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February 2010

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The author thanks various seminar participants for their helpful comments and suggestions. This research is financially supported by a grant-in-aid from the Zengin Foundation for Studies on Economics and Finance.

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Abstract

This paper investigates the factors that support a funding demand increase in regional economies under easing monetary conditions. The following results were empirically obtained on the basis of individual firms and the 47 regional data in the 2000s in Japan. The first result is that funding demand regionally increases where the relative size of private capital stock is large. This result suggests that industrial agglomeration complements easing monetary policy to induce regional funding demand. The second result is that regional banking soundness in lending markets also contributes to an increase in the funding demand. This suggests that another possible requirement of the money suppliers must be fulfilled to induce the regional funding demand.

JEL Classification Code: R11, R12, G21
Keywords: Regional Policy, Regional Banking Market, Monetary Policy

1. Introduction

In Japan, a zero interest rate and quantitative easing monetary policy continued for the five-year period spanning 2001–2005. This policy was lifted in 2005 when the Japanese economy showed signs of recovery, but, as of March 2009, the policy interest rate has again declined to zero percent. A concern relating to this policy that researchers were unable to solve during the previous zero interest rate period is: what policy measures should be employed when monetary easing does not induce the funding demand? Overcoming this "liquidity trap" was a very important task for the Japanese economy policy makers in the first half of the 2000s. In fact, overcoming the liquidity trap has been a common policy concern across all major industrialized countries since 2008.

In Japan, the zero interest rate economy has continued for long-term period, and participants of the Japanese financial market regard this as a stationary state. The reason being that the corporate funding demand shows little signs of recovery even under an extreme easing

monetary policy that has continued for a long-term period. Domestic bank restructuring and dramatic structural changes of the financial industry, which began in 1998, also support the stationary state view. Coupled with the direct financing trend of the borrowers, the loan–deposit ratio of the regional banks was pushed down to a 60%–70% level, which is a 20% decrease from the loan–deposit level in 1988.

Over the last 30 years, it has become common for regional banks in Japan to absorb household savings in each regional deposit market toward concluding commercial lending contracts with firms in three important cities (i.e., Tokyo, Osaka, and Nagoya). Therefore, as the number of direct financing firms in these important cities increase, the regional banks need to find new clients. As a result, the regional banks have been trying to find new borrowers in local markets and enhance their relationship with potential clients. Unfortunately, over the last ten years, regional funding demand has slumped due to the above banking restructuring processes. This paper sought to discover a common non-financial regional factor that promotes funding demand in any given region by using data from the 47 prefectures of Japan over the past several years in the current low interest rate economy.

The hypotheses that this paper examined are as follows. The first is that we hypothesize the transmission process of easing monetary policy varies depending on relative size of the private capital stock in any given region. The second, as the prominent existing literature suggests, is that funding demands in the regions where there are many manufacturers are likely to be stimulated by a cut in interest rates. We regard that the above two hypotheses as regional factors of the money-demand side. The regional factors of the supply-side are also important. Three additional hypotheses are the stability and competitiveness of the regional banking sectors. We propose the above financial supply-side requirements are necessary to induce the funding demand of non-financial firms.

This paper is divided into six sections. The first is the introduction section. In the next section, we review literature relating to our hypotheses and show how this paper contributes to the existing body of literature. In section three, we explain our hypothesis, empirical models, and our approach for analyzing and verifying the data. Section four explains how we obtained our data. In section five, we provide three sets of empirical results based on the methodologies as explained in section three. Finally, in section six we derive our conclusion from the empirical results detailed in section five.

2. Background and Existing Literature

There is a vast amount of literature discussing the relationship between financial intermediation and the transmission process of monetary policy. Garrison and Chang (1979), Toal (1977), Beare (1976), and Garrison and Kort (1983) have focused their research on the relationship between regional economy and monetary policy[2]. On the other hand, the amount of literature that treats the relationship between regional diversification of banking markets and the transmission process of monetary policy is not large. Among a small number of these research papers, there is agreement that the following three regional factors are engines of the regional funding demand: 1) the interest elasticity of funding demand for firms, 2) the ratio of manufacturing firms and small to medium sized enterprises, and 3) the stability of the regional banking sector.

A. Interest Elasticity of Funding Demand in a Given Region

As Carlino and Defina (1998)(1999) pointed out, many researchers have found that high-interest elasticity of funding demand is an important regional factor that stimulates funding demand in the economy. In other words, some firms are stimulated by a cut in interest rates, but others are not. Therefore, the number of interest-elastic firms was a key to activating easing monetary policy and depended on the interest elasticity of funding demand.

The recent trends of regional fixed asset investment have become increasingly polarized over the last twenty years. Firms in Tokyo and the neighboring prefectures actively increased investment, and consequently, private capital stock strongly increased. Funding demand for those investments were also very strong in the Tokyo area. On the other hand, firms in prefectures where there is a smaller population and where fewer industrial agglomerations were made found it very difficult to induce the funding demand. Therefore, in case of regional economies within Japan, the interest elasticity of funding demand and regional industrial agglomeration seem to be correlated.

In the mid-1990s, Carlino and DeFina (1995) employed vector autoregression (VAR) in their empirical analysis. Since then, this methodology has become the main econometric model used in the field of economics. One of the merits of this methodology is that it enables researchers to examine causalities among variables. Fratantoni and Schuh (2003), Owyang and Wall (2005), and Schunk (2004) employed Carlino and DeFina's (1995) VAR model to examine the regional transmission

[2] These literatures respectively examined eight regions of the United States and derived implications how the transmission of easing monetary policy by Federal Reserve Board were diversified across the regions.

mechanism. Carlino and DeFina (1998, 1999) had also developed their previous studies by estimating the regional transmission magnitudes.

The implications from Carlino and Defina's (1998)(1999) work can help us to understand what is happening in Japan. According to Carlino and Defina, the funding demand of interest rate elasticity depends on the formation of industrial agglomeration. If regional industrial policy has been successful in the region, the accumulated private capital stock will be relatively large and there will also be many supporting industries there. In these regions, as bank lending rates lower, it will likely induce the funding demand of the regional firms.

B. Ratio of Manufacturing Firms and SMEs in the Region

The existing literature indicates that the ratio of manufacturing firms and small to medium enterprises (SMEs) to the total number of firms in a region also influences the regional funding demand. This is due to the managerial information of large firms being relatively transparent, as it is an accountability requirement for investors. As a result, there are various funding methodologies available to large firms.

In case managerial information of the regional firm is not transparent for money suppliers, the agency cost must be covered by either collateral assets of the borrowers or monitoring efforts of the financial intermediaries. The ratio of fixed assets to total assets of manufacturing firms is generally higher than that of the non-manufacturing firms. Therefore, obtaining financing resources is easier when the fixed assets have a high value as collateral. Literatures use this as the background of the relationship between manufacturing firm ratio and regional funding demand.

Generally, SMEs do not have many funding methodologies. They often depend on bank borrowings for their external funding. Therefore, funding demands in regions with a high ratio of SMEs are likely to be induced by a cut in interest rates. According to Bernanke (1993), Bernanke and Blinder (1988), and Gertler and Gilchrist (1993), the ultimate purpose of the central bank's monetary policy is to influence the balance sheet of financial intermediaries through a change in policy interest rates. A change in the balance sheet of financial intermediaries ultimately influences the balance sheet of the borrowers.

Generally, the firms with various funding tools are large firms, which includes publicly listed firms. Most of these large firms are located in metropolitan areas. On the other hand, firms in regional areas are mainly unlisted firms and small firms. As Oliner and Rudebusch (1995) pointed out, bank borrowing is a main funding tool for regional firms, and this

funding activity is likely to be influenced by changes in interest rates. Although commercial banks undertake corporate credit risks, in this case, the easing monetary policy directly stimulates regional funding demand.

C. Stability of the Regional Banking Market Sector

Another important regional factor that may influence the funding demand is the stability of regional banks. Researchers have suggested that bank stability in a region may influence borrowers' fixed investment activities. This is a controversial topic among researchers in this field. Kashyap and Stein (1994) suggested that having large banks open up new regional branches would create an additional increase in commercial loans because the large banks generally have a high creditworthiness.[3]

We consider regional banking stability as one of the important factors for inducing regional funding demand. Hosono (2006) stressed the importance of bank stability for the regional financial intermediation. We also share this view. In addition to regional banking soundness, regions with interest rates above zero tend to have low banking competitiveness. As Lee and Nagano (2008) pointed out, while many regional lending markets are not competitive in Japan, a small number of regions are very competitive, and the lending rates are relatively high in these regions.

Basically, not many literature sources focus on the relationship between the regional diversification of banking market and regional funding demand. Hori and Kotaki (2003) and Noma (2007) discussed the relationship between the performance of the regional banks and the regional economic trends. Hori and Kotaki (2003) concluded that there were no statistical causalities between regional banking stability and regional macroeconomic performance. Alternatively, Noma (2007) concluded that an increase in regional commercial lending contributed to a growth in the industrial sector. However, neither Hori and Kotaki (2003) nor Noma (2007) mentioned the relationship between the diversification of the banking markets and the transmission mechanisms of monetary policy.

3. Testing the Hypothesis and the Equation Model

The purpose of this paper was to examine the regional factors that might influence the interest elasticity of funding demand in Japan. We first

[3] In this regard, the opposite view of Moore and Hill (1982) said that more active behaviors of the existing regional banks were more important than new entries by large banks since the regional banks had long-term relationship with borrowers in the region and there were fewer asymmetric information problems.

verified the regional factors that were empirically supported by the existing literature. These regional factors included the ratio of manufacturing industries in the region and regional bank stability. Secondly, we examined new variables that have not been discussed in the existing literature. These regional factors included the private capital stock and regional banking competitiveness. We chose to employ these variables because we hypothesized that easing monetary policy is effective where the existing regional private capital stock is large. We also hypothesized that easing monetary policy was effective when high soundness and competitiveness of the banking market promoted the lowering of lending rates in that region.

$$I_{it} = f(X_{it}, Y_{jt}^{1}, ..., Y_{jt}^{m}, Z_{jt}^{1}, ..., Z_{jt}^{n}) \tag{3.1}$$

$$X_{it} = g(I_{it}, R_{jt}, Z_{jt}^{1}, ..., Z_{jt}^{n}) \tag{3.2}$$

Here, I denotes a firm i's fixed asset investment in year t, X is the firm i's individual factor that influences the fixed asset investment in year t, Y denotes the factors that influence the firm's funding demand in region j, R is real lending interest rate within region j, and Z denotes the factors that influence lending behaviors of regional banks within region j.

$$\partial^2 I / \partial X \partial Y < 0, \qquad \partial X / \partial R > 0, \qquad \partial^2 X / \partial R \partial Z < 0 \tag{3.3}$$

Summarizing the above overall hypothesis of this paper, a decrease in interest payments improves internal funding ability, but it alone does not induce the firm's fixed asset investment. When the necessary regional conditions are fulfilled the investment additionally increases. To examine the above hypotheses, this paper employed the following empirical equations.

$$I/K = \phi_0 + \phi_1 ROA + \phi_2 DIR + \phi_3 ASSET + \phi_4 DER + \phi_5 STK \times DIR + \phi_6 MFG \times DIR + \phi_7 DIR^2 + \varepsilon \tag{3.4}$$

$$DIR = \theta_0 + \theta_1 I/K + \theta_2 RI + \theta_3 CAR \times RI + + \theta_4 CMP \times RI + \theta_5 RI^2 + \zeta \tag{3.5}$$

Dependent and Endogenous Variables

I/K: fixed tangible asset net increase (current year) plus depreciation expense (current year) divided by fixed tangible assets (previous year) of firm *i*

DIR: interest payments (current year) divided by total bank loan (current year) of firm *i*

Independent Variables

ROA: net profit (previous year) divided by total asset (previous year) of firm *i*

ASSET: natural logarithm of total asset (previous year) of firm *i*

DER: total debt (previous year) divided by total capital (previous year) of firm *i*

STK: private regional capital stock divided by gross prefectural product in prefecture *j* where firm *i*'s headquarters is located

STK × *DIR*: intersected variable between *STK* (previous year) and *DIR* (previous year)

MFG: nominal gross prefectural product from manufacturing sector to gross prefectural product in prefecture *j* where firm *i*'s headquarters is located

MFG × *DIR*: intersected variable between *MFG* (previous year) and *DIR* (previous year)

RI: annual average of short-term prime lending rate in year *t* minus year on year increase of consumer price index in prefecture *j* where firm *i*'s headquarters is located

CAR: weighted average of capital adequacy ratios of commercial banks registered in National Banker's Association in prefecture *j* where firm *i*'s headquarters is located

CAR × *RI*: intersected variable between *CAR* (previous year) and *RI* (previous year)

CMP: Herfindahl-Hirschman Index of regional bank lending outstanding in prefecture *j* where firm *i*'s headquarters is located

CMP × *RI*: intersected variable between *CMP* (previous year) and *RI* (previous year)

The above equations are estimated by two-stage least squares for simultaneous equation models with instrumental variables. I/K and DIR are assumed to be determined endogenously, while the other variables are set as instrumental variables. All the variables are first differenced to eliminate the possible individual firm effects.

As for the private capital stock, we used Ishikawa's (2003) methodology to estimate regional private capital stock. Ishikawa (2003) estimated values of private capital stocks of the forty-seven prefectures between 1980–1994. We extended these values to 2007 by using the following formula:

$$STK_{j,t} = STK_{j,t-1} \times (1 - a_t) - DP_{j,t} / p_{j,t} + IP_{j,t} \qquad (3.6)$$

STK: non-government capital stock in prefecture *j* ; *DP:* consumption of non-government fixed capital stock in prefecture *j* ; *IP:* non-government fixed capital formation in each prefecture *j* ; *P:* deflator of non-government fixed capital formation in prefecture *j* ; *a:* adjustment parameter

We calculated real values of non-government capital stock for each prefecture and then converted these to nominal values. The adjustment parameter of *a* was obtained from Ishikawa's (2003) work. Our hypotheses expected the following positive or negative results for equation models 3.4 and 3.5.

	Dependent Variables
Demand Side:	**Supply Side:**
Fixed Asset	Interest

	Investment / Fixed Tangible Assets (*I/K*)	Payments / Bank Loan (*DIR*)
Independent Variables:		
Endogenous Variables		
I/K: Fixed Asset Investment / Fixed Tangible Assets		+
DIR: Interest Payments / Bank Loan	-	
Instrument Variables		
ROA: Return on Assets	-	
ASSET: log of Total Assets	+	
DER: Debt to Equity Ratio	-	
*STK*DIR:* Intersected Variable between *STK* and *DIR*	-	
*MFG*DIR:* Intersected Variable between *MFG* and *DIR*	-	
RI: Real Short-term Prime Lending Rate		+
*CAR*RI*: Intersected Variable between *CAR* and *RI*		+
*CMP*RI*: Intersected Variable between *CMP* and *RI*		+

4. Data

Financial data of publicly unlisted firms were obtained from Bureau van Dijk, Inc., and the listed firms were obtained from Nikkei Data Co. We obtained regional characteristics data from the Cabinet Office, Nikkei Data Co., Nikkin Communications Inc., and Thomson Reuters Inc. The number of publicly unlisted samples was 18,187 and that of the listed firms was 3,820. Firms within the financial sector as well as real estate businesses were excluded from the samples. The number of the samples from the 47 prefectures is provided in Appendix A.

The regional bank data were obtained from Nikkei NEEDs Data Co. We obtained capital adequacy ratio, total assets, and other necessary data that represent regional banking stability and competitiveness from the regional bank data. Data from Nikkin Communications Inc. was also included in the regional bank data. This data was necessary because the lending data of regional banks from Nikkei NEEDs included data from both inside and outside the region of each bank's headquarters. We needed to employ lending data inside the prefecture.

Regional macroeconomic variables such as the private capital stock to nominal gross prefectural product (GPP) and the ratio of manufacturing sector GPP to total GPP were obtained from the Cabinet Office. Historically, these data have been provided by the respective regions. We prepared a panel dataset by merging the data of the above individual firm's financial and regional characteristics in 2001–2007.

5. Empirical Analyses

5. 1 Analysis of Regional Unlisted Firms

According to the Establishment and Enterprise Census of the Japanese Ministry of Affairs and Communications, unlisted firms account for more than 99% of the total number of enterprises in Japan. This suggests that regional industrial sectors mainly comprise of unlisted firms, especially SMEs. On the basis of this background, our first empirical analysis focused on publicly unlisted firms by employing the equation models discussed in section 3.

As explained in the preceding section, we employed the two-stage least squares for simultaneous equation model for this empirical analyses. Variables are first differenced in this analysis. The SIC code of manufacturing firms are 2000–3999, while that of non-manufacturing firms are 4000–8999 and excludes financial and real estate industries, whose SIC codes are 6000–6799. Industrial dummies are added based on the two-digit SIC codes. Year dummies are also added.

The empirical results are reported in Table 1. In case of unlisted manufacturing firm samples—model (A)—the parameter of interest payments to total bank loan (*DIR*) was insignificant but that of intersected variable between private capital stock (*STK*) and *DIR* was negatively significant. The parameter of intersected variables between manufacturing industry ratio (*MFG*) and *DIR* was also negatively significant. Alternatively, when the dependent variable is *DIR*, the parameter of intersected variables between the bank's capital adequacy ratio (*CAR*) and prime lending rate (*RI*) was positively significant. The intersection of variables between the bank's competitiveness (*CMP*) and *RI* was also positively significant.

Our hypotheses were also supported in the case of unlisted non-manufacturing firm samples—model (B). The parameter of the intersected variable between *STK* and *DIR* was negatively significant, but the parameter of intersected variables between *MFG* and *DIR* was insignificant. The parameter of intersected variables between *CAR* and *RI* was positively significant, while the intersection of the variable between *CMP* and *RI* was insignificant.

Table. 1 Regional Factors that Influence Regional Funding Demand: Unlisted Firms

(A) Manufacturing Firms	(a) Dep. Var.= I/K			(b) Dep. Var.= DIR		
	Est: First-Differenced			Est: First-Differenced		
Endogenous Variable						
DIR	0.167		(1.170)			
I/K				-0.260	***	(-18.450)
Instruments Variables						
ROA	-0.749	***	(-4.730)			
ASSET	1.725	***	(27.260)			
DER	-0.819		(0.374)			
DIR*STK	-2.862	**	(-2.470)			
DRI*MFG	-0.129		(-1.110)			
DIR^2	-0.232	**	(-2.080)			
RI				1.226	**	(2.550)
RI*CAR				0.063	*	(1.930)
RI*CMP				0.028	***	(4.750)
RI^2				0.139	**	(2.420)
Year Dummies	yes			yes		
Industrial Dummies	yes			yes		
Const	0.164	***	(7.460)	0.186	***	(19.130)
Wald Chi2	1,562.14	***		654.9	***	
Observations	19,205			19,205		
Firms	8,196			8,196		
R-squared	0.032			0.007		
(B) Non-Manufacturing Firms	(a) Dep. Var.= I/K			(b) Dep. Var.= DIR		
	Est: First-Differenced			Est: First-Differenced		
Endogenous Variable						
DIR	-1.114		(-0.924)			
I/K				-2.769	***	(-11.280)
Instruments Variables						
ROA	-0.306		(-0.920)			
ASSET	1.503	***	(12.490)			
DER	-0.571	***	(-3.140)			
DIR*STK	-1.237	*	(-1.840)			
DRI*MFG	-0.257		(-0.840)			
DIR^2	-3.966	**	(-4.860)			
RI				2.337	***	(3.870)
RI*CAR				-0.143		(-0.480)
RI*CMP				0.787	***	(3.600)
RI^2				0.139	**	(2.420)
Year Dummies	yes			yes		
Industrial Dummies	yes			yes		
Const	-0.167	***	(-6.180)	1.122		(0.650)
Wald Chi2	230.90	***		130.9	***	
Observations	9,991			9,991		
Firms	5,690			5,690		
R-squared	0.003			0.008		

Notes: ***, **, * indicate significance at 1%, 5%, and 10% levels of confidence, respectively.

5. 2 Analysis of Regional Listed Firms

The empirical results of listed firms are shown in Table 2, and they

suggest that our hypotheses are entirely supported, empirically. First, parameters for the intersected variables between *STK* and *DIR* were significantly negative when the dependent variable was fixed asset investment (I/K). The parameter of intersected variables between the *CAR* and *RI* was also positively significant when the dependent variable was *DIR*. These results are common both in manufacturing firm samples and non-manufacturing firm samples.

The chief differences between the results of listed and unlisted firms are that parameters for the intersected variables between *MFG* and *DIR* were insignificant in the case of the listed firm samples. The parameter of the intersected variables between the *CMP* and *RI* was also insignificant. We assume this to imply that the regional distribution of the listed firms is different from that of unlisted firms. In other words, more listed firms concentrate in the Tokyo metropolitan area where manufacturing industrial ratio is relatively low and the degree of banking competitiveness is high.

We also employed the two-stage least squares for simultaneous equation model for these empirical analyses. Variables are first differenced in this analysis. The Tokyo Stock Exchange Industrial Code for manufacturing firms is 3050–3800 and that for non-manufacturing firm is 4050–6100, which excludes financial and real estate industries. Industrial dummies are added based on the four-digit Tokyo Stock Exchange Industrial Code. Year dummies for 2001–2006 are added as well.

Table. 2 Regional Factors that Influence Regional Funding Demand: Listed Firms

(A) Manufacturing Firms	(a) Dep. Var.= I/K		(b) Dep. Var.= DIR	
	Est: First-Differenced		Est: First-Differenced	
Endogenous Variable				
DIR	0.383	(0.780)		
I/K			-0.729 ***	(-21.040)
Instruments Variables				
ROA	-0.464 ***	(-2.740)		
ASSET	1.374 ***	(21.270)		
DER	0.385 ***	(5.400)		
DIR*STK	-0.131 *	(-1.750)		
DIR*MFG	-0.088	(-1.100)		
DIR^2	1.370 *	(1.910)		
RI			1.889	(0.750)
RI*CAR			0.055 *	(1.830)
RI*CMP			-0.008	(-0.680)
RI^2			0.146	(0.830)
Year Dummies	yes		yes	
Industrial Dummies	yes		yes	
Const	-0.095 ***	(-8.520)	-0.100	(-10.530)
Wald Chi2	725.62 ***		478.7 ***	
Observations	12,054		120,584	
Firms	2,576		2,576	
R-squared	0.008		0.007	
(B) Non-Manufacturing Firms	(a) Dep. Var.= I/K		(b) Dep. Var.= DIR	
	Est: First-Differenced		Est: First-Differenced	
Endogenous Variable				
DIR	0.512	(0.340)		
I/K			-1.011 ***	(-14.290)
Instruments Variables				
ROA	-0.529 **	(-2.440)		
ASSET	0.857 ***	(12.650)		
DER	-0.442 ***	(-3.400)		
DIR*STK	-0.491 **	(-2.270)		
DIR*MFG	0.183	(0.250)		
DIR^2	1.370	(-0.640)		
RI			1.736	(0.160)
RI*CAR			0.361 *	(1.730)
RI*CMP			0.163	(0.081)
RI^2			0.001	(0.680)
Year Dummies	yes		yes	
Industrial Dummies	yes		yes	
Const	-0.183 ***	(-8.280)	-0.155 ***	(-4.460)
Wald Chi2	241.64 ***		212.7 ***	
Observations	5,982		5,982	
Firms	1,244		1,244	
R-squared	0.093		0.005	

Notes: ***, **, * indicate significance at 1%, 5%, and 10% levels of confidence, respectively.

5. 3 Re-Examination of Interest Elasticity of Funding Demand

Empirical results of the previous two sections completely support our hypotheses that industry agglomeration and high banking soundness are two necessary conditions to induce the fixed asset investment demand under monetary easing conditions. This section reexamines the empirical tests to confirm if the results are common when it is verified using individual firm data, by region. We estimated the interest elasticity of funding demands once again according to prefecture. Although we estimated these elasticities in sections 5.1–5.2, this section estimates them as per region. We employed the following empirical model.

$$I / K = const + \omega_1 ITR + \omega_2 ROA + \omega_3 ASSET + \psi \qquad (5.1)$$

I/K: Fixed tangible asset net increase (current year) plus depreciation expense (current year) divided by fixed tangible assets (previous year) of firm *i*
ITR: Interest payments (previous year) divided by total bank loan (previous year) of firm *i*
ROA: Net profit (previous year) divided by total Assets (previous year) of firm *i*
ASSET: Total asset (previous year) of firm *i*

The concept of the above equation is based on that of (3.1). However, variables of industry agglomeration and high banking market competition are common; that is, this micro data analysis uses only one data respective to each prefecture. Therefore, we first estimated (5. 1) for forty-seven prefectures and compared elasticities between the regions having high industry agglomeration and banking market competition and the others.

All the variables except *ROA* are converted to natural logarithm. We regard the parameter of *ITR* as interest elasticity of funding demand. First, we prepared the dataset of the sample firms of the forty-seven prefectures and estimated the above equation with fixed effect and random effect estimations. We reported either based on the information obtained from Hausman Specification Test and Breush Pagan LM Test in Table 3. The sample period is 2003–2008. The firm data are obtained from Bureau van Dijk, Inc. and the estimation uses data from unlisted firms. Independent variables other than *ITR* are employed in order to eliminate the influence from the internal funding ability and scale effect. Since the ratio of manufacturing industries in a region might influence the regional funding demand, five industrial dummies are added.

To compare interest elasticities of the funding demand between regions having high private capital stock and banking market competition and the others, we calculate, in advance, the deviation scores of private capital stock per capita and banking market Herfindahl–Hirshman Index, by region. Then, we compare the values of interest elasticity of demand

between the region having high and low deviation scores. Each deviation score is shown in Appendix C.

The results are generally consistent with those in 3.1–3.2. Nine prefectures in the top ten deviation score regions have shown that the interest elasticities of funding demand are significant, while two prefectures in the lowest ten score prefectures recorded significance. The point estimate values and the 95 percent confidence interval are also generally high in the top 10 deviation score prefectures. Tokyo is the only exception among the top 10 regions. We believe that this result originates from the diversification of corporate funding in this region—i.e., the trend of direct financing.

Table. 3 Interest Elasticity of Funding Demand Estimated by Individual Firm Data of 2003–2008

(A) Top Ten Prefectures in Regional Deviation Value of Private Capital Stock and Banking Market HHI

	(a)ITR	(b)95% Conf.Interval.	(c)ROA	(d)SIZE	(e)Dummies	(f)Estimation	(g) Firms & Observations
Aichi	-0.0764 *	-0.1570	1.0673 ***	0.2687 ***	Industry-yes	Fixed	4,222
	(0.0411)	0.0042	(0.0701)	(0.1005)	Year-yes		8,225
Tokyo	-0.0572	-0.1339	0.3563	0.9227 ***	Industry-yes	Fixed	5,116
	(0.0391)	0.0194	(0.3687)	(0.0929)	Year-yes		9,965
Shizuoka	-0.1075 ***	-0.1333	0.3597 ***	0.0890 ***	Industry-yes	Random	3,360
	(0.0132)	-0.0817	(0.1160)	(0.0136)	Year-yes		7,599
Hiroshima	-0.1452 *	-0.2999	0.6144	1.3777 ***	Industry-yes	Fixed	2,398
	(0.0789)	0.0095	(0.4773)	(0.1582)	Year-yes		4,464
Kanagawa	-0.1519 ***	-0.2299	0.2388	0.5970 ***	Industry-yes	Fixed	3,112
	(0.0398)	-0.0739	(0.3026)	(0.0881)	Year-yes		7,949
Osaka	-0.1057 **	-0.1933	0.5542	1.2698 ***	Industry-yes	Fixed	4,993
	(0.0447)	-0.0181	(0.4929)	(0.1036)	Year-yes		9,380
Hyogo	-0.1404 ***	-0.1956	1.6395 ***	-0.1310 ***	Industry-yes	Random	2,049
	(0.0207)	-0.0853	(0.3841)	(0.0207)	Year-yes		3,804
Shiga	-0.0776 *	-0.1586	0.7258 *	-0.1030 ***	Industry-yes	Random	742
	(0.0413)	0.0035	(0.3819)	(0.0313)	Year-yes		1,831
Ibaragi	-0.0540 **	-0.1078	-0.1505	0.0587 **	Industry-yes	Fixed	869
	(0.0272)	-0.0014	(0.2994)	(0.0262)	Year-yes		3,574
Kyoto	-0.0690 **	-0.1313	0.1229	0.5038 ***	Industry-yes	Fixed	1,487
	(0.0318)	-0.0067	(0.2686)	(0.0234)	Year-yes		3,614

Notes:

1. ***, **, and * indicate significance at 1%, 5%, and 10% levels of confidence, respectively.
2. The first and second rows under "(b) 95% Conf. Interval." are the lower and upper bound of the interval estimators, respectively.
3. The top rows under "(g) Firms and Observations" are the number of sample firms and the lower rows indicate the number of observations.

(B) Ten Lowest Prefectures in Regional Deviation Value of Private Capital Stock and Banking Market HHI

	(a)ITR	(b)95% Conf.Interval.	(c)ROA	(d)SIZE	(e)Dummies	(f)Estimation	(g) Firms & Observations
Tokushima	-0.1012	-0.2723	0.2524	1.1028 ***	Industry-yes	Fixed	699
	(0.0872)	0.0698	(0.8146)	(0.2038)	Year-yes		1,877
Miyazaki	-0.1540	-0.3869	-0.8673	1.2653 ***	Industry-yes	Random	812
	(0.1187)	0.0790	(0.7519)	(0.1926)	Year-yes		2,043
Hokkaido	0.0530	-0.0279	-0.1691	1.3235 ***	Industry-yes	Fixed	5,420
	(0.0413)	0.1339	(0.3218)	(0.1221)	Year-yes		8,998
Iwate	-0.1102 **	-0.2053	0.2518	0.4598 ***	Industry-yes	Fixed	1,541
	(0.0485)	-0.0151	(0.2964)	(0.1441)	Year-yes		3,555
Kochi	-0.0034	-0.1530	0.6671	0.8176 ***	Industry-yes	Fixed	634
	(0.0762)	0.1462	(0.9623)	(0.2189)	Year-yes		1,573
Shimane	-0.0383	-0.2503	-0.4859	0.9894 ***	Industry-yes	Fixed	863
	(0.0779)	0.1736	(0.6068)	(0.1973)	Year-yes		2,173
Kumamoto	-0.0883	-0.2376	0.1584	0.7907 ***	Industry-yes	Fixed	1,168
	(0.0761)	0.0610	(0.7941)	(0.1878)	Year-yes		2,596
Saga	-0.2253	-0.4442	-3.1172 ***	1.3404 ***	Industry-yes	Fixed	507
	(0.2105)	0.0831	(1.1239)	(0.2656)	Year-yes		1,080
Okinawa	-0.1003	-0.2220	1.5433 *	0.4155 ***	Industry-yes	Fixed	1,178
	(0.0620)	0.0214	(0.9215)	(0.1592)	Year-yes		2,770
Nara	-0.2792 ***	-0.4377	0.9716 **	0.5677 ***	Industry-yes	Fixed	645
	(0.0808)	-0.1208	(0.8649)	(0.1843)	Year-yes		1,780

Notes:

1. ***, **, and * indicate significance at 1%, 5%, and 10% levels of confidence, respectively.
2. The first and second rows under "(b) 95% Conf. Interval." are the lower and upper bounds of the interval estimators, respectively.
3. The top rows of "(g) Firms and Observations" are the number of sample firms, and that below is the number of observations.

6. Concluding Remarks

This paper addressed the demand of firm funding in an environment of increasing regional diversification of the funding market in Japan. The lending markets in metropolitan areas are different from those in smaller cities; this is because metropolitan areas have a larger number of publicly listed firms. The markets in local cities are also heterogeneous and diversified. This paper has empirically shown what has created new additional regional funding demand and what has not in the diversified banking markets. On the basis of our empirical studies, we found that developing industrial agglomerations and enhancing the stability of banking sectors in lending markets were necessary requirements.

One of the most important results in this paper is that funding demand depends on the degree of industrial agglomerations in the regional economy. Particularly in the case of publicly unlisted firms, we found that the intersection of private capital stock with borrowing rates significantly influenced the regional fixed asset investment. Therefore, the role of the capital stock is evidently important in stimulating the demand for corporate funding in regions. These empirical analyses suggest that the high degree of industrial agglomerations is a required condition toward achieving policy goals.

Another important result in this paper is that our hypotheses on

the relationship between regional banking market stability and the funding demand in a region were also supported. We statistically found that very sound banking markets had lower interest rates of debt and that the parameter of intersected variable between the variable and prime lending rate and banking stability is significant to the interest rate of the bank loan. Therefore, lowering policy interest coupled with the banking soundness influences the interest elasticity of demand of borrowers. However, according to the empirical results, an improvement in the internal funding ability—i.e., ROA—for the firm did not relate to the proxy of external funding demand—i.e., fixed asset investment increase. It is our belief that corporate return on assets is generally influenced by the business performance itself and that the level of the policy interest rate is not an important factor in determining external funding demands.

On the basis of the above empirical results, we derived the following conclusions. The regional diversified interest elasticity of funding demand depends on the degree of industrial agglomerations and the banking market stability across the regions. This means that in order to stimulate the regional funding demand, appropriate industrial policies and banking supervision in the regions are necessary. In other words, factors that increase the interest elasticity of funding demand are on both the demand and supply side of the regional money funding market.

A good example that supports the conclusions drawn in this paper is that well-performing regional banks recorded good financial results in 2009. The Bank of Yokohama Ltd., Chiba Bank Ltd., Hiroshima Bank Ltd., Shizuoka Bank Ltd., and Suruga Bank Ltd. are examples of these well performing banks. The headquarters for all of these banks are located in the regions where industrial agglomerations have historically progressed. Since the capital stock of manufacturing industries has increased in each region, the number of households and the population has also increased. In these regions, banking market competition has also been promoted because outsiders (i.e., banks from the Tokyo area and neighboring prefectures) have participated in the market. In these areas, competitive market environments have forced poor performing regional banks to exit from the markets. As a result, the existing regional banks are highly efficient and competitive.

This paper employed new additional variables to explain the determinants of regional diversification of funding demand. Accumulated private capital stock as a proxy for industrial agglomerations is one of these variables. This variable is also influenced by the size of public capital stock, but this paper did not verify the relationship between industrial agglomerations and the size of public capital stock. We have concluded that multiple requirements are needed to increase regional funding

demand. Future studies should examine how the public sector performs contributes to regional funding demand.

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Appendix A: The Number of Samples and the Descriptive Statistics

The following statistics are the number of firms employed for the empirical analyses. Descriptive statistics in Table A2 are for all sample periods.

Table A1 Number of Sample Firms by Prefecture

	Unlisted Firms	Listed Firms		Unlisted Firms	Listed Firms
Hokkaido	8,317	49	Shiga	755	11
Aomori	1,648	1	Kyoto	916	79
Iwate	1,619	3	Osaka	6,760	557
Miyagi	2,784	17	Hyogo	3,105	146
Akita	819	3	Nara	687	7
Yamagata	1,595	3	Wakayama	601	7
Fukushima	1,863	8			
			Tottori	650	3
Ibaragi	797	17	Shimane	896	4
Tochigi	1,087	10	Okayama	1,494	17
Gunma	1,109	18	Hiroshima	4,167	44
Saitama	1,930	56	Yamaguchi	903	16
Chiba	2,724	34			
Tokyo	13,870	1,790	Tokushima	788	1
Kanagawa	3,058	182	Kagawa	1,233	19
			Ehime	2,049	10
Niigata	3,322	30	Kochi	661	5
Toyama	1,320	25			
Ishikawa	2,576	24	Fukuoka	6,320	77
Fukui	1,368	11	Saga	590	3
Yamanashi	574	6	Nagasaki	1,472	5
Nagano	2,598	25	Kumamoto	1,942	7
Gifu	1,446	26	Oita	2,092	6
Shizuoka	5,067	49	Miyazaki	878	3
Aichi	6,258	212	Kagoshima	1,279	7
Mie	1,199	15	Okinawa	2,178	4

Note: As the variables are first differenced, the empirical analysis for the firms in sections 5.1 and 5.2 are not consistent with the numbers in the above samples.

Table A2 Descriptive Statistics

		Mean	Stv	Max	Min
I/K	natural logarithm of fixed tangible asset net increase (current year) plus depreciation expense (current year) divided by fixed tangible assets (previous year) of firm i				
	Unlisted Firms	-1.489	1.402	6.404	-13.453
	Listed Firms	-2.093	1.391	4.430	-10.079
DIR	natural logatithm of interest payments (current year) divided by bank loan of firm i				
	Unlisted Firms	-4.638	1.047	0.574	-13.994
	Listed Firms	-5.129	1.141	2.890	-12.080
ROA	net profit (previous year) divided by total assets (previous year) of firm i				
	Unlisted Firms	0.022	0.099	8.534	-5.343
	Listed Firms	0.045	0.124	0.657	-11.472
DER	natural logarithm of total debt (prevous year) divided by total capital (previous year) of firm i				
	Unlisted Firms	-0.365	0.430	3.783	-6.998
	Listed Firms	-0.702	0.544	5.957	-7.919
ASSET	natural logarithm of total assets (prevous year) of firm i				
	Unlisted Firms	8.361	1.500	15.040	1.380
	Listed Firms	10.600	1.730	17.299	3.466
MFG	nominal gross prefectural product from manufacturing sector to gross prefectural product (current year)				
	Regional Data	0.220	0.081	0.420	0.041
STK	private regional capital stock divided by gross prefectural product in each prefecture (current year)				
	Regional Data	1.921	0.225	2.521	1.123
RI	real short-term prime lending rate in each prefecture (current year)				
	Regional Data	0.029	0.005	0.046	0.009
CAR	weighted average of capital adequacy ratios of commercial banks registered in National Banker's Association in each prefecture where the banks eadquarter, book value of total assets are used for the weight (current year)				
	Regional Data	8.672	3.014	14.870	0.654
CMP	Herfindahl-Hirschman Index of regional bank lending outstanding in each prefecture (current year)				
	Regional Data	0.231	0.130	0.612	0.005

Appendix B: Deviation Scores of Private Capital Stock per Capita and Banking Market Herfindahl–Hirshman Index

We estimated the interest elasticity of funding demand of twenty prefectures with firm individual data of 2003–2006. The prefectures are chosen on the basis of the total deviation scores given below of the private capital stock per capita and the banking market HHI.

Table B. The top 10 and the lowest 10 Deviation Scores of Private Capital Stock per Capita and Banking Market Herfindahl-Hirshman Index

		1) Private Capital Stock divided by Population	2) HHI in Banking Market	3) Total
1	Aichi	75.3	74.8	150.1
2	Tokyo	96.1	51.1	147.2
3	Shizuoka	84.6	44.9	129.5
4	Hiroshima	61.9	58.2	120.1
5	Kanagawa	46.5	71.7	118.3
6	Osaka	47.3	69.6	116.8
7	Hyogo	46.5	62.9	109.4
8	Shiga	46.5	61.4	107.9
9	Ibaragi	47.0	60.9	107.9
10	Kyoto	47.0	60.6	107.7
38	Tokushima	45.1	46.3	91.4
39	Miyazaki	44.8	46.5	91.3
40	Hokkaido	38.3	51.8	90.1
41	Iwate	42.5	46.9	89.3
42	Kochi	40.9	47.2	88.1
43	Shimane	39.8	46.7	86.5
44	Kumamoto	38.5	46.4	84.9
45	Saga	36.8	47.0	83.7
46	Okinawa	35.7	46.0	81.7
47	Nara	33.5	46.6	80.1

Note: The above deviation scores are calculated by using averaged data of private capital stock per capita and banking market HHI in 1999–2006 by prefecture.