SHORTAGES IN CORPORATE LIQUIDITY DURING CRISES AND NORMAL TIMES: EVIDENCE FROM SEC FILINGS

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Abstract

During the 2008-2010 financial crisis a large number of firms experienced acute liquidity shortages and adjusted real policies such as their employment and investment decisions. Searching the texts of approximately 900,000 SEC filings from the past twenty years, we show that these reactions were very similar to the ones implemented by firms that face shortages during more normal times. However, what made the crisis unique was that many of the affected firms were large, profitable and difficult to distinguish from the median public company. As a result, both observable firm characteristics and widely-used financial constraint measures lost much of their informational content during the crisis. We discuss the theoretical and empirical implications of our findings and what they say about the nature of the financial crisis.

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1 Introduction

“As a result of the current economic crisis and to conserve cash, we suspended our cash dividends in the fourth quarter of 2008.”

(Officemax, 10-K filing for fiscal year 2008)

During the 2008-2010 financial crisis, a large decrease in the aggregate supply of credit (Becker and Ivashina, 2014) caused many firms to experience shortages in external finance and corporate liquidity. The existing literature establishes that this led to strong changes in important policies such as employment decisions (Chodorow-Reich, 2014), innovation efforts (Brown and Petersen, 2014; Paunov, 2012), and capital spending (Campello et al., 2010; Duchin et al., 2010). However, two important questions that have remained largely unanswered are (i) in what way financial crises affect the composition of liquidity constrained firms and (ii) whether firms that experience constraints during crises react differently than firms that do so during more normal times.

One reason why evidence on changes in the composition of constrained firms between crises and normal times is important is that it can help evaluate competing theoretical mechanisms. For example, a common feature of models with heterogeneous firms and financial frictions is that constraints tend to arise primarily in companies that are small or young. However, most evidence in support of this behavior stems from normal times and is not consistent with popular accounts suggesting that the crisis extended well beyond this specific group of firms. As a result, it has remained unclear whether the same mechanisms that can replicate the behavior of financial constraints during normal times also capture what happens in the aftermath of large financial disruptions.

Beyond the predictions of theoretical models, changes in the composition of constrained firms during crises also matter for the validity of widely used constraint measures such as those of Lamont et al. (2001), Whited and Wu (2006) and Hadlock and Pierce (2010). Specifically, because such measures rely on relationships between constraints and observable firm characteristics, they will be less informative during crises if these relationships break down or become weaker. Finally, we are interested in firm-level reactions to liquidity shortages, because the economic implications of financial crises may in part depend on how firms react. For example, if the crisis affected different types of firms than shortages that arise during normal times (as we document below), are these firms also able to respond in different ways and potentially mitigate the consequences of the shortages they face?

To be able to make progress on these questions, we need to address three main empirical challenges. First, the concept of liquidity is inherently difficult to measure. For example, it is not obvious if items such as undrawn credit lines, cash held abroad, or even certain types of inventories should be included in the definition.¹ Second, because firms’ desired levels of liquidity are not observable, it is difficult to establish which firms are actually experiencing shortages at a given point in time. Finally, credibly exogenous variation in corporate liquidity is particularly scarce outside of the financial crisis. Therefore, it is not clear how standard econometric techniques such

¹See Almeida et al. (2014) for a discussion of this issue.
as difference-in-difference specifications could be used to investigate how liquidity shortages affect real firm decisions during more normal times.

We tackle these challenges using a text-based approach that exploits narrative discussions contained in the corporate filings of public companies and allows us to investigate cases from both time periods in one consistent framework. We thus base our analysis on the point of view of the very firms whose behavior we ultimately aim to understand. Searching the texts of approximately 900,000 archived documents from the past 20 years, we first extract a large number of verbal discussions of firm-level liquidity shortages. In each one of these discussions, the reporting firms explicitly state that they were engaging in efforts to preserve their existing internal liquidity, presumably because they were unable to obtain sufficient external liquidity at reasonable costs. Then, quantifying the contents of these discussions, we investigate differences between liquidity shortages that occurred during the crisis and during more normal times, respectively.²

The verbal discussions that we extract from the filings allow us to assess both what types of firms were liquidity constrained at a given point in time, and how they reacted to these constraints. For example, a firm may state that it responded to a shortage by reducing capital expenditures. Given that this firm was taking an arguably costly measure to preserve its internal liquidity, we can classify it as constrained and then measure observable characteristics such as its size, age, and profitability. In addition, we can also record the reported reduction in capital expenditures as the firm’s corresponding reaction. Extracting this type of information systematically from a large number of narrative discussions, we are thus able to quantify potential changes over time in both the composition of the constrained firms and their corresponding reactions.

In total, our text-search yields narrative discussions of 1,388 firm-level liquidity shortages reported by 687 publicly traded companies. To assess if these observations are consistent with aggregate financial-market conditions, we first investigate how they are distributed over the 20-year sample period. We find that slightly more than one third of the shortages occurred during the 2008-2010 financial crisis, and approximately two thirds are distributed over the sixteen remaining years. Our dataset thus contains sufficient numbers of observations for both of the time-periods we are interested in. In addition, the fact that the number of firms we classify as constrained increases sharply between 2008 and 2010 suggests that our approach does indeed capture how difficult or costly firms find it to obtain external liquidity.

Next, to understand what types of firms tend to be liquidity-constrained during normal times and large financial crises, we investigate observable characteristics that are commonly thought to be related to financial constraints. For example, we consider their size, age, and profitability. This reveals a strong contrast: While liquidity-constrained firms are typically small, unprofitable, and subject to large cash outflows, many of the firms that reported shortages during the crisis were

²Our analysis builds on existing work that has also employed corporate filings to assess the reporting firms’ financial constraints such as Kaplan and Zingales (1997), Hadlock and Pierce (2010), Buehlmaier and Whited (2014), Bodnaruk et al. (2015), and Hoberg and Maksimovic (2015). However, because we are mainly interested in differences between two different time periods, we do not need to assume that reporting is generally unbiased. Instead, all of our main results will hold as long as potential reporting biases are approximately stable over time.
large, profitable, and even paid dividends in prior periods. Moreover, we show that many of the
firms that experienced shortages during the crisis would not have been identified as financially
constrained by standard measures such as those of Hadlock and Pierce (2010) and Whited and Wu
(2006). Indeed, our results suggest that these measures lost much of their informational content
between 2008 and 2010, with the median constrained and unconstrained firms having very similar
observable characteristics.

In light of these large compositional differences between the crisis period and more normal
times, we then investigate the types of reactions firms implemented to overcome the shortages they
faced. Providing evidence for the general validity of our narrative approach, we first show that
the reactions it establishes for the crisis period are consistent with the reactions prior studies have
documented for the same period using more standard econometric techniques. In particular, our
narrative data confirm the existing findings that the large shock of the financial crisis caused firms
to employ fewer people, to reduce their investment in fixed capital and R&D, and to change their
payout policies.3 Given this evidence in support of the validity of our approach, we then use it to
compare the reactions reported during the crisis to the reactions reported during normal times, a
period whose lack of exogenous variation in liquidity makes standard econometric methods difficult
to apply.

The main finding we obtain here is that the percentage of constrained firms that reduced their
dividends was much larger during the crisis than during normal times. However, this difference
is entirely consistent with the fact that constraints outside of the crisis period were concentrated in
firms that did not make cash payouts in the first place and therefore did not have the option to
adjust along this dimension. Moreover, aside from this increased usage of dividend reductions, we
find that the remaining types of reactions firms used during the two time periods were virtually
identical. Thus, what made the crisis unique was not the way in which constrained firms reacted,
but rather the fact that many of these firms were large, profitable and difficult to distinguish from
their unconstrained counterparts.

The results we present in this paper provide new insights into the nature of the 2008-2010
financial crisis, suggesting that it affected a large group of companies whose characteristics were
very similar to those of the median public firm in the economy. The view that the effects of financial
crises can extend beyond a small and well-identified set of firms is not uncommon in the popular
debate. At the same time, however, it is at odds with the notion that financial constraints are
concentrated among firms with large information asymmetries, e.g. those that are small, young, or
otherwise opaque. Moreover, it has previously been difficult to systematically investigate changes in
the composition of constrained firms over time, since standard methods rely on ex-ante assumptions
about what types of firms are typically subject to financial frictions.

One of the main implications of our findings is that neither commonly used observable firm
characteristics nor standard financial constraint measures would have correctly identified con-

3See Chodorow-Reich (2014) for evidence on the employment effects, Campello et al. (2010) and Duchin et al.
(2010) for the effects on investment in fixed capital, Paunov (2012) and Brown and Petersen (2014) for the effects on
R&D efforts, and Bliss et al. (2015) for the effects on payout policies.
strained firms between 2008 and 2010. As a result, we argue that such measures may not be appropriate for studying large crisis episodes and evaluating potential policy responses. Moreover, our findings also speak to the theoretical mechanisms that can cause financial constraints at the firm level. For example, one variable commonly associated with financial constraints in models with heterogeneous firms is size. Our results support the general importance of this characteristic and show that, on average, small firms are indeed more likely to experience constraints than large firms. However, they also highlight that mechanisms based on this characteristic alone are not sufficient for describing the cross-sectional and dynamic effects of large financial shocks.

2 Identifying Liquidity-Constrained Firms and Their Reactions

2.1 The General Methodology

In order to identify liquidity-constrained firms we consider narrative evidence obtained by searching the texts of approximately 900,000 archived corporate filings. In particular, we first extract a large number of verbal discussions in which reporting firms explicitly state that they were taking measures to preserve their internal liquidity, presumably because they were unable to generate sufficient external inflows at reasonable costs. Then, translating the contents of these discussions into statistical variables, we also capture textual information on exactly what policies the affected firms adjusted in order to overcome the shortages they were facing. As we show, the information we obtain in this way is consistent with both the aggregate supply of credit and prior findings on firm-level reactions to liquidity shortages.

2.2 Construction of the Dataset

For the actual construction of the dataset, we first obtain all annual and quarterly corporate filings available in EDGAR database maintained by the US Securities and Exchange Commission (SEC).

This leaves us with 898,215 documents filed by 40,152 different firms over the period 1994-2013. Then, we extract the texts contained in these reports and break them down into sentences using a disambiguation algorithm widely used in the computational linguistics literature. Finally, as discussed above, we identify firms facing liquidity shortages as those whose reports contain sentences in which they explicitly state that they were engaging in liquidity preservation efforts, or that they were actively exploring ways to do so.

4We use all documents filed as 10-K, 10-Q, 10-K405 as well as the corresponding small-business form types 10-KSB, 10-QSB, and 10-KSB40. The main reason why we run our searches on both annual and quarterly filings is that firms may sometimes discuss actions only in the context of a specific quarter and then not mention them again in the corresponding annual report. However, since this approach may in principle also lead to double counting, we eventually aggregate our data to annual frequency and record each type of information only once per year.

5We also remove tables and other non-text contents such as html tags before the sentence-boundary detection. The specific algorithm that we use to identify sentences is that of Kiss and Strunk (2006), trained on a large number of texts from the Wall Street Journal. The language of this training dataset is relatively similar to that used by firms in their corporate reports. Tailoring the approach to our texts, we also add some information about abbreviations that commonly occur in the corporate filings, such as “C.E.O.” and “C.F.O.”.
To do this, we first search the sentences of all filings for a number of general verbal patterns that are likely to indicate efforts of liquidity preservation. Then, reading all sentences that contain at least one of these patterns, we manually remove false positives. Table 1 summarizes the exact verbal patterns that we use for the automatic text-search step, with round brackets indicating that an element is optional and square brackets denoting that only one of the expressions they contain must occur. As discussed above, these patterns aim to capture cases in which firms explicitly disclose that they are taking specific measures to preserve their existing or internal liquidity. We thus build on the notion that constrained firms are those that have a demand for liquidity but find it difficult or too costly to fully satisfy this demand by generating additional external inflows. Moreover, by including the general terms “liquid” and “liquidity”, we ensure that our search captures not only discussions of cash, but also references to other types of liquidity that may be important for the reporting firms.

Table 1: Verbal Patterns Used to Pre-Select Candidate Sentences About Liquidity Shortages

<table>
<thead>
<tr>
<th>Pre-Selection Patterns for Sentences About Liquidity Shortages</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. “to [preserve/conserve] <em>(up to 5 additional words)</em> [cash/liquid/liquidity] <em>(up to 3 additional words)</em> [we/the company/the corporation]”</td>
</tr>
<tr>
<td>2. “[we/the company/the corporation] <em>(up to 20 additional words)</em> to [preserve/conserve] <em>(up to 5 additional words)</em> [cash/liquid/liquidity]”</td>
</tr>
</tbody>
</table>

Notes: The table shows verbal patterns used to pre-select candidate sentences that are likely to contain information about firm-level liquidity shortages and the corresponding reactions. Round brackets indicate optional elements. Square brackets denote that only one of the elements they contain is required to occur. The element *word* is a placeholder satisfied by any single word.

To illustrate the types of sentences that we obtain in this way, Table 2 displays a number of examples that satisfy at least one of the required patterns and were not classified as false positives in the subsequent reading step. Importantly, every sentence in our dataset indicates not only that the reporting firm faced a liquidity shortage, but also that it took one or more actions to overcome that shortage. For example, consider the first sentence shown in Table 2. This sentence indicates that the company reduced its capital expenditures in order to preserve its existing (internal) liquidity. Accordingly, we can not only classify the firm as liquidity constrained, but we can also record the reduction in capital expenditures as the reaction to this constraint.

6The appendix shows a number of such false positives, together with brief discussions on why we removed them from the dataset.

7As discussed above, what constitutes liquidity from the perspective of the firm is generally difficult to assess. Our approach does not require researchers to make a judgement call in this regard and instead emphasizes the perception and information set of the firms whose behavior we aim to understand. For example, if a company considers undrawn credit lines and tradable assets held for sale as part of its liquidity, both items will be reflected in our data.
Table 2: Sample Sentences About Liquidity Shortages

<table>
<thead>
<tr>
<th>Sample Sentence</th>
<th>Company Name</th>
<th>Fiscal Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>“During 1993, the company restricted capital expenditures in order to conserve cash.”</td>
<td>Calmat Co.</td>
<td>1993</td>
</tr>
<tr>
<td>“In addition, in order to conserve its liquidity, the company did not make certain 2001 and 2002 debt service and lease payments.”</td>
<td>Alterra Healthcare Corp.</td>
<td>2002</td>
</tr>
<tr>
<td>“In order to conserve our cash and manage our liquidity, we are implementing cost cutting initiatives including the reduction of employee headcount and overhead costs.”</td>
<td>Inksure Technologies Inc.</td>
<td>2008</td>
</tr>
</tbody>
</table>

Notes: The table shows extracted corporate report sentences about firm-level liquidity shortages and the corresponding reported reactions. The sentences were extracted from the corporate filings using the pre-selection patterns shown in Table 1 and a subsequent reading step.

For our analysis of the firm-level reactions to liquidity shortages, we record this type of information systematically. In particular, for each sentence, we first record the actions the firms describe. Then, we verify that these actions did not just occur at the same time as the reported liquidity shortages, but that they were actually taken in response to them. In other words, we remove actions that the firms may have taken simultaneously but for other reasons. Finally, to quantify how often firms responded in specific ways, we assign the recorded reactions to a number of different categories such as changes in the number of employees, research efforts, and fixed-capital investment. For ease of reading, we introduce and discuss these categories below, in the context of the empirical analysis.

2.3 Informational Content and the Role of Potential Reporting Biases

In assuming that the narrative statements about the reporting firms’ financial constraints are informative about reality, we mainly build on the existing work of Kaplan and Zingales (1997), Lamont et al. (2001), Hadlock and Pierce (2010), Buehlmaier and Whited (2014), Bodnaruk et al. (2015), and Hoberg and Maksimovic (2015). Like us, all of these studies exploit the texts of corporate filings to assess if or to what extent the reporting firms were financially constrained. Moreover, we also build on several studies that provide direct evidence for the filings’ informational content by investigating other economic topics.

For example, Balakrishnan et al. (2010) document that the texts can be used to form stock portfolios that outperform the market; Li et al. (2013) show that a text-based measure of competition correlates positively with more standard measures; and Pitschner (2017) shows that narrative discussions of price changes extracted from corporate filings can be used to construct an index that closely tracks aggregate inflation. Moreover, we, too, provide evidence for the informational content of the texts and show that what firms say in their filings is consistent with aggregate financial
market conditions and the results earlier studies have obtained using more standard methods.  

Fundamentally, the most important reason why the texts in corporate filings are informative about reality is that the SEC legally requires firms to provide reports that are both accurate and complete.  

Companies that violate reporting requirements stipulated by the SEC risk being investigated and/or reprimanded. Karpoff et al. (2008) estimate just how costly such investigations are for the affected firms. Their results show that on days when SEC investigations are announced (but have not yet confirmed an actual violation), the firms typically lose around 20% of their entire market value.

Beyond the SEC, firms and their filings are also under the scrutiny of specialized financial analysts that typically follow only small groups of firms over time and, therefore, tend to understand their business very well. Thus, even if we as researchers cannot verify all of the narrative statements firms make in their filings, well incentivized monitors do exist. Lastly, the Sarbanes-Oxley Act makes the reporting companies’ CEOs and CFOs personally liable for both incorrect information and material information that is missing from the filings. Therefore, incentives for truthful and complete reporting exist not only at the level of the reporting companies, but also for high-ranking management personnel.

Overall, there is thus both empirical and more theoretical support for the informational content of the corporate filing texts used by us and the existing literature cited above. One question that remains is whether firms generally tend to discuss some topics more frequently than others. Importantly though, because we are mainly interested in the variation between two different time periods, we do not need to assume that such reporting biases are absent from the texts. Instead, all of our main conclusions about differences between the crisis and more normal times will be valid as long as potential reporting biases are approximately stable over time. The assumptions we make in comparing the properties of two different economic environments are thus considerably weaker than those of studies that interpret the narrative evidence of corporate filings at an absolute level.

2.4 Descriptive Statistics and General Properties of the Dataset

Our final dataset contains a total of 1,338 reported firm-level liquidity shortages. Because the narrative information we use in this paper stems from the same filings that also contain the accounting information available via commercial databases such as Compustat, we are able to link the two

8The texts of SEC filings have also been used to investigate product-market competition (e.g. Hoberg and Phillips (2010)) and the usage of corporate credit lines (e.g. Sufi (2009) and Ivashina and Scharfstein (2010)). Furthermore, Ippolito et al. (2015) search the texts of filings in order to capture whether or not firms hedge floating rate loans. The accounting literature has investigated the informational content of forward-looking statements ((Li, 2010)) and mandatory risk-factor disclosures (e.g. Kravet and Muslu, 2013; Bao and Datta, 2014; Campbell et al., 2014) as well as the role of the complexity and tone in reporting (e.g. Li, 2008; You and Zhang, 2009; Feldman et al., 2010).

9Specifically, we rely on regulation S-K. See the discussion in Griffin (2003).

10The Sarbanes-Oxley Act was implemented in the aftermath of the dotcom bubble and requires both CFOs and CEOs to vouch in writing for the truthfulness and completeness of their filings. See the discussions in Geiger and Taylor III (2003) and Marden et al. (2003). Our sample includes observations that predate the Sarbanes-Oxley Act and thus were not subject to this requirement. However, all of our main findings are qualitatively robust to their exclusion.
types of information for most of the shortages in our dataset. This matching process leaves us with 1,289 liquidity shortages reported by 687 different companies as identified by their Compustat gvkey firm identifiers. Moreover, we also augment our dataset with information on the firms’ industry membership that we extract directly from the headers of the filings.\textsuperscript{11}

\textsuperscript{11}The fact that only small numbers of firms explicitly discuss liquidity shortages in their filings is consistent with the findings of Hoberg and Maksimovic (2015) and suggests that not all cases may get reported. In addition, while we carefully remove false positives from the dataset, it is possible that at least some of the relevant discussions firms do provide are not picked up by our initial search. Both of these possibilities are generally hard to test, because measuring financial constraints based only on observable characteristics is difficult and remains an active topic in the literature (e.g., Farre-Mensa and Ljungqvist, 2015). However, as discussed above, such selection effects do not affect the main results of our analysis as long as they are approximately stable over time.
Table 3: Observable Characteristics of Liquidity Constrained and Unconstrained Firms

<table>
<thead>
<tr>
<th></th>
<th>Unconstrained Firms</th>
<th>Liquidity-Constrained Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Assets Mean</td>
<td>6,055.62</td>
<td>1,466.92</td>
</tr>
<tr>
<td>Number of Employees Mean</td>
<td>7.51</td>
<td>2.93</td>
</tr>
<tr>
<td>Firm Age Med</td>
<td>13.0</td>
<td>12.61</td>
</tr>
<tr>
<td>Firm Profitability Mean</td>
<td>-0.71</td>
<td>-3.19</td>
</tr>
<tr>
<td>Cashflow Ratio Mean</td>
<td>-0.96</td>
<td>-3.9</td>
</tr>
<tr>
<td>Cash Ratio Mean</td>
<td>1.27</td>
<td>1.93</td>
</tr>
<tr>
<td>Dividend Ratio Mean</td>
<td>0.34</td>
<td>0.15</td>
</tr>
<tr>
<td>KZ Index Mean</td>
<td>-93.86</td>
<td>-85.84</td>
</tr>
<tr>
<td>Hadlock-Pierce Index</td>
<td>-2.84</td>
<td>-2.44</td>
</tr>
<tr>
<td>Whited-Wu Index Mean</td>
<td>-0.04</td>
<td>0.06</td>
</tr>
</tbody>
</table>

Notes: The sample includes all firms matched to Compustat at the gvkey/fiscal-year level. Constrained firms are those that report a liquidity shortage in a given fiscal year. The total number of liquidity shortages is 1,338. The shortages are reported by 687 different companies as identified by their Compustat gvkey identifiers. All firm characteristics are lagged by one period. Variable definitions are shown in Table A.1 of the appendix.
To illustrate the observable characteristics of the firms we identify as liquidity constrained, Table 3 presents descriptive statistics. Here, our emphasis is on the full sample, but we do investigate time-variation in these characteristics in the next section of the paper. The specific variables we look at include the age of the reporting firms, their size (as measured by their total assets and numbers of employees) and their profitability. Moreover, to capture the firms’ cash policies we consider their cash holdings, cash flows, and dividend payouts. Finally, we also investigate three measures that are widely used in the existing literature to identify financially constrained firms: The KZ-index of Lamont et al. (2001), the constraint measure of Hadlock and Pierce (2010), and the index of Whited and Wu (2006).

We find that the firms we identify as liquidity constrained tend to be somewhat smaller than their unconstrained peers, both in terms of total assets and employees. This finding is expected if information asymmetries and thus external finance premia tend to be relatively high for small firms. Furthermore, the constrained firms tend to be less profitable, have lower cash flows, and typically do not pay dividends. Lastly, they also tend to have higher levels of cash than the unconstrained firms. This last observation may appear somewhat surprising, but it is in fact consistent with existing evidence, such as that of Opler et al. (1999) and Denis and Sibilkov (2010), and typically attributed to the precautionary motive of cash holding.

In terms of the standard indicators of financial constraints, we find that the firms that report liquidity shortages tend to appear constrained in terms of both the measure of Whited and Wu (2006) and that of Hadlock and Pierce (2010). The KZ-index of Lamont et al. (2001), on the other hand, turns out to take very similar values in the groups we identify as constrained and unconstrained, respectively. One potential explanation for this is that the KZ index may capture constraints other than those immediately related to the firms’ liquidity. Moreover, the work of Farre-Mensa and Ljungqvist (2015) highlights that financial constraints are generally difficult to capture using only observable firm-level variables. Overall, the characteristics of the firms in our dataset are thus consistent with the findings of prior work and common notions about which types of firms tend to be constrained.

3 Empirical Findings

3.1 Reported Liquidity Shortages and Aggregate Credit Supply

Having identified liquidity-constrained firms using the text-based approach described above, we first explore the distribution of observations over the 20-year sample horizon and relate it to fluctuations in the aggregate supply of credit. This allows us to investigate to what extent the information firms provide in their filings is actually consistent with aggregate financial conditions. More specifically, if our approach does indeed capture events that we can reasonably interpret as firm-level liquidity...
shortages, we would expect to see a concentration during the 2008-2010 financial crisis. Moreover, as we have argued above, firm-level shortages in liquid assets can in principle also arise for reasons other than aggregate financial shocks. Therefore, we would not expect this concentration to be complete.

To visualize the distribution of the reported liquidity shortages over time, Plot B of Figure 1 displays their occurrence over the past 20 years. Furthermore, to illustrate financial market conditions and the availability of external finance, Plot A shows the Becker and Ivashina (2014) measure of aggregate credit supply. Together, the two plots document that our dataset contains discussions of more than 400 shortages related to the 2008-2010 drop in aggregate credit supply as measured by Becker and Ivashina (2014), as well as approximately 900 reported cases that are not driven by a large aggregate shock to financial market conditions.

Figure 1: Aggregate Credit Supply and Reported Liquidity Shortages Over Time

Notes: The figure illustrates the co-movement over time between aggregate credit supply and the number of firms reporting liquidity shortages in the corporate filings. Plot A shows aggregate credit supply as measured in Becker and Ivashina (2014). Plot B shows the fractions of all 1,338 extracted liquidity shortages reported in a given year. The shaded areas indicate the period we classify as belonging to the financial crisis. The reported liquidity shortages shown in Plot B are obtained from the texts of quarterly and annual corporate filings as described in Section 2. Liquidity shortages reported for fiscal years ending between January and May are assigned to the preceding calendar year.

These findings have two main implications for our analysis. First, because the dataset contains sufficient numbers of observations for both the crisis-period and more normal times, it does

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13This measure captures credit supply by considering firms that have a positive demand for external finance and can generally access both the bond market and bank credit. In essence, a decrease in the supply of credit is reflected by an increase in the fraction of these firms that use bond financing instead of bank credit.

14A less pronounced increase in the fraction of reported liquidity shortages occurs during the burst of the dotcom bubble around 2001. We assign these observations to the non-crisis regime because financial market conditions were largely stable during these years. However, all of our main results are robust to their exclusion.
indeed allow us to compare liquidity shortages from these two time periods and thus extend the prior work that has mostly focused on the financial crisis by itself. Second, the fact that a large spike in the number of shortages occurs during the financial crisis suggests that our measure does indeed succeed at capturing how difficult or costly firms find it to obtain new external liquidity.

3.2 Characteristics of Constrained Firms During the Crisis and Normal Times

So far we have shown that the number of firms that experienced liquidity shortages sharply increased during the years of the financial crisis. One question that naturally arises from this is whether this increase in the number of constrained firms was also associated with a change in their composition. The text-based approach we apply in this paper can provide new insights on this issue because it avoids a priori assumptions about what types of firms tend to be liquidity constrained. For example, it does not rely on the common notion that small firms tend to be more constrained than large firms. Instead, it identifies constrained firms based on their own narrative discussions and then yields their observable characteristics as a result.
Figure 2: Observable Characteristics Over Time

Notes: The figure shows lagged median financial characteristics of constrained and unconstrained firms. Constrained firms are those that report liquidity shortages in their annual or quarterly filings as described in Section 2. Firms are only considered to be liquidity constrained in those fiscal years in which they actually report the shortage. The sample includes all firms whose filings can be matched to Compustat at the gvkey/fiscal-year level. The total number of liquidity shortages is 1,338. The shortages are reported by 687 different companies as identified by their Compustat gvkeys. All firm characteristics are lagged by one period. Variable definitions are shown in Table A.1 of the appendix.
In Plots A, B, and C of Figure 2 we exploit this by showing lagged values of selected real characteristics for each fiscal year. We distinguish between the firms that report liquidity shortages in that year and those that do not. Because the variables we consider are highly skewed by a small number of extreme outliers in the right tails of the distributions (see Section 2), our focus here is on medians. Consistent with prior research and the full sample results shown above, we find that liquidity-constrained firms typically tend to be small and less profitable than their unconstrained peers. However, these differences are not constant over time and instead decrease drastically during the years of the financial crisis.

To assess whether the same is also true for the affected firms’ financial characteristics, we also consider median cash-flow ratios, median normalized cash holdings, and the fractions of firms that paid dividends in the periods immediately prior to the reported liquidity shortages. (Plots D, E, and F of Figure 2). Here, too, we find that the differences between the two groups of firms decrease sharply during the years of the financial crisis. More precisely, while constrained firms typically have negative cash flows, higher cash holdings, and are less likely to pay dividends than the unconstrained firms, all of these differences vanish almost entirely during the years 2008 and 2009.

Finally, we also investigate the behavior of widely-used financial constraint measures of Lamont et al. (2001), Hadlock and Pierce (2010), and Whited and Wu (2006). As already shown in section 2, the KZ index of Lamont et al. (2001) is not consistent with our classification of constrained and unconstrained firms. In fact, for the large majority of years in our sample, the median constrained firms have lower KZ index values than the median firm of those that we classify as unconstrained. For the Hadlock and Pierce (2010) and Whited and Wu (2006) measures, on the other hand, we see the same behavior documented for the remaining observable characteristics: Even though firms that are liquidity constrained during normal times do have the properties commonly thought to be associated with financial constraints, the firms that reported liquidity constraints during the crisis appear virtually identical to the median firm in the economy.

Generally speaking, the results we present here support the view that the crisis was a large systematic event that did not just affect a small and easily identifiable subset of firms. In addition, the finding that the characteristics of constrained and unconstrained firms become very similar during the financial crisis poses a challenge for many widely-used measures that rely on cross-sectional variation in such characteristics to establish which firms are constrained at a given point in time. In fact, our data suggest that the period for which standard financial constraint measures contain the least information is exactly the one policy makers and researchers have recently been interested in the most.

To quantify and assess this loss in informational content more formally, we also run a number of probit regressions (Table 5). These regressions capture the extent to which each of the observable firm characteristics can identify constrained firms during the crisis and normal times, respectively.

\[15\] An exception is the dividend payer dummy, which we consider below in terms of its mean, i.e. the percentage of firms that pay dividends.
Consistent with the graphical analysis shown above, we observe sharp decreases in this discriminatory power of the observable characteristics as captured by the Pseudo R-squared values of the regressions.

Table 4: Explanatory Power of Observable Characteristics for Liquidity Shortages

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Pseudo R-squared (×100)</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal Times</td>
<td>Financial Crisis</td>
</tr>
<tr>
<td>Total Assets</td>
<td>-0.00***</td>
<td>-0.00</td>
</tr>
<tr>
<td>Age</td>
<td>-0.00</td>
<td>0.01***</td>
</tr>
<tr>
<td>Profitability</td>
<td>-0.84***</td>
<td>-0.62***</td>
</tr>
<tr>
<td>Cashflow Ratio</td>
<td>-0.72***</td>
<td>-0.51***</td>
</tr>
<tr>
<td>Cash Ratio</td>
<td>0.87***</td>
<td>0.37***</td>
</tr>
<tr>
<td>Dividend Payer Dummy</td>
<td>-0.55***</td>
<td>0.06</td>
</tr>
<tr>
<td>KZ Index</td>
<td>-0.00***</td>
<td>-0.00***</td>
</tr>
<tr>
<td>Hadlock-Pierce Index</td>
<td>0.16***</td>
<td>0.02</td>
</tr>
<tr>
<td>Whited-Wu Index</td>
<td>0.90***</td>
<td>0.17*</td>
</tr>
</tbody>
</table>

Notes: The table shows the results of univariate probit regressions that investigate to what extent observable firm-characteristics were informative about liquidity shortages during the financial crises and normal times, respectively. The sample includes all firms matched to Compustat at the gvkey/fiscal-year level. The dependent variable in all models is a dummy indicating whether or not a firm reported a liquidity shortage in a given year. Constants are included but not reported. The financial crisis is defined as the years 2008-2010. All firm characteristics are lagged by one period and winsorized at the 5% level to reduce the impact of outliers. Variable definitions are shown in Table A.1 of the appendix. T-statistics based on robust standard errors are reported in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

3.3 Reported Reactions to Liquidity Shortages

As discussed above, one of the advantages of the text-based methodology we use in this paper is that it allows us to assess firm-level reactions to liquidity shortages during both the crisis and normal times using a single, consistent framework. This in turn means that we can assess to what extent our purely text-based approach is consistent with prior studies that have focused only on the crisis period, but done so using more standard econometric approaches. In addition, we are able to investigate if the larger and more profitable firms affected between 2008 and 2010 chose to respond in different ways. To capture the distribution of the reported reactions, we assign them to a number of different categories that reflect various real and financial policies. Previous studies have applied a similar type of approach to quantify verbal responses provided by firms in surveys.\(^\text{16}\)

Given that we, too, use verbal evidence provided directly by firms, it suits our analysis well.

\(^{16}\)For influential examples see Blinder et al. (1998) and Campello et al. (2010).
In setting up the grouping that we use for this part of our investigation, we aim to capture all types of reactions firms commonly report and at the same time distinguish between well defined economic concepts. The resulting categories are displayed in Table 5, together with some expressions firms regularly use to describe them. Importantly, while we find that these and other expressions are often very informative, we do not rely on them in the actual classification. Instead, to ensure a high level of accuracy, we code each sentence based on all information it contains. Moreover, whenever appropriate, we assign sentences to more than one category. The exact rules that we follow when assigning reported reactions to each of the categories are shown in the appendix.

Apart from the reaction categories, we also define three rules that determine whether or not we actually code reported behavior as a *response* to a liquidity shortage as opposed to changes that merely occurred at the same time. First, we exclude cases in which firms only describe how they would react to liquidity shortages that could hypothetically arise in the future. Second, we code only cases for which the sentences clearly indicate that the liquidity shortage was the cause and the reaction was the corresponding effect. Third, as long as this requirement is satisfied, we code both absolute changes and deviations from prior plans. For example, a company may either report that it reduced capital expenditures in response to a liquidity shortage, or that the liquidity shortage caused it to raise capital expenditures by less than initially planned. In our analysis, both of these cases appear as reductions in capital expenditures due to a liquidity shortage, because in both cases capital expenditures would have been higher in the absence of the shortage.
Table 5: Categories of Real and Financial Reactions to Liquidity Shortages

<table>
<thead>
<tr>
<th>Category</th>
<th>Short Name</th>
<th>Sample Expressions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Real Reactions</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General Cost Reduction Efforts</td>
<td>Costs General</td>
<td>‘cost cutting measures’, ‘expense reductions’, ‘cost containment plan’</td>
</tr>
<tr>
<td>Capital Expenditures</td>
<td>Capital Expenditures</td>
<td>‘capital expenditures’, ‘capital spending’, ‘capital investment’</td>
</tr>
<tr>
<td>Number of Employees</td>
<td>Employees</td>
<td>‘workforce’, ‘headcount’, ‘number of employees’</td>
</tr>
<tr>
<td>Salaries and Wages per Employee</td>
<td>Salaries and Wages</td>
<td>‘salary reductions’, ‘salary cuts’, ‘freeze on wage rates’</td>
</tr>
<tr>
<td>Research and Development Efforts</td>
<td>Research</td>
<td>‘research and development’, ‘innovation efforts’, ‘product development’</td>
</tr>
<tr>
<td>Inventory Holdings</td>
<td>Inventories</td>
<td>‘inventory reductions’, ‘tighter inventory levels’, ‘reduce excess inventory’</td>
</tr>
<tr>
<td>Marketing and Sales Efforts</td>
<td>Marketing</td>
<td>‘promotional expenditures’, ‘sales and marketing expenses’, ‘advertising expenses’</td>
</tr>
<tr>
<td><strong>Financial Reactions</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Payments in Equity and Related Securities</td>
<td>Equity Pay</td>
<td>‘stock in lieu of cash’, ‘common stock to pay’, ‘options as a means of compensation’</td>
</tr>
<tr>
<td>Dividends on Common Stock</td>
<td>Common Dividends</td>
<td>‘dividends on its common stock’, ‘cash dividends’, ‘dividend payments’</td>
</tr>
<tr>
<td>Payments Related to Real Transactions</td>
<td>Real Payments</td>
<td>‘payments to some of our suppliers’, ‘deferred payment to consultants’, ‘salary deferment program’</td>
</tr>
<tr>
<td>Payments Related to Debt</td>
<td>Debt Payments</td>
<td>‘debt service’, ‘quarterly interest’, ‘payments of interest’</td>
</tr>
<tr>
<td>Dividends on Preferred Stock</td>
<td>Preferred Dividends</td>
<td>‘dividends on [...] preferred stock’, ‘preferred dividends’, ‘preferred dividend payments’</td>
</tr>
<tr>
<td>Stock Repurchases</td>
<td>Stock Repurchases</td>
<td>‘market purchases of treasury stock’, ‘share repurchases’, ‘stock repurchase program’</td>
</tr>
</tbody>
</table>

Notes: The table shows the categories into which the reported reactions to liquidity shortages were grouped. For each category, the column ‘Sample Expressions’ displays a selected number of corresponding phrases that regularly occur in the assigned respective sentences. The sample expressions are not exhaustive. The sentences were assigned manually to the categories based on all the information they contain. The sentences were assigned to multiple categories whenever that best reflected their contents. The exact rules applied when coding the sentences are shown in the appendix.

Using the resulting grouping, we first investigate potential differences at a relatively high level, distinguishing only between real and financial reactions. As Figure 3 illustrates, we find...
that the two periods are remarkably similar in this regard. Specifically, reactions in terms of real variables are generally very frequent and account for approximately 70% of all implemented measures during both the crisis and normal times. Thus, even though the shock associated with the crisis is arguably unique, the relative frequencies at which the affected firms use financial and real measures to overcome their shortages are not.

Figure 3: Time-Variation in the Relative Importance of the Real and Financial Reaction Categories

Notes: The figure illustrates the relative importance of real and financial reactions during the financial crisis and normal times. The financial crisis is defined as fiscal years 2008-2010. Normal times are defined as all other fiscal years in the sample. Sample expressions and category definitions are shown in Table 5. The sentences were assigned to multiple categories whenever that best reflected their contents. The exact rules applied when coding the sentences are shown in the appendix. All sentences were manually assigned to the categories based on all the information they contain.

Of course, even though financial and real reactions are equally common during both time periods, there still may exist significant variation within these two groups. We investigate this in Figure 4. The first main finding we obtain here is that the results provided by our text-based analysis are consistent with those of various studies that have exploited the financial crisis to investigate the reactions to liquidity shortages using more standard econometric methods. In particular, our approach confirms that firms that faced liquidity shortage during the crisis reacted by employing fewer people (Chodorow-Reich, 2014), by reducing their investment in fixed capital (Campello et al., 2010; Duchin et al., 2010), by investing less in R&D (e.g. Paunov, 2012 and Brown and Petersen, 2014), and by reducing payouts to shareholders (Bliss et al., 2015). Thus, all reactions established by the existing studies mentioned above also emerge as important in our text-based methodology. We interpret this as evidence for the informational content of the extracted sentences and the general validity of our approach.
Notes: The figure illustrates the distribution of reported real and financial reactions to liquidity shortages, distinguishing between the period of the financial crisis and normal times. The financial crisis is defined as fiscal years 2008-2010. Normal times are defined as all other fiscal years in the sample. Sample expressions and category definitions are shown in Table 5. The sentences were assigned to multiple categories whenever that best reflected their contents. The exact rules applied when coding the sentences are shown in the appendix. All sentences were manually assigned to the categories based on all the information they contain.

In terms of the differences between the two time periods, we again find that there is only very limited variation. Within the group of real reactions (Plot A of Figure 4), the only noticeable difference is that reductions in capital expenditures were a slightly more common way of preserving internal cash resources during the crisis. However, even this difference is relatively small, and we show below that it is not statistically significant at the 5% level. Within the group of financial reactions (Plot B of Figure 4), we observe one main difference: During normal times, reductions in common dividends were only used by a very small number of firms. This is not entirely surprising, though, given the differences in prior dividend policies between the crisis and normal times that we documented above. Indeed, firms that were constrained during normal times simply did not have this margin of adjustment available to them.

Apart from differences in dividend reductions, these findings show that the reactions of firms that were financially constrained during the crisis were very similar to those of firms that experienced shortages during normal times. This similarity generally suggests that how firms
chose to react to liquidity shortages is not systematically related to the fundamental causes of these shortages. However, we have also seen that the composition of constrained firms was very different across these two time periods. Therefore, it is theoretically possible that some differences in reactions did exist but were at least partly offset or masked by the pronounced changes in the composition of the affected firms we documented above.

We investigate this possibility by running probit regressions of dummy variables indicating the occurrence of a particular reaction on a crisis indicator as well as a number of lagged firm-level controls that capture differences in the composition of the groups of affected firms in the two time periods.\textsuperscript{17} To ensure sufficiently large numbers of observations in the regressions, we include only those reactions that are reported in at least 50 cases. The controls that we use here capture both financial and real characteristics and include total assets, the number of employees, age, cashflows, cash holdings, profitability, the market-to-book ratio (as a proxy for Tobin’s Q) and a measure of asset tangibility.\textsuperscript{18} Furthermore, we include a set of dummies that capture whether or not firms paid dividends in the prior period, had positive R&D expenditures, and invested in fixed capital, respectively.

Table 6 shows the estimation results for both the real and financial reaction types. For each reaction category it presents one specification that only includes the financial-crisis indicator as well as a second specification that also controls for the affected firms observable characteristics. While the first type of specification can generally be considered a more formal test of whether or not a given reaction was unusually common during the financial crisis, the second type of specification captures to what extent the large compositional differences between the two time periods are important for these results. Because the observable firm characteristics themselves are not randomly assigned, they serve only as controls and do not warrant a causal interpretation. We therefore omit their estimated coefficients from the table for brevity.

The regression results we obtain are well in line with the graphical analysis presented above. Specifically, the only reaction type for which the baseline regressions indicate a statistically significant difference between the two time periods are reductions in common dividends. Moreover, the coefficients on the crisis dummy remain insignificant in the regressions that include the lagged firm-level characteristics. Thus, we do not find any evidence suggesting that the similarity in real reactions between the crisis period and normal times is a result of compositional effects. Rather, the similarity exists \textit{in spite} of these compositional differences. Liquidity-constrained firms commonly respond by reducing their real activity, but during the 2008-2010 crisis many of these firms were large and profitable.

\textsuperscript{17}By running separate regressions for each action we implicitly assume independence across these actions. This is an assumption that we could in principle have relaxed by estimating multinomial models using categories for specific actions and their combinations. However, the number of observations in some of the resulting categories would have been relatively low and thus resulted in imprecise estimates.

\textsuperscript{18}All variable definitions are shown in Table A.1 in the appendix.
Table 6: Firm Characteristics and Probabilities of Specific Reactions: Probit Regressions

<table>
<thead>
<tr>
<th>Financial Crisis Dummy</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controls for Firm Characteristics</td>
<td>Controls for Firm Characteristics</td>
</tr>
<tr>
<td>(not included)</td>
<td>(included)</td>
</tr>
<tr>
<td>General Costs</td>
<td>-0.01</td>
</tr>
<tr>
<td>(0.10)</td>
<td>(-1.80)</td>
</tr>
<tr>
<td>Genral Operations</td>
<td>-0.14</td>
</tr>
<tr>
<td>(1.13)</td>
<td>(-0.16)</td>
</tr>
<tr>
<td>Capital Expenditures</td>
<td>0.21*</td>
</tr>
<tr>
<td>(1.79)</td>
<td>(-0.90)</td>
</tr>
<tr>
<td>Employees</td>
<td>-0.16</td>
</tr>
<tr>
<td>(1.17)</td>
<td>(0.55)</td>
</tr>
<tr>
<td>Salaries</td>
<td>0.15</td>
</tr>
<tr>
<td>(1.10)</td>
<td>(1.10)</td>
</tr>
<tr>
<td>Research &amp; Development</td>
<td>-0.19</td>
</tr>
<tr>
<td>(1.08)</td>
<td>(-0.54)</td>
</tr>
<tr>
<td>Payments in Equity</td>
<td>-0.19</td>
</tr>
<tr>
<td>(1.34)</td>
<td>(0.81)</td>
</tr>
<tr>
<td>Common Dividends</td>
<td>0.70***</td>
</tr>
<tr>
<td>(5.37)</td>
<td>(1.18)</td>
</tr>
<tr>
<td>Real Payments</td>
<td>-0.30*</td>
</tr>
<tr>
<td>(1.73)</td>
<td>(-0.39)</td>
</tr>
</tbody>
</table>

Notes: The table shows the results of multivariate probit regressions that investigate which time-periods and firm characteristics are associated with specific types of reactions to liquidity shortages. The sample includes all firms matched to Compustat at the gvkey/fiscal-year level. The dependent variable in all models is a dummy indicating whether or not a firm reported a specific reaction for a given liquidity shortage. The financial crisis is defined as the years 2008-2010. Constants are included but not reported. All firm characteristics are lagged by one period and winsorized at the 5% level to reduce the impact of outliers. Variable definitions are shown in Table A.1 of the appendix. T-statistics based on robust standard errors are reported in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.
4 Discussion and Conclusion

During the 2008-2010 financial crisis a large number of firms faced acute shortages in liquidity and, as a result, adjusted important real policies such as their employment and investment decisions. In this paper, we have used narrative evidence from 20 years of corporate filings to investigate whether these crisis-related shortages were different from cases that occurred during normal times. In particular, we first searched the texts of almost 900,000 documents for discussions of firm-level liquidity shortages. Then, translating the contents of these discussions into statistical variables, we quantified what types of firms were affected and how they responded.

Our data show that liquidity shortages associated with the financial crisis led to very similar reactions as cases that occurred during more normal times. Specifically, the affected firms commonly responded by downsizing their operations, employing fewer people, and reducing investment in both fixed capital and R&D. However, what made the crisis unique was that many of the firms affected by it were large, fundamentally healthy, and profitable. This is in sharp contrast to normal times, during which liquidity constraints tend to be concentrated among small firms that have large cash outflows and are also fundamentally distressed. Moreover, we have shown that several widely-used measures of financial constraints were informative during normal times but lost much of their informational content between 2008 and 2010.

The results we establish shed new light on the nature of the crisis, suggesting that it affected a group of companies very similar to the median firm in the economy. The view that the immediate effects of the crisis were not limited to a small and well identified subset of firms is not uncommon among policy makers and in the public debate. At the same time, however, it is at odds with the widespread notion that liquidity shortages and financial constraints generally tend to be concentrated in opaque companies that are subject to large information asymmetries. Moreover, systematic empirical evidence on changes in the composition of liquidity-constrained firms between financial crises and normal times has previously been difficult to obtain using standard methods that rely on a priori assumptions about which types of firms typically tend to be constrained.

One immediate implication of our findings is that standard financial constraint measures such as those of Lamont et al. (2001), Whited and Wu (2006), and Hadlock and Pierce (2010) may not be sufficient for assessing the extent and economic implications of large financial crises. Indeed, as we have shown, many of the firms that experienced liquidity shortages between 2008 and 2010 would not have been classified as constrained in terms of such measures. While we do not perform an explicit welfare analysis, this type of error could potentially be important for optimal policy. For example, if central bankers and government officials underestimate the number and profitability of constraint firms, policy responses may be too small and not targeted at the right companies.

Beyond these practical considerations, our results also speak to the theoretical mechanisms that cause liquidity shortages and financial constraints. For example, one important firm characteristic commonly associated with financial constrains in theoretical models with heterogeneous firms is size. Our results support the general importance of this characteristic and show that, on average, small firms are indeed more likely to experience financial constraints than large firms.
However, they also suggest that size alone is not sufficient for capturing how access to liquidity at the firm-level is affected by very large financial shocks. In light of this, mechanisms that are able to better match the liquidity dynamics we document for the crisis appear to be an important issue to be explored in future work.

Another question our results highlight is whether there are other observable firm-level characteristics that can identify financial constraints not only during normal times, but also during financial crises. In this paper we have provided evidence suggesting that a large number of measures widely used in the existing literature do not succeed at this and instead only perform well during normal times. However, this finding does not necessarily imply that there are no other measures that perform more consistently over time. Automated text-based methods like the ones applied in this paper, Buehlmaier and Whited (2014), Bodnaruk et al. (2015), and Hoberg and Maksimovic (2015) could prove valuable for discovering such potential measures given that they provide information on financial constraints for very large numbers of firms and a time period of more than two decades.

Finally, apart from our empirical results, another contribution of this paper is in its methodology. While we build on an influential existing literature that has also used the texts of corporate filings to assess which firms are financially constrained, we are the first to systematically exploit precise grammatical structures of the same texts to also capture the corresponding firm-level reactions. This approach allows us to examine cases from both the crisis and normal times using a single, consistent framework. As we have shown, the results our framework yields are in line with both the aggregate financial market environment and results prior studies have established for the crisis period using more standard econometric approaches. This supports the general validity of our approach and suggests that the texts of corporate filings are not only informative about the extent to which firms are financially constrained, but also about other important aspects closely related to these constraints, such as the corresponding reactions.
References


Chodorow-Reich, Gabriel (2014) “The Employment Effects of Credit Market Disruptions: Firm-


A Appendix

A.1 Descriptions and Coding Rules of the Reported Reaction Categories

General Cost Reduction Efforts This category reflects cases in which firms disclose general cost reduction efforts without stating explicitly which types of costs they reduce.

Capital Expenditures This category captures reductions in investments in fixed assets. For example, it reflects decreases in both initial purchases and maintenance of property, plant and equipment.

Research and Development Efforts This category captures reductions in research and development efforts. Both the amount of money spent on these efforts and the number of employees dedicated to them are included in the definition.

Marketing and Sales Efforts This category captures reductions in marketing, advertising, and sales efforts. Both the amount of money spent on these efforts and the number of employees dedicated to them are included in the definition.

Salaries and Wages per Employee This category captures reductions in labor cost per employee or per hours worked. The types of costs reflected include salaries, wages, and related items such as contributions to employee health and retirement plans. Layoffs or reductions in hours worked are not coded in this variable unless they coincide with changes in labor costs per employee or per hours worked. Changes in the form of payment, for example from cash to non-cash, are not coded in this variable unless they coincide with or imply changes in labor costs per employee or per hours worked.

Number of Employees This category captures cases in which the reporting firms reduce the number of employees. It does not capture cases in which working hours per employee are reduced unless these cases are also associated with reductions in the size of the company’s workforce.

Inventory Holdings This category captures cases in which the reporting firms reduce the amount of inventories they hold.

Dividends on Common Stock This category captures reductions in the amount of dividends the reporting firms declare on their outstanding common stock. It only reflects cases in which the value of the dividend changes. For example, changes from cash to in-kind dividends or vice versa are not coded unless the amounts or values of the respective dividends also change. Changes in dividend amounts that are not explicitly associated with preferred shares are assumed to pertain to common equity and thus are reflected by this variable.

Dividends on Preferred Stock This category captures reductions in the amount of dividends the reporting firms declare on their preferred stock. It only reflects cases in which the amount or value of the dividend changes. For example, changes from cash to in-kind dividends or vice versa are not coded unless the amounts or values of the respective dividends also change. Changes in dividend amounts are only assumed to pertain to preferred shares if firms explicitly state this. Dividends not described as relating to preferred stock are assumed to refer to common stock dividends and thus are not captured by this variable.
Stock Repurchases  This category captures cases in which firms reduce the amount of repurchases of their own stocks.

Payments in Equity and Related Securities  This category captures cases in which firms make payments in equity or related instruments (e.g. warrants or options) instead of paying in cash.

Payments Related to Real Transactions  This category captures cases in which firms do not make or delay payments that are related to real transactions. Examples include salaries, wages, and payments to vendors. Cases in which the corresponding payments are made on time but by means other than cash are not captured by this variable.

Payments Related to Debt  This category captures cases in which firms do not make or delay payments that are related to debt or credit transactions. Examples include interest or principal payments. Cases in which the corresponding payments are made on time but not in cash are not captured by this variable.
A.2 Definitions of Observable Firm Characteristics

Table A.1: Definitions of Observable Firm Characteristics

<table>
<thead>
<tr>
<th>Firm Characteristic</th>
<th>Compustat Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Assets</td>
<td>Total Assets (at)</td>
</tr>
<tr>
<td>Employees</td>
<td>Employees (emp)</td>
</tr>
<tr>
<td>Firm Age</td>
<td>Current fiscal year – first fiscal year in Compustat, (at the gvkey level)</td>
</tr>
<tr>
<td>Firm Profitability</td>
<td>Operating income before depreciation (oibdp) / Total Assets (at)</td>
</tr>
<tr>
<td>Cashflow Ratio</td>
<td>Cashflow (oibdp−xint−txt−dvc) / Total Assets (at)</td>
</tr>
<tr>
<td>Cash Ratio</td>
<td>Cash (ch) / Total Assets (at)</td>
</tr>
<tr>
<td>Dividend Payer</td>
<td>Indicator variable for positive common dividends in cash (dvc)</td>
</tr>
<tr>
<td>Tobin’s Q</td>
<td>Market Value of Assets (at+csho<em>prcc−ceq−txdb) / 0.9</em>Total Assets (at)+0.1<em>Market Value of Assets (at+csho</em>prcc−ceq−txdb)</td>
</tr>
<tr>
<td>Tangibility</td>
<td>Property, Plant and Equipment (ppent) / Total Assets (at)</td>
</tr>
</tbody>
</table>

Notes: The table shows definitions of observable firm characteristics used in the main analysis. Brackets contain the Compustat item codes used to construct the respective variables. All resulting variables are winsorized at the 5% level to reduce the impact of outliers.
A.3 Removal of False Positives

One important step in the construction of the dataset used in this paper is the manual removal of false positives, i.e. the removal of sentences that were discovered by the automatic pre-selection algorithm even though they actually do not describe realized firm-level liquidity shortages. To illustrate the types of sentences we remove in this step, Table A.2 provides some examples as well as brief discussions that explain why we classify them as false positives.

Table A.2: Examples of Removed False Positives

<table>
<thead>
<tr>
<th>Sample Sentence</th>
<th>Company Name</th>
<th>Reason for Exclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>“In addition, the company can delay major capital investments or other funding requirements or pursue financing from other sources to preserve liquidity, if necessary.”</td>
<td>American Water Works Company Inc.</td>
<td>The sentence describes the actions the reporting company could take in a hypothetical scenario. It does not imply that the company was experiencing a liquidity shortage in the reporting period.</td>
</tr>
<tr>
<td>“We believe we have the ability to conserve liquidity when economic conditions become less favorable through any number of strategies including curtailment of store expansion plans and cutting discretionary spending.”</td>
<td>Tumi Holdings Inc</td>
<td>The sentence provides a general assessment of the reporting company’s ability to preserve liquid assets. It does not imply that the company was experiencing a liquidity shortage in the reporting period.</td>
</tr>
<tr>
<td>“In addition, changes in the capital markets have resulted in a more stringent lending environment for solar and sapphire companies, which in turn has caused decreased spending within the industries we serve, as customers try to preserve their liquidity.”</td>
<td>GT Advanced Technologies Inc</td>
<td>The sentence states that the customers of the reporting company were engaging in cash preservation efforts. It does not imply that the reporting company itself was also engaging in such efforts during the reporting period.</td>
</tr>
</tbody>
</table>

Notes: The table shows corporate filing sentences that were extracted using the pre-selection patterns shown in Table 1 but then classified as false positives in a subsequent manual reading step.