Yugoslav Journal of Operations Research
Volume 20 (2010), Number 2, 276-292
DOI:10.2298/YJOR1002275C

EVALUATING TOTAL OPERATIONAL VALUE AND ASSOCIATED RISKS OF FINANCIAL HOLDING COMPANIES IN TAIWAN

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Received: August 2004 / Accepted: May 2010

Abstract: This study comprises several different parts. The first part applies a normal benchmark valuation model established by Penman to assess the potential whole operational values of FHCs. The second part applies the concept of measuring financial risk as earnings variance to establish a financial risk measurement model. This model can be used to examine the degrees of financial risk before and after FHC's establishment, and to distinguish different combinations of FHC based on risk diversion efficiency. The final part of this research constructs a new value-risk relation model that can be applied to cross-analysis for measuring total operation value of FHCs with different degrees of financial risk. Through completion of the above steps this study will demonstrate what combination of FHC offers the co-benefits of risk diversion and high whole operational value.

Keywords: Financial holding companies, whole operational value, financial risk, value at risk, value-risk relation model.

AMS Subject Classification: 91B30, 91B28.

1. INTRODUCTION

An enterprise can use external growth strategies, including mergers, joint ventures, and the establishment of holding companies, to achieve objectives of expansion; increasing market share in the short-term, adjusting production scope to optimize economies of scale and operating multiple businesses to disperse operational risk during expansion [6]. The economic advantages of mergers are not obvious [31],

owing to risks involving site, production, personnel and executive decision-making [33]. In the U.S. financial markets, the deposit-loan ratio of commercial banks is restricted; only investment banks can underwrite securities; insurance companies can only supply insurance products and bank branch establishment is subject to geographical limitations [16]. These restrictions prevent financial institutions from offering timely and extensive services, restricting financial development [20]. Accordingly, financial institutions have established banking holding companies (BHC), which cannot disperse systematic risk [17]. To exploit economic synergies [4], financial institutions have devised the concept of integrating firms that operate in various financial industries as financial holding companies (FHC). The establishment of FHCs is a new trend in financial development [25]. Recently, the Japanese government lifted a ban on the establishment of holding companies. The U.S. government permitted financial institutions to found FHCs, and thus boosting financial system development. Financial firms can gain various advantages by transforming themselves into FHCs, including being able to supply customers with various products, enjoying economies of scale [14]; reducing overall enterprise risk and increasing total FHC operating value, and supporting risk management [7]. The Taiwanese government implemented the Law governing Financial Holding Companies in June, 2001, which allowed financial institutions to transform themselves into FHCs to increase their competitiveness.

FHCs have the following characteristics. FHCs comprise a group of financial firms that combine into a single firm and offer distinct financial services. FHCs satisfy customers by offering one-stop shopping services, and thus resemble a financial supermarket [8]. FHCs have sufficient capital to support financial product research and organizational expansion, and integrate financial institutions to increase market share; promote sales of financial products, and boost earnings. FHCs also offer the advantages of a BHC [14, 25]. An insurance company that has been reorganized into an FHC can reduce its risk, and increase the operation value of its constituent parts [7]. Additionally, financial companies that restructure themselves into FHCs exploit preferential tax rules or offset profits against losses to reduce payable tax for the FHC to a value lower than the total sub payable by the constituent firms. Enterprises in an FHC provide mutual support with financing, and prepare consolidated financial statements to raise their capital adequacy ratios [11], thus increasing operation value [27]. Restated, financial institutions that reorganize themselves into FHCs have increased operational value [2], and consequently should enjoy increased stock value. However, the reality is that stock values generally reduce following FHC formation. Furthermore, the financial risk faced by an FHC increases with changes in operating procedures [28]. The persistence of improved business performance for FHCs is uncertain. This study thus examines operational instability and the increased financial risk of FHCs, and measures their overall operational value and financial risks.

This work examines Taiwan based FHCs, examines overall enterprise operational value and financial risk in the year following establishment. Analysis is conducted to determine the structure of the relationships between the overall operating value and financial risk. This study has five main research objectives: first, to modify the business whole benchmarking value measurement model developed by Penman into a new FHC whole value measurement model adapted to evaluate the overall objective value of an FHC; second, to obtain the earnings, book value and market value of every FHC in Taiwan and then apply the whole value measurement model for FHCs estimate

the overall operating value for different combinations, and then compare it with that for the corresponding FHCs. The effect of FHC establishment on overall benchmarking value is also determined, to clarify whether FHC establishment creates financial synergies; third, to assess Z-scores for FHCs and their individual constituent enterprises to determine the efficiency of financial risk dispersal; fourth, to integrate the VaR (value at risk) and Z-score models into a single financial crisis measurement model, called a Z_{VaR} model. The model is used to measure VaR for bankrupt FHCs; the final objective is to perform cross analysis to determine what combination of firms in an FHC minimizes financial risk while increasing overall operational value. The results of this study can help FHC managers not only to understand overall operating value but also perceive financial risk and thus adopt hedging strategies to mitigate extreme financial crises. Additionally, this study provides a good reference for investors in FHCs making risk-hedging decisions.

2. BIBLIOGRAPHY

An FHC is generally formed when firms merge in order to reduce operational financial risk. Numerical methods are available for evaluating firm value. One such method is the Asset-based Valuation Model, which applies the Net Realization Value Method, Modified Book Value Method, Fair Market Value Method, Replacement Cost Method and Strategy Value Method [6]. These methods focus on evaluating assets, but ignore the influence of liabilities and net value on firm value, profitability and future cash flows, leading to the underestimation of firm value. The second method is the Cash Flow Discounted Model, which considers enterprise value to be the total net value of future expected cash flows. This method uses weighted-average cost of capital (WACC) as the discount rate [24]. The advantages of this method include its consideration of the time value of currency, the effect of accounting method on earnings, business and financial risk, perpetual operation value and demand for working capital. However, this method also suffers limitations associated with the difficulty of estimating prospective cash flows and the lack of objective methods for determining the discount period. The third method is the Adjusted Cash Flow Discounted Method, which is based on the Cash Flow Discounted Model, Adjusted Present Value Method and Substance Option Method. The first method simultaneously considers all present values of equity funds and the way in which the finance strategy influences the firm's present value [17]. The latter method focuses on the values of the firm's accounts [6]. However, this method suffers the same weaknesses as the Cash Flow Discounted Method.

Stockholder equity has an objective market value. Virtually all suppliers and buyers in financial markets thus consider stock values in their investment decision-making [32]; Thomson [30] considered return on equity (ROE), return on assets (ROA) and ratio of capital to assets to measure FHC performance. As ROE or ROA increase, or the capital to assets ratio of an FHC decreases, operational performance increases, as does shareholder wealth. Shareholder benefits can be increased if FHCs effectively use derivatives for hedging. Hedging strategy quality thus influences the wealth of FHC owners [7]. Most studies on this area use a single numerical measurement of business value, for example market value, book value or earnings. These studies assume that these numerical values are unrelated [5], but some researchers see this assumption as false

([10]; [21]). Penman [21] generated a whole business benchmark value measurement model that not only combined three methods for measuring firm value - discounted dividends, value of growth opportunities and multi-step development - and also modified the traditional appraisal method that simply selected the unit variable used to determine the entity value. Penman claimed that book value and earnings jointly determined the business value. Earnings are obtained from the Income Statement and book value is obtained from the Balance Sheet, each of which reflect firm overall working situation. The book value and earnings, reasonably weighted, correspond to the overall entity value. When business earnings increase or book value decreases, expected ROE increases, and future earnings can be more heavily weighted in the measurement of firm value.

Several factors influence business, most notably financial risk [4]. High returns motivate managers to accept high risk [26]. A business that cannot disperse financial risk and avoid bankruptcy has a value of zero [1]. Risk measurement methods include stationary and dynamic measurement methods; the former characterize risk using statistical values such as probability, expected value, variation, bias and peak, while the latter represent expected risks and variations thereof using time series. Such measurement methods focus on business operations variation or uncertainty [22]. Value at risk (VaR) is already an important index for assessing market risk. VaR is the greatest loss that can be borne, within confidence limits, during a particular period in a normal market situation. VaR can estimate risk more immediately and explicitly than can traditional methods. Furthermore, VaR can simply express the maximum loss and associated probability. Methods commonly used to calculate VaR include the variable-covariable method, historical simulation method and Monte-Carlo simulation model [29]. Jackson et al. [13] claimed that the historical simulation method was the best among these because it accurately predicts fluctuations in the data and has an easily understandable numerical model.

3. NUMERICAL MODEL

3.1 Variables and assumptions

The notation used for the numerical model in this paper is detailed below.

T	: the end of the period in this case a season considered in the models.
τ	: τ th season in the period considered by the models with τ =0,1,2,…, T .
k	: cost of equity capital, plus 1,such that $\rho = k + 1$.
V_t^T	: equity value discounted based on perpetual dividends during period t .
$\widetilde{d}_{t+\tau}$	: expected reinvestment dividend.
$\widetilde{X}_{t+\tau}$	: expected net earnings less dividends.
$\widetilde{X}^c_{t+\tau}$	: expected earnings, including expected reinvestment dividends.
$\widetilde{X}^{cd}_{t+\tau}$	: expected earnings combined with expected and reinvested dividend during
P_{im}	: stock market price of the i th FHC.
B_{i*}	: per book value of the i th FHC in the whole benchmark value measurement
X_{i*}	: earnings per share of the i th FHC in the whole benchmark value measurement
$W_{j\tau}$	: actual weight of the j th firm during the model period.

$\hat{w}_{i*}$	: assessed weight of earnings after the establishment of FHC in the whole
ϕ_τ	: discount factor of earnings; that is $\rho_\tau/(\rho_\tau-1)$.
$\hat{P}_i^*$	: estimated whole benchmark value of the i th FHC in the whole benchmark
$\hat{p}_{ij}^*$	: estimated whole benchmark value of the j th subsidiaries in the i th FHC in
C_{ij}	: contribution of each of the jth subsidiaries in the i th FHC to whole benchmark
G_i	: accuracy of the whole benchmark value measurement model of the i th FHC.
e_{ij}	: total net value of assets of the j th subsidiaries during the last season before
V_{ip}^*	: whole benchmark value of i th FHC before its establishment in the whole
$P_i(t)$	: price of the i th firm at time t.
$\Delta P_i(t)$	: vector daily loss or gain in stock prices (change in prices).
$HS-$	: q th probable simulated price on the first day in the future period ($P_i(1)$).
VaR_{1t}	: Value at Risk during period t.
PV_0	: mixed price of each subsidiary within an FHC.
$PV(q)$	: stock price under the q th loss state of FHC.
ΔPV	: mixed loss or income value of each subsidiary of the FHC.
VaR_{nt}	: VaR of a FHC with n subsidiaries at period t.
$\overline{VaR_n}$	: mean VaR during the change wicket of FHC before its establishment.
$\overline{VaR}_1$	: average VaR after FHC establishment.
P_{VaR}^*	: stock price of FHC, accounting for VaR and $\hat{P}_i^*$.
r_ℓ	: coefficient of each factor that explains the degree of risk, ℓ=1,2,3,4.
$EBIT$	: earnings before tax and interest.
TA	: total assets.
NWC	: net working capital, namely current assets minus current liabilities.
MVE	: market value of equity, namely the product of the common stock market price
BVE	: book value of equity.
TD	: total liabilities.
ARE	: accumulated retained earnings.
FON	: outstanding quantity of common stock.

The following assumptions are made to establish the numerical model and support effective research.

1. The price of equity is the discounted value of the dividend over an infinite horizon, and capital cost and current earnings determine future expected earnings.
2. The earnings and book value reflect all information regarding future earnings and price.
3. k denotes the total interest rate of the three-month Treasury bond and the historical risk premium of 6%.

4. The parameter used in the historical simulation method was $\alpha = 5\%$; the moving wicket was 250 days and the evaluation period was the following day.

3.2 Establishment of the whole benchmark measurement model

The business benchmark measurement model developed by Penman [21] is applied initially to establish an FHC whole benchmark value measurement model. This model considers FHC book value and earnings. Based on the business benchmark measurement model, stockholder equity is the present value of future perpetual dividends. Therefore, stockholders equity has price:

$$V_t^T \equiv (\rho_t^T - 1)^{-1} E(\sum_{\tau=1}^{T} \widetilde{X}_{t+\tau}^c) \tag{1}$$

and

$$E_t(\sum_{\tau=1}^{T} \widetilde{X}_{t+\tau}^c) \equiv E_t[\sum_{\tau=1}^{T} \widetilde{X}_{t+\tau} + \sum_{\tau=1}^{T} (\rho_t^{T-\tau} - 1)\widetilde{d}_{t+\tau}] \tag{2}$$

Equation (1) specifies the equity value during period t as the sum of firm discounted expected earnings, based on the equity capital cost during period $t+\tau$. Equation (2) demonstrates that part of the expected value results from the reinvestment of the current dividend, and the expected earnings are the combination of growth of current earnings and returns on reinvested dividends. As T tends to infinity, the equity value approaches the benchmark value, P^*, for which the expected earnings equals the sum of expected net earnings and expected returns on the reinvested dividends. Using the book value and earnings to measure the business value is more reasonable than using a single variable, such as book value or earnings. Accordingly, Penman [21] changed Eq. (1) to:

$$P_{j\tau} = (1 - W_{j\tau})B_{j\tau} + W_{j\tau}(\phi_\tau X_{j\tau} - d_{j\tau}) \tag{3}$$

Equation (3) uses estimated weights to merge the earnings and book value into an inner value. Based on the hypothesis of the irrelevance of MM dividends (Ross et al, 2002), Eq. (1) is substituted into Eq. (3) to yield the expected whole benchmark value of one subsidiary company of an FHC :

$$\hat{P}_i^* = (1 - \hat{w}_{i*})B_{i*} + \hat{w}_{i*}(\phi_* X_{i*}) \tag{4}$$

The weight in Eq. (4) enables the consolidation of earnings and book value to create a benchmark value measurement model for a firm. The weight $W_{j\tau}$ can be obtained from Eq. (3):

$$W_{j\tau} = (P_{j\tau} - B_{j\tau})/(\phi_\tau X_{j\tau} - B_{j\tau}) \tag{5}$$

According to the theorem of Penman, the weight of FHC earnings can be assessed based on the median weight calculated during every sample period. The weight can be expressed as:

$$\hat{w}_{i*} = Median[W_{j\tau}] \tag{6}$$

The model accuracy is measured by comparing the expected whole benchmark value from Eq. (4) with the actual market value, namely:

$$G_i = (1 - \left| P_{im} - \hat{P}_i^* \right| / P_{im}) \times 100\% \tag{7}$$

Accuracy exceeding 80% indicates acceptable evaluation efficiency [9]. If an FHC has n subsidiaries, then the contribution of the *j*th subsidiary to the overall operational value of the *i*th FHC is [24]:

$$C_{ij} = e_{ij} / \sum_{j=1}^{n} e_{ij} \tag{8}$$

Furthermore, the expected whole benchmark value of the FHC is:

$$V_{ip}^* = \sum_{j=1}^{n} C_{ij} \times \hat{p}_{ij}^* \tag{9}$$

Equation (9) describes the constructed FHC whole benchmark value measurement model, which is based on the concept of whole benchmark value developed by Penman.

3.3 Constructing a model for measuring financial risk

3.3.1 VaR model

The historical simulation method for determining VaR considers historical series of stock value data and assumes that stock prices return completely during future evaluation periods. The interval during which the prices are altered is known as the "changing wicket", during which the daily return is the natural logarithm of the closing price for the current day divided by that closing price. The distribution of historical net incomes is also considered for simulating and predicting future returns. Initially, the distribution of stock-price returns for an individual firm is simulated. $P_i(t)$ denotes the price of the i th asset in period t, and the stock prices for the last N+1 days are simulated . After deducting the prices on the previous two days, the $\Delta P_i(t)$ values of asset N are derived as a row of income data. This row represents the N types of income on the following day in the future. During a changing wicket 250 days [12], the stock price $P_i(0)$ plus historical income from $\Delta P_i(-1)$ to $\Delta P_i(-N)$ describe the N likely income situations on the next day:

$$HS\text{-}P_i(q) = P_i(0) + \Delta P_i(q),\ q = 1,2,\ldots,\mathrm{N} \tag{10}$$

Equation (10) describes the q th situation where the simulated price is the price on the following day in the future (Historical Simulation of S, HS-S). The distribution of stock returns is determined for every stock price, for various $p_{\alpha\%}$ to evaluate the loss of liquidation risk. If α = 5%, enabling the VaR to be expressed as [12]:

$$VaR_{1t} = p_{5\%}[\Delta P_i(q)] \tag{11}$$

Equation (11) can determine financial VaR of an FHC. When various assets and combinations of firms are considered, the historical income of each subsidiary must be simulated separately. The previous simulated income distribution of an FHC is then determined by multiplying the weighted sum of the historical simulated income of each subsidiary by the weights determined based on the net values of the assets of each subsidiary [3].

Consider n subsidiaries of an FHC, where C_1 to C_n denote the net weightings of the assets of each subsidiary. The price of the FHC, as a combination of its subsidiaries in the qth situation, is then:

$$PV_0 = C_1 P_1(0) + C_2 P_2(0) + \ldots + C_n P_n(0) \tag{12}$$

At time t=1(situation q) :

$$PV(q) = C_1(HS - P_1(q)) + C_2(HS - P_2(q)) + \ldots + C_n(HS - P_n(q)),\ q = 1,2,\ldots, N \tag{13}$$

The stock income vector of FHC is:

$$\Delta PV(q) = PV(q) - PV_0\ ,\ q = 1,2,\ldots, N \tag{14}$$

PV denotes the evaluated stock price and ΔPV represents the income value of the FHC. If ΔPV values are sorted in ascending order, the income distribution of the portfolio on one day can be described. Given α = 5%, VaR is as follows:

$$VaR_{nt} = p_{5\%}[\Delta PV(q)] \tag{15}$$

To determine the whole risk of a subsidiary during a specific period, the following equation is used:

$$\overline{VaR}_n = \sum_{t=1}^{T} VaR_{nt} / T \tag{16}$$

while the whole VaR of an FHC is:

$$\overline{VaR}_1 = \sum_{t=1}^{T} VaR_{1t} / T \tag{17}$$

Equations (16) and (17) can evaluate the VaR of any FHC. Finally, the stock price of the FHC can be determined using VaR:

$$P^*_{VaR} = PV_0 \times (1 - \overline{VAR}_1) \tag{18}$$

Firm value varies inversely with risk [15], even when the risk and value are simultaneously high [23]. The concept of marginal risk probability developed by Luciano et al. [18] is applied in this study to derive the relationship between the business value and risk of an FHC [19]. Expanding Eq. (18) into a Value-risk Relation Model yields:

$$F(V_q) = \Pr(\hat{P}^*_i \le P^*_{VaR}) < \alpha \tag{19}$$

Equation (19) presents the relationship between the value and risk of establishing an FHC.

3.3.2 Z_{VaR} model

The VaR model of FHC presented above can measure only the market risk value, but does not indicate whether the FHC can operate perpetually. This study thus combines Eq. (18) with the Z-score model [1] due to establish a new Z_{VaR} model. The model can be used to measure the marginal value of a financial risk crisis, and thus to assess whether an FHC experiencing a financial crisis is an insolvency risk given a certain VaR. The Z-score financial risk crisis model is:

$$Z = r_1 \frac{EBIT}{TA} + r_2 \frac{NWC}{TA} + r_3 \frac{MVE}{TD} + r_4 \frac{ARE}{TA} \tag{20}$$

Z-score<1.23 indicates that the firm has a high probability of insolvency; 1.23<Z <2.9 indicates uncertainty and Z >2.9 indicates the absence of insolvency risk. The Z_{VaR} model below was developed to examine whether an FHC facing financial risk is likely to face a bankruptcy crisis:

$$Z_{VaR} = r_1 \frac{EBIT}{TA} + r_2 \frac{NWC}{TA} + r_3 \frac{P^*_{VaR} \times FON}{TD} + r_4 \frac{ARE}{TA} \tag{21}$$

The Z_{VaR} model can be used to evaluate the liquidation risk.

4. POSITIVE RESEARCH

The models developed in Section 3 are used to demonstrate the hypotheses. Six hypotheses are posited. Hypothesis 1 is that the new FHC whole benchmark value measurement model can be used to objectively measure the whole operational value of an FHC; hypothesis 2 is that the establishment of an FHC generates financial synergy; hypothesis 3 is that the establishment of an FHC disperses financial risk; hypothesis 4 is that the new Z_{VaR} model can measure the degree to which an FHC risks insolvency in a financial crisis, given a certain VaR, and hypothesis 5 is that FHCs tend to have high value and low financial risk. Financial data were obtained for 13 FHCs for the period 2002/Q1 to 2003/Q1 were obtained to test these five hypotheses. The FHCs considered all had an operating history exceeding) one year; included HuaNan FHC, FuBang FHC, GuoTai FHC, KaiFa FHC, YuShan FHC, FuHua FHC, JauFeng FHC, TaiShin FHC, ShinGuang FHC, GuoPiau FHC, JianHua FHC, JungShin FHC and JihSheng FHC.

4.1 Positive analysis

This section described the content of analysis related to the hypotheses.

Table 1: $\hat{w}_{i*}$ of each FHC after it is established

(1) Measurement of the whole benchmark value and accuracy

Equations (5) and (6) evaluated the weight $\hat{w}_{i*}$ of earnings of individual FHCs listed in Table 1, to measure the benchmark value of each FHC. Table 2 lists the whole benchmark values $\hat{P}_i^*$ of the FHCs, calculated from Eq. (4). Comparing all $\hat{P}_i^*$ values with

the market value P_{im} gives accuracy of 87.38%. Accuracy exceeding 80% indicates that the model has good evaluation efficiency and can be accepted (Deng and Guo, 1996).

FHC	$\hat{w}_{i*}$
HuaNan	-0.999
FuBang	-1.129
GuoTai	-2.717
KaiFa	-0.443
YuShan	-0.237
FuHua	0.156
JauFeng	-0.047
TaiShin	-0.364
ShinGuang	-0.101
GuoPiau	0.351
JianHua	-0.183
JungShin	-1.234
JihSheng	0.440

Table 2: Accuracy degree examination for whole operational values of FHC

FHC	$\hat{P}_i$	P_{im}	$G_i = (1 - \left\|P_{im} - \hat{P}_i^*\right\| / P_{im}) \times 100\%$
HuaNan	20.39	23.61	86.36%
KaiFa	18.72	13.89	65.23%
GuoPiau	8.29	7.4	87.97%
JungShin	27.91	28.97	96.34%
FuHua	11.08	10.61	95.57%
GuoTai	28.2	39.7	71.03%
YuShan	11.81	16.73	70.59%
JauFeng	15.91	17.45	91.17%
JianHua	14.94	13.83	91.97%
JihSheng	7.94	7.87	99.11%
FuBang	32.72	27.86	82.56%
ShinGuang	10.39	10.19	98.04%
TaiShin	18.22	18.22	100.00%
Mean of G	--	--	87.38%

Unit：Dollar/ per stock)

(2) Financial synergy

Equation (6) yields the median of the weights, $\hat{w}_*$=0.18, of each FHC subsidiary over a decade. This median can be considered to assess the whole benchmark value of an FHC before its establishment. The whole benchmark value of the *i*th FHC before its

establishment is given by Eqs. (4) and (8), and is V_{ip}^*. The V_{ip}^* value of other FHCs are obtained similarly. After the FHC established, $\hat{P}_i^*$ and V_{ip}^* are compared to determine whether financial synergy exists (Table 3). Therefore, the hypothesis $H_o : \hat{P}_i^* - V_{ip}^* \le 0$ vs. $H_1 : \hat{P}_i^* - V_{ip}^* > 0$ is rejected because, when $\alpha = 0.05$, the P-value was smaller, being 0.037. FHC establishment results in favorable increase in whole benchmark value.

Table 3: Whole operational values of FHCs before and after their establishment

FHC	V_{ip}^*	$\hat{P}_i^*$	$(\hat{P}_i^* - V_{ip}^*)/V_{ip}^* \times 100\%$
HuaNan	19.13	20.39	6.59%
KaiFa	15.82	18.72	18.33%
GuoPiau	10.77	8.29	-23.03%
JungShin	19.19	27.91	45.44%
FuHua	8.93	11.08	24.08%
GuoTai	16.59	28.2	69.98%
YuShan	13.03	11.81	-9.36%
JauFeng	15.29	15.91	4.05%
JianHua	12.72	14.94	17.45%
JihSheng	12.1	7.94	-34.38%
FuBang	17.64	32.72	85.49%
ShinGuang	12.69	10.39	-18.12%
TaiShin	13.88	18.22	31.27%
Mean	--	--	16.75%**
(t-value)	--	--	(1.707982)

** 5% of Significance level (Unit: Dollar/per stock)

(3) Evaluating VaR and Z-score

This work applied the Historical Simulation method to estimate VaR, with the estimation period being the following day in future, α of 5% and moving wicket of 250 days. Equations (16) and (17) were used to estimate the VaR, and to estimate the VaR of every FHC. Table 4 listed the detailed outputs. Subsequently, the significant statistical examination method verifies whether the establishment of FHC is associated with risk reduction. According to Table 4, as well as knowledge of the VaR of each FHC before and after establishment, the hypotheses H_o: VaR_{after} - $VaR_{\text{before}} \le 0$ v.s H_1: VaR_{after} - VaR_{before} >0 are examined and statistical significance tests are performed. The P-value was fond to be 0.0683, less than the level of significance of 10%, and thus hypothesis H_o that represented the VaR after FHC established was exceeding before it established, was rejected.

Equation (20) assesses the Z-score, considering the weights of the subsidiaries of each FHC, as a measure of the influence of FHCs establishment. Table 5 presents the

calculated difference between the Z-scores of established FHCs and those of the constituent firms prior to FHC establishment. Statistical testing is conducted to determine whether FHC establishment disperses risk. The hypotheses $H_o : Zscore_{after} - Zscore_{before} = 0$ vs. $H_1 : Zscore_{after} - Zscore_{before} \neq 0$ are tested. From the table, given a significance level of $\alpha = 0.05$, the P-value was 0.0217 and thus H_o was rejected, meaning that establishing FHCs increases financial risk.

Table 4: Eestimated VaR of every FHC and their component companies

FHC	Before established VaR(1)	After established VaR(2)	After minus Before ((2)-(1))
HuaNan	-0.039400	-0.065400	-0.026000
FuBang	-0.039500	-0.033400	0.006100
GuoTai	-0.033400	-0.036800	-0.003400
KaiFa	-0.039100	-0.041200	-0.002100
YuShan	-0.029600	-0.043100	-0.013500
FuHua	-0.035300	-0.044900	-0.009600
JauFeng	-0.041200	-0.049300	-0.008100
TaiShin	-0.048800	-0.048900	-0.000100
ShinGuang	-0.039100	-0.059100	-0.020000
GuoPiau	-0.038700	-0.051300	-0.012600
JianHua	-0.045300	-0.037800	0.007500
JungShin	-0.038400	-0.033500	0.004900
JihSheng	-0.047600	-0.045400	0.002200
Mean	-0.039646	-0.045392	-0.00575**
(t-value)	--	--	(-2.003021)

** 5% of Significance level

Table 5: Evaluated Z-scores of FHCs

FHC	$Z-score$ [1] (before established)	$Z-score$ [2] (after established)	[1]-[2]
HuaNan	2.3413	1.8987	0.4426
FuBang	9.5931	4.1643	5.4288
GuoTai	6.6144	3.2385	3.3759
KaiFa	27.8838	10.2334	17.6504
YuShan	3.6436	2.5672	1.0764
FuHua	2.1880	2.0892	0.0988
JauFeng	13.5483	2.0448	11.5035
TaiShin	1.7742	1.4397	0.3345
ShinGuang	4.9317	1.8816	3.0501
GuoPiau	32.5322	6.0346	26.4976
JianHua	4.9206	2.2694	2.6512
JungShin	39.5642	2.6133	36.9509
JihSheng	3.4290	1.6869	1.7421
Mean	11.7665	3.2432	8.5233**
(t-value)			(2.6379)

** 5% of Significance level

(4) Measuring Z_{VaR}

This work applied historical simulation to estimate VaR, over an evaluation period of the following day in the future; α was 5% and the change wicket was 250 days. Equation (17) was used to estimate the VaR of each FHC, and Eq. (20) was used to yield the Z_{VaR} numerical model (as shown in Eq. (21)) for measuring financial risk for specific VaR values. Table 6 lists the analytical results, and reveals that FuBang FHC, GuoTai FHC, KaiFa FHC and JungShin FHC did not hit a critical point of bankruptcy during the Asian financial crisis. Meanwhile, the other firms sampled came close to bankruptcy. TaiShin had the highest probability of insolvency, with a Z_{VaR} value of close to 1.23.

Table 6: Z_{VaR} values of FHCs

FHC	Z_{VaR}
NanHua	1.8655**
FuBang	4.1082
GuoTai	3.1922
KaiFa	9.8339
YuShan	2.5297**
FuHua	2.0482 **
JauFeng	2.0007 **
TaiShin	1.3998 **
ShinGuang	1.8603 **
GuoPiau	5.7622
JianHua	2.2339 **
JungShin	2.5792 **
JihSheng	1.6605 **

*** Z_{VaR} <1.23 FHC that probably was exposed to risk of bankruptcy during financial crisis.

** 1.23< Z_{VaR} <2.9 express uncertainty

* Z_{VaR} >2.9 express without bankruptcy crisis

(5) Value-risk relationship and cross analysis

The whole benchmark and VaR values of FHCs were determined, and Eq. (19), the Value-risk Measurement Model, was applied to determine the FHCs operational values given various risks, as listed in Table 7. Among the FHCs, after FHC establishment increased the value-risk, including FuBang, KaiFa, FuHua, TaiShin,

ShinGuang, GuoPiau, JianHua and JihSheng. However, when the whole industry was investigated, there was no clear increase in value-risk following FHC establishment, which meant that FHC establishment could not enhance whole operational value of financial institutions and bring benefits of financial risk dispersion. A schematic curve was then plotted using the two dimensions of VaR, and the whole operational was expressed in Fig. 1. FHC combinations that disperse high risk and boost operational value were thus determined.

Table 7: the VaR difference before and after FHCs establishment

Company	after	before	difference
NanHua	20.39	22.07	-1.68
FuBang	32.72	26.93	5.79
GuoTai	28.20	38.24	-10.04
KaiFa	15.82	13.32	2.50
YuShan	11.81	16.01	-4.20
FuHua	11.08	10.13	0.95
JauFeng	15.91	16.59	-0.68
TaiShin	18.22	17.33	0.89
ShinGuang	10.39	9.59	0.80
GuoPiau	10.77	7.10	3.67
JianHua	14.94	13.31	1.63
JungShin	27.91	28.00	-0.09
JihSheng	7.94	7.51	0.43
Mean			-0.001581
t-value			-0.001471

** 5% of Significance level

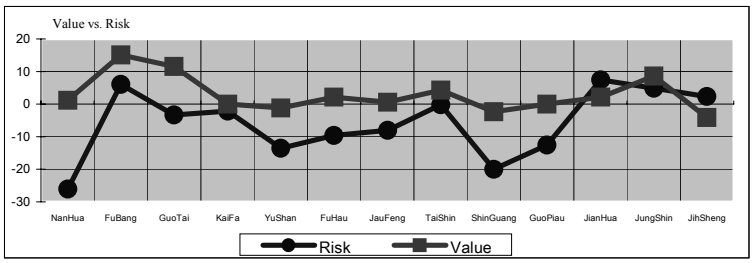

Fig. 1: Cross-analysis of values and risks

The values in Fig.1 represent the financial synergy associated with FHC establishment. The figure also shows risk dispersion. A value that exceeds the datum line (equal to zero) reveals financial synergy, and risk exceeding the datum line (equal to zero) is dispersed. Hence, Fig. 1 shows that FuBang FHC, JianHua FHC and JungShin FHC displayed high-risk dispersal and whole operational value. Table 7 also indicates that only FuBang FHC had high risk- dispersal efficiency and significantly increased whole operational value. In contrast, only YuShan FHC exhibited increased risk and reduced whole operational value.

4.2 Positive results

The main study results are as follows.

(1) This investigation developed a business whole benchmark evaluation model, which can be used to objectively measure the value of a FHC. Hypothesis 1 was supported.

(2) The whole benchmark value of the business after FHC establishment was significantly increased compared to previously, implying that FHC establishment brings financial synergy, and hypothesis 2 thus was accepted.

(3) FHC establishment significantly increases financial risk. The risks of the JungShin FHC, GuoPiau FHC, KaiFa FHC and JauFeng FHC were increased by more than 10 bases. FHC establishment increased firm financial risk, consistent with theory, and thus FHCs do not enjoy any advantages in terms of dispersed risk during the first year following their foundation. The related hypothesis was thus rejected.

(4) The new Z_{VaR} model was applied to objectively measure FHC insolvency risk. Besides FuBang FHC, GuoTai FHC, KaiFa FHC and JauFeng FHC, which have Z_{VaR} values exceeding 2.9, the remaining FHCs faced possible bankruptcy crisis. The FHCs were ranked in order of descending probability of bankruptcy as follows: TaiShin FHC, JihSheng FHC, ShinGuang FHC, HuaNan FHC, JauFeng FHC, FuHua FHC, JianHua FHC, YuShan FHC and JungShin FHC. The Z_{VaR} values can be compared to actual stock prices or earnings, enabling the Z_{VaR} model to be used to measure FHC financial risk. Hypothesis 4 was accepted.

(5) The Value-risk Relation Model was applied to perform cross analysis and determine that YSFHC faces high financial risk, with reduced operating value. Hypothesis 5 was firmly rejected.

5. CONCLUSION

The establishment of FHCs has become popular in recent years. However, whether establishing FHCs creates value remains controversial. At the end of 2003/Q1, 13 FHCs were established and operated for over one year in Taiwan. This work focuses on designing a FHC whole benchmark value measurement model to assess FHC business value, and determine whether establishing an FHC generates financial synergy. A new financial crisis risk model is also designed to estimate FHC risk of bankruptcy at a particular VaR. The main contributions of research are the development of the FHC

Benchmark Value Measurement Model, the Value-risk Relation Model and the Z_{VaR} Model, and the analysis demonstrated that FHC benefit from clear financial synergies. However, some FHCs do not benefit from dispersed financial risk, but instead suffer increased financial risk. The Z_{VaR} Model can be used to evaluate the degree to which each FHC faces a financial risk associated crisis, and some FHCs have Z_{VaR} values exceeding 2.9, while for others the values are below 1.23, indicating that none of the FHCs became insolvent. When the relationship between the values and risks of FHCs is considered, FHCs that combine banking, insurance and security firms (such as FuBang FHC) enjoy greater risk dispersal and high overall operational value. Notably, FHCs that comprise only a bank and a security firm (like YuShan FHC) face increased risk and reduced operating value. The results presented in this study can not only help FHC managers to understand the overall operational value of their enterprises, to help control business performance, but also to understand the risks they face. The findings also provide a useful reference for investors when evaluating an FHC or making decisions regarding the selection of FHC stocks as investment targets.

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