

**Is the KZ Index Useful?
New Evidence on Measuring Financial Constraints***

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ABSTRACT

Using rich qualitative information disclosed by firms, we evaluate the KZ index as a measure of financial constraints. In a large and diverse sample, we find that only two of the five components of the KZ index are robustly related to financial constraints categories derived from qualitative disclosures. Estimating models similar to those underlying the KZ index, the correlation between an updated index we construct and the traditional KZ index is approximately zero. We sort through many factors that have been associated with financial constraints. We find that firm size and age are particularly useful empirical predictors of constraints and propose a measure of constraints based on these characteristics.

JEL Classification: G31; G32; D92

Key words: KZ index; financial constraints; investment; cash flow; qualitative information

1. Introduction

Measuring financial constraints is an important practical issue in corporate finance research. In an influential paper, Kaplan and Zingales (1997) use rich qualitative information collected from disclosure filings to directly categorize a firm's level of financial constraints. As Kaplan and Zingales (1997) demonstrate, investment-cash flow sensitivities are not closely related to financial constraints categories, casting doubt on the investment-cash flow approach to measuring constraints. In light of this finding, researchers have turned to exploring alternative ways of measuring constraints.

The Kaplan and Zingales (KZ hereafter) direct approach to categorizing financial constraints is not practical for large samples since it requires extensive hand data collection. However, KZ report that their direct measure of constraints is correlated with several quantitative variables. Building on this, Lamont, Polk, and Saa-Requejo (2001) use the KZ sample and estimate an ordered logit model in which a firm's directly categorized level of constraints is modeled as a function of five Compustat-based variables. The coefficients from this model have been widely used in the literature to construct what is commonly referred to as the KZ index of financial constraints. This index loads positively on leverage and Q, and negatively on cash flow, cash levels, and dividends.

While the KZ index is widely used, there are reasons to question whether this use is appropriate. First, the coefficients underlying the index are derived from a very small and specially selected sample of firms using data from the 1970s and early 1980s. Second, the classification scheme used by KZ to categorize financial constraints could result in a mechanical link between constraints categories and index variables. For example, KZ use a firm's cash holdings in their categorization procedure. As a result, a firm's level of cash is partially built

into the dependent variable of the index regression. Thus, a significant loading on cash as an independent variable is both unsurprising and uninformative. Related comments apply to the dividend component of the index.

In this paper, we critically evaluate the KZ index. We follow the KZ approach of using direct qualitative information to categorize financial constraints, but we make modifications to address the concerns discussed above.¹ In particular, we deliberately choose a large and broadly representative sample of modern firms (356 randomly selected firms from 1995-2004). In addition, we use a constraints assignment procedure that is based entirely on qualitative statements made by firms rather than a mix of qualitative and quantitative information. This treatment should purge our estimates of any mechanical relation that arises from using the same information to code both the dependent and independent variables.

After making these modifications, we estimate ordered logit models that are analogous to the models underlying the KZ index. For two of the five index components, cash flow and leverage, we uncover coefficient estimates that are significant and agree in sign with KZ index. For two of the other five components, Q and dividends, the coefficients flip in sign across estimated models and in many cases are insignificant, particularly for the dividend variable. Finally, the remaining index component, cash holdings, generally has a positive and significant coefficient in models predicting constraints. This finding stands in sharp contrast to the negative loading of cash holdings in the KZ index. The positive effect we uncover is consistent with the hypothesis that constrained firms hold elevated levels of cash for precautionary reasons.

¹ The qualitative information we use to classify a firm's constraints status includes statements made by managers regarding the strength of a firm's liquidity position and their assessments of their firm's ability to raise any needed external funds. Additional details are provided below.

Clearly these coefficient estimates raise serious questions about the use of the traditional KZ index as a measure of financial constraints. To explore further, we calculate the traditional KZ index for the entire Compustat universe and compare this to an index constructed using the coefficient estimates from one of our baseline models. We find that the correlation between the traditional index and our new and improved version is approximately 0. In our view, this provides compelling evidence that the KZ index is likely to be a poor measure of financial constraints. Thus, it would appear prudent for researchers to apply extreme caution when using the traditional KZ index or interpreting results based on index sorts. These sorts may have nothing to do with actual financial constraints.

We are certainly not the first to question the usefulness of the KZ index as a measure of financial constraints. Recently, Whited and Wu (2006) use an Euler equation approach from a structural model of investment to create an alternative index (the WW index). As they report, the correlation between the Whited and Wu index (WW hereafter) and the KZ index is also approximately 0. Along other lines, Almeida, Campello, and Weisbach (2004) select several different firm characteristics that are often associated with constraints and report that these characteristics are not closely related to the KZ index.

These prior critiques of the KZ index are certainly informative and raise some important questions about how to measure financial constraints. However, in our view, this issue is not completely settled. In particular, the WW index requires certain technological assumptions regarding the investment process that may not be valid. Similarly, the traditional approach of selecting firm characteristics that indicate heightened constraints rests on *a priori* assumptions that may or may not hold. Our analysis exploits the insight of KZ that something may be learned by directly examining statements made by managers regarding their ability to finance investment

opportunities. If one does not have faith in this insight, it immediately follows that the KZ index is unlikely to be a useful measure of constraints. If one does have faith in the KZ insight, our results, which exploit this approach, lead to the same conclusion. Thus, we believe we make a particularly strong case that the KZ index should not be used as a measure of financial constraints.

A natural question that arises from our analysis is whether we can offer any new evidence on more appropriate ways of measuring financial constraints. To consider this issue, we examine the relation between a large set of quantitative variables and financial constraints categories derived from qualitative information. We find that some of the variables that others have identified as indicators of constraints are not significantly related to constraints categories. Two variables that do appear to be closely related to constraints are firm size and age. An appealing feature of these variables is that they are much less endogenous than most of the other variables that are frequently used as indicators of constraints.

Once we control for firm size and age, the only other variables that consistently predict a firm's constraints status are leverage and cash flow. However, given the endogenous nature of these variables, particularly the leverage variable, we are hesitant to use an index that is derived from a model that includes these additional factors. In addition, as we explain below, typical disclosure practices may lead us to underdetect the presence of constraints in firms with low leverage, thus possibly leading to a spurious coefficient on leverage. Given these concerns, we recommend that researchers rely solely on firm size and age to identify constrained firms, an approach that has a great deal of intuitive appeal.

To provide further guidance on the role of size and age in financial constraints, we examine different subsamples grouped by firm characteristics and time period. While there is

some minor variation in the estimates across groups, in general the form of the relation between size, age, and financial constraints categories is quite robust. It does appear that the role of both size and age in predicting constraints is nonlinear. In particular, as very young and small firms start to mature and grow, the predicted likelihood of being financially constrained falls sharply. After this initial drop, the incremental effect of age and size on constraints, while still present, is much more limited. From a practical perspective, this leads us to recommend that researchers use a financial constraints index that includes linear and quadratic terms for firm size and age, a measure that we refer to as the quadratic size-age or QSA index. If a researcher is studying a sample that is already restricted to very large and mature firms, the role of firm size and age as indicators of constraints may be quite limited.

Since all measures of financial constraints have some shortcomings, we attempt to provide corroboratory evidence regarding our quadratic size-age index. We first note that the literature on constraints provides extensive evidence that firm size, and to a lesser extent age, are frequently associated with diminished constraints. We then turn to a specific methodology for detecting constraints, the cash flow sensitivity of cash approach advanced by Almeida, Campello, and Weisbach (2004). If we sort firms into constrained and unconstrained groups using our quadratic size-age index, we do indeed find that the constrained firms display a significant sensitivity of cash to cash flow, while the unconstrained firms do not. This evidence increases our confidence in our quadratic size-age index as a reasonable measure of constraints. While we cannot prove that our index is the optimal measure of constraints, it has many advantages over other approaches including its intuitive appeal, its independence from various theoretical assumptions, and the presence of corroborating evidence from an alternative approach.

One shortcoming of our size-age index is that it will not pick up time variation in constraints arising from changing market conditions. Thus, we expect that it will do a better job in comparing a set of firms within a year rather than across years. The use of year dummies can alleviate this shortcoming. To better understand the role of macro factors in financial constraints, we add to our ordered logit models several variables that others have suggested as proxies for the overall level of constraints in the economy. Consistent with the work of Cohn (2008), we find that several of these factors including SEO activity, yield spreads on corporate bonds, and GDP growth are related to constraints in the expected manner. This adds to the existing evidence on macro variation in financial constraints. Inclusion of these macro factors has little impact on the estimated relation between firm size, age, and financial constraints.

The goal of the KZ paper was not to create a definitive index of financial constraints, but rather to show that investment-cash flow sensitivities may not be useful measures of constraints.² Given the data we have gathered, it is informative to revisit this part of their study. Our findings here confirm the main conclusions of KZ. In particular, using purely qualitative measures of constraints, we also find that investment-cash flow sensitivities are not monotonically increasing in a firm's classified level of constraints. Given this evidence, it would seem prudent to proceed cautiously using both the KZ index and investment-cash flow sensitivities as measures of financial constraints. There are significant problems with both approaches.

The rest of the paper is organized as follows. In section 2 we detail our sample selection procedure and our assignment of firms into financial constraints groups. In section 3 we critically evaluate the KZ index by studying the relation between constraints categories and the

² For a debate on interpreting the KZ evidence, see the comments by Fazzari, Hubbard, and Petersen (2000) and Kaplan and Zingales (2000). An extensive literature has developed exploring the usefulness of the investment-cash flow approach. See, for example, Cleary (1999), Erickson and Whited (2000), Alti (2003), and Moyen (2004).

KZ index components. In section 4 we study the relation between constraints categories and many other factors, with a particular emphasis on firm size and age. In section 5 we revisit the KZ evidence on investment-cash flow sensitivities. Section 6 concludes.

2. Sample Construction and Categorization of Financial Constraints

2.1 Sample selection

Our goal is to study a large and representative sample of modern public firms. Given the high costs of data collection, we set an initial target sample size of 400 firms. We begin with the set of all Compustat firms in existence at some point between 1995 and 2004. From this universe, we eliminate all financial firms (SIC codes 6000-6999), regulated utilities (SIC codes 4900-4949), and firms incorporated outside the U.S. We then sort firms by Compustat identifier and select for further analysis every 24th firm. This procedure results in a random sample of 407 firms that should be broadly representative of the overall Compustat universe.

After selecting this initial sample, we locate each firm's annual reports and 10-K filings from Lexis-Nexis and SEC EDGAR. We restrict the sample to firm-years for which we could locate at least one of these electronic filings. In addition, we require the availability of Compustat data to construct the various explanatory variables used in the subsequent analysis. Finally, we impose the requirement that the firm has nonzero sales and assets in the observation year. These procedures result in a final sample of 356 unique firms and 1848 firm-years during the 1995-2004 time period.

Our sampling procedures differ substantially from KZ who study 49 manufacturing firms (719 observations) from 1970 to 1984. Not only is our sample substantially larger and more recent, it is randomly selected and thus should be broadly representative of the universe of

publicly traded firms. In contrast, the KZ sample is distinctly non-random. In particular, as a consequence of selecting firms from the original Fazzari, Hubbard, and Petersen (1988) (FHP hereafter) study, the KZ sample requires firms to (a) pay low dividends, (b) survive for many years, (c) operate in a manufacturing industry, (d) be sufficiently large to be covered by Valueline, and (e) exhibit high sales growth. These sampling choices may have a substantial effect on inferences regarding the determinants of a firm's financial constraints status.

In Table 1 we present sample summary statistics. All variables are constructed following the KZ treatment. A couple of observations are worth noting. First, our sample exhibits a high degree of heterogeneity for each of the reported variables. This is to be expected, since our random sampling procedure should select a diverse set of firms. Second, our sample is predictably different from the KZ sample on many dimensions. In particular, comparing the medians in Table 1 to the corresponding figures in KZ, our sample firms are typically smaller and have lower (normalized) levels of cash flow and investment. These differences suggest that our sample may on average exhibit higher levels of financial constraints than the KZ sample. Interestingly, our median sample firm tends to hold substantially more cash than firms in the KZ sample. One possible reason for this difference is that smaller, more constrained firms may choose to hold more cash for precautionary reasons.

2.2 Collecting financial constraints information

Following KZ, we collect detailed qualitative information by carefully reading annual reports and 10-K filings. For each firm-year, we read the annual letter to shareholders and the management discussion and analysis (MD&A) section. In addition, we perform an electronic search through the entire text of the annual report and/or 10-K to identify all sections of text that

include the following keywords: financing, finance, investing, invest, capital, liquid, liquidity, note, covenant, amend, waive, violate, and credit.

Using these procedures, we extract every statement that pertains to a firm's ability to raise funds or finance its current or future operations.³ In many cases we identify multiple such statements. We assign to each individual statement an integer code from 1 to 5 with higher (lower) numbers being more indicative of the presence (lack) of constraints. These codes are based on the description provided by KZ regarding their categorization scheme. Later, we aggregate these codes to derive a single overall categorization of a firm's financial constraints status in any given year. It is important to note that there are literally hundreds of different types of relevant statements made by sample firms. Grouping this large number of statements into 5 categories necessarily requires some judgment. Specific examples of how we code different types of statements are reported in the appendix.

Following the spirit of the KZ algorithm, we assign to category 1 all statements that indicate that a firm has excessive or more than sufficient liquidity to fund all of its needs. In category 2 we place all statements that indicate that a firm has adequate or sufficient liquidity to fund its needs. The main difference between category 1 and 2 is the strength of the firm's language. In category 3 we place all statements that provide some qualification regarding the firm's ability to fund future needs, but do not indicate any type of current problem. Most of these statements are soft warnings, often generic or boilerplate in character, indicating that under some possible future scenario the firm could have difficulty raising funds or financing desired investments. Category 3 also includes all statements that are opaque and thus not easy to classify into the other groups.

³ We were assisted by two trained accountants in our searching and categorization efforts. All filings were searched independently by at least two individuals to minimize the probability of missing any relevant disclosure.

In category 4 we place all statements that indicate some current liquidity problem, but with no direct indication that these problems have led to a substantive change in the firm's investment policy or overt financial stress. This would include difficulties in obtaining financing or the postponing of a security issue. Finally, category 5 includes all cases of clear financial problems/constraints including a current and substantive covenant violation, a revelation that investment has been affected by liquidity problems, going concern statements, and involuntary losses of usual sources of credit.⁴

2.3 Categorization of firm's overall financial constraints status

We proceed to assign each firm-year to a single financial constraints group. Borrowing from the KZ algorithm and terminology, we create five mutually exclusive groups: NFC (not financially constrained), LNFC (likely not financially constrained), PFC (potentially financially constrained), LFC (likely financially constrained), and FC (financially constrained). We place in the NFC group firms with at least one statement coded as a 1 and no statement coded below a 2. These are firms that indicate more than sufficient liquidity and reveal no other evidence to the contrary. In the LNFC category we place all firms with statements solely coded as 2s. These are firms that indicate adequate or sufficient liquidity with no statements of excessive liquidity and no statements indicating any weakness.⁵

⁴ Some firms indicate that a covenant had been waived or amended. Often the firm indicates that the violation was technical in nature and not of substantive concern. For example, some firms indicate that a covenant was routinely waived and others indicate that an accounting ratio fell below a threshold because of a one time event such as an asset sale or special charge. Since these cases are quite different and less serious than current violations, in our baseline coding we ignore waived/amended covenants. Alternative treatments of these cases are discussed below.

⁵ We also place in this group the few observations with no useful qualitative disclosure that could be used to ascertain a firm's financial constraints status. If we exclude these observations, the results we report below in Table 3 are substantively unchanged.

In the PFC category we place all firms with mixed information on their constraints status. Specifically, we include all observations in which the firm reveals a statement coded as 2 or better (indicating financial strength), but also reveals a statement coded as 3 or worse (indicating possible financial weakness). We also include in this category cases in which all of the firm's statements are coded as a 3.

The LFC category includes firms with at least one statement coded as a 4, no statement coded as a 5, and no statement coded better than a 3. These are firms that have indicated some current liquidity problems, with no offsetting positive statement and no statement that is so severe that they are brought into the lowest (FC) category. Finally, all observations with at least one statement coded as a 5 and no other statement coded better than a 3 are assigned to the FC category. These are firms who clearly indicate the presence of constraints with no strong offsetting positive revelation.

We refer to this initial categorization scheme as qualitative scheme 1 and report a sample breakdown in column 1 of Table 2. One peculiar feature of this categorization procedure is that a large number of firms are placed in the PFC category (32.36% vs. 7.30% in the KZ sample). This elevated rate primarily reflects the fact that many firms in our sample provide boilerplate generic warnings about future uncertainties that could affect the firm's liquidity position. These statements place many firms that otherwise report strong financial health into the PFC category. In our estimation, many of these generic warning statements are uninformative. In particular, they appear to be included as a blanket protection against future legal liability and often pertain to unforeseen or unlikely contingencies that could potentially affect almost any firm.

In light of these observations, we prefer an alternative assignment procedure which ignores all generic or soft non-specific warnings regarding a firm's future liquidity position. This

procedure, which we refer to as qualitative scheme 2, is identical to qualitative scheme 1 outlined earlier except for ignoring this one class of statements. As we report in column 2 of Table 2, this modification moves many (a few) firms from the PFC grouping up into the LNFC (NFC) grouping. The frequency of firms in each group now more closely resembles the figures reported by KZ, although our sample still has more firms (fewer firms) in the weaker categories (strongest category).

The categorization schemes outlined above deliberately differ from the KZ procedure in that we ignore quantitative information on both the size of a firm's cash position and its recent dividend/repurchase behavior. As we discuss earlier, we do this because it seems inappropriate to incorporate these factors into the dependent variable in an ordered logit model when they are also included as explanatory variables. This treatment will lead to uninformative coefficients that are hardwired and potentially misleading in terms of their ability to describe the underlying relation between quantitative variables and qualitative disclosures of constraints.

For completeness, we experiment with modifying our qualitative scheme 2 categorization procedure to more closely match KZ by including quantitative information on dividends, repurchases, and cash balances. In particular, we move a firm's constraints status one notch upwards in a given year (e.g., from PFC to LNFC) if any of the following criteria are met: (a) the firm initiates a dividend, (b) the firm has a material increase in dividends (change in dividends/assets > 5th percentile of dividend increasers), (c) the firm repurchases a material number of shares (repurchases/assets > sample 5th percentile of repurchasers), (d) the firm's balance of cash and marketable securities normalized by capital expenditures falls in the top sample quartile. The resulting categorization is referred to in what follows as the qualitative/quantitative categorization scheme. We report in column 3 of Table 2 the percentage

of firms in each of the constraints categories using this alternative. The breakdowns here now more closely resemble the figures reported by KZ, with the modal category being firms in the most unconstrained (NFC) category.

3. Predicting Financial Constraints using Components of the KZ Index

3.1 Initial Models

In this section we estimate ordered logit models using the same specification that underlies the KZ index.⁶ For reasons we discuss above, the dependent variable in these models is derived solely from the qualitative information disclosed by firms pertaining to financial constraints. The dependent variable assumes a value of 1 for the most unconstrained (NFC) observations, up to 5 for the most constrained (FC) observations. Each firm-year is treated as a single observation and all explanatory variables are winsorized at the 1% tails. Variable definitions are borrowed directly from KZ and Lamont, Polk, and Saa-Requejo (2001).

We report our initial baseline models in columns 1 and 2 of Table 3 using the two different qualitative schemes to construct the dependent variable. As the figures illustrate, the coefficients on cash flow, Q, and debt, are significant (5%, 1% and 1% levels respectively) and of the same sign (negative, positive, and positive respectively) as in the KZ index. Thus, while the exact magnitudes differ from the KZ index, the coefficients are in general agreement with the index. The positive coefficients on the other two explanatory variables, dividends and cash, are both opposite in sign to their representation in the KZ index, and in the case of cash significantly so ($p < .01$). This suggests that these factors, particularly cash, may be related to financial constraints in a manner that is opposite of what is embodied in the KZ index.

⁶ The KZ index model was reported by Lamont, Polk, and Saa-Requejo (2001) and is calculated as $-1.002(\text{CashFlow}/K) + 0.283(Q) + 3.139(\text{Debt}/\text{Capital}) - 39.368(\text{Div}/K) - 1.315(\text{Cash}/K)$.

The estimates in these initial models raise some general questions about the validity of the KZ index as a measure of constraints. Of particular concern is the role of cash holdings as an indicator of constraints status. Before drawing conclusions, in columns 3-6 of Table 3 we consider some variations in our modeling choices. The dependent variable is based on qualitative scheme 2, as we believe that this is likely to be a more informative indicator of constraints. The corresponding results for qualitative scheme 1, which we do not report in the interest of brevity, are similar in character.

In column 3 of Table 3 we present estimates for a model with observations in the lower/upper 1% tails trimmed (i.e., eliminated) rather than winsorized. The coefficients here are all of the same signs as in the initial models, with some minor changes in significance levels. In column 4 we winsorize the explanatory variables at the 5% tail points. With the exception of dividends, the coefficients again have the same signs and similar significance levels to the earlier models. The coefficient on dividends in this model is negative and significant ($t=2.18$), thus now agreeing in sign with the KZ index.

While the preceding specifications use PPE to normalize some of the explanatory variables, it is also common to normalize by book assets. As we report in column 5, if we make this change, the coefficients on cash flow and debt continue to be significant and have signs that agree with the KZ index. However, the coefficients on Q and dividends are both insignificant, and the sign of the coefficient on Q now disagrees with the KZ index. In this model the positive coefficient on cash remains of an opposite sign to its loading in the KZ index, and it continues to be at least marginally significant ($t=1.71$).

Since our sample contains many small firms, in column 6 we impose a requirement that the firm must have book assets exceeding \$10 million. The coefficients on cash flow and debt

continue to be significant and agree in sign with the KZ index. The coefficients on Q and dividends remain insignificant, although they do agree in sign with the index. Similar to the other models, the coefficient on cash remains stubbornly positive and significant ($t=2.43$).

A few general conclusions emerge from this analysis.⁷ First, it does appear that a firm's cash flow and its debt level are consistently significantly related to qualitative indicators of a firm's constraints status in a way that is captured by the KZ index. The evidence on Q and dividends is more mixed. In some of the estimated models the coefficients on these variables are both significant and in agreement in sign with the KZ index. However, in some models the coefficients are insignificant, and in some cases the sign on the coefficient disagrees with the index. Since one could argue that any/all of these models are a reasonable way to model the available data, this evidence must be characterized as inconclusive. Certainly no strong case can be made that the KZ index correctly captures the ability of these two factors to predict constraints. This is particularly true for the dividend variable which is almost always insignificant.

Finally, the evidence on the cash variable is interesting and suggests that firms with more cash are actually more likely to be constrained, exactly the opposite of what is embodied in the KZ index. Our finding on cash holdings is consistent with the notion that constrained firms store cash for precautionary reasons, a hypothesis that has substantial prior support in the literature (e.g., Calomiris, Himmelberg, and Wachtel (1995), Opler, Pinkowitz, and Stulz (1999), and Almeida, Campello, and Weisbach (2004)). One can view our finding here as adding to this body of evidence.

⁷ We have conducted numerous other robustness checks including (a) adding year dummies to the models, (b) treating covenant waivers and amendments as equivalent to non-waived covenant violations, and (c) restricting attention only to firms with positive net income. The results with these modifications are quite similar in character to what we report in Table 3. In a few isolated cases some coefficients become insignificant at conventional levels.

The findings we present suggest that researchers using the KZ index should proceed with extreme trepidation. Our coefficients estimates, which are derived using a refined dependent variable and a large, modern, and representative sample, are not, as a group, strongly related to the KZ index coefficients. To make this notion more precise, we use the coefficients in our baseline model (column 2 of Table 3) to create a new and improved version of the KZ index. We then compute index values for the entire Compustat universe from 1995-2004 using both the new and improved index and also the traditional KZ index. In creating index values, we winsorize all Compustat variables at the 1% tails to minimize the effect of outliers. Across the population of Compustat firms, the correlation between the traditional index and the new and improved version is -0.023. This finding raises serious doubt about the usefulness of the KZ index as a measure of financial constraints.

3.2 Sampling choices and financial constraints

Our preceding results strongly suggest that the KZ index will be a poor measure of financial constraints for broad samples of modern firms. However, it remains possible that this index is useful for samples that more closely resemble the KZ sample. Since the KZ paper was intended to comment on the work of FHP, their sample is restricted to large, high growth, low-dividend, manufacturing firms that also satisfy a survival requirement.

To consider the impact of sampling choices on our findings, we report in columns 1-6 of Table 4 model estimates for subsamples that more closely match the KZ sample. The estimates in column 1 are for manufacturing firms only. The estimates in column 2 are for firms that are ranked in the top 1500 of the Compustat universe in book assets, a size cut that should roughly match the Valueline listing requirement in the original FHP sample. In column 3 we restrict

attention to firms with a dividend payout ratio of less than .1, a cutoff used in the original FHP categorization. In column 4 we consider only observations in which the firm's most recent annual real sales growth is positive. In column 5 we impose the condition that a firm survives from year t to year $t+3$ (year t to $t+2$ for the 2004 observations). Finally, in model 6 we require that observations satisfy all of the conditions imposed in columns 1-5.

The results in Table 4 using the various subsamples are generally similar in character to the corresponding earlier Table 3 estimates for the entire sample. The coefficients on cash flow and debt always agree in sign with the KZ index and are in many cases significant, particularly for the debt variable. The coefficients on Q and dividends flip in sign across the different subsamples and are only occasionally significant and consistent in sign with the index. Finally, the coefficient on cash always has a positive sign, disagreeing with the traditional KZ index, and in all cases but one the estimated coefficient is significant at the 10% level or better.

This analysis indicates that differences between our estimates and the corresponding coefficients underlying the KZ index do not appear to reflect simple differences in sample characteristics. Thus, we conclude that even if one is studying large mature firms such as those in the KZ sample, the KZ index is still unlikely to be a useful measure of constraints.

3.3 Bringing in quantitative information

Since differences in sample characteristics do not appear to cause the difference between our estimates and the KZ index coefficients, we are confronted with two remaining possibilities. First, it is possible that there has been a secular change in the determinants of financial constraints. Alternatively, it is possible that the KZ index estimates are driven by the

inappropriate inclusion of the same quantitative information in the dependent and independent variables.

To investigate the latter possibility, we present in column 7 of Table 4 estimates for an ordered logit model that uses the mixed qualitative/quantitative dependent variable introduced earlier. These findings are easy to characterize. All of the coefficients on the explanatory variables are significant and agree in sign with the KZ index. Moreover, if we create an index using these coefficients and correlate this with the traditional KZ index calculated over the Compustat universe, the correlation is a respectable .624. Thus, once we include quantitative information in the constraints assignment procedure, our estimates are reasonably supportive of the KZ index. The character of these results is substantively unchanged if we vary the model specification along the lines of columns 3-6 of Table 3.

These findings appear to explain the difference between our main findings above and the KZ index. In most of our initial models, cash and dividends do not significantly predict constraints in the manner embodied by the traditional index. Once we modify the modeling to include cash and dividends in the financial constraints assignment procedure, as is the case in the KZ index modeling, we find that these characteristics are significantly related to constraints with a sign that agrees with the index. However, for obvious reasons it is of dubious value to rely on coefficients derived from a regression in which the same information is incorporated into the dependent and independent variables. This shortcoming, rather than secular changes in the determinants of financial constraints, appears to be the fatal flaw underlying the KZ index.

4. Beyond the KZ Index

4.1 Sorting through factors that may predict constraints

Given the preceding evidence, it is clearly imprudent for researchers to rely on the KZ index as a measure of financial constraints. However, as we discuss earlier, other approaches to measuring constraints also have some important potential shortcomings. How then should researchers proceed? To offer some guidance on this issue, we examine the empirical factors that are most closely associated with financial constraints categories in our sample. This evidence serves two purposes. First, it allows us to offer independent evidence on factors that others have used to measure constraints. Second, it allows us to propose some parsimonious ways of measuring constraints within the framework of inferring constraints from qualitative disclosures. This leads us to proposing an intuitively appealing measure of constraints that we believe has much to recommend it.

For quantitative factors that may be associated with constraints, we consider the five variables in the KZ index, the six variables in the WW index (cash flow, dividend payer dummy, leverage, firm size, industry sales growth, and firm sales growth), and the four variables in the Almeida, Campello, and Weisbach (2004) (ACW hereafter) sorts (payout ratio, size, bond rating dummy, and commercial paper rating dummy). In addition, we consider firm age, a variable that other authors have associated with constraints (e.g., Rauh (2006), and Fee, Hadlock, and Pierce (2009)). While there is a close relationship between some of these variables, since each study uses different definitions, we consider all 16 variables.

We begin by estimating separate ordered logit models predicting a firm's constraints level (using qualitative scheme 2) as a function of each of these variables individually. The associated coefficients from these 16 regressions are reported in column 1 of Table 5. As the table illustrates, the coefficients on the five KZ variables are similar in character to what we report earlier, with some changes in significance levels.

Turning to the WW variables, the WW-cash flow and WW-leverage variables have the same signs and significance levels as their KZ counterparts. The firm size variable is negative and highly significant, indicating that larger firms are generally less constrained. Two of the other three WW variables are insignificant (dividend dummy and industry sales growth), while the other variable (firm sales growth) is significant but with a sign that is opposite of its representation in the WW index. This evidence suggests that firm size (log of assets) may be the only component of the WW index that helps to predict constraints above and beyond the factors that are included in the KZ index. Since WW propose using their six index components together, we report in column 2 coefficients from a single ordered logit model that includes all of the WW variables. The basic conclusion that emerges from these estimates is the same. Only cash flow, leverage, and firm size have significant coefficients that agree in sign with the WW index.

Moving to the ACW variables, the associated estimates in column 1 confirm again that firm size is closely related to financial constraints. Distributions (i.e., dividends plus repurchases) appear not to be significant predictors of financial constraints categories. The two variables that are unique to the ACW study are the variables indicating the lack of a bond or commercial paper rating. As the table illustrates, the coefficients on both of these variables are positive and significant, supporting the ACW assertion that unrated firms are generally more constrained. Finally, the coefficient in column 1 on the firm age variable is negative and highly significant, indicating that older firms tend to be less constrained.

The preceding results cast doubt on a subset of the factors that others have identified as proxies for financial constraints. However, we are still left with a large set of factors, many of which are highly correlated with each other. To choose from this set, we focus on firm size (log of assets) and age (years firm is public). These characteristics are (a) intuitively appealing, (b)

highly related to constraints within our sample, and (c) more exogenous than the others factors we consider.⁸ Given these desirable features, we include firm size and age in all future models and ask the practical question of whether the other variables in Table 5 have marginal explanatory power after size and age have been controlled for. We address this question by selecting each variable, one at a time, and then estimating ordered logit models with the selected variable plus size and age controls. The associated coefficient estimates are reported in column 3 of Table 5. Size and age coefficients in these models are always significant and of the expected sign (estimates not reported).

The results in column 3 are interesting. Only the cash flow and leverage variables emerge as factors with the correct signs that consistently predict constraints after size and age have been controlled for. The payout variables are significant, but always with the wrong sign. Many of the other variables, including the bond rating variable, become insignificant. This suggests that these variables may be reasonable measures of constraints viewed in isolation, but a large part of what they are capturing is likely related to firm size and age. If this is the case, using size and age directly is a more appealing approach.

Given the marginal explanatory power of cash flow and leverage, for completeness we report in column 4 coefficients from a parsimonious model that includes size, age, cash flow, and leverage as explanatory variables. As expected, all of these coefficients are highly significant. While it may be tempting to start using an index based on these coefficients, some caution is in order. First, several authors have noted that the endogenous nature of leverage may result in a nonmonotonic or sample-specific relation between leverage and financial constraints (e.g.,

⁸ The intuitive appeal of firm size and age as exogenous measures of constraints has been recognized by several researchers. In his comments on the Fazzari, Hubbard, and Petersen (1988) paper, Blinder (1988) specifically mentions these two factors as preferred measure of constraints. The published roundtable discussion and commentary at the end of that paper contains many similar reactions.

Acharya, Almeida, and Campello (2007), Hennessy and Whited (2007), Almeida, Campello, and Weisbach (2009)). If this is the case, it is not clear whether the linear role of leverage in our model estimated over a broad sample will apply in other contexts.

Adding to this concern, we suspect that there may be biases in qualitative disclosures that are systematically related to leverage and cash flow. In particular, constraints in our sample are often detected because of debt contracting events, for example covenant violations or tightening of credit terms. While constraints arising from these conditions may be important, it is possible that the most constrained firms may be entities with a limited or complete inability to borrow. This may be the situation facing firms with risky growth opportunities, high-levels of asymmetric information, and/or volatile cash flows. If an important tripwire that gets a firm classified as constrained is related to debt contracting, we will underdetect constraints for these firms. They have no covenants to violate or credit lines to lose. This could lead to a misleading coefficient on leverage, and to a lesser extent on cash flow, in the ordered logit models. Given these concerns, we believe that a more prudent approach is to rely solely on firm size and age as indicators of financial constraints status.

4.2 More evidence on size and age

Given the case we make above for using solely size and age as predictors of constraints, we present in column 1 of Table 6 estimates from a simple ordered logit model in which these two factors are the only explanatory variables. As the table illustrates, the coefficients are highly significant and of the expected sign. While these estimates could be used to create a simple

size-age index, a cursory examination of subsamples reveals nonlinear effects for both variables.⁹ We capture this nonlinearity in a simple way in column 2 by including quadratic terms. The linear terms on size and age are both negative, while quadratic terms are both positive. This indicates that as small and young firms start to grow and mature, the level of constraints initially drops sharply. However, as this process continues, the marginal effects of increases in size and age on constraints diminish in magnitude. The turning point of both quadratic relations is near the sample maximum, and thus the marginal effects do not appear to reverse in sign over any substantial part of the sample.¹⁰

The estimates in column 2 can be used to create an index that we will refer to as the quadratic size-age or QSA index. While we believe this is an appealing measure of constraints, it is prudent to take a closer look. We first consider the stability of the QSA index by splitting the sample in half by time period (1995-1999 and 2000-2004). We then estimate ordered logit models for each subperiod. As we report in columns 3 and 4 of Table 5, the coefficient estimates for the subperiods are reasonably close to one another and to the sample-wide estimates. To make this more precise, we create three indexes based on coefficients from the models in columns 2, 3 and 4. When we calculate these indexes for the entire Compustat universe, the

⁹ We note that the ordered logit model is a nonlinear model and size is defined in a nonlinear way (log of inflation adjusted assets). The nonlinear role of size and age in predicting constraints refers to nonlinearity above and beyond the nonlinear effects that are already present in our modeling approach and variable definitions.

¹⁰ The estimated turning point of relation for the size variable is approximately \$5 billion in assets representing the sample 95th percentile. The estimated turning point of the relation for the age variable is approximately 36 years corresponding to the sample 90th percentile. From a practical perspective, researchers using an index derived from the column 2 estimates may find it desirable to winsorize the size and age variables at these turning points.

resulting correlation between each pair of indices is in all cases .98 or greater.¹¹ This indicates that the QSA index is fairly stable across sample subperiods.

To further consider the stability issue, we collect out-of-sample data for 1990, a year substantially preceding our sample period. We randomly select 125 firms from 1990 with the requisite data available. Since larger and older firms were more likely to report their disclosure filings electronically in 1990, this sample is somewhat biased towards these mature firms. For the 1990 sample, we code the dependent variable in an analogous manner to our earlier coding.

Ordered logit estimates for the 1990 sample are reported in column 5 of Table 6. The coefficients are very similar in nature to the coefficients in the QSA index. More specifically, when we calculate index values based on these 1990 estimates and correlate this with the QSA index (i.e., the index based on column 2 coefficients estimated from 1995-2004), the correlation is still a healthy .97. Thus, even if we choose an alternative sample with somewhat different characteristics from an earlier year, the QSA index we propose is quite closely related to an index derived directly from the alternative sample.

Since earlier we raised the concern that we may underdetect constraints in firms with little or no leverage, in column 6 of Table 6 we report estimates restricted to the subsample of firms with some leverage. As the estimates reveal, this restriction does not have a major impact on the magnitude of the size and age coefficients. Moreover, the correlation between an index derived from these estimates and the QSA index is .99. In addition, in unreported results we experiment with creating indexes from models estimated over the subsamples of firms with above or below median leverage. The resulting two indexes both have a correlation of .96 or

¹¹ Following our earlier treatment, we winsorize all Compustat variables at the 1% tails when calculating index values. We maintain this treatment throughout the rest of the paper when calculating index correlations. All references to index correlations are measured over the 1995-2004 period.

greater with the QSA index. Thus, we find little evidence that leverage plays a large role in our estimated index.

Finally, we consider the possibility that the determinants of constraints may vary somewhat with industry characteristics. While it is not practical to consider different indexes for a large number of industries, in an attempt to gauge the sensitivity of our estimates to the character of a firm's industry, we estimate in column 7 of Table 6 a model restricted to the subset of manufacturing firms in our sample (SIC codes 2000-3999). The estimates on the size and age terms are reasonably close to the sample-wide estimates in column 2. Moreover, the correlation between an index derived from column 7 and the QSA index we propose is .99.

4.3 Corroboratory evidence

The preceding evidence indicates that firm size and age are closely related to qualitative disclosures regarding financial constraints. Moreover, the estimated quadratic relation between size and age and financial constraints appears to be fairly robust. This suggests that the QSA index should be a reasonable measure of constraints in a variety of contexts. However, the QSA index of constraints, like all other measures, has some potential shortcomings. In particular, the model underlying the QSA index relies on qualitative disclosures and there could be substantial noise in these disclosures. While it is difficult to assess the magnitude of this problem and its impact on our estimates, certainly the case for the QSA index could be strengthened with some corroborating evidence. We present here both indirect and direct evidence of this type.

Much of the prior literature on financial constraints reveals that firm size, and to a lesser extent firm age, are both related to the presence of financing constraints.¹² In many of these studies it appears that size is the firm characteristic that is most closely related to constraints, with larger firms being relatively less constrained. For example, Hennessy and Whited (2007) report estimates suggesting that external financing costs are most closely related to firm size, with costs decreasing sharply as a firm grows. In a different vein, Gertler and Gilchrist (1994) report that decisions of small firms are much more affected by tight monetary policy than large firms. A host of related results appear in the literature. Thus, the case that firm size and age are related to financial constraints has been demonstrated in a variety of different contexts.

To obtain more direct evidence, we check whether our index is successful in identifying constrained and unconstrained firms using the methodology of Almeida, Campello, and Weisbach (2004) (ACW). The ACW approach is appealing in that it uses only Compustat data, and thus it is easy to reproduce.¹³ As ACW emphasize, their approach does not offer a direct measure of the magnitude of constraints. Instead, it allows one to detect the presence of non-zero constraints with a given population of firms by testing whether there is a significant sensitivity of cash to cash flow within the population.

To conduct this analysis, we examine whether the cash flow sensitivity of cash varies by constrained and unconstrained firms identified from our QSA index. We select all Compustat observations from 1971-2004 and retain observations with data on assets, sales, market

¹² Since size and age are highly correlated, many authors discuss size effects and interchangeably refer to “large” and “mature” firms, implicitly implying that firm size variables capture both the direct role of size and the indirect role of age.

¹³ Several papers that study financial constraints including Rauh (2006) and Fee, Hadlock, and Pierce (2009) require unique data and thus are not suitable for checking our index. These authors report that firm size and age are both related to constraints in their studies. An alternative method for detecting constraints using only Compustat data is advanced by Almeida and Campello (2007).

capitalization, capital expenditures, and cash holdings. Similar to ACW, we eliminate observations in which cash exceeds total assets, asset or sales growth exceeds 100%, or market capitalization or property, plant, and equipment falls short of a \$10 million threshold in 1971 dollars. We winsorize all variables at the 1% tails. The only substantive difference in our treatment and the ACW treatment is that we do not restrict the sample to solely manufacturing firms.

We calculate the start of year QSA index value for every sample firm and place firms with index values in the top (bottom) tercile within the year cohort in the constrained (unconstrained) category. We follow the ACW treatment and regress a firm's annual change in normalized cash holdings against cash flow, Q , and a size variable (analogous to their table 3). The key coefficient of interest is the estimate on cash flow. If the QSA index is a useful measure of constraints, we expect the constrained (unconstrained) subsample to display a positive and significant (small and insignificant) coefficient on cash flow. All regression variables and estimation techniques are taken directly from the ACW study.

As the estimates in columns 1 and 2 of Table 7 reveal, the cash flow sensitivity of cash is positive and highly significant for the constrained group, while it is small and insignificant for the unconstrained group. This provides corroboratory evidence that the index we propose is useful in detecting financial constraints. We have experimented with altering these regressions by (a) restricting attention to the most recent decade, (b) identifying constrained and unconstrained firms based on sample-wide terciles rather than annual terciles, and (c) restricting attention solely to manufacturing firms. With each of these alterations we continue to find that constrained firms (unconstrained firms) have a significant (insignificant) sensitivity of cash to

cash flow. Thus, the ACW approach to detecting constraints provides substantial support for the size-age index approach that we advocate.

Summarizing our evidence, the quadratic size-age index we construct is robustly related to qualitative indicators of financial constraints within our sample. This index has intuitive appeal and relies on fairly exogenous firm characteristics. Moreover, prior work offers substantial evidence that the two components of this index are closely related to financial constraints. Finally, using an alternative approach to detect constraints advanced by Almeida, Campello, and Weisbach (2004), we show that our index is successful in identifying constrained and unconstrained groups of firms. Thus, the overall case for using the QSA index as a measure of constraints appears to be quite strong.

4.4 Time variation in financial constraints

The index we propose relies solely on firm characteristics that vary slowly over time. Consequently, this index, like many others, will be more effective in detecting cross-sectional variation in constraints as opposed to time variation. Given this feature, it would be prudent to include year fixed effects in any analysis that exploit the QSA index.

To provide some evidence on how financial constraints may vary over time, we augment our ordered logit models to include time-varying macro factors. We borrow here from Cohn (2008) who finds that financial constraints are related to SEO activity, yield spreads on corporate bonds, and GDP growth. We measure SEO activity as the number of SEOs during the most recent calendar year divided by the start-of-year number of firms on Compustat. Yield spreads are measured as the difference in rates between Baa and Aaa bonds as of the calendar year end that corresponds to the firm's fiscal year end. GDP growth is measured as the change in log of

real GDP between the most recent calendar year and the immediately preceding year. In addition, given its role in the work of Campello (2002) and Ashcraft and Campello (2007), we also consider federal funds rate.

When we add these variables, one at a time, to the baseline ordered logit model underlying the QSA index (model 2 of Table 6), the coefficients on the first three of these four variables are significant and have the expected sign, while the coefficient on the federal funds rate is small and insignificant. These coefficients indicate that constraints are elevated during times of cold equity markets, high yield spreads, and low economic growth. Similar to the findings of Cohn (2008), this evidence suggests that there can be important time variation in the severity of constraints arising from financial market conditions and/or macroeconomic activity.

Given the collinearity of these macro factors, it is not practical to include them all together in a single model. Since the SEO activity variable has the most explanatory power, we report in column 8 of Table 6 estimates for the augmented model that includes this factor. As is evident from the estimates, inclusion of this additional factor has little effect on the coefficients on the size and age variables. This suggests that the QSA index will be a reasonable cross-sectional indicator of constraints in many different economic environments.

5. The sensitivity of investment to cash flow

The intent of the KZ paper was not to motivate an index of financial constraints, but rather to comment on the usefulness of investment-cash flow sensitivities as measures of constraints. KZ demonstrate that in some cases firms in the most constrained categories actually exhibit a relatively low sensitivity of investment to cash flow, casting serious doubt on the

investment-cash flow approach. In this subsection we briefly reexamine this important finding using our more refined data and our larger, broader, and more modern sample.

In columns 3-6 of Table 7 we report results for traditional investment-cash flow regressions. All variables are defined as in the corresponding KZ models, with year and firm-fixed effects included but not reported. We impose an additional condition in all of these models that $\text{cash flow}/K \geq -1$, since without this requirement the sample-wide sensitivity of investment to cash flow is not significantly positive.¹⁴ This is not surprising, since large negative realizations of cash flow cannot result in negative levels of investment.

Proceeding in a similar manner to KZ, we assign firms to three groups based on their categorized level of constraints using qualitative scheme 2. We assign firms that are in the lowest two constraints categories (NFC and LNFC) for all years to the low constraints grouping. We assign firms that are ever in the highest two constraints categories (FC and LFC) in any year to the high constraints grouping. All other firms are placed in the middle grouping. As we report in columns 3-5 of Table 7, the estimated sensitivity of investment to cash flow does not differ significantly across the three groups, and the most constrained group actually has the lowest estimated sensitivity. Similar to KZ, these estimates provide no support for the existence of a positive monotonic relation between investment-cash flow sensitivities and constraints.

An alternative way to model the effect of constraints on investment-cash flow sensitivities is to use interaction terms. An advantage of this approach is that it lends itself to allowing a firm's constraints level to change over time. In column 6 of Table 7 we include a term interacting cash flow with a dummy variable indicating that the firm was in the FC or LFC category as of the start of the fiscal year. The coefficient on this interaction term is actually

¹⁴ Allayannis and Mozumdar (2004) suggest that investment-cash flow sensitivities are different for positive and negative realizations of cash flow. If we exclude all observations with negative cash flow, the main character of the investment-cash flow sensitivity results does not change, although some of the magnitudes do change.

negative and significant, suggesting that the most constrained firms may actually display a lower sensitivity of investment to cash flow than other firms. Thus, we are able to again confirm the main KZ finding that investment-cash flow sensitivities are not monotonically increasing in a firm's categorized level of financial constraints.

6. Conclusion

In this paper we borrow from the insights of Kaplan and Zingales (1997) and use qualitative information to assess a firm's level of financial constraints. We estimate ordered logit models predicting constraints as a function of the five quantitative variables in the well-known KZ index of financial constraints. Our approach parallels the modeling that underlies the KZ index as presented by Lamont, Polk, and Saa-Requejo (2001). The distinguishing features of our study is that we examine a large and broad set of modern firms and we categorize constraints using purely qualitative information rather than a mix of qualitative and quantitative information. This latter feature avoids an important problem in the original KZ index modeling in which some of the same information is used in coding both the dependent and independent variables.

In our empirical models we find that only two of the five KZ index components, cash flow and leverage, are consistently significantly related to financial constraints with a sign that agrees with the index. Two of the other index components, Q and dividends, flip in signs across models and are in many cases insignificant. The coefficient on the remaining index component, cash levels, is usually positive and significant. This positive sign disagrees with the KZ index but it is consistent with a precautionary motive for holding cash. Using our model coefficients to create an updated index, we find that the correlation between this updated index and the traditional KZ index is approximately zero. This provides compelling evidence that the KZ

index is unlikely to be a useful measure of financial constraints, a conclusion that has important implications for many studies.

To provide guidance on alternative measures of financial constraints, we select factors that others have identified as indicators of constraints and proceed to examine the relation between these factors and financial constraints categories derived from qualitative information. Firm size and age emerge as particularly useful predictors of constraints. After controlling for these factors, we find that several other variables do not predict constraints, suggesting that these variables may frequently proxy for size and/or age effects. The two variables that do appear to offer additional explanatory power are firm cash flow and leverage. However, given concerns about endogeneity issues and possible reporting biases, we advocate a conservative approach that uses only firm size and age in creating a measure of financial constraints.

Investigating more closely the role of firm size and age, we present evidence indicating that the role of these factors on financial constraints is nonlinear. As very young and small firms start to mature and grow, the predicted likelihood of being constrained falls sharply. After this initial drop, an incremental effect is still present, but diminishes in magnitude. This leads us to recommend a financial constraints index that includes linear and quadratic terms for firm size and age, a measure that we refer to as the quadratic size-age or QSA index.

We argue that the QSA index has much to recommend it over other approaches. First, this index has substantial intuitive appeal and relies on factors that are surely more exogenous than most of the alternatives. In addition, the estimates underlying this index appear to be fairly stable across various subperiods and subsamples. Strengthening the case further, we note that a substantial amount of past research identifies firm size and/or age as strong predictors of constraints in varied settings. Finally, in an effort to provide more direct corroboratory evidence,

we utilize the approach of Almeida, Campello, and Weisbach (2004) for detecting constraints by studying the sensitivity of cash to cash flow. Consistent with the hypothesis that our index successfully identifies constrained firms, we find that firms that our index indicates are constrained (unconstrained) display a positive and significant (small and insignificant) sensitivity of cash to cash flow.

To conclude, Kaplan and Zingales (1997) make an important contribution in providing evidence indicating that investment-cash flow sensitivities are unlikely to be useful measures of financial constraints. In this paper, we show that the leading alternative measure, the KZ index, is similarly flawed. Moreover, our evidence suggests that many other common measures of constraints may be, at best, only indirect indicators of a firm's constraints status. Firm size and age are intuitively appealing measures of constraints that have a long tradition in corporate finance research. Our findings suggest that a simple index based on these two factors is likely to be a reasonable measure of financial constraints in a variety of contexts. Until a compelling case can be made for a more complicated measure, we suggest that researchers rely on the simple alternative that we propose.

Appendix

We assign each statement to one of five mutually exclusive categories from 1 to 5 with lower (higher) numbers indicating a lack of (presence of) financial constraints. Statements coded as a 1 are disclosures that indicate that a firm anticipates more than sufficient or more than adequate liquidity to fund its needs. Statements using the word "strong" or a similar adjective when describing the firm's financial position are also assigned this code. Specific examples of statements that received a code of 1 include: "Management believes these resources are more than sufficient to meet planned short-term needs and provide for working capital requirements associated with projected growth," and "Our balance sheet remains strong and gives us a great deal of flexibility."

Statements that indicate sufficient or adequate liquidity are assigned a code of 2. The principal difference between category 1 codes and category 2 codes is in the strength of the language describing the firm's financial position, particularly with regard to whether the firm indicates more than sufficient versus sufficient liquidity. Specific examples of statements with a code of 2 are: "It is expected that operating cash flows, supplemented as needed with financing arrangements, will be sufficient to meet the firm's needs," and "Management believes that the present working capital as well as its available line-of-credit is adequate to conduct its present operations."

Statements coded as a 3 are statements that we found difficult to classify in that they are opaque in nature. Additionally, we classify statements that give a soft cautionary statement on future liquidity positions if certain scenarios were to come to fruition. The defining feature of statements coded as a 3 are that they do not indicate any financial strength but they also do not indicate any current liquidity problem. Examples of statements coded as a 3 include: "Funds raised in past periods should not be considered an indication of additional funds to be raised in any future periods. There is no assurance that such funds will be available to us on acceptable terms, if at all," and "There is no guarantee that the Company will be able to obtain the necessary financing."

Statements in which a firm indicates difficulty in raising financing or substantive current concerns about liquidity are coded as a 4 as long as the firm does not reveal that the problem has actually affected its investment decisions. Examples of statements coded as a 4 include: "During fiscal 2001 the firm initiated a private placement securities offering to raise capital to finance its acquisition program. In December 2001, the firm aborted this offering due to unfavorable market conditions," and "We were unable to complete a successful financing."

Finally, codes of 5 are reserved for all cases of clear financial problems/constraints including statements indicating that the firm: (a) is currently in violation of covenants, (b) has been cut out of usual sources of capital, (c) is renegotiating debt payments, (d) is forced to reduce investment because of liquidity issues, (e) has received a going concern statement from an auditor, and (f) has had an executive or director advance funds to the firm because of liquidity problems.

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Table 1: Sample Characteristics

	10th pct.	25th pct.	50th pct.	75th pct.	90th pct.
Cash flow/K	-4.212	-0.385	0.243	0.663	1.449
Cash/K	0.022	0.089	0.439	1.995	8.220
Dividends/K	0	0	0	0.035	0.139
Tobin's Q	0.835	1.070	1.535	2.401	4.044
Debt/total capital	0	0.040	0.275	0.550	0.891
Capital Exp./K	0.045	0.107	0.214	0.442	0.899
Property, plant, equipment (PPE)	0.496	3.510	20.664	110.481	623.670
Book assets	5.888	28.822	124.627	462.893	2056.975
Age	2	4	9	20	36
Sales growth	-0.292	-0.076	0.057	0.242	0.689

Note.-The figures in each column represent the sample percentiles for the indicated variable for a random sample of 1848 Compustat firm-years representing 356 firms operating during the 1995-2004 time period. The statistics are calculated over the final sample of firms with sufficient information available to enter the regressions in the subsequent tables. All variables are constructed from Compustat information. The PPE and Book Asset statistics are in millions of inflation adjusted year 2004 dollars. All variables that are normalized by K are divided by start of period PPE. Cash flow is defined to be operating income plus depreciation (Compustat item 18 + item 14). Cash is defined to be cash plus marketable securities (item 1). Dividends are total annual dividend payments (item 21 + item 19). Tobin's Q is defined as (book assets minus book common equity minus deferred taxes plus market equity) / book assets calculated as [item 6 - item 60 - item 74 + (item 25 x item 24)] / item 6. Debt is defined as short-term plus long term debt (item 9 + item 34). Total capital is defined as debt plus total stockholders' equity (item 9 + item 34 + item 216). If stockholders' equity is negative we set debt/total capital equal to 1. Capital expenditures are item 128. Age is defined to be the number of years preceding the observation year that the firm has a non-missing stock price on the Compustat file. Sales growth is defined as (sales in year t minus sales in year t-1)/sales in year t-1. Sales are first inflation adjusted before making this growth calculation.

Table 2: Frequency of Financial Constraints Categories

	<u>Constraints Assignment Procedure</u>		
	Qualitative Scheme 1	Qualitative Scheme 2	Qualitative/Quantitative Scheme
Not Financially Const.: NFC	10.28%	10.98%	55.84%
Likely Not Financially Const.: LNFC	50.49%	71.59%	31.01%
Potentially Financially Const.: PFC	32.36%	10.55%	6.44%
Likely Financially Const.: LFC	0.32%	0.32%	2.49%
Financially Const.: FC	6.55%	6.55%	4.22%

Note.-This table reports the fraction of all firm-year observations in which an observation is assigned to the indicated financial constraints group. Qualitative scheme 1 uses only qualitative statements made by firms in their filings subsequent to the fiscal year end regarding the firm's liquidity position and ability to fund investments. The exact algorithm used in coding and categorizing this information is detailed in the text. Qualitative scheme 2 is constructed identically to scheme 1 except it ignores all soft and generic non-specific warnings made by firms regarding possible future scenarios under which the firm could experience a liquidity problem. The qualitative/quantitative scheme augments scheme 2 by moving firms upwards one category if the firm materially increases dividends, repurchases shares, or has a high (top quartile) level of (cash/capital expenditures) on hand. Additional details concerning the assignment procedures are provided in the text and the appendix.

**Table 3: Ordered Logit Models
Predicting Financial Constraints Status**

	(1)	(2)	(3)	(4)	(5)	(6)
Cash flow/K	-0.008** (0.004)	-0.009** (0.004)	-0.035*** (0.008)	-0.143*** (0.017)	-0.896*** (0.117)	-0.021*** (0.008)
Q	0.037*** (0.009)	0.031*** (0.009)	0.084*** (0.023)	0.099** (0.040)	-0.004 (0.011)	0.037 (0.040)
Debt/total capital	1.837*** (0.156)	2.643*** (0.184)	2.758*** (0.195)	2.597*** (0.192)	2.387*** (0.191)	2.777*** (0.228)
Dividends/K	0.190 (0.164)	0.224 (0.182)	0.246 (0.334)	-1.171** (0.536)	-1.543 (1.531)	-0.074 (0.292)
Cash/K	0.025*** (0.004)	0.017*** (0.005)	0.019** (0.009)	0.035*** (0.013)	0.284* (0.167)	0.017** (0.007)
Log-likelihood	-1983.929	-1530.061	-1408.514	-1488.404	-1503.759	-1180.758
Pseudo-R ²	0.059	0.096	0.102	0.121	0.112	0.071
Observations	1848	1848	1752	1848	1848	1562
Specification	Baseline: Qualitative Scheme 1	Baseline: Qualitative Scheme 2	Exclude 1% Tails	Winsorize at 5%	Normalize by Assets	Assets > \$10 million

Note.-All coefficient estimates are maximum likelihood estimates of an ordered logit model estimated over annual observations. Asymptotic standard errors are reported in parentheses under the coefficients. The dependent variable in model 1 (models 2 - 6) is based on a firm's level of constraints using purely qualitative information following the algorithm described in the text for qualitative scheme 1 (qualitative scheme 2). The dependent variable is coded as an integer varying from 1 for the most unconstrained firms (NFC) to 5 for the most constrained (FC) firms. The cash flow, Q, debt, dividends and cash variables are defined as in the preceding tables and are constructed to be consistent with KZ and Lamont, Polk, and Saa-Requejo (2001). All fiscal year Compustat variables are matched to corresponding constraints information garnered from filings made immediately following the fiscal year end. K denotes start of year property, plant and equipment. The models in columns 1 and 2 are baseline models with the explanatory variables winsorized at the 1% tails. The model in column 3 excludes all observations with an explanatory variable falling in one of the 1% tails (except for variables that are naturally truncated at a minimum of 0). The model in column 4 winsorizes all explanatory variables at the 5% tails. The model in column 5 replaces the K=PPE normalization of the indicated explanatory variables with a K=book assets normalization. The model in column 6 requires a firm to have book assets exceeding \$10 million (inflation adjusted to 2004). Models 5 and 6 have explanatory variables winsorized at the 1% tails.

*Significant at 10% level

**Significant at 5% level

***Significant at 1% level

**Table 4: Ordered Logit Models of Constraints Status
Subsample Analysis and an Alternative Dependent Variable**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Cash flow/K	-0.011* (0.006)	-0.114 (0.071)	-0.011** (0.005)	-0.019** (0.009)	-0.004 (0.005)	-0.299 (0.245)	-0.019*** (0.004)
Q	0.047*** (0.015)	-0.273** (0.127)	0.018* (0.010)	0.061*** (0.022)	0.043*** (0.011)	-0.085 (0.264)	0.025*** (0.009)
Debt/total capital	2.294*** (0.251)	2.798*** (0.445)	3.027*** (0.233)	2.720*** (0.265)	2.229*** (0.221)	7.858*** (2.121)	2.707*** (0.167)
Dividends/K	0.254 (0.230)	-9.312*** (1.962)	-4.174 (3.679)	0.192 (0.330)	0.329 (0.209)	46.876 (45.221)	-0.513*** (0.195)
Cash/K	0.012* (0.006)	0.073** (0.033)	0.011* (0.006)	0.020*** (0.007)	0.017*** (0.006)	0.052 (0.057)	-0.022*** (0.006)
Log-likelihood	-858.767	-347.119	-925.249	-859.952	-1112.908	-34.497	-1796.799
Pseudo-R ²	0.085	0.112	0.122	0.087	0.079	0.267	0.109
Observations	1001	467	1277	1147	1372	69	1848
Dep. Variable	Qual. 2	Qual. 2	Qual. 2	Qual. 2	Qual. 2	Qual. 2	Qual./Quant
Sample	Manuf. Only	Size in Top 1500	Low Dividends	Pos. Sales Growth	Survivors	Satisfy (1) - (5)	All

Note.-All coefficient estimates are maximum likelihood estimates of an ordered logit model estimated over annual observations. Asymptotic standard errors are reported in parentheses under the coefficients. The dependent variable in models 1-6 (model 7) is based on a firm's level of constraints using qualitative scheme 2 (the qualitative/quantitative scheme) described in the text. The dependent variable is coded as an integer varying from 1 for the most unconstrained firms (NFC) to 5 for the most constrained (FC) firms. The cash flow, Q, debt, dividends and cash variables are defined as in the preceding tables and are constructed to be consistent with KZ and Lamont, Polk, and Saa-Requejo (2001). All fiscal year Compustat variables are matched to constraints information garnered from filings made immediately following the fiscal year end. K denotes start of year property, plant and equipment. Explanatory variables in all models are winsorized at the 1% tails. The model in column 1 restricts attention to observations for firms in manufacturing industries (SIC codes 2000-3999). The model in column 2 restricts attention to firms with book assets in the top 1500 of all Compustat firms as of the start of the observation year. The model in column 3 restricts attention to observations with total dividends/net income less than .1 in the year prior to the observation year. The model in column 4 considers only observations with positive real sales growth in the past year (i.e., real sales in year t > real sales in year t-1). The model in column 5 only retains observations in which the firm is known to survive for three years (two years in the case of 2004 observations) post the observation year. The model in column 6 retains only observations that satisfy the sampling requirements in the models of columns 1-5.

*Significant at 10% level

**Significant at 5% level

***Significant at 1% level

Table 5: Predicting Financial Constraints Status Using Alternative Explanatory Variables

Specification	Individual Variables	WW Vars. Together	Indiv. Vars + Size + Age	Parsimonious Model
	(1)	(2)	(3)	(4)
KZ: Cash Flow	-0.024*** (0.003)		-0.010*** (0.003)	
KZ: Q	0.071*** (0.008)		0.015* (0.009)	
KZ: Leverage	2.731*** (0.172)		2.858*** (0.181)	
KZ: (Dividends/K)	0.522*** (0.158)		0.156 (0.163)	
KZ: (Cash/K)	0.007 (0.004)		-0.006 (0.005)	
WW: Cash Flow	-1.217*** (0.107)	-0.626*** (0.106)	-0.657*** (0.100)	-0.592*** (0.100)
WW: Dividend Dummy	0.013 (0.113)	0.375*** (0.127)	0.470*** (0.122)	
WW: Leverage	0.804*** (0.242)	1.479*** (0.277)	1.914*** (0.260)	1.747*** (0.268)
WW: Size	-0.435*** (0.025)	-0.413*** (0.029)		-0.357*** (0.030)
WW: Industry Sales Growth	0.016 (0.308)	0.049 (0.317)	-0.197 (0.311)	
WW: Firm Sales Growth	0.122*** (0.043)	0.014 (0.046)	0.042 (0.043)	
ACW: Payout	0.085 (0.134)		0.252* (0.136)	
ACW: Size	-0.0001*** (0.00002)			
ACW: No Bond Rating	1.143*** (0.143)		-0.138 (0.169)	
ACW: No Comm. Pap. Rating	1.881*** (0.230)		0.133 (0.264)	
Firm Age	-0.044*** (0.004)			-0.025*** (0.004)

Note.- All coefficient estimates are derived from an underlying ordered logit model using firm-years as the unit of observation and a dependent variable based on qualitative scheme 2 coded as an integer varying from 1 for NFC firms up to 5 for FC firms. Standard errors are reported in parentheses. The timing convention in this table is the same as in Tables 3 and 4. Each estimate in column 1 is from a separate ordered logit model in which the indicated variable is the sole explanatory variable. The estimates in columns 2 and 4 are from single regressions in which all of the indicated variables are included simultaneously. Each estimate in column 3 is from a separate ordered logit model in which the WW size variable, firm age, and the indicated variable are included together as the only explanatory variables. The size and age coefficients in these column 3 models are not reported but are always significant and of the expected sign. The KZ variables are defined as in the earlier tables. WW-Cash flow is defined as (operating income plus depreciation)/start of year book assets. WW-Dividend dummy is a variable indicating positive preferred or common dividends. WW-Leverage is defined as (book value of long term debt)/current book assets. WW-Size is defined as the log of inflation adjusted (to 2004) assets. Industry sales growth is defined as the most recent annual percentage change in inflation-adjusted 3-digit industry sales. Firm sales growth is the firm's most recent annual percentage change in inflation-adjusted sales. ACW-payout is (common dividends + preferred dividends + share repurchases)/operating income. ACW size is the firm's inflation-adjusted book assets. ACW-No Bond Rating is set equal to 1(0) if a firm has debt in a given year but has no current bond rating (has a bond rating). This variable is set equal to missing if a firm does not have debt. The ACW commercial paper variable is defined in an analogous manner but indicates the lack/presence of a commercial paper rating. Age is defined as the current year minus the first year that the firm has a non-missing stock price on the Compustat file. All variables are winsorized at the 1% and 99% tails and leverage and ACW-payout ratios above 1 are set equal to 1. The ACW payout variable is set equal 1 if a firm has negative operating income and positive dividends. *Significant at 10% level, **Significant at 5% level, ***Significant at 1% level.

**Table 6: Ordered Logit Models of Constraints Status
Exploring the Role of Firm Size and Age**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Size	-0.393*** (0.026)	-0.832*** (0.067)	-1.149*** (0.120)	-0.632*** (0.082)	-1.300** (0.533)	-0.784*** (0.070)	-0.920*** (0.101)	-0.814*** (0.067)
(Size) ²		0.053*** (0.008)	0.079*** (0.013)	0.035*** (0.010)	0.076* (0.045)	0.049*** (0.008)	0.060*** (0.011)	0.051*** (0.008)
Age	-0.022*** (0.004)	-0.085*** (0.014)	-0.106*** (0.021)	-0.076*** (0.021)	-0.172** (0.070)	-0.088*** (0.015)	-0.071*** (0.019)	-0.084*** (0.015)
(Age) ²		0.001*** (0.0003)	0.001*** (0.0004)	0.001** (0.0005)	0.003** (0.002)	0.001*** (0.0003)	0.001*** (0.0004)	0.001*** (0.0003)
SEO Activity								-10.587*** (3.375)
Log-likelihood	-1515.317	-1477.870	-693.839	-751.820	-131.021	-1325.632	-832.304	-1472.913
Pseudo-R ²	0.105	0.127	0.148	0.117	0.106	0.128	0.113	0.130
Observations	1848	1848	953	895	125	1576	1001	1848
Sample	Original	Original	First Half 1995-1999	Second Half 2000-2004	New 1990 sample	Original, Levg. > 0	Original, Manuf. Only	Original

Note.-All coefficient estimates are maximum likelihood estimates of an ordered logit model estimated over annual observations. Asymptotic standard errors are reported in parentheses under the coefficients. The timing convention in this table is the same as in prior tables. The dependent variable in all models is based on a firm's level of constraints using qualitative scheme 2 described in the text. The dependent variable is coded as an integer varying from 1 for the most unconstrained firms (NFC) to 5 for the most constrained (FC) firms. Firm size is defined to be the log of assets (inflation adjusted to 2004). Age is defined as the current year minus the first year that the firm has a non-missing stock price on the Compustat file. Size and age are winsorized at the 1% and 99% tails. SEO activity is the number of SEOs during the calendar year that corresponds to the fiscal year divided by number of public firms on Compustat as of the start of the year. The model in columns 1, 2, and 3 include the entire 1995-2004 sample. The model in column 3 (column 4) includes the subsample of 1995-1999 (2000-2004) observations. The sample in column 5 is a new sample of 125 random firms in 1990 with an electronic 10-K or annual report filing available. The sample in column 6 (column 7) includes all observations in the original 1995-2004 sample in which the firm has a nonzero level of leverage (is assigned an SIC code of 2000-3999).

- *Significant at 10% level
- **Significant at 5% level
- ***Significant at 1% level

Table 7: OLS Regressions
The Sensitivity of Cash Holdings and Investment to Cash Flow

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable	$\Delta(\text{Cash}/\text{Assets})$	$\Delta(\text{Cash}/\text{Assets})$	I/K	I/K	I/K	I/K
Q	0.002 (0.002)	0.0019 (0.0012)	0.078*** (0.030)	0.023 (0.036)	0.009 (0.017)	0.062*** (0.023)
Cash Flow	0.042*** (0.010)	0.004 (0.012)	0.183*** (0.053)	0.223*** (0.070)	0.147* (0.083)	0.185*** (0.044)
Size	-0.001 (0.002)	-0.0006 (0.0018)				
Cash Flow * (LFC or FC)						-0.129** (0.066)
Adjusted R ²	0.216	0.067	0.299	0.223	0.247	0.265
# Observations	16,873	16,897	979	158	144	1281
Which Observations	QSA Index Constrained	QSA Index Unconstrained	Low Constraints	Medium Constraints	High Constraints	All Obs. With Qualitative Data

Note.-The dependent variable in models 1 and 2 is the annual change in a firm's holdings of cash and marketable securities normalized by assets. The dependent variable in models 3-6 is a firm's annual spending on capital expenditures normalized by K (start of year property, plant, and equipment). All coefficients are estimated from OLS regression models. The models in columns 1 and 2 are estimated from 1971-2004 with firm fixed effects and an error structure that corrects for heteroskedasticity and for within-period error correlation using the White-Huber estimator. The sample in column 1 (column 2) is the set of firms with QSA index values in the top tercile (bottom tercile) of all observations in the annual cohort measured as of the start of the observation year. The universe of firms included in columns 1 and 2 starts with the Compustat universe and imposes certain restrictions outlined in the text and similar to the restrictions imposed by Almeida, Campello, and Weisbach (2004) (ACW). All model variables in the column 1 and column 2 models are defined as in ACW and cash flow is normalized by start of year assets. In columns 3-6 the cash flow and Q variables are defined as in Table 3 and cash flow is normalized by K. The models in columns 3-6 include fixed effects and year effects. In all models Q and size (log of inflation adjusted assets) are measured as of the start of the observation year and cash flow is measured contemporaneously with the investment decision. The sample in columns 3-6 includes all observations from 1996 to 2004 with qualitative information on financial constraints measured as of the start of the fiscal year, with the additional requirement that cash flow/K \geq -1. All variables in the regressions of the table are winsorized at the 1% tails. In columns 3-5 we assign each firm to a single constraints category for the entire sample period and estimate a separate regression for the indicated set of firms. The constraints categories (low, medium, high) are based on the entire set of the firm's annual constraints categorizations. We assign firms that are in the lowest two annual constraints categories (NFC and LNFC) for all years to the low constraints grouping. We assign firms that are ever in the highest two annual constraints categories (FC and LFC) in any year to the high constraints grouping. All other firms are placed in the medium constraints grouping. The interaction term in column 6 is cash flow interacted with a dummy variable indicating whether a firm-year observation falls in the LFC or FC financial constraints groups as of the start of the observation year.

*Significant at 10% level
**Significant at 5% level
***Significant at 1% level