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Leverage, performance and capital adequacy ratio in Taiwan's banking industry

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ABSTRACT

We examine the relation between firms' financial structures and their risky investment strategies in Taiwan's banking industry. Regressions cover two subperiods: before the first financial reform (1996–2000) and after the first financial reform (2001–2006), to address the impacts of the first financial reform on banking firms' financial structures. Our first result demonstrates that the restrictions on CAR have indeed affected firms' risky investment strategies, as market share and leverage are positively related. Second, the firm performance is significantly and positively related to firm size, leverage and financial cost. Finally, the regression results show that financial structures for banking firms are positively related to the states of business cycle (i.e., cyclical). The positive signs coincide with Proposition 4 in our analytical model.

1. Introduction

The existing literature such as Brander and Lewis (1986) has examined the impact of oligopolistic firms' financial structures on their competition in the product market. It is concluded that a firm can use "debt" to commit to an aggressive output level and induce a favorable output reduction from its rival. However, as pointed by Doherty (1989), this line of research addressed the financial structure issue under the assumption that the firms' financing decisions are predetermined and separable from its operating decisions. "This convenient separating of financing and operating decisions is inappropriate for financial intermediaries". For example, debts in banks usually consist of deposits with various maturities; new depositors can join in or early withdrawal can occur when depositors remove their money for better returns elsewhere (see Diamond and Dybvig, 1983). Sealey (1983) also pointed out that similar issues arise for insurance firms. The sale of insurance policies generates the operating revenues of the insurance firms. Although these debt like instruments are sold in the insurance product market (rather than in the capital market), these afford the firm as a source of capital. The insurance "debt" issued by the insurers is used to construct a portfolio consisting of mostly of financial assets. These suggest that unlike other industries, debt levels in the banking industry will actually change with firms' current revenues and hence cannot be predetermined before competition.

Our paper will incorporate these observations in an imperfectly competition framework similar to Brander and Lewis (1986); two firms simultaneously choose their equity levels (rather than debts) in the first stage, and then decide how to allocate their capital between cash flow reserve and risky investment which is subject to the rival's competition. We assume instead that debt level is an increasing function of current revenue and will be determined endogenously with the operating decision. We will consider the possibility that too many early withdrawal might cause the firms go bankruptcy, and the impacts from the capital adequacy ratio (henceforth, CAR) requirement by Basel I and Basel II Accords (1988, 2004). We ask the same questions as in the existing literature but focus on the banking industry: How will banking firms' financial structures affect their risky investment decisions? How will firms' financial decisions change with the business status? What is the impact from the CAR requirement?

Assuming debt to vary with firms' current revenues and taking equity as the control variable for financial structure give us a different aspect to examine the impact of firms' financial decisions. In Brander and Lewis (1986), increasing debt has two impacts on firm value: to decrease the critical value of shock (representing the uncertain demand) and to increase the debt repayment. Since debt is predetermined before competition, the repayment will not affect firms' output levels. The only impact on

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the critical value of shock is to lift up the expected demand, increase marginal revenue, and increase output and profit. Hence, debt financing can commit a firm to an aggressive output stance. In our model, the equity level will be set prior to the risky competition. Equity issuing has three impacts on firm value. First, higher equity level can increase a firm's cash flow reserve, which also decreases the critical value of shock. The former increases the firm value directly and the latter will lift up the expected demand and marginal revenue, and also increase risky investments and returns. Second, higher equity level means more dividends to give away to equityholders, and this will decrease the marginal revenue, their investments and returns. The third impact is on the debt repayment, indirectly through its impacts on the return and the debt level.

For the combination of the three effects, Proposition 3 concludes that equity issuing will decrease firms' equilibrium risky investments, showing the domination of the latter two impacts. Proposition 4 also demonstrates that the equilibrium equity level is higher in a better business status. Finally, Basel I and Basel II Accords (1988, 2004) suggested that banking firms should follow a minimum risk-based capital requirement that the CAR be at least greater than 8%. Proposition 5 shows that if the CAR requirement is binding, then the result from Proposition 3 will be overturned and the equilibrium risky investment will be positively related to equity level. This gives us an alternative interpretation for the empirical tests on banking industry: if the risky investment or return is negatively related to equity level, then the CAR requirement is not effectively binding; otherwise, the CAR requirement is binding and firms' risk managements are affected.

We then test our theoretical results using panel data from Taiwan's banking industry. Our research is the first attempt to cover Taiwan's four core financial businesses:[1] banks, securities firms, property insurance firms and life insurance firms. We present the regression results for before the first financial reform (1996–2000) and after the first financial reform (2001–2006), to examine the impacts of the first financial reform on banking firms' financial structure. Our results first justify our theoretical assumption that debts are increasing function of firms' returns. Next, as described by Proposition 5, the restrictions on CAR have indeed affected firms' management strategies, as market share and leverage are positively related. The firm values are significantly and positively related to firm size, leverage and financial cost. Finally, the regression results show that financial structures for banking firms are positively related to the states of business cycle (i.e., cyclical). The positive signs coincide with Proposition 4 in our analytical model.

Section 2 describes a two stage game where two firms simultaneously choose their equity levels first, and then allocate their capital between cash flow reserves and risky investments, which are subject to the rival's competition. Section 3 provides the empirical tests of our theoretical results using data from Taiwan's banking industry. Section 4 concludes the paper.

2. The analytical model

We consider a two stage game between firm 1 and 2. In the first stage, the two firms simultaneously choose the levels of equity e_i (with a face value ν_i), which together with an initial debt level D_i^0 determined by, say, firm i's last period revenue, compose firm i's initial capital stock $(e_i\nu_i + D_i^0)$ in the first stage.[2] Each firm acts like a portfolio manager who allocates the received capital between cash flow reserve and risky investment, which is subject to the rival's competition. That is, in the second stage the two firms simultaneously choose their levels of risky investment which is characterized by a differentiated market with uncertain demand. This investment is assumed irreversible and the return will be realized at the end of stage 2.

Denote r_i as firm i's risky investment, and the remaining capital $e_i\nu_i + D_i^0 - r_i$ is hence the initial cash flow reserve. The risky investment is characterized by a differentiated market with uncertain demand. Denote $\pi_i(r_i, r_2, \varepsilon_i)$ as the return for this risky investment, which is the difference between revenue and variable cost: $\pi_i(r_1, r_2, \varepsilon_i) = P_i(r_1, r_2, \varepsilon_i)r_i - c_i(r_i)$. The random variable ε_i represents firm i's state of demand, which is identically and independently distributed on the interval $[\underline{\varepsilon}, \bar{\varepsilon}]$ according to a distribution function $G(\varepsilon_i)$ with density $g(\varepsilon_i)$.

We will make the conventional assumptions on demand and cost functions: $\partial P_i/\partial r_i < 0$, $\partial P_i/\partial r_j < 0$, $\partial^2 P_i/\partial r_i r_j < 0$, $\partial c_i/\partial r_i > 0$ and $\partial^2 c_i/\partial r_i^2 \geq 0$. This assumption describes that firm i's inverse demand function is decreasing in both r_i and r_j, and the cost is increasing and convex in its investment. In addition, we assume that higher values of ε_i will lead to higher demand and the marginal demand is higher in better states of the world, that is, $\partial P_i/\partial \varepsilon_i > 0$ and $\partial^2 P_i/\partial r_i \varepsilon_i > 0$. As an illustrative example for this differentiated competition, consider the following linear demand and quadratic cost functions: $P_i(r_1, r_2, \varepsilon_i)r_i = \alpha - \beta r_i - \gamma r_i + \varepsilon_i$ and $c_i(r_i) = r_i^2/2$. Under these assumptions, the return on risky investment has the conventional properties: $\partial^2\pi_i/\partial r_i^2 < 0$, $\partial^2\pi_i/\partial r_i \partial e_i = 0$ and $\partial^2\pi_i/\partial r_i \partial r_j < 0$.

Two specific issues will be discussed: the impact of the CAR requirement and the possibility of early deposit withdrawal. First, Basel I and Basel II Accords[3] (1988, 2004) suggested that firms should follow a minimum risk-based capital requirement that the CAR, a ratio of capital over risky credit exposures, be at least greater than 8%:

$$\frac{e_i\nu_i}{\pi_i(r_1, r_2, \varepsilon_i)} \geq 0.08, \quad \text{that is,} \quad \pi_i(r_1, r_2, \varepsilon_i) \leq 12.5(e_i\nu_i) \tag{1}$$

Given e_i and that $\pi_i(r_1, r_2, \varepsilon_i)$ is concave, if the requirement is binding, there will be a lower and upper bounds on r_i. Since only the upper bound can affect the determination of equilibrium, we will focus on this case and denote this upper bound by $\bar{r}_i(r_j, e_i)$.

Proposition 1. *The upper bound from the CAR requirement $\bar{r}_i(r_j, e_i)$ is increasing in e_i and decreasing in r_j.*[4]

According to Diamond and Dybvig (1983), the withdrawal decision will depend on the firm's current revenue, demand uncertainty and other depositors' withdrawal decisions. Under the first-come-first-serve rule, early withdrawers can fully retrieve their money until the firm's cash flow reserve is used up, then the firm declares bankruptcy and the debtholders get the remaining value. To simplify, we will eschew the detailed discussion on depositors' withdrawal decisions, and assume directly that the remaining debt is $D_i(\pi_i(r_1, r_2, \varepsilon_i))$. Since the amount of withdrawal will depend on firm's current revenue, the remaining debt is therefore a function of current revenue. For simplification, we assume that $D_i' > 0$ and $D_i'' < 0$, meaning that higher return can attract more deposits but in a decreasing rate.

Recall that firm i's initial cash flow reserve is $e_i\nu_i + D_i^0 - r_i$. Notice that the amount of early withdrawal $[D_i^0 - D_i(\pi_i(r_1, r_2, \varepsilon_i))]$ can also be negative and be interpreted as deposit increase. The current cash flow reserve becomes $e_i\nu_i + D_i^0 - r_i - [D_i^0 - D_i(\pi_i(r_1, r_2, \varepsilon_i))]$ or in short, $e_i\nu_i + D_i(\pi_i(r_1, r_2, \varepsilon_i)) - r_i$. There is a

[1] See the Act of Financial Holdings Companies, Article 4, Term 1–3.

[2] It is assumed that there is no other internal capital.

[3] See http://en.wikipedia.org/wiki/Capital_adequacy_ratio#cite_note-investo-pedia-0.

[4] The detailed characterization for the analytical results is referred to Ho and Hsu (2010).