MANAGERIAL EFFICIENCY OF SECURITIES FIRMS UNDER FINANCIAL HOLDING COMPANIES IN TAIWAN

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Abstract. Taiwan's government has been actively promoting financial holding companies (FHC), which offered the various services including banking and securities. This paper investigates effects of FHC on managerial efficiency of its integrated securities subsidiary. A panel data set during 2002-2005 of twelve to fourteen securities firms in Taiwan is constructed. Seven of them are affiliated with FHCs. The four-stage data envelopment analysis (DEA) proposed by Fried et al. (1999) is then applied. The following empirical findings are: (1) Under the regulation authority persuasion to form FHC, not the efficient ISFs allied with bank to form FHC. The FHC has a significant negative effect on the managerial efficiency of an ISF. (2) A higher duration of an ISF also significantly improves its technical efficiency. (3) Forming FHC would impose threat and create the incentives for efficiency in Securities industry.

Keywords: Four-stage data envelopment analysis (DEA), Panel data, Duration, Subsidiaries

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I. INTRODUCTION

Many economies encourage financial conglomeration and universal banking, including all EU member states and the United States. In the United States, *Gramm-Leach-Bliley Act* on November 12, 1999, permitted single holding companies to offer banking, securities and insurance. [Barth et al., 2000] This new regulatory is expected to accelerate the consolidation of financial services industry. In European Union, financial conglomerate and universal banking are backdated to the 1989 *Second Banking Directive*, which has been earlier implemented by all member economies. Banks, investment firms, and the insurance companies may hold reciprocal equity participation, implying that there are no limits on the formation of financial conglomerates. Followed by the progress of the European Union and the United States, financial holding companies (FHC) are a newly-arising organisational form in developing economies. The regulatory authority in Taiwan has been repeatedly encouraged domestic financial institutions to form FHC. The main purpose of forming FHC was to create the bigger and stronger financial conglomerates that are capable of competing with international financial groups and gain a foothold on the worldwide financial market. Accordingly, the Taiwan government enacted the *Financial Holding Company Act* in 2001 and permitted only the integrated securities firms (ISFs) to join in the FHC. As a consequence, through persuasion and pre-designation from the regulatory authority in Taiwan, there are continuously fourteen FHCs in Taiwan as listed in Table 1. Surprisingly, Taiwan authority pledged to freeze the FHC's license and further cut the number of FHC to half in 2006. The regime of forming FHC in Taiwan, therefore, offers an opportunity to assess the impact of might-be forced FHC on the efficiency of their subsidiaries.

[Table 1 inserts here.]

However, the issue of whether or not the FHC system can effectively improve an ISF's managerial efficiency is still not empirically studied. The lack of firm-level data has made research on securities firms very difficult and rare to see [Goldberg et al., 1991], not to mention the effects of FHC on their managerial efficiency. To author's knowledge, this is the first paper to investigate the influence of the might-be forced FHC on its securities subsidiaries in terms of managerial efficiency.

Research on the effect of forced mergers and acquisitions on the acquirer and the acquiring target is very limited. Chong et al. [2006] using an event study methodology examines the impact of the forced mergers scheme on the market-adjusted abnormal return of Malaysian banks. It shows that the forced merger mechanism destroys shareholders' value. Contrary to the findings on voluntary mergers in the United States and Europe, Malaysian acquiring banks have a significant negative cumulated abnormal return under the forced merger scheme. The result further affirms that politics are often intertwined with economics in less developed countries. Some researchers addressed on the efficiency comparisons between financial conglomerates and specialised banks. Vander Vennet [2002] analysed the cost and profit efficiency of European financial conglomerate, universal banks and specialised banks. He further defined three main areas of financial services in EU: traditional banking, insurance, and securities-related activities. Financial conglomerates are defined as financial services institutions that offer at least two of three main areas of financial services. Universal banks are defined as diversified banking firms that hold equity stakes in non-financial companies. Operationally, Universal banks are those firms whose equity stakes in non-financial companies account for more than 1 percent of total assets. Furthermore, universal banks required fulfilling the criteria of the ratio of non-interest income to total revenues higher than 5 percent. It is reported that financial conglomerates are revenue efficient than the specialised banks. Besides, the universal banks are both cost and profit efficient than the non-universal banks.

Steinherr and Huveneers [1994] also defined that the key feature of universal banking needs particularly hold equity shares of other companies five to 20 percent to monitor corporations as equity owner or maintain a universal banking relationship. Allen and Gale [1995] defined the relationship banks, such as the German, Dutch, and Swiss main banks, provided both debt and equity financing to companies. It also has the long-lasting relationship with them. It was another term for universal banks. Benston [1994] also mentioned that government regulators would either have to regulate universal banks very tightly, hence hindering economic efficiency if considering the risk of financial instability. From this viewpoint, the specialised smaller banks have a number of advantages. Because their functions are limited, government agents can monitor them more efficiently. Allen and Rai [1996] divided countries into two groups, which is universal banking countries and separated banking countries, which prohibit the function integration of commercial and investment banking. The study showed that large banks in separated banking countries had the largest measure of input inefficiency.

The securities industry is the centre of the capital market. Especially, In Taiwan and London, the stock market value to GDP is approximately 140. In addition, there is a higher turnover ratio in terms of trading value for Taiwan stock market compared with other major stock markets. It shows the Taiwan stock market is an entirely important market to address on it. The ISF, which perform various major services including investment banking, brokerage activity, underwriting services and proprietary trading, are undergoing significant changes in Taiwan. Except of voluntary mergers in the market, financial groups have acquired many largest securities firms including FHCs acquired them as one of subsidiaries.

Consequently, the top 14 market players account for 60% market shares of brokerage business.

Very limited, however, is known about the efficiency study on the securities sectors. Goldberg et al. [1991] adopted the survey data in translog multi-product cost function to examine the scale of economy and suggested that if the Glass-Steagall restrictions are relaxed, bank can enter the securities industry with a brokerage division of moderate scale about 30 millions in revenue. The author revealed that the cross-selling activities between bank and securities are able to increase the brokerage revenue. Accordingly, this paper would like to examine the impact for the brokerage revenue under FHC's structure.

Wang et al. [2003] used DEA and Tobit censored regression to assess technical efficiencies of ISFs in Taiwan based on 1991-1993 data. They concluded that the impact of the firm's service concentration on its technical efficiency is positive, which means the diversity of the services would decrease its technical efficiency. The firms with branches have lower technical efficiencies than those without any branches. It reveals that the purpose of setting up a new branch for ISF is to enlarge the geographical coverage of the brokerage market. While the stock market was declining, more branches instead become a burden for management and the increased complexities on operations make it difficult for managers' decision.

Accordingly, unlike Wang et al. only identified branch as a dummy variable (with or without branches), this paper adopts the number of branches as the continuous input variables to assess the technical efficiencies of ISFs. In addition, this paper wants to investigate whether the national trading volume is an environmental determinant on the technical efficiency.

There are some researches focused on the relationship between specialisation and efficiency. Fung [2006] investigates the relationship between scale efficiencies and

X-efficiency for bank holding companies (BHC) and indicates that a higher level of X-efficiency caused by more specialised banking activities might increase the efficient scale. Eaton [1995] and Wang et al. [1998] indicated that if the firms would dedicate on one or two specialised business, and then it helps make the high efficiency because of learning-curve effect. Wang and Yu [1995] investigate the economy of scope and economy of scale of ISFs in Taiwan. The study pointed out the performance of ISFs is better than that of specialised brokerage securities in terms of sales margin. Wang and Yu also select the ISF as their sample and concluded that when the number of branch office increases, the ISF would be the diseconomy of scope.

Unlike the research for the impact of parent holding company on its subsidiary is limited, most studies addressed on the merger impact on the financial institutions. Drake and Hall [2003] investigated the technical efficiency in Japanese banking incorporating with the problem loans under the large-scale merger wave. The result suggested that larger banks are operating well above minimum efficient scale and mergers would have limited opportunity to gain from eliminating X-inefficiencies. Especially, if the efficiencies have more to do with specialization, the trend towards enlargement and financial conglomeration in Japan may lead to decrease levels of scale efficiency and X-efficiency. On the contrary, Worthington [2001] uses discrete choice regression models to investigate the influence of financial, managerial and regulatory factors on the probability of a credit union merging during the period 1993-1995 and examines whether efficiency has increased in these same institution in the post merger period 1996-1997. The author adopted Tobit censored regression model with a panel framework to analyse post-merger efficiency. Mergers appear to have improved both pure technical efficiency and scale efficiency in the credit union industry. Grabowski et al. [1995] had also concluded that the treat of takeovers serves as an efficiency enforcement mechanism in bank. Hence, this paper first examines the technical efficiency of top 14 ISF and then investigates the treat from FHC imposing on the ISF's managerial efficiency.

This paper is organised as follows: The next section provides the four-stage data envelopment analysis (DEA) proposed by Fried et al. (1999). The third section explains the empirical model included data collection and choice of outputs and inputs. The fourth section consists of the empirical results, followed by a concluding section.

II. THE FOUR-STAGE DEA

Technical efficiency reflects the ability of firms to use as little input as possible to obtain a given level of output. Fried et al. [1999] introduced a four-stage data envelopment analysis. The management component of inefficiency is separated from the influences of the external environment which the management level are not able to control these influences. The result is a radial measurement of managerial efficiency. It's indeed the assessment of managerial competence on running business.

The first stage is to calculate a DEA frontier using the observable inputs and outputs according to the variable returns to scale (VRS) model. Charnes, Cooper and Rhodes [1978] proposed an input oriented model and assumed constant returns to scale (CRS) as follows:

$$\min_{\theta_i, \lambda_1 \ldots \lambda_N} \quad \theta_i$$

$$\text{s.t.} \quad -y_i^m + \sum_{i=1}^{N} \lambda_i y_i^m \geq 0, \ m = 1, \ldots, M,$$

$$\theta_i x_i^k - \sum_{i=1}^{N} \lambda_i x_i^k \geq 0, \ k = 1, \ldots, K,$$

$$\lambda_1, \lambda_2, \ldots, \lambda_N \geq 0, \tag{1}$$

where N is the number of ISF; K and M are respectively the number of inputs and outputs; x_i^k is the amount of the k-th input consumed by the i-th ISF; y_i^m is the amount of the m-th output produced by the i-th ISF; and λ is a scalar value representing a proportional contraction of all inputs, holding input ratios and output level constant.

Banker, Charnes and Cooper [1984] extended the CRS DEA model to account for VRS situation. The CRS linear programming problem can be easily added on equation and modified to be VRS model as below:

$$\sum_{i=1}^{N} \lambda_i = 1. \tag{2}$$

In this model, θ_i is the pure technical efficiency (PTE). Technical efficiency (TE) is the ability of management to implement a technically efficient production plan. [Berger et al., 1993]

$$TE_i = PTE_i \times SE_i, \tag{3}$$

where SE_i is the scale efficiency index for the ith DMU in a period. That is, technical efficiency is decomposed into pure technical efficiency and scale efficiency (Banker et al., 1984; Fung, 2006). If there is a difference in the TE and PTE scores for i-th firms, this indicates that the firms have scale inefficiency. Farrel [1957] radial technical efficiency scores and input slacks and output surplus are computed for each observation.

The DEA has been applied in activities of very diverse nature such as: public health (hospitals, clinical), education (schools, universities), banks, factories, fast food restaurants, etc. The characteristics of simultaneity and heterogeneity of services should not lead us to reject the usefulness indicators of efficiency [Navarro and Camacho, 2001; Klassen et al., 1998]. This paper adopts DEA to evaluate the securities firms' efficiency.

The second stage is to estimate the K input equations using Tobit censored regression. The dependant variables are radial plus slack input movement; the independent variables are measures of environmental variables applicable to the particular input. The objective is to quantify the effect of external conditions on the excessive use of inputs. The K equations are specified as:

$$xs_i^k = f_k(E_i^k, \beta_k, u_i^k); \quad i = 1, \ldots, N; k = 1, \ldots, K; \tag{4}$$

where xs_i^k is ISF's total radial plus slack movement for input k based on the DEA results from stage 1; E_i^k is a vector of variables characterizing the operating environment for ISF i that may affect the utilization of input; β_k is a vector of coefficient and u_i^k is a disturbance term. Here we adopt both continuous and categorical variables as regressors.

The third stage is to use the estimated coefficients from the abovementioned equations to predict total input slack for each ISF based on its environmental variables:

$$x\hat{s}_i^k = f_k(E_i^k, \beta_k), \; i=1, \ldots, N, \; k=1, \ldots, K \tag{5}$$

These predictions are used to adjust the primary input data for each ISF based on the difference between maximum predicted total input slack and predicted total input slack:

$$x_i^{k\,adj} = x_i^k + [\mathrm{Max}^k\{x\hat{s}_i^k\} - \hat{E}(xs_i^k | E_i^k)]; \; i = 1, \ldots, N; \; k = 1, \ldots, K. \tag{6}$$

This generates a new projected data set where the inputs are adjusted for influence of external conditions.

The final stage is to use the adjusted data set to re-compute the DEA model under the initial output data and adjusted input data. The result generates new radial and slack measures of inefficiency. These radial and slack scores measure the inefficiency that is attributable to management that is wholly managerial inefficiency.

III. THE EMPIRICAL MODEL

3.1 Data Collection

We construct a panel data set during 2002-2005 of top twelve to fourteen securities firms in Taiwan. The firm-specific financial data are collected from the peers' data exchange among the securities firms. At the fiscal year of 2002, some of these ISFs committed to establish FHC in 2003. This period offers us to measure the technical efficiency and managerial efficiency before imposing the impact of FHC. Each of these ISFs is treated as a decision-making unit (DMU) under DEA model. Two guidelines commonly are applied on the number of the DMUs. One is the total number of inputs and outputs should be less than one third of the number of DMUs in the DEA model. [Friedman and Sinuany-Stern, 1998] Another is the number of DMUs should be at least two times of the number of inputs multiply the number of outputs [Dyson et al., 2001]. In our model there are two inputs and two outputs. The number of DMUs in a year is hence more than triple of the total number of input and output items.

In order to increase the homogeneity of DMUs, ISF with top twelve to fourteen asset values are selected. As Table 2 shows, these selected ISFs account for more than 70 percent of the total asset of the entire ISF sectors in Taiwan.

[Table 2 inserts here.]

The top twelve ISFs have been exchanged data such as market share and brokerage revenue for peer comparison since 2001. Fu Hwa and Mega securities firms did not exchange the financial data with peers due to the smaller asset of Mega and unavailable data of Fu Hwa in 2002. The Mega Securities firm had merged another ISF to increase its asset almost triple compared with its asset in 2002. Two more ISFs joined the exchanged pool in 2003, making fourteen securities firms available for DEA.

3.2 Choice of Outputs and Inputs

The first stage DEA model included physical inputs and outputs in the strict production theory sense. There are two outputs: market share of brokerage business (MS) and revenue (BR), which is included the fee income, service charge in the brokerage business. The market share of brokerage business is the important factor to evaluate the performance for the senior manager. This paper is the first one to introduce the market share as an output to evaluate ISF's efficiency. The revenue from the brokerage business accounts for roughly 70% of total revenue of the security in top 10 Taiwan security firms. Revenue from brokerage business as an output was shown on the existing literature.

Two inputs are used to produce the brokerage services: branches (BO) and the discounted expense amount of the brokerage business (DE). Goldberg et al. [1991] was also adopted branch office as one of the inputs on the literature. In practice, high discounted expense amount provides benefits to customers. When the discounted amount is more, then it would motivate customers to trade equities on this ISF. It will also benefit for the brokerage market share. This paper is the first one to adopt the discounted expense amount as one input for research. Market share of the brokerage business are measured in percentage. Brokerage revenues and the discounted expense amounts are measured in NT$ 100 millions dollars. Table 3 presents the definition and explanation of variables. Table 4 displays descriptive statistics of the raw data.

[Tables 3 and 4 insert here.]

Four environmental variables are introduced to measure the effect of input utilization. Annual sales volume is the exchanged data among top fourteen ISFs. Durations are calculated by each firm's registration date in Taiwan Market Post Information System and asset values are the annual report data listed in the Taiwan Securities and Futures Bureau.

IV. EMPIRICAL RESULTS

4.1 Stage One: Initial DEA (BCC input-oriented Model)

This DEA model includes two outputs and two inputs. Efficiency scores for twelve integrated securities firms in 2002 and fourteen integrated securities firms in 2005 are computed using an input orientation and variable returns to scale technology.

Tables 5 to 8 show the initial result on the stage 1. The average technical efficiency (TE) of ISFs is 0.915 in 2002. The mean of TE (0.876) of ISFs under FHC is obvious less than the mean of TE (0.943) of ISFs without joining in FHC. It shows that not the efficient ISFs allied with bank to form FHC. Based on the result of technical efficiency at the first stage, only one of the efficient became the FHC's subsidiary in 2003. In addition, the average technical efficiency among ISFs had been increasing from 0.888 in 2003 to 0.928 in 2005 at the first-stage DEA results. It shows that forming FHC would impose threat and create the incentives for efficiency. One year before most FHC established in 2002, 67 percents of the ISFs in the sample are increasing returns to scale; 25 percents of the ISFs are constant returns to scale. There is only one ISF under the decreasing returns to scale that is the subsidiary of FHC because this FHC was approaching to merger another bank and did not dedicate its effort on the securities business. During 2003-2004, Fu-Bon, Taiwan, KGI and Sinopac are decreasing returns to scale owing to expanding their business via acquiring other specialised securities. There are three of four ISFs under FHC. Meanwhile, Non-FHC ISFs were trying to close the inefficient branches owing to the threat from FHC. For example, Yuanta Core Pacific Securities cut their branch offices from 107 in 2004 to 99 in 2005, but still maintained 8.26% of market share in 2005(8.1% in 2004) and increase its brokerage revenue from NT$5.54 billion to NT$5.93 billion.

[Tables 5, 6, 7 and 8 insert here.]

4.2 Stage Two: Quantifying the Effect of the Operating Environment

There are two regression equations, one for each input as below.

$$xs_i^1 = f_1(E_i^1, \beta_1, u_i^1)$$

$$xs_i^2 = f_2(E_i^2, \beta_2, u_i^2)$$

The dependent variables (xs_i^1 and xs_i^2) are total radial movement plus slack movement based on the first stage DEA results. E_i^1 and E_i^2 are the vector of environmental variables for ISF i that may affect the utilization of input.

The four independent variables are VOL for annual sales volume in brokerage, which is deeply influenced by Taiwan national trading volume, DUR for the duration in the security market, ASV for ISF's asset value and one dummy variable FHC to show if this ISF is the subsidiary of FHC. The purpose of the FHC dummies is to investigate whether the FHC would benefit its ISF subsidiary or not. This paper defines these environmental variables in Table 9.

[Table 9 inserts here.]

A (positive) negative coefficient on these environmental variables suggests that the environment is (un)favourable for an DMU, since it is associated with (greater) less excess use of inputs.

This regression result indicates that the duration of establishment (DUR) has a significantly negative coefficient in two equations. This suggests that it is a favourable operating environment. It shows that the ISFs with longer duration are able to draw the customers' attention, build up the customer royalty and make a lot of wealth involving in the brokerage revenue. Experienced ISFs are able to make less discounted expenditure and utilise the branch resource.

The FHC subsidiary variable (FHC) has a significantly positive coefficient in two equations. This suggests that the ISF under FHC is an unfavourable operating environment. The empirical result at the first stage has shown that not the efficient ISFs are able to join the FHC. Besides, fourteen FHCs established through persuasion and pre-designation from Taiwan regulatory authority. It might reveal that politics are possibly intertwined with economics in Taiwan. Consequently, the purpose of forming FHC is not to leverage the synergy among subsidiaries and to improve their efficiency better, instead FHC turn into a negative factor on its securities subsidiary. This result is consistent with the empirical finding in Malaysian banks in 2006. Chong et al. [2006] indicates that the forced merger mechanism destroys shareholders' value. Contrary to the findings on voluntary mergers in the United States and Europe, Malaysian acquiring banks have a significant negative cumulated abnormal return under the forced merger scheme. Moreover, the FHC's securities subsidiaries diversify their dedication on brokerage business itself in Taiwan due to on-going merging from FHC and cross-selling of banking products. Plus, the regulatory authority limited banking branches not to sell the security products directly due to the fact that the firewall regulation and small-scale securities firms' protection are on the top of economic growth. It's another major reason to corrupt the one-stop shopping synergy. It also makes the ISFs under FHC not allow leveraging the banking resources and furthermore decrease the security's branches.

The annual sales amount has insignificant coefficient on two equations in model I of Table 10. It shows that the ISFs could increase their market share on brokerage market even though Taiwan national trading turnover is uncontrollable. In addition, the asset value of each firm has also insignificant coefficient on two equations in model I of Table 10. More assets cannot be proved favourable or unfavourable to the securities firms.

The coefficient of annual sales volume variable (VOL) and asset value (ASV) are insignificant and are hence omitted for slack prediction. Those environmental variables with significant coefficients such as DUR and FHC are included for slack prediction.

[Table 10 inserts here.]

4.3 Stage Three: Data Adjustment

The parameter estimates present in model II of Table 10 and the following Tobit regression models are used to adjust the original input data according to equation (5).

$x\hat{s}^1 = 5.35987 - 0.31405\ DUR + 1.8928\ FHC$

$x\hat{s}^2 = 1.18623 - 0.090371\ DUR + 0.0643657\ FHC$

$x_i^{k\ adj} = x_i^k + [Max^k\{x\hat{s}_i^k\} - \hat{E}(xs_i^k | E_i^k)];\ i = 1, \ldots, 14;\ k = 1,2$

Table 11 summarizes predicted slacks and maximum predicated slacks for all inputs. The adjusted data control influences of external operating environment.

[Table 11 inserts here.]

In 2002, one year before most FHCs establishment, the result reports that the ISFs under FHC contribute to the maximum predicted slack and reveals that the unfavourable external environment. In 2003 and 2004, the maximum predicted slack is from Fu Hwa Securities firms, which owns the least favourable external environment including the shortest duration in the securities industry and the subsidiary of FHC. This predicted slack result is also consistent with the result of parameter estimates above.

4.4 Stage Four: Re-compute the managerial efficiency

Tables 5 to 8 show the initial result from the stage 1 and the stage 4. In 2002, except of the environmental effect, the average of TE for the ISFs under the FHC has been increased from 0.915 to 0.925. It's shown that the ISFs are able to dedicate their effort to improve efficiency if these securities could address on their specialised brokerage business. This result is also consistent with the existing literature that if the firms would dedicate on one or two specialised business, then it is able to make the high efficiency because of learning-curve effect. As a consequent of controlling for the environmental variables at the fourth stage, the average TE is increasing during 2002 and 2003. This result indicates that the FHC's impact to ISFs under the unfavourable environment is greater than the benefit to ISFs with longer duration under favourable environment. Instead, the average TE is decreasing and the average PTE is increasing at the fourth stage during 2004 and 2005. This result indicates that the FHC's negative impact to ISFs is less than the duration positive impact to ISFs in terms of TE. From the perspective of PTE, the penalty to ISFs under negative FHC's impact is greater than the duration impact.

V. CONCLUDING REMARKS

In evaluating performance, it is useful to compute measures of managerial inefficiency for firms operating under different environments. This paper demonstrates the four-stage DEA model on the panel data of ISFs during 2002 to 2005 and investigates the impact of environmental variables. The first stage is to compute the technical efficiency through the traditional BCC DEA model based on inputs and outputs and excluding the external variables. The second stage is to specify a system of equations with total input radial plus slack movement as the dependent variables and environmental variables as the independent variables. The third stage is to apply the results of Tobit regression to calculate the maximum predicted data and adjust the original input data. The fourth stage is to re-compute DEA based on the adjusted input value and generate the adjusted radial efficiency scores that remove the influence of the external variables on inefficiency.

Based on this four-stage DEA result, the FHC has a significant negative effect on the managerial efficiency of an ISF. The mean of TE of ISFs under FHC is obvious less than the mean of TE of ISFs without joining in FHC. It shows that not the efficient ISFs allied with bank to form FHC. However, the empirical result shows that forming FHC would impose threat and create the incentives for efficiency. For example, 2002, one year before FHC establishment, the majority of ISFs are increasing returns to scale. On the contrary, ISF would be decreasing returns to scale if its parent FHC addressed on quicker merger activities instead of efficiency improvement. Furthermore, if the firms would dedicate on one or two specialised business, then it will help to make the high efficiency because of learning-curve effect, which is also consistent with the existing literatures. It's obvious that the way individual ISF is run is much more important than its form of organization. As we are also able to observe that non-FHC ISFs were trying to close the inefficient branches owing to the threat from FHC.

Besides, FHCs established through persuasion and pre-designation from Taiwan regulatory authority. It might reveal that politics are possibly intertwined with economics in Taiwan. Consequently, the purpose of forming FHC is not to leverage the synergy among subsidiaries and to improve their efficiency better, instead FHC turn into a negative factor on its securities subsidiary. This result is consistent with the empirical finding in Malaysian banks in 2006. Moreover, the FHC's securities subsidiaries diversify their dedication on brokerage business in Taiwan due to on-going merging from FHC and cross-selling of banking products. Plus, the regulatory authority limited banking branches not to sell the security products directly due to the fact that the firewall regulation and small-scale securities firms' protection are on the top of economic growth. It's another major reason to corrupt the one-stop shopping synergy. It also makes the ISFs under FHC not allow leveraging the banking resources and furthermore decrease the security's branches. Relatively, Most FHCs try hard to expand their asset value through M&A instead of improving internal efficiency.

The annual sales amount and asset value have insignificant impact on managerial efficiency. It shows that the ISFs could increase their market share on brokerage market even though the national trading turnover is uncontrollable. Meanwhile, unlike banking research, asset value in Securities industry is not significantly relevant with efficiency.

A higher duration of an ISF also significantly improves its technical efficiency. It shows that the ISFs with longer duration had established the good reputation on customers. The customers are much willing to brokerage their equity in the long historical security and bring more revenue to this type of ISFs.

Taiwan government limited banking branches to offer the securities sales activity directly. This regulation would hinder the cross-selling services to customers and indirectly eliminate the opportunity for synergy creation. The ideal synergy creation would be built on the full-functional sales channel for banking, securities and insurance.

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TABLE 1. 14 FHCs ESTABLISHMENT IN TAIWAN

FHC	Registered Date	ISF as its Subsidiary	Joined Date
First	2003/1/2	First Taisec	2003/7/31
China Trust	2002/5/17	China Trust	2002/5/17
SinoPac	2002/5/9	SinoPac	2002/5/9
Waterland	2002/3/26	Waterland	2002/3/26
Shin Kong	2002/2/19	Shin Kong	2002/2/19
Taishing	2002/2/18	Taiwan	2003/1/1
Jih Sun	2002/2/5	Jih Sun	2002/2/5
Fu-Hwa	2002/2/4	Fu-Hwa	2002/2/4
Mega	2002/2/4	Mega	2002/2/4
E. Sun	2002/1/28	E. Sun	2002/1/28
Cathay	2001/12/31	Cathay	2004/12
China Development	2001/12/28	Grand Cathay	2002/11/8
Fu Bon	2001/12/19	Fu Bon	2001/12/19
Hua Nan	2001/12/19	Hua Nan Entrust	2002/11/14

TABLE 2. THE ASSET VALUE (IN BILLION NT$) OF TOP 14 ISFs IN TAIWAN

Securities	2002	Ranking	2005[#]	Ranking
1. Fu Bon [f]	65.012	2	62.639	7
2. Taiwan [f]	48.895	5	52.259	12
3. KGI	38.264	11	90.776	2
4. Yuanta Core Pacific	102.49	1	148.224	1
5. Capital	45.910	6	72.677	4
6. President	41.741	8	53.487	10
7. Polaris	42.397	7	70.531	5
8. MasterLink	40.012	9	70.391	6
9. SinoPac [f]	49.346	4	53.826	9
10. Grand Cathay [f]	51.415	3	77.436	3
11. Jih Sun [f]	38.718	10	57.848	8
12. Taiwan International	22.582	13	41.379	13
13. Fu-Hwa [f]	23.143	12	30.825	14
14. Mega [f]	18.792	14	51.903	11
Subtotal for top 14 firms	628.720	71.86%[a]	895.520	78.74%[a]
Total Assets for Integrated Securities	874.859		934.202	

Note: [f] represents this integrated securities is the subsidiary of financial holding Co.

[a] Sample size as a percentage of integrated securities sector population, and the percentage calculated according to total asset shares.

[#] Asset value has been divided by GDP deflator. (2002 = 100)

TABLE 3. DEFINITION AND EXPLANATION OF VARIABLES

Variable	Definition
MS = y^1	Market share for brokerage business (%)
BR = y^2	Brokerage revenue (NT$100Mn)
BO = x^1	Branch offices
DE = x^2	Discounted expenses (NT$100Mn)

TABLE 4. DESCRIPTIVE STATISTICS OF INTEGRATED SECURITIES FIRMS, 2002-2005

Variables	2002				2003				2004				2005			
	Mean	SD	Max	Min	Mean	SD	Max	Min	Mean	SD	Max	Min	Mean	SD	Max	Min
Outputs																
MS(%)	4.33	2.04	9.23	1.74	4.17	1.62	8.07	1.61	4.24	1.55	8.13	1.87	4.15	1.62	8.26	1.88
MS(%) -FHC	4.30	1.78	7.06	2.08	4.18	1.34	6.30	2.43	4.20	1.26	6.05	2.42	4.07	1.36	6.14	2.18
MS(%)- Non-FHC	4.34	2.35	9.23	1.74	4.16	1.96	8.07	1.61	4.28	1.90	8.13	1.87	4.23	1.95	8.26	1.88
BR(NT$100Mn)	22.66	10.54	48.39	9.68	18.89	10.49	45.09	1.41	24.94	12.40	55.44	1.54	27.06	11.30	59.25	12.55
BR-FHC	22.56	8.85	35.06	10.50	16.95	9.80	30.61	1.41	23.14	11.65	37.19	1.54	24.96	7.67	33.26	14.04
BR-Non-FHC	22.72	12.30	48.39	9.68	20.83	11.55	45.09	8.25	26.74	13.78	55.44	11.30	29.16	14.40	59.25	12.55
Inputs																
BO	42.50	18.60	88.00	20.00	46.71	17.28	93.00	20.00	51.00	19.39	107.00	26.00	49.50	18.23	99.00	26.00
BO-FHC	43.80	14.52	61.00	21.00	47.14	11.33	64.00	31.00	52.29	10.77	64.00	34.00	50.57	12.63	65.00	27.00
BO-Non-FHC	41.57	22.16	88.00	20.00	46.29	22.76	93.00	20.00	49.71	26.35	107.00	26.00	48.43	23.62	99.00	26.00
DE	6.85	2.50	10.40	2.44	6.67	2.75	11.56	2.45	10.02	3.41	15.12	4.34	8.88	3.33	14.78	4.01
DE-FHC	7.33	2.87	10.32	3.89	6.75	2.96	10.39	3.72	10.20	3.79	14.89	6.01	9.12	3.71	14.78	5.15
DE-Non-FHC	6.50	2.38	10.40	2.44	6.59	2.75	11.56	2.45	9.83	3.29	15.12	4.34	8.64	3.19	14.66	4.01

The sample size is 54.

BR and DE have been divided by GDP deflator. (2002 = 100)

TABLE 5. COMPARISON OF STAGE 1 AND STAGE 4 RESULTS in 2002

DMU	The 1st Stage in 2002				The 4th stage in 2002			
	TE	PTE	SE	RTS	TE	PTE	SE	RTS
1.Fu Bon [f]	1.000	1.000	1.000	crs	1.000	1.000	1.000	crs
2.Taiwan [f]	0.789	0.832	0.949	irs	0.862	0.902	0.956	irs
3.KGI	0.923	0.959	0.963	irs	0.921	0.946	0.974	irs
4. Yuanta Core Pacific	1.000	1.000	1.000	crs	1.000	1.000	1.000	crs
5. Capital	0.969	0.986	0.983	irs	1.000	1.000	1.000	crs
6. President	1.000	1.000	1.000	crs	1.000	1.000	1.000	crs
7. Polaris	0.961	0.991	0.970	irs	0.982	1.000	0.982	irs
8. MasterLink	0.873	0.890	0.980	irs	0.891	0.912	0.976	irs
9. SinoPac [f]	0.760	0.773	0.984	drs	0.812	0.813	0.999	irs
10. Grand Cathay [f]	0.841	1.000	0.841	irs	0.878	1.000	0.878	irs
11.Jih Sun [f]	0.992	1.000	0.992	irs	0.877	0.880	0.975	drs
12.Taiwan International	0.875	1.000	0.875	irs	0.882	1.000	0.909	irs
Mean	0.915	0.953	0.961		0.925	0.954	0.971	
FHC-Mean	0.876	0.921	0.953		0.886	0.919	0.962	
Non-FHC Mean	0.943	0.975	0.967		0.954	0.980	0.977	

Note: TE represents the technical efficiency;

PTE represents the pure technical efficiency;

SE represents the scale efficiency;

crs, irs and drs represent the constant returns to scale, increasing returns to scale and decreasing returns to scale;

[f] means ISF under FHC.

TABLE 6. COMPARISON OF STAGE 1 AND STAGE 4 RESULTS in 2003

DMU	The 1st Stage in 2003				The 4th stage in 2003			
	TE	PTE	SE	RTS	TE	PTE	SE	RTS
1. Fu Bon [f]	0.926	1.000	0.926	drs	1.000	1.000	1.000	crs
2. Taiwan [f]	0.859	0.894	0.961	drs	0.946	0.969	0.977	irs
3. KGI	0.906	0.937	0.967	drs	0.949	0.966	0.982	irs
4. Yuanta Core Pacific	0.912	1.000	0.912	drs	0.994	1.000	0.994	drs
5. Capital	0.838	0.864	0.970	irs	0.964	0.981	0.983	irs
6. President	1.000	1.000	1.000	crs	1.000	1.000	1.000	crs
7. Polaris	0.893	0.896	0.997	irs	1.000	1.000	1.000	crs
8. MasterLink	0.774	0.801	0.966	irs	0.867	0.905	0.958	irs
9. SinoPac [f]	0.935	0.996	0.939	drs	1.000	1.000	1.000	crs
10. Grand Cathay [f]	0.808	0.891	0.907	irs	0.922	1.000	0.922	irs
11. Jih Sun [f]	1.000	1.000	1.000	crs	0.969	0.972	0.997	drs
12. Taiwan International	0.820	1.000	0.820	irs	0.774	1.000	0.774	irs
13. Fu-Hwa [f]	1.000	1.000	1.000	crs	1.000	1.000	1.000	crs
14. Mega [f]	0.767	0.825	0.929	irs	0.909	0.962	0.942	irs
Mean	0.888	0.936	0.950		0.950	0.983	0.966	
FHC-Mean	0.899	0.944	0.952		0.964	0.986	0.977	
Non-FHC Mean	0.878	0.928	0.947		0.935	0.979	0.956	

Note: TE represents the technical efficiency; PTE represents the pure technical efficiency; SE represents the scale efficiency; crs, irs and drs represent the constant returns to scale, increasing returns to scale and decreasing returns to scale;

[f] means ISF under FHC.

TABLE 7 COMPARISON OF STAGE 1 AND STAGE 4 RESULTS in 2004

DMU	The 1st Stage in 2004				The 4th stage in 2004			
	TE	PTE	SE	RTS	TE	PTE	SE	RTS
1. Fu Bon [f]	0.976	1.000	0.976	drs	1.000	1.000	1.000	crs
2. Taiwan [f]	0.836	0.865	0.966	drs	0.898	0.899	0.999	irs
3. KGI	0.970	1.000	0.970	drs	1.000	1.000	1.000	crs
4. Yuanta Core Pacific	1.000	1.000	1.000	crs	0.955	1.000	0.955	drs
5. Capital	0.945	0.945	1.000	crs	0.926	0.958	0.967	irs
6. President	1.000	1.000	1.000	crs	1.000	1.000	1.000	crs
7. Polaris	1.000	1.000	1.000	crs	1.000	1.000	1.000	crs
8. MasterLink	0.877	0.904	0.970	irs	0.869	0.925	0.939	irs
9. SinoPac [f]	0.933	0.989	0.943	drs	1.000	1.000	1.000	crs
10. Grand Cathay [f]	0.808	0.890	0.908	irs	0.823	0.984	0.836	irs
11. Jih Sun [f]	0.990	1.000	0.990	irs	0.858	0.860	0.998	irs
12. Taiwan International	0.867	1.000	0.867	irs	0.757	1.000	0.757	irs
13. Fu-Hwa [f]	1.000	1.000	1.000	crs	1.000	1.000	1.000	crs
14. Mega [f]	0.757	0.810	0.934	irs	0.777	0.879	0.884	irs
Mean	0.926	0.957	0.966		0.919	0.965	0.953	
FHC-Mean	0.900	0.936	0.960		0.908	0.946	0.960	
Non-FHC Mean	0.951	0.978	0.972		0.930	0.983	0.945	

Note: TE represents the technical efficiency; PTE represents the pure technical efficiency; SE represents the scale efficiency; crs, irs and drs represent the constant returns to scale, increasing returns to scale and decreasing returns to scale;

[f] means ISF under FHC.

TABLE 8. COMPARISON OF STAGE 1 AND STAGE 4 RESULTS in 2005

DMU	The 1st Stage in 2005				The 4th stage in 2005			
	TE	PTE	SE	RTS	TE	PTE	SE	RTS
1. Fu Bon [f]	0.927	1.000	0.927	drs	1.000	1.000	1.000	crs
2. Taiwan [f]	0.870	0.909	0.957	drs	0.958	0.961	0.997	drs
3. KGI	1.000	1.000	1.000	crs	0.889	0.891	0.998	drs
4. Yuanta Core Pacific	1.000	1.000	1.000	crs	1.000	1.000	1.000	crs
5. Capital	0.974	0.980	0.994	drs	0.990	0.992	0.998	irs
6. President	1.000	1.000	1.000	crs	1.000	1.000	1.000	crs
7. Polaris	1.000	1.000	1.000	crs	1.000	1.000	1.000	crs
8. MasterLink	0.876	0.905	0.968	irs	0.811	0.883	0.919	irs
9. SinoPac [f]	0.909	0.912	0.997	drs	0.988	0.990	0.998	irs
10. Grand Cathay [f]	0.857	1.000	0.857	irs	0.646	0.803	0.804	irs
11. Jih Sun [f]	1.000	1.000	1.000	crs	1.000	1.000	1.000	crs
12. Taiwan International	0.848	1.000	0.848	irs	0.768	1.000	0.768	irs
13. Fu-Hwa [f]	1.000	1.000	1.000	crs	0.978	1.000	0.978	irs
14. Mega [f]	0.733	0.798	0.919	irs	0.839	1.000	0.839	irs
Mean	0.928	0.965	0.962		0.919	0.966	0.950	
FHC-Mean	0.900	0.946	0.951		0.916	0.965	0.945	
Non-FHC Mean	0.957	0.984	0.973		0.923	0.967	0.955	

Note: TE represents the technical efficiency; PTE represents the pure technical efficiency; SE represents the scale efficiency; crs, irs and drs represent the constant returns to scale, increasing returns to scale and decreasing returns to scale;

[f] means ISF under FHC.

TABLE 9. THE DEFINITION OF ENVIRONMENTAL VARIABLES

Environmental Variables	Definition	Unit
VOL	Annual sales volume in brokerage	NT$100BN
DUR	The duration based on the registration date in SEC	Year
FHC	=1 if this company is the subsidiary of FHC =0 if this company is specialised integrated security	0 and 1
ASV	Asset Value	NT$BN

TABLE 10. TOBIT REGRESSION RESULTS

	Model I		Model II	
	Dependent Variable		Dependent Variable	
Independent Variable	xs^1	xs^2	xs^1	xs^2
Constant	5.92144* (3.07348)	1.007757 (0.771678)	5.35987*** (1.67524)	1.18623* (0.606758)
Annual Sales Volume (VOL)	-0.16747 (0.138793)	-0.009493 (0.036362)	-	-
Duration (DUR)	-0.399029** (0.159752)	-0.092441** (0.038561)	-0.31405*** (0.103068)	-0.090371** (0.036396)
FHC Subsidiary (FHC)	2.62616* (1.52742)	0.688963* (0.403324)	1.8928** (0.891556)	0.643657* (0.387277)
Asset Value(ASV)	0.0532 (0.049616)	0.00572278 (0.013104)	-	-
σ	4.60222*** (0.719161)	1.2154*** (0.190384)	4.73582*** (0 .740611)	1.21709*** (0.190592)
Log likelihood function	-89.3665	-56.1899	-90.2002	-56.2851

Note: Numbers in the parentheses are standard deviations;

***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively;

the sample size is 54.

TABLE 11. PREDICTED SLACKS AND MAXIMUM PREDICTED SLACKS

Year	ISF	DUR	FHC	Predicted Slack $\hat{E}(xs_i^k \mid E_i^k)$ for	
				xs^1	xs^2
2002	1. Fu Bon [f]	19	1	1.286	0.113
	2. Taiwan [f]	14	1	2.856	0.565
	3. KGI	14	0	0.963	-0.079
	4. Yuanta Core Pacific	41	0	-7.516	-2.519
	5. Capital	14	0	0.963	-0.079
	6. President	14	0	0.963	-0.079
	7. Polaris	14	0	0.963	-0.079
	8. MasterLink	13	0	1.277	0.011
	9. SinoPac[f]	14	1	2.856	0.565
	10. Grand Cathay [f]	14	1	2.856	0.565
	11. Jih Sun [f]	41	1	-5.623	-1.875
	12. Taiwan Intl.	14	0	0.963	-0.079
Maximum predicted slack [$Max^k \{x\hat{s}_i^k\}$]				**2.856**	**0.565**
2003	1. Fu Bon [f]	20	1	0.972	0.022
	2. Taiwan [f]	15	1	2.542	0.474
	3. KGI	15	0	0.649	-0.169
	4. Yuanta Core Pacific	42	0	-7.830	-2.609
	5. Capital	15	0	0.649	-0.169
	6. President	15	0	0.649	-0.169
	7. Polaris	15	0	0.649	-0.169
	8. MasterLink	14	0	0.963	-0.079

	9. SinoPac[f]	15	1	2.542	0.474
	10. Grand Cathay [f]	15	1	2.542	0.474
	11. Jih Sun [f]	42	1	-5.937	-1.966
	12. Taiwan International	15	0	0.649	-0.169
	13. Fu-Hwa [f]	7	1	5.054	1.197
	14. Mega [f]	14	1	2.856	0.565
Maximum predicted slack [Max^k {$x\hat{s}_i^k$}]				**5.504**	**1.197**
Year	ISF	DUR	FHC	Predicted Slack $\hat{E}(xs_i^k \mid E_i^k)$ for	
				xs^1	xs^2
2004	1. Fu Bon [f]	21	1	0.658	-0.068
	2. Taiwan [f]	16	1	2.228	0.384
	3. KGI	16	0	0.335	-0.260
	4. Yuanta Core Pacific	43	0	-8.144	-2.700
	5. Capital	16	0	0.335	-0.260
	6. President	16	0	0.335	-0.260
	7. Polaris	16	0	0.335	-0.260
	8. MasterLink	15	0	0.649	-0.169
	9. SinoPac[f]	16	1	2.228	0.384
	10. Grand Cathay [f]	16	1	2.228	0.384
	11. Jih Sun [f]	43	1	-6.251	-2.056
	12. Taiwan Intl.	16	0	0.335	-0.260
	13. Fu-Hwa [f]	8	1	4.740	1.107
	14. Mega [f]	15	1	2.542	0.474
Maximum predicted slack [Max^k {$x\hat{s}_i^k$}]				**4.740**	**1.107**

2005	1. Fu Bon [f]	22	1	1.914	0.294
	2. Taiwan [f]	17	1	1.914	0.294
	3. KGI	17	0	-8.458	-2.790
	4. Yuanta Core Pacific	44	0	0.021	-0.350
	5. Capital	17	0	0.021	-0.350
	6. President	17	0	0.021	-0.350
	7. Polaris	17	0	0.335	-0.260
	8. MasterLink	16	0	0.021	-0.350
	9. SinoPac[f]	17	1	1.914	0.294
	10. Grand Cathay [f]	17	1	-6.566	-2.146
	11. Jih Sun [f]	44	1	1.914	0.294
	12. Taiwan Intl.	17	0	2.533	0.373
	13. Fu-Hwa [f]	9	1	2.228	0.384
	14. Mega [f]	16	1	6.939	1.740
Maximum predicted slack [$\text{Max}^k \{x\hat{s}_i^k\}$]				**6.939**	**1.740**