

Does First Financial Reform in Taiwan Improve the Performance of Focused Financial Firms?

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Abstract

We examine the impact of first financial reform in Taiwan that removes the separation of commercial and investment banking activities on the performance of focused financial firms. Applying data envelopment analysis (DEA), we find that they fail to achieve efficiency gains in the post-reform era. In particular, commercial banks experience lower technical and pure technical efficiencies while insurance companies and securities firms also show little improvement in operating performance. Our findings suggest that the benefits of financial reforms on the diversified financial holding companies documented in recent studies do not extend to these smaller focused financial firms. The overall efficiency gains driven by the financial deregulation is therefore rather limited. As a result, further consolidations in the financial sector may continue as smaller focused financial firms find it difficult to compete against their larger and more efficient financial conglomerates.

Keywords: Focused financial firms, Bank efficiency, First financial reform, Financial deregulation

JEL classification: G21, G28

1. Introduction

Following the global trend of financial liberalization for more than a decade, Taiwan introduced the Financial Institutions Merger Act in 2000 and Financial Holding Company Act in 2001 that removes the separation of commercial and investment banking activities imposed on its financial firms. Known as the first financial reform, it mirrors the Financial Services Modernization Act of the U.S. and the ‘Big Bang’ reform of Japan in 1999. In particular, it encourages domestic banks to merge with local securities firms, insurance companies, and asset management firms to form large financial holdings companies.¹

Recent empirical studies suggest that the recent reform have delivered what they were intended to achieve. Hsiao et al. (2010) report that commercial banks which are often an important part of larger financial holding companies (FHCs), exhibit higher operating efficiency in the post-reform period after an initial decline during the implementation period. They show that banks of higher operating efficiency are characterized by lower non-performing loan ratios and higher capital adequacy ratios. Wang et al. (2008) find that Taiwan’s stock market is receptive to the passage of the

¹Subsequent to the first financial reform, the so-called second-stage financial reform in 2004 encouraged further consolidation in the financial sector that was aimed to create fewer but larger financial institutions. However, very few new mergers took place. The objective of the second-stage reform therefore failed to materialize.

financial reforms. Securities firms, in particular, experience the highest abnormal returns among financial sectors because they are often viewed as good target firms by FHCs. Lo and Lu (2009) who examine the operating efficiency of FHCs document that larger FHCs tend to outperform their smaller counterparts. It suggests that FHC size is positively related to performance.

However, whether smaller and focused financial firms (FFFs thereafter) also benefit from the recent financial reforms remains an open question? Extant literature which includes studies about Taiwan banking reforms tends to focus mostly on the efficiency gains of large financial institutions with diverse banking activities (see e.g. DeYoung et al. (2009) for a comprehensive review of the literature). Little attention is paid to the performance of FFFs or non-FHCs that specialize in banking, insurance, or securities services.

Evanoff and Ors (2008) suggest that a more viable competitor such as a bank holding company due to consolidation in banking sector driven by banking reforms is likely to put competitive pressure on FFFs to improve their operating efficiency.² It follows that potential efficiency gains of FFFs induced by the recent financial reforms should be examined as a part of the total efficiency benefits in the financial sector.

To this end, this study examines changes in operating efficiency, if any, of FFFs

² We use independent or focused financial firms interchangeably in this paper.

prior to and after the financial reform. Accordingly, facing with greater competition against larger FHCs that tend to enjoy the advantages of scale and scope economies, and the benefits from cross-selling financial services by offering a “one-stop financial services”, FFFs would need to improve the operating efficiency to compete with their larger counterparts in the post-financial reform era.

Surprisingly, we find that commercial banks experience lower technical efficiency in the post-financial reform period. Input utilization by commercial banks tends to be low and has not improved after the first financial reform. Our results therefore differ from Evanoff and Ors (2008) who report efficiency gains by U.S. focused banks. Furthermore, insurance companies and securities firms also fail to uplift their operating efficiency. Taken together, FFFs, on average, make little efficiency gains in the post-reform era.

Furthermore, the lack of improvement in the performance of these FFFs in the post-reform period is not driven by failed banks which were either forced to merge with healthier banks or administered by Resolution Trust Corporation (RTC) that was set up to dissolve troubled banks. Controlling for the negative impact of mergers with failed banks does not change our findings that the efficiencies of FFFs fail to improve after the financial reform.

In sum, our results suggest that further consolidation in the financial services sectors

may continue in the foreseeable future. FFFs which fail to stay competitive after first financial reform may likely be acquired by larger and more efficient FHCs that result in fewer but larger financial institutions in the sector.

Overall, the paper fills a gap in the extant literature that tends to overlook the performance of smaller FFFs after financial deregulation. In particular, investigating the impact of financial reforms on the performance of narrowly-focused financial firms is important for a market such as Taiwan where it is characterized by a large presence of 45 FFFs.

It is also important to note that the majority of prior studies tend to focus only on commercial banks. The scope of our study is therefore broader as we also include insurance companies and securities firms. Equally important, most studies that examine the impact of bank mergers are in industrialized countries especially those in Europe (e.g. Diaz et al. (2004), Campa and Hernando (2006), and Beccalli and Frantz (2009)) and the U.S. (e.g. Estrella 2001, Knapp et al. (2006), Berger and Dick (2007), and Delong and DeYoung (2007)). The recent financial reforms in Taiwan, an emerging market, which follow closely in the spirit of the U.S., provide us with an opportunity to compare the outcomes of the reforms with those in the U.S.

The rest of the paper is structured as follows. Section 2 introduces the background

of financial industry liberalization in Taiwan. Section 3 discusses the methodology and Data Envelopment Analysis (DEA). Section 4 describes the sample, and measurement of input and output variables. Section 5 presents the empirical results and the last section concludes the paper.

2. Financial services liberalization in Taiwan

In responding to over-regulation that stifled market competition and restrained market mechanisms, Taiwan financial authority granted new bank charters since 1991. At its peak in 2001, there were 53 local banks and 38 foreign bank branches. Given that the financial market is small, the rapid growth in banking industry however comes at the expense of small market shares and low degree of product differentiations among banks. Although financial liberalization brought more competition, banks' profit margins were squeezed. The quality of banks' assets also deteriorated during the 1990s when they were more likely to acquire riskier assets.

According to Financial Supervisory Commission (Financial Statistics (2009)), local banks experienced a sharp decline in return on equity (ROE) and return on assets (ROA) between 1990 and 2001 from 20.79% to 3.60% and from 0.9% to 0.27% respectively. Non-Performing Loan (NPL) ratios also climbed sharply from 2.88% to 11.27%

between 1995 and 2001.

To solve the “over-banking” problem and to improve the performance of banks, the Financial Institutions Merger Act and the Financial Holding Companies Act were passed in 2000 and 2001 respectively that remove the barrier of mergers among banks, insurance companies, and securities firms. As part of the financial reform, financial institutions are required to lower their NPL ratio and improve bank liquidity.

Along with the legislatures, the Act for the Establishment and Administration of the Financial Restructuring Fund in 2001 was launched to set up funds for the Resolution Trust Corporation (RTC) to tackle troubled financial institutions. They were either liquidated or encouraged to merge with other financial institutions. As a result, NPL ratio has on average declined from 2.78% in 2004 to 1.54% in 2008.

Another motivation of the financial reform and increased supervisions by financial regulatory authority is to improve competitiveness of domestic institutions when Taiwan opens its financial market to the world. As a condition for accession to WTO, foreign financial institutions are permitted to compete directly with domestic financial firms across various financial services. The common view is that by increasing the size and the scope of local financial firms, the gap of level playing field may arguably be narrowed when larger foreign competitors arrive. It can therefore be argued that FFFs

will not only face competitions with their domestic FHCs but also those larger foreign competitors.

3. Data Envelopment Analysis (DEA)

We apply DEA to measure the performance of FFFs for the whole sample period and each of the two sub-periods, prior to and after the financial reform. The approach is widely used to measure comparative efficiency of homogeneous operating units and has been applied to efficiency for financial institutions (e.g. Sherman and Gold (1985), Ferrier and Lovell (1990), Miller and Noulas (1996), Sherman and Rupert (2006), Garcia-Cestona and Surroca (2008)).

Based on the production frontier of Farrell (1957), Charnes Cooper, and Rhodes (1978, CCR thereafter) introduce the efficiency measurement for a firm, and the optimization of inputs, outputs, and weights. Ratios of input usage and production output are then used to create efficient frontiers such that efficient and inefficient firms can be identified.

Under the assumption of variable returns to scale (VRS), Banker, Charnes, and Cooper (1984, BCC thereafter) extend the CCR efficiency measure by separating total factor productivity or technical efficiency into pure technical efficiency and scale

efficiency. The decomposition shows that an increase in technical efficiency not only could come from an improvement under certain technology but also from an increase in scale economies. As a percentage of maximum total factor productivity, technical efficiency provides a measurement for the potential improvement of a firm that input usage allows.

Algebraically, technical efficiency, φ , is estimated as follows,

$$\begin{aligned}
 & \underset{\varphi, \lambda}{\text{Min}} \varphi & (1) \\
 & \sum_{n=1}^N \lambda_n y_{mn} \geq y_{mi} \\
 & \text{subject to } \sum_{n=1}^N \lambda_n x_{kn} \leq \varphi x_{ki} \\
 & \lambda_1, \lambda_2, \dots, \lambda_N \geq 0
 \end{aligned}$$

where φ is the technical efficiency for bank i , $i = 1, 2, \dots, N$, λ is the weight placed on banks, y_{mi} is the output m for bank i , and x_{ki} is the input k for bank i . For estimating pure technical efficiency, an additional condition, $\lambda_1 + \lambda_2 + \dots + \lambda_N = 1$, is required for Eq. (1).

Scale efficiency is the ratio of technical efficiency under constant returns to scale over technical efficiency under variable returns to scale (pure technical efficiency). Conversely, scale inefficiency occurs when a firm operating with either increasing or

decreasing to scale. Pure technical efficiency measures the proportion by which a firm could potentially reduce its input usage using certain technology according to the VRS frontier.

4. Sample description

4.1 Variable definitions

A number of approaches to measure inputs and outputs has been used to measure efficiency such as production, asset, value-added, and user cost approaches. Since focused financial firms are intermediaries between parties of opposite claims and provide financial services rather than tangible goods, the intermediary approach is more preferable for our empirical analysis.

For commercial banks, operating expenses, interest expenses, and non-interest expenses are input items, while fixed assets, interest incomes, and non-interest incomes are output items. For insurance companies and securities firms, interest and non-interest expenses (incomes) are replaced by insurance payoff expenses and non-payoff expenses (premium and non-premium incomes), and commission and non-commission expenses (incomes) respectively. Table 1 defines each input and output variable.

<Insert Table 1>

4.2 Data

The sample is obtained from Taiwan Economic Journal (TEJ) database which covers all focused financial firms from 1995 to 2009. It includes 21 commercial banks, 8 insurance companies, and 16 security firms for a total of 45 FFFs. The sample period covers 7 years prior to and 8 years after the passage of Financial Holding Companies Act in 2001. As it takes time to realize the effect of financial reform, the choice of these two sub-periods provides sufficient time to compare whether FFFs improve their operating performance in the aftermath of the financial reform. For completeness, we also include 2009 (along with 2008 and 2007) to examine the performance of FFFs during the global financial crisis.

Over the sample period, the financial reform appears to speed up mergers among FFFs. There were only 2 mergers prior to the financial reform between 1995 and 2001. In contrast, 12 mergers took place between 2002 and 2009 in the post-reform period over which the majority of them were takeovers of financially troubled firms, especially of commercial banks.

5. Empirical results

5.1 Summary statistics

Table 2 reports the summary statistics of the input and output measures for each financial group. Among them, commercial banks have the highest average operating expense of NT\$3.6 billion and fixed assets of NT\$5.3 billion, reflecting the large number of branches and employees in the banking industry. Not surprisingly, they also have the highest investment of NT\$31 billion such as those in Treasury securities and in properties.

As expected, commercial banks tend to generate more interest expenses (NT\$8.9 billion) and interest income (NT\$13.2 billion) than non-interest expenses (NT\$3.8 billion) and non-interest incomes (NT\$2.5 billion) since their core businesses are in loans and deposits. However, insurance companies incur higher non-payout expenses (NT\$13.9 billion) than payout expenses (NT\$8.3 billion). On the income side, insurance companies rely on insurance premiums as their key source incomes (NT\$15.2 billion), outweighing the average non-premium incomes (NT\$8.6 billion). Overall, insurance companies have higher total incomes and expenses than commercial banks.

Given that Taiwan is a bank-oriented market, securities firms are by far the smallest financial firms in operations. As a result, the amounts of non-interest expense and operating income tend to be a fraction of those of commercial banks and insurance companies. However, due to the nature of the securities business, the average operating

expenses of securities firms related to promotion and managerial expenses are larger than that of insurance companies.

<Insert Table 2>

To check for the isotonicity relationship among input and output factors assumed under DEA, we calculate Pearson's correlation coefficients. Table 3 reports correlations between the inputs and outputs items. Although there are a few low correlations, most of the input items are highly correlated with output items for each type of FFFs. They should therefore satisfy the isotonicity requirement.

<Insert Table 3>

Our DEA construct also satisfies Golany and Roll (1989) who suggest that as a rule of thumb, the number of DMUs should be more than twice the sum of input and output variables. Our sample of 595 DMUs based on 45 sample firms from 1995 to 2009 far exceeds a total number of 7 input and output variables.

5.2 Efficiency Estimates

Next, we estimate the average technical efficiency, pure technical efficiency, and scale efficiency for each FFF based on the DEA method discussed in Section 3. Table 4 shows that among FFFs, commercial banks fare better than securities firms but worse

than insurance companies in average technical and pure technical efficiencies. Its average scale efficiency however is slightly lower than those of insurance companies and securities firms. Technical efficiency falls between 0.76 and 0.98, suggesting that a large variability of efficiency among commercial banks.

The superior performance of insurance companies reported in Table 4 is consistent with summary statistics shown in Table 2 where the difference between total input and output items is the largest in insurance companies. It is also important to note that the variability of technical efficiency is the smallest among insurance companies and the largest among securities firms, suggesting that most insurance companies consistently outperform other types of FFFs over the entire period.

By contrast, securities firms on average have the lowest technical efficiency of 0.82. Decomposing technical efficiency into pure technical and scale efficiencies reveals that the poor average technical efficiency of securities firms appears to be driven largely by the relatively low pure technical efficiency of 0.84 compared to the high average scale efficiency of 0.98. Utilization of inputs by securities firms therefore appears to be low or that the level of inputs into producing current income and investment is excessive.

To address the key question on whether financial reform improves the efficiencies

of FFFs, we estimate their time-series technical efficiencies for each year over the whole period. Figure 1 shows that although there is an initial increase in technical and pure technical efficiencies (TE and PTE) of commercial banks in the post-reform era, it declines three years after the financial reform and continues to deteriorate during global financial crisis (GFC) from 2008 to 2009. Even when efficiencies improve immediately after the financial reform, they fail to reach the height of the early years in the sample period. With commercial banks specifically in mind, the impact of the financial reform in boosting bank efficiencies appears to be limited.

Figure 2 shows that efficiencies of insurance companies are persistently high throughout the whole period. They tend to increase slightly after the financial reform but revert back thereafter. Since efficiencies are already high in the pre-reform period, there is little left for insurance companies to improve in the post-reform period. Surprisingly, insurance companies appear to experience little adverse impact from the GFC and recover quickly to the pre-crisis level in 2009.

Unlike commercial banks and insurance companies, efficiencies of securities firm are highly volatile over time. Even before the financial reform, the average technical and pure technical efficiencies vary widely from year to year. This indiscernible pattern continues into the post-reform period. It is therefore difficult to detect if financial

reform has had a real impact on securities firms based on the figure. One thing that seems clear and interesting is that the average efficiencies of securities firms tend to recover in the midst of GFC.

<Insert Table 4>

<Insert Figure 1, 2, and 3>

Results of nonparametric test reported in Table 5 confirm the depictions of the above figures. Commercial banks experience a significant decline in technical efficiency from 0.90 in the pre-reform period to 0.83 in the post-reform period. Pure technical and scale efficiencies exhibit a similar but lesser decline. By contrast, insurance companies show a slight improvement in technical efficiency from 0.96 to 0.97. Overall, they seem to achieve small efficiency gains in the post-reform era. For securities firms, there appears to be little impact across the efficiency measures. In sum, we find that not only commercial banks fail to benefit from first financial reform which was particularly designed to improve their operating performance, they also exhibit deterioration in efficiencies in the aftermath of the reform.

<Insert Table 5>

5.3. Tobit Regression Analysis

Sequel to the preliminary analysis, we conduct multivariate regression tests to examine variations in operating efficiency of FFFs from pre- to post-reform periods. We estimate the following Tobit regressions for each of the efficiency measures,

$$Efficiency_{i,t} = \alpha + b_1 Ln(Assets_{i,t}) + b_2 GDP_t + DT + DC + DI + T * DC + T * DI + DM + DF1 + DF2 + DS + \varepsilon_{i,t} \quad (2)$$

where $Efficiency_{i,t}$ is the technical efficiency, pure technical efficiency, or scale efficiency for firm i at time t , $Ln(Assets)$ is the natural log of assets, GDP_t is the growth rate of gross domestic product, DT is a dummy variable that takes on a value of one from year 2002 to year 2009 and zero otherwise, DC and DI are dummy variables that take on a value of one if the firm is a commercial bank and insurance company respectively, and zero otherwise, DM is a dummy variable that takes on a value of one if a merger takes places during the sample period and zero otherwise, DF_1 and DF_2 are dummy variables that take on a value of one during Asian financial crisis from 1997 to 1998 and during global financial crisis from 2008 to 2009 respectively, and zero otherwise, and DS is a dummy variable that takes on a value of one if the FFF is state controlled and zero otherwise.

Table 6 shows the regression results according to Eq. (2). Consistent with the

descriptive statistics in Table 4, insurance companies have the highest technical and pure technical efficiencies (DI), followed by banks (DC), and securities firms over the whole period after controlling for size ($\ln(\text{assets})$) and growth (GDP). Dividing the sample period into two sub-periods between pre- and post-reform periods, the dummy variable DT indicates that financial reform makes little difference on FFFs.

A closer look at the impact of financial reform reveals that commercial banks experience lower technical and pure technical efficiencies during the post-reform period ($T * DC$). In contrast, insurance companies and securities firms exhibit little changes between the two sub-periods. These regression results after controlling for firm characteristics and specific events are similar to the univariate results shown in Table 5.

While mergers among FFFs may potentially lower operating efficiency due to mergers with troubled FFFs especially in the post-reform period, controlling for these events (DM) indicate that the decline in the efficiencies of banks is unlikely to be driven by the merger effect.³ It also suggests that part of the financial reform under which troubled banks were forced to liquidate their assets or merged with healthier banks has not improved the overall operating efficiency in the banking sector.

Finally, our findings are robust to the two financial crises over the sample period.

³ Six of the eight post-reform bank mergers were with troubled banks while merges among insurance companies were under “healthy” conditions.

Adding DF1 and DF2 dummy variables to control for Asian Financial Crisis between 1997 and 1998, and Global Financial crisis between 2008 and 2009 does not affect the regression results. Similar results apply after controlling for banks that are state controlled (DS). Taken together, our results suggest that FFFs do not become more competitive against their larger financial conglomerates. In the case of commercial banks, the efficiencies fall further behind after the financial reform.

<Insert Table 6>

5. Conclusion

In this paper, we examine the effect on the performance of focused FFFs after the passage of 2001 Financial Holding Company (FHC) Act in Taiwan. Under the Act, financial institutions are permitted to form holding companies that own and manage commercial banks, insurance companies, and securities firms. Current studies document that FHCs tend to increase operating efficiency and improve competitiveness as a result of economies of scale and scope, and synergy of cross-selling various financial services. Our study addresses a follow-up question as to whether the financial reform also enhances the performance of FFFs.

Our investigation suggests that FFFs fail to achieve efficiency gains in the

post-reform era. Instead, the performance of commercial banks declines after the financial reform. There is also little evidence that the financial reform significantly improves the technical efficiencies of insurance companies and securities firms. The results suggest that the benefits of the financial reform may only be limited to the large and diversified FHCs rather than over the entire financial sector.

Given that Taiwan is home to 15 FHCs and 45 FFFs, and the benefits of first financial reform are restricted to FHCs, the overall social gains of the financial reform are limited. With competitions likely to intensify in the financial sector due to the deregulations including a larger presence of foreign financial institutions, our findings suggest that further consolidations especially for commercial banks may take place in the near future. Mergers with large FHCs may continue as the smaller and less efficient FFFs find it difficult to compete against their larger counterparts.

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Table 1 Input and Output Variables

This table defines the items that are classified under each input and output variables.

	Variables	Items
Inputs	Operating Expenses	Promotion expenses, management expenses, and other expenses.
	Interest, insurance payouts, or commission expenses	The expenses from core business including interest expenses for banks, insurance payouts for insurance companies, or commission expenses for securities firms.
	Non-interest, non-payoffs, or non-commission expenses	Loss on trading accounts, investment loss, exchange loss, credit card charge, value loss on inventory, other losses, operating loss, loan provision and bad debt for loan, etc.
	Fixed Assets	Net value of fixed assets such as Land, building and construction, machinery and equipment, other equipment, re-value of fixed assets, etc.
Outputs	Interest, insurance premium, or commission incomes	Revenues and premiums from the core business including interested revenues, insurance premiums and commission revenues.
	Non-interest, non-premium or other incomes	Gains on trading accounts, investment income, gain-disposal investments, reversal-loss on investment, trustee fee, exchange gain, reversal of reserve for interest and principal, security brokerage income, credit card incomes, other incomes such as other operating incomes, etc.
	Investment	Investment in short-term and long-term assets such as Treasury securities and properties.

Table 2 Summary statistics of input and output variables of focused financial firms:
1995 to 2009

This table presents the summary statistics of the input and output items for DEA analysis for banks, insurance companies, and securities firms. The figures reported are in millions of NT\$.

Variables	Mean	Sta. Dev.	Minimum	Maximum
<i>Banks:</i>				
Operating expense	3,635	3,597	381	17,626
Interest expenses	8,885	12,167	1,765	81,357
Non-interest expenses	3,847	4,831	548	29,293
Fixed assets	5,337	6,023	323	33,591
Interest incomes	13,186	15,966	12	97,986
Non-interest incomes	2,566	2,494	55	14,239
Investment	31,745	48,263	311	349,000
<i>Insurance:</i>				
Operating expense	1,119	733	327	4,043
Insurance payout expenses	8,360	9,116	2,015	71,240
Non-payout expense	13,965	19,220	560	110,000
Fixed assets	1,359	1,584	149	7,391
Premium incomes	15,261	17,211	3,271	100,000
Non-premium incomes	8,637	11,687	155	86,357
Investment	30,630	61,970	650	382,000
<i>Securities:</i>				
Operating expense	1,650	1,407	74	6,420
Commission expenses	409	374	16	1,931
Non-commission interest expenses	721	1,448	23	9,558
Fixed assets	1,579	1,473	7	6,851
Commission incomes	2,431	2,238	109	10,566
Non-commission incomes	1,453	1,762	36	9,583
Investment	2,928	4,775	4	28,733

Table 3 Cross Correlations among Input and output Variables

This table presents Pearson's correlation coefficients between the input and output variables for banks, insurance companies, and securities firms.

	Operating expenses	Interest expenses	Non-interest expense	Fixed Assets	Interest incomes	Non-interest incomes	Investment
<i>Banks:</i>							
Operating expenses	1.00						
Interest expenses	0.82	1.00					
Non-interest expenses	0.40	0.21	1.00				
Fixed Assets	0.92	0.78	0.41	1.00			
Interest incomes	0.91	0.98	0.30	0.84	1.00		
Non-interest incomes	0.84	0.75	0.36	0.80	0.80	1.00	
Investment	0.68	0.51	0.24	0.65	0.56	0.74	1.00
	Operating expenses	Payout expenses	Non-payout expense	Fixed Assets	Payout incomes	Non-payout incomes	Investment
<i>Insurance:</i>							
Operating expenses	1.00						
Payout expenses	0.19	1.00					
Non-payout expenses	0.38	0.86	1.00				
Fixed Assets	0.69	0.36	0.64	1.00			
Premium incomes	0.33	0.91	0.97	0.55	1.00		
Non-premium incomes	0.35	0.89	0.94	0.57	0.88	1.00	
Investment	0.36	0.88	0.98	0.58	0.96	0.94	1.00
<i>Securities:</i>							

	Operating expenses	Comm. expenses	Non-comm. expenses	Fixed Assets	Comm. incomes	Non-comm. incomes	Investment
Operating expenses	1.00						
Comm. expenses	0.69	1.00					
Non-comm. Expenses	0.47	0.32	1.00				
Fixed Assets	0.88	0.63	0.35	1.00			
Comm. incomes	0.92	0.84	0.41	0.78	1.00		
Non-comm. insurance	0.81	0.47	0.73	0.64	0.70	1.00	
Investment	0.78	0.36	0.29	0.78	0.66	0.65	1.00

Table 4 Average efficiencies of non-FHCs

This table presents the average efficiency measures of commercial banks, insurance companies, and securities firms over the sample period

	N	Average Technical Efficiency		Average Pure Technical Efficiency		Average Scale Efficiency	
		mean	S. D.	mean	S. D.	mean	S. D.
<i>Banks:</i>							
Kings Town Bank	15	0.86	0.07	0.88	0.07	0.99	0.02
Kaohsiung Business Bank	9	0.76	0.06	0.81	0.05	0.94	0.05
Taitung Business Bank	12	0.77	0.17	0.92	0.08	0.83	0.12
Taichung Commercial Bank	15	0.89	0.08	0.90	0.07	0.98	0.02
China Bills Finance Corporation	15	0.97	0.07	0.99	0.04	0.98	0.04
Farmers bank of China	11	0.91	0.07	0.94	0.07	0.97	0.02
China Trust and Investment Corporations	12	0.79	0.27	0.96	0.08	0.83	0.26
General Bank	8	0.89	0.06	0.90	0.05	0.99	0.01
Dah An Commercial Bank	7	0.97	0.01	0.98	0.02	0.99	0.01
The Chinese Bank	12	0.98	0.03	0.98	0.02	1.00	0.01
Taiwan Business Bank	15	0.86	0.08	0.95	0.05	0.90	0.04
Bank of Kaohsiung	14	0.88	0.09	0.89	0.10	0.99	0.02
Cosmos Bank	15	0.85	0.13	0.86	0.13	0.99	0.02
Union Bank of Taiwan	15	0.82	0.13	0.89	0.09	0.93	0.10
Far Eastern International Bank	15	0.89	0.07	0.91	0.07	0.98	0.03
Chung Shing Bank	9	0.81	0.21	0.85	0.16	0.93	0.09
Ta Chong Bank	15	0.89	0.07	0.91	0.06	0.97	0.04
EnTie Commercial Bank	15	0.91	0.09	0.92	0.09	0.99	0.01
bowa bank	12	0.79	0.11	0.80	0.11	0.99	0.02
OCBC Bank	12	0.76	0.07	0.78	0.07	0.98	0.02
Taiwan Cooperative Bank	13	0.91	0.07	1.00	0.01	0.91	0.07
Average		0.87	0.12	0.91	0.10	0.96	0.09
<i>Insurance:</i>							
Union Insurance	15	0.94	0.04	0.97	0.04	0.97	0.02
China Life Insurance Company	15	0.98	0.03	0.99	0.03	1.00	0.00
Chartis Taiwan Insurance Co., Ltd.	11	0.95	0.04	0.96	0.04	0.99	0.02
Taiwan Fire & Marine Insurance Co., Ltd.	15	0.96	0.03	0.98	0.03	0.98	0.02
Taiwan Life Insurance Co., Ltd.	14	0.98	0.03	0.98	0.03	1.00	0.00
Central Reinsurance Corporation	14	0.99	0.02	1.00	0.01	0.99	0.01
The First Insurance Co.,Ltd.	15	0.93	0.02	0.97	0.03	0.97	0.03
Average		0.96	0.04	0.98	0.03	0.98	0.02

Securities:

Polaris Securities Co., Ltd.	15	0.70	0.09	0.76	0.13	0.94	0.07
President Securities Corp.	15	0.86	0.09	0.90	0.10	0.96	0.05
MasterLink Securities Corporation	15	0.83	0.09	0.85	0.10	0.98	0.02
Tai Yu Securities Co., Ltd.	8	0.71	0.14	0.72	0.13	0.99	0.05
Yuanta Core Pacific Securities Co.,Ltd	12	0.97	0.04	0.98	0.04	0.99	0.02
Capital Securities Corp.	15	0.83	0.10	0.85	0.10	0.98	0.05
KGI Securities Co. LTD.	15	0.85	0.14	0.87	0.13	0.98	0.03
Horizon Securities Co., Ltd.	15	0.55	0.17	0.56	0.18	0.99	0.04
Concord Securities Co.,Ltd.	15	0.72	0.11	0.75	0.14	0.97	0.04
Asia Securities Co., Ltd.	9	0.69	0.13	0.69	0.12	0.99	0.02
Sampo Securities Co., Ltd.	6	0.92	0.08	0.93	0.05	1.00	0.04
Tachan Securities Co., Ltd.	15	0.85	0.16	0.86	0.13	0.99	0.10
Ta Ching Securities Co., Ltd.	15	0.94	0.07	0.94	0.06	1.00	0.02
Ta Chong Securities Co., Ltd.	12	0.82	0.13	0.86	0.10	0.99	0.04
Polaris MF Global Futures Co., Ltd.	11	0.90	0.07	0.92	0.07	0.97	0.05
Capital Futures Corp.	11	0.98	0.05	0.97	0.00	0.99	0.05
Average		0.82	0.16	0.84	0.15	0.98	0.05

Table 5 Nonparametric results of efficiency measures around first financial reform
This table presents the test results of changes in efficiency measures prior to and after first financial reform. * and ** denote significance level at the 5 percent and 1 percent level respectively.

	Technical Efficiency	Pure Technical Efficiency	Scale Efficiency
Banks:			
1995~2001	0.90	0.92	0.97
2002~2009	0.83	0.89	0.94
Z	-3.76	-1.67	-2.01
Asymptotic Significance (2-tailed)	0.00**	0.09*	0.04*
Insurance companies:			
1995~2001	0.96	0.98	0.98
2002~2009	0.97	0.98	0.99
Z	-2.27	-0.55	-1.86
Asymptotic Significance (2-tailed)	0.02*	0.59	0.06
Securities firms:			
1995~2001	0.83	0.85	0.97
2002~2009	0.81	0.84	0.96
Z	-0.60	-0.35	-0.62
Asymp. Sig. (2-tailed)	0.55	0.72	0.54

Table 6 Regression results of non-FHC efficiencies around financial reform

This table presents the effect of financial reform on the operating efficiency of commercial banks, insurance companies, and securities firms. Assets are the asset value of non-FHCs. GDP is the growth rate of gross domestic product. DT is a dummy variable that takes on a value of one from year 2002 to year 2009, and 0 otherwise. DC is a dummy variable that takes on a value of one if the firm is a commercial bank and zero otherwise. DI is another dummy variable that takes on a value of one if the firm is an insurance company and zero otherwise. DM is a dummy variable that takes on a value of one if a merger took place for the firm during the sample period and zero otherwise. DF_1 and DF_2 are dummy variables that take on a value of one during Asian financial crisis from 1997 to 1998 and during global financial crisis from 2008 to 2009 respectively, and zero otherwise, and DS is a dummy variable that takes on a value of one if the FFF is state controlled and zero otherwise * and ** denote statistical significant at 5 percent and 1 percent level respectively.

	Technical Efficiency	Pure Technical Efficiency	Scale Efficiency
Intercept	0.73** (0.00)	1.00** (0.00)	1.03 (0.32)
Ln(Assets)	0.01 (0.32)	0.00 (0.92)	0.12 (0.32)
GDP	0.35 (0.47)	0.47 (0.49)	0.34 (0.89)
DT	-0.06 (0.19)	-0.04 (0.51)	-0.57 (0.34)
DC	0.14** (0.01)	0.30** (0.00)	-0.39 (0.31)
DI	0.45** (0.00)	0.82** (0.00)	-0.33 (0.47)
DT*DC	-0.13* (0.02)	-0.16 (0.06)	-0.02 (0.96)
DT*DI	0.20 (0.15)	0.11 (0.61)	1.01 (0.34)
DM	-0.10** (0.01)	-0.10* (0.05)	-0.35 (0.31)
DF1	0.02 (0.72)	0.01 (0.84)	0.10 (0.67)
DF2	-0.03 (0.62)	0.00 (0.99)	-0.26 (0.43)
DS	0.08 (0.09)	0.18* (0.03)	-0.10 (0.61)
Adjusted R^2	0.16	0.15	0.11
N	576	576	576

Figure 1

Average Efficiencies of Commercial Banks from 1995 to 2009

This figure shows the various average efficiencies of commercial banks from 1995 to 2009. TE, PTE, and SE denote overall efficiency, technical efficiency, pure technical efficiency, and scale efficiency respectively.

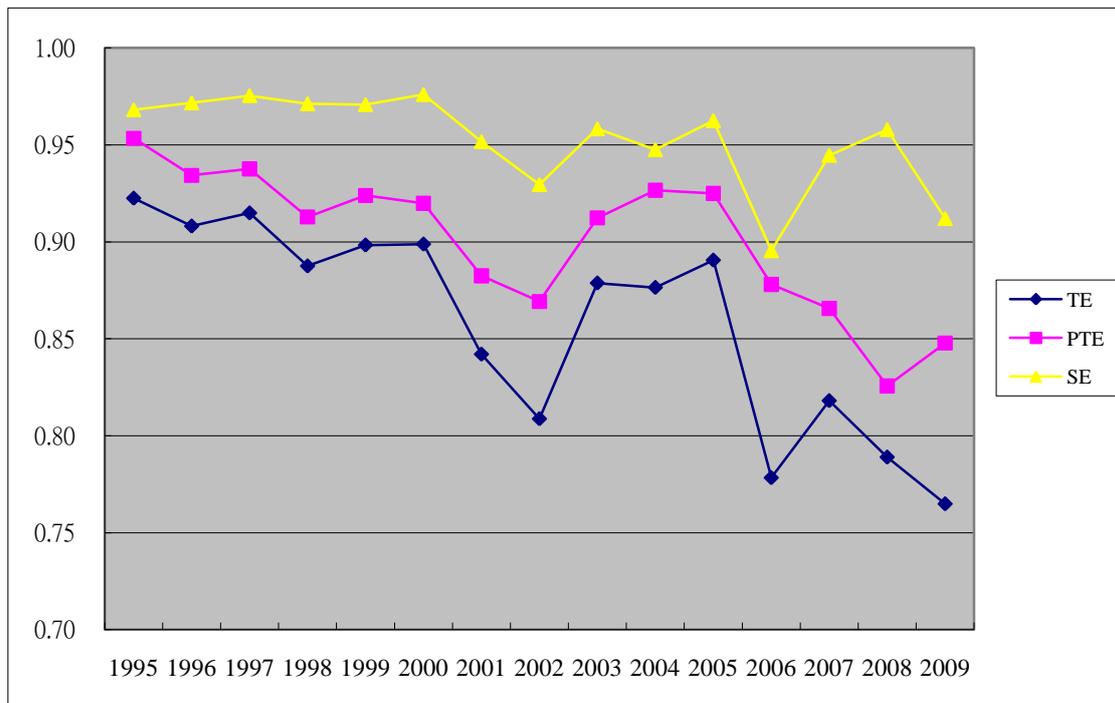


Figure 2

Average Efficiency of Insurance Companies from 1995 to 2009

This Figure shows the various average efficiencies of insurance companies from 1995 to 2009. TE, PTE, and SE denote overall efficiency, technical efficiency, pure technical efficiency, and scale efficiency respectively.

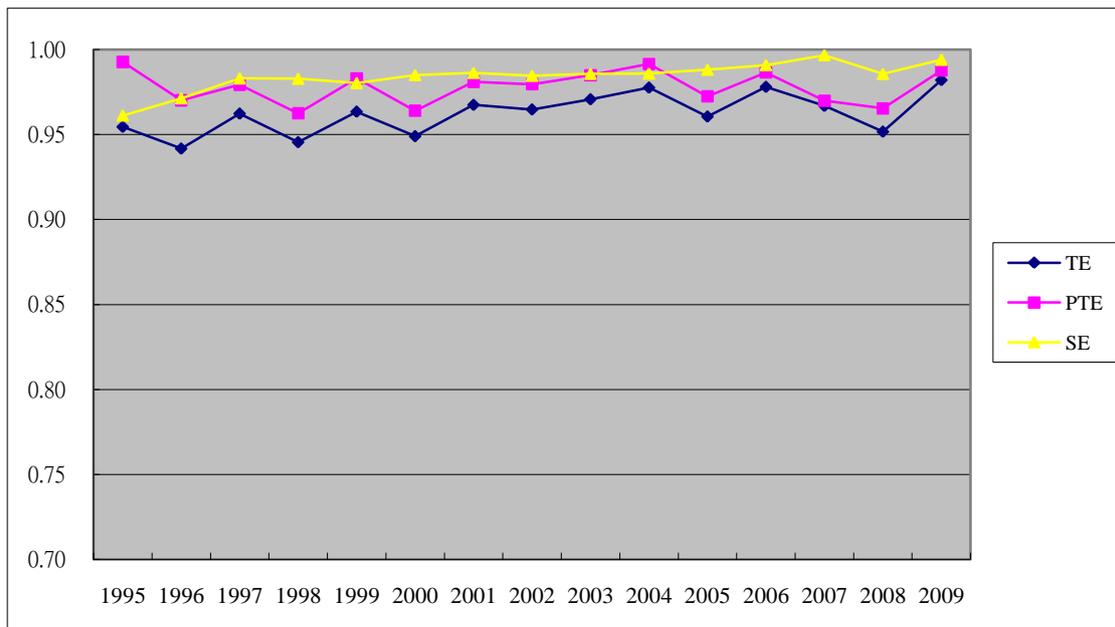


Figure 3

Average Efficiencies of Securities Firms from 1995 to 2009

This Figure shows the various average efficiencies of securities firms from 1995 to 2009. TE, PTE and SE denote technical efficiency, pure technical efficiency, and scale efficiency respectively.

