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OWNERSHIP AND NONPERFORMING LOANS: EVIDENCE FROM TAIWAN'S BANKS

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We first derive a theoretical model to predict that the relation between nonperforming loan ratios and government shareholdings can be downward-sloping, upward-sloping, U-shaped, and inversely U-shaped. An increase in the government's shareholding facilitates political lobbying. On the other hand, private shareholding induces more nonperforming loans (NPLs) to be manipulated by corrupt private owners. We adopt a panel data set of forty Taiwanese commercial banks during 1996–99 for empirical analysis. The results show that the rate of NPLs decreased as the ratio of government shareholding in a bank rose (up to 63.51 percent), while the rate thereafter increased. Bank size was negatively related to the rate of NPLs. Rates of NPLs are shown to have steadily increased from 1996 to 1999. Banks established after deregulation, on average, had a lower rate of NPLs than those established before deregulation.

I. INTRODUCTION

LOANS are the major output provided by banks, but they are a risky output—there is always an ex ante risk for a loan to finally become nonperforming. Nonperforming loans (NPLs) can be treated as undesirable outputs or costs to a bank which will decrease the bank's performance (Chang 1999). The risk from NPLs mainly arises when the external economic environment worsens such as during economic depressions (Sinkey and Greenawalt 1991). Since the 1997 Asian financial crisis, NPLs have rapidly accumulated in many Asian economies (Chang 1998; Lauridsen 1998; Robison and Rosser 1998; Wade 1998). Controlling NPLs is hence very important for both an individual bank's overall performance (McNulty, Akhigbe, and Verbrugge 2001) and an economy's financial environment.

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The 1997 Asian financial crisis has had a great impact on Taiwan. Listed companies are now reportedly facing a series of their own financial crises. As a result, stock collateral pledged to banks has depreciated steeply due to a drastic fall in local stock prices caused by the financial crisis. At the same time, real estate prices have also dropped, with many investors facing a hard time with their own insolvency problems. As a result, the NPL ratio of Taiwan's financial institutions jumped from 4.18 percent at the end of 1997 to 7.48 percent in June 2002.

The *Economist* (November 11, 2000) reported that bad loans among Taiwan's domestic banks rocketed to new highs and a local financial crisis seemed imminent. The *New York Times* (December 5, 2000) and *Business Week* (December 11, 2000) cited Salmon Smith Barney in reporting that the ratio of NPLs among listed banks in Taiwan amounted to more than 6 percent, and because of the narrow definition of NPLs in official statistics, it could in reality be as high as between 10 to 15 percent. On December 6, 2000, Standard & Poors also revised its outlook on Taiwan from "stable" to "negative." According to official statistics by Taiwan's Bureau of Monetary Affairs, the NPL ratio in Taiwan is in fact rising very fast. Many researchers are warning that Taiwan may have a looming banking crisis (Montgomery 2002).

Most existing literature finds that state-owned banks are vulnerable to political lobbying and administrative pressure, resulting in a higher NPL ratio. Novaes and Werlang (1995) find that state-owned financial institutions underperform the market because their portfolios concentrate on NPLs caused by loans to the government. They take Brazil and Argentina as examples. Jang and Chou (1998) adopt the ratio of NPLs to total loans as the measure of risk. They then use 1986–94 data of thirteen Taiwanese banks for an empirical study. The average risk-adjusted cost efficiency of the four provincial-government-owned banks is the lowest among the sample banks.

The famous Coase Theorem says that the assignment of property rights (ownership) will not affect economic efficiency as long as the transaction cost is zero (Coase 1960; Cheung 1968, 1969). However, the real world is imperfect and the transaction cost can be sufficiently high. In an imperfect world with high transaction costs, ownership does matter for economic efficiency, and different ownership types are associated with different transaction costs (Cooter and Ulen 2000). Thus, we can change the conduct and the corresponding performance by changing ownership (Stiglitz 1974, 1998). Therefore, privatization may help a bank resist political lobbying and administrative pressure and hence reduce its politics-oriented loans.

After the Conservative Party led by Margaret Thatcher won the 1979 election, the United Kingdom started an all-out effort to privatize its public enterprises. The privatization experience there has since become an example followed by many developed and developing countries. One of the main objectives of privatization is to improve the efficiency of public enterprises (Bishop, Kay, and Mayer 1994). Most countries achieve privatization through the transfer of ownership, but during the

process of privatization, the government may not transfer all of its shareholdings. As a result, private and public sectors will jointly own an enterprise. Boardman, Eckel, and Vining (1986) define a mixed enterprise as "encompassing various combinations of government and private joint equity participation." In the early 1990s, Taiwan began to pursue privatization of its own public enterprises in order to enhance competition and economic efficiency across all industries.

Deregulation in Taiwan's banking industry consists of two major aspects: privatization of public enterprises and entrance opportunity. During the past twelve years, nine state-owned banks have been privatized; these have been the Chang Hwa Commercial Bank, First Commercial Bank, Hua Nan Commercial Bank, Taiwan Business Bank, Taiwan Development & Trust Corporation, Farmers' Bank of China, Chiao Tung Bank, Bank of Kaohsiung, and Taipei Bank. Taiwan's government in 1991 released the Commercial Bank Establishment Promotion Decree in order to remove the legal barriers to entry into its banking markets. Twenty-four new commercial banks were established thereafter, bringing the total number of domestic commercial banks in Taiwan to forty-eight by 2002. Taiwan's government is still trying to make its banking markets more competitive for public, mixed, and private banks.

In an imperfect (but real) world, public ownership may help improve a bank's performance. Bureaucratic power becomes more important to productivity in a more centralized, constrained, or imperfect economic environment. Tian (2000) explicitly models bureaucratic power and degree of market imperfection into a Cobb-Douglas production function. His model predicts that in an imperfect economic environment, a mixed enterprise maximizes social surplus by balancing bureaucratic procurement power and management incentives.

The major goal of a private enterprise is profit maximization. However, for public enterprises, profit maximization is never the primary goal. Public enterprises are required to achieve particular social ends, such as reducing the unemployment rate, promoting economic development, etc. Most governments set up mixed enterprises so as to combine the economic efficiency of private enterprises with the sociopolitical goals of public enterprises.

Eckel and Vining (1985) provide the first step toward analyzing the performance of mixed enterprises. They suggested that there are three reasons for converting public enterprises to mixed enterprises. First, mixed enterprises easily achieve higher profitability and social goals at a lower cost than public enterprises. Second, mixed enterprises have less bureaucratic restrictions than public enterprises. Third, mixed enterprises need less capital investment from the government than public enterprises. Boardman, Eckel, and Vining (1986) also pointed out that mixed enterprises have three major advantages in comparison with public enterprises. The first advantage is that mixed enterprises demand less capital cost than public enterprises. The second is that mixed enterprises are more efficient than public enterprises,

while the third advantage is flexibility whereby mixed enterprises achieve both profitability and social goals more efficiently than public enterprises.

Boardman, Eckel, and Vining (1986) indicated that the conflict of interest between shareholders and managers reduces mixed enterprise performance. Boardman and Vining (1991) further discussed the effect of government vis-à-vis private ownership on the internal management of an enterprise. They argued that public ownership is inherently less efficient than private ownership since public banks lack sufficient incentive and generate higher cost inefficiencies. They further pointed out (p. 225): "Different ownership conditions affect the extent to which mixed enterprises engage in profit maximization, sociopolitical goal maximization, and managerial utility maximization (or a combination). They also affect the degree of conflict between one owner and another, and between an owner and management." They predicted that mixed enterprises would have more owner conflicts and poorer performances—the worst of both worlds. However, more empirical evidence is required to judge whether or not mixed enterprises have the highest inefficiencies.

Corruption is not unusual in many countries. According to the Global Corruption Report, annually investigated and reported by Transparency International (2003), corruption is still a worldwide phenomenon, especially in developing countries. People pay bribes to buy licenses, jobs, and votes, to reduce taxes, to get more lenient enforcement, etc. (Tullock 1996). Bribery takes place in a corrupt society and as Liu (1996) summarized, corruption has three important aspects: (a) it is a rent-seeking activity induced by deviation from the perfectly competitive market; (b) it is illegal; and (c) it involves some degree of power. With the existence of corruption, the market is no longer perfectly competitive.

The public sector is certainly not the only corruptible sector in society, because the private sector can also be corruptible. In many developing countries, the civil society is still immature and it is a long way from achieving a lifestyle of democracy and the rule of law (Finkel, Sabatini, and Bevis 2000; Johnson and Wilson 2000). People are not used to legal contracting and democratic decision making. As a result, the private sector also resorts to informal connections and illegal means for seeking economic rents. In this case, the 100 percent privatization of a public bank may not be able to decrease its NPL ratio. For example, in Taiwan many financial institutions manipulated by families and/or local political factions have higher rates of NPLs. In this case, government shareholding may help complement their weak internal control.

We will explain how government shareholding affects civil corruption and lobbying and hence NPL ratios. A panel data set of forty banking firms in Taiwan during the period 1996–99 is used for estimation. This paper is organized as follows: Section II provides the theoretical model; Section III presents the data source, econometric modeling, and empirical results; and Section IV sets forth this paper's conclusions.

II. THE THEORETICAL MODEL

Three essential factors need to be taken into account to determine the NPL ratio and ownership: political lobbying, civil corruption, and joint ownership. Interest groups engage in political lobbying in order to affect administrative decisions. The state-owned banks monitored by both the administrative and legislative branches are more vulnerable to political lobbying than private banks. In a country with a corrupt private sector, a private bank can easily become a family-owned business, illegally supplying risky loans to enterprises controlled by the same family. Mafias and local political factions can also control financial institutions for illegal money laundering and for money borrowing. Interaction between public and private owners can also affect loan quality. If they check and balance each other, then the risk of default can be reduced. However, if they collude with each other, then the risk of default will be increased.

In our model, there is a bank under S ($0 \leq S \leq 1$) portion of the government's shareholdings. A bank makes loans to either the public sector or the private sector (or both). Therefore, for any bank the sum of loans ratio to public and private sectors must be exactly one. In every society with limited loans, public and private sectors compete for bank loans. Without losing generality, we assume that initially these two sectors equally split the loans of a bank.

The public sector puts political pressure on this bank in order to gain loans so as to fulfill policy targets or to save enterprises with good political connections. The ratio of extra loans gained by political lobbying is B. The extra benefit of the ratio of politically gained loans to the public sector is $R \cdot B$, where the parameter $R > 0$ represents the marginal benefit to the public sector by increasing its ratio of loans.

Political lobbying becomes more effective in obtaining a loan as the government-held share of the bank increases. It is reasonable to assume that there is a marginally increasing political lobbying cost function. Without loss of generality, the political cost function can be expressed as $\frac{\Gamma}{2}(1-S)^{\alpha}B^2$. The parameter Γ is strictly positive and a higher Γ corresponds to a greater difficulty in political lobbying. The effectiveness of political lobbying is strictly increasing with the share of stocks held by the government, with the parameter $\alpha > 0$, while the political lobbying cost is marginally increasing with the share of privately held stocks and gained loans.

In a corrupt civil society, internal control decreases as the government stock share increases. That is, in a society that lacks civil self-discipline, government regulation may help compensate for the deficiency in a bank's internal control. The extra loans ratio here gained by civil corruption is b. The extra benefit of the ratio of loans gained through civil corruption to the private sector is $r \cdot b$. The parameter $r > 0$ is the marginal benefit to the private sector by increasing its ratio of loans.

Private corruption becomes more effective in obtaining loans as the private stock share increases. Without loss of generality, the civil corruption cost function can be expressed as $\frac{\gamma}{2}S^{\beta}b^2$. The parameter γ is strictly positive and a higher γ corresponds to a greater difficulty in gaining loans through civil corruption. The civil corruption cost is marginally increasing with the share of government-held stocks and gained loans, where the parameter $\beta > 0$.

The ratio of loans gained by the public and private sectors are $\frac{1}{2} + B - b$ and $\frac{1}{2} + b - B$, respectively. This is a lobby game between the public and private sectors to gain extra loans. The strategic interaction between the public and private sectors will affect the equilibrium loan ratios; i.e., both sectors will evenly split the loans under equal (or zero) efforts to gain extra loans. A sector with a relatively higher effort will gain a higher ratio of loans.

Therefore, the net benefit of the government concerning this bank is:

$$G(B) = \underbrace{R(\frac{1}{2} + B - b)}_{\text{Benefit of political lobbying}} - \underbrace{\frac{\Gamma}{2}(1-S)^{\alpha}B^2}_{\text{Cost of political lobbying}}. \tag{1}$$

The net benefit of the private sector concerning this bank is:

$$g(b) = \underbrace{r(\frac{1}{2} + b - B)}_{\text{Benefit of civil corruption}} - \underbrace{\frac{\gamma}{2}S^{\beta}b^2}_{\text{Cost of civil corruption}}. \tag{2}$$

The net benefit maximization problems of public and private sectors concerning this bank are:

$$\underset{B}{\text{Max}}\, G(B) = R(\frac{1}{2} + B - b) - \frac{\Gamma}{2}(1-S)^{\alpha}B^2, \tag{3}$$

$$\underset{b}{\text{Max}}\, g(b) = r(\frac{1}{2} + b - B) - \frac{\gamma}{2}S^{\beta}b^2. \tag{4}$$

We first solve the two sectors' net benefit maximization problems and obtain equilibrium extra loans gained from this bank by political lobbying and civil corruption:

$$[B^*, b^*] = \left[\frac{R}{(1-S)^{\alpha}\Gamma}, \frac{r}{S^{\beta}\gamma}\right]. \tag{5}$$

The second-order conditions are $-\Gamma(1-S)^{\alpha} < 0$ and $-\gamma S^{\beta} < 0$, which always hold under our parameter setup. Note that B^* strictly increases with R, but strictly decreases with Γ. Note that $\frac{\partial B(S)}{\partial S} = \alpha(1-S)^{-\alpha-1}\frac{R}{\Gamma} > 0$ and $\frac{\partial^2 B(S)}{\partial S^2} = \alpha(1+\alpha)(1-S)^{-\alpha-2}\frac{R}{\Gamma} > 0$. That is, B is a strictly convex function of S for all $\alpha > 0$.

As long as the increasing marginal costs (the decreasing returns) assumption is imposed, then B is a strictly convex function of S. Similarly, we also have $\frac{\partial b(S)}{\partial(1-S)} = \beta S^{-\beta-1}\frac{r}{\gamma} > 0$ and $\frac{\partial^2 b(S)}{\partial(1-S)^2} = \beta(1+\beta)S^{-\beta-2}\frac{r}{\gamma} > 0$. That is, b is a strictly convex function of $(1-S)$ for all $\beta > 0$. As long as the increasing marginal costs (the decreasing returns) assumption is imposed, then b is a strictly convex function of $(1-S)$.

Not every case of loans gained by lobbying will necessarily turn out to be nonperforming, but part of these lobbying-gained loans do become nonperforming; i.e., a proportion Ψ of loans to the public sector and a proportion ψ of loans to the private sector will become nonperforming, which will make up the total amount of NPLs. The variable U is a nonnegative random variable with the mean $\bar{U} > 0$, representing the stochastic NPL ratio. Therefore, this bank's NPL ratio caused by political lobbying (*NPPL*) is $\Psi(\frac{1}{2} + B - b)$ and the NPL ratio caused by civil corruption (*NPCC*) is $\psi(\frac{1}{2} + b - B)$. Moreover, there is a joint ownership effect on this bank's NPL ratio (*NPJO*): $\rho S^{\theta}(1-S)^{1-\theta}$, with $0 < \theta < 1$. The coefficient ρ is positive if the two sectors act collusively to obtain loans, and is negative if the two sectors check and balance each other. Note that the joint ownership effect becomes zero if the bank is purely public ($S = 1$) or purely private ($S = 0$).

To sum up, we can express the ratio of this bank's total NPLs (*TNPL*) function as:

$$\begin{aligned} TNPL &= \Psi(\frac{1}{2} + B - b) + \psi(\frac{1}{2} + b - B) + \rho S^{\theta}(1-S)^{1-\theta} + U \\ &= NPPL + NPCC + NPJO + U. \end{aligned} \tag{6}$$

The expected ratio of this bank's total NPLs is:

$$\begin{aligned} E(TNPL) &= \Psi(\frac{1}{2} + B - b) + \psi(\frac{1}{2} + b - B) + \rho S^{\theta}(1-S)^{1-\theta} + \bar{U} \\ &= NPPL + NPCC + NPJO + \bar{U}. \end{aligned} \tag{7}$$

Substituting (5) for (7), this bank's expected NPL ratio can be explicitly expressed as a function of the government stock share:

$$E(TNPL(S)) = \frac{1}{2}(\Psi + \psi) + (\Psi - \psi)[B(S) - b(S)] + \rho S^{\theta}(1-S)^{1-\theta} + \bar{U}. \tag{8}$$

Note that $\frac{\partial[B(S) - b(S)]}{\partial S} = \frac{\partial B(S)}{\partial S} + \frac{\partial b(S)}{\partial(1-S)} > 0$; that is, without the joint ownership effect, the ratio of total NPLs is strictly increasing [decreasing] with the share of government stockholdings if $\Psi - \psi > [<] 0$.

Figures 1 to 6 depict the relation between the government's stock share and the

Fig. 1. Without Joint Ownership Effect ($\Psi - \psi > 0$)

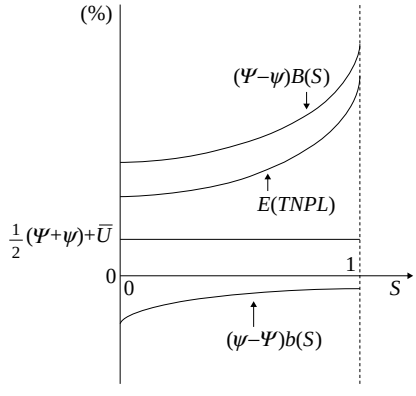


Fig. 2. Without Joint Ownership Effect ($\Psi - \psi < 0$)

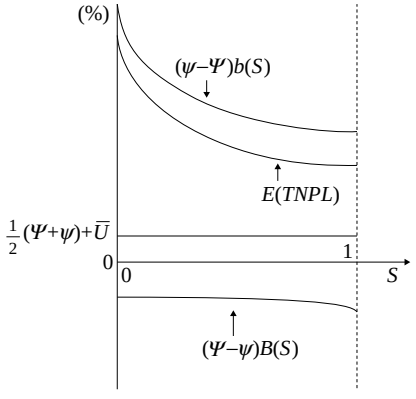


Fig. 3. With Joint Ownership Effect ($\Psi - \psi > 0$ and $\rho < 0$)

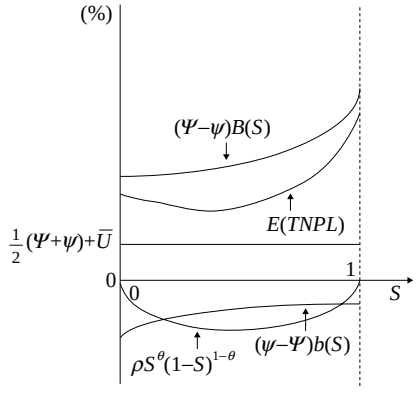


Fig. 4. With Joint Ownership Effect ($\Psi - \psi < 0$ and $\rho < 0$)

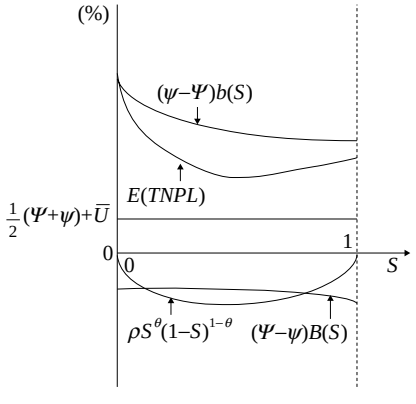


Fig. 5. With Joint Ownership Effect ($\Psi - \psi > 0$ and $\rho > 0$)

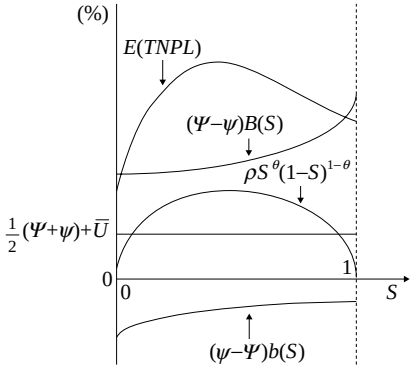
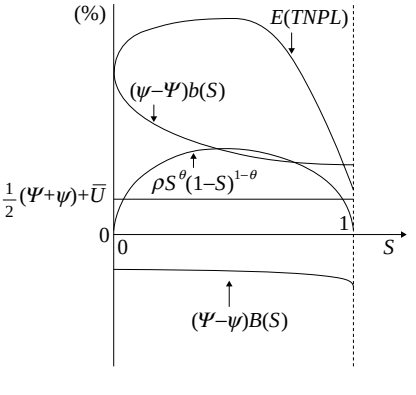


Fig. 6. With Joint Ownership Effect ($\Psi - \psi < 0$ and $\rho > 0$)



TNPL ratio from Equation (8). Without the joint ownership effect, the expected NPL ratio will be strictly increasing (when $\Psi - \psi > 0$) or decreasing (when $\Psi - \psi < 0$) with the government's stock share. The former is when the public sector has a higher NPL ratio and the associated NPL ratio ranking is: public, mixed, and private banks (see Figure 1). The latter is when the civil sector has a higher NPL ratio and the associated *TNPL* ranking is: private, mixed, and public banks (see Figure 2). In both cases, our theoretical model predicts that a mixed bank on average will have a medium *TNPL* and the total NPL ratio will be either upward- or downward-sloping in accordance with the share of government stockholdings.

When the joint ownership effect on the NPL ratio is negative and its magnitude is sufficiently large, then a mixed bank may have the lowest NPL ratio, and the relation between the NPL ratio and government shareholdings is U-shaped (Figures 3 and 4). In other words, mixed bank ownership minimizes the NPL ratio by balancing political lobbying pressure and civil corruption. When the joint ownership effect on the NPL ratio is positive and sufficiently large, then a mixed bank may have the highest NPL ratio, and the relation between the NPL ratio and government shareholdings is inversely U-shaped (Figures 5 and 6). In other words, mixed bank ownership maximizes the NPL ratio because of the collusion between the public and private owners. From the above discussion, we obtain the following propositions:

PROPOSITION 1. *Without the joint ownership effect, a bank's NPL ratio is strictly decreasing or increasing in accordance with government shareholdings.*

PROPOSITION 2. *If the joint ownership effect on NPL ratios is negative and its magnitude is sufficiently large, then the relation between a bank's NPL ratio and government shareholdings is U-shaped.*

PROPOSITION 3. *If the joint ownership effect on NPL ratios is positive and sufficiently large, then the relation between a bank's NPL ratio and government shareholdings is inversely U-shaped.*

III. EMPIRICAL ANALYSIS

Our data set consists of forty Taiwanese commercial banks (all established before 1996) during the period of 1996–99. In 1996 this data set consisted of four public commercial banks (where the government's shareholding in each bank was almost 100 percent), ten mixed commercial banks (where the government's shareholding ranged from 1 to 99 percent), and twenty-six private commercial banks, for a total of forty commercial banks in our sample set. Through the government's ongoing process of privatization, by the end of 1999 there were two public commercial banks, ten mixed commercial banks, and twenty-eight private commercial banks. Our data sources were financial releases and public statements and Taiwan Economic News Service reports.

When analyzing the panel data, ordinary least squares (OLS) estimators may be inconsistent and/or meaningless if heterogeneity exists across firms (Hsiao 2003). The fixed- and random-effects models can take into account the heterogeneity across firms by allowing variable intercepts. The choice among these three models is based on some statistical tests: *F*-test (the OLS model versus the fixed-effects model), LM test (the OLS model versus the random-effects model), and the Hausman test (the random-effects model versus the fixed-effects model). We will employ these three tests to choose the best model to perform our empirical analysis. The dependent variable is the rate of NPLs for commercial banks.

As shown by our theoretical model, state-owned banks monitored by both the administrative and legislative branches are easily distorted by interest groups which engage in heavy political lobbying. The size of government shareholding may hence be positively related to the rate of NPLs. However, private banks in the corrupt private sector can easily become family-owned businesses which may supply risky loans to enterprises controlled by the same family. This indicates that private banks might possibly have higher rates of NPLs. The joint ownership effect depends on whether or not the two types of owners check and balance each other. These three effects suggest that a downward-sloping, upward-sloping, U-shaped, or inversely U-shaped effect may exist for government shareholding on the NPL ratio. In other words, mixed banks might have the highest, medium, or lowest rate of NPLs. We will hence include the linear and quadratic terms of government shareholding in the empirical model. Coefficients of the linear and quadratic terms can be used to check the effects of government shareholding on the NPL ratio.

Large-sized banks have more resources to evaluate and to process loans. These can improve the quality of loans and thus effectively reduce the rate of NPLs. A bank's size is hence expected to be negatively related to NPLs, but at a diminishing rate.

The return on loans is a bank's major source of revenue. Banks sometimes have to accept some risky loans because of the pressure to create revenue. If banks can successfully diversify their sources of revenues, then they should be able to ease the pressure for revenues from loans and thus effectively reduce the rate of NPLs. We apply the entropy index to measure the degree of diversification. It is defined as:

$$\text{entropy index} = -\sum_{j=1}^{n} S_j \ln S_j, \tag{9}$$

where S_j is the share of jth revenue and n is the number of revenue sources. The larger the entropy index is, the higher the bank's diversification is. We consider three types of bank revenue: the provision of loan services (including business and individual loans), portfolio investment (mainly government securities and equity shares, along with public and private enterprise securities), and noninterest income (including transaction fees, revenue from securities investment, and other business revenue).

In 1991 Taiwan's government released the Commercial Bank Establishment Promotion Decree in order to ease the legal barriers to entry into its banking markets. Banks established after 1991 have quite different business cultures and/or strategies in comparison with those established before 1991. Furthermore, the older a bank is, the more the accumulated NPLs they seem to have. Therefore, this study consists of a dummy variable to represent whether or not a bank was established after 1991.

The *Economist* (November 11, 2000), the *New York Times* (December 5, 2000), and *Business Week* (December 11, 2000) all mentioned that Taiwan might suffer its own version of a financial crisis because NPLs had risen so dramatically. Our data set also shows this pattern where the average NPL ratios were 4.39, 4.42, 4.72, and 5.52 from 1996 to 1999, respectively. Therefore, we include a variable to represent the time factor. According to the pattern of the NPLs, we expect the coefficient of the time variable to be positive. As such, the empirical model is specified as:

$$\begin{aligned} NPL_{nt} = {} & \beta_{0n} + \beta_1 SHARE_{nt} + \beta_2 SHARESQ_{nt} + \beta_3 SIZE_{nt} + \beta_4 SIZESQ_{nt} \\ & + \beta_5 ENTROPY_{nt} + \beta_6 D1991_{nt} + \beta_7 TIME_{nt} + \varepsilon_{nt}, \\ & n = 1, \ldots, N, \;\; t = 1, \ldots, T, \end{aligned} \tag{10}$$

where ε_{nt} are random disturbances with mean 0 and variance σ_ε^2; $\beta_{0n} = \beta_0$ for all n in the OLS model; β_{0n} are fixed in the fixed-effects model; $\beta_{0n} \overset{iid}{\sim} N(\beta_0, \sigma_\beta^2)$ and both β_{0n} and ε_{nt} are independent in the random-effects model. The definition and sample mean of the variables in Equation (10) are presented in Table I.

The empirical results of the relationship between government shareholding and NPLs are represented in Table II. Since *D1991* is a time-invariant dummy variable, the fixed-effects model encounters the problem of collinearity if we include this

TABLE I

VARIABLE DEFINITIONS AND SAMPLE MEANS

Variables	Description	Sample Mean
NPL	The rate of NPLs	4.7614
SHARE	The percentage of government shareholdings	17.8971
SHARESQ	Square of *SHARE* divided by 100	12.9688
SIZE	Real assets (NT$100 billion)[a]	5.4552
SIZESQ	Square of *SIZE* divided by 100	4.6316
ENTROPY	Entropy index for revenues[b]	0.1152
D1991	1 if the bank was established after deregulation; 0 otherwise	0.4000
TIME	Time factor, the year of the data period minus 1995	2.5000

[a] We divide the nominal assets by the GDP deflator (1996 = 1.00) to obtain real assets.

[b] There are three types of revenue: the provision of loan services (including business and individual loans), portfolio investment (mainly government securities and equity shares, along with public and private enterprise securities), and noninterest income (including transaction fees, revenue from securities investment, and other business revenues).

TABLE II

EMPIRICAL RESULTS OF GOVERNMENT SHAREHOLDING AND NONPERFORMING LOANS

Variables	The Random-Effects Model		The Fixed-Effects Model	
	Coefficients	*t*-ratio	Coefficients	*t*-ratio
Constant	7.0396***	7.570	—	—
SHARE	–0.0630**	–2.264	–0.0282	–0.630
SHARESQR	0.0496**	2.022	0.0323	0.911
SIZE	–0.3845***	–3.480	–0.6239**	–2.021
SIZESQR	0.1362***	3.457	0.2208**	2.013
ENTROPY	3.4269	0.789	14.0402**	2.388
D1991	–4.8094***	–5.288	—	—
TIME	0.4807***	6.000	0.5639***	4.760
R^2	0.3416		0.9187	
F-test (d.f.) [*p*-value]	28.329 (39, 114) [0.000]			
LM test (d.f.) [*p*-value]	163.45 (1) [0.000]			
Hausman test (d.f.) [*p*-value]	7.5 (6) [0.277]			
Number of cross-sections (observations)	40 (160)			

Note: Since *D1991* is a time-invariant dummy variable, we exclude this variable when we estimate the fixed-effects model and perform the *F*-test, the LM test, and the Hausman test.
** *p*-value ≤ 0.05, *** *p*-value ≤ 0.01.

time-invariant variable. Hence, when estimating the fixed-effects model and performing the *F*-test, the LM test, and the Hausman test, we have to exclude the time-invariant dummy variable *D1991*. The *F*-test and the LM test suggest that both fixed- and random-effects models are better than the OLS model; in other words, heterogeneity exists across firms. Moreover, based on the result of the Hausman test, the random-effects model is better than the fixed-effects model. Hence, we only interpret the random-effects model which has been reestimated by adding the time-invariant variable *D1991*.

The estimated coefficients not only significantly affect NPLs, but are also consistent with the expected signs except for the insignificant coefficient of entropy index. The quadratic effects of the coefficients of government shareholding on NPLs imply that the NPL ratio decreases as the government shareholding in a bank rises (up to 63.51 percent), while after that the NPL ratio increases. These results support the Proposition 2 of our theoretical model. That is, mixed banks have the lowest rate of NPLs among Taiwanese public, mixed, and private commercial banks. In other words, the joint ownership effect on NPL ratios should be negative and its magnitude is sufficiently large in Taiwan's banking industry.

Political lobbying and private corruption both increase the NPL ratio in Taiwan. When the government share in a commercial bank has been greater than 63.51

TABLE III

PERFORMANCE OF TAIWAN'S BANKS WHEN CLASSIFIED BY GOVERNMENT SHAREHOLDING RATIOS

Indicators of Performance (Mean)	Government Shareholding Ratios (%)				
	0–20	20–40	40–60	60–80	80–100
Number of banks (1996–99)	118	6	12	6	18
Capital (NT$ million)	5,627.17	22,924.00	17,037.08	5,739.17	24,915.61
Liquidity ratio (current asset / current liability)	421.1914	199.5917	202.2242	184.5867	575.4517
NPL ratio (%)	5.1395	5.2500	4.4667	2.8633	3.0506
Profit rate (%):					
Deposit / loan	1.0465	1.2830	0.9363	1.9365	0.9702
Return on assets	2.9541	0.5850	10.0133	9.0633	0.9611
Return on equity	4.4359	9.2250	10.9950	6.5233	9.3646
Operating cost / revenue	76.19159	73.18394	71.30772	81.11584	73.82267

Note: The total number of samples is 4 (periods) × 40 (per period) = 160.

percent, the rate of the bank's NPLs decreases following privatization. However, when the government share has been less than 63.51 percent, the NPL ratio increases through privatization.

Table III provides some evidence for the existence of the inversely U-shaped relationship between government shareholding ratios and various indicators that show the performance of banks such as returns on assets (ROA) and returns on equity (ROE). When checked against government shareholding ratios, indicators of profit rates reveal the inversely U-shaped relations. Banks with the best financial performance all fall in the range of government shareholding ratios between 40 and 60 percent. This further confirms the best performance for the mixed ownership of commercial banks in Taiwan.[1]

Bank size is negatively related to the rate of NPLs, which supports our argument that larger banks have more resources for determining the quality of loans. The positive coefficient of the quadratic term implies that this effect appears at a diminishing rate. According to the empirical results, the optimal bank size on average to achieve the lowest rate of NPLs is NT$14.12 trillion.

The coefficient of the entropy index is the only insignificant coefficient in the empirical model. One possible explanation is that bank revenue mainly comes from loans. The data set shows that the average revenue share resulting from loans is 97.78 percent. The highest share is 99.22 percent and the lowest is 92.41 percent. Hence, revenue source diversification cannot effectively reduce the rate of NPLs.

The significant time effect suggests that the NPL ratios steadily increased from

[1] We gratefully acknowledge an anonymous referee's recommendation to report estimates by both random-effects and fixed-effects models in Table II and to construct Table III, which provides more information to support our findings.

1996 to 1999. This may reflect the fact that the Asian financial crisis did affect Taiwan's banking industry. The coefficient of the time-invariant dummy variable *D1991* is significantly different from zero, indicating that the random-effects model should include this variable. This empirical result indicates that banks established after deregulation, on average, have a lower NPL ratio than those established before deregulation. More precisely, the NPL ratio for banks established after deregulation, on average, is 4.81 percent lower than that for banks established before deregulation.

IV. CONCLUDING REMARKS

In this paper we first established a theoretical model to predict the relation between government shareholding in commercial banks and the ratio of NPLs. When both public and private sectors are corrupt (imperfect), the relationship between government shareholding and the rate of NPLs can be upward-sloping, downward-sloping, U-shaped, or inversely U-shaped. Therefore, a mixed bank on average may have the highest, medium, or the lowest NPL ratio.

We then adopted a panel data set with forty Taiwanese commercial banks during 1996–99 for empirical analysis. Based on the results of the Hausman test, the random-effects model was shown to be better than the fixed-effects model. Our major empirical findings in this paper are: (1) the rate of NPLs decreases as government shareholding in a bank rises (up to 63.51 percent), while thereafter it increases; (2) bank size is negatively related to the rate of NPLs; (3) revenue source diversification cannot effectively reduce the rate of NPLs; (4) rates of NPLs steadily increased from 1996 to 1999; and (5) banks established after deregulation, on average, have a lower rate of NPLs than those established before deregulation.

This paper's findings advocate the following propositions: (1) in a society with an imperfect private sector, government shareholding may help improve bank performance; and (2) in an economic environment with high transaction costs, ownership types will affect economic efficiency. This also provides further evidence why mixed ownership can be an efficient ownership type and explains (justifies) its existence.

For the theoretical part, this paper uses a simple lobby game between the public and private sectors to derive theoretical propositions. However, other game-theoretical frameworks (such as the contract theory) may also be applied. A future study may incorporate more intricate explanatory variables that represent profits of investment by government and private institutions. The information structure among the bank management and public and private shareholders is also worth taking into account.[2]

[2] We gratefully acknowledge the advice of an anonymous referee to explicitly express the limitations of the current theoretical model.

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