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# Bank deposit interest rate pass-through and geographical segmentation in Japanese banking markets



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## 1. Introduction

Recent merger and acquisition (M&A) waves among Japanese regional financial intermediaries raise a question about their social costs: Do they harm depositors and borrowers who dwell in the regions where the mergers took place?<sup>1</sup> As Williamson (1968) discusses, mergers involve social costs and benefits. The former will arise from the increases in market power, and the latter, from efficiency gains after mergers. According to the economics perspective, when social costs dominate, the merger becomes undesirable (also known as the Williamson trade-off).

Before assessing the effects of M&As in Japanese banking markets, the possible geographic segmentation of Japanese banking markets must be investigated. If banking markets are integrated nationwide and banks have no market power in their respective regional markets (i.e., if banks' pricing behavior is

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#### ABSTRACT

This paper estimates the pass-through from market interest rates to deposit interest rates to investigate whether the Japanese bank deposit markets are geographically segmented. A unique feature of this paper is the use of monthly deposit interest rates posted by 106 regional banks from March 1999 to March 2010. Following the theoretical results from a simple banking activity model with Cournot competition, I estimate the long run pass-through of each regional bank utilizing the panel cointegration method. The empirical results of this paper show a significant negative correlation between regional market concentration and pass-through, which implies the existence of geographical market segmentation. © 2014 Elsevier B.V. All rights reserved.

independent of regional market concentration), then the social costs arising from mergers in regional markets would be negligible.

Examining the segmentation of regional banking markets is also important when considering the effects of monetary policy, especially transmission through the interest rate channel. Traditionally, the assumption in the literature has been that policy rates exhibit one-to-one effects on retail rates (De Graeve et al., 2007). However, given the geographical segmentation of banking markets, the pass-through from market rates to lending interest rates (deposit interest rates) is expected to be higher (lower) in concentrated markets (Freixas and Rochet, 2008). Therefore, the geographic segmentation implies that even the interest rate channel has distributional effects.<sup>2</sup>

In Japan, although existing literature has focused on the geographical segmentation in the bank loan markets, consensus among researchers has yet to be reached. For example, Kano and Tsutsui (2003) focus on the Japanese loan markets and conclude

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<sup>&</sup>lt;sup>1</sup> Hosono et al. (2009) report that the number of regional banks (regional banks and second regional banks) decreased from 134 in 1980 to 112 in 2005 and that of shinkin banks decreased from 462 to 301 during the same period.

<sup>&</sup>lt;sup>2</sup> A cross-country comparison by Gunji et al. (2009) demonstrates that the effects of monetary policy depend on the degree of competition in the banking industry. Specifically, their empirical analysis reveals that the loan supply of banks that operate in countries where banking markets are concentrated responds more to monetary policy shocks identified by the VAR models. Accordingly, it is suggested that the pass-through from market rates to lending interest rates is positively related to the degree of market concentration.

that the markets for regional banks and second regional banks (relatively large regional financial intermediations) are not segmented by prefecture, whereas those for shinkin banks (relatively small regional financial intermediations) are segmented based on the regional differences among loan interest rates. The authors also demonstrate that the loan rates of shinkin banks tend to be higher in prefectures with concentrated markets.<sup>3</sup> Ishikawa and Tsutsui (2013), by contrast, present evidence of geographical segmentation of loan markets by estimating prefectural loan demand and supply equations.

A possible vulnerability in the previous study is its use of estimated lending rates. For example, Kano and Tsutsui (2003) use average lending interest rates calculated from banks' financial statements. Given the differences in the maturity compositions and the lending strategies among banks, the calculated interest rates might possibly be biased by measurement errors.

This paper is also an empirical attempt to examine the geographical segmentation of Japanese banking markets but with a focus on time deposit markets. Time deposits are considered more suitable to examine this question, because they have more affinity with conventional oligopoly theory. For example, every bank depositor essentially faces the same interest rates if his or her deposit amount and maturity are the same, differently from the case of loan markets in which interest rates depend on borrowers' attributes. In addition, it is presumed that depositors are less concerned with bank accessibility factors, such as branch network locations or ATM services, when they make time deposits. Therefore, it is reasonable to say that time deposits are homogeneous goods as long as secured depositors are considered.

The unique features of this paper are as follows. First, by using a monthly panel data set of actual deposit interest rates posted by all Japanese regional banks (regional banks and second regional banks), this paper tries to avoid measurement errors that might arise from the calculations of average interest rates based on financial statements. Second, by employing the recent pass-through approach (Sørensen and Werner, 2006; De Graeve et al., 2007; Gambacorta, 2008), this paper highlights the differences in pass-through from market rates to deposit interest rates. This approach facilitates identifying market power effects separately from efficiency effects (the effect that inefficient banks set lower deposit rates).

Summarily, the empirical results of this paper indicate that (1) the levels of deposit interest rates are significantly different among prefectures, (2) the pass-through from market rates to deposit rates is incomplete for all banks and maturities, (3) lower pass-through rates are observed in prefectures with concentrated markets, and (4) the existence of large nationwide banks operating

in regional markets curbs the exercise of market power by regional financial institutions. These findings imply that regional financial institutions as a whole are not perfectly competitive and bank deposit markets are segmented by prefecture.

The rest of the paper is organized as follows: Section 2 explains the empirical strategy of this paper. Section 3 describes the data set, which is followed by the empirical results described in Section 4. Section 5 concludes the paper.

### 2. Empirical strategy

This paper investigates (1) whether the Japanese banking markets are geographically segmented and (2) whether banks' oligopolistic behavior is observable in concentrated markets. This paper primarily aims at measuring the correlation between passthrough and the extent of regional market concentration in the following order. Firstly, I derive an empirical model based on a simple Cournot competition where equilibrium deposit interest rates are determined by the number of banks operating in their respective regions, the market interest rates, and the marginal costs of deposit-taking. Secondly, I compile monthly panel data on time deposit interest rates that have been posted by Japanese regional banks and data on government bond yields whose remaining maturities are equal to those of deposits. By using the data set, I estimate each bank's cointegrating relationships between deposit rates and market rates, which correspond to long-run pass-through rates. Finally, following the methodology of De Graeve et al. (2007), I regress the estimated cointegrating vectors on the indices of prefectural deposit market concentration to analyze the correlation between the two. If the regional markets are segmented and banks behave oligopolistically, the extent of regional market concentration is expected to be negatively correlated with pass-through rates.

#### 2.1. A simple theoretical model

In order to derive an empirical model, I consider a model of a simple Cournot competition similar to that of Freixas and Rochet (2008). Here I assume that deposit and loan markets are segmented and there exist  $N_j$  homogeneous banks in every regional market (*j*). Banks collect deposits (*D*) at a cost and pay interest at a rate of  $r^D$  to depositors. They invest the deposit in the loan market (*L*) and the bond market (*S*) and receive interest at a rate of  $r^L$  and  $r^S$ , respectively. To offer loans, banks also incur costs, and I assume that both costs are linear in *D* and *L*. Banks behave oligopolistically in the deposit and loan markets, but behave as price takers in the bond market. The profit ( $\pi$ ) maximization problem for bank *i* in the region *j*, therefore, can be described as:

$$\max_{k,i} = r^{L} \left( L_{j,i} + \sum_{k \neq i} L_{j,k} \right) L_{j,i} + r^{S} S_{j,i} - r^{D} \left( D_{j,i} + \sum_{k \neq i} D_{j,k} \right) D_{j,i} - \gamma_{j} D_{j,i} - \lambda_{j} L_{j,i}$$
(1)  
s.t.  $L_{j,i} + S_{j,i} = D_{j,i}$ 

where  $r^{D}(D)$ ,  $r^{L}(L)$ ,  $\gamma_{j}$ , and  $\lambda_{j}$ , indicate the reverse supply function of deposits; the reverse demand function of loans; the marginal cost of deposit-taking; and the marginal costs of loan-provision, respectively. The first order condition of deposit-taking for bank *i* can be written as:

$$\frac{\partial \pi_{j,i}}{\partial D_{j,i}} = r^{S} - r^{D} \left( D_{j,i}^{*} + \sum_{k \neq i} D_{j,k} \right) + \frac{\partial r^{D}(D_{j})}{\partial D_{j}} D_{j,i}^{*} - \gamma_{j} = 0$$
(2)

where  $D_{j} = \sum_{k=1}^{N_{j}} D_{j,k}$ .

The best response function of bank i can be derived in order to satisfy Eq. (2). Since banks are assumed to be homogeneous, an

<sup>&</sup>lt;sup>3</sup> Hannan (1991) shows that banks in more concentrated markets offer higher loan interest rates in the U.S. Likewise, Berger and Hannan (1989) find that lower deposit interest rates are posted by banks operating in concentrated markets. Hannan and Berger (1991) focus on how banks' deposit rates react when market rates fluctuate, and their evidence from multinomial logit estimation shows that banks in more concentrated markets are less likely to change deposit interest rates. On the other hand, Prager and Hannan (1998) investigate the effect of mergers on deposit interest rates and find that interest rates posted by consolidated banks decrease after the merger. Berger et al. (1999) provide an extensive literature survey on this topic. They categorize the literature that investigates the relationship between interest setting behavior and market concentration as "static analysis," and the literature that compares banks' behavior before and after M&As as "dynamic analysis."

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