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On the dynamics of small and medium-sized enterprises: Evidence from Japan

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ADB Working Paper Series

**ON THE DYNAMICS OF SMALL
AND MEDIUM-SIZED ENTERPRISES:
EVIDENCE FROM JAPAN**

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Izidin El Kalak, and
Hidenori Takahashi

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Abstract

The main objective of this paper is to understand how the changes in the macroeconomic conditions (the global financial crisis) relate to the investment and financial decision-making for each of the different size categories of SMEs. To do so, we use a large dataset of 764,963 observations in Japan for the time period from 2006 to 2014. This large size of dataset enables us to understand the heterogeneity of SMEs on the financing and investment decision-making: such as the size, industry, and region. Our findings are of particular importance to regulators because they show that SMEs are dynamic in nature where they change their financial behavior in response to any macroeconomic shock. In addition, we report differences among the different size subsample at the sales growth and state/industry GDP growth levels; hence, this requires the design of a unique set of regulations for each group accordingly to properly enhance the growth potential for each group and for SMEs as a whole. Moreover, these findings have implications on lenders especially banks to treat each size group within SMEs differently while lending or assessing creditworthiness.

Keywords: SMEs, size categories, macro-economic shocks, investment, financing policy, Japan

JEL Classification: G28, G32, G38

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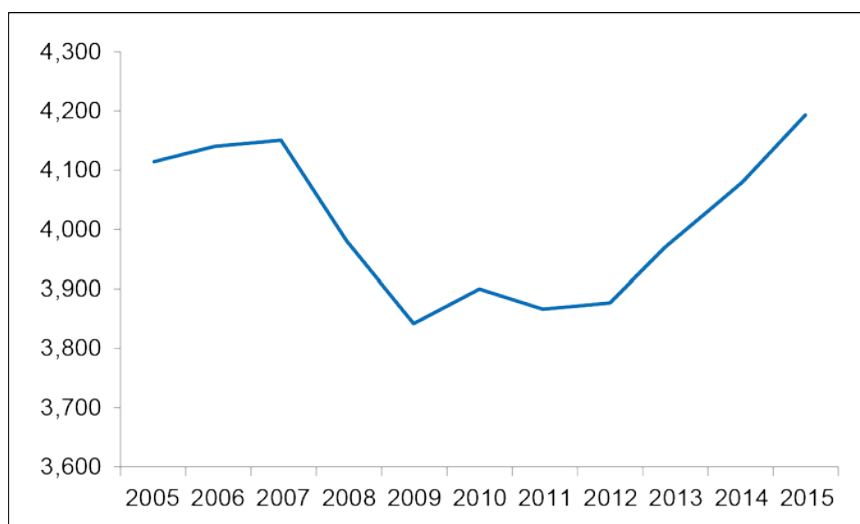
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1. INTRODUCTION

In the last ten years, a turmoil of financial events (e.g., the global financial crisis and the Great East Japan Earthquake) has hit the Japanese economy followed by regulatory correction acts¹ aiming to recover the national economy afterward (Ciro, 2016). These changes in the economy lead to huge fluctuations in the Japanese GDP per capita during the past decade, creating high uncertainty in the firms' financial decision making especially for small and medium-sized enterprises (SMEs).

Figure 1 plots the GDP per capita from 2005 to 2015 collected from the Japanese cabinet office, showing that GDP has sharply declined from 2007 to 2009 when the financial crisis propagates worldwide. In the following years, the productivity raised again with some turbulence due to the impact of the earthquake in 2011. Recently, from 2015 onward, the productivity has begun to boost again, while recording even higher levels than that of the pre-financial crisis. Some of these patterns were identified in previous literature such as Yamori et al. (2013) who stressed the severity of the financial crisis on the Japanese economy and how these affected the Japanese banks and firms alike.

Figure 1: GDP per Capita in Japan



This figure plots the GDP per capita across the sample period from 2006 to 2016. The data is extracted from the website of the Cabinet Office, Japan. The Y axis represents the monetary value of GDP per capita in thousands of yen.

Many of these studies focus on the immediate regulatory aspects that aim to reduce the severity of these crises or the direct effect of the crises on the economy and SMEs as passive receivers of the crises. Despite the importance of the previous literature, we believe in the need to understand the full dynamics of SMEs' financial decision-making through periods of macroeconomic changes and how SMEs try to adapt and survive the financial hit. Therefore, we propose a more dynamic empirical study to shed the light on the financial behavior of SMEs. More precisely, the main objective of this paper

¹ The Japanese government tried to overcome the global financial crisis and the great east Japan earthquake by adopting different corrective measures such as "Measures to Counter Difficulties in People's Daily Lives in 2008" and the "Special Measures for Strengthening Financial Functions in 2008 and its modified version 2011". For more details see Yamori et al. (2013) and Japanese Bankers Association (2015).

is to understand how such changes in the macroeconomic conditions relate to the investment and financial decision-making for each of the different size categories of SMEs, enabling us to understand the heterogeneity of SMEs on the financing and investment decision-making.

The overall contribution of this paper is to further improve our understanding of the dynamics of Japanese SMEs' financial decision makings. To do so, we provide two-fold specific contributions to the literature. Firstly, we study how the macroeconomic conditions in Japan relate to the investment and financial decision-making for Japanese SMEs. More precisely, we link the 2007–2009 global financial crisis with SMEs financial decision-making, focusing on cash holding, debt holding, and investment corporate decisions within these SMEs. Secondly, we contribute to the literature of SMEs by measuring the effect of macroeconomic conditions on the different SMEs' size categories. For this purpose, we divide our sample of SMEs into different size quantiles to capture any changes in the SME's financial decision-making for each size category.

Our findings are as follow. First, from our descriptive statistics, we find that, over time, SMEs in Japan increase their cash holding levels while they decrease their debt ratios. These changes are associated with an overall increase of investment levels and profitability. Second, we study the determinants of the debt, cash, and investment in a joint test by using the seemingly unrelated regression (SUR) estimates. We find that SMEs decrease their debt while they increase cash holdings. Further, we find a positive relationship between debt and investment.

While studying the impact of the global financial crisis on the financial decision making of SMEs, we find an observable decline of investment during the crisis period and the interaction term of investment with the crisis indicator show that SMEs with high cash amount and low debt amount decrease their investment during the crisis period. Additionally, we find that SMEs with high amount of debt at the pre-crisis period additionally borrow more money from financial institutions and do not use it for investment. SMEs without debt increase their investments during the crisis period. This may imply that zero debt firms have some financial flexibility and can afford to invest as they want during financial shocks in the economy.

Finally, we analyze the dynamic relationship among the key financial decision variables by dividing the sample into different categories according to SMEs' size based on the number of employees. Overall, we did not find any statistically significant differences among the different size groups for our key financial variables. However, differences among the subsample exist at the sales growth and state/industry GDP growth levels. We report that SMEs in low GDP growth increase debt ratio only in small size companies whereas a positive relation in larger firm size subgroups is reported. Cash is negatively related to regional growth in the smallest group indicating that SMEs in low growth opportunity increase cash. Overall, these results imply the heterogeneity in financing behavior due to different SME size.

These findings are of particular importance to regulators because they show that different growth, investment, and financing needs differ substantially among the different size categories; hence, this requires the design of a unique set of regulations for each group accordingly to properly enhance the growth potential for each group and for SMEs as a whole. Moreover, these findings have implications on lenders, especially banks, to treat each size group within SMEs differently while lending or assessing creditworthiness.

2. RELATED LITERATURE

The examination of economic shocks on the firms' financial behavior is an intensively studied topic, even before the recent global financial crisis in 2007. Bernanke (1983) studied the effect of the US great depression during 1930 to 1933 on the US economy, and more precisely its effect on the cost of credit intermediation and the bankruptcies of firms and banks. This vast literature can be further classified into two main strands. The first strand studies the effect of financial shocks on the firms' financial behaviors within the same country/region. For example, Bliss et al. (2015) attempt to find out to what extent US firms adjusted their payout policies in response to the 2001 recession and the 2007–2008 financial crisis, which represented shocks to the relative costs and benefits of internal and external financing sources. Kahle and Stulz (2013) provide different findings, which are inconsistent with the popular narrative of a negative shock to bank credit, where they test whether the financial and investment policies of US firms are in line with the conventional prediction that gives great importance to the bank lending supply shock as the main cause for changes in financial and investment policies during the financial crisis. Song and Lee (2012) investigate the long-term effect of the Asian financial crisis (1996–1998) on corporate cash holdings in eight East Asian countries. They find that firms increase their cash holding levels through decreasing their investments post crisis. This led them to conclude that the Asian financial crisis has systematically changed the firms' cash holding policies.

On the other hand, a second strand of literature has emerged investigating how economies were affected by financial shocks through transmission channels across national borders and country differences. Frankel and Saravelos (2010) investigate whether leading indicators can help explain the cross-country incidence of the 2008–09 financial crisis. They find that greater foreign reserves are important in alleviating the spill-over. Cetorelli and Goldberg (2011) find evidence that countries more integrated with global financial markets suffered greater output losses during the crisis. In addition, Claessens et al. (2010) and Blanchard et al. (2010) document similar findings. However, Rose and Spiegel (2011) fail to find strong evidence that country factors, including bilateral trade and financial linkages with the U.S, are associated with how the crisis impacted individual countries.

On a more micro-level analysis, Claessens et al. (2012) study the impact of the global financial crisis on firm-level performance and the role of global linkages in transmitting the crisis. They find that trade linkages played a significant role in the spill-over of crisis, while the evidence for the role of financial linkages is considerably weaker. Chava and Purnanandam (2011) examine the impact of the Russian financial crisis in 1998 on the US banking sector and their depended firms. They find that firms that primarily relied on banks for capital suffered larger valuation losses during this period and subsequently experienced a higher decline in their capital expenditure and profitability as compared to firms that had access to the public-debt market.

More in line with our study, many scholars have attempted to examine the effect of the aftermath of the financial crisis on the Japanese economy, such as Ogawa and Tanaka (2013) who examined the nature of the shocks hitting SMEs during the financial crisis (classified into demand, supply, and financial shocks) and report that the demand shock was the most prevalent shock that hit SMEs. They report that SMEs tackled the crisis through passing the shock long to their suppliers and seeking help from both private and public financial institutions. Ogura (2016) developed a theoretical model followed by empirical analysis from the Japanese market providing evidence that government-controlled banks significantly increased their lending to SMEs whose main bank is a large bank operating internationally or nationwide in the 2007–2009 financial

crisis. Yamori et al. (2013) also provide a detailed discussion on the various regulatory support programs for SMEs and bank lending mechanisms to SMEs during the financial crisis. While many SMEs were hit by the financial crisis, they had to apply for loans or reschedule their existing loans in order to preserve their cash holding levels and compensate for the loss of cash flow (Ogura, 2016). As the profitability of SMEs was badly affected, the increase of SMEs' bank lending lead to a parallel increase in non-performing loans; thus, the financial services agency agreed to expand SMEs loans and not classify rescheduled loans to SMEs as non-performing loans.

Our study further contributes to this literature by examining the effect of a financial shock, represented by the global financial crisis, on firms' financial behavior in other countries, represented by the Japanese SMEs. Our study is a micro-level study which aims to examine the dynamics of SMEs' financial decision-making through a period of external crisis.

3. EMPIRICAL ANALYSIS

3.1 Data

Our empirical analysis is performed using a panel data from the ORBIS database, where we have used the HDD version published in March 2016. We exclude firm-year observations for variables with missing values. Also, we remove any observation that generates wrong information in the data set, such as when the sum of liabilities and equity is not the same as total assets or when the asset values are negative. The final sample employs annual firm-level accounting data for 764,943 firm-year observations for the time period from 2006 to 2014.

The Small and Medium Enterprise Agency (SMEA)² in Japan has established widely used standards to define SMEs based on capital size and a number of employees. As per these standards, a firm is considered an SME if it meets the following conditions: (i) A capital size of ¥50m or less, ¥100m, ¥300m for services, wholesale, and manufacturing firms, respectively; (ii) A total number of employees of 100 or less, 100 or less, 300 or less for services, wholesale, and manufacturing firms, respectively. In our paper, we follow their definition to identify our sample of SMEs.

3.2 Definition of Variables

Below is the definition of the variables used in our analysis. The four capital letter acronyms in brackets are the variable code in ORBIS dataset.

The debt ratio is defined as the sum of short-term loan [LOAN] and total loans from financial institutions [LTDB] divided by total assets [TOAS]. The cash ratio is defined as the cash and cash equivalents [CASH] divided by total assets [TOAS]. ROA is EBIT [OPPL] divided by total assets [TOAS]. Investment is the one year change in the tangible assets [TNAS] plus depreciation [DEPR] divided by total assets [TOAS]. Sales Growth is the one-year growth rate of the sales from the previous year. All of them are winsorized at the top and bottom 1 percentile. Industry classification we use is based on the NACE 2 industry code.

² http://www.chusho.meti.go.jp/sme_english/outline/02/01.html

3.3 Methodology

Our purpose is to show how the relationship among the debt usage, investment and cash holdings changes due to macroeconomic changes affecting SMEs. Our baseline models are represented in the below three equations.

$$\text{Debt Ratio}_{it} = \alpha + \beta_1 \text{Investment}_{it} + \gamma_1 \text{Cash Ratio}_{it} + X_{it-1} \delta_1 + \text{year}_t + \epsilon_{1it} \quad [1]$$

$$\text{Investment}_{it} = \alpha + \beta_2 \text{Cash Ratio}_{it} + \gamma_2 \text{Debt Ratio}_{it} + X_{it-1} \delta_2 + \text{year}_t + \epsilon_{2it} \quad [2]$$

$$\text{Cash Ratio}_{it} = \alpha + \beta_3 \text{Investment}_{it} + \gamma_3 \text{Debt Ratio}_{it} + X_{it-1} \delta_3 + \text{year}_t + \epsilon_{3it} \quad [3]$$

Because the main three variables are jointly determined and then there may be a potential error correlation between the three estimations, we estimate the three equations simultaneously using the seemingly unrelated equation (SUR) model.³

As control variables, we use ROA, $\ln(\text{Assets})$, Sales Growth, and State/Industry GDP Growth. ROA is included in order to control the performance of the firm that would largely affect the debt, investment and cash policy. Further, sales growth represents the growth opportunity of the firm. Also, we include State/Industry GDP Growth in order to control for the macroeconomic condition that would influence the financial decision of SMEs, especially micro firms.

4. RESULTS

4.1 Summary Statistics

Table 1 explains the summary statistics of the main variables and changes of financial decision makings during the last ten years. Panel A of Table 1 reports the descriptive statistics of the main four variables namely cash ratio, debt ratio, investment, and ROA. The mean values of the four variables are 26.57%, 35.76%, 2.62%, and 3.61% for cash holding, debt ratio, investment, and ROA, respectively.

Panel B represents the mean values of the main variables each year over the sample period from 2006 to 2014. We find that, over time, SMEs in Japan increase their cash holding levels (from 22.51% in 2006 to 29.06 in 2014) while they decrease their debt ratios (from 36.17% in 2006 to 33.52% in 2014). These changes are associated with an overall increase of investment ratio (from 2.4% to 3.5%) and ROA (from 2.96% to 5.92%). However, the investment ratio of Japanese SMEs experienced fluctuations during the last 10 years, where it was 2.4% in 2007⁴ and dropped to 2.08% in 2010, and then recovered to 3.5% in 2014. We also notice some fluctuations in the profitability of Japanese SMEs, represented by ROA, where the mean value of ROA was 2.96% in 2006 and then dropped to 1.59% in 2009. After that, the ROA increased to 5.92% in 2014 which is higher than the pre-financial crisis level.

³ The OLS analysis is also conducted but the results are similar to those by SUR model.

⁴ Notice that because the investment is the difference in tangible asset, we cannot compute that of 2006 or the beginning of our sample period due to the lack of the prior year information.

Panel C of Table 1 reports the mean values for the variables before the crisis (a. 2006 and 2007), during the crisis (2008-2009), and post the crisis (2010)⁵. In addition, we conduct a t-test analysis between (a and b) and (a and c) to identify whether the differences in means are statistically significant. The increase of cash during the crisis period is observed, the average cash-to-assets ratio is 1.86 percentage points higher than the pre-crisis period. Debt ratio has also increased in the same period for 0.52 percentage points where the average debt ratio during the crisis period is 36.55% compared to the pre-crisis period mean value of 36.04%. In addition, we find a decline of 0.11% in the investment level during the crisis compared to that before the crisis. Finally, as expected, the profitability of SMEs also dropped during the crisis period to 2.14% from 3% before the crisis.

Table 1: Summary Statistics

Panel A	Cash Ratio	Debt Ratio	Investment	ROA
Mean	26.57	35.76	2.62	3.61
St. Dev	21.47	28.97	6.77	15.74
10 Pctile	3.9	0	-0.88	-8.72
25 Pctile	9.75	6.78	0	-0.89
Median	21	33.79	0.53	2.01
75 Pctile	38.37	59.23	2.97	6.61
90 Pctile	58	77.08	9.15	16.8
Panel B Time-series Trend of Mean				
2006	22.51	36.17		2.96
2007	23.42	35.93	2.4	3.03
2008	24.02	35.92	2.39	2.73
2009	25.68	37.15	2.18	1.59
2010	26.58	36.66	2.08	2.31
2011	27.35	36.64	2.23	3.03
2012	28.1	35.78	2.66	4.49
2013	28.56	34.74	3.05	5.04
2014	29.06	33.52	3.5	5.92
Panel C t-test around Crisis Period				
a. 2006 and 07	23.01	36.04	2.40	3.00
b. 2008 and 09	24.87	36.55	2.29	2.14
c. 2010	26.58	36.66	2.08	2.31
difference (b - a)	1.86	0.52	-0.11	-0.86
<i>p-value</i>	0.00	0.00	0.00	0.00
difference (c - a)	3.56	0.62	-0.31	-0.70
<i>p-value</i>	0.00	0.00	0.00	0.00

This table reports the summary statistics of the main financial measures. *Panel A* reports the descriptive statistics for the four main variables namely Cash ratio, debt ratio, investment, and ROA. *Panel B* represents the mean values of the main variables each year over the sample period. *Panel C* reports the mean values for the variables before the crisis (a. 2006 and 2007), during the crisis (2008-2009), and post the crisis (2010). In addition, the t-test significance difference values between (a and b) and (a and c) are reported with their p-values.

⁵ We do not use the information after 2011 in order to eliminate the impact of the earthquake and subsequent tsunami.

4.2 Time-Series Changes by SME Size

Table 2 reports how the firm size relates to the financial decision-making of Japanese SMEs. Panel A reports the cash ratio by firm size. Interestingly SMEs, on average, holds less cash as their size increases. The average cash ratio of the smallest size group is 25.5% while that of the largest group is 15%. Moreover, cash ratios increase over time for all sub-samples where the largest increase is observed in the smallest size group. There is an increase of 4.6 (25.5%-20.9%) percentage points in the smallest group, while it is an increase of 1.7 percentage points in the largest group.

Table 2: Time Series Trends

Panel A Changes in Cash Holding Ratio				
Cash Ratio	N. of Emp<= 5	5<N. of Emp<= 10	10<N. of Emp<= 50	N. of Emp>= 50
2006	20.9	18.6	17.4	13.3
2007	21.8	19.2	17.6	13.4
2008	23	19	17.3	13.1
2009	24.7	20.8	19	14.4
2010	25	21	19.4	15.3
2011	25.8	21.7	19.9	15.7
2012	26.7	22.6	20.8	16.3
2013	27.5	23.5	21.4	16.7
2014	28.5	25	22.2	16.6
Average	25.5	21.5	19.5	15
Panel B Changes in Debt Ratio				
Debt Ratio	N. of Emp<= 5	5<N. of Emp<= 10	10<N. of Emp<= 50	50<N. of Emp<= 100
2006	34.3	38.8	35.2	32.1
2007	33.1	38.4	34.7	31
2008	31.9	38.5	34.9	31.5
2009	32.2	41.1	37	33.1
2010	30.9	40.9	36.6	31.5
2011	31.6	40.7	36.2	30.3
2012	30.6	38.8	34.7	28.9
2013	28.9	36.6	33.2	28
2014	28	34	31	26.8
Average	30.8	38.5	34.7	30.3
Panel C Changes in Investment Level				
Investment	N. of Emp<= 5	5<N. of Emp<= 10	10<N. of Emp<= 50	50<N. of Emp<= 100
2006				
2007	0.158	0.337	0.474	1.1
2008	0.0202	0.256	0.453	1.16
2009	0.0019	0.217	0.403	1.03
2010	0.0043	0.197	0.378	0.798
2011	0.00114	0.246	0.416	0.949
2012	0.0543	0.414	0.58	1.14
2013	0.213	0.587	0.763	1.29
2014	0.436	0.834	0.932	1.44
Average	0.0892	0.38	0.545	1.11

continued on next page

Table 2 *continued*

Panel D Changes in Profitability				
ROA	N. of Emp<= 5	5<N. of Emp<= 10	10<N. of Emp<= 50	50<N. of Emp<= 100
2006	2.23	1.7	2.04	2.86
2007	2.2	1.59	1.97	2.94
2008	1.98	1.32	1.81	2.75
2009	1.51	0.728	1.25	2.07
2010	1.73	0.769	1.36	2.38
2011	2	0.995	1.51	2.64
2012	2.8	1.55	1.89	2.86
2013	3.23	1.88	2.08	2.81
2014	3.95	2.73	2.77	3.14
Average	2.43	1.45	1.84	2.72

This table reports the time series trends of the main variables each year over the sample period from 2006 to 2014 by firm size. Firm size is divided into four categories according to the number of employees. *Panel A* presents the mean values of cash holding across years for different size samples. *Panel B* presents the mean values of debt ratio across years for different size samples. *Panel C* presents the mean values of investment across years for different size samples. *Panel D* presents the mean values of profitability across years for different size samples.

Panel B of Table 2 reports the debt ratio for each firm size group. On average, micro firms (with less than five employees) holds an approximately equal percentage of debt (30%) to that of the medium firms (with more than 50 employees), whereas small firms (with more than five employees but less than 10 and more than 10 employees but less than 50) hold higher debt ratio of 38.5% and 34.7%, respectively.

4.3 Baseline Analysis

We conduct a multivariate analysis to examine the dynamic relationship among three main variables, namely: debt ratio, cash holding ratio, and investment. Because a reverse causality exists among these three variables, we use the seemingly unrelated regression (SUR estimation). Our control variables are ROA, total assets (natural logarithm), sales growth, state/industry level GDP growth, and year fixed-effects.

Our results are reported in Table 3, where column 1 uses the debt ratio as a dependent variable and shows a significantly positive association between debt ratio and investment, while cash ratio enjoys a significantly negative association with debt. Column 2 uses investment as the dependent variable, where it shows a negative relation with cash ratio and positive relation with debt. Column 3 uses the cash ratio as dependent variable and finds a negative relationship with investment and debt.

Both, higher ROA and sales growth rate link to lower debt, higher amount of investment and higher amount of cash. The macroeconomic condition or the GDP growth in the same state/industry also has negative relationship with debt ratio, and positive relationship with investment and cash ratio.

Table 3: Dynamics of SMEs by SUR Estimation

	Entire Sample		
	Debt Ratio	Investment	Cash Ratio
	[1]	[2]	[3]
Investment	0.273*** (0.00437)		-0.235*** (0.00297)
Cash Ratio	-0.943*** (0.00149)	-0.0356*** (0.000448)	
Debt Ratio		0.0191*** (0.000305)	-0.435*** (0.000688)
ROA	-0.00780*** (0.000516)	0.00128*** (0.000136)	0.00382*** (0.000351)
ln(Assets)	-2.557*** (0.0178)	-0.302*** (0.00472)	-3.033*** (0.0116)
Sales Growth	-0.0204*** (0.000851)	0.0174*** (0.000224)	0.00673*** (0.000579)
State/Industry GDP Growth	-0.912** (0.380)	0.595*** (0.100)	0.597** (0.258)
Year dummy	Yes	Yes	Yes
N. of Observations	746,115	746,115	746,115
R-Squared	0.068	0.021	0.147

This table examines the dynamic relationship among three main variables namely: debt ratio, cash holding ratio, and investment using the seemingly unrelated regression (SUR) estimation method discussed in section 3. Dependent variables are debt ratio, investment, and cash ratio, respectively. Control variables contain ROA, natural logarithm of total assets, sales growth, one-year GDP growth in the same state/industry. Year fixed-effect is also included. ***, **, and * represent 1%, 5%, and 10% significance level, respectively.

4.4 The Impact of a Global Financial Crisis

Table 4 presents the results of the dynamic relationship between debt ratio, investment, and cash ratio with the effect of the global financial crisis. Columns [1] to [3] report the results with the same model used in Table 3 but restrict the sample for the crisis period, 2008 and 2009. The directing of the coefficients of the three main variables are similar to that in Table 3. The debt ratio positively relates to investment and negatively relates to the cash ratio. Investment negatively relates to cash ratio and positively relates to debt ratio. Lastly, the cash ratio is negatively related with investment and debt ratio.

Further in columns [4] to [6], we add new variables. Crisis is an indicator variable takes the value of one for the observations in 2008 and 2009. Also, we add an interaction term between the Crisis and three financial variables. For the debt ratio and investment, we find that the relationship is stronger in the crisis period. In column [4], the estimated coefficient of Crisis is positive indicating that SMEs increase the level of debt ratio during the crisis period. Further the degree is pronounced for SMEs with high investment and low level of cash holding.

Column [5] shows the main determinants of SMEs investment. Interestingly, the estimated coefficient of the Crisis is statistically insignificantly different from zero. Then the decline of the investment during the crisis period observed in Table 2 is observed in some specific type of SMEs. The interaction term with Crisis show that SMEs with high cash amount and low debt amount decrease their investment during the crisis period.

Finally, column [6] shows the positive effect of the Crisis indicating that SMEs, during the crisis period, increase their cash holding. Further, it is pronounced for the high debt SMEs.

Table 4: The Impact of the Global Financial Crisis

Sample is... Dependent Variable	2008 and 2009			Entire Sample		
	Debt Ratio [1]	Investment [2]	Cash Ratio [3]	Debt Ratio [4]	Investment [5]	Cash Ratio [6]
Investment	0.370*** (0.00974)		-0.239*** (0.00630)	0.263*** (0.00489)		-0.238*** (0.00332)
Cash Ratio	-0.953*** (0.00336)	-0.0361*** (0.000953)		-0.940*** (0.00165)	-0.0345*** (0.000497)	
Debt Ratio		0.0234*** (0.000617)	-0.399*** (0.00141)		0.0187*** (0.00346)	-0.440*** (0.000779)
Crisis				1.881*** (0.141)	0.0383 (0.0513)	0.318*** (0.0985)
... x Investment				0.0453*** (0.0108)		0.00832 (0.00736)
... x Cash Ratio				-0.0110*** (0.00356)	-0.00591*** (0.00107)	
... x Debt Ratio					0.00145** (0.000727)	0.0212*** (0.00165)
Control Variables	Included	Included	Included	Included	Included	Included
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
N. of Observations	165,216	165,216	165,216	746,115	746,115	746,115
R-Squared	0.068	0.016	0.137	0.067	0.021	0.147

This table presents the results of the dynamic relationship between debt ratio, investment, and cash ratio with the effect of the global financial crisis. Columns [1] to [3] in *panel A* report the regression results for the sample period during the financial crisis (2008 and 2009), while Columns [4] to [6] in *panel B* report the regression results for the entire sample period where we include an indicator variable representing the crisis period (crisis). Also, in *panel B*, we include interaction variables between crisis and investment, crisis and cash ratio, and crisis and debt ratio. Year fixed-effect is also included. ***, **, and * represent 1%, 5%, and 10% significance, respectively.

4.5 The Impact of Global Financial Crisis and SMEs Financial Characteristics

In this section, we examine the dynamic relationships among three main variables namely: debt ratio, cash holding ratio, and investment through different firm characteristics using the seemingly unrelated regression (SUR) estimation method discussed in section 3. We divide our sample into three sub-samples according to different firm characteristics, namely high debt SMEs (columns [1] to [3]), high cash SMEs (columns [4] to [6]), and zero-debt SMEs (columns [7] to [9]).

High debt SMEs are defined as SMEs with debt ratio found in the top quartile of the sample grouped by state and industry at 2007. High cash SMEs are defined as SMEs with cash ratio found in the top quartile of the sample grouped by state and industry at 2007. Zero-debt SMEs are defined as SMEs with no debt holding during the 2007.

For the group of high debt SMEs, a positive relationship is reported between debt ratio and the crisis indicator, which contradicts our results in Table 4. This may indicate that SMEs with high amount of debt at the pre-crisis period additionally borrow more money from financial institutions and do not use it for investment. The drop of investment level for these SMEs is observed in column [2]: the interaction term Crisis x Cash Ratio has a negative coefficient. The Crisis has negative coefficient in column [2], indicating that high debt firms on average decrease investment and the degree is pronounced for those with high cash ratio.

Table 5: Firm Characteristics and the Financial Crisis

Sample is... Dependent Variable	High Debt			High Cash			Zero Leverage		
	Debt Ratio [1]	Investment [2]	Cash Ratio [3]	Debt Ratio [4]	Investment [5]	Cash Ratio [6]	Debt Ratio [7]	Investment [8]	Cash Ratio [9]
Investment	0.331*** (0.00695)		-0.162*** (0.00441)	0.341*** (0.00688)		-0.206*** (0.00454)	0.423*** (0.00924)		-0.642*** (0.0185)
Cash Ratio	-0.862*** (0.00251)	-0.0248*** (0.00708)		-0.980*** (0.00215)	-0.0268*** (0.00602)		-0.181*** (0.00217)	-0.0384*** (0.00111)	
Debt Ratio	0.02115*** (0.00455)	0.02115*** (0.00455)	-0.350*** (0.00103)		0.0197*** (0.000404)	-0.432*** (0.000953)		0.0952*** (0.00211)	-0.693*** (0.00825)
Crisis	0.551*** (0.150)	-0.231*** (0.565)	-0.116 (0.107)	1.255*** (0.145)	-0.0652 (0.0499)	0.229** (0.0976)	1.348*** (0.201)	0.359*** (0.101)	2.110*** (0.278)
... x Investment	0.0597*** (0.0124)		-0.00765 (0.00785)	0.0292** (0.0122)		-0.00726 (0.00802)	0.0209 (0.0155)		-0.0108 (0.0313)
... x Cash Ratio	0.0304*** (0.00458)	-0.00826*** (0.00128)		0.00332 (0.00389)	-0.00613*** (0.00108)		0.0307*** (0.00390)	-0.00686*** (0.00198)	
... x Debt Ratio		0.00577*** (0.00826)	0.0251*** (0.00188)		0.00361*** (0.000728)	0.0208**** (0.00173)		0.0507*** (0.00430)	0.0541*** (0.0171)
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. of Observations	450,676	450,676	450,676	516,941	516,941	516,941	69,893	69,893	69,893
R-Squared	0.054	0.012	0.112	0.014	0.140	0.140	0.069	0.030	0.072

This table examines the dynamic relationship among three main variables namely: debt ratio, cash holding ratio, and investment through different firm characteristics using the seemingly unrelated regression (SUR) estimation method discussed in section 3. We divide our sample into three sub-samples according to different firm characteristics. Columns [1] to [3], in *panel A*, include the sample of high debt SMEs, which are defined as SMEs with debt ratio found in the top quartile of the sample. columns [4] to [6], in *panel B*, include the sample of high cash SMEs, which are defined as SMEs with cash holding ratio found in the top quartile of the sample. Columns [7] to [9], in *panel C*, include the sample of zero leverage SMEs, which are defined as SMEs with zero debt ratio. These three criteria, high debt, high cash, and zero leverage, are based on the accounting information at the pre-crisis period, 2007. ***, **, and * represent 1, 5, and 10% significance, respectively.

When we restrict on the zero-leverage subsample, we find a positive coefficient for Crisis in column [8]. This implies that firms without debt increases their investments during the crisis period. This may imply that zero debt firms have some financial flexibility and can afford to invest as they want during financial shocks in the economy.

4.6 The Impact of SMEs' Size Dynamics

Finally, we analyze whether the dynamic relationship among the key financial decision variables changes by the firm size based on the number of employees using the SUR estimation method discussed in section 3. The results are reported in Table 6, where we divide our sample into sub-samples according to different size categories. Panel A, includes the sample of SMEs where the number of employees is <5. Panel B, includes the sample of SMEs where the number of employees is >5 and <=10. Panel C, includes the sample of SMEs where the number of employees is >10 and <=50. Panel D, includes the sample of SMEs where the number of employees is >50. The relationship among the three variables: Investment, Cash Ratio, and Debt Ratio is almost identical in all subsamples. The investment positively relates to the GDP growth except for the largest firm size group.

The difference among the subsample exists at the Sales Growth and State/industry GDP Growth. Column [1] of each Panel shows that SMEs in low GDP growth increase debt ratio only in small size companies whereas no/or positive relation in large firm size subgroups.

Finally, cash is negatively related to regional growth in the smallest group indicating that SMEs in low growth opportunity increase cash. However, in the large size subgroups, firms in high potential growth increase cash, implying that SMEs with high growth opportunity increase their retained earnings and do not use it for large investments. Overall, these results imply the heterogeneity in financing behavior due to different SMEs size.

Table 6: The Effect of Size Dynamics

Panel A	N. of Emp<= 5	Debt Ratio	Investment	Cash Ratio
		[1]	[2]	[3]
Investment		0.0623*** (0.00793)		-0.321*** (0.00616)
Cash Ratio		-0.727*** (0.00277)	-0.0478*** (0.000916)	
Debt Ratio			0.00564*** (0.000718)	-0.442*** (0.00169)
Sales Growth		-0.0145*** (0.00138)	0.0148*** (0.000415)	0.0111*** (0.00108)
State/Industry GDP Growth		-4.248*** (0.878)	0.577** (0.264)	-1.250* (0.685)
Control Variables		Included	Included	Included
N. of Observations		175,610	175,610	175,610
R-Squared		0.100	0.018	0.134

continued on next page

Table 6 *continued*

Panel B 5<N. of Emp<= 10	Debt Ratio [1]	Investment [2]	Cash Ratio [3]
Investment	0.258*** (0.00991)		-0.203*** (0.00691)
Cash Ratio	-0.970 (0.00320)	-0.0287*** (0.000979)	
Debt Ratio		0.0178*** (0.000683)	-0.472*** (0.00156)
Sales Growth	-0.0211*** (0.00186)	0.0146*** (0.000487)	-0.00340*** (0.00130)
State/Industry GDP Growth	-2.211*** (0.853)	0.858*** (0.224)	-0.654 (0.595)
Control Variables	Included	Included	Included
N. of Observations	146,981	146,981	146,981
R-Squared	0.098	0.023	0.120
Panel C 10<N. of Emp<= 50	Debt Ratio [1]	Investment [2]	Cash Ratio [3]
Investment	0.505*** (0.00706)		-0.173*** (0.00459)
Cash Ratio	-1.043*** (0.00237)	-0.0263*** (0.000698)	
Debt Ratio		0.0322*** (0.000451)	-0.438*** (0.000994)
Sales Growth	-0.0231*** (0.00154)	0.0190*** (0.000387)	-0.00140 (0.000995)
State/Industry GDP Growth	0.818 (0.543)	0.268* (0.137)	0.972*** (0.352)
Control Variables	Included	Included	Included
N. of Observations	310,168	310,168	310,168
R-Squared	0.099	0.027	0.123
Panel D N. of Emp > 50	Debt Ratio [1]	Investment [2]	Cash Ratio [3]
Investment	0.755*** (0.0125)		-0.262*** (0.00685)
Cash Ratio	-0.858*** (0.00508)	-0.0487*** (0.00127)	
Debt Ratio		0.0420*** (0.000693)	-0.257*** (0.00152)
Sales Growth	-0.0214*** (0.00351)	0.0290*** (0.000822)	-0.00529 (0.00192)
State/Industry GDP Growth	4.087*** (0.988)	0.326 (0.233)	2.641*** (0.541)
Control Variables	Included	Included	Included
N. of Observations	113,356	113,356	113,356
R-Squared	0.071	0.029	0.075

This table presents the results of the dynamic relationship between debt ratio, investment, and cash ratio while taking into account the different size categories within SMEs based on the number of employees using the seemingly unrelated regression (SUR) estimation method discussed in section 3. *Panel A*, includes the sample of SMEs where the number of employees is <5. *Panel B*, includes the sample of SMEs where the number of employees is >5 and <=10. *Panel C*, includes the sample of SMEs where the number of employees is >10 and <=50. *Panel D*, includes the sample of SMEs where the number of employees is >50. Dependent variables are debt ratio, investment, and cash ratio, respectively. Control variables contain ROA, natural logarithm of total assets, sales growth, one-year GDP growth in the same state/industry. Year fixed-effect is also included. ***, **, and * represent 1%, 5%, and 10% significance level, respectively.

5. CONCLUSION

The main objective of this paper is to understand how the changes in the macroeconomic conditions, namely the global financial crisis, relate to the investment and financial decision-making for each of the different size categories of SMEs. To do so, we use a large dataset of 764,963 observations in Japan for the time period from 2006 to 2014. This large-sized dataset enables us to understand the heterogeneity of SMEs on the financing and investment decision-making – such as the size, industry, and region. Our findings are of particular importance to regulators because they show that SMEs are dynamic in nature where they change their financial behavior in response to any macroeconomic shock. In addition, we report differences among the different size subsample at the sales growth and state/industry GDP growth levels; hence, this requires the design of a unique set of regulations for each group accordingly to properly enhance the growth potential for each group and for SMEs as a whole. Moreover, these findings have implications on lenders especially banks to treat each size group within SMEs differently while lending or assessing creditworthiness.

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