The Asian Financial Crisis and Non-performing Loans: Evidence from Commercial Banks in Taiwan

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Financial crises have been a worldwide phenomenon in the last decade. This study tries to investigate how the 1997 Asian financial crisis affects the non-performing loans of Taiwan. We adopt a panel data set with 40 Taiwanese commercial banks (established before 1996) for the period of 1996-1999 for empirical analysis. We find that both banks’ loans and sizes are positively related to the rate of non-performing loans, but at a diminishing rate; rates of non-performing loans steadily increased from 1996 to 1999, possibly resulting from the 1997 Asian financial crisis; banks established after deregulation, on average, have a lower rate of non-performing loans than those established before deregulation.

I. Introduction

Has Taiwan come to a local financial crisis? The Economist pointed out, Nov. 11, 2000, that bad loans in Taiwanese domestic banks reached new highs, and that a local financial crisis is immediate. The New York Times, Dec. 5, 2000, and Business Week, Dec. 11, 2000, followed suit by citing Salmon Smith Barney that the non-performing loans (NPL) ratio among listed banks in Taiwan had amounted to over 6 percent, and because of the narrow definition in official non-performing loan statistics, the NPL ratio could in reality be as high as between 10 to 15 percent. Standard & Poors also revised its outlook on Taiwan from stable to negative on December 6, 2000.

Loans are one of the major outputs provided by a bank, but the loan is a risk output. There is always an ex ante risk for a loan to eventually become non-performing. Non-performing loans can be treated as undesirable outputs or costs to the bank that does the loaning, which decrease the bank’s performance (Chang, 1999). The risk from NPL arises as the external economic environment becomes worse off such as economic depressions (Sinkey and Greenawalt, 1991). Since the 1997 Asian financial crisis, NPL have swiftly accumulated in many Asian economies (Chang, 1998; Lauridsen, 1998; Robinson and Posser, 1998; Wade, 1998). Controlling NPL is thus very important for both an individual bank’s performance (McNulty et al., 2001) and an economy’s financial environment.

Financial crises have been an increasing international phenomenon in the last decade, possibly a result of deregulation and liberation of financial systems. Taiwan’s government in 1991 released the Commercial Bank Establishment Promotion Decree in order to relieve the legal entrance barriers to banking markets. The banking industry faced new competition and shocks when deregulation began to take place, and Taiwan’s government is still today trying to make its banking markets more competitive. Because
of the increasing competition, many banks have expanded into multiple ventures, effectively increasing their running risks, which has led to declines in productivity and management efficiency. Banks established after deregulation seem to have different business cultures and/or strategies in comparison to those established before deregulation. Furthermore, those banks established after deregulation are private, whereas public and/or mixed banks are all established before deregulation. State-owned banks monitored by both the administrative and legislative branches are easily distorted by interest groups engaged in political lobbying. As a result, the difference between old and new banks is worth further investigation.

The Asian financial crisis is a good example of something that has greatly impacted Taiwan’s economy. Listed companies are now reportedly facing a series of their own financial crisis. Though on the surface the banks have collaterals for their loans, due to a steep fall in the local stock market caused by the financial crisis, stock collateral pledged to banks have grown into a silent crisis for banks. According to statistics by the Bureau of Monetary Affairs, Ministry of Finance, the NPL ratio is indeed rising. This study will examine how the Asian financial crisis has affected the NPL of Taiwan.

This paper is organized as follows: Section II consists of the data source and econometric model. Empirical results are discussed in section III. Section IV concludes this paper.

II. Data Source and Empirical Model

Our data set consists of 40 Taiwanese commercial banks, established before 1996, for the period of 1996 to 1999. The data sources are financial releases and public statements and Taiwan Economic News Service reports. Since we have a four-year panel data set, we deflate the nominal variables by a GDP deflator with 1996 as the base period.

When analyzing the panel data, ordinary least squares (OLS) estimators may be inconsistent and/or meaningless if there exists heterogeneity across firms (Hsiao, 1986). The fixed- and random-effects models can take into account the heterogeneity across firms by allowing variable intercepts. Our choice among these three models is based on some statistical tests: F-test (the OLS model vs. the fixed-effects model), LM test (the OLS model vs. the random-effects model), and the Hausman test (the random-effects model vs. the fixed-effects model). We will employ these three tests to choose the best model to perform an empirical analysis. The dependent variable is the rate of non-performing loans.

Firms with large loans may experience a rapid accumulation of human capital through learning-by-doing. This may result in the management being more effective, production processes becoming more efficient, and employees being more productive. These will help keep NPL down. We further assert that the marginal contribution of loans on the NPL ratio is declining.

Large-sized banks have more resources to evaluate and process their loans. They can improve the quality of loans and thus effectively reduce the rate of NPL. However, the
effect will decline as a bank's size increases. A bank's size hence is anticipated to decrease NPL, but at a diminishing rate.

The 1997 Asian financial crisis has greatly impacted almost all Asian economies, as evidenced by NPL swiftly accumulating in many Asian countries (Lauridsen, 1998; Robinson and Posser, 1998; Wade, 1998). *The Economist* (November 11, 2000), *The New York Times* (December 5, 2000), and *Business Week* (December 11, 2000) all have mentioned that Taiwan might suffer its own version of a financial crisis, because NPL have risen steadily. Our data set also shows a pattern where the average rates of NPL are 4.39, 4.42, 4.72, and 5.52 for 1996 to 1999, respectively. Therefore, we include a variable to represent a time factor. According to the pattern of the NPL, we expect the coefficient of the time variable to be positive. This study also consists of a dummy variable to represent whether or not a bank was established after 1991, because that is the year that Taiwan's government liberated its commercial banking industry. Those banks established after 1991 (deregulation) are all private, while public and/or mixed banks are all established before 1991. Since state-owned banks are monitored by both the administrative and legislative branches, they are easily distorted by interest groups engaged in political lobbying. Hence, those banks established before deregulation are expected to have higher NPL ratios.

### III. Empirical Result

According to the above discussion, the empirical model is specified as:

\[
NPL_{nt} = \beta_0 + \beta_1 Loan_{nt} + \beta_2 LoanSQ_{nt} + \beta_3 Size_{nt} + \beta_4 SizeSQ_{nt} + \beta_5 D1991_{nt} + \beta_6 Time_{nt} + \varepsilon_{nt}, \quad n = 1, \ldots, N, \quad t = 1, \ldots, T,
\]

where \( \varepsilon_{nt} \) are random disturbances with mean 0 and variance \( \sigma^2 \); \( \beta_{0n} = \beta_0 \) for all \( n \) in the OLS model, \( \beta_{0n} \) are fixed in the fixed-effects model, \( \beta_{0n} \) are \( iid N(\beta_0, \sigma^2) \), and both \( \beta_{0n} \) and \( \varepsilon_{nt} \) are independent in the random-effects model. The definition of the variables and the empirical result are presented in Table 1.

Since \( D1991 \) is a time-invariant dummy variable, the fixed-effects model encounters the problem of collinearity if we include this time-invariant variable. Hence, when we perform the F-test, the LM test, and the Hausman test, we 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, there exists heterogeneity across firms. Moreover, based on the result of the Hausman test, the random-effect model is better than the fixed-effects model. Hence, we only present and interpret the random-effect model in which the model has been re-estimated by adding the time-invariant variable \( D1991 \).

The estimated coefficients not only significantly affect NPL, but also are consistent with the expected signs. The quadratic effects of the loans' coefficients imply that the NPL ratio decreases a bank's loans go higher up to NTS$763.1 billion (with 1996 as the
based period), while the NPL ratio thereafter increases. This suggests that loans create an effect of learning-by-doing, but at a diminishing rate.

A bank’s size is positively related to the NPL ratio, which supports our argument that larger banks have more resources that will help improve the quality of loans. The positive coefficient of the quadratic term implies that this effect appears at a diminishing rate. According to the empirical result, an optimal bank’s real assets (with 1996 as the base period) that will achieve on average the lowest NPL ratio are those banks with assets of NT$ 14.59 trillion.

The significant time effect suggests that the NPL ratios steadily increased from 1996 to 1999. This may reflect the fact that the Asian financial crisis did in fact affect Taiwan’s bank industry. One possible explanation for Taiwan being affected by the crisis is from the fact that it saw a 29% percent decrease in exports to the five nations in ASEAN (Association of South-East Asian Nations). This, of course, led to a decrease in cash flow to its manufacturing sector, which in turn could no longer payback the loans.

The coefficient of the time-invariant dummy variable $D_{1991}$ is significantly different from zero with p-value less than 0.0001. This indicates that the random-effects model should include this variable. This empirical result illustrates that banks established after the year of deregulation have a lower NPL ratio on average than those established before deregulation. More precisely, the rate of NPL for banks established after deregulation were an average 5.82 percent lower than that for banks established before deregulation. This may reflect the fact that banks established after 1991 (deregulation) are all private, but public and/or mixed banks are all established before 1991. The public and/or mixed banks monitored by both the administrative and legislative branches are easily distorted by interest groups engaged in political lobbying. Hence, this may result in the higher rate of NPL for those banks established before regulation.

**IV. Conclusion**

Financial crises have sprung up globally in the last decade, with deregulation and a liberation of financial systems being two possible important factors. Furthermore, both financial deregulation and liberation have played a pivotal role in Taiwan’s financial development and stability. This study tries to investigate how the Asian financial crisis affected Taiwan’s NPL ratio. We adopt a panel data set with 40 Taiwanese commercial banks during 1996-1999 for empirical analysis. Based on the results of the $F$-test, the LM test, and the Hausman test, the random-effects model is used to estimate the interested parameters. Empirical results show: (1) Both banks’ loans and their sizes are positively related to the NPL ratio, but at a diminishing rate. (2) Rates of NPL steadily increased from 1996 to 1999, possibly resulting from the Asian financial crisis. (3) Banks established after deregulation on average have a lower NPL ratio than those established before deregulation.

**Footnote**

1 The spot exchange rate was US$ 1 = NT$ 34.521 on November 5, 2001.
Table 1. Empirical Results of The Random-Effects Model

<table>
<thead>
<tr>
<th>Variables</th>
<th>Definition</th>
<th>Coefficients</th>
<th>t-ratio</th>
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<tbody>
<tr>
<td>Constant</td>
<td>The mean of random intercepts.</td>
<td>9.6794***</td>
<td>13.032</td>
</tr>
<tr>
<td>Loan</td>
<td>Real business and individual loans (NT$ 100 billion).</td>
<td>-2.1312***</td>
<td>-7.329</td>
</tr>
<tr>
<td>LoanSQ</td>
<td>Square of LOAN divided by 100.</td>
<td>13.9640***</td>
<td>8.288</td>
</tr>
<tr>
<td>Size</td>
<td>Real assets (NT$ 100 billion).</td>
<td>-0.2291*</td>
<td>-1.784</td>
</tr>
<tr>
<td>SizeSQ</td>
<td>Square of SIZE divided by 100.</td>
<td>0.0785*</td>
<td>1.724</td>
</tr>
<tr>
<td>D1991</td>
<td>1 if the bank was established after deregulation; 0 otherwise.</td>
<td>-5.8218***</td>
<td>-6.047</td>
</tr>
<tr>
<td>Time</td>
<td>Time factor, the year of the data periods minus 1995.</td>
<td>0.6851***</td>
<td>15.665</td>
</tr>
</tbody>
</table>

| F-test (d.f.) [p-value] | 30.93 (39, 116) [0.000] |
| LM test (d.f.) [p-value] | 182.50 (1) [0.000] |
| Hausman test (d.f.) [p-value] | 6.11 (5) [0.295] |

| $R^2$ | 0.3105 |

| Number of Cross-sections (Observations) | 40 (160) |

\(a\) Since \(D1991\) is a time-invariant dummy variable, we exclude it when we perform the \(F\)-test, the LM test, and the Hausman test.

Note: (1) The dependent variable is the NPL ratio. We deflate the nominal variables, Loan, LoanSQ, Size, and SizeSQ by the GDP deflator (1996 = 1.00) to obtain the real variables.

(2) *: P-value ≤ 0.1; **: P-value ≤ 0.05; ***: P-value ≤ 0.01.
References


