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Abstract
This paper addresses the way optimal cash holdings decisions may be affected in episodes of adverse liquidity shocks. Motivated by the recent financial crisis, we are particularly interested in understanding how firm characteristics can explain differences in the adjustment speed to desired cash holdings, and how these characteristics determine whether a firm is more or less affected during a liquidity crisis. To address those issues, we use a large panel dataset with quarterly information of Chilean firms during the period 1996 through 2009. In line with some previous empirical evidence, our findings show that leverage, banking debt, liquid assets, size and volatility affect cash holdings. We also find that liquidity crises have had an overall negative and economically significant effect on the firms' cash holdings and this effect varies across firm size. In addition, our results reveal other important component of heterogeneity across firms: we find that medium-sized firms are less capable of adjusting cash holdings than do small and large firms.

Resumen
En este trabajo se analiza empíricamente cómo la liquidez de las empresas —medida por la tenencia de caja y activos equivalentes— se ve afectada durante episodios de restricciones crediticias. Se analiza, además, si ciertas características de las firmas determinan una mayor o menor velocidad de ajuste a los niveles deseados de liquidez. También se estudia si existen efectos distintos de las crisis de liquidez que dependan de estas características. Para ello, se utiliza un panel con información trimestral de empresas chilenas durante el período 1996-2009. Coherentemente con la evidencia para otras economías, se encuentra que el endeudamiento, el acceso a deuda bancaria, la liquidez de los activos, el tamaño y la volatilidad de las ventas son determinantes importantes de la liquidez de las empresas. Los resultados indican que las mayores restricciones crediticias han tenido un efecto negativo y económicamente significativo sobre la liquidez de las empresas chilenas, y que este efecto difiere según el tamaño de la firma. Además, los resultados revelan un comportamiento heterogéneo de las empresas ante *shocks* de liquidez. Se encuentra que las empresas de tamaño mediano presentan una velocidad de ajuste menor que la de las empresas pequeñas o grandes.

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1. Introduction

A relatively large bunch of literature has studied the determinants of firms' liquidity, specifically the factors affecting corporate cash holdings (Almeida et. al, 2002; Dittmar *et al*., 2003; Opler *et al.*, 1999; Pinkowitz and Willimanson, 2001; Kim *et al.*, 1998; Bruinshoofd and Kool, 2004 and Ozkan and Ozkan, 2004). Few works, however, have analyzed how firms adjust cash holdings when facing liquidity shocks such those experienced by many economies during the recent financial crisis[1].

In this paper we investigate differences across firms in the way they are affected by liquidity shocks. In particular, we are interested in understanding how firm characteristics may accelerate or to impede the adjustment in cash holdings. We also analyze how these characteristics determine whether a firm is more or less affected during a liquidity crisis. In our empirical analysis we study whether smaller firms are more likely to suffer from the effects of liquidity shocks. To address those questions, we use a large panel dataset with quarterly information for firms in Chile during the period 1996 through 2009. We are now aware of other papers studying similar questions. In general, little is known about the effects of liquidity crisis on firm performance in developing countries. There are some previous studies analyzing the effects of the Asian crisis during the 1990´s, but most of then emphasize different issues than those addressed in this paper[2].

There are several reasons why this may be an important issue. First, a liquidity shock may reduce a firm's liquidity and negatively affect their survival chance. Second, liquidity shocks may have amplified effects on aggregate activity and employment whenever some

[1] One exception is Elkinawy and Stater (2007) who investigate the determinants of cash holdings and firm value in Argentina, Mexico and Brazil. They analyze how two specific crises – Mexico in 1994-1995 and Brazil in 1999 – altered the determinants of these variables. However, they do not analyze how the crisis directly affected firms liquidity.

[2] See, for example, Claessens, Djankov and Xu (2000) and Blalock, Gertler and Levine (2008).

firms cannot obtain enough cash to fulfill their short-term obligations. Third, the identification of differences in firms exposure to liquidity shocks could be important for policy makers monitoring financial stability.

In line with some of the previous empirical evidence, our findings show that size, leverage, banking debt and liquid assets affect cash holdings negatively. We also find that higher industry volatility increases cash holdings, which is consistent with the idea that higher liquidity is partially motivated by precautionary motives. Considering liquidity crises, we find evidence that firms have been less able to adjust cash holdings when facing negative shocks and these effects vary widely across firm size. In general, episodes of liquidity shortage have a negative and economically significant effect on firms' cash holdings, especially on smaller firms.

The remainder of the paper is structured as follows. In the second section, we present our data and the main stylized facts on corporate cash holdings across firms and industries. In the third section, we present the empirical methodology and discuss the theoretical foundations for our estimations. In the fourth section, we discuss our results under two alternative definitions of liquidity crises. In the fifth section, we present our conclusions and ideas for future research.

2. Data Description and Main Facts

We obtain our data from listed firms at the Chilean Superintendency of Securities and Insurance (SVS), available on a quarterly basis from 1986 to 2009. According to Chilean regulation, companies that offer publicly stocks or debt instruments must be registered and file certain information. These firms must provide financial statements and other information on a quarterly basis, and be audited once a year. The same is true for companies with more than 500 shareholders and those for which at least 10% of their

subscribed capital is in the hands of a at least 100 people. There are also cases of specific registry requirements[3] and others of voluntary registration[4]. Thus, this database provides more coverage than those that only include the largest and most traded firms. This group of companies holds 100% of local bond issuance, over 70% of corporate external liabilities (bank loans and bonds), but only 20% of local bank loans[5]. For our empirical analysis we use financial data from the firms' non-consolidated financial statements for the period 1996Q1-2009Q1. Even though we try to follow the methodology in previous literature as much as possible, we are subject to availability constraints in our choice of financial variables. We were not able to find information on some variables, such as dividend payments, advertising and R&D investment and ownership structures, which previous literature has found to be significant determinants of cash holdings

We dropped from our sample of financial firms, companies with toll road, and other infrastructure concessions (project finance), major state-owned enterprises (ENAP, CODELCO, METRO, EFE)[6], and small firms related to the educational, sports and entertainment sectors, most of which report voluntarily and/or only on a yearly frequency. Our final sample consists of 479 firms and 15.402 observations (on average, 290 firms each quarter).

One limitation of this dataset is that it is biased to large public issuing firms. Thus, our results may be not applicable to smaller firms, which tend to be important in terms of domestic bank lending. However, the firms in this sample represent a very large proportion

[3] Such as requirements to bus service companies in the concessions of the new public transportation system in the city of Santiago (Plan Transantiago).
[4] In these cases, companies aim to have better access to different types of financing.
[5] Source: Superintendency of Securities and Insurance, Superintendency of Banks and Financial Institutions and Central Bank of Chile.
[6] These firms are not considered in our sample because they have government specific guarantees and credit access terms that differ from the rest of the companies in the sample. These features provide them with enough support in the event of financial distress, even though they can present weak financial indicators.

of Chilean GDP[7]. In addition, the sample represents the best source of information given its complete financial detail, standardized format and availability through quarterly financial statements (FECU). Thus, it contains more financial information than other widely used sources in Chile such as the National Annual Industry Survey (ENIA).

The distribution of assets and liabilities across sectors is relatively concentrated. Electric utilities, paper & forest products, retail and mining represent 60% of assets and almost 70% of financial debt. This distribution has changed over time, as some sectors became more important in terms of assets and liabilities. Table 1 shows that between 1996 and 2008, the retail and marine & air transportation sectors have increased their participation, whereas the sectors of telecommunications and food, beverage & tobacco have reduced their importance in terms of total assets and debt.

Another potential problem with this dataset is the use of non-consolidated information. In theory, consolidated data is better suited to the aim of financial analysis, as it shows the net financial position of a group of companies, eliminating the double counting that arises when the individual data of various subsidiaries of a group are aggregated. Indeed, simply adding the individual accounts of companies that belong to the same group leads to overstatement of financial costs and debt ratios, as the flows of financing and liabilities between the members of the group are counted twice. For the purpose of liquidity assessment, using only individual accounts can hide liquidity problems of subsidiaries that are part of the group or economic unit (consolidated) but are not listed in the SVS. The opposite is also true. A parent company with liquidity problems at individual level may actually have enough liquid assets in a subsidiary which is not listed in the SVS. The extent of the impact on the analysis caused by this phenomenon is directly linked to the number of

[7] The financial debt (banks and bonds) represented almost 41% of GDP at the end of 2008.

intermediate parent companies created by the groups. Despite that, we use non-consolidated data because consolidated data is not available for the period of 1996 through 2000 covering the Asian crisis of 1997-1998[8].

In Figure 1 we show some stylized facts about firm cash holdings during three episodes of liquidity crisis[9]. We compare average cash holdings – weighted by assets – for the period during the crisis and the average in the corresponding quarters before the crisis[10]. For all firms, we find evidence of a small reduction in cash holdings only during the first crisis. For the two more recent crises, the evidence shows an increase in average cash holdings in respect to pre-crisis period. The evidence for large firms is very similar to that of whole sample. This may be expected given that we weighted our observations by assets (Panel B). However, for the rest of the firms, the evolution of cash holdings looks somewhat different. Medium sized firms drastically reduced their cash holdings during the first crisis and tended to maintain the same cash to assets ratio during the two most recent crises (Panel C). In the case of small firms, there is a general reduction in cash holdings over time, and also a reduction compared to the pre-crisis period for all three episodes (Panel D). This could suggest that liquidity crises may disproportionately affect the smaller firms[11].

We analyze how cash holdings have evolved in different industries. Figure 2 present evidence on this issue. An upward (downward) sloping line indicates that, compared to the

[8] We have compared indicators using consolidated and non-consolidated information for the period 2001-2009 and, even though there are changes in liquidity holdings, there are not important differences for a firm or industry over time.
[9] The period of liquidity crises are defined in detail in the next section.
[10] The first period corresponds to the Asian crisis, between the first and third quarter of 1998. To compare with similar quarters, the pre-period crisis is between the first and third quarter of 1997. The same procedure is applied for the other two crises.
[11] These groups of firms are defined according to the distribution of assets (in real terms) for every year. The small firms are those with total assets lower than the 33% of the distribution. Large firms are those with total assets higher than the 66% of the distribution.

pre-crisis period, the average cash holdings in that industry has increased (reduced) during the crisis. Note how the evidence is highly heterogeneous across different sectors and episodes of liquidity crises. With some minor exceptions, most of industries experienced a reduction in cash holdings during the first crisis, while during the other two crises the evidence is mixed. In fact, some sectors, for example food, experienced an increase in cash during the first crisis, but a reduction in the last two episodes. This evidence suggests that industries differ greatly in terms of exposure to liquidity shocks and that, apparently, there are not systematic differences across different episodes.

3. Methodological Issues

We follow the previous literature on determinants of cash holdings, specifically Ozkan and Ozkan (2004) which estimate the following equation:

$$Cash_{it} = \delta Cash_{it-1} + \beta X_{it} + \alpha_i + \alpha_t + \varepsilon_{it} \qquad (1)$$

Where *Cash* is firm cash holdings measured as the ratio of total cash and equivalent items to total assets, α_i and α_t are firm and time fixed effects respectively, and the vector *X* includes variables that theoretical models suggest as important for explaining firm-specific differences in cash holdings.

The theoretical models emphasize two main determinants of cash holdings: transaction costs and precautionary motives. These two determinants define the type of variable that we include in the vector *X*[12]. In terms of transaction costs, we use the size of firms to capture the idea that large firms have less information asymmetry than small firms, and then lower cost of external financing because of scale economies resulting from a

[12] All of the explanatory variables are defined in Table 2. Table 3 present the descriptive statistics of these variables.

substantial fixed cost component of security issuance costs (Barclay and Smith, 1996). Following this argument, the hypothesis is that larger firms should hold less cash.

The literature suggests that another determinant of the cost of funding could be leverage. In the presence of transaction costs, higher leverage may act as substitute for cash holdings. Thus, an increase in debt financing would be associated with lower cash holdings. However, it has been also argued that high debt may also increase the probability of financial distress, and through this effect, to increase cash holdings (Ozkan and Ozkan, 2004).

Access to banking debt may also affect cash holdings decisions. Following the idea of Fama (1985) that banks have some comparative advantage in minimizing information costs and can get access to no-publicly available information, banks loans can signal positive information about firms. Thus, firms with more bank debt are expected to have better access to external finance and less need to hold cash. In our specifications, we distinguish between short-term and long-term banking debt.

Finally, we include other three variables that may affect cash holdings: cash flow, assets liquidity, and sales volatility. Firms with higher cash flows, due to the nature of their business, are expected to have lower cash holdings because cash flow provides a ready and immediate source of liquidity. Meanwhile, greater liquid assets reduce the holdings of cash because the firm may be in better position to fulfill short-term liquidity needs. Finally, in the case of sales volatility, a positive relationship is expected because a higher variability increases cash holdings as a way to hedge uncertainty (precautionary motive).

The dynamic specification in equation (1) has been justified by the existence of adjustment costs on some unobserved level of desired cash holdings (Ozkan and Ozkan, 2004). These costs may impede instantaneous variations in cash holdings following

changes in firm-specific characteristics and/or random shocks. Adjustments costs could be exacerbated during liquidity crises when the financial system may experience severe restrictions to normal functioning. In fact, the current financial crisis has shown that central banks sometimes need to intervene through liquidity injections to the financial system.

We extend this specification to analyze four main issues. First, we are interested in analyzing how episodes of liquidity crises have affected overall cash holdings. We include a dummy variable for these episodes in the specification of equation (1). Second, we study how firm liquidity adjustments may be affected during a crisis. To do so, we include an interaction term between the lagged dependent variable and the dummy variable for liquidity crises. Third, we study whether firm size affects adjustment of cash holdings by introducing an interaction between lagged cash holdings and size dummy variables. Fourth, we analyze how the effect of crises, if any, depends on firm size. We introduce interactions between the dummy for liquidity crises and size dummy variables. One maintained hypothesis in poor financially developed economies is that smaller firms have lower access to credit, and these firms could then be proportionally more affected in episodes of liquidity shortfalls.

Considering these four issues, the empirical model is specified as:

$$Cash_{it} = \delta_0 Cash_{it-1} + \delta_1 Crisis_t + \delta_2 Cash_{it-1} * Crisis_t + \delta_3 Cash_{it-1} * Z_{it} + \delta_4 Crisis_t * Z_{it} + \\ + \beta X_{it} + \alpha_i + \alpha_t + \varepsilon_{it}$$

Where *Crisis* is a dummy variable for episodes of liquidity shocks and *Z* is a set of two size dummy variables: one for medium sized firms and the other for large sized firms. These size categories are defined according to the size distribution for each year. Medium

sized firms are those with assets larger than the 33% percentile and lower than the 66% percentile. Larger firms are those with assets larger than the 66% percentile[13].

We need to define episodes of liquidity crisis. To do that, we look at periods where the economy has been affected by a significant liquidity shock. The recent fall in liquidity following the Lehman's bankruptcy of September 2008 is one example. The previous Asian crisis is another potential candidate. In order to define these episodes in a more formal way, we use deviations of the Monetary Policy Rate (MPR) from its trend using the Hodrick-Prescott filter. A liquidity period crisis is defined for those quarters where the MPR is over one standard deviation from its trend level.

As shown in Figure 3, in addition to well known crises episodes, this procedure allows us to identify certain quarters during the period 2001-2002 as another period of liquidity shock. Thus, under this definition, we have three crises periods. The Asian shock analysis covers the period 1998Q2-1998Q4. The second one is the period 2001Q3-2002Q1. The third one is the episode of the current financial crisis and covers the period 2008Q3-2008Q4.

We also use an alternative definition of liquidity crisis taking those periods when the inter-banking loans rate is significantly above – one standard deviation – the monetary policy rate. These are periods where the banking system faces severe funding shortages and the interest rate of loans among banks is increased relative to normal ones. This translates in important restrictions in the banking system ability to satisfy liquidity need of firms.

In Table 4, we present the episodes identified using the two definitions of liquidity crisis. Compared to the previous indicator, this includes one additional episode of liquidity

[13] We have also estimated the model dividing the sample in four different size classes and using total assets as a continuous variable for size. The results do not change substantially.

crisis. There are also some small differences in which quarters the crises fall compared with the previous procedure. As we show in the next section, however, the results tend to be similar using these two definitions.

The estimation of this model using standard fixed effects present some econometric challenges. First, there is an expected correlation between the error term and the lagged dependent variable. Second, most of the variables contained in the vector *X* are not strictly exogenous. One solution to these problems is to use the Arellano and Bover (1995) and Blundell and Bond (1998) estimator for dynamic panel data, known as System GMM. This estimator augments Arellano and Bond (1991) by making the additional assumption that the first differences of instrument variables are uncorrelated with the fixed effects[14].

A crucial assumption for the validity of GMM is that the instruments are exogenous. When the model is overidentified, the validity of these assumptions can be tested using the standard GMM test statistic for overidentifying restrictions, or Sargan / Hansen test, under the null that the implied moment conditions are valid[15]. In this context, another key assumption is that there is no serial correlation in the disturbances ε_{it}. The null hypothesis is that there is not second-order serial correlation in the first-differenced residuals (see Arellano and Bond, 1991)[16].

4. Results

In Table 5, we present our first set of results using the definition of liquidity crisis corresponding to significant deviations from the monetary policy rate. Considering the

[14] The Arellano-Bover/Blundell-Bond estimator builds a system of 2 equations – the original equation as well as the transformed one –allowing the introduction of more instruments and it can dramatically improve efficiency.
[15] See Sargan (1958) and Hansen (1982).
[16] As we show in the last rows of Tables 5 and 6, we cannot reject that instruments are valid and that there is not second order autocorrelation.

main determinants of cash holdings, the evidence is mostly consistent with results from previous works. The exception is the positive, but not significant effect of cash flow on cash holdings. The coefficient of lagged cash holdings is positive and significantly different from zero at 1%, providing evidence that there are adjustment costs for reaching a target cash ratio. In general, our results show evidence that liquidity crises are associated with lower cash holdings, although the parameter is not significant in column (1).

Like Ozkan and Ozkan (2004), we find that the effect of leverage on cash holdings is negative and significant. We also find that a large proportion of liquid assets and banking debt (both short and long term) reduce cash holdings. Similar to previous studies, our results show that larger firms maintain less cash holdings. Also, we find that an increment in industry volatility is associated with an increase in cash holdings.

In Columns (3), (4), and (5) we sequentially include the interactions between lagged cash holdings and crises, the interactions between lagged cash holdings and firm size, and finally the interactions between firm size and crises. The effect of the main determinants of cash holdings tends to be robust to the inclusion of these interactions. We find that the interaction of crises and lagged cash holdings is positive and significant, suggesting that adjustment costs are larger during episodes of negative liquidity shocks.

The interactions between lagged cash holdings and dummy variables for medium and large firms are positive and significant. Moreover, the parameter is higher for medium size firms. This implies that there is a nonlinear relationship between size and adjustment costs. Our results suggest that medium firms are those with larger adjustment costs in comparison with small and large firms.

Finally, the interaction between crisis and size dummy variables are positive and significant, showing that medium and large firms are relatively less affected than small firms during episodes of liquidity crisis [17].

In Table 6 we present our results using an alternative definition of crisis. In this case, we use episodes of significant deviations of the inter-banking rate from the monetary policy rate. The results for the explanatory variables are similar to the previous estimations. The positive and significant coefficient for the lagged dependent variable indicates that there is persistence in cash holdings. We confirm that sales volatility are positively associated with cash holdings and leverage, assets liquidity, bank debt and size affect negatively to cash holdings.

Regarding the interactions terms capturing heterogeneous effects of crisis and different adjustment costs by firms, we find that all of them are statistically significant. Thus, our evidence of heterogeneous effects is robust to an alternative definition of liquidity crisis. To shed light on this issue we calculate the parameter of adjustment velocity for the entire sample and for the three different size categories[18]. For all of these parameters, we also calculate the confidence interval from estimations of column (4) in Tables 5 and 6 to look at whether differences are statistically significant.

The parameters and the confidence interval for the velocity of adjustment are shown in Figure 4. The velocity of adjustment is approximately 0.20-0.30 when it is evaluated at the sample mean and it is larger for small firms. Note that, according to the confidence

[17] However, as we show below, when we calculate the parameter for the effect of liquidity crisis on different firm sizes we find that these differences are statistically significant only for small firms.

[18] The parameter for the velocity of adjustment is given by $\left(1-\delta_0-\delta_2 Crisis-\delta_{3m} Medium-\delta_{3l} Large\right)$, where $Crisis$, $Medium$ and $Large$ are the sample mean of the dummy variables included in the estimation. This parameter is computed as $\left(1-\delta_0-\delta_2 Crisis\right)$ for small firms, $\left(1-\delta_0-\delta_2 Crisis-\delta_{3m} Medium\right)$ for medium firms, and $\left(1-\delta_0-\delta_2 Crisis-\delta_{3l} Large\right)$ for large firms.

intervals displayed as the line crossing the bar, these values for small and large firms are also statistically higher than the velocity of adjustment calculated for medium sized firms. This evidence is similar for both indicators of liquidity crisis.

We also present the calculations of the crisis dummy for the entire sample and according to firm size. These are shown in Figure 5. First, we find that a liquidity crisis is associated with a reduction in cash holding of between 0.4% and 1.5% of total assets in the short run, and about 7.0% to 8.5% in the long run[19]. These figures are also significant economically[20]. Interestingly, both measures of liquidity crises show that there are significant differences in the effect of liquidity only for small firms. As shown in Figure 5, we can reject the hypothesis that the coefficient for small firms is the same as those for medium and large firms.

Thus, these results are in line with the hypothesis that smaller firms have lower access to credit and consequently could be more affected in episodes of liquidity shortages. Moreover, the non-monotonic relationship between size and adjustment costs may be due to the fact that intermediate size firms are more dependent on external funding for financing liquidity than smaller firms, but they do not have as many funding alternatives as larger firms.

5. Conclusions

This paper use a large panel dataset of Chilean firms to address how cash holdings decisions may be affected by episodes of negative liquidity shocks. We are particularly motivated by the effects of the recent financial crisis and the lack of evidence on these

[19] In Figure 5 we show only the short run parameters. The long-run parameters are obtained by dividing the short-term parameters by the coefficient of the lagged dependent variable.
[20] The mean of the dependent variable (cash holdings over total assets) is 0.049 and the standard deviation is 0.126 (see Table 3).

issues for developing countries. This evidence is particularly interesting for these countries whose financial markets are less developed and for whom it has been traditionally argued that smaller firms are disproportionally affected during episodes of liquidity shortages.

Our main results are mostly similar with evidence provided by previous empirical analysis. We find that leverage, bank debt, liquid assets, and size reduce cash holdings. Confirming the idea that cash holdings are also determined by precautionary motives, we find that time-varying industry sales volatility increases cash holdings. However, our results do not show a significant effect of cash flows on cash holdings.

Regarding episodes of liquidity crisis, the evidence presented in this paper show that negative liquidity shocks are associated with an economically significant reduction in cash holdings. We find that this negative effect is larger for small firms and it might be consequence of a lower access to credit.

We have also analyzed whether firms differ in their ability to adjust cash holdings when facing. The evidence found on this regard reveals that there is nonlinear relationship between size and adjustment costs; medium-sized firms are those with larger adjustment costs in comparison with small and large firms.

Finally, the fact that monetary authorities implement special interventions during periods of liquidity shortage in order to inject liquidity in financial markets is a relevant issue for future research, especially during the recent crisis where most of public authorities around the world intervened actively to reduce the negative effects of the international liquidity shock. It may be quite interesting to study how these interventions have differentiated effect across firms.

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Table 1

Total Assets and Financial Debt by sector

(Percentage)

	Total Assets				***Financial Debt***			
	1996	**2000**	**2005**	**2008**	**1996**	**2000**	**2005**	**2008**
Food, Beverage & Tobacco	10,2	8,6	8,4	7,5	10,0	8,4	7,2	6,5
Retail	6,5	5,9	11,5	12,2	5,1	5,8	11,0	15,2
Homebuilding & Construction	4,8	3,3	3,1	2,9	2,9	3,5	2,5	2,4
Paper & Forest Products	17,1	20,3	14,6	14,3	11,8	10,2	14,2	12,3
Marine & Air Transportation	2,9	4,4	4,8	5,8	1,7	3,0	3,0	7,1
Metals & Mining	8,5	8,6	8,8	11,1	10,7	11,6	8,6	11,6
Telecommunications	10,8	9,8	8,8	7,2	23,0	13,9	10,1	6,1
Water Utilities	3,7	4,0	6,2	5,2	2,0	4,1	8,7	7,3
Electric Utilities	25,2	25,0	24,5	24,0	31,8	33,8	33,1	29,7
Health Care	0,8	0,7	0,5	0,5	0,5	0,5	0,6	0,7
Conglomerates	9,4	9,4	8,8	9,4	0,4	5,2	1,0	1,1
Total	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**

Based on Standard & Poor's Global Industry Classification Standard (GICS).

Table 2

Variables Definition

Variable	***Definition***
Cash	Cash and equivalent items/Total assets
Cash flow	Operating profit / Total assets
Volatility	Yearly standard deviation of industry sales growth.
Leverage	(Current liabilities + Non-current liabilities) / Total Assets
Liquidity	(Current assets – Current liabilities / Total assets) - Cash
Bank Debt ST	Short-term bank borrowing / (Current liabilities + Non-current liabilities)
Bank Debt ST	Long-term bank borrowing / (Current liabilities + Non-current liabilities)
Size	Three categories defined from the size distribution: Small, Medium, Large
Crisis	i) Dummy variable defined for quarters when the monetary policy rate is one standard deviation above its trend level ii) Dummy variable defined for quarters when the inter-banking rate is one standard deviation above the monetary policy rate.
Quarterly Dummy variables (53)	For each quarter from the first quarter of 1996 to the first quarter of 2009.

Table 3

Descriptive Statistics

Variable	***Obs***	***Mean***	***Std. Dev.***
Cash	14102	0.052	0.134
Cash Flow	14102	0.001	1.301
Volatility	14102	0.043	0.061
Leverage	14102	0.281	0.104
Liquidity	14102	0.024	0.103
Short Term Bank Debt	14102	0.121	0.183
Long Term Bank Debt	14102	0.155	0.231
Medium	14102	0.339	0.473
Large	14102	0.340	0.474
Crisis 1 (Monetary Policy Rate)	14102	0.160	0.366
Crisis 2 (Inter-Banking Rate)	14102	0.300	0.458

Table 4

Liquidity Crises

Indicator	***Periods***
Monetary Policy Rate	1998Q2-1998Q4 2001Q3-2002Q1 2008Q3-2008Q4
Inter-Banking Rate	1997Q4-1998Q3 2000Q4-2001Q3 2004Q4-2005Q4 2007Q4-2008Q2

Table 5

Panel Data Regressions: Liquidity Crisis based on Monetary Policy Rate

	(1)	*(2)*	*(3)*	*(4)*
Cash(-1)	0.632	0.575	0.515	0.508
	(12.81)**	(8.28)**	(5.74)**	(5.53)**
Cash Flow	0.000	0.000	0.000	0.000
	(0.19)	(0.11)	(0.04)	(0.07)
Volatility	0.044	0.043	0.037	0.037
	(2.55)*	(2.46)*	(2.15)*	(2.15)*
Leverage	-0.018	-0.018	-0.019	-0.019
	(2.78)**	(2.66)**	(2.61)**	(2.59)**
Liquidity	-0.018	-0.018	-0.019	-0.019
	(2.78)**	(2.66)**	(2.61)**	(2.59)**
Bank Debt ST	-0.027	-0.028	-0.025	-0.025
	(3.59)**	(3.28)**	(2.89)**	(2.88)**
Bank Debt LT	-0.015	-0.015	-0.016	-0.016
	(3.63)**	(3.29)**	(3.3)**	(3.28)**
Medium	-0.023	-0.024	-0.037	-0.041
	(4.13)**	(3.66)**	(3.95)**	(3.78)**
Large	-0.026	-0.027	-0.037	-0.041
	(4.31)**	(3.81)**	(3.74)**	(3.63)**
Crisis	-0.002	-0.020	-0.022	-0.041
	(0.40)	(2.97)**	(3.00)**	(3.17)**
Crisis*Cash(-1)		0.309	0.343	0.369
		(4.63)**	(4.36)**	(4.29)**
Cash(-1)*Medium			0.313	0.318
			(3.53)**	(3.52)**
Cash(-1)*Large			0.199	0.201
			(2.34)*	(2.33)*
Crisis*Medium				0.024
				(2.56)*
Crisis*Large				0.026
				(2.77)**
Constant	0.056	0.061	0.067	0.070
	(5.73)**	(4.97)**	(4.75)**	(4.63)**
Observations	14102	14102	14102	14102
Instruments	60	61	63	65
Sargan p-value	0.018	0.126	0.321	0.340
AR(1) p-value	0.000	0.000	0.000	0.000
AR(2) p-value	0.129	0.274	0.245	0.259

Robust t statistics in parentheses. * significant at 5%; ** significant at 1%. All regressions include unreported quarter-specific dummy variables.

Following Roodman (2009), $Cash_{it-2}$ and X_{it-2} were used as instruments and the dimension of the instrument matrix was reduced by collapsing it horizontally in order to mitigate instrument proliferation that weakens Sargan test of overidentifying restrictions.

Table 6

Panel Data Regressions: Liquidity Crisis based on Inter-Banking Rate

	(1)	*(2)*	*(3)*	*(4)*
Cash(-1)	0.632	0.471	0.377	0.367
	(12.81)**	(5.19)**	(3.05)**	(2.90)**
Cash Flow	0.000	0.000	0.000	0.000
	(0.19)	(0.01)	(0.13)	(0.25)
Volatility	0.044	0.051	0.045	0.044
	(2.55)*	(2.47)*	(2.09)*	(2.08)*
Leverage	-0.018	-0.019	-0.020	-0.020
	(2.78)**	(2.59)**	(2.53)*	(2.54)*
Liquidity	-0.018	-0.019	-0.020	-0.020
	(2.78)**	(2.59)**	(2.53)*	(2.54)*
Bank Debt ST	-0.027	-0.031	-0.029	-0.029
	(3.59)**	(3.43)**	(3.02)**	(3.00)**
Bank Debt LT	-0.015	-0.016	-0.017	-0.017
	(3.63)**	(3.30)**	(3.33)**	(3.30)**
Medium	-0.023	-0.025	-0.041	-0.050
	(4.13)**	(3.66)**	(3.98)**	(3.75)**
Large	-0.026	-0.029	-0.042	-0.052
	(4.31)**	(3.81)**	(3.81)**	(3.64)**
Crisis	-0.009	-0.034	-0.038	-0.061
	(2.28)*	(4.88)**	(4.66)**	(4.30)**
Crisis*Cash(-1)		0.389	0.451	0.481
		(4.59)**	(4.16)**	(4.17)**
Cash(-1)*Medium			0.342	0.343
			(3.64)**	(3.60)**
Cash(-1)*Large			0.274	0.277
			(2.77)**	(2.77)**
Crisis*Medium				0.030
				(2.83)**
Crisis*Large				0.033
				(3.01)**
Constant	0.056	0.069	0.079	0.086
	(5.73)**	(5.19)**	(4.91)**	(4.71)**
Observations	14102	14102	14102	14102
Instruments	60	61	63	65
Sargan p-value	0.018	0.035	0.129	0.130
AR(1) p-value	0.000	0.000	0.000	0.000
AR(2) p-value	0.129	0.531	0.696	0.672

Robust t statistics in parentheses. * significant at 5%; ** significant at 1%. All regressions include unreported quarter-specific dummy variables.

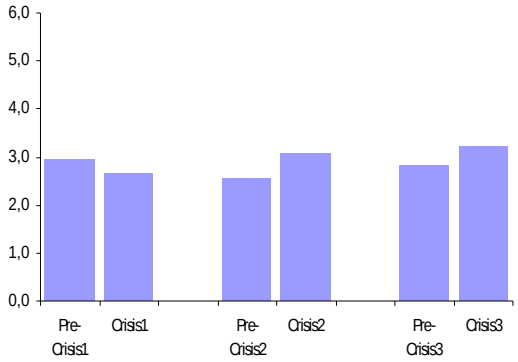
Following Roodman (2009), $Cash_{it-2}$ and X_{it-2} were used as instruments and the dimension of the instrument matrix was reduced by collapsing it horizontally in order to mitigate instrument proliferation that weakens Sargan test of overidentifying restrictions.

Figure 1

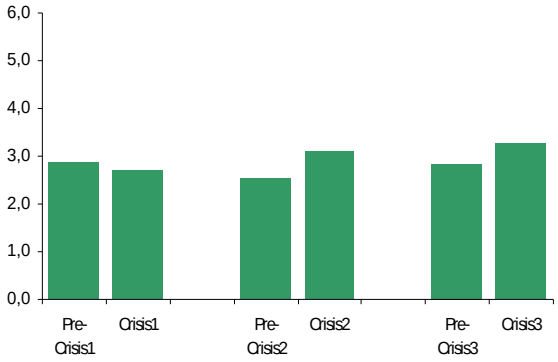
Cash and Equivalent Items to Total Assets by Firm Size (*)

(Weighted average)

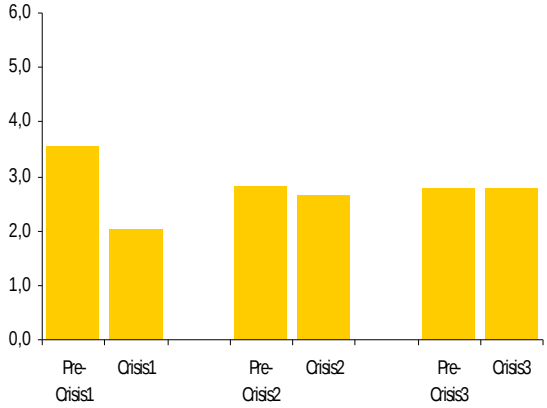
A. All Firms



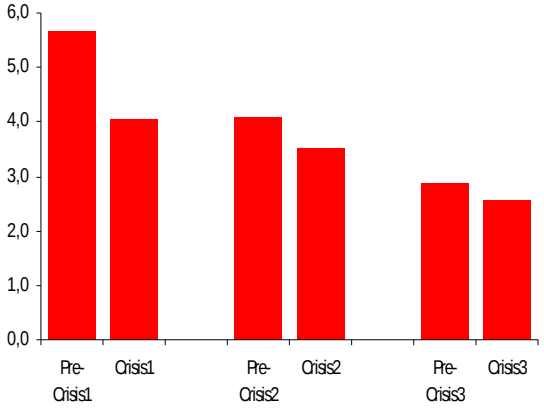
B. Large Firms



C. Medium Firms



D. Small Firms

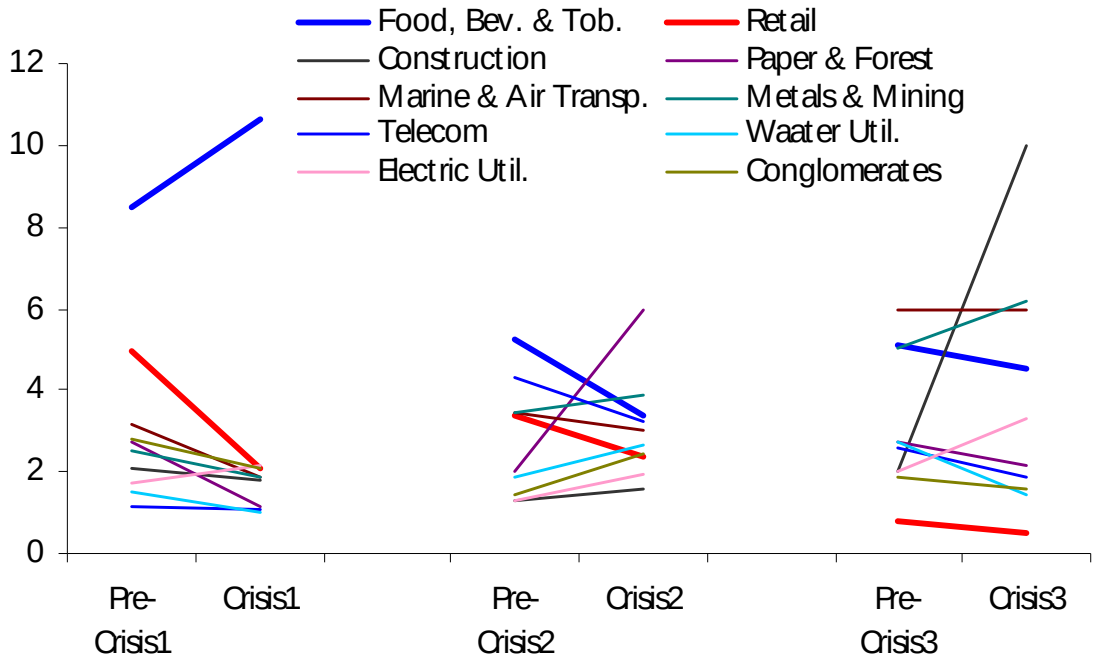


(*)Defined from the distribution of total assets in constant prices.

Figure 2

Cash and Equivalent Items to Total Assets by Industry (*)

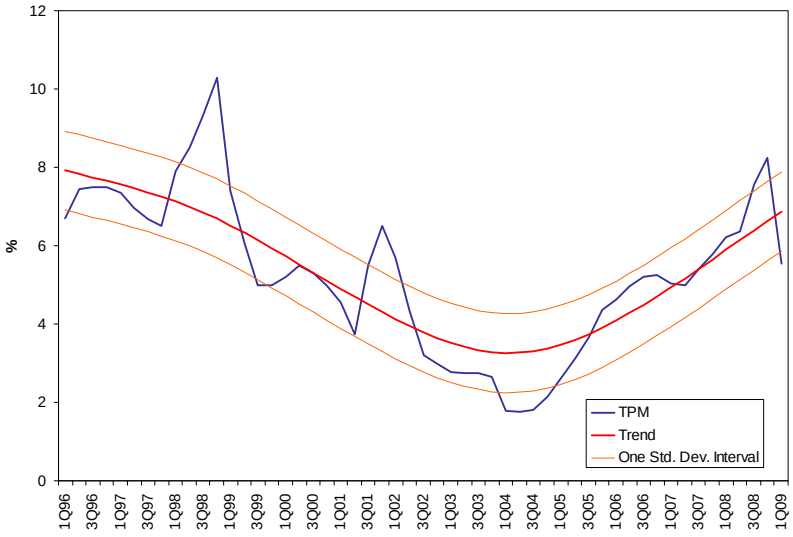
(Weighted average)



(*) Based on Standard & Poor's Global Industry Classification Standard (GICS).
(**) The sharp rise of the ratio in the construction industry during the third crisis is principally due to the increase of cash of Madeco, after the sale of its Wire and Cable Unit at the end of 3Q2008. Madeco represents in our sample 26% of total assets and 89% of cash and equivalents items of the construction industry at 4Q2008.

Figure 3

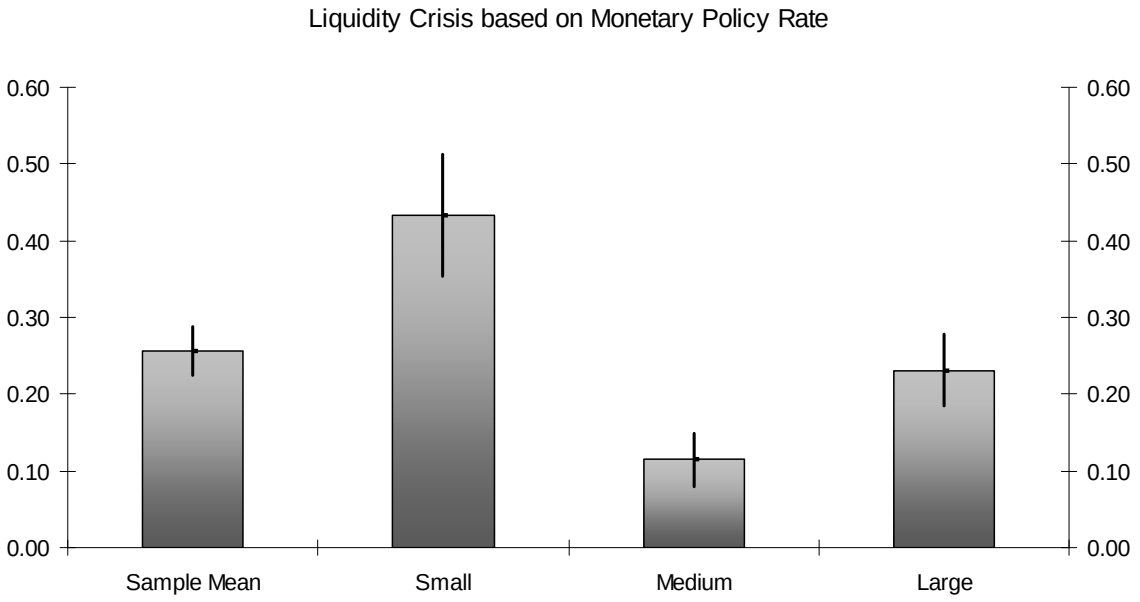
Monetary Policy Rate 1996:01 – 2009:01



Source: Central Bank of Chile and author's calculations.

Figure 4

Adjustment Velocity by Firm Size



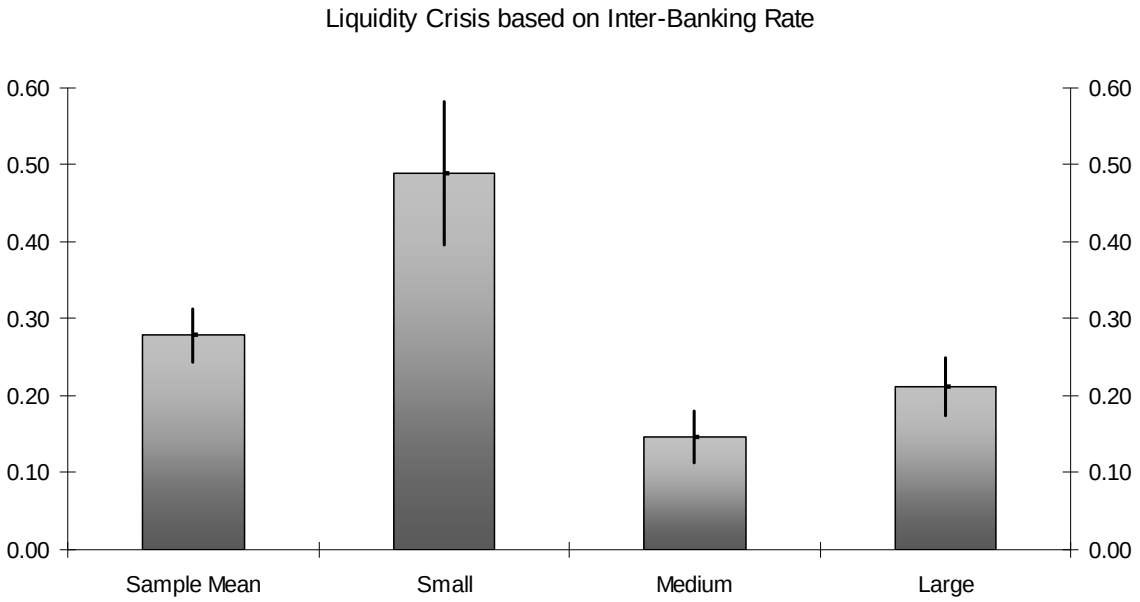
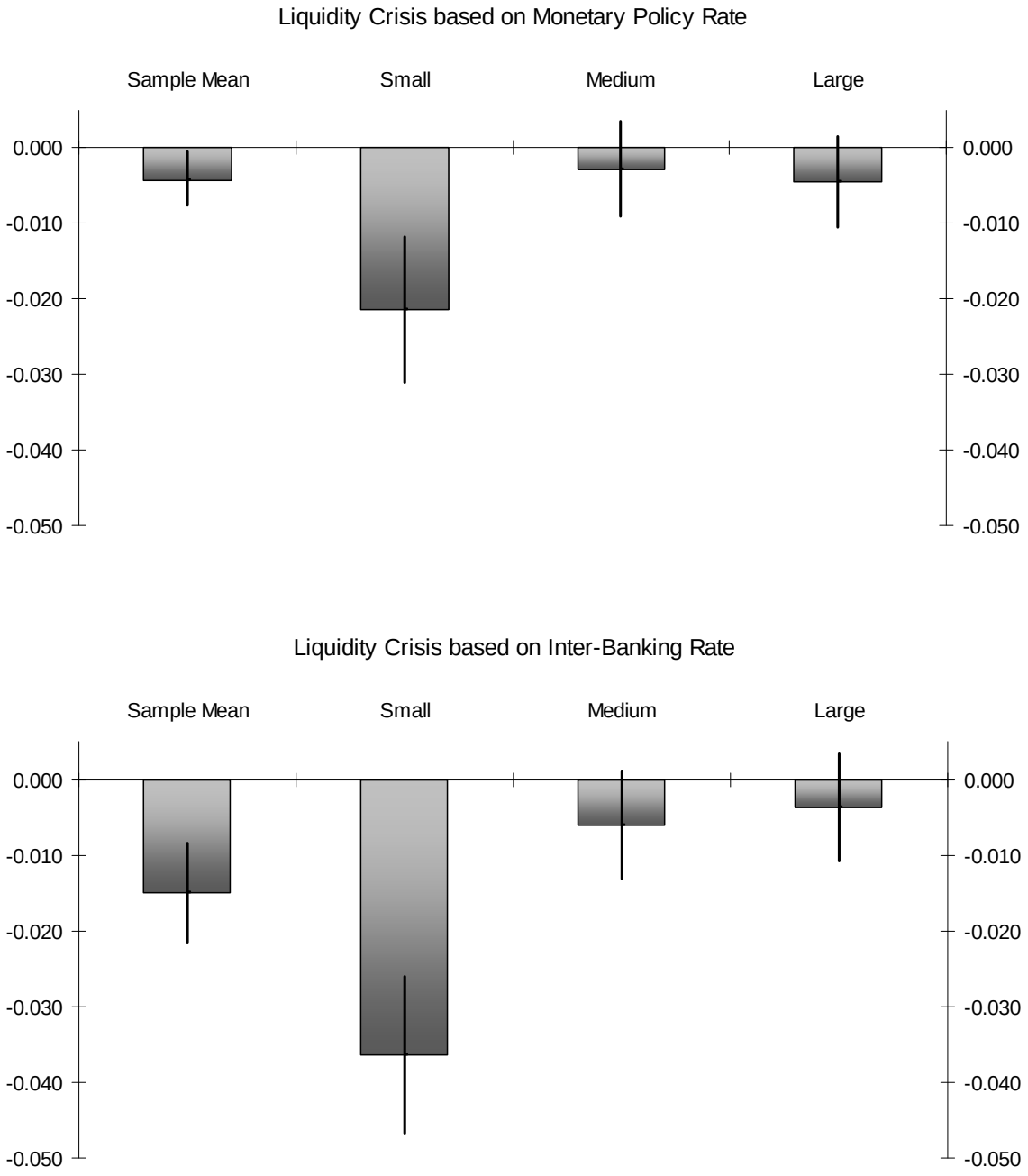


Figure 5

Liquidity Crisis Effects by Firm Size



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