlling for differences in firm size. The reported results are based on variables scaled by net assets (total assets minus current liabilities). We replicate all the tests by scaling variables by total book assets, by the sum of book debt plus market equity, and by sales. The results are very similar and do not affect our conclusions.

There is an important econometric issue that needs to be addressed. The pecking order theory treats the financing deficit as exogenous. The financing deficit includes investment and dividends. Yet, much financial theory is devoted to attempting to understand the determinants of these factors. As a result, it is not entirely obvious that the components of the financing deficit should be properly regarded as exogenous. If they are truly endogenous, then the regression in Eq. (2) is misspecified. If a model is misspecified, then small changes to the specification may lead to large changes in the coefficient estimates. The model is also likely to be unstable across time periods and its performance would likely not generalize to other samples of firms. Such instability would itself be indicative of a failure of the model.

In order to deal with these concerns, two steps are taken. First, all tests are subjected to a large number of robustness checks. In most cases the findings are robust. However, the findings are not robust on one crucial dimension. Requiring firms to have complete trading records over the period 1971–1989 makes a big difference to the coefficient estimates. Second, the ability of the estimated models to predict debt issues by a holdout sample of firms is directly examined. This is a simple way to address concerns about model misspecification. A model may fit well within sample but its performance may not generalize. Such a model is, of course, much less interesting than an empirical model that also performs well out of sample.

The ability of each fitted model to predict is tested on data from the five years subsequent to (or prior to) the time period over which the model is fit. For each firm year in the holdout sample, we plug the actual values of the exogenous variables into the fitted equation. This provides a predicted value of the endogenous variable (usually net debt issue). In this manner, we obtain five years of firm-specific predictions from each fitted model. To assess the quality of these predictions, the predicted debt issues are regressed against a constant and the actual debt issues. A good fit will be reflected in an intercept of zero, a slope of one, and a high R^2. In order to save space we only report the R^2 that is obtained on the hold out sample.

2.1. Using the same information: disaggregation of the financing deficit

To test the pecking order theory we need to aggregate the accounting data. Is the aggregation step justified? It seems plausible that there could be information in DEF_{it} that helps to account for ΔD_{it}, but not in the manner hypothesized by the pecking order theory. An easy way to check whether the aggregation step is justified is to run the equation on a disaggregated basis and then check whether the data satisfies the aggregation step.

Consider the following specification,

$$\Delta D_{it} = a + b_{\mathrm{DIV}}\mathrm{DIV}_t + b_I I_t + b_W \Delta W_t - b_C C_t + e_{it}. \quad (4)$$

Under the pecking order theory, it is DEF_{it} itself that matters. A unit increase in any of the components of DEF_{it} must have the same unit impact on ΔD_{it}. The pecking order hypothesis is thus $b_{\mathrm{DIV}} = b_I = b_W = b_C = 1$. If that hypothesis is correct, then the aggregation in Eq. (1) is justified. If however, the significance is actually only driven by some of the individual components, then alternative coefficient patterns are possible.

2.2. Using other information to account for leverage

The pecking order test implicitly makes different exogeneity assumptions and uses a different information set than is conventional in empirical research on leverage and leverage-adjusting behavior. Harris and Raviv (1991) explain the conventional set of variables and then Rajan and Zingales (1995) distill these variables into a simple cross-sectional model.

The conventional set of explanatory factors for leverage is the conventional set for a reason. The variables have survived many tests. As explained below, these variables also have conventional interpretations. Excluding such variables from consideration is therefore potentially a significant omission. It is also true that including such variables potentially poses a tough test for the pecking order theory.

The conventional leverage regression is intended to explain the level of leverage, while the pecking order regression is intended to explain the change rather than the level. As long as the shocks are uncorrelated across years, we can equally well run the conventional specification in first differences. Of course, a lower R^2 will be obtained. The assumption of uncorrelated shocks is unlikely literally correct. When we run the

conventional regression in first differences, we expect to lose some accuracy. Running the conventional regression in first differences may also bias the variable coefficients towards zero. It turns out that this bias is not large enough to alter our conclusions about the relative empirical validity of the two approaches. The benefit is that we then have an appropriate specification in which to nest the financing deficit variable. Alternatively, one could run a regression that explains the level of leverage, then use a cumulated past financing deficit variable to represent the pecking order. If that is done there is an issue about when to start the cumulating. We try such a procedure and obtain results that are very similar to those reported in Table 7.

At the heart of the conventional empirical analysis is a regression of leverage on four factors: tangibility of assets (denoted T), market-to-book ratio (denoted MTB), log sales (denoted LS), and profitability (denoted P). Let Δ denote the first differences between years. Our version of the basic regression equation is therefore

$$\Delta D_i = \alpha + \beta_T \Delta T_i + \beta_{MTB} \Delta MTB_i + \beta_{LS} \Delta LS_i + \beta_P \Delta P_i + \beta_{DEF} DEF_i + \varepsilon_i. \quad (5)$$

Eq. (5) is simply a conventional regression run in first differences but with financing deficit as an added factor. In the conventional regression, this term is not present.

From the perspective of testing the pecking order, the most important of the conventional variables is tangibility. According to Harris and Raviv (1991), under the pecking order theory, one might expect that firms with few tangible assets would have greater asymmetric information problems. Thus, firms with few tangible assets will tend to accumulate more debt over time and become more highly levered. Hence, Harris and Raviv argue that the pecking order predicts that $\beta_T < 0$. This is not the conventional prediction regarding the role of tangibility. A more common idea is based on the hypothesis that collateral supports debt. It is often suggested that tangible assets naturally serve as collateral. Hence, collateral is associated with increased leverage. The usual prediction is that $\beta_T > 0$.

Firms with high market-to-book ratios are often thought to have more future growth opportunities. As in Myers (1977), there may be a concern that debt could limit a firm's ability to seize such opportunities when they appear. Goyal et al. (2002) find that when growth opportunities of defense firms decline, these firms increase their use of debt financing. Barclay et al. (2001) present a model showing that the debt capacity of growth options can be negative. The common prediction is that $\beta_{MTB} < 0$.

Large firms are usually more diversified, have better reputations in debt markets, and face lower information costs when borrowing. Therefore, large firms are predicted to have more debt in their capital structures. The prediction is that $\beta_{LS} > 0$.

The predictions on profitability are ambiguous. The tradeoff theory predicts that profitable firms should be more highly levered to offset corporate taxes. Also, in many asymmetric information models, such as Ross (1977), profitable firms are predicted to have higher leverage. But Titman and Wessels (1988) and Fama and French (2002) show that this is not a common finding. Instead, the literature finds profits and leverage to be negatively correlated. While MacKay and Phillips (2001) challenge this common finding, we expect to find that $\beta_P < 0$.

Fama and French (2002) note that the negative relationship between profits and leverage is consistent with the pecking order theory. But the pecking order is not the only possible interpretation of the relationship. There are at least two issues. First, current profitability can also serve as a signal of investment opportunities. There is a large macro-finance literature, including studies by Gilchrist and Himmelberg (1995) and Kaplan and Zingales (1997), in which this interpretation issue plays a key role. It is well known that it is difficult to construct a convincing proxy for investment opportunities. If Tobin's q or the simpler measure, market-to-book assets, is measured with error, then it may not adequately control for the information content in a firm's profitability. For an analysis of measurement error in this context, see Erickson and Whited (2000).

The second issue is that firms may face fixed costs of adjustment. Fischer et al. (1989) analyze the effect of having fixed costs associated with actively adjusting leverage. When a firm earns profits, debt gets paid off and leverage falls automatically. Only periodically will large readjustments be made in order to capture the tax benefits of leverage. Empirically, most of the data reflects the process of paying off the debt by using profits. Thus, profitable firms will be less levered even if the tradeoff theory is at work and the adjustment costs are taken into account.

3. Data

We need the data from funds flow statements to test the pecking order theory. This restricts the beginning of the sample period to 1971 since that is when American firms started reporting funds flow statements. The data ends with 1998. Variables are deflated to constant 1992 dollars.

Following standard practice, financial firms (6000–6999), regulated utilities (4900–4999), and firms involved in major mergers (Compustat footnote code AB) are excluded.[2] Also excluded are firms with missing book value of assets and a small number of firms that reported format codes 4, 5, or 6. Compustat does not define format codes 4 and 6. Format code 5 is for the Canadian file. The balance sheet and cash flow statement variables as a percentage of assets are trimmed to remove the most extreme 0.50% in either tail of the distribution. This serves to remove outliers and the most extremely misrecorded data.[3]

The balance sheet presentation of corporate assets and liabilities is reasonably consistent over time. Average common-size balance sheets for a number of years between 1971 and 1998 are presented in Table 1. The asset side shows significant changes over time. Cash increases dramatically over the period, going from 5% to

[2] Leaving in the data on firms involved in major mergers had no material effect on our conclusions. We, therefore, do not report these results separately.

[3] Prior to trimming, several balance sheet and cash flow statement items are recoded as zero if they were reported missing or combined with other data items in Compustat. The data is often coded as missing when a firm does not report a particular item or combines it with other data items. After examining accounting identities, we determine that recoding missing values on these items as zero respects the reported accounting identities.

Table 1
Common-size balance sheet for US industrial firms
This table presents average balance sheets for US industrial firms for selected years. Financial firms and utilities are excluded. The value of each balance-sheet item is calculated as a percentage of the book value of total assets and then averaged across each firm reporting data on Compustat in that year. When firms report combined cash and short-term investments, we include these amounts with cash and recode short-term investments as zero. In addition, the following items are recoded as zero when they were either missing or combined with other data items: investment and advances (#31 and #32), intangibles (#33), other assets (#69), debt in current liabilities (#34), income taxes payable (#71), other current liabilities (#72), other liabilities (#75), deferred taxes and ITC (#35), and minority interest (#38).

	Average balance sheet item as a fraction of total assets						
Year	1971	1975	1980	1985	1990	1995	1998
Number of observations	2,833	4,889	4,639	5,305	5,243	7,368	7,301
Assets:							
+ Cash (#162)	0.053	0.054	0.052	0.083	0.098	0.120	0.135
+ Short-term investment (#193)	0.041	0.042	0.051	0.051	0.030	0.043	0.048
+ Receivables—total (#2)	0.197	0.206	0.213	0.193	0.190	0.188	0.177
+ Inventories—total (#3)	0.239	0.241	0.220	0.179	0.166	0.143	0.122
+ Current assets—other (#68)	0.015	0.017	0.019	0.023	0.026	0.032	0.033
= Current assets—total (#4)	0.548	0.567	0.566	0.543	0.525	0.542	0.532
+ Net property, plant, and equipment—total (#8)	0.351	0.342	0.351	0.345	0.330	0.300	0.282
+ Investments and advances—equity method (#31)	0.014	0.011	0.011	0.011	0.009	0.007	0.007
+ Investment and advances—other (#32)	0.022	0.021	0.022	0.025	0.021	0.020	0.018
+ Intangibles (#33)	0.034	0.030	0.020	0.029	0.049	0.056	0.076
+ Assets—other (#69)	0.026	0.022	0.024	0.035	0.049	0.055	0.059
= Total assets (#6)	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Liabilities:							
+Debt in current liabilities (#34)	0.070	0.085	0.084	0.094	0.101	0.078	0.076
+Account payable (#70)	0.097	0.111	0.120	0.114	0.115	0.113	0.104
+Income taxes payable (#71)	0.020	0.017	0.016	0.009	0.008	0.007	0.006
+Current liabilities—other (#72)	0.060	0.076	0.088	0.094	0.102	0.117	0.123
=Current liabilities—total (#5)	0.249	0.296	0.315	0.320	0.339	0.324	0.322
+Long-term debt—total (#9)	0.191	0.198	0.195	0.183	0.194	0.174	0.184
+Liabilities—other (#75)	0.011	0.013	0.015	0.021	0.027	0.035	0.030
+Deferred taxes and ITC (#35)	0.017	0.019	0.023	0.021	0.018	0.013	0.011
+Minority Interest (#38)	0.003	0.003	0.002	0.003	0.004	0.004	0.004
=Liabilities—total (#181)	0.473	0.534	0.558	0.568	0.611	0.566	0.575
+Preferred stock—carrying value (#130)	0.010	0.010	0.010	0.013	0.019	0.025	0.030
+Common equity—total (#60)	0.517	0.453	0.429	0.413	0.351	0.383	0.348
=Stockholders' equity—total (#216) =(#130+#60)	0.527	0.466	0.442	0.432	0.389	0.435	0.424
=Total liabilities and stockholders' equity (#6)	1.000	1.000	1.000	1.000	1.000	1.000	1.000

13% of total book assets. Intangibles double from 3.4% to 7.6% of the total assets. At the same time, inventories, and property, plant, and equipment experience large declines. In contrast to the assets side of the balance sheet, the liability side is quite stable during this period.

American firms report their accounts in a number of different formats over the last thirty years. To have a consistent time-series, we merge the different format codes to a common format. The data from 1971 to 1987 is from the "Cash Statement by Sources and Use of funds." The standard form of reporting corporate cash flows changed in 1988. For fiscal years ending before July 15, 1988, there are three distinct but closely related formats (Compustat format codes 1, 2, 3) that were permitted for companies to report their cash flows. Beginning in 1988, most firms start reporting Statement of Cash Flows (format code 7). In the earlier period, the structure has funds from operations plus other sources of funds minus uses of working capital equals change in working capital. The cash flows since July 15, 1988 are structured as income plus indirect operating activities plus investing activities plus financing activities equals change in cash and cash equivalents. A disaggregated version of these statements is fairly lengthy and is therefore relegated to Appendix A. The fact that this statement is lengthy is itself important to recognize. It implies that when testing the pecking order, a large number of separate elements are being aggregated.

It has been suggested that the pecking order hypothesis must be true empirically. This is because it is "well known" that, to a first approximation, firms do not issue much equity after the IPO. If equity issues are known to be zero, then by the accounting identity in Eq. (1), the financing deficit must be equal to the debt issue. As shown in Table 2, this conjectured first approximation to an accounting identity is misleading. Much more equity is issued than is sometimes recognized.

Table 2 presents cash flows in an aggregated form that matches Eq. (1). In this table, the financing deficit grows over time. To a dramatic degree, net equity issues grow at a faster rate than net debt issues. The number of public firms grows significantly over the period studied. Therefore, an obvious hypothesis is that the magnitude of equity reflects a large number of IPOs. To check this, we remove the data for each firm for the first year that it appeared in Compustat. The results (not reported) show that removing these observations has only a minor effect. The large use of net equity is not merely an IPO effect.

Firm size and discreteness both play a role in understanding the evidence in Table 2. During the 1980s and especially the 1990s, a significant influx of small firms became publicly traded. These small firms use relatively more equity financing than do large firms. Table 2 reports the mean values. Due to discreteness, there is a big gap between the mean and the median debt and equity issues. The median net debt issue and the median net equity issue are both close to zero despite the large mean values. Apparently many firms remain out of both the debt and equity markets most of the time. Occasionally, they enter these markets actively. The magnitudes of the interventions are often large relative to the firm size.

While the tables provide snapshots in selected years, it is also helpful to consider the year-by-year trends in the relative use of debt and equity. Fig. 1 shows the changing roles of net debt and net equity relative to the financing deficit over assets

Table 2
Corporate cash flows

	Average funds flow and financing as a fraction of total assets						
	1971	1975	1980	1985	1990	1995	1998
Number of observations	2,823	4,838	4,561	5,129	5,069	7,052	6,931
Cash dividends[a]	0.015	0.011	0.012	0.009	0.009	0.007	0.006
Investments[b]	0.094	0.079	0.114	0.122	0.079	0.104	0.109
Δ Working capital[c]	0.037	0.016	0.033	−0.003	−0.007	0.034	−0.011
Internal cash flow[d]	0.103	0.096	0.095	0.042	0.020	0.017	−0.032
Financing deficit[a + b + c − d]	0.043	0.010	0.064	0.085	0.061	0.129	0.135
Net debt issues (#111–#114)	0.016	0.005	0.019	0.019	0.007	0.021	0.034
Net equity issues (#108–#115)	0.027	0.005	0.045	0.066	0.053	0.108	0.101
Net external financing (net debt issues + net equity issues)	0.043	0.010	0.064	0.085	0.061	0.129	0.135

[a] Item 127.

[b] For firms reporting format codes 1 to 3, investments equal Item 128 + Item 113 + Item 129 + Item 219 − Item 107 − Item 109. For firms reporting format code 7, investments equal Item 128 + Item 113 + Item 129 − Item 107 − Item 109 − Item 309 − Item 310.

[c] For firms reporting format code 1, Change in net working capital equals Item 236 + Item 274 + Item 301. For firms reporting format codes 2 and 3, change in net working capital equals − Item 236 + Item 274 − Item 301. For firms reporting format code 7, change in net working capital equals − Item 302 − Item 303 − Item 304 − Item 305 − Item 307 + Item 274 − Item 312 − Item 301.

[d] For firms reporting format codes 1 to 3, internal cash flow equals Item 123 + Item 124 + Item 125 + Item 126 + Item 106 + Item 213 + Item 217 + Item 218. For firms reporting format code 7, internal cash flow equals Item 123 + Item 124 + Item 125 + Item 126 + Item 106 + Item 213 + Item 217 + Item 314.

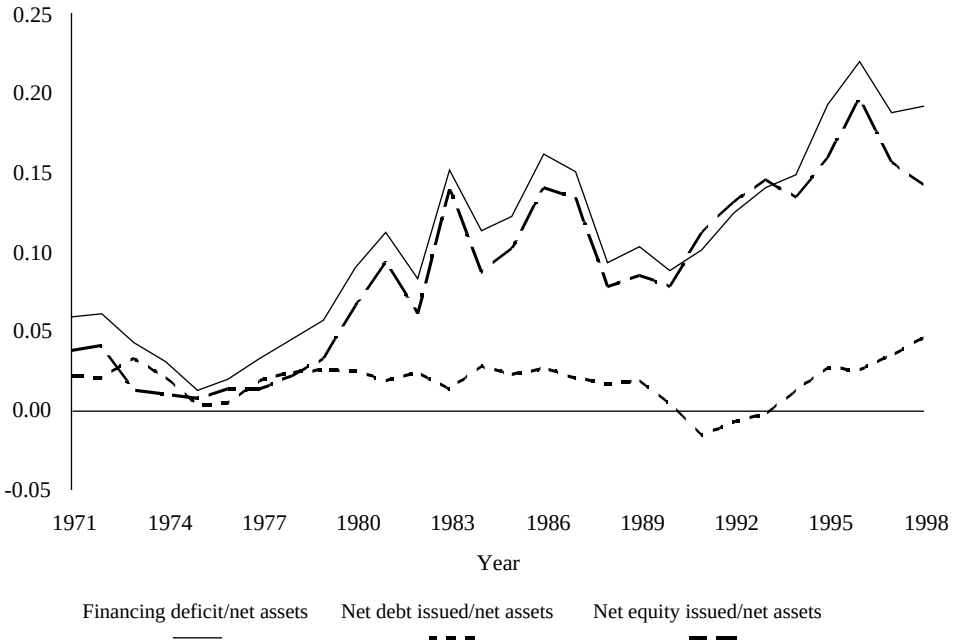

Fig. 1. Average financing deficit to net assets, net debt issued to net assets, and net equity issued to net assets, 1971–1998. The figure plots annual averages of the ratios of financing deficit to net assets, net debt issued to net assets, and net equity issued to net assets for the period between 1971 and 1998. The sample comprises U.S. firms on the Compustat files. Financial firms and regulated utilities are excluded. The financing deficit is calculated as cash dividends plus investments plus change in working capital minus internal cash flow. Net debt issued is long-term debt issuance minus long-term debt redemption. Net equity issued is the issue of stock minus the repurchase of stock. The variables are constructed using data from Compustat funds-flow statements.

for the full 1971–1998 period. Because of the accounting cash flow identity, it is natural to expect that net debt and net equity ought to track the financing deficit. Under the pecking order, one would expect that the debt would track the financing deficit much more closely than would net equity. Empirically, the reverse is observed. Adding the currently maturing debt to the financing deficit and omitting IPO firms have only very minor impacts on the picture. The correlation between net equity and the financing deficit is 0.80, while the correlation between the financing deficit and net long-term debt is only 0.48.

The information reported in Table 2 and depicted in Fig. 1 conveys an important message. According to Myers (2001) a major advantage of the pecking order is that it explains why the bulk of external financing takes the form of debt. What Table 2 shows is that this is empirically not observed. A great deal of external financing takes the form of equity. Graham (2000) shows that some firms use debt conservatively and that these firms employ more equity than debt. The low debt levels employed by some firms remain theoretically challenging. Minton and Wruck (2001) and

Lemmon and Zender (2001) provide further evidence. In many years more equity than debt is used on average.

A second important aspect of Table 2 concerns the importance of retained earnings relative to external financing. According to Myers (2001), typically most investment is financed by internal cash flow. Table 2 shows that during the 1980s and 1990s, this is not the typical pattern. Over time, the internal cash flow declines in relative importance as a source of financing.

4. Empirical tests

Shyam-Sunder and Myers (1999) study data from the period 1971 to 1989. Results are presented separately for their sample period (1971–1989) and for subsequent years (1990–1998) for many specifications. This facilitates comparisons.

Table 3 provides the results of regressions for the same time period as Shyam-Sunder and Myers (1999). We follow their approach of reporting results separately for net debt issued, gross debt issued, and the change in the debt ratio. We also attempt to match their sample selection criteria. The most significant of their criteria is the requirement that firms report continuously on the necessary variables. These criteria result in a sample with 768 firms and 19 years of data for each firm. This is significantly larger than their sample of 157 firms.

Many other restrictions are tried. Examples include requiring firms to report continuously on a variety of other variables or only considering firms for inclusion based on specific Compustat format codes. Adding more restrictions does result in sample sizes becoming smaller. However, we did not manage to exactly identify their 157 firms. These further restrictions lead to samples for which the empirical results are very similar to those reported in Table 3. We therefore place minimum restrictions consistent with our understanding of the treatment of data in their paper.

The results in Table 3 start with net debt issued as the dependent variable in a sample of firms with no gaps permitted. Despite the differences in sample size, we do replicate the coefficients on the financing deficit reported by Shyam-Sunder and Myers (1999). As reported in column (1) of Table 3, the estimated coefficient for this sample is 0.75 and the R^2 is 0.71. Support for the pecking order theory is strong in this case. The findings for gross debt and change in debt ratio departs somewhat from their results.

For the holdout sample R^2s, there is a choice of whether to use the same restricted set of firms or instead to examine the broader population of firms. It is not a case of one being right and the other being wrong. These two alternatives provide different information about what the fitted equation tells us. The full sample holdout test shows whether the fitted model accounts for the broad population of firms that exist over the subsequent five years. The restricted sample holdout test shows whether the fitted model accounts for the debt issuing decisions of the surviving members of the selected sample over the next five years. The attrition rate among the selected sample of firms is rather high in the next five years. For the survivors, the predictability is very good. Of course, the pecking order theory does not predict which firms will

Table 3
Pecking order tests for the time period 1971–1989
The sample period is 1971–1989. Financial firms and utilities are excluded. The sample in columns (1)–(3) additionally excludes firms with gaps in reporting of relevant flow of funds data. The following regression is estimated: $\Delta D_{it} = a + b_{PO}\mathrm{DEF}_{it} + e_{it}$, where ΔD_t is the net or gross amount of debt issued, and the financing deficit, DEF_t, is the sum of dividends, investment, change in working capital (change in operating working capital + changes in cash + changes in short term debt), minus the cash flow after interest and taxes. All variables are scaled by net assets. The dependent variable in Columns (3) and (6) is the change in long-term debt to net assets ratio. The holdout sample period is from 1990 to 1994. Standard errors are reported in parentheses.

	1971–1989			1971–1989		
	Data *with no gaps permitted* in the reporting of flow of funds data			Data *with gaps permitted* in the reporting of flow of funds data		
	Net debt issued (1)	Gross debt issued (2)	Change in debt ratio (3)	Net debt issued (4)	Gross debt issued (5)	Change in debt ratio (6)
Constant	0.001[b]	0.060[a]	−0.005[a]	−0.002[a]	0.080[a]	−0.003[a]
	(<0.001)	(0.001)	(0.001)	(<0.001)	(0.001)	(<0.001)
Financing deficit	0.748[a]	0.601[a]	0.426[a]	0.283[a]	0.267[a]	0.147[a]
	(0.004)	(0.008)	(0.006)	(0.002)	(0.002)	(0.002)
N	14,592	14,592	14,592	89,883	89,735	83,463
R^2	0.708	0.296	0.270	0.265	0.159	0.055
R^2—Holdout sample (full)	0.135	0.039	0.001	0.135	0.039	0.001
R^2—Holdout sample (restricted)	0.678	0.085	0.115			

[a]Indicates significance at the 0.01 level.
[b]Indicates significance at 0.10 level.

survive. For the broader population of firms, the predictability is poor. The full population out-of-sample results show that the model results do not generalize.

There is nothing in the pecking order theory that requires the use of balanced panels of firms. Comparison of columns (1)–(3) with columns (4)–(6) shows that requiring firms to have no reporting gaps has a nontrivial impact on the results. Both the estimated coefficient on the financing deficit, and the R^2, decline sharply when we examine the broader population of U.S. firms over the period 1971–1989. As column (4) of Table 3 shows, the coefficient on financing deficit in the net debt issued regression is 0.28 with an R^2 of 0.27. The results from regressions that explain gross debt issued and change in debt ratio as a function of financing deficit similarly show substantial declines in both coefficient estimates and R^2s when the focus shifts from the 768 firm sample that traded continuously to the broader population of publicly traded U.S. firms.[4]

How did the firms with no gaps in the reporting of funds flow data differ from the broader population? The 768 firms that reported continuously during 1971–1989 were large. Their book value of assets is almost twice that of the broader population of firms. These firms also issue significantly higher amounts of debt and significantly lower amounts of equity. The R^2 on the hold out samples show that fitted equations from the period 1971–1989 have a very limited ability to forecast leverage behavior during the next five years.

Are the results specific to a particular time period? To address this question, Table 4 uses the data from the 1990s and initially requires the included firms to report continuous data on the flow of funds. We then relax the continuous reporting criteria to examine whether the results are sensitive to the period, the requirement that firms report continuous funds flow data or both. The coefficient estimates and the R^2s are now uniformly lower, even when we require that firms have no reporting gaps.

During 1990–1998 the no-reporting-gap firms were large equity issuers. The average ratio of net equity issued to net assets was 0.033 and the average ratio of net debt issued over net assets was 0.008. Thus, we see that time period plays a major role. Comparing Table 3 to Table 4 shows that support for the pecking order theory was weaker in the 1990s.

4.1. Disaggregating the financing deficit

The aggregation step embodied in the pecking order is a nontrivial imposition of structure on the data. Is that structure justified empirically? Table 5 reports disaggregated deficit component regressions for the earlier period.

[4] We tried a great many additional variations to see if greater support could be found for the pecking order theory. To save space, we do not report the details of most of these variations. We tried different ways of constructing the deficit variable. We experimented with including current maturities of long-term debt at the beginning of period to the deficit variable. We also experimented with excluding changes in cash and changes in current debt from the change in working capital. In every case, the magnitude of the estimated coefficient and the R^2 appeared marginally worse, without affecting our overall conclusion. We also examined a simple deficit variable that excludes extraordinary and non-operating flows. As expected, the estimated coefficients and R^2s worsen significantly.

Table 4
Pecking order tests for the time period 1990–1998
The sample period is 1990–1998. Financial firms and utilities are excluded. The sample in Columns (1)–(3) additionally excludes firms with gaps in reporting of relevant flow of funds data. The following regression is estimated: $\Delta D_{it} = a + b_{PO}\mathrm{DEF}_{it} + e_{it}$, where ΔD_t is the net or gross amount of debt issued, and the financing deficit, DEF_t, is the sum of dividends, investment, change in working capital (change in operating working capital + changes in cash + changes in short term debt), minus the cash flow after interest and taxes. All variables are scaled by net assets. The dependent variable in Columns (3) and (6) is the change in long-term debt to net assets ratio. The holdout sample period is from 1985 to 1989. Standard errors are reported in parentheses.

	1990–1998			1990–1998		
	Data *with no gaps permitted* in the reporting of flow of funds data			Data *with gaps permitted* in the reporting of flow of funds data		
	Net debt issued (1)	Gross debt issued (2)	Change in debt ratio (3)	Net debt issued (4)	Gross debt issued (5)	Change in debt ratio (6)
Constant	−0.004[a]	0.086[a]	−0.004[a]	−0.007[a]	0.112[a]	−0.006[a]
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Financing deficit	0.325[a]	0.234[a]	0.125[a]	0.148[a]	0.152[a]	0.025[a]
	(0.004)	(0.008)	(0.005)	(0.002)	(0.003)	(0.002)
N	18,225	18,225	18,225	57,687	57,616	52,861
R^2	0.283	0.048	0.041	0.120	0.046	0.002
R^2—holdout sample (full)	0.217	0.119	0.032	0.217	0.119	0.032
R^2—holdout sample (restricted)	0.252	0.145	0.042			

[a] Indicates significance at the 0.01 level.

Table 5
Disaggregating the flow of funds deficit
The following regression is estimated: $\Delta D_{it} = a + b_{DIV}DIV_t + b_I I_t + b_W \Delta W_t - b_C C_t + e_{it}$, where ΔD_t =amount of net or gross debt issued, Div_t is the amount of cash dividends paid, I_t is the investments, ΔW_t is the change in working capital, and C_t is the internal cash flow after interest and taxes. In Columns (3), (6), and (8), the dependent variable is the change in the long-term debt to net assets ratio. The sample period is 1971–1993 in Columns (1) to (3), and the period is 1971–1989 for Columns (4)–(9). Results in Columns (4)–(6) are based on data with no gaps permitted in the reporting of the relevant flow of funds data. The holdout sample period is the five-year period beginning the end of the estimation period. Financial firms and utilities have been removed. Standard errors are reported in parentheses.

	1971–1989			1971–1989			
	Data *with no gaps permitted* in the reporting of flow of funds data			Data *with gaps permitted* in the reporting of flow of funds data			
	Net debt issued (1)	Gross debt issued (2)	Change in debt ratio (3)	Net debt issued (4)	Gross debt issued (5)	Change in debt ratio (6)	Net debt issued (7)
Constant	−0.006[a]	0.072[a]	0.003[b]	−0.030[a]	0.062[a]	−0.007[a]	−0.020[a]
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Cash dividends	0.884[a]	−0.209[a]	0.678[a]	0.372[a]	−0.516[a]	0.294[a]	0.339[a]
	(0.020)	(0.037)	(0.028)	(0.018)	(0.024)	(0.020)	(0.018)
Investments	0.774[a]	0.631[a]	0.450[a]	0.393[a]	0.391[a]	0.189[a]	0.431[a]
	(0.005)	(0.009)	(0.007)	(0.002)	(0.003)	(0.003)	(0.002)
Δ Working capital	0.723[a]	0.529[a]	0.360[a]	0.246[a]	0.141[a]	0.068[a]	0.296[a]
	(0.005)	(0.009)	(0.007)	(0.002)	(0.002)	(0.002)	(0.002)
Internal cash flow	−0.739[a]	−0.564[a]	−0.527[a]	−0.190[a]	−0.161[a]	−0.176[a]	−0.245[a]
	(0.005)	(0.010)	(0.008)	(0.002)	(0.002)	(0.002)	(0.002)
Current maturity of long-term debt							−0.167[a]
							(0.005)
N	14,565	14,565	14,565	88,892	88,826	82,969	81,588
R^2	0.705	0.322	0.301	0.289	0.187	0.095	0.339
R^2—holdout sample (full)	0.125	0.034	0.004	0.155	0.040	0.010	0.164
R^2—holdout sample (restricted)	0.695	0.097	0.136				

[a]Indicates significance at the 0.01 level.

Column (1) in Table 5 is relatively supportive of the pecking order aggregation step. If this column is examined in isolation, one could conclude that the evidence, while rejecting aggregation, is actually reasonably favorable to the theory. However, this result is a function of the requirement that firms have no gaps in funds flow data over the entire period from 1971 to 1989. When we include firms that do not have complete records (in columns (4)–(7)), the sample becomes much larger and the observed coefficients change dramatically. During the 1990s, the evidence moves further away from supporting the pecking order aggregation hypothesis.

How should we interpret the coefficients on the components of the financing deficit? We start with cash dividends. Table 5 shows that when net debt issues are considered the coefficient on cash dividends is positive, but when gross debt issues are considered it is negative. This stems from the fact that dividend-paying firms issue less long-term debt but they also redeem less when compared to non-dividend paying firms. It is worth noting that the tradeoff theory also predicts a positive relation between dividends and debt. High dividend paying firms are likely to be those that expect to continue to generate large cash flows and have small investment needs in relation to cash flows.

The pecking order theory predicts a positive sign and a unit coefficient on investments in both fixed assets and working capital. According to the theory, after controlling for internal cash flows, investments in fixed assets and working capital should be matched dollar for dollar by increases in debt issues. But this is not the only idea. The tradeoff theory also predicts a positive relation between investments and debt. Higher investments add to assets in place, increasing tangible assets. This increases debt capacity. The positive relation between changes in working capital and net debt issues might also reflect timing issues. If a firm issues long-term debt then it receives cash. Until the firm spends that cash, it can be put into bank accounts or other short-term investments that are included in working capital.

At the typical firm, internal cash flow does lead to some reduction in debt issues, but the magnitude of the effect is surprisingly small once one includes the behavior of firms that do not have complete trading records. There is a large literature showing a negative relation between leverage and profitability. However, as noted earlier, if internal cash flow measures future growth opportunities, then the tradeoff theory also predicts the observed negative relation on cash flows.

In column (7) of Table 5, the current portion of long-term debt is added as a further explanatory variable. As previously discussed, Shyam-Sunder and Myers (1999) include the current portion of long-term debt as a component of the financing deficit. The financing deficit variable studied in this paper does not include it. Column (7) illustrates why it was dropped. The sign is negative and the magnitude is fairly small. This is not at all what is predicted by the pecking order theory. This evidence is consistent with a model in which transaction costs play a significant role. When long-term debt comes due, it is not automatically replaced with new debt.

4.2. A priori selection criteria for pecking order firms

The evidence presented so far has shown that the pecking order theory does not account for the broad patterns in the financing of American firms. This does not rule

out the possibility that some firms have the hypothesized unit slope coefficient in Eq. (2). The theory suggests looking for firms prone to adverse selection problems. Table 3 suggests looking at large firms.

The pecking order theory is based on a difference of information between corporate insiders and the market. The driving force is adverse selection. Accordingly, it is natural to examine firms that are commonly thought to be particularly subject to adverse selection problems, such as small firms and high-growth firms. Table 6 shows that the evidence strongly rejects this hypothesis. The pecking order performs much worse for these firms. This evidence is consistent with Helwege and Liang (1996), who study a sample of firms that had an IPO in 1983, and thus were fairly small on average. Helwege and Liang (1996) find that the use of external financing by these firms did not match the pecking order prediction.

Since small firms do not generally follow the pecking order, consideration next turns to large firms. Consideration is also given to firms that are likely to have less severe adverse selection problems, such as firms paying dividends and firms with moderate leverage. The results show that the pecking order theory does in fact perform much better for large firms. Neither moderate leverage nor the payment of dividends substitutes for the effect of firm size.

This evidence shows that firm size is critical.[5] There is a monotonic improvement of the performance of the pecking order predictions as the firm size increases. For the largest quartile, there is reasonable support for the pecking order prediction. For the smallest set of firms, the pecking order is rejected. In the middle, the support for the theory grows with firm size.

Overall, the results based on data from the period 1971–1989 show that the smallest firms do not follow the pecking order, but the largest firms do, and the medium size categories are somewhat pecking order-like over this time period. There is strong evidence that at least some aspects of the financing patterns have changed over time. Does this have an effect on the interpretation of the role of firm size?

The last four columns of Table 6 provide evidence from the period 1990–1998. Support for the pecking order declines significantly. During the 1990s, it is only the top quartile of firms that are at all supportive. Even for the top quartile of firms, the numerical coefficients move further from the pecking order predictions. In columns (5) and (6) the holdout sample predictions are considerably poorer than the in sample R^2 would suggest. This is consistent with the evidence in columns (9) and (10) showing that corporate-debt-issuing behavior changes during the 1990s. This shows that, in addition to firm size, the time period also matters for the tests of the pecking order. Large firms in earlier decades are most supportive of the pecking order theory, while smaller, high-growth firms provide the strongest rejections of the theory. Support for pecking order declines even for larger firms in the 1990s.

The results on large firms match well with the results from the survey of financial managers carried out by Graham and Harvey (2001). They report that some

[5] We treat firm size as exogenous. This is quite common in corporate finance studies. Of course, there is a deeper level of consideration at which firm size itself might be explained. Kumar et al. (2001) study some aspects of this question.

Table 6
Pecking order tests for sub-samples of small and large firms
Firms are sorted into quartiles based on total assets. The table presents pecking order tests on firms that pay strictly positive dividends, firms with moderate leverage, and high-growth firms. Moderate leverage is defined by the omission of the top two and bottom two deciles. High growth firms are those with a market-to-book ratio in excess of the 75th percentile of the distribution. The following regression is estimated: $\Delta D_{it} = a + b_{PO}\mathrm{DEF}_{it} + e_{it}$, where ΔD_t = the amount of net debt issued, and DEF_t is the sum of dividends, investment, change in working capital (change in working capital + change in cash + change in short term debt), minus the cash flow after interest and taxes. All variables are scaled by net assets. Standard errors are reported in parentheses.

	1971–1989			1971–1989				1990–1998			
	High growth	Strictly positive dividends	Moderate leverage	Smallest firms	Medium small firms	Medium large firms	Largest firms	Smallest firms	Medium small firms	Medium large firms	Largest firms
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Constant	0.003[b]	0.002[a]	0.001	−0.017[a]	−0.014[a]	−0.006[a]	<0.000	−0.021[a]	−0.021[a]	−0.015[a]	<0.000
	(0.001)	(<0.001)	(<0.001)	(0.001)	(0.001)	(0.001)	(<0.001)	(0.002)	(0.001)	(0.001)	(0.001)
Financing deficit	0.127[a]	0.558[a]	0.244[a]	0.164[a]	0.428[a]	0.623[a]	0.753[a]	0.087[a]	0.162[a]	0.355[a]	0.675[a]
	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.005)	(0.004)
N	17,440	44,606	55,438	21,218	22,754	22,808	22,623	13,131	14,886	14,768	14,472
R^2	0.096	0.535	0.220	0.151	0.414	0.598	0.740	0.075	0.133	0.280	0.626
R^2—holdout sample	0.041	0.187	0.111	0.093	0.152	0.274	0.615	0.112	0.365	0.569	0.718

[a] Indicates significance at the 0.01 level.
[b] Indicates significance at the 0.05 level.

financial managers expressed views similar to the pecking order, but apparently not due to adverse selection.

4.3. Conventional leverage regressions

Even if a theory is wrong, it could still be helpful if it does a better job of accounting for the evidence than competing theories. The pecking order is a competitor to more conventional empirical leverage specifications. Accordingly, the next test of the theory is to see how the financing deficit works when added to a conventional leverage regression. To provide a suitable structure to nest both the pecking order theory and the conventional variables, the regressions are run in first differences. As explained in Section 2.2, first differences can bias the conventional variables towards zero. The dependent variable in these regressions is the change in market leverage. Using book leverage yields similar results.

Table 7 presents the results. The estimated coefficients on the market-to-book assets ratio, tangibility, firm size, and profitability have the usual signs. The coefficient signs are negative on the market-to-book ratio, positive on tangibility, positive on log of sales, and negative on profitability.

In column (2), the leverage regression is estimated with financing deficit as an additional explanatory variable. If the pecking order were the key driver, it should have wiped out the effects of the conventional variables. It did not do so. Adding the deficit variable to the regression did not have much effect on the magnitudes and significance of the coefficients on the conventional variables. However, the financing deficit is empirically relevant.

In column (3), the leverage regressions are re-estimated with lagged leverage as an additional explanatory variable. The coefficient on lagged leverage is fairly large in magnitude and statistically significant. The negative sign on lagged leverage suggests that mean reversion is at work as predicted by the tradeoff theory. Inclusion of lagged leverage does not affect the sign and significance of most of the other variables in the regression.

While the pecking order theory is rejected, this does not mean that the financing deficit is ignored. As shown in columns (4)–(9), the information contained in the financing deficit appears to be factored in, along with many other considerations, particularly when large firms adjust leverage. But as shown in column (8) of Table 7, even for the largest set of firms, it is easy to reject the hypothesized unit coefficient on the financing deficit.

It is interesting to consider the R^2 on the hold out samples. Adding the financing deficit and adding lagged leverage adds remarkably little to the performance of the fitted equations once account is taken of the conventional factors. This is consistent with Fama and French (2002) who argue that mean reversion in corporate leverage is surprisingly weak.

Most studies report on levels of leverage rather than on changes in leverage. Accordingly, for completeness, we also estimate analogous regressions run in levels. The results (omitted in order to save space) show that the cumulative financing deficit added about 1% to the explanatory power of the regressions. The estimated

Table 7
Leverage regressions with conventional variables and deficit for small and large firms, 1971–1993
The basic regression is $\Delta D_i = \alpha + \beta_T \Delta T_i + \beta_{MTB} \Delta MTB_i + \beta_{LS} \Delta LS_i + \beta_P \Delta P_i + \varepsilon_i$. Here D is defined as the ratio of total debt to market capitalization, T =Tangibility is defined as the ratio of fixed assets to total assets. MTB is the market-to-book ratio defined as the ratio of the market value of assets (book value of assets plus the difference between market value of equity and book value of equity) to the book value of assets. LS is log sales defined as the natural logarithm of constant sales. P is profit defined as the ratio of operating income to book value of assets. In several specifications, the basic regression is augmented with the financing deficit. Regressions are estimated with fixed firm effects, both with and without a lagged dependent variable. The sample period is 1971–1993. Financial firms and utilities are excluded. Small firms are those with book value of assets less than the 25th percentile of the distribution. Large firms are those with book value of assets greater than the 75th percentile of the distribution. Standard errors are reported in parentheses.

	All firms			Small firms			Large firms		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Constant	−0.019[a]	−0.021[a]	0.025[a]	−0.001	−0.011	0.024[a]	−0.022[a]	−0.018[a]	0.028[a]
	(0.002)	(0.002)	(0.002)	(0.007)	(0.007)	(0.007)	(0.003)	(0.003)	(0.003)
Δ Tangibility	0.155[a]	0.176[a]	0.156[a]	0.112[a]	0.123[a]	0.098[a]	0.118[a]	0.181[a]	0.176[a]
	(0.007)	(0.007)	(0.007)	(0.017)	(0.018)	(0.018)	(0.012)	(0.012)	(0.012)
Δ Market-to-book	−0.031[a]	−0.029[a]	−0.028[a]	−0.021[a]	−0.021[a]	−0.020[a]	−0.054a	−0.050a	−0.050[a]
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Δ Log sales	0.025[a]	0.017[a]	0.008[a]	−0.002	−0.001	−0.006[b]	0.077[a]	0.035[a]	0.030[a]
	(0.001)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Δ Profitability	−0.217[a]	−0.221[a]	−0.183[a]	−0.079[a]	−0.082[a]	−0.058[a]	−0.718[a]	−0.580[a]	−0.535[a]
	(0.004)	(0.004)	(0.004)	(0.006)	(0.007)	(0.007)	(0.013)	(0.013)	(0.013)
Financing deficit		0.125[a]	0.125[a]		0.028[a]	0.039[a]		0.230[a]	0.218[a]
		(0.002)	(0.002)		(0.005)	(0.005)		(0.005)	(0.005)
Lagged leverage			−0.124[a]			−0.115[a]			−0.104[a]
			(0.002)			(0.007)			(0.004)
N	82,613	79,317	79,207	11,197	10,328	10,301	24,590	23,797	23,772
R^2	0.190	0.219	0.208	0.126	0.133	0.128	0.300	0.360	0.349
R^2—Holdout sample	0.094	0.115	0.103	0.080	0.080	0.072	0.217	0.290	0.281

[a] Indicates significance at the 0.01 level.
[b] Indicates significance at the 0.10 level.

coefficients on the conventional variables had the usual signs including positive on tangibility, negative on the market-to-book assets, positive on log of sales, and negative on profitability. In this case, lagged leverage is significant and has a positive sign. It also has a significant impact both within sample and in the hold out sample.

5. Conclusions

The pecking order theory is tested on a broad cross-section of publicly traded American firms over the period 1971–1998. In contrast to what is often suggested, internal financing is not sufficient to cover investment spending on average. External financing is heavily used. Debt financing does not dominate equity financing in magnitude. Net equity issues track the financing deficit quite closely, while net debt does not do so. The current portion of long-term debt is not treated as part of the financing deficit. These facts are surprising from the perspective of the pecking order theory.

The pecking order theory is a competitor to the conventional leverage regressions. It is thus important to examine the relative importance of the two approaches. In specifications that nest the two approaches, the financing deficit adds a small amount of extra explanatory power. But the financing deficit does not challenge the role of the conventional leverage factors.

When narrower samples of firms are considered the greatest support for the pecking order is found among large firms in earlier years. Over time, support for the pecking order declines for two reasons. More small firms are publicly traded during the 1980s and 1990s than during the 1970s. Since small firms do not follow the pecking order, the overall average moves further from the pecking order. However, the time period effect is not entirely due to more small firms in the 1990s. Even when attention is restricted to the largest quartile of firms, support for the pecking order theory declines over time. Equity becomes more important.

Many aspects of the evidence pose serious problems for the pecking order. But this does not mean that the information contained in the financing deficit is completely irrelevant. The components of the financing deficit appear factored in to some degree, particularly by large firms, when they adjust their leverage.

Appendix A

Statement of disaggregated cash flows is given in Table 8.

Appendix B

Data on economic variables are provided in Table 9.

Appendix C

Pair-wise correlations among key variables is given in Table 10.

Table 8
Average corporate statement of disaggregated cash flows
This table presents average cash flow statement for US industrial firms for selected years. The data is from Compustat. For years up to and including 1985 Compustat format codes 1, 2, and 3 are used. Starting in year 1990 format code 7 is used. These formats have different standard presentations. We have followed format 7 to the extent possible. Financial firms and utilities are excluded. Also excluded are firms involved in major mergers. The value of each income statement and cash flow item is expressed as a fraction of total assets for each firm and then averaged across firms. Other fund from operation aggregates extraordinary items, deferred tax, equity in net loss, loss (gain) on sale of PPE and sale of investments, and funds from operations—other.

	Average statement of cash flow items as a fraction of total assets						
	1971	1975	1980	1985	1990	1995	1998
Number of observations	2,833	4,889	4,639	5,297	5,231	7,352	7,277
Income							
+ Sales (#12)	1.426	1.563	1.525	1.298	1.293	1.250	1.119
− Cost of goods sold (#41)	1.046	1.140	1.105	0.932	0.910	0.869	0.784
− Selling, general and admin. expenses (#189)*	0.259	0.297	0.302	0.328	0.348	0.355	0.372
= Operating income before depreciation (#13)	0.135	0.128	0.119	0.035	0.034	0.022	−0.043
− Depreciation and amortization (#14)	0.038	0.041	0.041	0.051	0.053	0.050	0.053
= Operating income after depreciation (#178)	0.096	0.086	0.077	−0.022	−0.020	−0.030	−0.099
− Interest expense (#15)*	0.018	0.027	0.034	0.031	0.035	0.025	0.024
+ Non operating income and special items (#61+ #17)*	0.009	0.009	0.019	0.008	0.001	−0.005	−0.011
= Pre tax income (#170)	0.087	0.068	0.062	−0.048	−0.060	−0.067	−0.141
− Income taxes—total (#16)	0.044	0.041	0.039	0.026	0.019	0.019	0.016
− Minority interest (#49)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
= Income before extra ordinary items (#18)	0.042	0.026	0.023	−0.072	−0.079	−0.086	−0.157
− Dividend: preferred (#19)	0.001	0.001	0.001	0.001	0.001	0.001	0.002
+ Common Stock equivalents—dollar savings (#191)*	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
+ Extraordinary items and discontinued operations (#48)*	−0.003	0.003	0.002	0.002	0.001	−0.001	−0.001
Net Income (#172)	0.037	0.028	0.024	−0.071	−0.080	−0.087	−0.157
Indirect operating activities							
= Income before extra ordinary items (#123)	0.042	0.026	0.023	−0.071	−0.079	−0.086	−0.157
+ Depreciation and amortization (#125)*	0.040	0.042	0.042	0.053	0.058	0.055	0.058

+ Other funds from operation (#124+#126+#106+#213+#217)*	0.006	0.013	0.011	0.020	0.024	0.025	0.039
= Funds from operations—total (#110)	0.088	0.081	0.076	0.008	0.007	−0.001	−0.052
+ Accounts receivables—dec. (Inc.) (#302)*	—	—	—	—	−0.010	−0.026	−0.017
+ Inventory—decrease (increase) (#303)*	—	—	—	—	−0.004	−0.014	−0.007
+ Accounts payable and accrued liabilities—increase (decrease) (#304)*	—	—	—	—	0.013	0.021	0.015
+ Income taxes-accrued—increase (decrease) (#305)*	—	—	—	—	<0.001	0.001	<0.001
+ Asset & liabilities—other (net change) (#307)*	—	—	—	—	0.001	0.002	0.003
= Operating activities—net cash flow (#308)	—	—	—	—	0.003	−0.022	−0.062
Investing activities	—	—	—	—			
− Increase in investment (#113)*	0.006	0.006	0.010	0.011	0.008	0.011	0.013
+ Sale of investment (#109)*	0.001	0.004	0.005	0.006	0.007	0.010	0.010
− Capital expenditure (#128)*	0.071	0.070	0.094	0.086	0.069	0.075	0.075
+ Sale of property, plant, and equipment (#107)*	0.007	0.008	0.011	0.011	0.006	0.005	0.005
− Acquisitions (#129)*	0.008	0.004	0.006	0.014	0.010	0.017	0.028
+ Short term investment—change, and investing activities — other (#309 + #310)*	—	—	—	—	0.002	−0.005	0.002
= Investing activities—net cash flow (#311)	—	—	—	—	−0.075	−0.101	−0.104
Financing activities							
+ Sale of common and preferred stock (#108)	0.030	0.009	0.053	0.079	0.061	0.121	0.117
− Purchase of common and preferred stock (#115)*	0.003	0.003	0.004	0.006	0.006	0.005	0.011
− Cash dividends (#127)*	0.015	0.011	0.012	0.009	0.009	0.007	0.005
+ Long term debt—issuance (#111)	0.055	0.054	0.066	0.078	0.077	0.096	0.112
− Long term debt—reduction (#114)*	0.038	0.047	0.047	0.056	0.066	0.069	0.070
+ Changes in current debt (#301)*	<0.001	<0.001	<0.001	−0.011	−0.003	−0.006	−0.006
+ Financing activities—other (#312)*	—	—	—	—	−0.001	<0.001	<0.001
= Financing activities—net cash flow (#313)	—	—	—	—	0.061	0.145	0.156
+ Exchange rate effect (#314)*	—	—	—	—	<0.001	<0.001	<0.001
= Cash and cash equivalent—Inc. (Dec.) (#274)	—	—	—	—	−0.001	0.024	0.003
Sources of funds—other (#218)*	0.015	0.014	0.015	0.025	—	—	—
Uses of funds—other (#219)*	0.017	0.013	0.016	0.026	—	—	—
Working capital change—other (#236)*	0.036	0.017	0.032	0.008	—	—	—

*Indicates that the item has been recoded as zero if it were either missing or combined with other data items.

Table 9
The sample period is 1971–1998 Financial firms and utilities are excluded.
The variables are as follows (Compustat data item numbers in parentheses). Book value of assets is total assets (#6). Sales is net sales (12). Book value of debt is the sum of debt in current liabilities (#34) plus long-term debt (#9). Dividend is cash dividend (#127). Capital investments is capital expenditures (#128) + increase in investments (#113) + acquisitions (#129) + other use of funds (#219) − sale of PPE (#107) − sale of investment (#109). Change in working capital is the working capital change-other (#236) plus change in cash (#274) plus change in short term debt (#301). Internal cash flow is income before extraordinary items (#123) plus depreciation and amortization (#124) and some other extraordinary flows. Financing deficit is dividend, plus investments, plus change in working capital minus operating cash flow after interest and taxes. Net debt issued is issuance of long-term debt (#111) minus reduction of long-term debt (#114). Net equity issued is sale of common stock (#108) minus purchase of common stock (#115). Book leverage is defined as the ratio of book value of debt divided by book debt plus book equity.

Variable	Observation	Mean	Standard deviation	Minimum	Maximum
Book value of assets (in millions of 1992 $)	114,994	657.18	2,306.69	0.18	31,535.86
Sales (in millions of 1992 $)	115,049	714.20	2,232.51	0.00	29,950.10
Book value of debt (in millions of 1992 $)	115,089	180.93	638.63	0.00	8,126.32
Dividends (in millions of 1992 $)	115,041	12.96	55.07	0.00	790.14
Capital investments (in millions of 1992 $)	114,672	66.17	246.13	−88.17	3,326.06
Δ Working capital (in millions of 1992 $)	114,662	7.57	57.16	−469.44	650.93
Internal cash flow (in millions of 1992 $)	114,689	75.99	276.75	−38.69	3,725.55
Financing deficit (in millions of 1992 $)	114,647	10.57	72.44	−467.35	889.64
Issuance of long-term debt (in millions of 1992 $)	111,970	33.97	131.79	0.00	1,829.01
Reduction of long-term debt (in millions of 1992 $)	115,064	23.92	93.52	0.00	1,384.43
Net debt issued (in millions of 1992 $)	111,754	8.10	63.84	−373.25	808.03
Sale of common stock (in millions of 1992 $)	112,663	5.95	24.82	0.00	351.78
Purchase of common stock (in millions of 1992 $)	115,084	2.46	16.37	0.00	315.86
Net equity issued (in millions of 1992 $)	112,363	3.33	23.72	−235.44	300.56
Total net external financing (in millions of 1992 $)	109,702	11.40	72.51	−430.07	903.19

Cash dividend/net assets	115,173	0.01	0.03	0.00	0.29
Capital investment/net assets	114,961	0.15	0.20	−0.98	1.84
Net increase in working capital/net assets	114,921	0.02	0.31	−3.85	1.39
Internal cash flow/net assets	114,949	0.09	0.33	−4.65	1.34
Financing deficit/net assets	115,611	0.09	0.32	−1.04	3.37
Gross debt issued/net assets	112,147	0.11	0.21	0.00	2.71
Net debt issued/net assets	112,325	0.02	0.16	−1.14	1.14
Net equity issued/net assets	112,799	0.08	0.26	−0.27	2.95
Net external financing/net assets	110,609	0.09	0.32	−1.02	3.37
Current maturity of long-term debt/net assets	105,574	0.04	0.10	0.00	1.52
Change in long-term debt/net assets ratio	104,042	0.00	0.15	−1.07	1.13
Long-term debt/total assets	115,310	0.19	0.19	0.00	1.32
Book leverage	115,338	0.37	0.33	−2.58	4.64
Tangibility (net fixed assets/total assets)	115,029	0.34	0.23	0.00	0.95
Market value of assets/book value of assets	90,721	1.66	1.54	0.46	18.44
Profitability (operating income/assets)	114,872	0.09	0.20	−2.58	0.52

Table 10
This table presents pair-wise correlations among key variables
p-values are provided in parentheses. Table 4 provides variable definitions.

Variable		DIV	*X*	ΔWC	CF	DEF	GD	ND	NE	NT	LEV	TNG	MBK	SLS	PROF
Cash dividend/net assets	DIV	1.00													
Investment/net assets	*X*	−0.04													
		(0.00)	1.00												
ΔWorking capital/net assets	ΔWC	0.01	−0.18												
		(0.00)	(0.00)	1.00											
Internal cash flow/net assets	CF	0.16	0.06	0.53											
		(0.00)	(0.00)	(0.00)	1.00										
Financing deficit/net assets	DEF	−0.11	0.37	0.27	−0.37										
		(0.00)	(0.00)	(0.00)	(0.00)	1.00									
Gross LT debt issued/net assets	GD	−0.10	0.28	0.01	−0.10	0.34									
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	1.00								
Net LT debt issued/net assets	ND	−0.02	0.35	0.13	−0.05	0.48	0.52								
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	1.00							
Net Equity issued/net assets	NE	−0.11	0.22	0.25	−0.35	0.80	0.03	−0.05							
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	1.00						
Net external financing/net assets	NT	−0.11	0.38	0.27	−0.38	1.00	0.34	0.47	0.81						
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	1.00					
Total debt/book capitalization	LEV	−0.17	0.09	−0.16	−0.12	0.04	0.41	0.15	−0.08	0.04					
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	1.00				
Tangibility	TNG	0.09	0.17	−0.11	0.08	−0.07	0.07	0.05	−0.12	−0.07	0.16				
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	1.00			
Market/book assets	MBK	−0.01	0.14	0.02	−0.22	0.36	0.00	0.01	0.41	0.36	−0.14	−0.11			
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.25)	(0.06)	(0.00)	(0.00)	(0.00)	(0.00)	1.00		
Log Sales	SLS	0.32	−0.08	0.06	0.28	−0.26	−0.04	0.00	−0.31	−0.27	0.06	0.13	−0.31		
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.62)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	1.00	
Profitability	PROF	0.25	−0.02	0.34	0.74	−0.40	−0.08	−0.04	−0.41	−0.40	0.06	0.12	−0.29	0.43	
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	1.00

References

Asquith, P., Mullins Jr., D.W., 1986. Equity issues and offering dilution. Journal of Financial Economics 15, 61–89.

Barclay, M.J., Morellec, E., Smith, C.W., 2001. On the debt capacity of growth options. Unpublished working paper. University of Rochester, NY.

Barclay, M.J., Smith, C.W., 1995a. The maturity structure of corporate debt. Journal of Finance 50, 609–631.

Barclay, M.J., Smith, C.W., 1995b. The priority structure of corporate liabilities. Journal of Finance 50, 899–917.

Cadsby, C.B., Frank, M., Maksimovic, V., 1990. Pooling, separating, and semiseparating equilibria in financial markets. Review of Financial Studies 3, 341–367.

Chirinko, R.S., Singha, A.R., 2000. Testing static tradeoff against pecking order models of capital structure: a critical comment. Journal of Financial Economics 58, 417–425.

Eckbo, E., 1986. The valuation effects of corporate debt offerings. Journal of Financial Economics 15, 119–152.

Erickson, T., Whited, T., 2000. Measurement error and the relationship between investment and q. Journal of Political Economy 108, 1027–1057.

Fama, E., French, K., 2002. Testing tradeoff and pecking order predictions about dividends and debt. Review of Financial Studies 15, 1–33.

Fama, E., MacBeth, J.D., 1973. Risk, return, and equilibrium: empirical tests. Journal of Political Economy 81, 607–636.

Fischer, E.O., Heinkel, R., Zechner, J., 1989. Dynamic capital structure choice: theory and tests. Journal of Finance 44, 19–40.

Gilchrist, S., Himmelberg, C.P., 1995. Evidence on the role of cash flow for investment. Journal of Monetary Economics 36, 541–572.

Goyal, V.K., Lehn, K., Racic, S., 2002. Growth opportunities and corporate debt policy: the case of the U.S. defense industry. Journal of Financial Economics 64, 35–59.

Graham, J., 2000. How big are the tax benefits of debt? Journal of Finance 55, 1901–1941.

Graham, J., Harvey, C.R., 2001. The theory and practice of corporate finance: evidence from the field. Journal of Financial Economics 60, 187–243.

Harris, M., Raviv, A., 1991. The theory of capital structure. Journal of Finance 46, 297–356.

Helwege, J., Liang, N., 1996. Is there a pecking order? Evidence from a panel of IPO firms. Journal of Financial Economics 40, 429–458.

Kaplan, S.N., Zingales, L., 1997. Do investment-cash flow sensitivities provide useful measures of financing constraints? Quarterly Journal of Economics 112, 167–215.

Kumar, K., Rajan, R., Zingales, L., 2001. What determines firm size? Unpublished working paper. University of Chicago.

Lemmon, M.L., Zender, J.F., 2001. Looking under the lamppost: An empirical examination of the determinants of capital structure. Unpublished working paper. University of Utah and University of Arizona.

MacKay, P., Phillips, G., 2001. Is there an optimal industry financial structure? Unpublished working paper. University of Maryland.

Minton, B.A., Wruck, K.H., 2001. Financial conservatism: Evidence on capital structure from low leverage firms. Unpublished working paper. Ohio State University.

Myers, S.C., 1977. Determinants of corporate borrowing. Journal of Financial Economics 5, 147–175.

Myers, S.C., 1984. The capital structure puzzle. Journal of Finance 39, 575–592.

Myers, S.C., 2001. Capital structure. Journal of Economic Perspectives 15, 81–102.

Myers, S.C., Majluf, N., 1984. Corporate financing and investment decisions when firms have information that investors do not have. Journal of Financial Economics 13, 187–221.

Rajan, R.G., Zingales, L., 1995. What do we know about capital structure? Some evidence from international data. Journal of Finance 50, 1421–1460.

Ross, S., 1977. The determination of financial structure: the incentive signaling approach. The Bell Journal of Economics 8, 23–40.

Shyam-Sunder, L., Myers, S.C., 1999. Testing static tradeoff against pecking order models of capital structure. Journal of Financial Economics 51, 219–244.

Smith, C.W., Watts, R.L., 1992. The investment opportunity set and corporate financing, dividend and compensation policies. Journal of Financial Economics 32, 263–292.

Titman, S., Wessels, R., 1988. The determinants of capital structure choice. Journal of Finance 43, 1–21.