ECONOMIC　RESEARCH　CENTER
DISCUSSION　PAPER

E-Series

No.E19-11

Klein and Monti meet Weyl and Fabinger: Imperfect competition in the banking sector

by

Takanori Adachi

September 2019

ECONOMIC RESEARCH CENTER
GRADUATE SCHOOL OF ECONOMICS
NAGOYA UNIVERSITY

Klein and Monti meet Weyl and Fabinger: Imperfect competition in the banking sector*

Takanori Adachi†

September 9, 2019

Abstract

The Monti-Klein model of monopolistic banking is extended by Weyl and Fabinger's (2013) conduct parameter approach to include oligopolistic banking. By considering imperfect competition in loan and deposit markets, I show that whether an increase in the conduct parameter in one market also raises the equilibrium rate in the other market depends on whether the marginal cost of loan/deposit increases or decrease as the amount of the other "product" increases. Specifically, if the cross partial derivative of the cost function is positive, then an increase in the conduct parameter in the loan market *lowers* the deposit rate, whereas an increase in the conduct parameter in the deposit market *raises* the lending rate.

Keywords: Banking Industry; Imperfect Competition; Conduct Parameter Approach.

JEL classification: D43; G21; L13.

1 Introduction

In this note, I study the Monti-Klein model of monopolistic banking in the loan and the deposit markets (Klein 1971; Monti 1972; Dermine 1986; Gunji and Miyazaki 2019) by using Weyl and Fabinger's (2013) conduct parameter approach to consider oligopolistic banking in both loan and deposit markets. Banks "produce" loan and deposit services for firms and consumers by incurring production cost. This is captured by the standard cost functions with two outputs. It is shown that the cross partial derivative of the cost function is key: if it is

*I am grateful to a Grant-in-Aid for Scientific Research (C) (18K01567) from the Japan Society of the Promotion of Science. All remaining errors are my own.

†School of Economics, Nagoya University, 1 Furo-cho, Chikusa-ku, Nagoya 464-8601, Japan. E-mail: adachi.t@soec.nagoya-u.ac.jp

positive (resp. negative), then an increase in the conduct parameter in the loan market *lowers* (resp. raises) the deposit rate, whereas an increase in the conduct parameter in the deposit market *raises* (resp. lowers) the lending rate.

2 Model

I follow Freixas and Rocht's (2008, Ch. 3) exposition of the Monti-Klein model. The demand for loans is described by $L(r_L)$, which is downward sloping, whereas the supply of deposits from households is given by an upward sloping function, $D(r_D)$. The banking industry as a whole provides deposit and loan services; its production technology is captured by a cost function $C(D, L)$, which satisfies the regularity conditions. Thus, the representative bank has the following profit function:

$$\pi(r_L, r_D) = (r_L - \overline{r})L(r_L) + [(1-\alpha)\overline{r} - r_D]D(r_D) - C[D(r_D), L(r_L)],$$

where $\overline{r} \geq 0$ is the fixed rate on the interbank market, and $\alpha \in [0, 1)$ is the rate for compulsory reserves. To study the equilibrium pricing, consider a small increase in the lending rate, r_L. Then, imperfectly competitive banks recognize that they capture only $100 \times \theta_L$ percent of the profit gain by raising the lending rate, where $\theta_L \in [0, 1]$ is the conduct parameter for the lending market, measuring the degree of imperfect competition in lending, with $\theta_L = 1$ being monopoly and $\theta_L = 0$ being perfect competition. Let $\Delta r_L > 0$ and $\Delta L < 0$ be the increase in r_L and the associate change in the amount of lending, respectively. Then, given the equilibrium deposit rate r_D^* and the amount of deposits D^*,the bank equates the marginal profit gain and the loss from raising r_L (see Figure 1):

$$\underbrace{\theta_L \Delta r_L L + \frac{\partial C}{\partial L} \cdot (-\Delta L)}_{\text{Marginal Gain}} = \underbrace{(r_L - \overline{r})(-\Delta L)}_{\text{Marginal Loss}}.$$

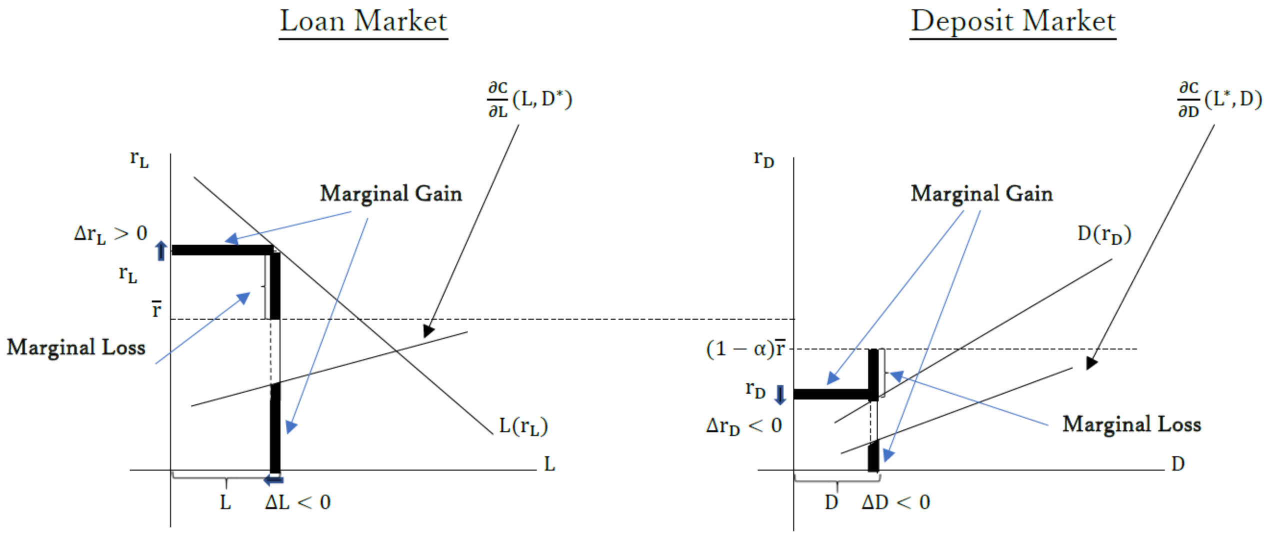
Similarly, given the equilibrium lending rate r_L^* and the amount of loans D^*, the bank also equates the marginal gain and the marginal loss from lower the savings rate in the deposit market (see Figure 1):

$$\underbrace{\theta_D(-\Delta r_D)D + \frac{\partial C}{\partial D} \cdot (-\Delta D)}_{\text{Marginal Gain}} = \underbrace{[(1-\alpha)\overline{r} - r_D](-\Delta D)}_{\text{Marginal Loss}}.$$

Then, formally, the equilibrium rates (r_L^*, r_D^*) satisfy:

$$\frac{\left[(r_L^* - \overline{r}) - \frac{\partial C}{\partial L}[D(r_D^*), L(r_L^*)]\right]}{r_L^*} = \frac{\theta_L}{\epsilon_L(r_L^*)}$$

Figure 1: Bank's Pricing Incentives



and

$$\frac{\left[(1-\alpha)\bar{r} - r_D^* - \frac{\partial C}{\partial D}[D(r_D^*), L(r_L^*)]\right]}{r_D^*} = \frac{\theta_D}{\epsilon_D(r_D^*)},$$

where $\epsilon_L(r_L) \equiv -\frac{r_L L'(r_L)}{L(r_L)} > 0$ is the price elasticity of demand in the loan market, and $\epsilon_D(r_D) \equiv \frac{r_D D'(r_D)}{D(r_D)} > 0$ is the price elasticity of supply in the deposit market.

3 Analysis

Now, define $F(r_L, r_D; \theta_L) \equiv \left\{(r_L - \bar{r}) - \frac{\partial C}{\partial L}[D(r_D), L(r_L)]\right\} \epsilon_L(r_L) - \theta_L r_L$ and $G(r_L, r_D; \theta_D, \alpha) \equiv \left\{(1-\alpha)\bar{r} - r_D - \frac{\partial C}{\partial D}[D(r_D), L(r_L)]\right\} \epsilon_D(r_D) - \theta_D r_D$. Then,

$$\underbrace{\begin{bmatrix} \frac{\partial F}{\partial r_L} & \frac{\partial F}{\partial r_D} \\ \\ \frac{\partial G}{\partial r_L} & \frac{\partial G}{\partial r_D} \end{bmatrix}}_{\equiv K} \begin{bmatrix} \frac{\partial r_L}{\partial \theta_L} \\ \\ \frac{\partial r_D}{\partial \theta_L} \end{bmatrix} = - \begin{bmatrix} \frac{\partial F}{\partial \theta_L} \\ \\ \frac{\partial G}{\partial \theta_L} \end{bmatrix},$$

which indicates

$$\begin{bmatrix} \frac{\partial r_L}{\partial \theta_L} \\ \\ \frac{\partial r_D}{\partial \theta_L} \end{bmatrix} = \frac{-1}{\underbrace{\det(K)}_{<0}} \begin{bmatrix} -\frac{\partial G}{\partial r_D} r_L \\ \\ \frac{\partial G}{\partial r_L} r_L \end{bmatrix},$$

where

$$\det(K) \equiv \left(\frac{\partial F}{\partial r_L}\right)\left(\frac{\partial G}{\partial r_D}\right) - \left(\frac{\partial F}{\partial r_D}\right)\left(\frac{\partial G}{\partial r_L}\right)$$
$$= \left(\frac{\partial F}{\partial r_L}\right)\left(\frac{\partial G}{\partial r_D}\right) - \underbrace{\left(\frac{\partial^2 C}{\partial L \partial D}\right)^2 D' L' \epsilon_L \epsilon_D}_{<0} > 0$$

because it is assumed that

$$\frac{\partial F}{\partial r_L} = \left[(r_L - \overline{r}) - \frac{\partial C}{\partial L}\right]\epsilon_L^{'} + \left(1 - \frac{\partial^2 C}{\partial L^2}L'\right)\epsilon_L - \theta_L > 0$$

and

$$\frac{\partial G}{\partial r_D} = \left[(1-\alpha)\overline{r} - r_L - \frac{\partial C}{\partial D}\right]\epsilon_D^{'} + \left(-1 - \frac{\partial^2 C}{\partial D^2}D'\right)\epsilon_D - \theta_D > 0.$$

Hence, an increase in $\theta_L$raises the lending rate:

$$\frac{\partial r_L}{\partial \theta_L} = \frac{\frac{\partial G}{\partial r_D} r_L}{\det(K)} > 0$$

whereas whether it raises or lowers the deposit rate depends on the sign of the cross partial derivative of the cost function, $C(D, L)$:

$$\frac{\partial r_D}{\partial \theta_L} = \frac{\underbrace{\frac{\partial^2 C}{\partial L \partial D}}_{\gtrless 0} \cdot \underbrace{(L' \epsilon_D r_L)}_{<0}}{\underbrace{\det(K)}_{>0}} \lesseqgtr 0.$$

Specifically, if the marginal cost of loan or deposit increases for a larger amount of deposit or loan, respectively ($\frac{\partial^2 C}{\partial L \partial D} > 0$), the deposit rate *decreases* if the conduct parameter in the loan market θ_L increases.

Similarly, the effect of an increase in the conduct parameter in the deposit market θ_D on the equilibrium loan and deposit rates is captured by

$$\begin{bmatrix} \frac{\partial r_L}{\partial \theta_D} \\ \\ \frac{\partial r_D}{\partial \theta_D} \end{bmatrix} = \frac{1}{\underbrace{\det(K)}_{>0}} \begin{bmatrix} \underbrace{\frac{\partial^2 C}{\partial L \partial D}}_{\gtrless 0} \cdot \underbrace{(D' \epsilon_L r_D)}_{>0} \\ \\ \underbrace{\frac{\partial F}{\partial r_L} r_D}_{>0} \end{bmatrix},$$

which implies that if the marginal cost of loan or deposit increases for a larger amount of deposit or loan, respectively, the lending rate *increases* if the conduct parameter in the deposit market

θ_D increases.

Finally, it is shown that the an increase in the rate for compulsory reserves has a similar effect. Specifically,

$$\begin{bmatrix} \dfrac{\partial r_L}{\partial \alpha} \\[2ex] \dfrac{\partial r_D}{\partial \alpha} \end{bmatrix} = \underbrace{\frac{1}{\det(K)}}_{>0} \begin{bmatrix} \underbrace{\dfrac{\partial^2 C}{\partial L \partial D}}_{\gtrless 0} \cdot \underbrace{(D' \epsilon_L \overline{r} \epsilon_D)}_{>0} \\[4ex] \underbrace{\dfrac{\partial F}{\partial r_L} \overline{r} \epsilon_D}_{>0} \end{bmatrix},$$

that is, an increase in α unambiguously raises the deposit rate r_D, whereas whether it also raises the lending rate r_L depends on the sign of $\frac{\partial^2 C}{\partial L \partial D}$.

References

Dermine, J. 1986. "Deposit Rates, Credit Rates and Bank Capital: The Klein-Monti Model Revisited." *Journal of Banking & Finance*, 10(1), 99-114.

Freixas, Xavier, and Jean-Charles Rochet. 2008. *Microeconomics of Banking*, Second Edition, The MIT Press.

Gunji, Hiroshi, and Kenji Miyazaki. 2019. "An Industrial-Organization Approach to Conventional and Unconventional Monetary Policy." Unpublished.

Klein, Michael A. 1971. "A Theory of the Banking Firm." *Journal of Money, Credit and Banking*, 3(2), Part 1, 205-218.

Monti, Mario. 1972. "Deposit, Credit and Interest Rate Determination under Alternative Bank Objective functions." Giorgio P. Szegö and Karl Shell (Eds.), *Mathematical Methods in Investment and Finance*, North-Holland, 430-454.

Weyl, E. Glen, and Michal Fabinger. 2013. "Pass-Through as an Economic Tool: Principles of Incidence under Imperfect Competition." *Journal of Political Economy*, 121(3), 528-583.