Bank market concentration, relationship banking and small business liquidity

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Abstract

This paper examines two contrasting interpretations of how bank market concentration (*Market Power Hypothesis*) and banking relationships (*Information Hypothesis*) affect three sources of small firm liquidity (cash, lines of credit and trade credit). Supportive of a market power interpretation, we find that in a highly concentrated banking market, small firms hold less cash, have less access to lines of credit, and are more likely to be financially constrained, use greater amounts of more expensive trade credit and face higher penalties for trade credit late payment. We also find support for the information hypothesis: relationship banking improves small business liquidity, particularly in a concentrated banking market, thereby mitigating the adverse effects of bank market concentration derived from market power. Our results are robust to different cash, lines of credit and trade credit measures and to alternative empirical approaches.

1. Introduction

Unlike the liquidity decisions of large firms, less is understood about the effects of bank concentration and relationship banking on small firm liquidity (Opler et al., 1999; D'Mello et al., 2008). Theoretical ambiguities also persist. Because concentrated banking structures imply market power inefficiencies, Klein (1971) suggests that bank concentration leads to small firms facing greater financial constraints (Beck *et al.*, 2004) and higher capital costs (Rice and Strahan, 2010). We refer to this as the *market power hypothesis*. Petersen and Rajan (1995) theorize, however, that relationship banking may significantly alter the relationship between bank concentration and the financing of informationally opaque small firms. They argue that banks with market power are incentivized to acquire private information and are better able to efficiently internalize the costs of collecting such information than banks in more competitive markets. Consequently, this helps reduce information asymmetries between banks and small firms, thereby potentially promoting small firm liquidity as banks are able to offer better access to external sources of finance. In the Petersen and Rajan (1995) model, therefore, small firms have better access to finance in concentrated banking markets where creditors "have an assurance of obtaining future surplus[es] from firm[s] and consequently accept lower returns up front" (p. 440). Empirically, Marquez (2002) provides support for the impacts of relationship banking by showing that bank market competition disperses borrower-specific information, thereby making it more difficult for banks to overcome information asymmetries with consequent deleterious impacts on the small firm's ability to access finance. Han et al. (2009a) also show that small firms have better access to bank finance in more concentrated banking markets. In sum, there is theoretical and empirical evidence to support what we refer to as the *information hypothesis*.

The existence of these two alternative perspectives on the role of bank concentration on small firm liquidity raises two central research questions: 1) Does bank concentration adversely affect the liquidity of small firms? and 2) Does relationship banking support small firm liquidity so that they are more likely to hold appropriate levels of cash, have greater access to lines of credit and be less prone to using expensive trade credit? These questions are of practical significance to small firms because if they are unduly financially constrained by bank concentration (Beck and Demirgüç-Kunt, 2006), it is likely to impact on their productivity and ability to bring forward new innovations (Storey and Greene, 2010). Equally, there have been long-standing and on-going policy concerns about the role that bank concentration has on small firms both in the United States and in other developed economies (Rice and Strahan, 2010). This reflects concerns about social welfare losses that may arise from bank concentration (Maudos and de Guevara, 2007) and concerns that bank concentration may impede the ability of small firms to contribute to economic growth (Ryan et al, 2014; Chong et al, 2013).

This aim of this paper is to investigate how banking market competition and relationship banking affects small firm liquidity. Our key contribution is to examine how three key measures of small firm liquidity (cash holdings, lines of credit and trade credit) - both on their own and together - are affected by bank market concentration and relationship banking. We focus on cash holdings because of their importance to small firm profitability, valuations and survival (Mach and Wolken, 2011; Harford et al., 2008). Despite this, to our knowledge, there have only been two earlier studies of small firm cash holdings (Faulkender, 2002; García-Teruel and Martínez-Solano, 2008). Similarly, although credit lines are also a common source of small firm liquidity (Sufi, 2009), prior studies have typically focused on credit line usage by large firms (Acharya et al, 2013). Finally, while there is widespread recognition that trade credit is a more expensive substitute for lines of credit (Petersen and

Rajan, 1994; 1997; Ryan et al, 2014; Cuñat, 2007), prior research has often focused on lending rather than liquidity decisions (Ratti et al., 2008) despite small firms having less access to capital markets. In sum, one contribution of this paper is that it considers how banking concentration and relationship banking impact individually on these three main forms of small firm liquidity.

However, what is particularly novel about this study is that we are the first, to our knowledge, to examine how bank concentration and relationship banking impacts on all these three different forms of liquidity together. Examining these sources together is important because they are often used as substitutes. For example, non-operational cash (unconditional liquidity) is used as a buffer against cash flow shocks while credit lines (conditional liquidity) provide liquidity to support firms seeking to exploit business opportunities (Lins et al., 2010). Sufi (2009) also shows that firms with low (high) cash flows are less (more) likely to have credit lines. Faulkender (2002) identifies that cash holdings are negatively related to the use of trade credit while Acharya et al., (2013) show that firms with higher risk profiles prefer holding cash rather than using credit lines. Moreover, trade credit is used as a substitute of bank credits, especially for less liquid firms (McGuinness and Hogan, 2014). In sum, therefore, the central novelty of this paper is that we separately and jointly consider the impacts of bank concentration and relationship banking on three main sources of small firm liquidity.

Our results show that when all three forms of liquidity are considered together, small firms in a highly concentrated banking market have less access to lines of credit and use more expensive trade credit. In terms of the individual forms of liquidity, we also find that in a concentrated banking market small firms hold less cash, are more likely to be financially and liquidity constrained, have less access to lines of credit, use greater amounts of trade credit and face higher penalties if they pay trade credit late. These findings are consistent with a

market power interpretation which suggests that bank concentration has a negative impact on small firm liquidity. Nonetheless, we also find that if small firms have built longer banking relationships in concentrated banking markets, they hold more cash, have better access to lines of credit and have greater financial slack, which militates against the adverse effects of banking market concentration. Such results are consistent with the *information hypothesis*. What, therefore, emerges from our study is support for both market power and information hypotheses, suggesting that these two approaches are not mutually exclusive.

The remainder of the paper is structured as follows: Section 2 reviews the existing theoretical and empirical literature on small business liquidity, bank market concentration and relationship banking. Section 3 presents the data and defines the key measures. Section 4 reports the main results with additional robustness tests. Section 5 discusses the findings and points to the implications of our study.

2. Bank market concentration and small firm liquidity

Given that about half of all US small firms headquarter in highly concentrated banking markets (Han and Zhang, 2012), there have been concerns about the impact of bank consolidation on US small firms (Rice and Strahan, 2010). This is despite - following on from the passage of the IBBEA deregulation of banking in the 1990s - the removal of both inter and intra state branching and banking restrictions. Although this deregulation led to an initial increase in the supply of credit and small firms paying lower prices for their loans, Federal Deposit Insurance Corporation (FDIC) data subsequently has shown that since around the start of this century, bank concentration levels have plateaued. Illustrative of this are two statistics from FDIC data between 2004-2013: (1) the average value of bank concentration, expressed in terms of the Herfindahl-Hirschman Index, was 1077 with a standard deviation as low as 76 over this period; and (2) in terms of the Panzar-Rosse H

statistic, the long term equilibrium for bank competition over the same period was, on average, 0.52 with a standard deviation of 0.08. Both statistics therefore show that bank concentration has remained stable and there has been little year-to-year variation (as measured by the standard deviations) over the period 2004-2013.

Theoretically, there exist two divergent interpretations of the impact of these stable levels of bank market concentration on small firm liquidity. In terms of the market power hypothesis, Klein (1971) suggests that as competition decreases among banks, market power is increased. The net effect is that lower competition causes greater financial constraints for small firms (Beck and Demirgüç-Kunt, 2006). Moreover, if a concentrated market is dominated by large banks, lenders will rely heavily on hard and quantitative information to make lending decisions (Stein, 2002). As a result, it is difficult for small firms to raise external finance because they lack hard information, such as collateralizable assets and credit ratings. These effects are also shown in terms of small firm lending. Rice and Strahan (2010) show that in those US States with more open bank branching, small firms were more likely to borrow from banks and borrowed at lower interest rates compared to less open states. Other studies show that loan rates charged in a concentrated market are higher (Degryse and Ongena, 2005); that increases in market power increase small firm financial constraints (Ryan et al., 2014); and new entrants face greater difficulties in accessing credit in a concentrated banking market (Cetorelli and Strahan, 2006). In essence, the market power hypothesis gives rise to predictions that in a concentrated banking market small firm liquidity will be adversely impacted, suggesting that trade credit is used to a greater extent, lines of credit are less available and, subject to the characteristics of the small firm, there will be deviations from the optimal cash holdings of the small firm.

An alternative view of bank concentration, however, is that concentration actually improves small firm liquidity. Central to this is the presence of information asymmetries

between the lender and the borrower in terms of adverse selection and moral hazard problems. The advantages of relationship banking may differ depending on the structure of the banking market (Han et al., 2009a). One view is that relationship banking is a source of competitive advantage for small banks because their loan officers are better able to reduce bank-small firm information asymmetries. In contrast, staff in large banks may have less access to the 'inside track' on small firm customers, partly because large banks find it difficult to process 'soft' information and partly because the bank prefer a systematic and quantitative transactional approach to small firm finance (Stein, 2002; Berger et al., 2001). Petersen and Rajan (1995) identify that private information acquisition is more easily internalized by lenders in a concentrated market and informationally opaque firms find it easier to raise external finance in a concentrated market than in a competitive market (Han et al., 2009a). Similarly, the models provided by Dell'Ariccia and Marquez (2004) as well as Berger et al., (2004) suggest that concentrated (monopolistic) power can provide incentives to alleviate asymmetric information issues. This gives rise to predictions that there are favorable benefits from relationship banking in concentrated markets with small firms being less likely to be liquidity constrained, having greater access to lines of credit and being less likely to use trade credit.

In sum, the market power and information approaches suggest alternative predictions for the impact of bank concentration on small firm liquidity. These approaches, however, are not mutually exclusive but reflect that the market power hypothesis is rooted in a concern about market efficiencies while relationship banking is more concerned with the impact of information asymmetries. Nonetheless, no clear resolution has emerged from prior empirical research to identify which of these two perspectives has salience for better understanding small firm liquidity issues.

3. Data and variables

3.1. Data

Our data are the 1998 and 2003 US Survey of Small Business Finances (SSBF98 and SSBF03). These data both survey the finances of for-profit, non-financial, non-farm, and non-subsidiary businesses with fewer than 500 employees. In total, we use the pooled 7,801 small firms available to us from both the SSBF98 (3,561 small firms) and SSBF03 (4,240 small firms)[1].

Like Vickery (2008) and Rice and Strahan (2010), we control for the possible sample selection bias by using the weights provided in SSBF98 and SSBF03. These data are advantageous for four reasons. First, they provide a representative picture of US small firm finance. Second, these data are comprehensive. For example, one advantage of these data is that they allow the identification of local banking structures. This is important because Rice and Strahan (2010) show that US small firm-banking relationships are often geographically constrained to localities. Third, besides providing rich data on small firm liquidity, these data are superior to ready-to-use databases which are unrepresentative and lack information on small firm data. Moreover, although individual bank data may also provide valuable information, it is often impossible to make between bank comparisons. Finally, as shown above, one central feature of US banking is that bank concentration levels have remained stable with little year-to-year variation since the deregulation of the banking industry in the 1990s. One further indication of this is that Mach and Wolken (2006) provide evidence that small firms still continue to use commercial banks as their main source of external finance.

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[1] The US definition of small firms (fewer than 500 employees) differs from the EU/OECD definition (fewer than 250 employees). However, in the SSBF98 and SSBF03, there were only 128 firms that had more than 250 employees (1.64%) with 61.4% being micro firms (0-9 employees), 20.72% being small firms (10-49 employees) and 16.2% being medium sized firms (50-249 employees). Subsequent robustness tests (not shown due to space constraints but available on request from the authors) showed that excluding the 128 firms our results remained robust.

3.2. Dependent variables

We use three dependent variables. First, to examine cash holdings, we follow Faulkender (2002) and use a cash/sales ratio. We complement this by using – as a robustness check - cash/total assets as an alternative dependent measure of cash holdings (Pinkowitz and Williamson, 2001) (see: Table 7). Second, to assess lines of credit, we use total lines of credit/total assets to reflect bank credit line availability (Compello et al, 2011). We complement this by using unused credit lines as a robustness check. This is valuable because it is a measure of financial slack of the business (Houston et al, 2001). For our final dependent variable, we use account payables/total cost of goods and services (Cuñat, 2007) as a measure of trade credit. Again, this is complemented by using an alternative measure of trade credit - the penalty charges in percentage terms if trade credit is paid late. Moreover, to provide further depth to our analysis of these sources of small firm liquidity, we consider the overall effects of banking market structure and relationship banking by assessing financial (=1 if a firm's applications for loan were rejected over the last three years and/or they are discouraged borrowers[2]; 0 otherwise) and liquidity constraints (=1 if a sample firm does not pay back credit cards in full; 0 otherwise). This is valuable because it controls for the variation of banking market and relationship banking effects on different liquidity instruments.

To investigate the impacts on cash holdings, credit lines and trade credit together, we use our three main dependent measures to consider the substitute effects of cash vs. lines of credit; trade credit vs. credit lines; and cash vs. trade credit by building cash to credit lines ratios, cash to trade credit ratios and credit lines to trade credit ratios as the dependent variables.

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[2] Discouraged borrowers are those businesses that would like to access external finance but do not apply because they feel they would be turned down by banks (Fraser, 2014). In our US data, we find that 9.24% were rejected borrowers and 10.64% were discouraged borrowers. These are similar to the findings from Fraser (2014) for the UK. Discouraged and rejected borrowers tend to be far fewer than 'happy' non-seekers (i.e. businesses not seeking external finance) which make of the bulk of small firms (Fraser, 2014).

Table 1 reports the descriptive statistics. It shows that the average cash holding by small firms (cash/total assets) is 23%. This is higher than that commonly found in large and publicly traded firms in both the US firms (4.4%, Pinkowitz et al., 2006) and the UK (9.9%, Ozkan and Ozkan, 2004) and reflects, *inter alia*, greater demands on cash among small firms for investment, for transactions purposes and the limited access to reasonably priced cash alternatives, such as lines of credits. Table 1 also shows that, on average, the cash to sales ratio is 8% which is similar to 7.1% that reported by Faulkender (2002) on US small firms. Credit lines represent about 18% of small firm assets, in line with that of randomly selected sample firms (15.9%) (Sufi, 2009) and that from 2009 Q1 CFO Survey (23.85%) (Campello et al (2011). Trade credit also accounts for 6% of costs of goods sold. Table 1 further shows that 24% and 20% of small firms are liquidity and financially constrained, respectively.

[Table 1 around here please]

3.3.   Bank market concentration and relationship banking variables

Like Vickery (2008) and Petersen and Rajan (1995), we use a categorical measure of the Herfindahl-Hirschman Index (HHI: 100% bank deposit) to measure *local* bank market concentration (a banking market is competitive if HHI is between 1 and 1000 (HHI competitive=1); moderately concentrated if it is between 1000 and 1800 (HHI moderately concentrated=1); and highly concentrated if it is greater than 1800 (HHI highly concentrated=1)[3]. Table 1 shows that only 6% of small firms were located in a competitive banking market, 44% in a moderately concentrated banking market and 50% in a highly concentrated market. These concentration levels are very similar to that found by Vickery (2008). Table 1 also shows that the banking market was slightly more competitive in 2003 (7%

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[3] We use this categorical HHI measure because the continuous value of HHI is not available. We did approach the Federal Reserve as part of this study to gain access to HHI as a continuous variable. However, the Federal Reserve rejected this request, citing that it would impact on the confidentiality of the firms in the SSBF.

competitive and 49% highly concentrated) than it was in 1998 (5% competitive and 52% highly concentrated) as a consequence of the 1990s interstate branching deregulation (see: Rice and Strahan, 2010 for similar effects) but, as we saw earlier, bank concentration has remained broadly stable since this period of time.

In line with the extant literature, we also measure key features of relationship banking: the length of relationship with the primary financial institution (Petersen and Rajan, 1994; Agostino et al, 2011) (average 10 years, ranging from 0 to 96 years); number of banking relationships (Hernández-Cánovas and Martínez-Solano, 2007; Iturralde et al, 2010) (average 2.59 relationships); type of the primary financial service provider (Han et al., 2009b) (85% are banks); and physical distance (average 7.15 miles) to the primary financial institution (e.g. Degryse and Ongena, 2005).

3.4. Control Variables

Since there is strong evidence that small firm characteristics and macroeconomic conditions impact on small firm liquidity (Faulkender, 2002; García-Teruel and Martínez-Solano, 2008; Ehling and Haushalter, 2012), we control for firm level characteristics[4] by size (total assets), organizational type (corporation), industrialized return on assets (industry normalized ROA), current debt (current liability/total assets) and inventory (inventory/total assets) ratios, industry cash flow risk (standard deviation of cash flow to assets in a specific industry; Bates et al., 2011) and a categorical risk rating (Dun&BradStreet score)[5]. We also control for macroeconomic conditions by 1-year lagged regional GDP growth (Rice and

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[4] In the preliminary tests, we also considered corporate governance variables (e.g. number of owners, whether firm is owner-managed). We found that these factors had no impact (see also Al-Najjar, 2015). This reflects that 90% of small firms in the sample are owner-managed, 84% are family-owned and 54% have only one owner. This limits the potential for agency problems in terms of cash holdings (Ang, 1991). Therefore, we excluded them from the following tests.

[5] The 2003 survey offers risk rating with 6 categories and the 1998 survey has 5 categories. We follow Rice and Strahan (2010:872) and recategorize the 2003 rating to lie between 1-5, with 5 being the most risky and 1 being the least risky.

Strahan, 2010; García-Teruel and Martínez-Solano, 2008), industry (SIC-2D), region and year.

3.5. Analytical Strategy

We analyse our three dependent variables by using Weighted Least Squares (WLS) regressions to limit sample selection biases. The baseline model specification is as follows:

$$Liquidity = \beta_0 + \beta_1 \times banking\ relation + \beta_2 \times banking\ market\ concentration + \beta_3 \times$$
$$control\ variables + \varepsilon\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

where *liquidity* is measured as cash/sales (Table 2), credit lines/total assets (Table 3), and trade credits/cost of goods sold (Table 4) and ε is the error term. Eq. (1) tests market power hypothesis by examining the effects of individual banking market concentration measures. We also focus on interaction effects (Eq. 2) in terms of the length of time in a banking relationship and bank concentration, as a test for the information hypothesis. We consider relationship duration because this reflects Petersen and Rajan (1994, 1995) who showed the importance of relationship duration in concentrated banking markets.

$$Liquidity = \beta_0 + \beta_1 \times banking\ relation + \beta_2 \times banking\ market\ concentration + \beta_3 \times control$$
$$variables + \beta_4 \times (banking\ relation \times banking\ market\ concentration) + \varepsilon\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

Following this logic, we investigate the effects of banking relation and banking market concentration on financial and liquidity constraints (Table 5). One advantage of measuring financial and liquidity constraints is that it allows us to assess whether bank market structure and banking relationships have harmful or beneficial effects on the liquidity

of small firms. It also allows us to control for the variation of such effects on different types of liquidity. To examine the alternative sources of liquidity (Table 6), we define '*liquidity*' in Eq. (1) and Eq. (2) as cash/(cash+credit lines), trade credit/(trade credit+credit lines) and cash/(cash+trade credit). Finally, to test the robustness of our results, we use different sets liquidity measures, and Tobit models for cash holdings (Table 7). We also examine Variance Inflation Factors (VIFs) for each model for evidence of multicollinearity and follow the approach used by Craig and Hardee (2007) to investigate endogeneity issues in our data.

4.   **Empirical results**

4.1 Cash holdings

Table 2 shows support for both the market power and information hypotheses: Model 1 shows that small firms with longer banking relationships hold more cash (0.04%, p=0.1), equivalent to about $1,626 more cash with average sales. Model 2 shows supporting evidence for both market power and information hypothesis. In support of the market power hypothesis, small firms hold less cash in highly concentrated banking markets (-1.15%, p=0.1), equivalent to about $46,741 less cash than in other banking markets. Nonetheless, relationship banking increases small firm cash holding but only in highly concentrated banking markets (0.08%, p=0.1), consistent with Han et al. (2009a) and supporting information hypothesis. Robustness checks (Table 7) show results that are consistent with these findings: small firms hold less cash in a concentrated banking market; and relationship banking increases cash holding levels in a highly concentrated banking market.

[Table 2 around here please]

4.2.   Lines of Credit

Table 3 shows further support for both hypotheses. In terms of marker power, Models 1-4 show that highly concentrated banking structure reduces both the availability and liquidity 'slack' of small firms in terms of credit lines. For example, Model 1 shows total lines of credit are less available in a highly concentrated bank market (-2.16%, p=0.1) while Model 3 shows that small firms have smaller amount of unused lines of credit (-1.48%, p=0.1). This is equivalent to about $42,344 less total value of credit lines and $29,013 less unused value of credit lines in a highly concentrated market for an average small firm. These effects are also evident when interaction effects between bank concentration and the length of the banking relationship is considered. Nonetheless, there is also evidence to support the information hypothesis. The interactions in Models 2 and 4 show that if a small firm has a longer banking relationship in a either a moderately or highly concentrated banking market, this alleviates the unfavorable effects of banking concentration since small firms have more total and unused lines of credit. For example, an additional year of relationship banking increases the availability of credit lines in a non-competitive banking market by about 0.3% (p=0.1) and the unused value for credit lines by about 0.2% (p=0.05).

[Table 3 around here please]

4.3.   Trade Credit

In Table 4, Model 1 shows that in either a moderately or highly concentrated banking market small firms use more trade credit. When compared to a competitive banking market, this represents about 0.7% of their costs of goods sold. Model 3 also shows that small firms in highly concentrated banking markets pay higher penalties on late repayment compared to other banking markets (17.17%, p=0.1). Both reflect a fact that in a concentrated banking

market, small firms have less access to and face higher costs on bank credit and as a result, small firms use greater amount of more expensive trade credit and pay higher penalties on late repayment. This again supports a market power interpretation of bank concentration. In terms of interaction effects, Table 4 reports no support for the information hypothesis. The table also shows that the adjusted R^2 is low for models 3 and 4. As with Petersen and Rajan (1994) who also found low levels of adjusted R^2, one possible reason is the limited variation of the dependent variable which ranges from 0 to 36.9%. Another possible reason is because of the limited relevant information available from the dataset. We keep using the same set of independent variables to make them comparable to other models.

[Table 4 around here please]

4.4.   Financial and liquidity constraints

To complement the findings on cash holdings, lines of credit and trade credit, Table 5 considers financial and liquidity constraints. In terms of liquidity constraints, both Model 1 (without interaction effects) and Model 2 (with interaction effects) show that bank competition has a favorable impact on small firm liquidity by decreasing the probability of being liquidity constrained (marginal effects of 7.32% (p=0.1) and 6.80% (p=0.1), respectively). Models 3 and 4 show that compared with other banking markets, highly concentrated banking market increases the likelihood a small firm being liquidity and financially constrained (marginal effects of 2.13% (p=0.1) and 3.23% (p=0.1), respectively). Table 5, therefore, provides support for the market power hypothesis. As with earlier, Table 5 also provides support for the relationship banking theory. Models 1, 3 and 4 indicate that as banking relationships lengthen, the probability of being liquidity or financially constraint is lower.

[Table 5 around here please]

In summary, Tables 2-5 present evidence to support both the market power and information hypotheses. We find that in a concentrated banking market small firms are more likely to have insufficient cash holdings and that they are pushed to use more trade credit which, if these are paid late, leads to them paying higher penalty charges. Moreover, small firms have less available lines of credit lines and unused liquidity slacks. Nonetheless, small firms that have longer relationships with their bank also benefit - particularly in a concentrated banking market - in terms of increased cash holdings, greater availability of credit lines and credit slack and a lower probability of being financially constrained. Such effects are not evident in a competitive banking market (except for the probability of being financially constrained).

4.5 Cash, Lines of Credit and Trade Credit: Alternative Sources of Liquidity

Table 6 presents the results of our comparison of the three sources of small firm liquidity. This is important because the bank concentration effects may vary over different types of liquidity instruments and earlier results show cash, credit lines and trade credits respond differently to bank market concentration. Consistent with earlier results (Tables 2 and 3), Model 1 in Table 6 shows that in a highly concentrated banking market, small firms have a higher cash/(cash + total credit lines) ratio (2.16%, p=0.1) suggesting that the use of credit lines is more sensitive to bank market concentration than cash holdings. Moreover, following on from Tables 3 and 4 which showed that small firms have less credit lines and use more trade credits, Model 3 in Table 6 shows that the ratio between trade credits/(trade credits + credit lines) is higher in a highly concentrated market than in a competitive banking

market by 4.7% (p=0.01). Model 5 shows that the ratio of cash/(cash + trade credits) is lower in a highly concentrated banking market than in other markets by 1.53% (p=0.05), suggesting that small firms hold less cash but also have to use more trade credits as an expensive liquidity substitute in a highly concentrated bank market. Table 6 shows little evidence of information effects on the selection of liquidity instruments.

[Table 6 around here please]

4.6 Robustness Tests

We report Variance Inflation Factors (VIFs) values for our main results (Tables 2-6). The highest VIF value across these tables is 4.57, indicating little evidence of multicollinearity in our analysis. However, because of the limitations of the data, we are not able to explicitly test for endogeneity using a Hausman or related test because there is no appropriate exogenous instrumental variable in our data. Instead, we followed Craig and Hardee (2007) and dropped 'risky' variables one by one to ascertain whether the remaining variables have similar coefficients (sign and size). We did this on a number of key variables (e.g. risk, current ratio, inventory, etc.,) and found no evidence of significant changes. Using this approach leads us to make a cautious assessment that endogeneity issues are not apparent in our analysis. Furthermore, to test the robustness of our findings on cash holdings, we employ Tobit models and also use 'cash/total assets' as an alternative measure to cash/sales (Table 7). Our earlier results on cash holding are still robust: we find that in a highly concentrated banking market, small firms hold less cash (market power hypothesis) but that these adverse effects are mitigated by developing longer banking relationships (information hypothesis).

[Table 7 here please]

5.   Discussion and Conclusions

The impact of bank market concentration on small firm finance has been a long term issue in the US. It has remained so because bank concentration levels have been stable since the deregulatory reforms of the 1990s. Bank market concentration rates have also been a concern in other developed economies, particularly as the financial crisis has shown that in markets were there bank concentration is high, small firm access to finance is limited (Ryan et al, 2014; Chong et al, 2013). Much of the evidence for these effects investigates small firm lending. Our contribution has been to examine - for the first time to our knowledge - the impact of bank concentration and relationship banking on three key measures of small firm liquidity (cash holdings, lines of credit and trade credit). Besides investigating these impacts separately, one further novelty has been to consider the joint impacts of these three measures. In doing so, we have provided new insights on the effects of relationship banking and bank market concentration on small firm liquidity. One key result is that in a highly concentrated bank market, small firms hold less cash and they are more likely to be financially and liquidity constrained than in a competitive bank market. They also have less access to lines of credit, use more expensive trade credit and face higher penalties if they pay trade credit late. Our findings also show that in concentrated bank markets the availability of credit lines is sensitive than cash holdings and small firms opt for trade credits as a substitute to holding cash and using credit lines.

Our findings, therefore, support the market power hypothesis: higher levels of bank market concentration constrain the liquidity position of small firms. For policy makers, this suggests that there is a need to continue to investigate ways of increasing competition among small firm finance providers. One route is to provide pathways for challenger banks to

emerge. Another is to continue to develop and support more novel forms of financial assistance such as crowdfunding. Increasing competition is beneficial because competition increases the supply of credit to small firms (Chava, 2013) and helps banks to better diversify their risks (Amore, 2013). Without increased competition, it is likely that small firms in currently highly concentrated banking markets will need to continue to carefully manage their liquidity position if they wish to survive and grow their business (Mach and Wolken, 2011). While increased competition is valuable, banks may also reflect on the support that they provide to both existing and prospective small firms. One finding from Fraser's (2014) work on lending to discouraged borrowers is that banks could do more to improve awareness of bank decision making processes. Equally, as Fraser (2014) also suggests, policy makers and business support stakeholders could do more to improve the financial literacy of small firms to help promote better access to bank finance.

Our results, however, also give support to the information hypothesis. One key result is that those small firms in longer term banking relationships can gain favorable effects that militate against the unfavorable effects of bank concentration. These positives include reducing the likelihood of being financially and liquidity constrained, increased cash holdings, and access to more credit lines. These results have implications for both small firms and their banks. For small firms located in a highly concentrated bank markets, our findings suggest the need to develop stronger links with their bank. Moro et al. (2014) identify those Italian small firms that actively and voluntarily disclose information benefit from lower interest rates. Our results support these findings and indicate that there are benefits from small firms developing closer links with their bank. They also suggest that small firms operating in concentrated bank markets may be better placed by adopting a more monogamous relationship with their bank. Equally, one way of promoting better banking relationships is

for banks to adopt more relationship orientated rather than transaction based support to their small firm clients.

The fact that we find support for both the market power and information hypotheses is perhaps not surprising. Each of these theoretical traditions approach small firm liquidity from differing start points and are not mutually exclusive: market power is focused on the efficiency considerations of bank market concentration on the supply of finance while the information hypothesis is focused on the impacts of information asymmetries on small firm liquidity. Our support for both hypotheses, therefore, implies that unbridled bank competition may have leave banks open to 'free-rider' issues that make them less willing to acquire private information from informationally opaque small firms. This implies that policy makers have a difficult juggling act in developing banking markets that allow competition to thrive while still allowing banks to develop mutually beneficial relationships with their small firm customers.

We recognize that this paper – like all papers - is subject to some limitations. Despite the comprehensive nature of our data, we would have liked to investigate HHI as a continuous variable. Unfortunately, these data remain confidential. Moreover, as with other banking market structure measures (e.g. Lerner's Index, CR_n), one other limitation of using HHI is that it fails to fully capture non-bank sources of competition. Although depository financial institutions such as commercial banks remain the pre-eminent financial service and product supplier to small firms (Mach and Wolken, 2006), sources of small firm funding from non-bank sources have become more readily available which have led to changes – which our data do not fully allow us to capture – in terms of small firm financing (Fraser et al., 2015; Kirby and Worner, 2014). Hence, we call for further research on how the mix of bank and non-bank financing by small firms impacts on the liquidity position of small firms.

Our cross-sectional data also do not allow us to explicitly investigate endogeneity. Hence, although in our robustness checks we adopt Craig and Hardee's (2007) approach to examining endogeneity, our results need to be interpreted cautiously. Moreover, although we use weights to inhibit selection bias, our results may still under-represent very young and very small firms. Nonetheless, we hope that this research encourages other researchers to examine further nuances in the relationship between bank concentration, relationship banking and small firm liquidity. Future research, for example, could extend our research by considering how small firm performance and cash holdings vary with differing bank market conditions. In addition, future research could usefully consider the possible non-monotonical effects of banking market concentration on small firms so that future theorizing can further identify the boundary conditions of both the market power and information hypotheses. Indeed, although our results do provide some support for the information hypothesis, it would be useful for further research to consider when, for example, relationship banking in concentrated banking markets begins to militate against the unfavorable effects of bank concentration. Equally, further research could fruitfully build on what we are not able to do in this paper and consider how bank size and market share influences small firm liquidity. Finally, although bank concentration levels have remained stable over this century and some of the effects of the financial crisis may have lessened for recovering small firms (Cowling et al., 2015), there is a need for further work on the impacts of the financial crisis on small business banking market and small business liquidity.

In summary, this paper has used large scale comprehensive US data to examine the effects of bank concentration and relationship banking on small firm liquidity. It is a departure from prior research because we have examined cash holdings, lines of credit and trade credit both independently and jointly. Our results provide evidence of market power effects but also demonstrate that small firms can gain benefits from relationship banking that

can militate against these bank concentration effects. We see that these findings have important implications for policy makers, banks and small firms, particularly as bank market concentration has been a persistent feature of banking in the US and other developed economies.

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Table 1: Variable Definitions and Descriptive Statistics

Variables		Pooled Samples			1998		2003	
	Obs	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Small business liquidity and finance								
Cash/Total Assets[1]	7476	0.23	0.28	0.23	0.28	0.23	0.28
Cash/Sales[1]	7497	0.08	0.11	0.07	0.11	0.08	0.11
Total Lines Of Credits To Assets[1]	7650	0.18	0.34	0.15	0.32	0.21	0.36
Unused Lines Of Credit To Asset[1]	7650	0.10	0.21	0.09	0.19	0.12	0.22
Trade Credit/Cost Of Goods[1]	7801	0.06	0.10	0.06	0.11	0.04	0.08
Being Liquidity Constrained (0,1)	3392	0.24	0.43	0.26	0.44	0.22	0.42
Being Financially Constrained (0,1)	7801	0.20	0.40	0.24	0.43	0.16	0.37
Cash / (Cash + Total Lines Of Credit)	7203	0.68	0.40	0.72	0.39	0.65	0.41
Cash / (Cash + Trade Credit[2])	7234	0.66	0.37	0.65	0.38	0.68	0.36
Trade Credit/(Trade Credit[2] + Total Lines Of Credit)	5267	0.56	0.42	0.61	0.41	0.52	0.42
Penalty Charges % If Trade Credit Paid Late[3]	5260	0.52	0.57	0.56	0.58	0.48	0.56
Banking market condition (HHI)								
HHI competitive (0,1)	7800	0.06	0.24	0.05	0.22	0.07	0.25
HHI moderately concentrated (0,1)	7800	0.44	0.50	0.43	0.49	0.44	0.50
HHI highly concentrated (0,1)	7800	0.50	0.50	0.52	0.50	0.49	0.50
Banking Relationship								
Length Of Primary Relationship (Years)	7600	9.81	9.72	7.99	8.28	11.32	10.54
Distance (Natural Log Miles To Primary Bank)	7600	1.50	1.37	1.49	1.37	1.51	1.37
Bank (0,1)	7600	0.85	0.36	0.86	0.35	0.84	0.37
Number Of Relationships	7801	2.59	1.82	2.36	1.73	2.78	1.87
Firm Characteristics								
Corporation (0,1)	7769	0.55	0.50	0.49	0.50	0.60	0.49
Risk Rating (1 Least Risky; 5 Most Risky)	7772	2.86	1.06	2.97	1.04	2.77	1.08
Industrialized Return On Assets (ROA)	7497	-0.05	0.07	-0.08	0.09	-0.02	0.04
Current Ratio (Current Liability/Assets)	7648	0.20	0.28	0.21	0.30	0.18	0.26
Inventory/Assets	7649	0.15	0.23	0.16	0.23	0.14	0.22
Industry Cash Flow Risk (Std.Dev Of Cash Flow To Asset Ratio)	7801	1.74	0.38	1.82	0.34	1.68	0.39
Firm Age	7801	15.54	12.28	14.44	12.11	16.46	12.34
Start-Up (0, 1): Firm Age Less Than 2 Years	7801	0.07	0.26	0.08	0.27	0.07	0.25
Total Assets[3] (In $M)	7650	1.96	7.90	1.49	5.37	2.35	9.50
Total Sales[3] (In $10m)	7685	0.41	1.14	0.35	1.51	0.46	1.31
Total Employees	7801	28.78	56.47	25.53	54.60	31.51	57.86
Other Control Variables								
Regional GDP Growth (1 Year Lagged)%	7801	5.62	1.26	6.13	1.16	5.19	1.18

To control for outlier effects, variables[1] are winsorized at 5/95th percentile. The real value of trade credit is not available from the data. What is available is the % of costs of goods are on trade credit. We therefore follow Love et al. (2007) and use 'trade payables' to measure trade credits in the variables[2]. Variables[3] are in original value and in natural logarithm value in the following analysis.

Table 2: Weighted Least Squares regression: Small firm cash holdings (dependent variable - cash/sales)

Dependent Variable	cash/sales[1]	
Model	**1**	**2**
Constant	0.1322***	0.1362***
	(0.0320)	(0.0324)
Macroeconomic Characteristics		
Regional GDP growth %	-0.0014	-0.0014
	(0.0016)	(0.0016)
Firm Characteristics		
Log Total assets ($)	0.0052***	0.0052***
	(0.0009)	(0.0009)
Corporation (0,1)	-0.0241***	-0.0243***
	(0.0043)	(0.0044)
Risk rating (1 least risky; 5 most risky)	-0.0079***	-0.0080***
	(0.0016)	(0.0016)
Industrialized ROA	-0.2038***	-0.2021***
	(0.0318)	(0.0311)
Current ratio	-0.0486***	-0.0485***
	(0.0055)	(0.0054)
Inventory/total assets	-0.0577***	-0.0573***
	(0.0071)	(0.0072)
Industry cash flow risk	-0.0107	-0.0108
	(0.0106)	(0.0106)
Firm age	0.0002	0.0002
	(0.0002)	(0.0002)
Start-up	0.0313***	0.0309***
	(0.0065)	(0.0067)
Relationship Characteristics		
Length of primary relationship (year)	0.0004*	0.0000
	(0.0002)	(0.0004)
Distance (mile)	0.0022	0.0022
	(0.0015)	(0.0015)
Bank (0,1)	-0.0087	-0.0084
	(0.0062)	(0.0062)
Number of relationships	-0.0104***	-0.0104***
	(0.0012)	(0.0012)
Banking Market Characteristics		
HHI competitive (0,1)	-0.0038	-0.0040
	(0.0062)	(0.0079)
HHI highly concentrated (0,1)	-0.0033	-0.0115*
	(0.0033)	(0.0060)
Interaction Terms		
HHI moderately concentrated*Length of relationship		0.0000
		(0.0005)
HHI highly concentrated*Length of relationship		0.0008*
		(0.0004)
Control variables (industry, region and year)	Yes	Yes
Obs	7,050	7,050
Adj R²	0.0906	0.0917

Dependent variable used is Cash/sales[1] and defined and cash-to-sales ratio and winsorized at 5th/95th percentile The model used is weighted least square (WLS) clustered by the strata provided by SSBF. ***, **, * stand for significance level at 1%, 5% and 10% respectively. Standard errors are reported in parentheses. Control variables include dummies of industry (SIC-2D), region and year. Results of control variables are not reported but available on request from authors. VIF values show a highest value of 4.33 except for interaction terms, indicating little evidence of multicollinearity.

Table 3: Weighted Least Squares regression: Small firm total lines of credit and unused lines of credit (dependent variables - total lines of credit / total assets (Models 1 and 2) and lines of credit unused/total assets (Models 3 and 4))

	Total Lines of Credit		Lines of Credit Unused	
Model	**1**	**2**	**3**	**4**
Constant	0.1449**	0.1830***	0.0849**	0.0945**
	(0.0708)	(0.0693)	(0.0427)	(0.0452)
Macroeconomic Characteristics				
Regional GDP growth %	0.0154**	0.0155**	0.0065*	0.0065*
	(0.0067)	(0.0068)	(0.0037)	(0.0037)
Firm Characteristics				
Log Total assets ($)	-0.0158***	-0.0159***	-0.0081***	-0.0081***
	(0.0027)	(0.0027)	(0.0014)	(0.0015)
Corporation (0,1)	0.0639***	0.0646***	0.0325***	0.0328***
	(0.0103)	(0.0104)	(0.0059)	(0.0060)
Risk rating (1 least risky; 5 most risky)	-0.0250***	-0.0249***	-0.0202***	-0.0202***
	(0.0066)	(0.0066)	(0.0035)	(0.0035)
Industrialized ROA	0.0024	-0.0039	0.0262	0.0255
	(0.1085)	(0.1076)	(0.0598)	(0.0601)
Current ratio	0.0485*	0.0487*	0.0153	0.0153
	(0.0278)	(0.0280)	(0.0157)	(0.0158)
Inventory/total assets	0.0258	0.0234	-0.0048	-0.0044
	(0.0207)	(0.0206)	(0.0103)	(0.0103)
Industry cash flow risk	0.0453	0.0384	0.0377**	0.0380**
	(0.0294)	(0.0267)	(0.0162)	(0.0162)
Firm age	0.0000	0.0000	-0.0001	-0.0001
	(0.0005)	(0.0005)	(0.0003)	(0.0003)
Start-up	0.0147	0.0145	-0.0052	-0.0052
	(0.0265)	(0.0265)	(0.0145)	(0.0146)
Relationship Characteristics				
Length of primary relationship (year)	0.0007	-0.0019	0.0006	-0.0012
	(0.0006)	(0.0012)	(0.0004)	(0.0008)
Distance (mile)	0.0075**	0.0076**	0.0034*	0.0034*
	(0.0031)	(0.0031)	(0.0020)	(0.0020)
Bank (0,1)	0.0256*	0.0252*	0.0202**	0.0199**
	(0.0148)	(0.0147)	(0.0092)	(0.0092)
Number of relationships	0.0340***	0.0338***	0.0177***	0.0177***
	(0.0042)	(0.0043)	(0.0024)	(0.0024)
Banking Market Characteristics				
HHI competitive (0,1)	-0.0006		-0.0069	
	(0.0180)		(0.0100)	
HHI moderately concentrated (0,1)		-0.0324		-0.0135
		(0.0207)		(0.0132)
HHI highly concentrated (0,1)	-0.0216*	-0.0441**	-0.0148*	-0.0243*
	(0.0124)	(0.0208)	(0.0074)	(0.147)
Interaction Terms				
HHI moderately concentrated*Length of relationship		0.0035*		0.0022**
		(0.0018)		(0.0010)
HHI highly concentrated*Length of relationship		0.0024*		0.0018**
		(0.0014)		(0.0009)
Control variables	Yes	Yes	Yes	Yes
Obs	7,298	7,298	7,298	7,298
Adj R²	0.0492	0.0495	0.0430	0.0434

Models used are WLS clustered by the strata provided by SSBF. Dependent variables are winsorized at 5th/95th percentile. ***, **, * stand for significance level at 1%, 5% and 10% respectively. Standard errors are reported in parentheses. Control variables include year, industry and region. The results for these control variables are not reported here but available from the authors on request. The highest VIF value is 4.34 except for interaction terms again indicating little evidence of multicollinearity.

Table 4: Weighted Least Squares regression: Small firm Trade Credit and Trade Credit Late Payment Penalty (%) (dependent variables - trade credit/cost of goods (Models 1 and 2) and penalty charges in % if trade credit is paid late (Models 3 and 4))

	Trade Credit		% charges if trade credit paid late	
Model	**1**	**2**	**3**	**4**
Constant	-0.0892***	-0.0882***	0.7648***	0.7490***
	(0.0201)	(0.0203)	(0.1552)	(0.1532)
Macroeconomic Characteristics				
Regional GDP growth %	-0.0010	-0.0010	-0.0258**	-0.0262**
	(0.0010)	(0.0010)	(0.0109)	(0.0110)
Firm Characteristics				
Log Total assets ($)	0.0105***	0.0105***	-0.0053	-0.0054
	(0.0009)	(0.0009)	(0.0076**)	(0.0076)
Corporation (0,1)	-0.0248***	-0.0248***	-0.0451	-0.0438**
	(0.0034)	(0.0034)	(0.0214)	(0.0217)
Risk rating (1 least risky; 5 most risky)	0.0035***	0.0034***	-0.0065	-0.0061
	(0.0011)	(0.0011)	(0.0138)	(0.0137)
Industrialized ROA	-0.0188	-0.0184	0.1912	0.1842
	(0.0244)	(0.0242)	(0.2382)	(0.2366)
Current ratio	0.2212***	0.2212***	0.0276	0.0265
	(0.0083)	(0.0083)	(0.0319)	(0.0318)
Inventory/total assets	0.013***	0.0132***	-0.0514	-0.0512
	(0.0048)	(0.0047)	(0.0420)	(0.0416)
Industry cash flow risk	-0.0024	-0.0024	0.0270	0.0282
	(0.0062)	(0.0062)	(0.0468)	(0.0465)
Firm age	-0.0001	-0.0001	0.0006	0.0006
	(0.0001)	(0.0001)	(0.0011)	(0.0011)
Start-up	0.0059	0.0058	-0.0522*	-0.0526*
	(0.0052)	(0.0052)	(0.0315)	(0.0314)
Relationship Characteristics				
Length of primary relationship (year)	-0.0002	-0.0008	0.0003	0.0000
	(0.0002)	(0.0006)	(0.0014)	(0.0030)
Distance (mile)	0.0007	0.0007	-0.0063	-0.0063
	(0.0016)	(0.0016)	(0.0074)	(0.0074)
Bank (0,1)	-0.0005	-0.0005	-0.0294	-0.0312
	(0.0029)	(0.0028)	(0.0261)	(0.0257)
Number of relationships	-0.0033***	-0.0033***	0.0027	0.0023
	(0.0008)	(0.0008)	(0.0072)	(0.0072)
Banking Market Characteristics				
HHI competitive (0,1)	-0.0071*	-0.0020	-0.0633	-0.0406
	(0.0043)	(0.0074)	(0.0443)	(0.0572)
HHI highly concentrated (0,1)	-0.0014	-0.0038	0.0457*	0.0805**
	(0.0024)	(0.0033)	(0.0245)	(0.0370)
Interaction Terms				
HHI moderately concentrated*Length of relationship		0.0005		0.0024
		(0.0006)		(0.0034)
HHI highly concentrated*Length of relationship		0.0008		-0.0013
		(0.0005)		(0.0034)
Control variables	Yes	Yes	Yes	Yes
Obs	7,298	7,298	5,078	5,078
Adj R²	0.3991	0.3994	0.0283	0.0290

Models used are WLS clustered by the strata provided by SSBF. Trade Credit is defined as (Account Payables/Total Cost of Goods and Services) which is winsorized at 5th/95th percentile. ***, **, * stand for significance level at 1%, 5% and 10% respectively. Standard errors are reported in parentheses. Control variables include year, industry and region. The results for these control variables are not reported here but available from the authors on request. The highest VIF value is 4.41 except for interaction terms.

Table 5: Probit Models: Liquidity and financial constraints (dependent variable – being liquidity constrained (Models 1 and 2) and financially constrained (Models 3 and 4))

	Liquidity Constraint				Financial Constraint			
	1	**Marginal effects**	**2**	**Marginal effects**	**3**	**Marginal effects**	**4**	**Marginal effects**
Constant	-0.0560 (0.5108)		-0.0595 (0.5209)		-1.0008*** (0.3678)		-1.0296*** (0.3552)	
Macroeconomic Characteristics								
Regional GDP growth %	0.0341 (0.0288)	1.08%	0.0340 (0.0289)	1.07%	-0.0486* (0.0299)	-1.31%	-0.0488* (0.0299)	-1.31%
Firm Characteristics								
Log Total assets ($)	-0.1033*** (0.0216)	-3.26%	-0.1033*** (0.0217)	-3.26%	-0.0851*** (0.0144)	-2.29%	-0.0849*** (0.0145)	-2.29%
Corporation (0,1)	-0.1861*** (0.0461)	-5.79%	-0.1858*** (0.0466)	5.79%	0.0022 (0.0616)	0.06%	0.0032 (0.0620)	0.09%
Risk rating (1 least risky; 5 most risky)	0.2148*** (0.0279)	6.77%	0.2150*** (0.0282)	6.77%	0.2969*** (0.0283)	8.00%	0.2973*** (0.0279)	8.01%
Industrialized ROA	-1.3052** (0.6006)	-41.14%	-1.3045** (0.6024)	-41.12%	0.0033 (0.4003)	0.09%	0.0041 (0.4014)	0.11%
Current ratio	0.4785*** (0.0815)	15.08%	0.4787*** (0.0815)	15.09%	0.4339*** (0.0794)	11.69%	0.4341*** (0.0790)	11.69%
Inventory/total assets	0.3676** (0.1596)	11.59%	0.3674** (0.1584)	11.58%	0.1678 (0.1263)	4.52%	0.1670 (0.1264)	4.50%
Industry cash flow risk	-0.2341 (0.2102)	-7.38%	-0.2336 (0.2107)	-7.36%	0.1222 (0.1240)	3.29%	0.1238 (0.1245)	3.33%
Firm age	-0.0003 (0.003)	-0.01%	-0.0002 (0.0030)	-0.01%	-0.0129*** (0.0025)	-0.35%	-0.0129*** (0.0025)	-0.35%
Start-up	-0.1006 (0.0798)	-3.08%	-0.1007 (0.0798)	-3.08%	-0.1026 (0.0864)	-2.66%	-0.1030 (0.0860)	-2.69%
Relationship Characteristics								
Length of primary relationship (year)	-0.0138*** (0.0045)	-0.44%	-0.0158 (0.0105)	-0.49%	-0.0154*** (0.0035)	-0.41%	-0.0209** (0.0085)	-0.56%
Distance (mile)	0.0024 (0.0294)	0.08%	0.0024 (0.0293)	0.07%	0.0501** (0.0159)	1.35%	0.0501*** (0.0159)	1.35%
Bank (0,1)	-0.0370 (0.1108)	-1.18%	-0.0373 (0.1105)	-1.18%	0.0229 (0.0816)	0.61%	0.0210 (0.0818)	0.56%
Number of relationships	0.1371*** (0.0222)	4.32%	0.1371*** (0.0221)	4.32%	0.1673*** (0.0143)	4.51%	0.1670*** (0.0144)	4.50%
Banking Market Characteristics								
HHI competitive (0,1)	-0.2527* (0.1427)	-7.32%	-0.233* (0.1273)	-6.80%	-0.0197 (0.1108)	-0.53%	0.0449 (0.1225)	1.23%
HHI highly concentrated (0,1)	-0.0716 (0.0698)	-2.26%	-0.0677 (0.1065)	-2.13%	0.0789* (0.0477)	2.13%	0.1199* (0.0659)	3.23%
Interaction Terms								
HHI moderately concentrated*Length of relationship			0.0023 (0.013)	0.07%			0.0088 (0.0101)	0.24%
HHI highly concentrated*Length of relationship			0.0019 (0.0126)	0.06%			0.0035 (0.0096)	0.09%
Control variables (industry, region and year)	Yes		Yes		Yes		Yes	
Obs	3,172		3,172		7,298		7,298	
Adj R²	0.0910		0.0910		0.1248		0.1250	
Predicted Prob	24.62%		24.62%		18.78%		18.76%	

Model 1 and 2 are financial constraint models, while Model 3 and 4 are liquidity constraint models. ***, **, * stand for significance level at 1%, 5% and 10% respectively. Standard errors are reported in parentheses. Control variables include dummies of industry (SIC-2D), region and year. Results of control variables are not reported but available on request from authors. The highest VIF value is 4.50 except for interaction terms.

Table 6: Cash, lines of credit and trade credit: alternative sources of liquidity (dependent variables are cash/(cash+total lines of credit) (Model 1), trade credit/(trade credit + total lines of credit) (Model 2) and cash/trade credit (Model 3)).

Model	Model 1 Cash vs. Lines of Credit		Model 2 Trade credit vs. Lines of Credit		Model 3 Cash vs. Trade Credit	
Model	**1**	**2**	**3**	**4**	**5**	**6**
Constant	1.4228***	1.4381***	0.6130***	0.6367***	1.4173***	1.3723***
	(0.0725)	(0.0728)	(0.1103)	(0.1105)	(0.0633)	(0.0613)
Macroeconomic Characteristics						
Regional GDP growth %	-0.0172***	-0.0172***	-0.0125*	-0.0123*	-0.0079	-0.0078
	(0.0062)	(0.0063)	(0.0068)	(0.0069)	(0.0054)	(0.0055)
Firm Characteristics						
Log Total assets ($)	-0.0298***	-0.0299***	0.0106**	0.0107**	-0.0401***	-0.0395***
	(0.0034)	(0.0034)	(0.0050)	(0.0050)	(0.0018)	(0.0018)
Corporation (0,1)	-0.0438***	-0.0444***	-0.0367*	-0.0377*	-0.0035	-0.0044
	(0.0128)	(0.0128)	(0.0220)	(0.0221)	(0.0079)	(0.008)
Risk rating (1 least risky; 5 most risky)	0.0127**	0.0126**	0.0293***	0.0292***	-0.0262***	-0.0266***
	(0.0060)	(0.0060)	(0.0072)	(0.0071)	(0.0051)	(0.0052)
Industrialized ROA	0.1339	0.1395	0.1403	0.1412	0.0931	0.0641
	(0.1217)	(0.1209)	(0.1782)	(0.1773)	(0.0646)	(0.0611)
Current ratio	-0.0496*	-0.0494*	0.4672***	0.4681***	-0.729***	-0.7298***
	(0.0275)	(0.0274)	(0.0302)	(0.0302)	(0.0157)	(0.0156)
Inventory/total assets	-0.1093***	-0.1092***	0.0174	0.0182	-0.1854***	-0.1776***
	(0.0275)	(0.0272)	(0.0385)	(0.0383)	(0.0165)	(0.0164)
Industry cash flow risk	-0.0662***	-0.0670***	-0.1358***	-0.1382***	0.0588***	0.086***
	(0.0255)	(0.0256)	(0.0441)	(0.0447)	(0.0201)	(0.016)
Firm age	-0.0004	-0.0004	-0.0001	-0.0001	-0.0004	-0.0004
	(0.0006)	(0.0006)	(0.0010)	(0.0010)	(0.0005)	(0.0005)
Start-up	0.0048	0.0041	-0.0072	-0.0085	0.0088	0.0089
	(0.0225)	(0.0225)	(0.0301)	(0.0301)	(0.0124)	(0.0124)
Relationship Characteristics						
Length of primary relationship (year)	-0.0001	0.0006	-0.0003	0.0011	0.0008*	0.0018
	(0.0006)	(0.0014)	(0.0010)	(0.0013)	(0.0005)	(0.0012)
Distance (mile)	-0.0093**	-0.0092**	-0.0134**	-0.0134**	-0.0009	-0.0009
	(0.0037)	(0.0037)	(0.0059)	(0.0060)	(0.0034)	(0.0034)
Bank (0,1)	-0.0383**	-0.0371**	-0.0264	-0.0251	0.0003	0.0018
	(0.0149)	(0.0147)	(0.0238)	(0.0238)	(0.0105)	(0.0106)
Number of relationships	-0.046***	-0.0458***	-0.0288***	-0.0284***	-0.0134***	-0.0132***
	(0.0052)	(0.0053)	(0.0060)	(0.0061)	(0.0028)	(0.0028)
Banking Market Characteristics						
HHI competitive (0,1)	0.0078	-0.0125	0.0187	-0.0158	-0.0004	-0.0196
	(0.0192)	(0.0259)	(0.0199)	(0.0291)	(0.0108)	(0.0136)
HHI highly concentrated (0,1)	0.0216*	-0.0014	0.0470***	0.0101	-0.0153**	-0.0308***
	(0.0131)	(0.0115)	(0.0169)	(0.0202)	(0.0060)	(0.0099)
Interaction Terms						
HHI moderately concentrated*Length of relationship		-0.0023		-0.0037		-0.0020
		(0.0019)		(0.0023)		(0.0012)
HHI highly concentrated*Length of relationship		0.0002		0.0001		0.0004
		(0.0016)		(0.0014)		(0.0011)
Control variables (industry, region and year)	Yes	Yes	Yes	Yes	Yes	Yes
Obs	6,930	6,930	5,099	5,099	6,956	6,956
Adj R²	0.1307	0.1315	0.1490	0.1506	0.4834	0.4832

Models used are WLS clustered by the strata provided by SSBF. ***, **, * stand for a significance level at 1%, 5% and 10% respectively. Standard errors are reported in parentheses. Control variables include year, industry and region. The results for these control variables are not reported here but available from the authors on request. The highest VIF value is 4.57 except for interaction terms.

Table 7: Robustness tests: Cash Holdings (Weighted Tobit models)

Model	1	2	3	4
	Cash/sales	Cash/sales	Cash/assets	Cash/assets
Constant	0.1386***	0.1449***	1.3003***	1.3013***
	(0.0419)	(0.0427)	(0.0817)	(0.0848)
Macroeconomic Characteristics				
Regional GDP growth %	-0.0017	-0.0017	-0.0062	-0.0062
	(0.0022)	(0.0021)	(0.0044)	(0.0044)
Firm Characteristics				
Log Total assets ($)	0.0066***	0.0066***	-0.0763***	-0.0763***
	(0.0012)	(0.0012)	(0.0028)	(0.0028)
Corporation (0,1)	-0.0310***	-0.0312***	0.0533***	0.0533***
	(0.0053)	(0.0053)	(0.0082)	(0.0082)
Risk rating (1 least risky; 5 most risky)	-0.0101***	-0.0102***	-0.0331***	-0.0331***
	(0.0018)	(0.0018)	(0.0061)	(0.0061)
Industrialized ROA	-0.2260***	-0.2236***	0.3184***	0.3187***
	(0.0397)	(0.0387)	(0.1215)	(0.1214)
Current ratio	-0.0618***	-0.0618***	-0.0106	-0.0106
	(0.0069)	(0.0068)	(0.0134)	(0.0134)
Inventory/total assets	-0.0744***	-0.0740***	-0.3085***	-0.3085***
	(0.0095)	(0.0095)	(0.0157)	(0.0157)
Industry cash flow risk	-0.0153	-0.0155	-0.0115	-0.0115
	(0.0131)	(0.0131)	(0.0249)	(0.025)
Firm age	0.0001	0.0001	0.0001	0.0001
	(0.0002)	(0.0002)	(0.0005)	(0.0005)
Start-up	0.0388***	0.0383***	0.0073	0.0072
	(0.0072)	(0.0074)	(0.0200)	(0.0201)
Relationship Characteristics				
Length of primary relationship (year)	0.0006**		0.0011***	
	(0.0003)		(0.0005)	
Distance (mile)	-0.0049	-0.0054	0.0042	0.0032
	(0.0073)	(0.0092)	(0.0182)	(0.0227)
Bank (0,1)	-0.0062*	-0.0168**	-0.0180**	-0.0196
	(0.0038)	(0.0071)	(0.0085)	(0.0149)
Number of relationships	-0.0049	-0.0054	0.0042	0.0032
	(0.0073)	(0.0092)	(0.0182)	(0.0227)
Banking Market Characteristics				
HHI competitive (0,1)	-0.0049	-0.0054	0.0042	0.0032
	(0.0073)	(0.0092)	(0.0182)	(0.0228)
HHI highly concentrated (0,1)	-0.0062*	-0.0168**	-0.0180**	-0.0196
	(0.0038)	(0.0071)	(0.0085)	(0.0149)
Interaction Terms				
HHI competitive*Length of relationship		0.0000		0.0011
		(0.0004)		(0.0012)
HHI moderately concentrated*Length of relationship		-0.0001		0.0010
		(0.0004)		(0.0009)
HHI highly concentrated*Length of relationship		0.0011***		0.0012**
		(0.0004)		(0.0005)
Control variables	Yes	Yes	Yes	Yes
Obs	7,050	7,050	7,131	7,131

The models employed are weighted Tobit clustered by the strata provided by SSBF and dependent variables are winsorized at 5th/95th percentile. ***, **, * stand for significance level at 1%, 5% and 10% respectively. Standard errors are reported in parentheses. Control variables include year, industry, region, macroeconomic conditions and firm level characteristics. The results for these control variables are not reported here but available from the authors on request.