RIETI Discussion Paper Series 17-E-045

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TSURUTA, Daisuke
Nihon University

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https://www.rieti.go.jp/en/

RIETI Discussion Paper Series 17-E-045
First Draft: March 2017
Revised: March 2019

Working Capital Management during Financial Crisis: Evidence from Japan[†]

Daisuke Tsuruta
College of Economics, Nihon University

Abstract

This paper demonstrates the adjustment speed of firm working capital and the relationships between working capital and firm performance in Japan during the global financial crisis. Using quarterly firm-level data, we find that the adjustment of working capital was weaker during the crisis. Moreover, the negative relationship between excess working capital and firm performance became more significant during the crisis, especially for larger firms. However, this crisis-related working capital–firm performance effect does not appear to persist for very long, because to finance any excess working capital, firms borrow from banks and reduce their internal cash both during and outside periods of crisis.

Keywords: Working capital, financial crisis, firm performance, inventories, trade receivables
JEL classification: G31; G32; G01

[†] This study was conducted as part of the project ``Study on Corporate Finance and Firm Dynamics" at the Research Institute of Economy, Trade and Industry (RIETI). This study uses microdata from the Surveys for the Financial Statements Statistics of Corporations by Industry (Houjin Kigyou Toukei Chosa) conducted by the Ministry of Finance and was financially supported by a Grant-in-Aid for Scientific Research (C) #16K03753 from the Japan Society for the Promotion of Science. The author would also like to thank Hikaru Fukanuma, Kaoru Hosono, Masayuki Morikawa, Yoshiaki Ogura, Hiroshi Ohashi, Arito Ono, Hirofumi Uchida, Iichiro Uesugi, Wako Watanabe, Peng Xu, and Makoto Yano for many valuable comments. The seminar participants at RIETI also provided useful comments. All remaining errors are mine.

1 Introduction

In this paper, we investigate how the level of working capital deviated from the target level of firms during the recent global financial crisis. We also examine how firms mitigated any excessive working capital following the crisis over time. In general, working capital consists of trade receivables, inventories, and trade payables. During the global financial crisis, the level of working capital increased for the following reasons. First, with the rapid decline in firm sales, the level of firm inventories became unexpectedly excessive. Second, as many firm customers began to experience economic distress, they delayed payment for goods and services. This accounted for an increase in unpaid trade receivables. Third, with the decline in firm sales during the crisis, the purchase of goods also decreased, leading to a decline in trade payables (Tsuruta and Uchida, 2013). Lastly, the increase in the probability of default during the economic downturn led to a decline in the supply of trade payables (Raddatz, 2010; Boissay and Gropp, 2013). For the most part, firms finance their excessive working capital using their available financing sources. However, if the credit constraints for firms are severe, carrying excessive working capital can diminish firm performance because firms are obliged to use relatively expensive sources of finance. Therefore, firms should adjust the level of working capital toward some firm-specific target level during and after periods of crisis.

Using Japanese quarterly firm-level data, we investigate the following issues. First, following previous studies (Kieschnick et al., 2013; Baños Caballero et al., 2013), we estimate the target level of working capital for firms. Then, using this model, we predict the level of excess working capital found in firms during the global financial crisis after 2008. Second, using the estimation method introduced by Flannery and Rangan (2006) and Baños Caballero et al. (2013), we estimate the adjustment speed of working capital during the crisis. As these studies argue, firms adjust their level of working capital toward the target level. As a result, if firms quickly mitigate the excess in working capital caused by the crisis, it should not affect them greatly. However, if the adjustment speed slows

during the crisis period, then carrying excessive working capital can be harmful to firm performance. Third, we investigate the empirical relationship between excessive working capital and firm performance (in terms of profitability). If excessive working capital is indeed harmful to firm performance, the estimated empirical relationship should be negative.

Japanese data are especially suitable for the study of working capital management during the recent crisis. First, the real shock of the crisis was especially great for Japanese firms as the real growth rate of GDP fell from 2.2% in fiscal year (FY) 2007 to –1.0% in 2008 and –5.5% in 2009. This was much more severe than in comparable developed countries.[1] Second, our data include many small businesses, which are typically financially constrained (Berger and Udell, 1998). Excessive working capital is an especially important consideration for small business, so using this information, we can investigate the negative effects of working capital during the shock more precisely. In addition, public credit guarantees increased in Japan during the crisis period for small businesses, so the estimation results including small businesses have rich policy implications. Finally, our data are quarterly (not yearly), so we can examine the periods of working capital adjustment in finer detail.

Our results are as follows. First, the level of excess working capital increased during the financial crisis after 2008. After late 2009, the level decreased and returned to its pre-crisis level. Second, the adjustment speed of working capital requirements in late 2008 and early 2009 was slower than that in other periods. This suggests that firms faced some constraints in adjusting their working capital levels to their target values during the financial crisis. Conversely, the adjustment speed after late 2009 was similar to that before the crisis, so firms could adjust their working capital requirements only a year

[1]According to the World Economic Outlook Database compiled by the International Monetary Fund, the percentage change in GDP in 2009 was –5.6% in Germany and –5.5% in Italy. In the remaining G7 countries, the percentage change was between –3% and –4%. In addition, the percentage change in GDP in 2008 was less than –1% only in Japan and Italy. These data suggest that the negative effects of the global financial crisis were especially severe in Japan.

after the first occurrence of the financial crisis. Third, the estimated negative relationship between firm performance and excessive working capital requirements was stronger during the crisis. This implies that firms were unable to reduce their working capital during the crisis period. As firms financed excessive working capital during both the crisis and non-crisis periods with bank loans and internal cash, this negative effect results from real not just financial factors. Finally, the negative effects of excessive working capital and the slow speed of working capital adjustment were more severe for larger firms.

In terms of related work, Hill et al. (2010) estimate the determinants of working capital requirements and show that growing firms, firms facing costly external finance, and financially distressed firms all invest less in working capital. In contrast, firms with high internal finance capacity and high credit availability invest more in working capital. Elsewhere, many extant studies (for example, Deloof, 2003; Kieschnick et al., 2013; Baños Caballero et al., 2014; Aktas et al., 2015) estimate the relationship between working capital management and corporate performance and demonstrate that because both high and low levels of working capital have negative effects on firm performance, there is an optimal level of working capital. In other work, Baños Caballero et al. (2013) estimate a partial adjustment model and show that the speed of adjustment of working capital is faster if firms have bargaining power and their external financing constraints are not severe. However, all of these studies investigate the effects of a financial crisis on working capital management in non-crisis periods. In this paper, we investigate the relationship between firm performance and working capital and the adjustment speed of working capital during a particular crisis period, which represents our main contribution to the corporate finance literature.

Outside this literature, some studies (for example, Love et al., 2007; Garcia-Appendini and Montoriol-Garriga, 2013; Casey and O'Toole, 2014; Carbó-Valverde et al., 2016) do focus on periods of financial crisis and the impact on the relationship between trade credit policy and the supply of bank loans, while Almeida et al. (2012) investigate the

effects on firm investment. However, to our knowledge, few studies investigate the effects of a financial crisis on firm performance using quarterly firm-level data including small businesses.

The remainder of the paper is organized as follows. Section 2 describes the dataset and provides an overview of the data during the sample period. Section 3 examines the determinants of working capital requirements and the levels of excess working capital during the crisis period. In Section 4, we introduce the partial adjustment model and discuss the estimation results. Section 5 provides the estimation results concerning the relationship between excessive working capital and firm performance. Section 6 concludes the paper.

2 Data

2.1 Outline of Data

We use quarterly firm-level data from the Surveys for the Financial Statements Statistics of Corporations by Industry (*Houjin Kigyou Toukei Chosa* in Japanese) (hereafter, quarterly FSSC) conducted by the Ministry of Finance (MOF). According to the MOF website,[2] the quarterly FSSC are "...one part of the fundamental statistical surveys under the Statistics Act and have been conducted as sampling surveys so as to ascertain the current status of business activities of commercial corporations in Japan." The target firms for the quarterly FSSC are all commercial corporations in Japan with 10 million yen of capital or more. The MOF has the list of all corporations in Japan that report tax payments. In 2010, the total population in the FSSC was 1,125,866 firms with 10 million yen or more of capital. By size, this comprised 823,205 firms with 10 to 20 million yen of capital, 210,311 firms with 20 to 50 million yen, 58,995 firms with 50 to 100 million yen, 27,899 firms with 100 million to 1 billion yen, and 5,456 firms with 1 billion yen or more.

[2]For details of the survey, see http://www.mof.go.jp/english/pri/reference/ssc/index.htm.

To forward their questionnaire, the MOF selects sample firms as follows.[3] Before FY2008, the survey selected all firms with 1 billion yen or more of capital, with those firms with capital of between 100 million and 1 billion yen selected by sampling with varying probability. According to the MOF, all firms with capital of 600 million yen or more are included, representing a complete survey for these firms. The MOF then selected firms with less than 100 million yen of capital by sampling with equal probability at the beginning of every fiscal year. After FY2009, all firms with capital of 500 million yen or more were included, again representing a complete survey for these firms. The MOF then again selected smaller firms, but with less than 500 million yen of capital, by sampling with equal probability at the beginning of every fiscal year. Therefore, for those firms, there is again a different sample of target firms each fiscal year. As a result, while we have a panel dataset for firms generally, it is not possible to construct this panel using the same firms in different years. The response rate each fiscal year is around 70–90%, which differs by firm size.

The quarterly FSSC includes data on firm balance sheets and profit and loss statements each quarter. Balance sheet data are available at the beginning and end of each quarter.[4] To focus on the crisis period, our data cover the period between 2007 and 2010, while to enable comparison with a non-crisis period we include the period between 2003 and 2006. We obtain 568,492 and 278,634 firm-quarter observations for 89,777 and 53,333 firms over the periods 2003–2010 and 2007–2010, respectively.[5] The coverage ratios in 2010 were 1.63% (all firms), 0.20% (10 to 20 million yen of capital stock), 1.08% (20 to 50 million yen), 3.18% (50 to 100 million yen), 27.42% (100 million to 1 billion yen), and 89.29% (1 billion yen or more). Coverage was not high for small firms. Nonetheless, as our firms

[3]For the questionnaire itself, see the MOF's website:
https://www.mof.go.jp/pri/reference/ssc/outline.htm#questionnaire (in Japanese, last date accessed: October 2018).

[4]This means that we can calculate the quarterly growth rate of balance sheet items.

[5]As Kieschnick et al. (2013) argue, if a firm's working capital is excessive, the probability of default is higher. This may result in the bankruptcy and exit of some firms, so the level of working capital has some effect on sample selection. However, we cannot identify which firms actually exit.

are randomly sampled from the list of all firms that report tax payments in Japan, our database is unbiased and suitable for investigating the activity of Japanese firms.

We define small, medium, and large firms as follows. Small firms are firms with 5 or fewer employees in the wholesale, service, and retail industries and 20 or fewer employees in all other industries. Medium firms are firms with 6–100 employees in the wholesale, service, and retail industries and 21–300 employees in all other industries. Large firms are firms that are neither small nor medium firms. To define small and medium firms, we follow the employee criteria in the definition of "small and medium enterprises" in the Small and Medium-sized Enterprise Basic Law. [6]

2.2 Simple Statistics

We define the working capital requirements (WCR) as the sum of trade receivables and inventories, minus trade payables, normalized by total sales: [(trade receivables + inventories – trade payables) / total sales]. Figure 1 depicts the median WCR by year and firm size. As shown, the median WCR fluctuates before 2008q2 and increases after 2008q1 for all firm sizes. The peak WCR is in either 2009q2 or 2009q3, and WCR only returns to its pre-crisis level after 2010. The increase in WCR is mainly the result of the decline in sales. Figure 2 illustrates the median quarterly growth rate of sales by year and firm size. As shown, sales growth generally falls after 2008q3. The trough in sales growth is in 2009q1 and the growth rate returns to its pre-crisis level in 2009q4. In Figures 3, 4, and 5, we plot the 25th, 50th (median), and 75th percentiles of the growth rates of inventories, trade receivables, and trade payables, respectively. Figure 3 shows that the median growth of

[6] According to *the 2005 White Paper on Small and Medium Enterprises in Japan* by the Small and Medium Enterprise Agency, "small and medium enterprises" (SMEs) under the Small and Medium-sized Enterprise Basic Law are defined as enterprises with capital stock not in excess of ¥300 million or with 300 or fewer regular employees, and sole proprietorships with 300 or fewer employees. However, the definition of SMEs in the wholesale industry is enterprises with capital stock not in excess of ¥100 million or with 100 or fewer employees, whereas in the retail industry they are enterprises with capital stock not in excess of ¥50 million or with 50 or fewer employees. In the service industry, SMEs are enterprises with capital stock not in excess of ¥50 million or with 100 or fewer employees. For their part, "Small enterprises" are defined as enterprises with 20 or fewer employees. However, in the commercial and service industries, they are enterprises with five or fewer employees."

inventories is nearly zero in all years and quarters, suggesting that firms barely adjusted their level of inventories, even though sales declined during the crisis. Focusing on the 75th percentile, the growth rate of inventories fell significantly, suggesting that some firms decreased their inventories in 2009q1. Figures 4 and 5 show that the growth rates of trade receivables and payables were negative in 2009q1 and q2, respectively. In addition, the 25th percentile of trade receivables and payables declined significantly. Overall, these figures suggest that trade credit decreased after the initial credit crisis.

Figure 6 illustrates the median ratio of operating income to total assets by year and firm size. As shown, the median operating incomes of both medium and large firms fell significantly after 2008q3, suggesting that the financial crisis affected the profitability of these firms. In contrast, while the median operating income ratio of small firms also declined in 2008, it fell much less than for medium and large firms. These data suggest that the negative impact of the financial crisis on firm performance was more severe for medium and large firms.

3 Global Financial Crisis and Working Capital

3.1 Empirical Strategy

To demonstrate the effects of the financial crisis on working capital, we estimate the excess WCR of firms as follows. First, we estimate the determinants of WCR using the following regression equation:

$$\begin{aligned} WCR_{i,t,q} &= \alpha_1 Firm\ growth_{i,t,q} + \alpha_2 GPM_{i,t,q} + \alpha_3 OCF_{i,t,q} + \alpha_4 Firm\ size_{i,t,q-1} \\ &+ \alpha_5 Distress\ dummy_{i,t,q-1} + \alpha_6 GDP_{t,q} + \zeta_q + \eta_i + \epsilon_{i,t,q} \end{aligned} \quad (1)$$

where $\epsilon_{i,t,q}$ is the error term of firm i for quarter q in year t, ζ_q is the quarter fixed effect from q1 to q4, and η_i is the industry fixed effect. As discussed, WCR is the sum of

trade receivables and inventories, minus trade payables, normalized by total sales: [(trade receivables + inventories – trade payables) / total sales]. Following Hill et al. (2010), we specify firm growth, the gross profit margin (GPM), operating cash flow (OCF), firm size, a firm distress dummy, and quarter and industry fixed effects as control variables.

We define firm growth as the natural logarithm of a firm's total assets in year-quarter t,q minus those in year-quarter t,q–1. Hill et al. (2010) use sales growth as the proxy of firm growth. As the sample of firms changes at the beginning of each fiscal year, data on the sales growth in the first quarter of the fiscal year are unavailable for many firms. For this reason, as a proxy variable for sales growth, we use asset growth because of the positive correlation with sales growth. GPM is the ratio of a firm's cost of goods sold to total sales in quarter q of year t. OCF is the ratio of a firm's operating income plus depreciation and amortization to its total assets in quarter q of year t. Firm size is the natural logarithm of a firm's total assets in year-quarter t,q–1. The distress dummy takes a value of one if a firm's leverage (defined as the ratio of the book value of a firm's debt to the book value of its assets) is in the top two deciles for its industry in year-quarter t,q–1.[7] Similarly, following Baños Caballero et al. (2013), we use the growth rate of gross domestic product (GDP) in quarter q in year t to control for macroeconomic conditions. To calculate the estimated WCR after 2007, we are unable to use year dummies, so by using GDP, we can both control for macroeconomic conditions and estimate the post-2007 level of WCR.

As Hill et al. (2010) argue, the predicted effects of sales growth on WCR are negative, so those for asset growth are also negative. However, asset growth is higher if firms increase their capital and inventory investment. Therefore, if the effects of investment on WCR are stronger than for sales growth, the effects of asset growth should be positive. Furthermore, as Petersen and Rajan (1997) reveal, firm growth has positive effects on trade payables because of high credit demand. In addition, firm growth has positive

[7]This definition of distress is identical to that in Molina and Preve (2009) and Hill et al. (2010).

effects on trade receivables if the growth rate is positive, and negative effects otherwise. In sum, the predicted sign of firm growth is ambiguous.

In a typical firm operating cycle, firms purchase inventories and increase the cost of goods sold, financed in turn via trade payables. Firms then sell their products and increase sales before they collect cash, which then increases trade receivables. GPM is the difference between sales and the cost of goods sold, which has some effects on WCR. Therefore, we employ GPM as an explanatory variable. Firms that have a positive OCF can invest working capital without resorting to external finance. Therefore, OCF has positive effects on WCR.

Firm size is a proxy for a firm's transparency. Because of information asymmetry between borrowers and lenders, smaller firms face credit constraints. Therefore, they cannot acquire sufficient credit to invest in working capital. Firm size is also a proxy for market access and creditworthiness. Together, these imply that firm size should have positive effects on WCR.

When firms are financially distressed, they cannot acquire enough credit (Opler and Titman, 1994). Thus, working capital investment is lower in financially distressed firms. Furthermore, suppliers offer less trade credit to financially distressed firms (Molina and Preve, 2009), so trade payables in these firms are significantly lower. Together, these suggest that the distress dummy should have negative effects on WCR.

3.2 Estimation Results

Table 1 provides summary statistics for the dependent and independent variables in equation (1). Column (1) of Table 2 provides the estimated results of equation (1) using the sample period from 2003 to 2010. The signs of the estimated coefficients for GPM and firm size are positive and that of the distress dummy is negative. All are statistically significant at the 1% or 10% level. These results are similar to those in Hill et al. (2010). However, the estimated coefficient of firm growth is positive while that of OCF is negative,

results which contrast with those in Hill et al. (2010). For their part, Hill et al. (2010) argue that firms with positive OCF can finance positive WCR, so the effects of OCF on WCR are positive. Alternatively, however, Petersen and Rajan (1997) argue that cash flow generation lowers trade receivables, which reduces the level of working capital. Our estimation results are consistent with those in Petersen and Rajan (1997), not those in Hill et al. (2010). In column (2), we detail the estimation results of equation (1) using the subsample period before the crisis (between 2003 and 2006). The main difference is that the estimated coefficient for GDP is now statistically insignificant. The remaining coefficients are similar to the results in column (1).

To investigate the level of excess working capital during the financial crisis, we calculate the predicted WCR after 2007 using the estimated results of equation (1). Using the predicted WCR for each observation, we calculate the excess WCR as the actual WCR minus the predicted WCR. We calculate two types of predicted excess WCR. The first employs the estimated result in column (2) of Table 2 (hereafter, excess WCR1). This estimation result uses the subsample before the crisis period, so the predicted level of WCR is the target level in the pre-crisis period. The second is calculated using the estimated result in column (1) of Table 2 (hereafter, excess WCR2), which includes the sample period covering the financial crisis (the crisis period).

Table 3 provides the summary statistics for excess WCR1 and WCR2. Figures 7 and 8 depict the average excess WCR1 and WCR2, respectively, by quarter for each year and firm size. Following the collapse of Lehman Brothers in September 2008, the excess WCR increases up until 2009q1, while for medium and large firms, the excess WCR decreases in 2009 and returns to its pre-crisis level in 2010. This implies that the negative effects of the financial shock on working capital lasted for about a year. In contrast, the trend in excess WCR in small firms is ambiguous, suggesting that the impact on the working capital of small firms was not as severe during the financial crisis.

To confirm the trend in excess WCR, we estimate equation (1) using the sample

between 2003 to 2010, adding dummies for each year.[8] If the level of WCR was excessive during the financial crisis in 2008, the estimated coefficients of the year dummies after 2007 should be positive. The results in column (3) of Table 2 show that the estimated coefficient of the 2009 dummy is larger than in the other years. This result also implies that working capital was excessive for firms after the crisis period.

Hill et al. (2010) argue that firms with high sales volatility invest more in inventories. In our data, the standard deviation of sales for each firm is unavailable. Because of this limited availability of data, we cannot employ sales volatility. Accordingly, to mitigate any omitted variable bias, we use a fixed-effects model to control for unobserved firm fixed effects (including the effects of sales volatility) in column (4) of Table 2. When we estimate the regression with firm fixed effects, the estimation results are similar to those without fixed effects. Furthermore, we cannot use sales growth because we cannot calculate the sales growth in the first quarter of the fiscal year for many firms, as already discussed. Nonetheless, in column (5), we estimate the coefficient of sales growth using a limited number of observations. Sales growth is the natural logarithm of a firm's total sales in quarter q minus those in quarter q–1. The estimated coefficient for sales growth is negative and statistically significant at the 1% level, which is consistent with the results in Hill et al. (2010).

4 Adjustment Toward Firm Targets

4.1 Change in WCR and Excess WCR

If the level of working capital deviates from the target level, firms should adjust their working capital toward the target level. Figures 9 and 10 depict the relationships between the excess WCR1 and WCR2 predicted by equation (2) and the change in WCR in the subsequent quarter (WCR in the subsequent quarter – WCR in the current quarter),

[8] To highlight the effects of the crisis, we set 2006 as the benchmark or reference year.

respectively. The y-axis details the four quantiles of excess WCR, being groups with very low, low, high, and very high excess WCR. We also split the sample by firm size and year. The figures in parentheses on the y-axis show the average excess WCR for each group. If firms adjust their WCR toward the predicted target level, the changes in WCR will be positive for the group of firms with low excess WCR and negative for the group of firms with high excess WCR. Both figures show that the change in WCR is negative if firms are in the top group of excess WCR. This suggests that if firms have excess WCR, they adjust toward the target level. Focusing on the difference between years, the change in WCR was less in 2008, implying that the adjustment of WCR weakened during the crisis period. In addition, the change in WCR for large and medium firms was lower in 2008, so the weak adjustment of WCR during the crisis was more significant for medium and large firms. We can also see that the changes in WCR in 2009 were larger than in the pre-crisis years, suggesting that firms adjusted for the excess WCR caused by the financial crisis after 2009. Therefore, we predict that the negative shock of excess WCR was most serious in 2008, but lessened after 2009.

4.2 Partial Adjustment Model

Following Flannery and Rangan (2006), we estimate a partial adjustment model to investigate the effects of the financial crisis on working capital management. Following equation (1), we assume that the target level of WCR is

$$WCR^*_{i,t,q} = \alpha X_{i,t,q} \tag{2}$$

where $X = (Firm\ growth_{i,t,q}, GPM_{i,t,q}, OCF_{i,t,q}, Firm\ size_{i,t,q-1}, Distress\ dummy_{i,t,q-1}, Industry\ dummy_i, Quarter\ dummy_q, Year\ Dummy_t)$. In a frictionless world, firms immediately adjust the actual level of WCR to the target level. However, the WCR adjustment cost for firms in the real world is significant. Therefore, we need to model the incomplete

adjustment of firm WCR, especially because during the financial crisis, firms may have faced difficulty in adjusting their level of WCR. In this analysis, we adopt a standard partial adjustment model, presented by Flannery and Rangan (2006).

$$WCR_{i,t,q} - WCR_{i,t,q-1} = \lambda(WCR^{*}_{i,t,q} - WCR_{i,t,q-1}) + \tilde{\delta}_{i,t,q} \tag{3}$$

The proportion λ represents the gap between the actual and target level of WCR in each year-quarter. If λ is close to one, firms adjust their level of WCR immediately. A large λ represents a high speed of adjustment of WCR. From equations (2) and (3), the following estimation equation is derived.

$$WCR_{i,t,q} = \alpha\lambda X_{i,t,q} + (1-\lambda)WCR_{i,t,q-1} + \tilde{\delta}_{i,t,q} \tag{4}$$

Using quarterly firm-level data during the pre- and post-crisis years (2007–2010), we estimate λ. To estimate the heterogeneous adjustment speed of WCR, we include interaction variables for the year dummies (or year-quarter dummies) and $WCR_{i,t,q-1}$ in the regression model. To control for any seasonal difference in the adjustment speed, we specify interaction variables between WCR and the quarter dummies.[9] If firms faced any constraints on the adjustment of WCR during the financial crisis, λ should be higher. Therefore, in this case, the estimated coefficient for the interaction between the crisis year dummy (2009) and $WCR_{i,t,q-1}$ will be positive.

4.3 Estimation Results

Table 4 provides the estimation results for equation (4) including the interaction terms between WCR and the year dummies. We estimate using a random-effects model to

[9]Our estimation results roughly reveal that the adjustment speed is faster in q1, which is just prior to the end of the accounting year for many Japanese firms.

control for firm heterogeneity.[10] In column (1), we provide the estimation result using the full sample. As shown, the estimated coefficient for WCR is positive and statistically significant at the 1% level. The magnitude of the coefficient $(1 - \hat{\lambda})$ is 0.4086, thereby supporting the incomplete adjustment of WCR. While the coefficients of the interaction variables between WCR and the year dummies for 2008 and 2010 are not statistically significant, that for 2009 is positive and statistically significant. These results suggest that the adjustment speed of WCR was slower during the crisis year (2009). In addition, the adjustment speed returned to its pre-crisis level in 2010.

In columns (2)–(4), we estimate the regression equation after separating the sample by firm size. The coefficient for the interaction term between WCR and the year dummy for 2008 is positive and statistically significant for large and medium firms, as shown in columns (2) and (3), respectively. In contrast, that for small firms is not statistically significant. This suggests a slower adjustment speed for large and medium firms.

We now investigate the heterogeneous effects by crisis and non-crisis period in greater detail. Table 5 provides the estimation results including the interaction terms for the year-quarter dummies. According to the estimation results using the full sample shown in column (1), the coefficients for the interaction variables between WCR and the year-quarter dummies are positive and statistically significant in 2008q4, 2009q1, and 2009q2, suggesting that the adjustment of WCR was weaker immediately following the collapse of Lehman Brothers. In contrast, after 2009q3, the estimated coefficients for the interaction variables are statistically insignificant, suggesting firms were able to adjust their WCR as usual. Similar to Table 4, we estimate the heterogeneous effects of WCR by firm size. The estimated coefficient for the interaction variable between WCR and the year-quarter dummy for 2009q1 is positive and statistically significant for medium and large firms. Conversely, that for small firms is negative. These results are similar to those in Table 4.

[10] If we estimate using the fixed-effects model, the estimated coefficients for WCR are negative and statistically significant. As this can be under-biased, we use the random-effects model. If we estimate the interaction variables using the fixed-effects model, the results are similar to those using the random-effects model.

According to Baños Caballero et al. (2013), firms with better access to external finance can adjust their excessive working capital more quickly. To explain the difference in λ, we estimate the interaction variables between WCR in t,q–1 and the proxies for dependence on external finance. If the financial crisis worsened the credit constraints for firms with a high dependence on external finance, λ should be higher, which would suggest that the adjustment was weaker for these firms. Alternatively, if firms that depended on external finance enjoyed high credit availability during the crisis, λ should be lower during the crisis. We employ three proxies reflecting the dependence on external finance, namely, the short-term bank borrowing ratio, the total bank borrowing ratio, and the corporate bond ratio. The short-term bank borrowing ratio is the ratio of a firm's short-term bank borrowings to its total assets in quarter q–1. The total bank borrowing ratio is the ratio of a firm's short-term bank borrowings plus long-term bank borrowings to its total assets in quarter q–1. The corporate bond ratio is the ratio of a firm's corporate bonds to its total assets in quarter q–1.

Table 6 provides the estimation results for these interaction variables. The estimated coefficient of $\text{WCR}_{t,q-1}\times$Year Dummy×Short-term Bank Borrowing Ratio is statistically insignificant, implying that the adjustment speed was neither slower nor faster in bank-dependent firms (in column 1). The estimated coefficient of $\text{WCR}_{t,q-1}\times$Short-term Bank Borrowing Ratio is positive and statistically significant at the 10% level (in column 2). On the other hand, the estimated coefficient of $\text{WCR}_{t,q-1}\times$Corporate Bond Ratio is positive and statistically significant at the 1% level (in column 3). The magnitude of the coefficient is also larger, suggesting that the adjustment speed of firms with a high level of corporate bond financing was slower during the sample period. The obvious reason for the slower adjustment speed is the collapse of the corporate bond market during the global financial crisis. As the Bank of Japan pointed out in its *Financial System Reports* in March 2010, large firms at the time were unable to finance their credit demand using the corporate bond market, so they borrowed more from banks. This implies that many large firms

faced severe constraints accessing external finance, so their adjustment speed was lower, which is consistent with the notion of Baños Caballero et al. (2013).

In sum, the estimation results of the partial adjustment model suggest that the adjustment of WCR was weaker after the financial crisis. Therefore, firms could not mitigate their excessive WCR during the crisis period quickly. This negative effect was especially serious for medium and large firms. Nevertheless, the adjustment speed returned to its non-crisis level after 2010, so firms could mitigate their excessive WCR more quickly in this period.

5 Firm Performance and Excessive Working Capital

5.1 Empirical Strategy

In the previous section, we estimated the gap between the target and actual WCR (excess WCR) and showed that firms' excess working capital was larger after the financial crisis. In addition, the adjustment of working capital did not appear to be working as usual, so firms had much more excess working capital after the financial crisis. Previous studies (for example Kieschnick et al., 2013) argue that high working capital reduces firm performance. We predict that this negative effect of working capital was rather more serious during the financial crisis because the adjustment of excessive working capital was weak.

To investigate the relationship between firm performance and working capital, we estimate the following regression using the subsamples for the pre- and post-crisis periods (2007–2010):

$$\begin{aligned} Firm\ Performance_{i,t,q} &= \gamma_1 Excess\ WCR_{i,t,q} + \gamma_2 Excess\ WCR_{i,t,q} \times YearDummy_t \\ &+ \mathbf{Y}_{i,t,q}\gamma_3 + \kappa_t + \mu_q + \theta_i + \iota_{i,t,q} \end{aligned} \tag{5}$$

where firm performance is a dependent variable for firm i in year t, quarter q; $\mathbf{Y}_{i,t,q}$ is a

vector of control variables (firm size, firm growth, fixed assets ratio, leverage); θ_i is the firm fixed effects of firm i; κ_t is the year fixed effects from 2007 to 2010; μ_q is the quarter fixed effects from q1 to q4; and $\iota_{i,t,q}$ is the error term of firm i in year t, quarter q.

We use firm profitability as a proxy of firm performance, and two proxies of profitability, namely, the ordinary income and operating income ratios. The ordinary income ratio is the ratio of a firm's ordinary income to its total assets, while the operating income ratio is the ratio of a firm's operating income to its total assets. As ordinary income includes interest payment expenses, the level of interest rates will reduce the ordinary income ratio, especially if firms increase bank borrowings or banks raise contractual interest rates. However, there is no comparable effect of interest rates on the operating income ratio. Accordingly, if excessive working capital is harmful for firms, the negative effects of excess WCR will be significant during the crisis period. Therefore, we predict that the estimated coefficients for the interaction variables between excess WCR and the year-quarter dummies will be negative after 2008. As for the other variables, the fixed assets ratio is the ratio of a firm's fixed assets to its total assets at the beginning of the quarter, and leverage is the ratio of a firm's book value of total debt to the book value of total assets at the beginning of the quarter.

5.2 Estimation Results

Table 7 details the estimation results of equation (5) using ordinary income as a proxy for firm performance. To investigate the heterogeneous effects of working capital on firm performance by year, we estimate the coefficients for the interaction variables between excess WCR and the year dummies. We specify 2007 as the benchmark year. We specify excess WCR1 in Table 7 as the dependent variable. Column (1) shows the estimation results using all samples. The coefficient of excess WCR is negative and statistically significant. This result is similar to previous studies (for example, Aktas et al., 2015) that found that the coefficient for working capital is negative with respect to firm performance.

Focusing on the estimation results of the interaction variables between excess WCR and the year dummies, the estimated coefficient is negative and statistically significant for 2009. This suggests that the negative effects of excess WCR were higher during the financial crisis.

Columns (2)–(4) display the heterogeneous effects by firm size. Focusing on these, we provide the estimation results for large firms in column (2), those for medium firms in column (3), and those for small firms in column (4). The estimated coefficients for the interaction variables in 2008 and 2009 are negative and statistically significant for large firms. As such, the negative effects of excess WCR were more severe for large firms. However, these same variables are insignificant for medium and small firms. Especially, for small firms, the estimation coefficients of excess WCR change to positive and are statistically significant at the 1% level, suggesting no evidence of a negative effect of excess WCR.

The estimated effects for the fixed assets ratio are negative while those for firm size, growth, and leverage are positive. These effects are statistically significant at the 1% level, implying that large, growing, and highly leveraged firms were more profitable. Further, firms with a high level of fixed assets were less profitable. Table 8 shows the estimation results for excess WCR and interactions with the year dummies in equation (5) using excess WCR2. The results are similar to those in Table 7.

To investigate the heterogeneous effects of working capital on firm performance by year and quarter, we estimate the coefficients for the interaction variables between excess WCR and the year-quarter dummies (shown in Table 9). We specify 2007q1 as the benchmark quarter. Column (1) shows the estimation results using all samples. The estimated coefficients in 2009q1, q2, and q3 are negative and statistically significant at either the 1% or 10% level. Apart from 2010q2, the estimated coefficients for the remaining interaction variables are not statistically significant. These results suggest that the negative effects of excess WCR appeared during the financial crisis, but almost immediately became

insignificant. Focusing on the heterogeneous effects by firm size, we detail the estimation results for large firms in column (2), those for medium firms in column (3), and those for small firms in column (4). Column (2) shows that the estimated coefficient for excess WCR is negative and statistically significant at the 1% level. In addition, the coefficients for the interaction variables in 2009q1 and q3 are negative and statistically significant at the 5% level. In column (3), we show the estimation results using a subsample of medium firms. Some coefficients for the interaction variables are statistically significant before 2008, and these are still negative and statistically significant at the 5% level in 2009q1 and q2. These results imply that the negative effects of excess WCR on firm performance were more severe for large and medium firms. After 2009q4, the negative effects are statistically insignificant, apart from 2010q2, suggesting that firms adjusted for excess WCR up until 2010q4. In contrast, column (3) shows that the interaction variables are either positive or statistically insignificant in small firms. This implies that the negative effects of excessive working capital were insignificant for small firms during both the crisis and non-crisis periods.[11]

Tables 10 and 11 provide the estimation results using the operating income ratio as the dependent variable and excess WCR1 and WCR2 as proxies of working capital. Similar to the estimation results in Tables 7 and 8, the coefficient for the interaction variable between excess WCR1 and the year dummy for 2008 is negative and statistically significant (column 1). Focusing on the effects for large firms, we see that the coefficients for the interaction variables from 2008 to 2009 are negative and statistically significant. These results imply that excess WCR has negative effects on the performance of large firms during the crisis period, consistent with the results in Tables 7 and 8. Conversely, using the subsample of small firms, while the estimated coefficients for the interaction variables are either positive or negative, all are statistically insignificant. We also provide the estimation results for

[11]Following earlier studies (for example. Baños Caballero et al., 2014), we re-estimated the effects of actual WCR (not excess WCR). The estimated results for WCR and the interactions between WCR and the year-quarter dummies are similar to those using excess WCR.

the interaction variables between excess WCR and the year-quarter dummies in Table 12. As shown, the coefficients of the interaction variables between excess WCR1 and the year-quarter dummies are negative and statistically significant in 2009q1, 2009q2, and 2009q3 (column 1). For large and medium firms, the coefficients for the interaction variables from 2009q1 to 2009q3 are negative and statistically significant (apart from 2009q2 for large firms and 2009q3 for medium firms). These results are then consistent with those in Table 9. However, using the subsample of small firms, the results in Table 12 also show that the coefficients of the interaction variables are either positive or negative, but again all are statistically insignificant.

For the most part, the negative effects of the financial crisis around 2008 were transmitted from outside Japan, such as the US subprime mortgage crisis and the collapse of Lehman Brothers. Therefore, firms that depended on sales from exports suffered more seriously from the negative shock from the financial crisis. In general, larger firms depend more on exports, so the negative shock on working capital was more severe for large than small firms.

5.3 Financial Sources

We show that the negative effects of excessive working capital on firm performance were greater in 2009, especially for larger firms. These negative effects could have arisen from one of the following reasons. The first is a real factor in that firms may have adjusted for excessive working capital, so their profitability became lower. For example, after the shock, demand suddenly fell, so firms may have needed to sell their excess inventories at a lower price, which lowered firm profitability. The second is a financial factor in that firms potentially could not finance their excess WCR during the shock as they faced severe financial constraints. If this was the case, they also could not have achieved profitable investment when facing limited opportunities for investment. As a result, profitability would again be lower for firms with excessive working capital.

To investigate which of these factors were significant, we estimate equation (5), specifying bank borrowings and cash holdings (normalized by the firm's total assets) as dependent variables. If the financial factor was significant, the effects of the excess WCR on bank borrowings should not be positive, implying that firms with excess WCR could not borrow more, even though they needed it, and reduced cash holdings more to mitigate any financial shortfall.

Table 13 provides the estimation results using bank borrowings as the dependent variable. As in Table 7, column (1) details the estimation results for all firms, column (2) for large firms, column (3) for medium firms, and column (4) for small firms. To provide insights into the heterogeneous effects of excess WCR each year, we include interaction variables between excess WCR and the year dummies. The estimated coefficients for excess WCR are negative and statistically significant at the 1% or 5% level in all columns. This suggests that firms with excess WCR borrowed more from banks. Therefore, the financial constraints for firms with high excess WCR were not severe. Focusing on the interaction variables between excess WCR and the year dummies, we can see that the coefficients of all variables are statistically insignificant, suggesting that the financial constraints were no more severe during the shock.

Table 14 provides the estimation results using cash holdings (normalized by total assets) as the dependent variable. If firms used internal cash to finance excess WCR, the estimated coefficients for excess WCR on cash holdings should be negative. Additionally, if the financial constraints were severe for firms with high excess WCR during the shock, these firms would have used more internal cash. As a result, the negative coefficients for excess WCR on cash holdings should be larger in magnitude. All columns in Table 14 demonstrate that the estimated coefficients for excess WCR are negative, suggesting that firms typically financed excess WCR using internal cash. Focusing on the interaction variables between excess WCR and the year dummies, the estimated coefficients are positive. This suggests that firms (apart from small firms) used less internal cash to finance

excess WCR during the shock. This also supports the argument that the negative effects of excess WCR were not the result of financial factors.

6 Conclusion

In this paper, we estimate the amount of a firm's excess working capital and the adjustment speed of working capital during the financial crisis period. We find that the amount of excess working capital increased following the collapse of Lehman Brothers in 2008. In addition, the adjustment speed was slower during the crisis period. We also find that carrying excessive working capital worsened firm performance, because our estimation results show that the negative relationships between excess working capital and profitability were stronger during the crisis period. However, the slow adjustment and negative effects of working capital were not significant in late 2009, suggesting that the negative effects of the crisis on working capital disappeared after about a year.

The results of this paper have several policy implications. Our results show that the negative effects of excessive working capital on firm performance persist for up to two years. Furthermore, we did not find any negative effects arising from the availability of bank loans. Therefore, public support during financial crises (for example, public credit guarantees and government lending) is currently not necessary for financing working capital. In contrast, our estimation results imply that because the implemented policies were adequate during the financial crisis, there were no negative effects on working capital. As Ono et al. (2013) found, the total amount of public credit guarantees increased after late 2009, which enhanced credit availability for small businesses. Our estimation results show that the adverse effects on bank loans during the financial crisis were insignificant, especially for small businesses, which implies that the public guarantees successfully increased the supply of bank loans. However, this does not mean that social welfare was improved by the public guarantee program because the cost side of credit guarantees (for example, adverse selection and moral hazard) was also significant, as argued by Saito and Tsuruta

(2018). Together, these account for the survival of zombie firms, which necessarily leads to inefficient allocation.

References

Aktas, N., Croci, E., Petmezas, D., 2015. Is working capital management value-enhancing? Evidence from firm performance and investments. Journal of Corporate Finance 30, 98–113.

Almeida, H., Campello, M., Laranjeira, B., Weisbenner, S., 2012. Corporate debt maturity and the real effects of the 2007 credit crisis. Critical Finance Review 1 (1), 3–58.

Baños Caballero, S., García-Teruel, P. J., Martínez-Solano, P., 2013. The speed of adjustment in working capital requirement. European Journal of Finance 19 (10), 978–992.

Baños Caballero, S., García-Teruel, P. J., Martínez-Solano, P., 2014. Working capital management, corporate performance, and financial constraints. Journal of Business Research 67 (3), 332–338.

Berger, A. N., Udell, G. F., 1998. The economics of small business finance: The roles of private equity and debt markets in the financial growth cycle. Journal of Banking & Finance 22, 613–673.

Boissay, F., Gropp, R., 2013. Payment defaults and interfirm liquidity provision. Review of Finance 17 (6), 1853–1894.

Carbó-Valverde, S., Rodríguez-Fernández, F., Udell, G. F., 2016. Trade credit, the financial crisis, and SME access to finance. Journal of Money, Credit and Banking 48 (1), 113–143.

Casey, E., O'Toole, C. M., 2014. Bank lending constraints, trade credit and alternative financing during the financial crisis: Evidence from European SMEs. Journal of Corporate Finance 27, 173–193.

Deloof, M., 2003. Does working capital management affect profitability of Belgian firms? Journal of Business Finance & Accounting 30 (3-4), 573–588.

Flannery, M. J., Rangan, K. P., 2006. Partial adjustment toward target capital structures. Journal of Financial Economics 79 (3), 469–506.

Garcia-Appendini, E., Montoriol-Garriga, J., 2013. Firms as liquidity providers: Evidence from the 2007–08 financial crisis. Journal of Financial Economics 109 (1), 272–291.

Hill, M. D., Kelly, G. W., Highfield, M. J., 2010. Net operating working capital behavior: A first look. Financial Management 39 (2), 783–805.

Kieschnick, R., Laplante, M., Moussawi, R., 2013. Working capital management and shareholders' wealth. Review of Finance 17 (5), 1827–1852.

Love, I., Preve, L. A., Sarria-Allende, V., 2007. Trade credit and bank credit: Evidence from recent financial crises. Journal of Financial Economics 83 (2), 453–469.

Molina, C. A., Preve, L. A., 2009. Trade receivables policy of distressed firms and its effect on the costs of financial distress. Financial Management 38 (3), 663–686.

Ono, A., Uesugi, I., Yasuda, Y., 2013. Are lending relationships beneficial or harmful for public credit guarantees? Evidence from Japan's emergency credit guarantee program. Journal of Financial Stability 9 (2), 151–167.

Opler, T. C., Titman, S., 1994. Financial distress and corporate performance. Journal of Finance 49 (3), 1015–40.

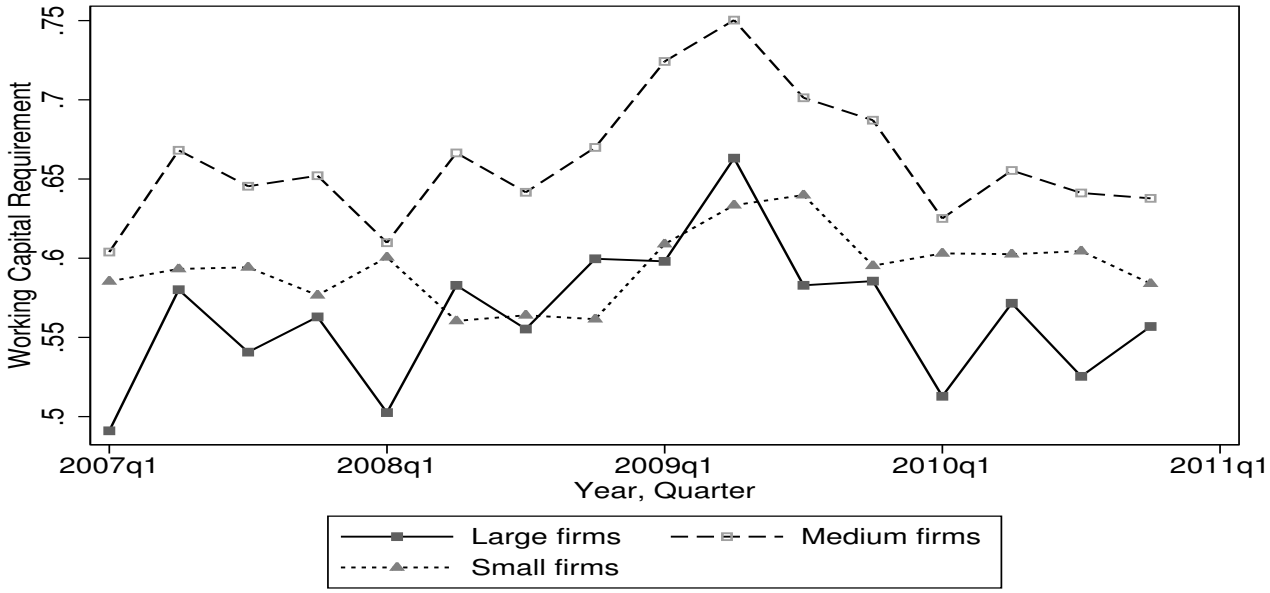
Petersen, M., Rajan, R. G., 1997. Trade credit: Theories and evidence. Review of Financial Studies 10 (3), 661–691.

Raddatz, C., 2010. Credit chains and sectoral comovement: Does the use of trade credit amplify sectoral shocks? Review of Economics and Statistics 92 (4), 985–1003.

Saito, K., Tsuruta, D., 2018. Information asymmetry in small and medium enterprise credit guarantee schemes: Evidence from japan. Applied Economics 50 (22), 2469–2485.

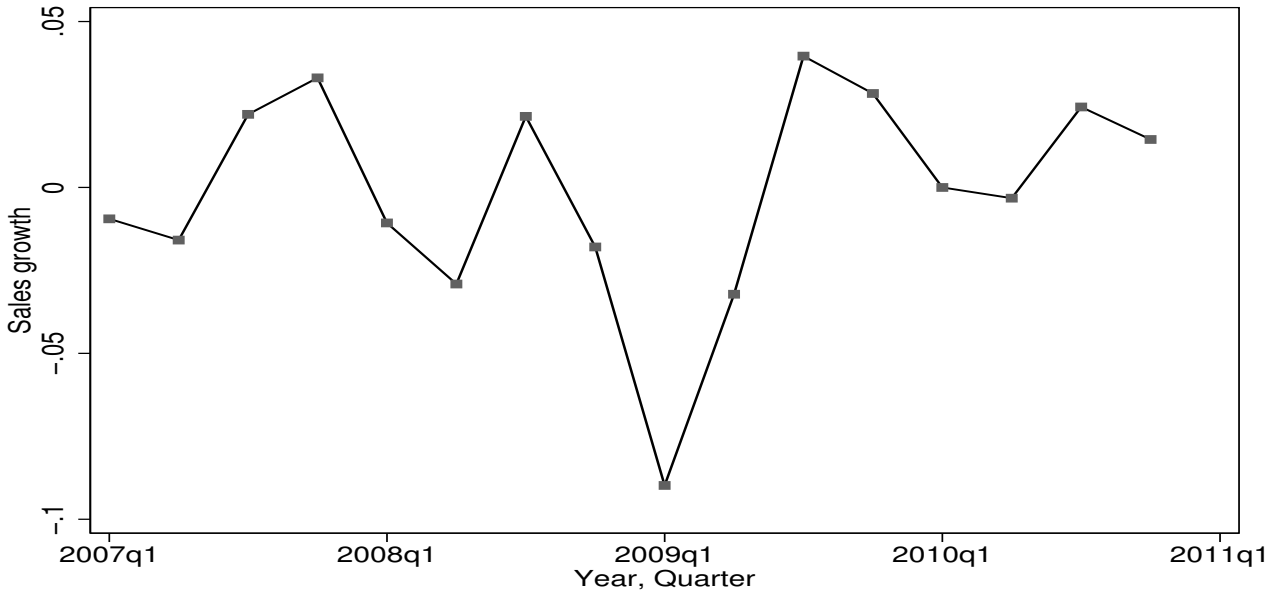
Tsuruta, D., Uchida, H., 2013. Real Driver of Trade Credit. Discussion papers 13-E-037, Research Institute of Economy, Trade and Industry (RIETI).

Figure 1: Median WCR from 2007q1 to 2010q4, by Firm Size



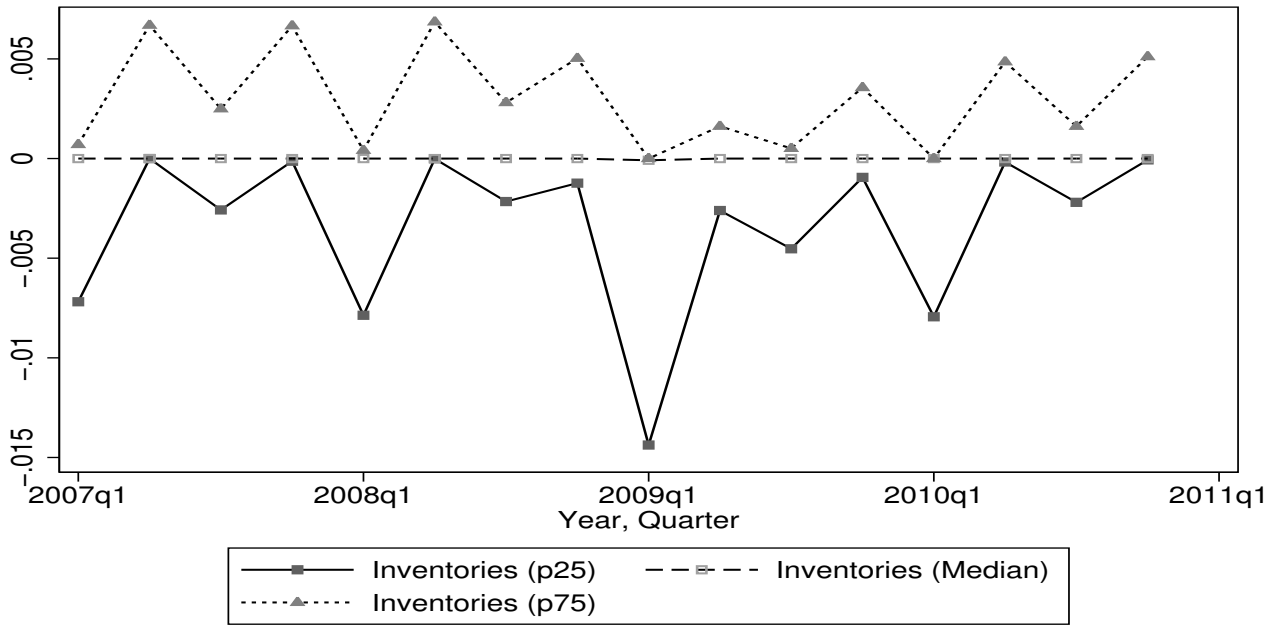
Note: This figure shows the median WCR by firm size and year-quarter.

Figure 2: Median Quarterly Sales Growth from 2007q1 to 2010q4, by Firm Size



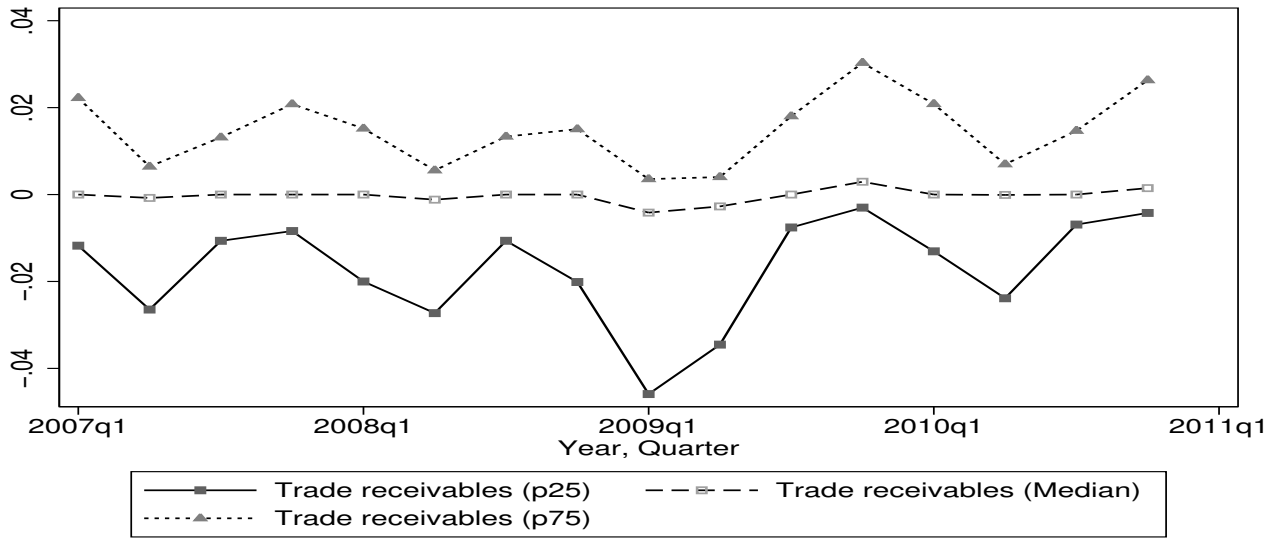
Note: This figure depicts the median quarterly growth rate of sales by firm size and year-quarter.

Figure 3: 25th, 50th (Median), and 75th Percentiles of Quarterly Growth of Inventories from 2007q1 to 2010q4



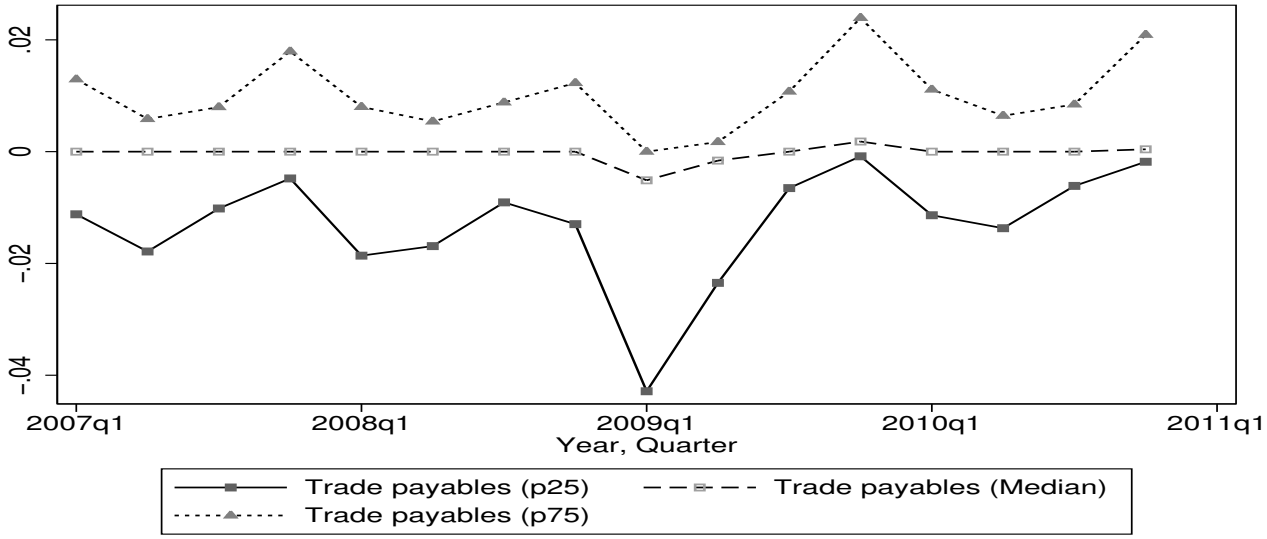
Note: This figure depicts the 25th, 50th (median), and 75th percentiles of the quarterly growth rate of inventories, normalized by total assets in t,q–1 by year-quarter.

Figure 4: 25th, 50th (Median), and 75th Percentiles of Quarterly Growth of Trade Receivables from 2007q1 to 2010q4



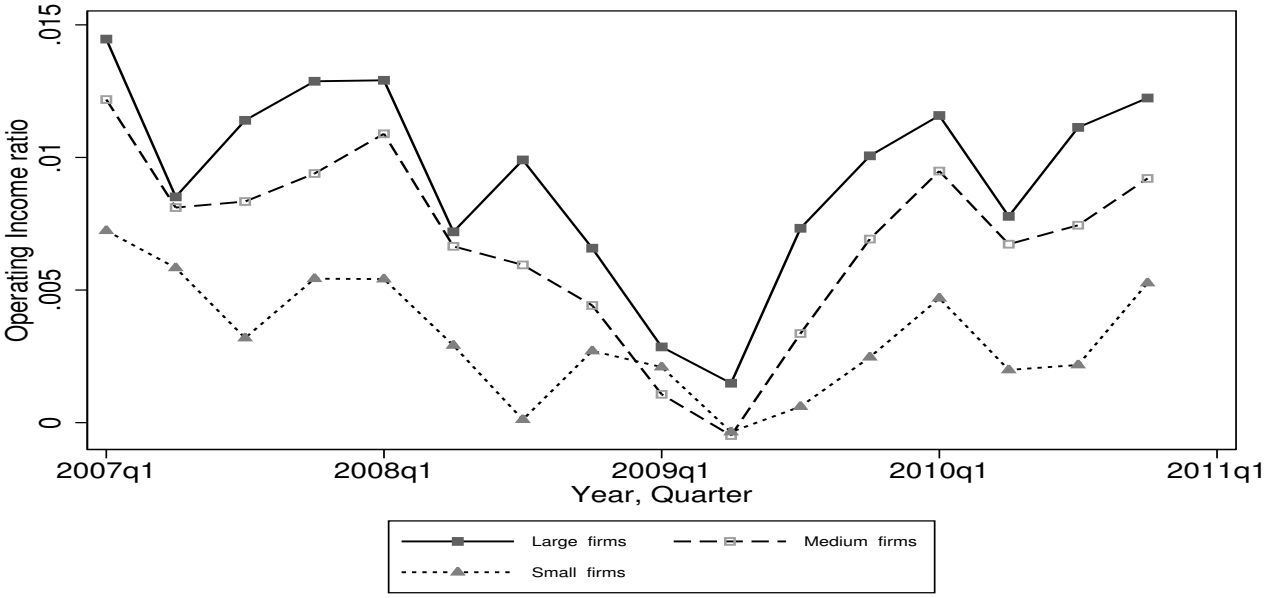
Note: This figure depicts the 25th, 50th (median), and 75th percentiles of the quarterly growth rate of trade receivables, normalized by total assets in t,q–1 by year-quarter.

Figure 5: 25th, 50th (Median), and 75th Percentiles of Quarterly Growth of Trade Payables from 2007q1 to 2010q4



Note: This figure depicts the 25th, 50th (median), and 75th percentiles of the quarterly growth rate of trade payables, normalized by total assets in t,q–1 by year-quarter.

Figure 6: Median Operating Income Ratio from 2007q1 to 2010q4, by Firm Size



Note: This figure depicts the median ratio of firm operating income to total assets, by firm size and year-quarter.

Table 1: Summary Statistics

Panel A: Sample years = 2003–2010

Variable	N	Mean	SD	Min	p1	p50	p99	Max
WCR	568,492	0.5949	0.8963	–0.9831	–0.4873	0.3584	4.5000	8.6667
WCR (previous quarter)	471,441	0.5960	0.8803	–0.9371	–0.4500	0.3636	4.3618	9.0000
Firm growth	568,492	0.0017	0.1058	–0.9975	–0.3217	0.0000	0.3389	0.5274
GPM	568,492	0.3273	0.2950	–0.4902	–0.1396	0.2306	1.0000	2.0000
OCF	568,492	0.0159	0.0384	–0.2160	–0.1136	0.0139	0.1346	0.1923
Firm size	568,492	8.0279	2.2398	0.0000	2.9957	8.1438	13.3200	16.4492
Distress dummy	568,492	0.1930	0.3946	0.0000	0.0000	0.0000	1.0000	1.0000
GDP	568,492	0.2142	1.2371	–4.1000	–4.1000	0.3000	1.8000	1.8000
ΔWCR	472,093	–0.0017	0.5863	–8.3735	–1.8629	0.0000	1.8148	9.0000
Operating income	567,577	0.0078	0.0364	–0.2292	–0.1222	0.0072	0.1181	0.1748
Ordinary income	567,226	0.0082	0.0367	–0.2314	–0.1213	0.0072	0.1208	0.1815
Fixed assets	568,491	0.4684	0.2672	0.0000	0.0011	0.4565	0.9821	1.0000
Leverage	568,492	0.6377	0.3326	0.0000	0.0150	0.6517	1.7549	2.7778

Panel B: Sample years = 2007–2010

Variable	N	Mean	SD	Min	p1	p50	p99	Max
WCR	278,634	0.6075	0.9120	–0.9831	–0.4742	0.3654	4.5983	8.6667
WCR (previous quarter)	232,147	0.6054	0.8915	–0.9368	–0.4419	0.3694	4.4055	9.0000
Firm growth	278,634	–0.0011	0.1026	–0.9742	–0.3144	0.0000	0.3266	0.5274
GPM	278,634	0.3264	0.2984	–0.4900	–0.1563	0.2292	1.0000	1.0000
OCF	278,634	0.0152	0.0387	–0.2160	–0.1147	0.0133	0.1341	0.1922
Firm size	278,634	8.0177	2.2592	0.0000	2.9957	8.1122	13.3984	16.3855
Distress dummy	278,634	0.1923	0.3941	0.0000	0.0000	0.0000	1.0000	1.0000
GDP	278,634	–0.0166	1.6457	–4.1000	–4.1000	0.6000	1.8000	1.8000
ΔWCR	231,889	0.0004	0.5683	–8.3333	–1.7765	0.0000	1.7727	9.0000
Operating income	278,166	0.0068	0.0366	–0.2292	–0.1232	0.0065	0.1172	0.1747
Ordinary income	277,997	0.0074	0.0369	–0.2313	–0.1220	0.0066	0.1198	0.1815
Fixed assets	278,634	0.4650	0.2671	0.0000	0.0000	0.4526	0.9802	1.0000
Leverage	278,634	0.6211	0.3355	0.0000	0.0129	0.6306	1.7553	2.7778
Bank borrowings	277,046	0.2142	0.2490	0.0000	0.0000	0.1175	0.9153	1.1667
Cash holdings	278,634	0.1500	0.1657	0.0000	0.0000	0.0952	0.7586	1.0000

Note: This table provides summary statistics of the variables used in the econometric analysis.

Table 2: Regression Results for the Determinants of Working Capital Requirements

	(1)	(2)	(3)	(4)	(5)
Dependent variable			WCR		
Firm growth	0.2459***	0.2592***	0.2502***	0.3306***	
	(0.012)	(0.016)	(0.012)	(0.015)	
GPM	0.0830***	0.1051***	0.0837***	0.2268***	0.0688***
	(0.006)	(0.008)	(0.006)	(0.017)	(0.006)
OCF	–2.6579***	–2.5922***	–2.6430***	–2.7219***	–2.1326***
	(0.032)	(0.045)	(0.032)	(0.055)	(0.035)
Firm size	0.0215***	0.0248***	0.0216***	0.1247***	0.0207***
	(0.001)	(0.001)	(0.001)	(0.011)	(0.001)
Distress dummy	–0.0064*	–0.0184***	–0.0061*	–0.0176***	–0.0072**
	(0.003)	(0.004)	(0.003)	(0.007)	(0.004)
GDP	–0.0035***	–0.0020		–0.0058***	–0.0017*
	(0.001)	(0.003)		(0.001)	(0.001)
Sales growth					–0.1577***
					(0.004)
Year=2003			0.0252***		
			(0.004)		
Year=2004			0.0069		
			(0.004)		
Year=2005			0.0039		
			(0.004)		
Year=2007			0.0123***		
			(0.004)		
Year=2008			0.0112**		
			(0.004)		
Year=2009			0.0655***		
			(0.005)		
Year=2010			0.0192***		
			(0.004)		
Quarter fixed effects	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	No	No	No	Yes	No
Observations	568,492	289,858	568,492	568,492	476,613
R^2	0.108	0.108	0.108	0.033	0.124

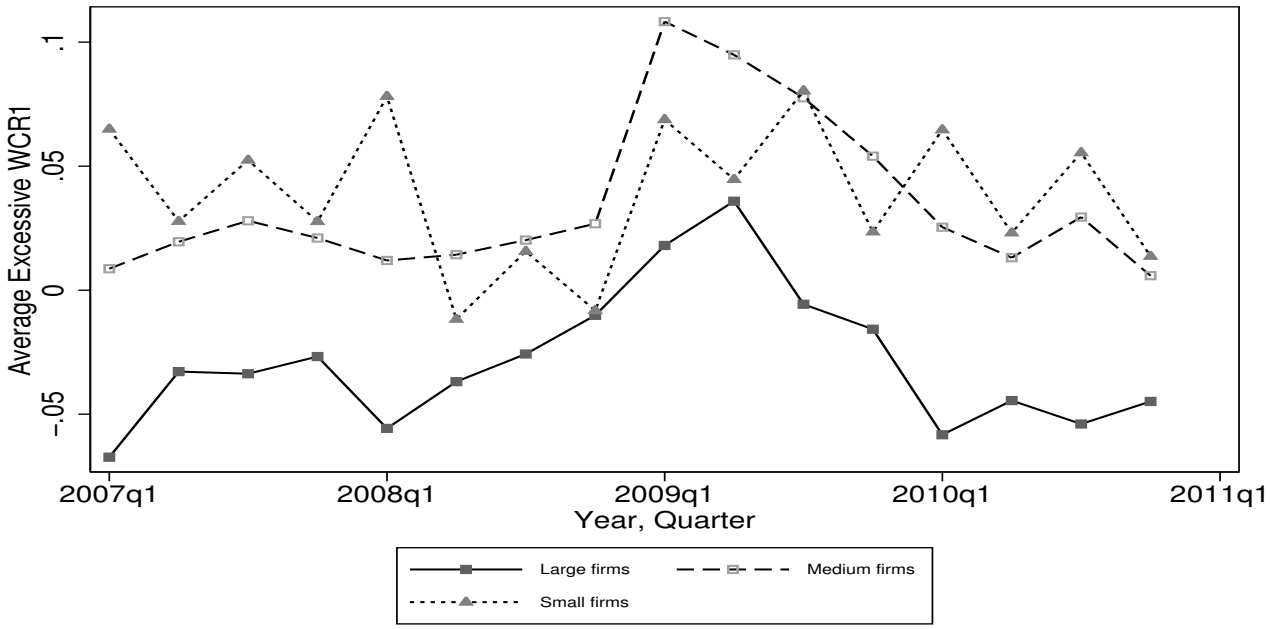
Note: This table presents estimates of least-squares and fixed-effects regressions with WCR as the dependent variable (equation 1). WCR is the sum of trade receivables and inventories, minus trade payables, normalized by total sales. Firm growth is the natural logarithm of a firm's total assets in year-quarter t,q minus that in year-quarter t,q–1. GPM is the ratio of a firm's cost of goods sold to total sales in quarter q of year t. OCF is the ratio of a firm's operating income plus depreciation and amortization to its total assets in quarter q of year t. Firm size is the natural logarithm of a firm's total assets in quarter q of year t–1. The distress dummy takes a value of one if a firm's leverage (= the ratio of the book value of a firm's debt to the book value of its assets) is in the top two deciles for its industry in quarter q of year t–1. Sales growth is the natural logarithm of a firm's total sales in year-quarter t,q minus those in year-quarter t,q–1. In column (2), we include seven dummies for each year between 2003 and 2010, where 2006 (the pre-crisis year) is the benchmark year. In addition, we include quarter and industry dummies in both columns. * denotes significance at the 10 percent level, ** at the 5 percent level, and *** at the 1 percent level.

Table 3: Summary Statistics for Excess WCR1 and WCR2

Variable	N	mean	sd	min	p1	p50	p99	max
Excess WCR1	278,166	0.0126	0.8650	–2.2873	–1.2055	–0.1448	3.8689	8.3858
Excess WCR2	278,166	0.0081	0.8608	–2.3086	–1.2163	–0.1474	3.8581	8.3524

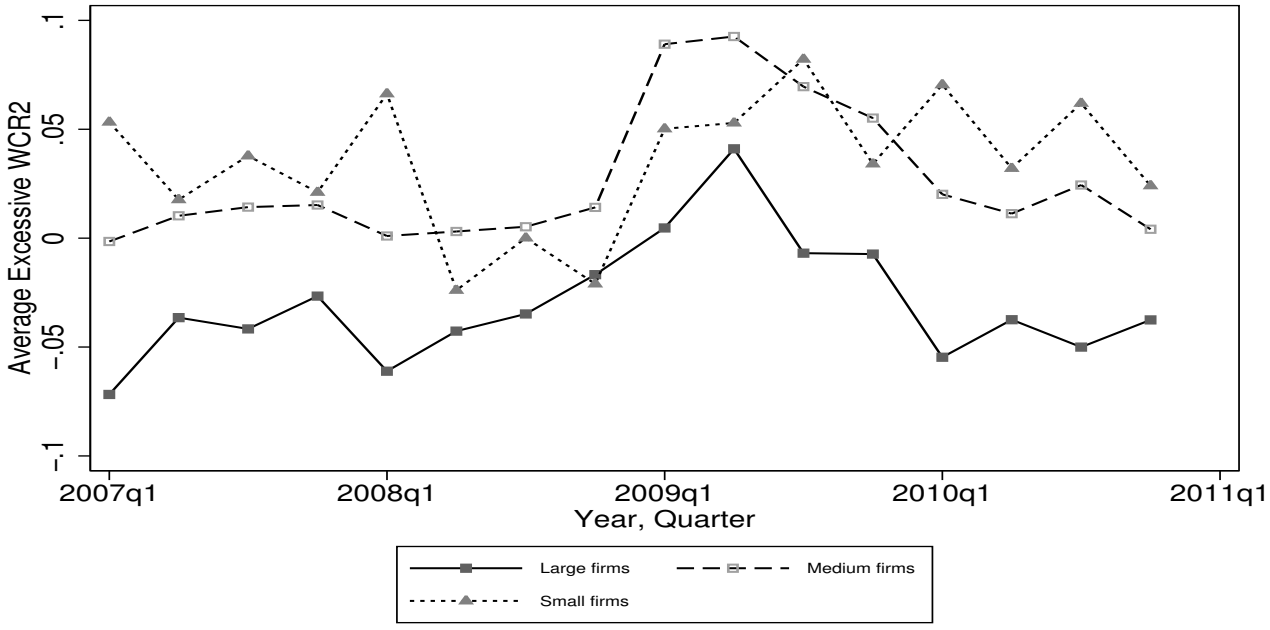
Note: This table provides summary statistics of excess WCR1 and WCR2 estimated using the results in Table 2.

Figure 7: Average Excess WCR1 from 2007q1 to 2010q4, by Firm Size



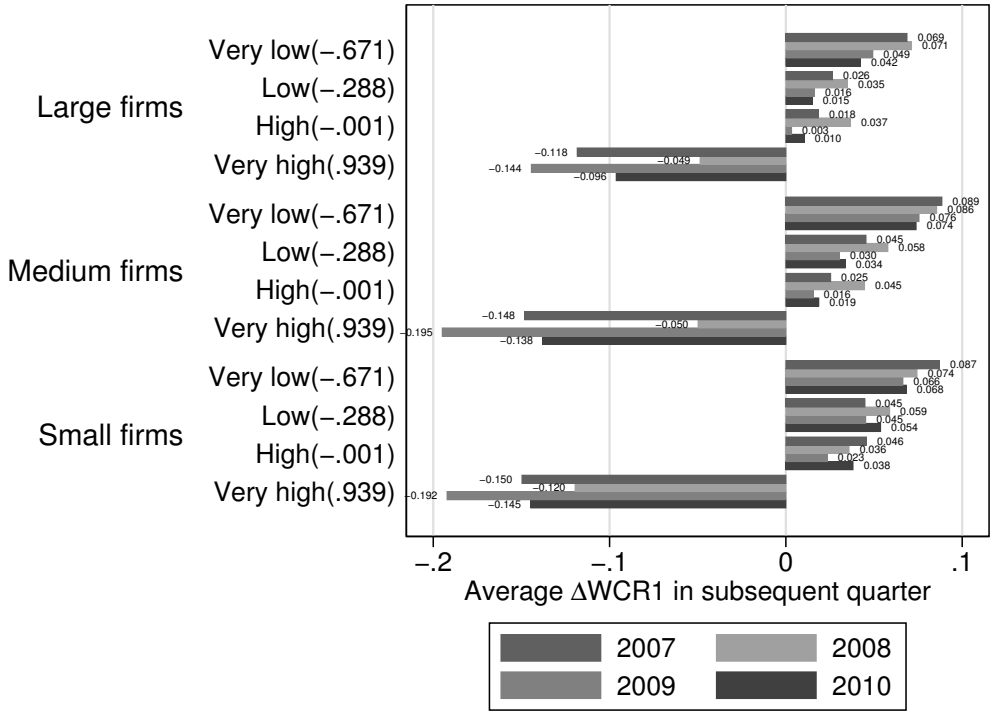
Note: This figure depicts the average excess WCR calculated using the estimation results in column (2) of Table 2, by firm size.

Figure 8: Average Excess WCR2 from 2007q1 to 2010q4, by Firm Size



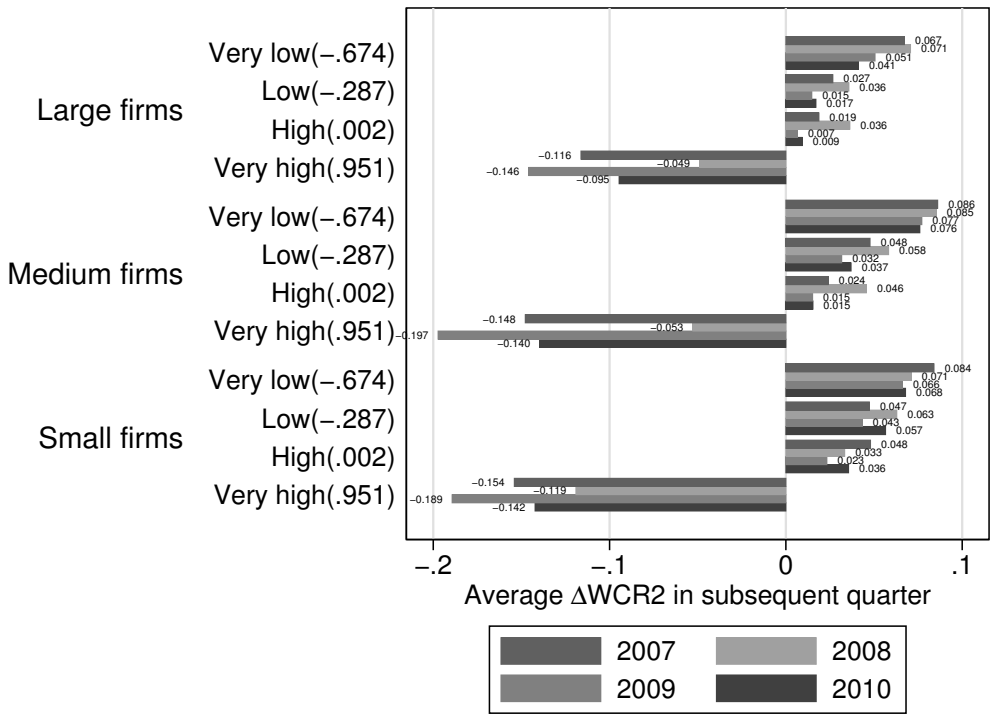
Note: This figure depicts the average excess WCR calculated using the estimation results in column (1) of Table 2 by firm size.

Figure 9: Average Excess WCR1 and ΔWCR1, by Firm Size



Note: This figure depicts the average change in WCR in the subsequent quarter, by the level of WCR1, firm size, and year.

Figure 10: Average Excess WCR2 and ΔWCR2, by Firm Size



Note: This figure depicts the average change in WCR in the subsequent quarter, by the level of WCR2, firm size, and year.

Table 4: Regression Results for the Partial Adjustment Model

	(1)	(2)	(3)	(4)
Dependent variable	WCR			
Firm size	All	Large	Medium	Small
WCR in t,q–1	0.4086***	0.4999***	0.4535***	0.5634***
	(0.013)	(0.025)	(0.018)	(0.025)
WCR in t,q–1	–0.0051	0.0166	0.0045	–0.0360
×2008 Dummy	(0.010)	(0.016)	(0.017)	(0.024)
WCR in t,q–1	0.0254**	0.0281*	0.0394**	–0.0404
×2009 Dummy	(0.010)	(0.016)	(0.016)	(0.025)
WCR in t,q–1	–0.0041	–0.0046	0.0077	–0.0315
×2010 Dummy	(0.011)	(0.018)	(0.017)	(0.026)
WCR in t,q–1	0.0908***	0.2753***	0.0931***	–0.0604*
×2Q Dummy	(0.016)	(0.030)	(0.025)	(0.032)
WCR in t,q–1	0.0436***	0.0804***	0.0344**	0.0042
×3Q Dummy	(0.010)	(0.019)	(0.015)	(0.021)
WCR in t,q–1	0.0611***	0.2238***	0.0737***	–0.0679***
×4Q Dummy	(0.012)	(0.026)	(0.018)	(0.022)
Firm growth	0.2404***	0.0969***	0.3689***	0.2453***
	(0.020)	(0.035)	(0.034)	(0.040)
GPM	0.1319***	0.1267***	0.1462***	0.1343***
	(0.011)	(0.017)	(0.015)	(0.019)
OCF	–2.3746***	–2.7586***	–2.5449***	–1.8198***
	(0.062)	(0.159)	(0.091)	(0.094)
Firm size	0.0113***	0.0091***	0.0364***	0.0132***
	(0.001)	(0.002)	(0.003)	(0.003)
Distress dummy	–0.0209***	–0.0609***	–0.0270***	0.0143
	(0.005)	(0.007)	(0.007)	(0.010)
Year fixed effects	Yes	Yes	Yes	Yes
Quarter fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Observations	232,147	83,319	89,762	53,826
R^2	0.603	0.695	0.597	0.594

Note: This table presents estimates of random-effects regressions (equation 4) with WCR as the dependent variable. WCR is the sum of trade receivables and inventories, minus trade payables, normalized by total sales. The definitions of the other independent variables are in the notes accompanying Table 2. We include seven dummies for each year between 2008 and 2010 (2007 is the benchmark year). In addition, we include quarter and industry dummies. * denotes significance at the 10 percent level, ** at the 5 percent level, and *** at the 1 percent level.

Table 5: Regression Results for the Partial Adjustment Model using Year-Quarter Dummies

	(1)	(2)	(3)	(4)
Dependent variable	WCR			
Firm size	All	Large	Medium	Small
WCR in t,q–1	0.4143***	0.4911***	0.4573***	0.6069***
	(0.015)	(0.027)	(0.022)	(0.034)
WCR in t,q–1	–0.0431***	0.0047	–0.0289	–0.1030**
×2008q1 Dummy	(0.016)	(0.024)	(0.024)	(0.042)
WCR in t,q–1	0.0072	0.0353	–0.0140	–0.0145
×2008q2 Dummy	(0.021)	(0.028)	(0.036)	(0.093)
WCR in t,q–1	0.0075	0.0135	0.0302	–0.0088
×2008q3 Dummy	(0.015)	(0.024)	(0.025)	(0.036)
WCR in t,q–1	0.0329*	0.0273	0.0331	0.0077
×2008q4 Dummy	(0.018)	(0.028)	(0.029)	(0.041)
WCR in t,q–1	0.0713***	0.1265***	0.1211***	–0.0752*
×2009q1 Dummy	(0.017)	(0.027)	(0.027)	(0.044)
WCR in t,q–1	0.0663***	0.0304	0.0381	0.0052
×2009q2 Dummy	(0.022)	(0.029)	(0.034)	(0.103)
WCR in t,q–1	–0.0009	–0.0024	0.0045	–0.0254
×2009q3 Dummy	(0.014)	(0.022)	(0.023)	(0.035)
WCR in t,q–1	0.0050	–0.0414	0.0180	–0.0172
×2009q4 Dummy	(0.017)	(0.027)	(0.027)	(0.040)
WCR in t,q–1	–0.0287*	0.0047	–0.0157	–0.0964**
×2010q1 Dummy	(0.017)	(0.027)	(0.026)	(0.043)
WCR in t,q–1	–0.0165	0.0063	–0.0538*	0.0612
×2010q2 Dummy	(0.021)	(0.032)	(0.032)	(0.075)
WCR in t,q–1	0.0108	0.0044	0.0305	–0.0073
×2010q3 Dummy	(0.016)	(0.027)	(0.025)	(0.034)
WCR in t,q–1	0.0121	–0.0332	0.0423	–0.0085
×2010q4 Dummy	(0.018)	(0.030)	(0.027)	(0.040)
Year fixed effects	Yes	Yes	Yes	Yes
Quarter fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Observations	232,147	83,319	89,762	53,826
R^2	0.604	0.698	0.601	0.593

Note: This table presents estimates of random-effects regressions (equation 4) with WCR as the dependent variable. The definitions of the dependent and independent variables are in the notes accompanying Table 2. Estimation results for the control variables are omitted. We include seven dummies for the years between 2008 and 2010 (2007 is the benchmark year). In addition, we include quarter and industry dummies. * denotes significance at the 10 percent level, ** at the 5 percent level, and *** at the 1 percent level.

Table 6: Regression Results for the Partial Adjustment Model

	(1)	(2)	(3)
Dependent variable		WCR	
Proxy of dependence	Short-term bank borrowings	Total bank borrowings	Corporate bonds
WCR in t,q–1	0.4003***	0.3988***	0.3988***
	(0.014)	(0.015)	(0.013)
WCR in t,q–1	–0.0140	–0.0141	–0.0035
×2008 Dummy	(0.012)	(0.012)	(0.010)
WCR in t,q–1	0.0210*	0.0202*	0.0291***
×2009 Dummy	(0.012)	(0.012)	(0.010)
WCR in t,q–1	–0.0064	–0.0081	–0.0041
×2010 Dummy	(0.013)	(0.013)	(0.012)
WCR in t,q–1	0.0571	0.0614*	0.2408***
×Dependence	(0.038)	(0.037)	(0.039)
WCR in t,q–1	0.0538	0.0494	–0.0633
×2008 Dummy×Dependence	(0.046)	(0.045)	(0.045)
WCR in t,q–1	0.0272	0.0285	–0.0977**
×2009 Dummy×Dependence	(0.045)	(0.043)	(0.049)
WCR in t,q–1	0.0160	0.0254	–0.0465
×2010 Dummy×Dependence	(0.051)	(0.049)	(0.051)
WCR in t,q–1	0.0903***	0.0899***	0.0903***
×2Q Dummy	(0.016)	(0.016)	(0.016)
WCR in t,q–1	0.0437***	0.0436***	0.0428***
×3Q Dummy	(0.010)	(0.010)	(0.010)
WCR in t,q–1	0.0610***	0.0610***	0.0597***
×4Q Dummy	(0.012)	(0.012)	(0.012)
Firm growth	0.2403***	0.2402***	0.2406***
	(0.020)	(0.020)	(0.020)
GPM	0.1338***	0.1339***	0.1307***
	(0.011)	(0.011)	(0.011)
OCF	–2.3758***	–2.3749***	–2.3664***
	(0.062)	(0.062)	(0.062)
Firm size	0.0109***	0.0107***	0.0129***
	(0.001)	(0.001)	(0.001)
Distress dummy	–0.0247***	–0.0252***	–0.0286***
	(0.005)	(0.005)	(0.005)
Year fixed effects	Yes	Yes	Yes
Quarter fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
Observations	232,147	232,147	232,147
R^2	0.603	0.603	0.602

Note: This table presents estimates of random-effects regressions (equation 4) with WCR as the dependent variable. WCR is the sum of trade receivables and inventories, minus trade payables, normalized by total sales. The short-term bank borrowing ratio is the ratio of a firm's short-term bank borrowings to its total assets in quarter q–1. The total bank borrowing ratio is the ratio of a firm's short-term bank borrowings plus long-term bank borrowings to its total assets in quarter q–1. The corporate bond ratio is the ratio of a firm's corporate bonds to its total assets in quarter q–1. The definitions of the other independent variables are in the notes accompanying Table 2. We include seven dummies for the years between 2008 and 2010 (2007 is the benchmark year). In addition, we include quarter and industry dummies. * denotes significance at the 10 percent level, ** at the 5 percent level, and *** at the 1 percent level.

Table 7: Regression Results for the Effects of Excessive Working Capital (WCR1) on Ordinary Income

	(1)	(2)	(3)	(4)
Dependent variable	Ordinary income			
Proxy for WCR	Excess WCR1			
Firm size	All	Large	Medium	Small
Excess WCR	–0.0007**	–0.0032***	–0.0019***	0.0019***
	(0.000)	(0.001)	(0.000)	(0.001)
Excess WCR	0.0001	–0.0004	–0.0001	0.0005
×2008 Dummy	(0.000)	(0.000)	(0.000)	(0.001)
Excess WCR	–0.0007**	–0.0013***	–0.0005	–0.0005
×2009 Dummy	(0.000)	(0.000)	(0.000)	(0.001)
Excess WCR	–0.0001	–0.0009**	0.0003	–0.0000
×2010 Dummy	(0.000)	(0.000)	(0.000)	(0.001)
Firm size	0.0109***	0.0106***	0.0138***	0.0166***
	(0.001)	(0.001)	(0.001)	(0.003)
Firm growth	0.0872***	0.0753***	0.0885***	0.1020***
	(0.001)	(0.002)	(0.002)	(0.003)
Fixed assets	–0.0264***	–0.0331***	–0.0295***	–0.0169***
	(0.002)	(0.003)	(0.003)	(0.004)
Leverage	0.0497***	0.0376***	0.0639***	0.0558***
	(0.002)	(0.004)	(0.004)	(0.004)
Year fixed effects	Yes	Yes	Yes	Yes
Quarter fixed effects	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Observations	277,997	91,360	108,577	71,018
R^2	0.087	0.104	0.094	0.086

Note: This table presents estimates of fixed-effects regressions (equation 5) specifying the firm ordinary income to total assets ratio as the dependent variable. WCR1 is the actual WCR minus the predicted WCR using the coefficients estimated in column (2) of Table 2. The fixed assets ratio is the ratio of a firm's fixed assets to its total assets. Leverage is the ratio of a firm's total liabilities to its total assets in year t. The definitions of the independent variables are in the notes accompanying Table 2. We include three dummies for year and three dummies for quarter. * denotes significance at the 10 percent level, ** at the 5 percent level, and *** at the 1 percent level.

Table 8: Regression Results for the Effects of Excessive Working Capital (WCR2) on Ordinary Income

	(1)	(2)	(3)	(4)
Dependent variable	Ordinary income			
Proxy for WCR	Excess WCR2			
Firm size	All	Large	Medium	Small
Excess WCR	–0.0003	–0.0029***	–0.0016***	0.0024***
	(0.000)	(0.001)	(0.000)	(0.001)
Excess WCR	0.0001	–0.0003	–0.0000	0.0005
×2008 Dummy	(0.000)	(0.000)	(0.000)	(0.001)
Excess WCR	–0.0006**	–0.0012***	–0.0004	–0.0005
×2009 Dummy	(0.000)	(0.000)	(0.000)	(0.001)
Excess WCR	–0.0000	–0.0008**	0.0003	–0.0001
×2010 Dummy	(0.000)	(0.000)	(0.000)	(0.001)
Year fixed effects	Yes	Yes	Yes	Yes
Quarter fixed effects	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Observations	277,997	91,360	108,577	71,018
R^2	0.087	0.103	0.094	0.087

Note: This table presents estimates of fixed-effects regressions (equation 5) specifying the firm ordinary income to total assets ratio as the dependent variable. WCR2 is the actual WCR minus the predicted WCR using the coefficients estimated in column (1) of Table 2. The definitions of the independent variables are in the notes accompanying Tables 2 and 7. We include three dummies for year and three dummies for quarter. * denotes significance at the 10 percent level, ** at the 5 percent level, and *** at the 1 percent level.

Table 9: Regression Results for the Effects of Excessive Working Capital (WCR1) on Ordinary Income

	(1)	(2)	(3)	(4)
Dependent variable		Ordinary income		
Proxy for WCR		Excess WCR1		
Firm size	All	Large	Medium	Small
Excess WCR	–0.0003	–0.0035***	–0.0007	0.0007
	(0.000)	(0.001)	(0.001)	(0.001)
Excess WCR	–0.0006	0.0004	–0.0016**	0.0006
×2007q2 Dummy	(0.001)	(0.001)	(0.001)	(0.002)
Excess WCR	0.0000	0.0002	–0.0009	0.0016
×2007q3 Dummy	(0.001)	(0.001)	(0.001)	(0.002)
Excess WCR	–0.0001	0.0005	–0.0013*	0.0021
×2007q4 Dummy	(0.001)	(0.001)	(0.001)	(0.002)
Excess WCR	0.0003	0.0004	–0.0009	0.0019
×2008q1 Dummy	(0.001)	(0.001)	(0.001)	(0.002)
Excess WCR	–0.0004	–0.0003	–0.0015**	0.0021
×2008q2 Dummy	(0.001)	(0.001)	(0.001)	(0.002)
Excess WCR	–0.0004	–0.0010	–0.0010	0.0019
×2008q3 Dummy	(0.001)	(0.001)	(0.001)	(0.002)
Excess WCR	–0.0004	0.0005	–0.0012	0.0014
×2008q4 Dummy	(0.001)	(0.001)	(0.001)	(0.002)
Excess WCR	–0.0010*	–0.0017**	–0.0017**	0.0011
×2009q1 Dummy	(0.001)	(0.001)	(0.001)	(0.002)
Excess WCR	–0.0015***	–0.0006	–0.0023***	–0.0004
×2009q2 Dummy	(0.001)	(0.001)	(0.001)	(0.002)
Excess WCR	–0.0009*	–0.0018**	–0.0013	0.0007
×2009q3 Dummy	(0.001)	(0.001)	(0.001)	(0.002)
Excess WCR	–0.0003	–0.0002	–0.0009	0.0015
×2009q4 Dummy	(0.001)	(0.001)	(0.001)	(0.002)
Excess WCR	0.0001	–0.0010	–0.0004	0.0017
×2010q1 Dummy	(0.001)	(0.001)	(0.001)	(0.002)
Excess WCR	–0.0010*	–0.0007	–0.0014*	0.0003
×2010q2 Dummy	(0.001)	(0.001)	(0.001)	(0.002)
Excess WCR	–0.0003	–0.0003	–0.0005	0.0009
×2010q3 Dummy	(0.001)	(0.001)	(0.001)	(0.002)
Excess WCR	–0.0001	–0.0004	–0.0007	0.0017
×2010q4 Dummy	(0.001)	(0.001)	(0.001)	(0.002)
Firm size	0.0109***	0.0107***	0.0138***	0.0167***
	(0.001)	(0.001)	(0.001)	(0.003)
Firm growth	0.0872***	0.0754***	0.0885***	0.1021***
	(0.001)	(0.002)	(0.002)	(0.003)
Fixed assets	–0.0264***	–0.0331***	–0.0295***	–0.0169***
	(0.002)	(0.003)	(0.003)	(0.004)
Leverage	0.0497***	0.0376***	0.0638***	0.0557***
	(0.002)	(0.004)	(0.004)	(0.004)
Year fixed effects	Yes	Yes	Yes	Yes
Quarter fixed effects	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Observations	277,997	91,360	108,577	71,018
R^2	0.087	0.104	0.095	0.087

Note: This table presents estimates of fixed-effects regressions (equation 5) specifying the firm ordinary income to total assets ratio as the dependent variable. WCR1 is the actual WCR minus the predicted WCR using the coefficients estimated in column (2) of Table 2. The definitions of the independent variables are in the notes accompanying Table 2. We include three dummies for year and three dummies for quarter. * denotes significance at the 10 percent level, ** at the 5 percent level, and *** at the 1 percent level.

Table 10: Regression Results for the Effects of Excessive Working Capital (WCR1) on Operating Income

	(1)	(2)	(3)	(4)
Dependent variable	Operating income			
Proxy for WCR	Excess WCR1			
Firm size	All	Large	Medium	Small
Excess WCR	–0.0007**	–0.0030***	–0.0018***	0.0016**
	(0.000)	(0.001)	(0.000)	(0.001)
Excess WCR	0.0002	–0.0004	–0.0000	0.0009
×2008 Dummy	(0.000)	(0.000)	(0.000)	(0.001)
Excess WCR	–0.0005**	–0.0013***	–0.0003	–0.0003
×2009 Dummy	(0.000)	(0.000)	(0.000)	(0.001)
Excess WCR	0.0002	–0.0006*	0.0004	0.0002
×2010 Dummy	(0.000)	(0.000)	(0.000)	(0.001)
Firm size	0.0112***	0.0109***	0.0147***	0.0160***
	(0.001)	(0.001)	(0.001)	(0.002)
Firm growth	0.0844***	0.0731***	0.0858***	0.0984***
	(0.001)	(0.002)	(0.002)	(0.003)
Fixed assets	–0.0265***	–0.0321***	–0.0294***	–0.0174***
	(0.002)	(0.003)	(0.003)	(0.004)
Leverage	0.0484***	0.0377***	0.0624***	0.0521***
	(0.002)	(0.004)	(0.004)	(0.004)
Year fixed effects	Yes	Yes	Yes	Yes
Quarter fixed effects	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Observations	278,166	91,379	108,611	71,106
R^2	0.086	0.108	0.093	0.083

Note: This table presents estimates of fixed-effects regressions (equation 5) specifying the firm operating income to total assets ratio as the dependent variable. The definitions of the dependent and independent variables are in the notes accompanying Tables 2 and 7. We include three dummies for year and three dummies for quarter. * denotes significance at the 10 percent level, ** at the 5 percent level, and *** at the 1 percent level.

Table 11: Regression Results for the Effects of Excessive Working Capital (WCR2) on Operating Income

	(1)	(2)	(3)	(4)
Dependent variable	Operating income			
Proxy for WCR	Excess WCR2			
Firm size	All	Large	Medium	Small
Excess WCR	–0.0003	–0.0026***	–0.0015***	0.0021***
	(0.000)	(0.001)	(0.000)	(0.001)
Excess WCR	0.0003	–0.0004	0.0000	0.0009
×2008 Dummy	(0.000)	(0.000)	(0.000)	(0.001)
Excess WCR	–0.0005*	–0.0013***	–0.0003	–0.0004
×2009 Dummy	(0.000)	(0.000)	(0.000)	(0.001)
Excess WCR	0.0002	–0.0006	0.0004	0.0002
×2010 Dummy	(0.000)	(0.000)	(0.000)	(0.001)
Year fixed effects	Yes	Yes	Yes	Yes
Quarter fixed effects	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Observations	278,166	91,379	108,611	71,106
R^2	0.086	0.107	0.093	0.084

Note: This table presents estimates of fixed-effects regressions (equation 5) specifying the firm operating income to total assets ratio as the dependent variable. The definitions of the dependent and independent variables are in the notes accompanying Tables 2 and 8. We include three dummies for year and three dummies for quarter. * denotes significance at the 10 percent level, ** at the 5 percent level, and *** at the 1 percent level.

Table 12: Regression Results for the Effects of Excessive Working Capital (WCR1) on Operating Income

	(1)	(2)	(3)	(4)
Dependent variable	Operating income			
Proxy for WCR	Excess WCR1			
Firm size	All	Large	Medium	Small
Excess WCR	–0.0001	–0.0030***	–0.0006	0.0013
	(0.000)	(0.001)	(0.001)	(0.001)
Excess WCR	–0.0011**	0.0000	–0.0019***	–0.0006
×2007q2 Dummy	(0.000)	(0.001)	(0.001)	(0.002)
Excess WCR	–0.0002	0.0001	–0.0008	0.0008
×2007q3 Dummy	(0.000)	(0.001)	(0.001)	(0.001)
Excess WCR	–0.0006	0.0002	–0.0012	0.0006
×2007q4 Dummy	(0.000)	(0.001)	(0.001)	(0.001)
Excess WCR	0.0001	0.0000	–0.0006	0.0009
×2008q1 Dummy	(0.001)	(0.001)	(0.001)	(0.002)
Excess WCR	–0.0008	–0.0008	–0.0017**	0.0015
×2008q2 Dummy	(0.001)	(0.001)	(0.001)	(0.002)
Excess WCR	–0.0005	–0.0012*	–0.0012	0.0018
×2008q3 Dummy	(0.000)	(0.001)	(0.001)	(0.002)
Excess WCR	–0.0004	0.0005	–0.0012	0.0012
×2008q4 Dummy	(0.001)	(0.001)	(0.001)	(0.002)
Excess WCR	–0.0011**	–0.0019**	–0.0015**	0.0006
×2009q1 Dummy	(0.001)	(0.001)	(0.001)	(0.002)
Excess WCR	–0.0017***	–0.0010	–0.0022***	–0.0012
×2009q2 Dummy	(0.000)	(0.001)	(0.001)	(0.002)
Excess WCR	–0.0010**	–0.0016**	–0.0012	–0.0001
×2009q3 Dummy	(0.001)	(0.001)	(0.001)	(0.002)
Excess WCR	–0.0006	–0.0007	–0.0009	0.0005
×2009q4 Dummy	(0.001)	(0.001)	(0.001)	(0.002)
Excess WCR	–0.0000	–0.0008	–0.0003	0.0009
×2010q1 Dummy	(0.001)	(0.001)	(0.001)	(0.002)
Excess WCR	–0.0011**	–0.0007	–0.0014*	–0.0004
×2010q2 Dummy	(0.000)	(0.001)	(0.001)	(0.002)
Excess WCR	–0.0004	–0.0003	–0.0004	0.0001
×2010q3 Dummy	(0.001)	(0.001)	(0.001)	(0.002)
Excess WCR	–0.0002	–0.0004	–0.0007	0.0012
×2010q4 Dummy	(0.001)	(0.001)	(0.001)	(0.002)
Firm size	0.0109***	0.0107***	0.0138***	0.0167***
	(0.001)	(0.001)	(0.001)	(0.003)
Firm growth	0.0872***	0.0754***	0.0885***	0.1021***
	(0.001)	(0.002)	(0.002)	(0.003)
Fixed assets	–0.0264***	–0.0331***	–0.0295***	–0.0169***
	(0.002)	(0.003)	(0.003)	(0.004)
Leverage	0.0497***	0.0376***	0.0638***	0.0557***
	(0.002)	(0.004)	(0.004)	(0.004)
Year fixed effects	Yes	Yes	Yes	Yes
Quarter fixed effects	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Observations	278,166	170,164	108,611	71,106
R^2	0.086	0.088	0.094	0.083

Note: This table presents estimates of fixed-effects regressions (equation 5) specifying the firm operating income to total assets ratio as the dependent variable. WCR1 is the actual WCR minus the predicted WCR using the coefficients estimated in column (2) of Table 2. The definitions of the other independent variables are in the notes accompanying Tables 2 and 9. We include three dummies for year and three dummies for quarter. * denotes significance at the 10 percent level, ** at the 5 percent level, and *** at the 1 percent level.

Table 13: Regression Results for the Effects of Excessive Working Capital (WCR1) on Bank Borrowings

	(1)	(2)	(3)	(4)
Dependent variable	Bank borrowings			
Proxy for WCR	Excess WCR1			
Firm size	All	Large	Medium	Small
Excess WCR	0.0072***	0.0123***	0.0073***	0.0040**
	(0.001)	(0.001)	(0.001)	(0.002)
Excess WCR	0.0006	0.0008	0.0009	0.0006
×2008 Dummy	(0.001)	(0.001)	(0.001)	(0.001)
Excess WCR	–0.0000	0.0002	0.0004	0.0004
×2009 Dummy	(0.001)	(0.002)	(0.002)	(0.002)
Excess WCR	–0.0000	–0.0010	–0.0001	0.0024
×2010 Dummy	(0.001)	(0.002)	(0.002)	(0.002)
Firm size	0.0125***	0.0311***	–0.0014	0.0097
	(0.004)	(0.006)	(0.006)	(0.007)
Firm growth	–0.0042	0.0195***	–0.0138***	–0.0131**
	(0.003)	(0.005)	(0.004)	(0.006)
Fixed assets	0.1087***	0.1135***	0.1166***	0.0733***
	(0.007)	(0.012)	(0.011)	(0.014)
Leverage	0.1743***	0.1692***	0.1809***	0.1652***
	(0.008)	(0.015)	(0.014)	(0.014)
Year=2008	–0.0007	0.0032***	–0.0025***	–0.0102***
	(0.001)	(0.001)	(0.001)	(0.001)
Year=2009	0.0069***	0.0145***	0.0053***	–0.0146***
	(0.001)	(0.001)	(0.001)	(0.002)
Year=2010	–0.0003	0.0060***	–0.0036**	–0.0194***
	(0.001)	(0.001)	(0.002)	(0.003)
Quarter fixed effects	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Observations	277,046	91,255	108,313	70,461
R^2	0.068	0.074	0.069	0.070

Note: This table presents estimates of fixed-effects regressions specifying the firm bank borrowings to total assets ratio as the dependent variable. The definitions of the independent variables are in the notes accompanying Table 7. We include three dummies for year and three dummies for quarter. * denotes significance at the 10 percent level, ** at the 5 percent level, and *** at the 1 percent level.

Table 14: Regression Results for the Effects of Excessive Working Capital (WCR1) on Cash Holdings

	(1)	(2)	(3)	(4)
Dependent variable	Cash holdings			
Proxy for WCR	Excess WCR1			
Firm size	All	Large	Medium	Small
Excess WCR	–0.0148***	–0.0157***	–0.0133***	–0.0166***
	(0.001)	(0.001)	(0.001)	(0.001)
Excess WCR	–0.0003	0.0024***	–0.0011	–0.0005
×2008 Dummy	(0.000)	(0.001)	(0.001)	(0.001)
Excess WCR	0.0030***	0.0070***	0.0026***	0.0010
×2009 Dummy	(0.001)	(0.001)	(0.001)	(0.001)
Excess WCR	0.0017**	0.0057***	0.0013	–0.0002
×2010 Dummy	(0.001)	(0.001)	(0.001)	(0.002)
Firm size	–0.0109***	–0.0042	–0.0079**	–0.0154**
	(0.003)	(0.004)	(0.004)	(0.007)
Firm growth	0.0200***	0.0267***	0.0186***	0.0203***
	(0.003)	(0.003)	(0.004)	(0.006)
Fixed assets	–0.2173***	–0.1811***	–0.1979***	–0.2534***
	(0.007)	(0.010)	(0.012)	(0.015)
Leverage	–0.0573***	–0.0456***	–0.0608***	–0.0634***
	(0.004)	(0.006)	(0.006)	(0.009)
Year=2008	–0.0030***	–0.0026***	–0.0037***	–0.0046***
	(0.000)	(0.000)	(0.001)	(0.001)
Year=2009	0.0082***	0.0100***	0.0078***	0.0004
	(0.001)	(0.001)	(0.001)	(0.002)
Year=2010	0.0105***	0.0128***	0.0103***	0.0012
	(0.001)	(0.001)	(0.001)	(0.003)
Quarter fixed effects	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Observations	278,634	91,411	108,759	71,379
R^2	0.081	0.078	0.072	0.089

Note: This table presents estimates of fixed-effects regressions specifying the firm cash holdings to total assets ratio as the dependent variable. The definitions of the independent variables are in the notes accompanying Table 7. We include three dummies for year and three dummies for quarter. * denotes significance at the 10 percent level, ** at the 5 percent level, and *** at the 1 percent level.