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An Empirical Analysis on the Prediction of Chinese Financially Distressed Listed Companies

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This paper presents an in-depth analysis of financially distressed listed companies in China between 1998 and 2002. We compare the predictive power of multiple discriminant analysis (MDA), logistic regression, and neural network models. We design and implement 126 different forecasting models using different predictive methods, different sample proportions, and different initial independent variables. The aim is to determine which model(s) and variables are best applicable for the short-term prediction of financial distress in China. We find that logistic regression models are superior to multiple discriminant analysis models in terms of prediction accuracy rate, restriction of sample distribution or prediction cost, but the neural network models show promise in their low Type I and Type II errors. The paper also inherently tests the applicability of variables traditionally used for bankruptcy prediction to the purpose of financial distress prediction in China.

Keywords: financial distress prediction, neural networks, Chinese listed companies, Chinese special treatment events

Introduction

As the fast and stable growth of China's economy gains global recognition, the Chinese stock market is capturing the attention of international investors.[1] In 2003, when the QFII (Qualified Foreign Institutional Investor) system was introduced to allow foreign investors to invest directly in China's domestic stock market, top international investment banks, such as Citigroup, Credit Suisse First Boston, Goldman Sachs, Hong Kong and Shanghai Banking Corporation [HSBC], and Nomura Securities promptly applied for, and received their licenses. In addition, the Dutch bank ING Group NV, the German firm Allianz AG, Societe General of France, and Fortis established Sino-foreign joint venture fund management firms and brokerage houses to enable them to invest in shares and bonds in China. Recently, the Chinese authority has been determined to de-list some of the listed firms given their bad performance. Thus, it is important for investors (foreign and domestic) and

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[1] The two major Chinese stock exchanges, Shanghai and Shenzhen, have only been in existence since 1990 and 1991, respectively. Despite the relative youth of these two exchanges, the number of listed firms had reached 1,287 by the end of 2003. The total market capitalization of listed Chinese firms stood at US$464 billion at the end of 2002 and US$514 billion at the end of 2003. These amounts are equal to half of China's GDP, making the Chinese capital market the third largest in the Asia-Pacific region behind those of Japan and Hong Kong.

policy makers develop a sound prediction model to analyze these Chinese financially distress firms.

Financial distress prediction research was boomed in the 1960s. There are various prediction models including Zeta discriminant model, logistic regression model, linear probability model, and a more recent technique such as the neutral network. These models predominantly predict bankruptcy. The objective of this paper is to develop an optimal model for predicting financial distress in China's listed firms, using as a base, basis of multiple discriminant analysis (MDA), logistic regression models, and neural network models. The paper will also inherently test the applicability of these predominantly bankruptcy models to the prediction of financial distress in China. Using different proportions of samples and initial independent variables, we select the best model and financial indicators which can predict short-term performance of financial distress in Chinese listed companies. It seems that a logistic model with the sample proportion similar to the actual population, one-year financial indicators, and changes in variables for three-year as initial independent variables appear to predict these firms well. A closer look into the Type I and Type II error results of the neural network models also shows potential deserving further investigation.

This study contributes to current studies on financial distress prediction in the following ways: First, this is the first paper to examine this issue in terms of publicly listed firms in China, which makes the results useful for banking credit risk management and investors. Second, this study is the first to utilize the neural network model to predict the bankruptcy of Chinese firms, and thus explores a new way of making such predictions. Third, the variables examined in this paper are much more comprehensive than those included in previous papers. Not only are static variables included, but also dynamic[2] variables. The paper also opens an interesting area of research comparing with the Type I and Type II error rates of traditional statistical models as compared to neural networks. Finally the paper tests the applicability of traditional bankruptcy models, such as Altman Z-score, previously tested on mature markets to the prediction of financial distress within an emerging market like China.

This paper is organized as follows: Section 2 reviews previous studies on predicting the different forms of financial distress, while a discussion of the research methodology follows in Section 3. The selection of the sample and the initial independent variables and models are described in Section 4 and Section 5, respectively. Section 6 analyzes the empirical results and Section 7 concludes the paper.

Literature Review

In the prediction of financial distress, two kinds of statistical methods are commonly used: parametric statistical methods and the non-parametric statistical methods. The representative methods for the former are multiple discriminant analysis and logistic regression models; and the representative model for the latter is the neural network approach.

Altman (1968) first adopted the multiple discriminant method to study corporate failure. He combined traditional single financial ratio analysis with statistical analysis and developed the well-known *Z*-Score model. Many scholars followed his lead, e.g., Edmister (1972), Altman, Haldeman, and Narayanan (1977), Collins (1980), Casey and Bartczak (1985), and Gombola, Haskins, Ketz, and Williams (1987). Altman and Eisenbeis (1978) investigated the stability, predictive power, and variable analysis method of the linear discriminant model by Maurice and Tollefson (1975) and compared the model with other models. They found that the

[2] In this application, the term "dynamic" refers to the change of these variables over various horizons. Since much of the data used is directly from balance sheets, it is important that the movement in these accounts is also investigated as a potential source of important information for prediction.

predictive power of linear discriminant models is higher than that of proportional chance models and maximum chance models. However, Ohlson (1980) pointed out that multiple discriminant analysis requires samples to be normally distributed, which will affect the validity of the models. After comparing the multiple discriminant analysis and logistic regression model, he first applied the latter to predict the bankruptcy of companies in non-financial industries. Zavgren (1985) theoretically compared multiple discriminant analysis and the logistic regression model and concluded that the logistic regression is more practical. He also pointed out that Ohlson (1980) did not take full advantage of the logistic regression model in his study. Logistic regression models have since been used by H. D. Platt, M. B. Platt, and Pedersen (1994), Sheppard (1994), Mossman, Bell, Swartz, and Turtle (1998), Tirapat and Nittayagasetwat (1999).

Coats and Fant (1993) are the first to use a neural network model to conduct a predictive study of the financial distressed companies in non-financial industries. Their study was novel in their use of auditors' reports as an indication of financial distress rather than the use of filing for bankruptcy. Jain and Nag (1997) established two approaches to identifying the relevant input variables for the network models. In the first approach, all of the 14 variables are used as inputs to train the neural network. The second approach involved two stages. In the first stage, a logical model is used to identify variables that are significantly related to the dependent variable. A subset of seven significant variables from the first stage is then used as inputs to train the neural network in the second stage. Their results showed that the 14 input networks do not lead to any significant improvements in prediction relative compared to the seven variables. In this case, they showed that the inclusion of a greater number of variables does not always lead to increased accuracy.

Research Methodology

We develop the optimal model based on a comparison of three methods: multiple discriminant analysis, logistic regression, and neural network models. The first two have been widely used in previous studies predicting corporate financial distress. The neural network model was first used for bankruptcy prediction by Coats and Fant (1992). Its predictive power has been recognized by many scholars since including Coats and Fant (1993), Jain and Nag (1997), Kim and McLeod (1999).

Models

Altman (1968) first utilized multiple discriminant analysis (MDA) to study corporate financial distress. MDA classifies data into discrete categories, and establishes a boundary equation which maximizes the discrimination between categories. *Z* scores of observed samples are calculated and compared to critical values to calculate the features of the observed samples. In studying corporate financial distress, scholars commonly use Fisher discriminant analysis together with stepwise discriminant analysis to determine the financial indicators most applicable to the discriminant equation. The common discriminant equation is commonly employed as:

$$Z_i = a_0 + a_1 X_{i1} + a_2 X_{i2} + a_3 X_{i3} + \ldots + a_n X_{in} \tag{1}$$

A logistic regression model is fundamentally different from a discriminant analysis model in that the former does not require observations to be normally distributed or have equal variance[3]. It is often used to predict the probability of the occurrence of a particular event, such as a corporate financial condition, like

[3] MDA has been criticized because it requires that the decision set used to distinguish between distressed and viable firms must be linearly separable and that ratios used in the model are treated as completely independent.

bankruptcy, etc.. Zavgren (1985) showed that the logit model offers better empirical discrimination. Let Y be a dependent variable that represents the final outcome: $Y = 0$ for failed firms, $Y = 1$ for non-failed ones. The probability is that $Y_i = 0$ is a function of observation i's characteristics.

$$P(Y_i = 0) = P_i = \frac{1}{1 + e^{-W_i}} \tag{2}$$

where W_i represents a univariate or multivariate function of a set of predictors for the sample items, X_i.

$$W_i = X_0 + \sum_{j=1}^{n} \beta_{ij} X_{ij} \tag{3}$$

where β_{ij} is a set of corresponding parameters to be estimated. The following log likelihood function is often used to express the conditional probability of a sample belonging to a feature group.

$$Y_i = \ln(\frac{P_i}{1 - P_i}) = X_0 + \sum_{j=1}^{n} \beta_{ij} X_{ij} \tag{4}$$

A logistic regression model usually sets the cut-off point at 0.5. In our study, if $P_i < 0.5$, we classify the observation as a distressed firm in financial distress, i.e., if the probability of financial distress ($Y_i = 0$) is larger than the probability of non-financial distress ($Y_i = 1$), we indicate that observation i is a firm in financial distress.

Many neural network models exist. Coats and Fant (1993) adopted Cascade-Correlation (cascor) algorithm method. This network contains an input, hidden, and output layer, and differs from more traditional networks as they are directly connected to the output layer. In this case, the output layer consists of only one variable representing the categorization of the firm as distresses or non-distressed. A cascor network without the hidden layer would simply perform in the same way as multiple discriminant analysis. Coats and Fant (1993) found that this model becomes technically mature and widely used for sample discrimination and cross sectional data analysis. Following these results, we employ this type of neural network in our study.

In configuring the neural network[4] training continued until one of the following conditions were met; the number of iterations reached 150,000, the model error rate for the training sample reached 5% or lower, the error rate for the testing sample reached 5% or lower, the number of iterations for the error rate of the training sample reached 5,000 without change or the number of iterations for the error rate of the testing sample reached 5,000 without change. In order to ensure that the network is not trapped in any local minima, a training weight histogram is viewed to further decide whether training should be continued or not. The ratio of training samples to testing samples is 1 : 3, which is randomly determined by the system from the input of the 200 observations. The test observations are not used in the training process other than making the decision whether to continue training.

Sample Design

Definition and Selection of Sample Companies

Financial distress is a broad concept that comprises several situations in which firms face some form of financial difficulty. The most common terms used to describe these situations are "bankruptcy", "failure", "insolvency", and "default". To identify financially troubled firms, we used ST (Special Treatment) firms rather than traditional bankruptcy. In order to enhance Chinese listed companies' governance practice and protect investors' interests, the China Securities Regulatory Commission [CSRC] introduced a special delisting

[4] NeuroForecaster was used to prepare and run the neural networks.

mechanism in 1998. Under the guidelines set forth by the CSRC, China's two stock exchanges—the Shanghai and Shenzhen Stock Exchanges—started to classify some listed firms as "Special Treatment" (ST) firms. A firm will be designated an ST firm if there is any of certain abnormalities in its financial status or other aspects, resulting in investors' difficulty in judging the company's prospects, to the detriment of investors' benefits or interests. Typically, a listed firm becomes an ST firm if any of the following four conditions holds: (1) it has negative net profits for two consecutive years; (2) the shareholders' equity is lower than the registered capital (the par value of the shares); (3) on auditing the firm's financial report, the auditors issue negative opinions or declare that they are unable to issue opinions; and (4) the firm's operations have been stopped and there is no hope of operations being restored within three months, due to a natural disaster or serious accident; or the firm is involved in a damaging lawsuit or arbitration.[5]

Our sample data is collected from the *CSMAR Financial Databases* developed by Shenzhen GTA Information Technology Co., and the China Accounting and Finance Research Center at the Hong Kong Polytechnic University. The special treatment policy came into effect in April 1998, we then select companies that received special treatment between 1998 and 2002 as our sample of companies in financial distress. We initially include all listed companies, which received special treatment between 1998 and 2002, resulting in 147 firms. We then exclude eight listed companies that received special treatment, not due to financial abnormalities. We also exclude 39 listed companies, for which financial data in the three years before financial distressed firms was not available. The remaining 100 ST companies form the samples for this study. Table 1 reports characteristics of samples.

Table 1

Industrial Distribution of the Samples of Companies in Financial Distress

Industry sector	Number of financially distressed firms
Agriculture, forestry, husbandry, and fishery	2
Manufacturing	55
Construction	1
Transportation and warehousing	3
Information technology	5
Wholesale and retail trade	8
Real estate	7
Social services	5
Comprehensive	14

Since the CSRC decides whether a listed company should receive special treatment in accordance with the previous year's annual report, an ST company actually runs into financial distress in the year before receiving special treatment. Therefore, year T in this study refers to the year in which a listed company actually experiences financial distress (i.e., the year before special treatment). The year T-1 refers to the year before a listed company experiences financial distress, and so on. For instance, if a listed company was specially treated in 2001, 2000 is the year when the company went into financial distress (i.e., year T), and the year T-1 refers to 1999.

[5] The special treatment means, for example, that the stocks are traded with a 5% price-change limit each day, vs. 10% for normal stock. Its interim reports must be audited. Also, if an ST firm continues to suffer loss for one more year, it will be designated a particular transfer (PT) firm. PT stocks can only be traded on Friday, with a maximum 5% upside limit to last Friday's close, but no restriction on the downside. PT firms will be delisted if they do not become profitable within one year.

After the samples of financial distress are determined, we use the following principles to select the control samples. Companies in the control sample are chosen based primarily on their industry membership. Industry codes must be equivalent and first should neither show any ST classification nor negative performance. Firm size is also matched by using total assets at year T-4[6].

Observation Window

Many studies (Beaver, 1966; Altman, 1968; Zavgren, 1985; Sheppard, 1994; Doumpos & Zopounidis, 1999) used financial data in the five years before a company experiences financial distress, while others (Edmister, 1972; Coats & Fant, 1992, 1993) used financial data in the previous three years. A long observation window leads to a reduction in the predictive power of financial indicators should the macroeconomic environment change, while a short window makes it difficult to determine a long-term trend toward worsening financial conditions. Both cases may reduce the practical value of a model. We use financial data in three consecutive years prior to bankruptcy. Assuming that a company is classified as ST in year T, then the window spans through the T-1, T-2, and T-3 years. For instance, if a company runs into financial distress in 2002, we will analyze its financial statements in 2001, 2000, and 1999.

Sample Size and Proportion

Our final sample comprises of 100 financial distressed companies and 100 healthy companies as a control group. We randomly select 80 distressed firms and 80 healthy firms to apply the various models. The remaining 40 firms are held for out of sample tests. There is no consensus regarding the proportion of distressed versus healthy firms should be used within the test set. There are three common choices for selecting a sample proportion. The first, paired samples used by Beaver (1966), Altman (1968), Altman et al. (1977), Collins (1980), Kim and McLeod (1999), Doumpos and Zopounidis (1999). The second approach uses a proportion in which the number of financial distressed firms is less than that of healthy firms to avoid deviating the proportion of distressed firms in estimated sample from the population. This approach also has concerns with establishing an accurate proportion of distressed firms existing in the population. Frydman, Altman, and Kao (1985), Coats and Fant (1993), Platt et al. (1994), and others used a proportion between 1 : 2 to 1 : 4.[7] Ohlson (1980), Huang, Dorsey, and Bosse (1994), Hill, Perry, and Andes (1996), Tirapat and Nittayagasetwat (1999), and Mckee and Greenstein (2000) employed the total population as their samples. When using neural networks, the use of entire samples is not recommended as results may be driven by model over-fitting and not by the predictive power of the model itself. We compare the predictive power of models constructed under three mostly utilized proportions: 1 : 1, 1 : 2, and 1 : 3.

Specifications of Initial Independent Variables and the Model

Variables

Previous studies of corporate financial distress and bankruptcy have generally selected financial variables in five categories: asset liquidity, solvency, operating capacity, profitability, and growth potential.[8] However,

[6] This paper defines the observation period as three years before financial distress (T-1, T-2, and T-3). It is generally considered that the size of asset will shrink when a company runs into financial distress. We select the total assets in year T-4 as the benchmark to measure a sample's size.

[7] They do not provide the rationale for choosing a proportion of between 1 : 2 and 1 : 4.

[8] As to cash flow statement data, according to Casey and Bartczak (1985) and Gombola et al. (1987), these indicators contribute little to the improvement of the predictive power of models. At the same time, no standardized cash flow statement data of listed Chinese companies are available before 1998. Therefore, we do not take cash flow data into consideration in our study.

many studies are quite subjective in the selection of specific variables. In order to overcome the problem, we collect all initial independent variables used in previous studies, and delete the duplicate variables with identical implications. There are a total of 95 predictive variables.[9]

According to Edmister (1972), Sheppard (1994), and Platt et al. (1994), changes over time in financial variables also contain predictive information. To test the impact of changes in variables, we include the three-year average change in the financial ratios in some models. The changes in financial ratios are calculated as follows:

$$A(t-1,t) = \frac{A(t) - A(t-1)}{\left| \frac{A(t) + A(t-1)}{2} \right|} \tag{5}$$

$$A(t-2,t-1,t) = \frac{1}{3} A(t-2,t-1) + \frac{2}{3} A(t-1,t) \tag{6}$$

$A(t)$ denotes a variable in year T. $A(t\text{-}1, t)$ denotes the change in a financial ratio from year T-1 to year T. $A(t\text{-}2, t\text{-}1, t)$ denotes the change in a financial ratio over a period of three years. The numerator in Equation (5) indicates the difference between the values of a financial indicator in two consecutive years; while the denominator is the absolute value of the variable's mean within two consecutive years. When both the numerator and denominator are negative, the measure is misleading, thus, the absolute value is used. The predictive power of the changes in a financial ratio is stronger in the year closer to the one when financial distress is experienced. Taking this factor into consideration, Equation (6) assigns a weight of two-thirds to the change in a financial ratio in the period from year T-1 to year T, and a weight of one-third to the change in the period from year T-2 to year T-1. We also examined the information resulting from adjusting variables with the industry mean and yearly mean. However, the results indicate these adjustments do not improve the discriminatory power of models.

Specification of Models

We examine 14 models classified into two broad categories: static and dynamic models. Within the group of static models there are simple static models and static variable mean models. The dynamic models consist of the simple dynamic variable models and the industry mean-adjusted models. Static variables models include Models 1, 2, and 3. In Model 1, only financial indicators in year T-1 are included as the independent variables. For example, if a company experienced financial distress in 1999, only financial indicators for 1998 are used. Only financial indicators in year T-2 are included as the independent variables in Model 2. For example, if a company experienced financial distress in 1999, only financial indicators for 1997 are used. In Model 3, only financial indicators in year T-3 are included as the independent variables. For example, if a company experienced financial distress in 1999, only financial indicators for 1996 are used.

To avoid possible influence of the abnormal values of financial indicators in individual years, we utilize the two or three year means of financial ratios to predict corporate financial condition. The means of static financial variables in the three years before financial distress are used as the independent variables in Model 4. The means of static financial variables of two years and three years prior to the financial distress are used as the independent variables in Model 5. This model is helpful in predicting companies' ability to repay mid-term and long-term (more than one year) loans.

A dynamic variable model incorporates the three-year average change of financial ratios. We expect that

[9] Please refer to Appendix A for the details.

dynamic financial indicators have more information to reflect firms' future financial performance. In Model 6, the static financial ratios in year *T*-1 and the three-year average change of financial ratios are used as independent variables. In Model 7, the means of the static financial ratios in the three years before financial distress and the three-year average change of financial ratios are used as independent variables.

An industry mean-adjusted model is constructed by replacing the original financial ratios in Models 1 to 7 with the financial ratios deflated by industry means and is used to eliminate inter-industry variations of corporate financial conditions.

Comparison of Discrimination Results

This paper adopts two kinds of classification accuracy to evaluate and compare the predictive power of the various models under the different sample proportions. Discriminant accuracy rate is the classification accuracy rate in estimation sample groups, while prediction accuracy rate is the classification accuracy rate in prediction sample groups.

Since the prediction accuracy rate does not contain any information already used the building of models, it is a better reflection of the generalization ability and stability of the model rather than the discriminant accuracy rate. We take the prediction accuracy rate as the benchmark to determine the predictive power of models.

A Type I error is said to occur when a viable firm is classified as bankrupt, while a Type II error occurs when a bankrupt firm is classified as healthy one. Classification accuracy rates are divided into Type I and Type II accuracy rates by error type. Type I error rate is calculated as the ratio of bankrupt firms that are wrongly described as viable firms. Type II error rate is calculated as the ratio of healthy firms wrongly described as financial distressed firms.

Analysis of Empirical Results

Descriptive Statistics

Descriptive statistic results show that most of indicators selected can reflect the differences between companies in financial distress or not as shown in Table 2. Sixty-seven and 80 variables show difference at 5% and 10% significance level, respectively. The percentage of indicators of asset liquidity and operating efficiency that exhibit significant difference increases as a company approaches financial distress, thus supporting the statements that variables from time periods approaching the financial distress increase in their predictability. It shows that the short-term predictive power of the two categories of financial variables is superior to their long-term predictive power. There are 11 (61.11%) and 12 (66.67%) indicators of solvency in year *T*-3 and *T*-1 respectively that show significant differences. However, in year *T*-2, only eight indicators exhibit differences. This may be attributed to the peculiarity of these indicators. Corporate liabilities include both long-term and short-term liabilities. The former has significant impact on long-term financial condition and does not place a major burden on companies in the short term, while the latter has a direct bearing on corporate financial performance within one year.

Profitability indicators are highly predictive in our difference tests. There are 20, 21, and 22 indicators that are different at 5% significance level within three years respectively. They are concentrated on almost the same indicators. It supports the common practice in past studies of using profitability indicators. Indicators of growth potential have no remarkable warning role in year *T*-3. However, in the year closer to financial distress, the proportion of indicators that exhibit significant differences rises rapidly, even exceeding the proportion of the

profitability indicators and reaching as high as 78.57% in year *T*-1. There are five, eight, and 11 indicators that are significantly different at 5% level in year *T*-3, *T*-2, and *T*-1, respectively. Most of these indicators are related to owner's equity, an accounting entry that deserves our attention. See Figure 1.

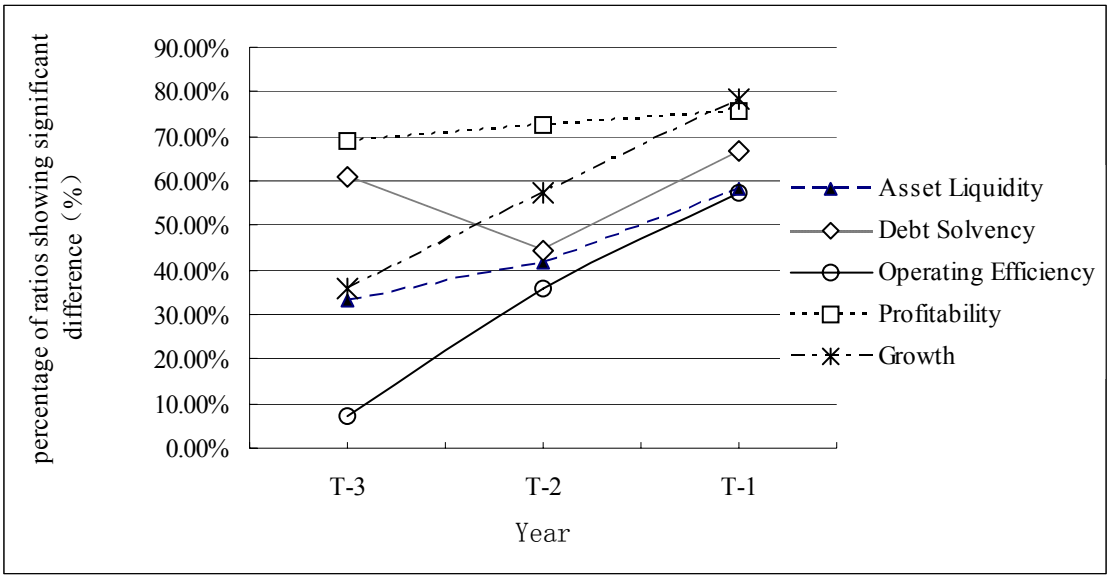

Figure 1. Percentage of ratios showing significant difference at 5% significance level.

Table 2

Initial Financial Ratios Showing Significant Difference at 5% Significance Level

Year	Asset liquidity	Debt solvency	Operating efficiency	Profitability	Growth
T-1	14 (63.64%)	12 (66.67%)	8 (61.54%)	22 (78.57%)	11 (78.57%)
T-2	10 (45.45%)	8 (44.44%)	5 (38.46%)	21 (75.00%)	8 (57.14%)
T-3	8 (36.36%)	11 (61.11%)	1 (7.69%)	20 (71.43%)	5 (35.71%)

Notes. Number of variables in five categories: Asset Liquidity 22, Debt Solvency 18, Operation Efficiency 13, Profitability 28, and Growth 14. The number in parentheses is the percentage of variables significant at 5% to the total number of variables in the categories.

Comparison Among MDA Model, Logistic Regression Model, and the Neural Network Model

Table 3 compares the classification test results of different models. The predictive power and final variables of each model are quite different. Among the 42 models[10], logistic regression models have the highest discriminant accuracy rate, followed by multiple discriminant analysis models and neural network models. Under the logistic regression models, the models' accuracy rates exceed 80% with one exception. There are 16 models whose accuracy rates reach 100%. The accuracy rates of multiple discriminant analysis models exceed 80%, but there are only three models whose accuracy rates reach 100%. The discriminant accuracy rates of neural network models are relatively unsatisfactory. However, all of them are above 70%. Among all models, 12 have accuracy rates of 70% to 80% and 18 have accuracy rates of 80% to 90%. The remaining 12 models have accuracy rates above 90%, but no model has an accuracy rate of 100%. This result is a preliminary

[10] There are 14 models with different initial independent variables and each model has three forms with different sample proportions, so there is a total of 42 models. These 42 models are constructed under multiple discriminant analysis, logistic regression and neural network method.

indication that the neural network model is not suffering from statistical overfitting.

Table 3 lists the numbers of final independent variables in various models. The number of variables usually is used as one of the criteria to measure model prediction cost. Prediction cost is important so far as it addresses whether a greater number of variables will lead to higher level of predictive accuracy. In logistic regression models, the numbers of ultimate independent variables are all below 20 except for three models. The average number of independent variables is 14. Whereas, multiple discriminant analysis models have more variables, 30 on average and neural network models have an average of 22 variables. Therefore, we can conclude that multiple discriminant analysis models have the highest prediction cost, followed by neural network models and logistic regression models.

In sum, we conclude that if discriminant accuracy rate is taken as a measure of the models' efficiency and the number of variables as a measure of models' prediction cost, the logistic regression model is superior to the other two models.

Analysis of Different Sample Proportions

We use three sample proportions (1 : 1, 1 : 2, and 1 : 3[11]) in each model to conduct an analysis to determine whether the difference between sample distribution and population would significantly influence the models' discriminatory power. As shown in Table 3, the discriminant accuracy rate of the static variable model 1-3, the static mean model 4-5 and their corresponding industry mean adjusted model 8-12 rises significantly with the decreasing proportion of distressed company samples. It is particularly significant under logistic regression models. The differences between the accuracy rates of models with 1 : 1 and 1 : 2 sample ratios are generally larger than the accuracy rates of the models with 1 : 2 and 1 : 3 sample ratios. However, for dynamic variable model 6-7 and their corresponding industry mean adjusted model 13-14, the impact of sample ratio is not significant because their discriminant accuracy rates are close to 100%.

Table 3

Model Accuracy Rate and Number of Variables Included

	Discriminant accuracy rate (%)			Number of variables		
Models	MDA	LOGIT	NNM	MDA	LOGIT	NNM
Sample 1: 100-100						
Model 1	91.5	91.5	90.0	16	11	25
Model 2	78.0	83	75.50	13	14	25
Model 3	80.5	79.5	71.50	25	12	23
Model 4	90.5	93.5	84.50	23	12	24
Model 5	81.5	81.5	77.50	10	12	19
Model 6	98.0	98.5	90.00	44	17	19
Model 7	96.5	94.5	88.00	48	15	22
Model 8	91.5	100	90.50	18	19	20
Model 9	87	88.5	71.00	26	21	20
Model 10	87	81.5	70.00	38	19	28
Model 11	88	90	90.00	15	10	24
Model 12	88	85.5	75.50	36	18	25
Model 13	97	100	85.30	45	17	22
Model 14	98	97	93.20	45	17	23

[11] The proportion is the number of firms in financial distress: the number of firms not in financial distress.

(Table 3 continued)

	Discriminant accuracy rate (%)			Number of variables		
Models	MDA	LOGIT	NNM	MDA	LOGIT	NNM
Sample 2: 50-100						
Model 1	93.3	100	85.80	20	15	23
Model 2	83.3	92	70.67	15	20	21
Model 3	91.3	80.7	70.67	35	11	9
Model 4	91.3	100	90.00	21	18	22
Model 5	86.7	90	71.33	19	17	23
Model 6	98.7	100	90.3	39	13	16
Model 7	99.3	99.3	95.60	47	16	26
Model 8	94.0	91.3	86.67	11	5	17
Model 9	90.1	91.3	80.67	23	14	21
Model 10	90	100	77.33	23	27	18
Model 11	98	96	90.00	46	14	23
Model 12	88	90	74.67	23	22	15
Model 13	99.3	100	89.40	57	15	23
Model 14	100	100	86.70	62	13	18
Sample 3: 30-100						
Model 1	93.1	100	89.80	14	14	22
Model 2	87.7	90	89.23	17	11	24
Model 3	92.3	92.3	83.08	25	13	21
Model 4	93.8	93.1	86.15	21	13	24
Model 5	88.5	90	80.00	16	11	21
Model 6	100	100	94.90	43	10	24
Model 7	98.5	100	94.90	34	14	23
Model 8	96.9	100	86.92	21	9	20
Model 9	93.1	92.3	82.31	26	10	21
Model 10	92.3	100	83.08	22	19	27
Model 11	99.2	100	78.46	44	14	20
Model 12	91.5	89.2	83.85	24	9	21
Model 13	98.5	100	92.80	37	10	25
Model 14	100	100	87.80	54	11	23

Notes. MDA: Multiple discriminant analysis; LOGIT: Logistic regression model; NNM: Neural network model.

The number of variables of various multiple discriminant analysis models varies greatly and does not show a certain trend. The number of variables of logistic regression models with three proportions of samples shows a declining trend with the decrease in the proportion of distressed company samples. In addition, the number of variables of neural network models is constant, at approximately 20.

Comparison of Models With Different Initial Independent Variables

This section compares the model with different independent variables. The analytical results show that the closer the year to a company's financial distress, the stronger the discriminatory power of the financial indicators. Towards the year of financial distress, companies' situation is worsening, therefore, financial indicators are expected to contain an increasing level of predictive information. This has been widely recognized by most studies. We also find that the change over time of financial variables can significantly improve the discriminatory power of models and the adjusted variables with industry mean and yearly mean

cannot significantly improve the discriminatory power of models.

We conduct an analysis on the distribution of the ultimate independent variables in the discriminant function of a model in Table 4[12]. The implications of various items in the table are explained below. Short-term discriminant variable—appears in the ultimate function of Model 1 or Model 8, or appears in the ultimate function of Model 6 or Model 13 as a financial indicator for an individual year. Mid-term variable appears in the ultimate function of Model 2 or Model 9. Long-term variable appears in the ultimate function of Model 3 or Model 10. Yearly mean variable appears in Models 4, 5, 7, 11, 12, or 14 as a yearly mean variable. Variable of change trend appears in Models 6, 7, 13, or 14 as the change trend of a financial indicator.

Table 4

Final Variables Distribution in Models

Variables	Total number of occurrence/model	Short-term	Middle-term	Long-term	Yearly mean variables	Change trend variables
X_{58}	6.22	1.75	5.00	9.00	4.66	5.25
X_{40}	6.14	6.00	7.50	3.50	5.33	2.00
X_{85}	5.71	2.75	7.00	7.00	5.83	1.50
X_{82}	5.43	5.00	7.00	2.50	4.50	2.50
X_{17}	4.71	1.25	3.50	6.50	5.33	2.25
X_{94}	4.50	4.00	0.50	2.00	3.17	5.75
X_{52}	4.43	3.75	6.00	0.00	4.50	2.00
X_{78}	4.21	5.50	2.50	0.00	2.50	4.25
X_{95}	4.07	3.75	2.50	4.00	4.50	0.50
X_{18}	3.64	4.50	1.50	4.00	3.00	1.00
X_{87}	3.57	2.25	0.00	6.50	4.17	0.75
X_{84}	3.43	1.00	2.00	8.00	1.67	3.50
X_{35}	3.36	2.50	2.00	5.50	2.67	1.50
X_{74}	3.29	2.25	1.00	1.50	3.00	3.50
X_{48}	3.29	0.00	4.50	5.00	3.83	1.00
X_{20}	3.14	0.75	5.00	5.00	3.00	0.75
X_{80}	3.00	2.25	4.00	1.50	2.00	2.50
X_{65}	3.00	0.75	2.50	1.00	3.83	2.25
X_{21}	2.79	2.25	3.50	3.00	2.00	1.25
X_{88}	2.64	4.00	0.00	2.00	2.17	1.00
X_{70}	2.57	0.25	5.00	1.50	2.00	2.50
X_{47}	2.57	3.25	2.00	3.50	0.67	2.00
X_{81}	2.50	3.00	3.50	2.50	1.00	1.25
X_{69}	2.50	3.75	1.00	2.00	1.33	1.50
X_{27}	2.50	0.75	7.00	0.00	1.50	2.25
X_{45}	2.50	0.00	0.50	2.50	1.33	5.25
X_{36}	2.43	3.50	0.00	0.50	2.67	0.75
X_{91}	2.29	0.00	6.00	2.50	1.50	1.50
X_{41}	2.29	0.00	2.50	2.00	2.67	1.75
X_{62}	2.29	1.25	4.00	1.00	2.00	1.25
X_{40}	2.29	2.00	3.00	0.50	2.50	0.50
X_{15}	2.21	2.00	1.50	4.00	0.83	1.75

[12] The table only lists the variables whose total number of occurrences is above 2.14 or whose number of occurrences in other items is above 4.00.

(Table 4 continued)

Variables	Total number of occurrence/model	Short-term	Middle-term	Long-term	Yearly mean variables	Change trend variables
X_{49}	2.21	1.00	0.00	5.00	2.17	1.00
X_{93}	2.14	0.00	4.50	3.00	1.83	1.00
X_{1}	2.14	0.75	1.50	2.50	2.17	1.50
X_{67}	2.14	2.25	1.50	2.50	1.67	0.75
X_{68}	2.07	0.00	1.00	4.50	1.33	2.50
X_{25}	2.07	5.00	0.50	1.50	0.50	0.50
X_{73}	2.00	0.75	0.00	2.00	0.00	5.25
X_{77}	2.00	0.50	0.00	2.50	0.00	5.25
X_{50}	2.00	0.00	0.00	6.50	1.17	2.00
X_{54}	1.86	1.50	4.00	1.00	0.83	1.25
X_{2}	1.79	1.00	4.00	1.00	1.33	0.75
X_{23}	1.71	1.25	0.00	5.00	1.00	0.75
X_{61}	1.57	0.00	4.50	3.00	0.50	1.00
X_{63}	1.57	1.25	4.00	1.00	0.17	1.50
X_{64}	1.29	1.50	4.00	0.00	0.33	0.50

Since a variable[13] may be used as their initial independent variable by several models, the more times the variable is included, the more likely it is to appear in the ultimate functions of models. We utilize the (number of occurrences/number of models) to analyze the distribution of variables. In general, the larger the number of indicator occurrence is, the more stable its discriminatory power is. Among 95 independent variables, 47 indicators show stable discriminatory power. Most of them have a value of more than 2.14 in the column of "total number of occurrence". Other variables in Table 4 have high values in terms of other items. Among them, there are 18 indicators in the profitability category, nine in the growth potential category, eight in operating efficiency, seven in liquidity, and six in the solvency category. Therefore, the indicators of profitability, growth potential and operating efficiency can reflect corporate financial condition better than the indicators of other categories.

Analysis of Key Models

Most of loans issued by Chinese commercial banks to enterprises are short-term in nature. They require repayment within one to two years. Commercial banks are more concerned about the financial well-being of invested enterprises in a one- or two-year time frame. In addition, most stock investors are short-term investors. Therefore, we focus on how to predict whether a company will run into short-term financial distress in this section. The short-term discriminant models, including Models 1, 6, 7, 13, and 14.

χ^2 value for discriminant. In MDA and LOGIT models, the χ^2 of 15 discriminant equations of five models under three proportions of samples are shown in Table 5. The value in column Chi-Square is χ^2 of the corresponding discriminant equation, *df* is the degree of freedom of the discriminant equation (i.e., the number of the ultimate independent variables of the equation and *Sig.*) indicates the significance level of the discriminant equation. Given a certain number of variables, the larger the value of χ^2 is, the higher the degree

[13] Here, we ignore the differences between "single financial indicator" and "single financial indicator/industry mean".

of fitness of an equation is. Fifteen equations we list are all significantly effective at the 0.1% level.

Table 5

χ^2 of Discriminant Functions of MDA and LOGIT Models

	MDA			LOGIT		
	Chi-Square	*df*	Sig.	Chi-Square	*df*	Sig.
Sample 1: 100-100						
Model 1	183.328	16	0.000	179.449	11	0.000
Model 6	283.548	44	0.000	251.071	17	0.000
Model 7	281.498	48	0.000	191.266	15	0.000
Model 13	293.163	45	0.000	274.371	17	0.000
Model 14	284.659	45	0.000	246.601	17	0.000
Sample 2: 50-10						
Model 1	160.229	20	0.000	187.676	15	0.000
Model 6	243.882	39	0.000	189.852	13	0.000
Model 7	279.754	47	0.000	182.386	16	0.000
Model 13	292.693	57	0.000	189.281	19	0.000
Model 14	298.382	62	0.000	190.502	15	0.000
Sample 3: 30-100						
Model 1	160.229	20	0.000	139.322	14	0.000
Model 6	257.066	43	0.000	137.575	10	0.000
Model 7	233.24	34	0.000	135.819	14	0.000
Model 13	217.251	37	0.000	140.115	10	0.000
Model 14	254.961	54	0.000	136.744	11	0.000

Notes. MDA: Multiple discriminant analysis; LOGIT: Logistic regression model; NNM: Neural network model.

Analysis of estimation samples.[14] To further investigate the discriminatory power of various models, we examine factors affecting discriminant accuracy rate, including Type I and Type II error rates. Type I error rate refers to the percentage of distressed firms that are wrongly discriminated as healthy, while Type II error rate refers to the proportion of healthy firms that are wrongly discriminated as distressed. The overall error rate may be evaluated through a weighted average of Type I and Type II error rates by the sample size of each group.

Table 6 lists Type I error rates, Type II error rates and overall error rates of various models under three discriminant methods and three sample groups.

In general, logistic regression models have the lowest error rates (in terms of Type I, Type II, and overall error rate) of discrimination among the estimation samples, mostly reaching an accuracy rate of 100%, followed by multiple discriminant analysis models. Given the way in which regression models are statistically calculated these results are expected. Neural network models have the highest error rates. This is consistent with our previous analytical results of the discriminant accuracy rate of these models. In fact in terms of the neural network model, low Type I and Type II errors in the estimation sample would be an indicator of statistical overfitting.

[14] An estimation sample, also called an original sample, is used by the system to construct the discriminant function of a model. In neural network models, an estimation sample is defined as a training sample.

Table 6

Error Rate of Estimation Samples

Error type	Type I error (%)			Type II error (%)			Overall error (%)		
	MDA	LOGIT	NNM	MDA	LOGIT	NNM	MDA	LOGIT	NNM
Sample 1: 100-100									
Model 1	7.0	7.0	12.0	10.0	10.0	8.0	8.5	8.5	10.0
Model 6	2.0	1.0	12.0	2.0	2.0	8.0	2.0	1.5	10.0
Model 7	6.0	4.0	8.0	1.0	7.0	16.0	3.5	5.5	12.0
Model 13	4.0	1.0	12.0	2.0	0.0	17.3	3.0	0.5	14.7
Model 14	2.0	1.0	5.3	2.0	5.0	8.0	2.0	3.0	6.8
Sample 2: 50-100									
Model 1	8.0	0.0	33.3	6.0	0.0	4.1	6.7	0.0	14.2
Model 6	4.0	0.0	18.0	0.0	0.0	5.4	1.3	0.0	9.7
Model 7	2.0	2.0	7.7	0.0	0.0	2.7	0.7	0.7	4.4
Model 13	2.0	0.0	18.0	0.0	0.0	6.8	0.7	0.0	10.6
Model 14	0.0	0.0	33.3	0.0	0.0	2.7	0.0	0.0	13.3
Sample 3: 30-100									
Model 1	26.7	0.0	33.3	1.0	0.0	4.1	6.9	0.0	11.2
Model 6	0.0	0.0	12.5	0.0	0.0	2.7	0.0	0.0	5.1
Model 7	3.3	0.0	20.8	1.0	0.0	0.0	1.5	0.0	5.1
Model 13	6.7	0.0	25.0	0.0	0.0	2.7	1.5	0.0	8.2
Model 14	0.0	0.0	45.8	0.0	0.0	1.35	0.0	0.0	12.2

Notes. MDA: Multiple discriminant analysis; LOGIT: Logistic regression model; NNM: Neural network model.

Analysis of prediction samples.[15] Prediction samples can better than the estimation sample to predict corporate financial condition in practical applications. For the MDA and LOGIT models[16], we utilize prediction samples of three different proportions to test the models' prediction accuracy rate: 40 samples (20 : 20) for models under the sample proportion of 100 : 100, 30 samples (10 : 20) for models under the sample proportion of 50-100 and 26 samples (6 : 20) for models with the sample proportion of 30-100. For neural network models, the number of testing samples is 1/4 of the number of original samples, which are randomly selected.

The error rates of various models with prediction samples are shown in Table 7. There exist significant difference between the results of models in prediction samples and those in estimation samples. In MDA and LOGIT models, the error rates in prediction samples are much higher than those in estimation samples, but overall error rates are below 20%. The error rates of logistic regression models under three proportions of prediction samples are relatively lower than those of multiple discriminant analysis models. Under MDA and LOGIT models, Model 6 with the sample ratio of 1 : 3 has the lowest overall prediction error rate, and its prediction error rates are 11.5% and 7.7%, respectively. In contrast, neural network models have great advantages over MDA and LOGIT methods. Error rates of neural network models with prediction models are not only much lower than those of MDA and LOGIT models, but also lower than those of estimate samples under neural network methods. The overall error rates are mostly below 10%. Model 6 with a 1 : 1 ratio has the lowest overall prediction error rate, at only 2.0%.

[15] Prediction sample, also called new sample, is used by the system to test the predictive power of the discriminant function of a model. In neural network models, a prediction sample is defined as a testing sample.

[16] Prediction samples are randomly selected from all samples and do not necessarily correspond to the original samples with respect to industry and size.

Table 7

Error Rate of Prediction Samples

Error type	Type I error (%)			Type II error (%)			Overall error (%)		
	MDA	LOGIT	NNM	MDA	LOGIT	NNM	MDA	LOGIT	NNM
Sample 1: 100-100									
Model 1	20.0	25.0	8.0	15.0	20.0	4.0	17.5	22.5	6.0
Model 6	10.0	10.0	0.0	25.0	25.0	4.0	17.5	17.5	2.0
Model 7	45.0	20.0	0.0	25.0	20.0	8.0	35.0	20.0	4.0
Model 13	35.0	15.0	4.0	10.0	20.0	12.0	22.5	17.5	8.0
Model 14	15.0	20.0	4.0	15.0	15.0	24.0	15.0	17.5	14.0
Sample 2: 50-100									
Model 1	40.0	20.0	9.1	20.0	10.0	0.0	26.7	13.3	2.7
Model 6	10.0	10.0	9.1	15.0	10.0	3.9	13.3	10.0	5.4
Model 7	40.0	20.0	9.1	5.0	5.0	3.9	16.7	10.0	5.4
Model 13	30.0	20.0	9.1	10.0	10.0	3.6	16.7	13.3	5.4
Model 14	40.0	30.0	9.1	15.0	10.0	0.0	23.3	16.7	2.7
Sample 3: 30-100									
Model 1	33.3	16.7	16.7	30.0	10.0	3.9	30.8	11.5	6.3
Model 6	16.7	16.7	16.7	10.0	5.0	3.9	11.5	7.7	6.3
Model 7	33.3	33.3	16.7	10.0	10.0	0.0	15.4	15.4	3.1
Model 13	50.0	16.7	16.7	20.0	5.0	0.0	26.9	7.7	3.1
Model 14	33.3	33.3	16.7	10.0	5.0	3.9	15.4	11.5	6.3

Notes. MDA: Multiple discriminant analysis; LOGIT: Logistic regression model; NNM: Neural network model.

If we take the overall error rate and Type I error rate of prediction as the criteria to measure the discriminant methods, neural network models are optimal, followed by logistic regression models and multiple discriminant analysis models. However, we cannot conclude that neural network models have the strongest predictive power[17] because the feature of this model is probably connected with the model development standard adopted by the system. In NeuroForecaster software, the model combines training sample (discriminant) error rate and testing sample (prediction) error rate to determine whether to stop training (i.e., the model constructed actually contains the information about testing samples). It is questionable to take the error rate of the samples as the criteria to measure models' predictive power. However, in MDA and LOGIT models, discriminant functions themselves do not contain information from testing samples. So the error rate of testing samples can be regarded as a proper measure on the predictive power of these models. Further investigation into the neural network model is required in order to isolate whether these results are a result of the training methods used or whether the results are as robust as those of the MDA and LOGIT analysis.

Due to the above reasons, we cannot make an accurate judgment of the predictive power of neural network models and beg further investigation. At the same time, the number of ultimate independent variables in this kind of models is almost 20, much higher than those of logistic regression models.

Determining the final model. Taking predictive power and predicted cost (the number of variables included in the model) into consideration, logistic regression models achieve the best overall performance. Model 6 with three proportions of samples under the discriminant method demonstrates strong predictive power

[17] It should be noted that neural network models have a low prediction error rate, but the highest regression error rate among the three discriminant methods.

(See Table B2 in Appendix B for information on specific coefficients). Prediction error rates in the three samples are 17.5%, 10.0%, and 7.7%, respectively. In this model, type I error rate is below 16.7% and fewer financial variables result in less discrimination cost. On the basis of the above analytical results, we select Model 6 with a 1 : 3 sample ratio under the logistic discriminant method as the optimal model, which includes 10 variables and a prediction accuracy rate of 92.3%. The coefficients are specified as follows:

$$Y = -7.224 - 1.692X_1 - 12.577X_2 - 0.542X_3 + 69.423X_4 - 246.478X_5$$
$$+534.11X_6 - 62.245X_7 - 6.628X_8 + 1.676X_9 - 0.629X_{10}$$

where:

X_1 = Inventory turnover in year T-1;

X_2 = Turnover of total assets in year T-1;

X_3 = (Profit from core business/Net profit) in year T-1;

X_4 = (Net value of fixed assets/Owner's equity) in year T-1;

X_5 = ln (Tangible assets) in year T-1;

X_6 = [Net profit/(Total assets − Total current assets)] in year T-1;

X_7 = Changes in [(Owner's equity + Long term liabilities)/Fixed assets] for three years;

X_8 = Changes in [(Profit from core business + Profit from other business)/(Gross profit + Financial expenses)] for three years;

X_9 = Changes in [(Profit from core business + Profit from other business)/Gross profit)] for three years;

X_{10} = Changes in [(Gross profit in current year − Gross profit in previous year)/|(Gross profit in current year + gross profit for the previous year)/2|)] for three years.

The discrimination point is 0.5, when Y value is less than 0.5, a company is in financial distress. The larger the Y value, the better a firm's financial performance.

Conclusions

This study compares the empirical results of various models using different discriminant methods, sample proportions and initial independent variables to determine the financial indicators most applicable for short-term prediction of financial distress among China's listed companies. We find that logistic regression models are superior to multiple discriminant analysis models in terms of prediction accuracy rate, restriction of sample distribution and prediction cost. The predictive power of a neural network model, as a new financial distress prediction model, is difficult to measure due to its complexity in its current configuration and deserves further attention before a final conclusion is made. When the changes over time in financial indicators are incorporated, model prediction accuracy is greatly improved. Since the accuracy rate with data from individual companies is high, the inclusion of industry mean does not significantly improve models' predictive power. The indicators of profitability show a great difference between firms in financial distress and firms not in financial distress in mean difference tests while differences in other categories of indicators vary over time. In the year closest to financial distress, differences in the various indicators, with the exception of solvency ratios, are more significant. Forty-eight variables of 95 independent variable indicators in all models show stable discriminatory power. Most of them have an average number of occurrences of more than 2.14 in the models with different initial independent variables included, while others have higher values in other areas, concentrated on the indicators of profitability, growth potential and operating efficiency.

In the analysis of short-term financial distress prediction models, the chi-square statistics of the final discriminant equations of all models with three proportions of samples under three discriminant methods are all significant at the 0.1 level. Model 6 with the three ratios of samples under logistic regression model demonstrates strongest predictive power, of which the model with a 30 : 100 ratio has a prediction accuracy rate of 92.3%. With respect to financial variables, growth potential and profitability are crucial to companies' future financial performance.

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Appendix A

Table A1

Financial Ratios—Initial Variables

Classification	No.	Ratios
Liquidity	X_1	Working capital/Total assets
	X_2	Working capital/Sales
	X_3	Current ratio × (Current assets/Current liabilities)
	X_4	Quick ratio × [(Current assets − Inventory)/Current liabilities]
	X_5	(Cash + Short-term investment + Notes receivable + Accounts receivable + Other receivable + Advanced accounts − Provision for bad debt)/Current liabilities
	X_6	(Cash + Short-term investment + Notes receivable + Net accounts receivable)/Current liabilities
	X_7	Cash/Total assets
	X_8	Cash/Current liabilities
	X_9	Current assets/Sales
	X_{10}	Cash ratio × (Cash + Market securities)/Current liabilities
	X_{11}	Cash/Sales
	X_{12}	Quick assets/Total assets
	X_{13}	Current assets/Total assets
	X_{14}	Quick assets/Working capital
	X_{15}	Quick assets/Sales
	X_{16}	Current assets/Working capital
	X_{17}	Accounts payable/Sales
	X_{18}	(Cash + Market securities)/Inventory
	X_{19}	(Cash + Short-term investment)/Current assets
	X_{20}	(Cash + Short-term investment + Notes receivable)/Current assets
	X_{21}	(Short-term loans + Notes payable)/(Cash + Short-term investment + Notes receivable)
	X_{22}	(Current assets year end − Current assets year beginning)/|(Current assets year end + Current assets year beginning)/2|
Debt	X_{23}	Total liabilities/Total assets
	X_{24}	Total liabilities/Sales
	X_{25}	Long-term liabilities/(Owner's equity − Current liabilities)
	X_{26}	Total/Owner's equity
	X_{27}	Interest coverage ratio × (EBIT/Financial expenses)
	X_{28}	Long-term debt ratio × (Long-term liabilities/Total liabilities)
	X_{29}	Owner's equity/Total liabilities
	X_{30}	Net profit/Total liabilities
	X_{31}	Current assets/Total liabilities
	X_{32}	Current liabilities/Working capital
	X_{33}	Short-term liabilities/Owner's equity
	X_{34}	(Owner's equity + Long-term liabilities)/Net fixed assets

(Table A1 continued)

Classification	No.	Ratios
Debt	X_{35}	Long-term liabilities/(Current assets − Current liabilities)
	X_{36}	(Current assets − Current liabilities)/(Total assets − Current liabilities)
	X_{37}	(Current assets − Current liabilities)/Total liabilities
	X_{38}	(Current assets − Current liabilities)/(Total assets − Total liabilities)
	X_{39}	Total liabilities/Capital
	X_{40}	(Short-term loan + Long-term loan + Securities payable)/Capital
Operating efficiency	X_{41}	Inventory/Working capital
	X_{42}	Inventory/Sales
	X_{43}	Capital turnover × [Net sales/(Net fixed assets + Working capital)]
	X_{44}	Total assets turnover × (Sales/Total assets)
	X_{45}	Operating expense/Revenue
	X_{46}	Revenue/Total liabilities
	X_{47}	Financial expense/Revenue
	X_{48}	Average accounts receivable/Revenue
	X_{49}	Revenue/(Average current assets − Average current liabilities)
	X_{50}	Average inventory/Revenue
	X_{51}	Revenue/(Average total assets − Average current assets)
	X_{52}	Inventory turnover × (Cost of goods sold/Inventory)
	X_{53}	Accounts receivable turnover × (Cost of goods sold/Accounts receivable)
Profitability	X_{54}	Undistributed profit/Total assets
	X_{55}	ROE × (Net profit/Total assets)
	X_{56}	Return on net assets × (Net profit/Owner's equity)
	X_{57}	Profit from core business/Net profit
	X_{58}	Profit from core business/Revenue
	X_{59}	Net profit/Total assets
	X_{60}	Operating profit/Owner's equity
	X_{61}	Profit from other business/Owner's equity
	X_{62}	Profit from core business/Total assets
	X_{63}	Profit from other business/Total assets
	X_{64}	Profit from core business/|Net profit|
	X_{65}	EBT/Sales
	X_{66}	EBT/Total assets
	X_{67}	EBT/Owner's equity
	X_{68}	(EBT + Depreciation)/Total liabilities
	X_{69}	EBIT/Total assets
	X_{70}	(Profit − Income tax)/Revenue
	X_{71}	Net profit/Revenue
	X_{72}	Profit/Total assets
	X_{73}	(Profit + Financial expense)/Average current assets
	X_{74}	Net profit/Average current assets
	X_{75}	Profit from core business/Average net fixed assets

(Table A1 continued)

Classification	No.	Ratios
Profitability	X_{76}	Profit from core business/(Average total assets − Average current liabilities)
	X_{77}	(Profit from core business + Profit from other business)/(Average total assets − Average current liabilities)
	X_{78}	Net profit/(Average total assets − Average current liabilities)
	X_{79}	(Profit + Financial expense)/Profit
	X_{80}	(Operation profit + Profit from other business)/(Profit + Financial expense)
	X_{81}	(Operation profit + Profit from other business)/Profit
Growth	X_{82}	Equity per share
	X_{83}	Reserves per share
	X_{84}	Undistributed profit per share
	X_{85}	Ln(Tangible assets)
	X_{86}	Owner's equity/Total assets
	X_{87}	(Owner's equity − Capital)/Total assets
	X_{88}	Net fixed assets/Owner's equity
	X_{89}	Owner's equity/Sales
	X_{90}	Net fixed assets/(Owner's equity − Intangible assets and other assets)
	X_{91}	(Owner's equity year end − Owner's equity year beginning)/|(Owner's equity year end + Owner's equity year beginning)/2|
	X_{92}	(Total assets year end − Total assets year beginning)/|(Total assets year end + Total assets year beginning)/2|
	X_{93}	(Revenue of year t − Revenue of year t-1)/|(Revenue of year t + Revenue of year t-1)/2|
	X_{94}	(Profit of year t − Profit of year t-1)/|(Profit of year t + Profit of year t-1)/2|
	X_{95}	(Net profit of year t − Net profit of year t-1)/|(Net profit of year t + Net profit of year t-1)/2|

Appendix B

Table B1

Variables of Model 1 Under Logistic Regression Method

1 : 1				1 : 2				1 : 3			
Param.	Coeff.	Wald	Sig.	Param.	Coeff.	Wald	Sig.	Param.	Coeff.	Wald	Sig.
X_{52}	-0.185	8.059	0.005	X_{53}	-0.325	2.783	0.095	X_{2}	-21.949	3.983	0.046
X_{63}	59.323	5.141	0.023	X_{15}	-22.397	4.464	0.035	X_{43}	-54.433	4.945	0.026
X_{24}	-0.415	2.993	0.084	X_{44}	-114.338	4.326	0.038	X_{54}	-736.957	4.734	0.030
X_{25}	-0.047	6.728	0.009	X_{54}	-998.908	4.491	0.034	X_{24}	-9.334	1.616	0.204
X_{82}	2.342	16.687	0.000	X_{83}	167.782	4.61	0.032	X_{33}	19.924	3.688	0.055
X_{88}	2.909	8.225	0.004	X_{84}	93.821	3.656	0.056	X_{83}	154.571	4.112	0.043
X_{18}	0.023	3.571	0.059	X_{88}	133.791	4.474	0.034	X_{18}	-0.834	4.327	0.038
X_{21}	0.028	2.477	0.116	X_{47}	-140.294	1.947	0.163	X_{20}	153.084	4.204	0.040
X_{35}	-0.36	5.751	0.016	X_{35}	-17.14	4.54	0.033	X_{35}	-14.075	4.666	0.031
X_{40}	-0.876	6.578	0.010	X_{49}	-2.139	4.212	0.040	X_{40}	-24.672	4.533	0.033
X_{74}	20.7	31.088	0.000	X_{40}	-48.317	4.584	0.032	X_{78}	880.928	4.677	0.031
				X_{78}	872.682	4.458	0.035	X_{81}	0.189	4.785	0.029
				X_{77}	0.32	4.616	0.032	X_{94}	-6.731	1.272	0.259
				X_{92}	53.155	3.792	0.052	X_{95}	14.221	1.989	0.158
				X_{95}	3.4	4.216	0.040				
Constant	-4.921	12.499	0.000		146.782	4.445	0.035		129.47	4.959	0.026

Note. X: financial ratio of a single year.

Table B2

Variables of Model 6 Under Logistic Regression Method

1 : 1				1 : 2				1 : 3			
Param.	Coeff.	Wald	Sig.	Param.	Coeff.	Wald	Sig.	Param.	Coeff.	Wald	Sig.
X_1	30.985	4.616	0.032	X_{55}	4,651.522	4.286	0.038	X_{52}	-1.692	1.713	0.191
X_{56}	141.966	6.703	0.01	X_{66}	-2,818.69	4.008	0.045	X_{44}	-12.577	0.663	0.416
X_{62}	-54.662	4.092	0.043	X_{85}	5.662	2.327	0.127	X_{57}	-0.542	1.529	0.216
X_{82}	8.268	6.919	0.009	X_{87}	88.851	2.556	0.110	X_{88}	69.423	2.939	0.086
X_{85}	-1.902	4.473	0.034	X_{18}	-0.941	4.36	0.037	X_{85}	-246.478	2.444	0.118
X_{88}	13.831	4.702	0.03	X_{85}	-151.84	3.203	0.074	X_{78}	534.11	2.871	0.090
TIX_{52}	-15.795	7.257	0.007	TIX_{66}	-0.066	0	0.992	TIX_{34}	-62.245	2.563	0.109
TIX_{44}	-9.874	2.222	0.136	TIX_{17}	-27.009	3.893	0.048	TIX_{80}	-6.628	2.508	0.113
TIX_{24}	-21.525	6.242	0.012	TIX_{88}	95.206	4.417	0.036	TIX_{81}	1.676	2.808	0.094
TIX_{87}	-18.659	6.118	0.013	TIX_5	22.746	2.027	0.155	TIX_{94}	-0.629	0.982	0.322
TIX_{45}	-17.97	6.277	0.012	TIX_{50}	40.318	3.807	0.051				
TIX_{47}	-0.17	6.286	0.012	TIX_{72}	-3.886	0.26	0.610				
TIX_{40}	14.691	7.007	0.008	TIX_{94}	-0.731	4.489	0.034				
TIX_{73}	0.943	0.699	0.403								
TIX_{75}	-0.745	6.268	0.012								
TIX_{77}	-0.194	4.201	0.04								
TIX_{94}	-0.107	7.532	0.006								
Constant	7.334	0.233	0.629		-137.485	2.737	0.098		-7.224	1.994	0.158

Notes. *X*: financial ratio of a single year; *TIX*: changes in variables for three years.

Table B3

Variables of Model 7 Under Logistic Regression Method

1 : 1				1 : 2				1 : 3			
Param.	Coeff.	Wald	Sig.	Param.	Coeff.	Wald	Sig.	Param.	Coeff.	Wald	Sig.
AX_{65}	-9.541	15.73	0.000	AX_{41}	-1.131	2.371	0.124	AX_{85}	3.537	0.801	0.371
AX_{87}	19.767	14.962	0.000	AX_{55}	417.661	0.544	0.461	AX_{87}	125.062	3.047	0.081
AX_6	-2.202	11.974	0.001	AX_{65}	-15.61	2.151	0.142	AX_{18}	-0.392	2.346	0.126
AX_{74}	38.932	20.101	0.000	AX_{66}	-6.79	0	0.990	AX_{94}	3.334	0.224	0.636
AX_{95}	1.316	8.214	0.004	AX_{17}	62.61	2.346	0.126	TIX_{41}	-2.961	2.348	0.125
TIX_{55}	-0.339	4.063	0.044	AX_{85}	-6.022	2.665	0.103	TIX_{65}	-18.318	0.91	0.340
TIX_{63}	0.049	0.085	0.770	AX_{87}	173.769	2.807	0.094	TIX_{34}	-21.838	2.86	0.091
TIX_{65}	-0.076	1.304	0.253	AX_{35}	0.971	2.425	0.119	TIX_{89}	-16.372	2.797	0.094
TIX_{68}	0.114	6.739	0.009	AX_{94}	-12.273	2.516	0.113	TIX_{70}	-5.942	0.617	0.432
TIX_{34}	-1.844	1.786	0.181	TIX_{29}	-48.39	2.184	0.139	TIX_{71}	51.242	1.897	0.168
TIX_{82}	13.511	13.535	0.000	TIX_{45}	-24.822	2.611	0.106	TIX_{77}	-1.341	0.66	0.416
TIX_{45}	-3.244	11.058	0.001	TIX_{51}	-18.468	1.993	0.158	TIX_{78}	-2.603	1.732	0.188
TIX_{77}	-0.072	5.614	0.018	TIX_{73}	27.502	2.38	0.123	TIX_{91}	4.722	2.649	0.104
TIX_{78}	0.191	4.646	0.031	TIX_{74}	6.581	2.67	0.102	TIX_{94}	-0.586	2.385	0.123
TIX_{94}	-0.012	4.112	0.043	TIX_{75}	-1.514	3.012	0.083				
				TIX_{94}	-0.148	0.748	0.387				
Constant	-3.436	9.328	0.002		73.642	2.263	0.132		-86.483	1.043	0.307

Notes. *AX*: Average ratio in three years; *TIX*: changes in variables for three years.

Table B4

Variables of Model 13 Under Logistic Regression Method

1 : 1				1 : 2				1 : 3			
Param.	Coeff.	Wald	Sig.	Param.	Coeff.	Wald	Sig.	Param.	Coeff.	Wald	Sig.
IAX_{67}	5.478	4.398	0.036	$TIAX_{54}$	8.857	0.189	0.664	$TIAX_{34}$	-0.111	0	0.992
IAX_{69}	4.817	4.538	0.033	$TIAX_{58}$	-2.482	0.29	0.590	IAX_{52}	-9.085	1.656	0.198
IAX_{25}	0.611	2.27	0.132	$TIAX_{61}$	-6.35	4.323	0.038	IAX_{66}	38.023	1.886	0.170
IAX_{82}	85.302	3.572	0.059	$TIAX_{27}$	-0.047	0.043	0.835	IAX_{69}	-0.493	0.013	0.910
IAX_{87}	20.801	1.823	0.177	$TIAX_{30}$	3.997	1.23	0.267	IAX_{25}	0.981	0.036	0.850
IAX_{88}	13.929	4.072	0.044	$TIAX_{83}$	24.711	1.108	0.293	IAX_{82}	55.615	1.734	0.188
IAX_{18}	-1.104	0.254	0.614	$TIAX_{84}$	-1.054	0.39	0.532	IAX_{36}	-4.253	2.201	0.138
IAX_{36}	-2.691	3.552	0.059	$TIAX_{85}$	928.886	3.537	0.060	IAX_{40}	-18.407	1.655	0.198
IAX_{40}	-15.904	4.56	0.033	$TIAX_{72}$	1.507	0.071	0.790	IAX_{78}	-6.07	1.769	0.184
IAX_{95}	-1.521	4.52	0.034	$TIAX_{73}$	16.179	3.693	0.055	IAX_{94}	-0.369	1.608	0.205
$TIAX_{55}$	1.214	4.54	0.033	$TIAX_{74}$	-1.044	0.022	0.882				
$TIAX_{32}$	3.389	4.497	0.034	$TIAX_{77}$	0.1	0.006	0.937				
$TIAX_{45}$	-32.943	3.58	0.058	$TIAX_{92}$	0.377	2.454	0.117				
$TIAX_{40}$	20.409	4.638	0.031	IAX_{64}	-4.474	4.097	0.043				
$TIAX_{73}$	1.915	1.021	0.312	IAX_{83}	15.468	3.741	0.053				
$TIAX_{74}$	-0.558	0.049	0.825	IAX_{87}	83.259	4.131	0.042				
$TIAX_{94}$	1.638	3.938	0.047	IAX_{36}	-4.322	3.912	0.048				
				IAX_{79}	-1.591	0.757	0.384				
				IAX_{80}	2.041	0.928	0.335				
Constant	-78.331	4.535	0.033		-46.242	3.991	0.046		-15.236	0.936	0.333

Notes. *IAX*: Average industry-adjusted ratio in three years; *TIAX*: changes in *IAX* for three years.

Table B5

Variables of Model 14 Under Logistic Regression Method

1 : 1				1 : 2				1 : 3			
Param.	Coeff.	Wald	Sig.	Param.	Coeff.	Wald	Sig.	Param.	Coeff.	Wald	Sig.
$AIAX_{1}$	2.878	7.969	0.005	$AIAX_{58}$	0.689	0.966	0.326	$AIAX_{57}$	12.081	1.659	0.198
$AIAX_{82}$	46.292	10.292	0.001	$AIAX_{65}$	1.172	0.717	0.397	$AIAX_{65}$	2.863	1.495	0.221
$AIAX_{88}$	-1.345	8.568	0.003	$AIAX_{69}$	11.497	3.271	0.071	$AIAX_{30}$	10.103	1.404	0.236
$AIAX_{6}$	-3.039	6.019	0.014	$AIAX_{32}$	0.695	1.385	0.239	$AIAX_{17}$	25.77	1.399	0.237
$AIAX_{36}$	-3.184	9.771	0.002	$AIAX_{34}$	-18.42	2.217	0.137	$AIAX_{87}$	104.383	1.232	0.267
$AIAX_{40}$	-10.134	10.034	0.002	$AIAX_{85}$	-3.301	0.003	0.958	$AIAX_{48}$	-29.331	1.745	0.186
$AIAX_{72}$	4.55	8.337	0.004	$AIAX_{87}$	68.69	3.286	0.070	$AIAX_{78}$	-6.241	1.584	0.208
$AIAX_{76}$	3.407	7.174	0.007	$AIAX_{78}$	-1.87	2.919	0.088	$AIAX_{94}$	-2.924	1.787	0.181
$AIAX_{78}$	-1.29	9.388	0.002	$TIAX_{11}$	12.025	1.704	0.192	$TIAX_{68}$	6.641	0.742	0.389
$AIAX_{95}$	-0.429	7.99	0.005	$TIAX_{54}$	6.557	1.736	0.188	$TIAX_{72}$	-2.943	0.316	0.574
$TIAX_{58}$	-0.095	1.209	0.272	$TIAX_{55}$	-13.714	2.257	0.133	$TIAX_{78}$	21.117	1.531	0.216
$TIAX_{68}$	3.309	9.183	0.002	$TIAX_{61}$	-3.076	2.827	0.093				
$TIAX_{82}$	31.908	10.059	0.002	$TIAX_{68}$	14.949	2.625	0.105				
$TIAX_{84}$	-0.368	10.075	0.002	$TIAX_{84}$	-1.25	2.667	0.102				
$TIAX_{45}$	-21.946	10.17	0.001	$TIAX_{78}$	27.006	2.829	0.093				
$TIAX_{77}$	-0.01	0.29	0.590								
$TIAX_{79}$	-0.129	1.109	0.292								
Constant	-25.315	10.163	0.001		-43.538	0.396	0.529		-57.464	0.819	0.365

Notes. *IAX*: Average industry-adjusted ratio in three years; *TIAX*: changes in *IAX* for three years.

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Performance and Stock Return in Australian Banking

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This paper examines the relationship between the total shareholder return (TSR) and performance of Australian banks over the period 2001-2010. In particular, it investigates whether returns of banks in the stock market can be explained by changes in their performance. First, we use a weighted financial ratio-based Data Envelopment Analysis (DEA) model to estimate the performance of banks. We then regress changes in performance against the total shareholder returns to investigate their relationship. The results indicate that changes in performance are reflected in TSR. That is, well-performed banks tend to generate more return for their stockholders.

Keywords: performance, data envelopment analysis (DEA), shareholder return, banks

Introduction

A well-performed banking system is critically important for businesses development, given the role it plays in the economy of nations. In Australia, in March 2011, the financial sector was the largest industry sector by 32% of the whole capital in the market with value of $480 billion. Additionally, caused by compulsory superannuation Australia has the 4th largest pension fund pool in the world which highlights the role of banking industry in this country. Due to this key position, measuring banks and financial institutions' performance is an issue of major interest for academics and policy makers (e.g., Avkiran, 1999, 2000, 2004; Kirkwood & Nahm, 2006; Moradi-Motlagh, Saleh, Abdekhodaee, & Ektesabi, 2011; Neal, 2004; Paul & Kourouche, 2008; Sathye, 2001, 2002; Sturm & Williams, 2004; Walker, 1998; Wu, 2008).

Recent competitive pressures have progressively driven banks to strategically focus on generating returns to shareholders. Therefore, the investigation of the determinants of bank performance and their relationship with share prices has become increasingly important (Beccalli, Casu, & Girardone, 2006). However, only very limited studies have examined the relationship between bank performance and stock performance in Australia and to our knowledge, Kirkwood and Nahm (2006) have conducted the only study which uses non-parametric techniques to measure the performance and examines this relationship for the time period between 1995-2002.

Due to the lack of any recent studies and after gathering through the literature as well as industry reports, it is clear to us that there is a need not only to measure the performance of Australian banks using non-parametric techniques but also to examine its relationship with stock performance. In this study, Data Envelopment Analysis (DEA) as a non-parametric technique is applied to aggregate four main dimensions of the performance namely profitability, growth, efficiency, and marketability to construct the performance measure. This approach can give us a wider view for better understanding of Australian banks performance in

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comparison with other studies in this area where they consider one or two aspects of the performance as discussed in the following sections. Additionally, to examine the relationship between the banks performance and their stock performance, banks total shareholder returns are regressed against the performance indexes measured by a weighted financial ratio-based DEA model.

This study makes four main contributions. It is the first study in the Australian banking industry which measures the performance using a financial ratio-based DEA model. Second, the study period is unique and distinct from other studies in Australia and includes recent years. Third, this selection of financial ratios has not been implemented in the previous bank performance studies in the international literature. Fourth, it is the only study that the relationship between the performance induced from a ratio-based DEA model and the total shareholder return has been examined in the banking industry across countries.

The reminder of this paper is organized as follows: Section 2 reviews the relevant literature, and the methodology is discussed in Section 3. Empirical results are detailed in Section 4, and the summary and conclusion are given in Section 5.

Literature Review

In recent years, DEA has been increasingly applied to evaluate banks performance in most counties (see Fethi & Pasiouras, 2010). However, based on the current literature, studies on the relationship between stock return and bank performance are limited. Although, there is only one study focused on such a relationship in the case of Australian banking, but there are a number of studies that use DEA based models to examine the performance of Australian banking (Avkiran, 2004; Kirkwood & Nahm, 2006; Neal, 2004). However, as Paul and Kourouche (2008) explained the studies that have focused on banking efficiency are limited and all have applied input oriented DEA to data relating primarily to the pre-Willis period.

Avkiran in a series of papers (1999, 2000, 2004) applied DEA to analysis the efficiency of Australian banks. In 1999, he measured operating efficiencies, employee productivity, profit performance, and average relative efficiency for Australian trading banks from 1986 to 1995. In his investigations on the role of the mergers and the benefit to publics, he concluded that the role of mergers in efficiency gain is not necessarily positive, a sentiment share by most other researchers in this field. Avkiran (2000) examined the change in productivity of the retail banking in the deregulated period 1986-1995. His findings indicated an overall rise in total productivity (on average 3.2% per year) driven more by technological progress than technical efficiency. Finally for the same study period, in 2004 by decomposing the technical efficiency, he discussed that pure technical inefficiency emerges as a greater source of inefficiency than scale efficiency.

Avkiran studies in Australian banking were followed by other academics after 2000. Sathye (2002) measured productivity changes in Australian banks by the Malmquist index using DEA technique during the period 1995 to 1999. He concluded that there is a decline in technical efficiency and total productivity factor during the study period and also no correlation was found between size and productivity which is important in the context of bank merger debate in Australia. Neal (2004) investigated X-efficiency and productivity changes in Australian banking between 1995 and 1999. His study differed from the earlier studies by examining efficiency by bank type and finds the regional banks are less efficient than other banks.

More recent study in Australia by Paul and Kourouch (2008) examined the technical efficiency of Australian banks during the post-Wallis period (1997-2005). The results based on DEA reveal that the extent of

technical efficiency varies across the banks and over the years. As on one side, the National Australia Bank, Commonwealth Bank and Macquarie Bank were found to be technically efficient, and on the other side, Adelaide Bank, the Bank of Queensland and Westpac Bank are found to be prominently inefficient. To sum up, more details about different approaches are provided in Table 1 to present a summary of studies in banking industry using DEA.

Table 1

A Summary of Bank Performance Studies Using DEA Technique in Different Countries

Author(s)	Country	Method	Inputs	Outputs	Indexes
Halkos and Salamouris (2004)	Greek	Profitability and efficiency ratios		RDIBA, ROE, ROA, profit/loss per employee, Efficiency ratio, net interest margin	Performance
Sathye (2001)	Australia	Intermediation	Labor, capital, loanable funds	Loans, demand deposit	Technical efficiency/allocative efficiency
Luo (2003)	USA	• Production • Market	• Stage 1: Employees, assets, equity • Stage 2: Revenue, profit	• Revenue, profit • Market value, stock price, EPS	• Profitability efficiency • Marketability efficiency
Asmild, Paradi, Aggarwall, and Schaffnit (2004)	Canada	Production	Employees, book value of physical; Assets, other non-interest expense	Deposits, loans, securities, deposits with other banks, other non-interest income	Productivity
Ho and Zhu (2004)	China	• Production • Profitability	• Stage 1: Capital stocks, assets, branches, employees • Stage 2: Sales, deposit	• Sales, deposits • Net income, interest income, non-interest income	• Efficiency • Effectiveness
Angelidis and Lyroudi (2006)	Italy	Value added	Total earning assets, loans, deposits	Personnel expense, other operating expense, total fixed assets	Productivity
Beccalli et al. (2006)	Europe	Intermediation	Deposits, labor, capital	Total loans and securities	Efficiency
Kirkwood and Nahm (2006)	Australia	Intermediation	• Model A: Employees, property, plant and equipment, interest-bearing liabilities • Model B: Employees, property, plant and equipment, interest-bearing liabilities	• Interest-bearing assets, non-interest income • Profit before tax	• Efficiency • Profit efficiency
Paul and Kourouche (2008)	Australia	Intermediation	Interest expense, non-interest expense	Net interest income, non-interest income	Technical efficiency

In comparison with all mentioned studies in the banking industry performance, a small number of them investigate the relationship between their results and the stock performance (e.g., Beccalli et al., 2006; Fiordelisi & Molyneux, 2010; Pasiouras, Liadaki, & Zopounidis, 2008). Kirkwood and Nahm (2006) conducted the only study in Australia which examined the relationship between changes in efficiency and stock returns. Their results indicated that changes in bank efficiency are reflected in stock return. The reported coefficient of determination (R-squared) in their study was 29.2%.

Beccalli et al. (2006) linked changes in efficiency to changes in stock performance of European banks across five countries using DEA and Stochastic Frontier Analysis (SFA). They concluded that results derived

from DEA are reflected in changes in stock prices while this trend is less clear for SFA. The coefficient of determination for DEA is reported 14.6% while this measure for SFA is only 0.01%.

Sufian and Majid (2007) investigated the long efficiency change of Singapore commercial banks during the period of 1993-2003. They established statistical relationship between cost efficiency and share price performance by employing regression analysis. The results suggested that cost efficiency explain the share price performance of Singapore banks with determination coefficient of 47%.

In order to advance the aforementioned literature, we made several contributions by developing a weighted financial ratio DEA model with unique combination of financial ratios. Additionally, it is the first study that the result of a financial ratio DEA model is examined and linked to the total shareholder return as a reliable performance measure which has been noted by Neslihan (2007) as a measure that cannot be manipulated by executives in the same way that earnings can.

Methodology and Model

Performance Measurement

Performance measurement is the process whereby an organization establishes the parameters within which programs, investments, and acquisitions are reaching the desired results (Thompson, Strickland, & Gamble, 2007). Although, in general a number of studies have been conducted related to the performance measurement, but Carton and Hofer (2006) believed that despite the importance of accurately measuring organizational performance in most areas of academic research, there have been very few studies that have directly addressed the question of how overall organizational performance is or should be measured.

There is no doubt that the performance is a multi-dimensional concept. However, the earlier studies have been conducted on the banking industry focus mostly on one or two aspects of the performance as demonstrated in Table 1 which is in line with the finding of Murphy, Trailer, and Hill (1996). They asserted that the frequently analysis shows an overwhelming proportion of studies are measuring only one or two dimensions of performance predominantly efficiency and profitability measures.

Traditionally, due to simplicity and ease of understanding of financial ratios, they have been applied in banks' performance analysis. Although the use of financial ratios assists the evaluation of bank performance, but there are several limitations that must be considered. Unlimited number of ratios that can be created from financial statement data are often contradictory and confusing, thus ineffective for the assessment of overall performance (Paradi, Vela, & Yang, 2004). Additionally, failure to account for generating an overall measure, combined with the inability to distinguish the best performers makes financial ratios analysis inadequate as a sole tool for performance measurement. Moreover, one bank might be strong on one ratio and poor on another one.

Not only DEA does not have the mentioned drawbacks but also as a frontier method it has several advantages like, dealing with multi input and output processes, no need for assigning a weight for inputs or outputs and the ability of constructing an overall relative measure based on the distance to frontiers in the sample. As a result, there is a consensus between academics that frontier approaches (parametric or non-parametric) have preference than financial ratios as Berger and Humphrey (1997) emphasized that although partial performance ratios are informative, they are not as broadly-based as frontier analysis.

DEA Models

DEA is a non-parametric linear programming technique that estimates the relative performance of the decision making units (DMUs) based on the observations in the sample. Since DEA was initiated by Charnes, Cooper, and Rhodes (1978), it has been widely applied to measure the performance of organizations in both public and private sectors (see Emrouznejad, Parker, & Tavares, 2008). Although DEA applications in multiple-input and output environment has spread rapidly but the capability of this technique in aggregating ratios has been neglected for many years. Fernandez-Castro and Smith (1994) reformulated DEA to introduce a ratio-based model to aggregate a set of financial ratios to a single measure which is called the General Non-Parametric Corporate Performance (GNCP). The mathematical formula of their model is as follows:

$$\max \alpha_l \tag{1}$$

Subject to:

$$\sum_{n=1}^{N} \lambda_n R_{in} \geq \alpha_l R_{il}$$

$$\sum_{n=1}^{N} \lambda_n = 1$$

$$\alpha_l \geq 0, \lambda_n \geq 0 \ \ (n = 1,\ 2,\ ..., N)$$

where R_{in} = the ith ratio of the nth DMU, and λ_n = the nth DMU weight value.

Not only a review of the literature indicates that few studies have focused on financial ratio DEA models across countries but also specifically, it is worth mentioning that this model has not been applied in Australian banking industry beforehand.

Halkos and Salamouris (2004) conducted the first study applying the GNCP model proposed by Fernandez-Castro and Smith (1994) in measuring the performance of the Greek commercial banks. They used six financial ratios which are profitability and efficiency ratios. Neglecting to cover the other aspects of bank performance such as growth and marketability and lack of clear explanation about the selection process of financial ratios in similar studies were the key motivations for us to introduce a multi-dimensional model based on performance studies which will be explained in details in this section.

Proposed Model

Three main gaps in the literature are as follows: (1) the selection process of financial ratios is poorly explained. For example, Fernandez-Castro and Smith (1994) remarked that the selection of ratios in their studies is not of any particular significance. (2) Ignoring the use of value judgment and prior knowledge about the importance of ratios associated in the model. This draw back exists in all similar previous studies. For instance, Halkos and Salamouris (2004) used six financial ratios to measure the performance of Greek commercial banks without considering any assumption about their importance. (3) Almost all of the studies which estimate efficiency and then regress it on sets of explanatory variables have been unable to explain more than just a small proportion of its total variation (Berger & Humphrey, 1997). For example, Kirkwood and Nahm (2006) in case of Australian banks, reported an R-squared of 0.29 that although it demonstrates a positive relationship but it is not able to explain a high proportion of changes in stock returns.

In the present paper, we are driven by all the above issues to develop an overall and comprehensive model

to assess the banking industry in Australia by formulating the preference of financial ratios, constructing weight restrictions to our multiplier model and examining the result to investigate the capability of the model to explain stock return.

The advantage of full flexibility in identifying inefficiency can be seen as a disadvantage of DEA where there is value judgments which can reflect known information about how the factors used by DMUs behave, and/or accepted beliefs or preference on the relative worth of inputs, outputs or even DMUs (Thanassoulis, Portela, & Allen, 2004). In GNCP model, the full flexibility of weight has been considered, therefore, to avoid the mentioned problem and to have a realistic result, we develop a weighted model which enables us to consider the importance of selected ratios as follows:

$$\max \sum_{n=1}^{N} \lambda_n R_{i0} \tag{2}$$

Subject to

$$\sum_{n=1}^{N} \lambda_n R_{in} \leq 1$$

$$\lambda_i R_{in} \geq \lambda_j R_{jn}$$

$$\lambda_n \geq 0 \ \ (n = 1, \ 2, \ ..., N)$$

where R_n = the ith ratio of the nth bank, and λ_n = the nth ratio weight value.

The proposed model in this paper consists of four financial ratios related to four main different dimensions of the performance which have been selected based on their importance and findings of other studies. There is no doubt that the profitability is the primary dimension of the performance and among the profitability indexes the return on asset (ROA) commonly has been utilized. Murphy et al. (1996) demonstrated that ROA is one of the most frequently used measures in performance studies.

Murphy et al. (1996) showed that the growth is the second most common performance dimension used to measure the overall organizational performance. Typical growth measures are change in total assets and sales. We selected change in total asset which according to the finding of Carton and Hofer (2006), it provided the most relative information among other measures of growth.

The efficiency indexes have been measured in the most of bank performance studies as shown in Table 1. The total asset turnover is one of the key ratios used to determine how efficiently a firm is using its assets in generating sales, which is a major determinant of operating income (Keown, Martin, Petty, & Scott, 1994). Due to the importance of this measure, it has been selected as a proxy of the efficiency in this paper.

The marketability is the last, but not the least measure we consider. Recently, it is a dimension that has taken more attention of researchers. Luo (2003) measured marketability for the USA banks and concluded that the time is ripe for researchers and policy makers to place more emphasis on the marketability efficiency and marketability related issues. We chose price to book value as a proxy of market ratios due to the findings of other studies that mention price to book value is a useful predictor of future returns (Carton & Hofer, 2006; Fama & French, 1998; Malkiel, 2003).

Finally, the article highlights and examines the relationship of the performance and total shareholder return to compare the result of GNCP model and the proposed model which is presented in the next section.

Data

Observing a bank's relative efficiency on a selection of variables over a number of years provides an insight into performance of that bank compared to its peers (Avkiran, 1999). In this study, we consider 10 years for seven Australian banks. As a result, there are 70 data observations. Due to limited sample size, we employ data pooling approach assuming there is no technical change during the study period similar to recent studies in Australia (Kirkwood & Nahm, 2006; Moradi-Motlagh et al., 2011; Paul & Kourouche, 2008).

Seven Australian banks based on the market value in the Australian Stock Exchange (ASX) are considered in this paper. Names and abbreviations used in this study are demonstrated in Table 2.

Table 2

List of Sample Banks

DMU	Name of bank	Abbreviation used	Category
1	Commonwealth	CBA	Large
2	Westpac	WBC	Large
3	Australia and New Zealand Bank	ANZ	Large
4	National Australia Bank	NAB	Large
5	Macquarie Group	MQG	Medium
6	Bendigo and Adelaide	BEN	Medium
7	Bank of Queensland	BOQ	Medium

As described in the previous section, four financial ratios of ROA, change in total asset, asset turnover, and change in price to book value have been collected for seven sample banks. Data are obtained from FinAnalysis database and Table 3 demonstrates a descriptive statistics of these ratios from 2001 to 2010.

Table 3

Summary of Financial Ratios

		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
ROA (%)	Max	1.07	1.18	1.20	1.19	1.54	1.07	1.10	1.08	0.79	0.95
	Mean	0.90	0.92	0.90	0.89	1.02	0.87	0.88	0.74	0.58	0.76
	SD	0.21	0.22	0.23	0.21	0.31	0.21	0.20	0.24	0.15	0.18
	Min	0.53	0.61	0.62	0.62	0.66	0.52	0.53	0.43	0.37	0.53
Change in asset	Max	1.42	1.25	1.36	1.38	1.18	2.15	1.28	2.82	1.34	1.13
	Mean	1.16	1.08	1.13	1.22	1.10	1.33	1.20	1.46	1.09	1.07
	SD	0.12	0.09	0.11	0.13	0.05	0.38	0.07	0.61	0.17	0.05
	Min	1.06	0.99	1.05	1.03	1.02	1.12	1.12	1.15	0.89	0.98
Asset turnover	Max	8.24	8.71	10.31	7.84	13.39	15.35	8.17	8.51	7.67	7.15
	Mean	7.39	6.78	6.80	6.93	8.63	8.60	7.63	7.55	6.48	6.22
	SD	0.59	0.90	1.60	0.53	2.21	2.99	0.40	0.78	0.74	0.51
	Min	6.82	5.93	5.63	6.16	7.15	7.17	6.92	6.06	5.47	5.66
P/B	Max	3.64	3.26	2.31	2.75	3.01	3.35	3.34	2.28	2.23	2.14
	Mean	2.33	2.31	1.99	1.97	2.15	2.58	2.69	1.58	1.48	1.46
	SD	0.65	0.48	0.17	0.41	0.46	0.47	0.47	0.47	0.59	0.50
	Min	1.69	1.74	1.84	1.52	1.67	2.03	2.14	0.93	0.7	0.79

Carton and Hofer (2006) emphasized in their key findings that growth rate of total asset does not provide statistically significant incremental information beyond that provided by the corresponding static financial performance measure. Moreover, they mentioned that the change in price to book value provides the best information about the return to shareholder after Alman's Z score. Based on their finding and other mentioned studies in the previous section, we impose the following restrictions on model where λ_1, λ_2, λ_3, and λ_4 note the weight of change in price to book value, ROA, asset turnover and change in asset growth, respectively:

$$R_1\lambda_1 \geq R_2\lambda_2 \geq R_3\lambda_3 \geq R_4\lambda_4$$

Bank Performance and Stock Performance

In this study, stock performance is represented by total shareholder return, which has been used as the most appropriate comparative measure as it focuses on the delivery of shareholder value and is a well understood and tested mechanism to measure performance. Additionally, it has been applied as one of the main long term incentive criteria to pay reward to bank mangers. For example, in the Commonwealth bank, the long term incentive that was granted under the Equity Reward Plan (ERP) in 2005 fully vested in July 2008, reflecting total shareholder returns from July 14, 2005 to July 14, 2008 that were above the 75th percentile of returns of companies within the peer group.

Following Chu and Lim (1998), we examine the relationship between performance and total shareholder return according to the following regression model:

$$R_{it} = \beta_0 + \beta_1 P_{it} + \varepsilon_{it} \quad (3)$$

where R_{it} is the total shareholder returns and ε_{it} is the change in banking performance measured by our proposed DEA model. This regression model aims to establish the extent to which changes in the estimated performance scores influence total shareholder return.

Empirical Result

Derived from the proposed model the banks performances have been measured and demonstrated in Table 4. The results demonstrate that the average of the overall performance of the selected banks has decreased in the second half of the study period. Precisely, the average of the performance between 2001 and 2005 is greater than the period 2006 to 2010.

Table 4

DEA Performance Scores

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Average	0.72	0.72	0.66	0.65	0.71	0.76	0.78	0.61	0.50	0.54
Average (2001-2005)					0.69	Average (2006-2010)				0.64

The trend has been presented in Figure 1. Although the performance has an upward trend from 2003 to 2006, it has been fallen sharply after 2006. Moreover, there is an improvement in performance after recent financial crisis which is in line with Demirgüç-Kunt, Detragiache, and Gupta (2006) who found that banks enhance their operational efficiency after a crisis, on average during the following two years. Moreover, the results reveal that banks performance varies across the banks and over the years. While Macquarie bank has the best performance in 2006 and 2010, NAB has the least average score among the large banks and between the

smaller banks, Bank of Queensland has the least average score which are consistent with figures of total shareholder returns.

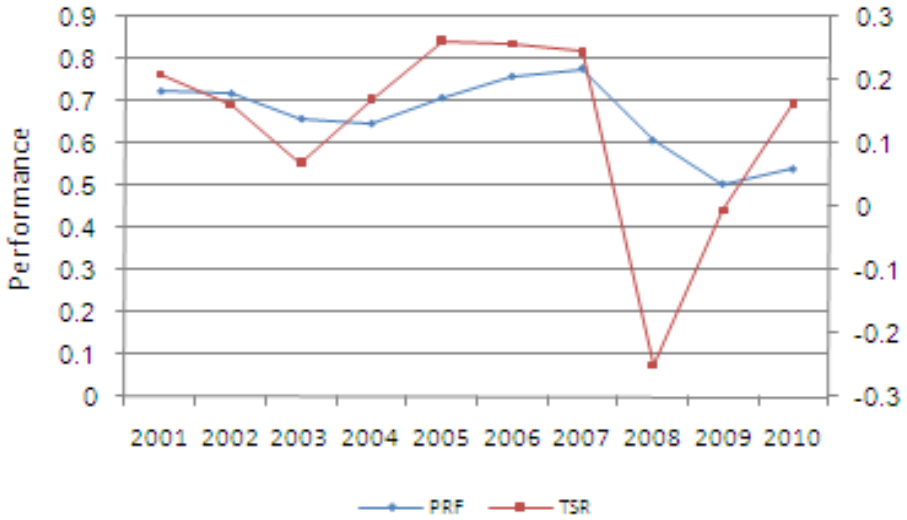

Figure 1. The trend of performance and TSR from 2001 to 2010.

Most performance studies utilize only one variable to represent organizational performance, and ROA is the most frequently used measure. However, ROA explain only 4% of the variation in market return to shareholder (Carton & Hofer, 2006). To investigate whether there is any relationship between the performance scores and the total shareholder return, we examine this relationship using regression analysis. As presented in Table 5 and Figure 2, these two indexes are positively correlated which means as we expected that the banks performance is reflected in their total shareholder returns. Specifically, Table 5 illustrates the result of regression analysis not only for changes in performance versus total shareholder return but also demonstrates the correlation of performance components in our model with total shareholder return.

Table 5

Regression Analysis

Parameter	Change in performance score	ROA	Asset turnover	Asset growth	P/B
Constant	0.148	-0.048	-0.027	0.158	-0.24
Independent variable	1.31	20.842	0.021	-0.025	0.179
R	0.77	0.21	0.14	0.028	0.47
R^2	0.60	0.04	0.02	0.0008	0.22
Adjusted R^2	0.59	0.03	0.005	-0.01	0.21
Significance level	> 0.001	> 0.1	> 0.3	> 0.8	> 0.001

To be precise, R-square of 0.6 at a high level of significance proves a strong correlation between two measures. It is worth mentioning that if we use the GNCP model and recalculate the R-square again, it will be reached at 0.15. In other words, the much higher explanatory power of proposed model in comparison to the GNCP model implies that the effect of value judgment is higher that can be neglected. Finally, these results seem to suggest that total shareholder return can be explained better by performance changes using the proposed model than by financial ratios.

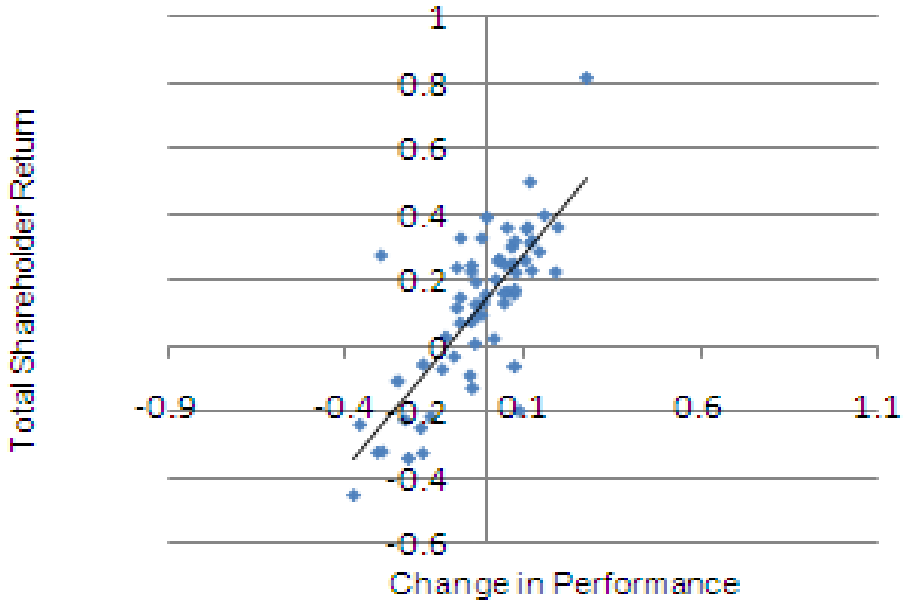

Figure 2. Performance and total shareholder return.

Conclusions

In this paper, we introduced a weighted financial ratio-based DEA model consist of four dimensions of performance namely, profitability, growth, efficiency, and marketability. On the contrary of previous studies that consider limited aspects of the performance, the proposed model in this paper covers four determinants of the performance which have been integrated and presented as an overall performance index. The results indicate during the 10 years study period, the average of the performance of Australian banks in the first half of the period is less than the second half which can be explained mostly due to the effect of the financial crisis. We also found that the performance changes has a positive and statistically significant relationship with the total shareholder return, and that this relationship is stronger for the proposed weighted model in this paper compare to the GNCP model which has been used in similar studies. This finding confirms Thanassoulis et al.'s (2004) arguments that DMUs have in some contexts value judgments that can be formalized, a priori, and therefore should be taken into account in the performance assessments.

This study makes several unique contributions and extends the literature by: (1) identifying the most important financial ratio from four main aspect of organizational performance which can explain the total shareholder return; (2) developing a weighed financial ratio-based DEA model to integrate mentioned ratios; and (3) investigating the ability of the model to explain the total shareholder return and comparing with the GNCP model. Moreover, this study can help banks to apply more practical non-parametric models to integrate traditional performance measures like financial ratios in a way that not only enables them to compare their positions in comparison with rivals but also gives them more knowledge about the stock return in market.

Finally, this paper suggests that using the proposed model has the capability to explain the total shareholder return better than financial ratios. Also it is worth mentioning that although the results from the proposed model are interesting, further studies are necessary to expand the result to other countries or industries.

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An Exploratory Study Into the Implementation of Management Accounting Changes in Australia

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This paper is an exploratory study which investigates the introduction and implementation of management accounting changes in Australia. The study first examines the introduction of relatively new management accounting techniques in professional journals, conferences, workshops, and professional development programs over a four-year period in Australia. These are among the main sources of transferring information on cost and management accounting changes to potential users in Australia. The purpose of such a study is to get a clear picture of the scope and extent of recently developed cost and management accounting techniques introduced to practitioners in Australia. By identifying the major management accounting changes and developments faced by organizations, the study then investigates the extent of implementations of such changes in practice. The study further explores the hindering and facilitating factors contributing to the implementation of new management accounting changes in organizations.

Keywords: activity-based costing (ABC), activity-based management (ABM), balanced scorecard (BSC), target costing (TC), just-in-time (JIT), strategic management, management accounting innovations

Introduction

A number of theories and metaphors have been used to explain the implementation of management accounting changes in organizations. For instance, some studies have used metaphors like translation, imitation, and fashion to describe the processes of changes by which new ideas (changes) travel between the members of a social system (Røvik, 1996). Wang, Heng, and Chau (2010) addressed several further theories which could explain the processes of the diffusion of an innovation or implementation of changes in organizations as follows: the theories of transaction cost economics, stakeholder theory, organization learning theory, institutional theory, transaction cost theory, and social cost theory. As with the above, the diffusion innovation theory (Rogers, 2003) has been used to describe the processes of changes and the implementation of new techniques/practices in organizations. This theory suggested that a wide range of contextual factors (such as organizational strategy, organizational culture, organizational structure, characteristics of innovations, communication channels, and environmental factors, etc.) could influence the diffusion of innovations in organizations (Adam & Fred, 2008; Al-Omiri & Drury, 2007a; Askarany, 2006; Askarany & Smith, 2004, 2008; Askarany & Yazdifar, 2009; Askarany & Yazdifar, 2012; Berling, 2008; Englund & Gerdin, 2008; Qian & Ben-Arieh, 2008; Yazdifar & Askarany, 2012; Yazdifar, Askarany, Askary, & Daneshfar, 2005). However,

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while the majority of studies initiated by the above theories and metaphors and found some associations between management accounting changes and some contextual factors (addressed by adopted theories), the findings are inconclusive, inconsistent, and mixed (Al-Omiri & Drury, 2007a; Askarany & Yazdifar, 2012; Baird, 2007; Baird, Harrison, & Reeve, 2007; Cobb, Innes, & Mitchell, 1993; Innes & Mitchell, 1995; Innes, Mitchell, & Sinclair, 2000; Langfield-Smith, 1997; Pierce, 2004; Yazdifar & Askarany, 2012). Furthermore, from organizations' point of views, understanding factors contributing to innovative behavior in organizations and influencing organizations' decisions to proceed with the changes have remained relatively undeveloped, inconclusive, and inconsistent (Cho & Pucik, 2005). This situation encourage an exploratory study to identify the most prevalent contextual factors (from organizations' perspectives) influencing the implementation of new managerial changes or the adoption of relatively new management accounting techniques in organizations.

Given the above, current study is aiming to investigate the introduction and the implementation of management accounting changes in Australia. It also intends to explore the hindering and facilitating factors (from organizations' perspectives) contributing to the implementation of new management accounting changes in organizations.

Our research inquiry in the current study is guided by an exploratory theoretical paradigm (Lincoln & Guba, 1985). The aim of this study is to explore a current gap in our understanding about the contextual factors (from organizations' perspectives) influencing the implementation of management accounting changes in organizations.

The remainder of the paper is structured as follows. Next sections present the literature review, the research methodology adopted, the findings and data analysis and finally the conclusions.

Literature Review

Recent studies suggest that the take-up of most of management accounting changes introduced during the past three decades still lag behind those of traditional systems (Al-Omiri & Drury, 2007b; Anderson & Young, 1999; Askarany, 2003; Askarany, Smith, & Yazdifar, 2007a, 2007b; Askarany & Yazdifar, 2007; Askarany, Yazdifar, & Askary, 2010; Baird, 2007; Gosselin, 1997; Langfield-Smith, 1997). For example, Chenhall and Langfield-Smith (1998) have found that the level of adoption of most of relatively new management accounting techniques in Australia were fairly lower than those of the traditional techniques. For instance, the ranking in terms of the extent of adoption of some of the new techniques were as follows: "activity-based costing ranked" (24), "activity-based management" (21), "product life cycle analysis" (20), and "target costing" (27). Given the above, they found the following rankings in terms of the extent of adoption of some of traditional management accounting techniques: "analysis for budgeting and for planning financial position" (1), "capital budgeting" (2), and "performance evaluation using return on investment" (3). Likewise, the published studies on the diffusion of management accounting innovation in the UK and New Zealand depict a similar picture (Abdel-Kader & Luther, 2006; Al-Omiri & Drury, 2007a; Askarany et al., 2010; Cotton, Jackman, & Brown, 2003; Yazdifar & Askarany, 2009).

However, except few (e.g., activity-based costing and balanced scorecard) other management accounting changes and innovations have relatively received less publicity in the literature. So, it is not very clear what the other main management accounting innovations/changes that organizations are faced with. We may refer to any relatively new management accounting technique as "innovation" or "change" in this paper. Reviewing cost and management accounting innovations of the past few decades, Björnenak and Olson (1999: 327) identified

the major recently developed cost and management accounting techniques in the literature (which received adequate attention by practitioners) as follows:

(1) Activity-based costing (ABC);

(2) Activity management (AM) and activity-based management (ABM);

(3) Local information systems (LS);

(4) Balanced scorecard (BSC);

(5) Life cycle costing (LCC);

(6) Target costing (TC);

(7) Strategic management accounting (SMA).

Besides above techniques, following managerial tools are also considered as relatively recent management accounting innovations: Key performance indicators (KPIs), resource accounting and budgeting (RAB), zero-based budgeting (ZBB), functional analysis, and resource management (Lapsley & Wright, 2004).

In line with the above techniques, Chenhall and Euske (2007) referred to some of the recent management accounting innovations under management control systems as follows: activity-cost-management, target costing, LCC, quality costing, and performance management innovations such as economic value added (EVA), shareholder value analysis (SVA), value based management (VBM), and BSC. There is no universal consensus with respect to what techniques constitute recent management accounting innovations (Cadez & Guilding, 2008). It is argued that many management accounting techniques drawn from other disciplines such as engineering and economics (Miller, 1998; Miller, Kurunmäkii, & O'Leary, 2008). According to Miller et al. (2008), practices such as standard costing, discounted cash flow (DCF), the distinction between fixed and variable costs, break-even analysis, and much more have been drawn from disciplines other than accounting and then adapted, and constituted as the core of accounting. However, regardless of the origins which management accounting techniques are drawn from, according to Chenhall and Langfield-Smith (1998), the most popular recently developed techniques which have received considerable attention by Australian practitioners can be listed as follows: ABC; ABM; BSC; benchmarking; SMA; and TC.

Given the above, to gain a better picture regarding the awareness of Australian practitioners about recent management accounting innovations, the following section examines the extent of introduction of recently developed cost and management accounting techniques to potential practitioners and users in Australia.

The Extent of Introduction of Recently Developed Cost and Management Accounting Techniques to Practitioners in Australia

To examine the extent of introduction of recently developed cost and management accounting techniques to practitioners in Australia, the most widely available technical, professional, and Australian practitioner journals in the field of management accounting were reviewed. These journals included Business Review Weekly (BRW), CPA Journal (the journal of CPA Australia), and Charter (the journal of ICAA). Furthermore, Institute of Chartered Accountants in Australia [ICAA] and CPA conferences, workshops, and professional developments programs in South Australia during a four-year period (1996-1998) were investigated. These were among the main sources of transferring information on cost and management accounting innovations to potential users in Australia. The purpose of such an investigation was to get a clear picture of the scope and the extent of recently developed cost and management accounting techniques introduced to practitioners in Australia. Table 1 exhibits the frequency of the most relevant topics regarding recently developed cost and

management accounting techniques/changes discussed in the above-mentioned professional journals, conferences, workshops, and professional development programs over the period 1996 to 1999 in Australia.

Table 1
Frequency of Discussion of Recently Developed Cost and Management Accounting Innovations/Changes

Techniques	BRW	Charter	CPA	Conferences	Total No. of discussions	Percentage (%)
Performance measurement and BSC	10	12	6	32	60	19.6
ABC	4	14	7	28	53	17.2
Value chain analysis	5	9		18	32	10.4
Total quality management (TQM)	16	6	2	7	31	9.8
Strategic measurement	8	6	1	12	27	8.8
Risk measurement		1	3	18	22	7.1
Change in measurement	5	7	2	4	18	5.8
Benchmarking	7	4		6	17	5.5
Re-engineering	6	3	1	5	15	4.9
EVA, SVA, and VBM	3	2		5	10	3.2
TC		2	2	3	7	2.3
LCC	1			4	5	1.6
Learning organization	1		1	3	5	1.6
Outsourcing				4	4	1.3
Just-in-time (JIT)	1	1	1		3	1

The above examination shows that ABC is the most talked about techniques introduced to practitioners in Australia. This is in line with the suggestions made by studies which examined the implementation of ABC in practice (Al-Omiri & Drury, 2007a; Alcouffe, Berland, & Levant, 2008; Alsaeed, 2005; Baird et al., 2007; Englund & Gerdin, 2008; Kallunki & Silvola, 2008; Major & Hopper, 2005). However, as Table 1 shows, there are a variety of other management accounting practices which have been addressed in the literature and introduced to Australian practitioners through professional journals, workshops and conferences in recent years.

Given the above, a further survey was carried out to explore the extent of the implementation of above management accounting changes/innovations in practice. The survey also intended to explore the contextual factors influencing the implementation of management accounting changes (from users'/organizations' perspectives).

Research Method and Findings

A cross-sectional mailed survey was implemented in this study to examine the extent of implementation of management accounting innovations in Australia. The survey conducted in 2003, targeting 501 CPA members employed in building and construction, energy, engineering, healthcare, metals, mining and extraction, paper and packaging, retail, distribution and transport. CPA is the largest professional accounting body in Australia with the majority of its members dealing with cost and management accounting techniques in commerce and industry, making it an appropriate sample for this study.

The targeted respondents were asked to identify the extent of implementation of six most widely cited management accounting techniques in their organizations as follows: ABC; ABM; BSC; benchmarking; SMA; and TC. In an open question, targeted respondents were also asked to list any other management accounting technique implemented, discussed, or introduced in their organizations.

Following Booth and Giacobbe (1998), a questionnaire was designed to seeking information on the level of implementation of above management accounting innovations/changes as follows: Discussions have *not* taken place regarding the introduction of this practice (with anchor of 1); a decision has been taken *not* to introduce the innovation (with anchor of 2); some consideration is being given to the introduction of the innovation (with anchor of 3); the innovation has been introduced on a trial basis(with anchor of 4); the innovation has been implemented and accepted (with anchor of 5).

Using the above scale, the targeted respondents were asked to identify the extent of implementation of the following six management accounting techniques/changes in their organizations: ABC; ABM; BSC; benchmarking; SMA; and TC. In an open question, the targeted respondents were also asked to list any other management accounting technique implemented, discussed or introduced in their organizations.

The questionnaire includes two further open questions seeking information on the major strengths and weaknesses of their implemented management accounting techniques as potential contextual factors influencing managers' decisions to implement (or not) new management accounting changes in their organizations.

Pilot tests of the instrument were initially undertaken with a group of university academics, managers, and management accountants. Before the survey instrument was mailed to the organizations under investigation, its content validity was addressed by asking a group of management accounting lecturers and postgraduate students with manufacturing experience to review the instrument for clarity and meaning and to refine the design and focus of the content further. Modifications were made as deemed necessary. To help motivate response, respondents were offered a final report of the results together with the resulting recommendations to facilitate the implementation of recent cost and management accounting innovations in their organizations.

Responses to the survey were gathered by 100 questionnaires, representing a response rate of 20%. Non-response bias was examined both by using the aggregate details provided by CPA members (number of employees, implemented innovations, and the activities of the firms) and through a comparison between early and late responses. The former showed responses to be representative, the latter showed that there was no perceived difference between these responses, suggesting that non-response bias would not influence the outcomes. Table 2 illustrates the extent of the implementation of relatively new management accounting changes in Australian firms.

Table 2
The Extent of the Implementation of Relatively New Management Accounting Changes/Innovations in Australian Firms

Management accounting innovations	No discussion (%)	Decided not to introduce (%)	Some consideration is given (%)	Introduced on trial basis (%)	Implemented and accepted (%)	Total (%)
ABC	38	13	21	9	19	100
ABM	54	9	17	9	11	100
BSC	36	4	16	21	23	100
Benchmarking	25	3	20	17	35	100
SMA	53	4	13	17	13	100
TC	53	5	13	13	16	100

According to Table 2, the implementation of six management accounting changes addressed in the current study ranges from 11% (ABM) to 35% (benchmarking). Table 3 reports the details of the analysis of scale reliability and unidimensionality for the above management accounting innovations/changes. The six-item

measure achieved an alpha value of 0.6406 (Cronbach, 1951), and a standardized item alpha of 0.6407. This figure is marginally below the value of 0.70 recommended by Nunnally (1978, p. 245), but can be regarded as moderate (Brownell & Dunk, 1991, p. 697) and acceptable (Daft & Macintosh, 1981, p. 214). Table 3 further shows the total-item correlations for each of the scale composites, with ranges from 0.3280 to 0.4184. According to De Vaus (1991, p. 239), values above 0.30 generally indicate acceptable scale unidimensionality.

Table 3

Analysis of Scale Reliability and Unidimensionality: Management Accounting Innovations

Management accounting techniques	Cases	Mean	Std. Dev.	Correlated item-total correlation	Alpha if item deleted
ABC	100	2.5800	1.5320	0.3280	0.6129
ABM	100	2.1400	1.4356	0.3609	0.6014
BSC	100	2.9600	1.6387	0.3632	0.6005
Benchmarking	100	3.3900	1.5884	0.3601	0.6014
SMA	100	2.3800	1.5941	0.4184	0.5789
TC	100	2.3900	1.6261	0.3918	0.5892

The above innovations were tested for univariate normality using the Kolmogorov-Smirnov test and the tests of the indices of skewness and kurtosis. In all cases, the assumption that the sample represents a normal population could not be rejected. The findings of current study suggest that the frequency of adopters of recently developed cost and management accounting innovations (addressed in this study) in Australia are still less than those of non-adopters. This is despite the expectation that the adoption of recent management accounting changes are growing due to their contribution to overall performance of organizations (Adam & Fred, 2008; Banker & Mashruwala, 2007; Dikolli, Kinney, & Sedatole, 2007; Kelly, 2007; Vera-Munoz, Shackell, & Buehner, 2007).

Besides above six techniques, we asked our targeted respondents (in an open question) to list any other management accounting changes/innovations which were either discussed or used by them. According to the findings, there were a number of other managerial tools listed by respondents (which were either discussed or at least used by one or more organizations) as follows:

DCF, TQM, CUSUM charts (cumulative sum control chart) and optimum transfer pricing, computer technology, opportunity cost budgeting, ZBB, decision trees, critical path scheduling, and management by objectives, information economics and agency theory, JIT scheduling, strategic business units, experience curves, portfolio management, materials resource planning, diversification, matrix organization and product repositioning, LCC, value-added management, theory of constraints, vertical integration, private labels throughput accounting, business process reengineering, quality functional deployment, outsourcing, gain-sharing, core competencies, time-based competition and learning organization, lean accounting, KPIs, RAB, ZBB, functional analysis, resource management, and time-driven activity-based costing.

Not all above techniques are pure management accountings changes/innovations. Furthermore, the development and introduction of some of above techniques dates back to more than 50 years ago (as explained in the following paragraph). However, the implementation of many of these techniques are not very prevalent in the literature. So, these findings could help future researchers in this area to expand their views and address various issues/questions regarding the implementation of above techniques in practice. The following paragraph provides some information regarding the history and introduction of above techniques in the

literature. According to Hagerty (1997) and Smith (1999), we can categorize the development and introduction of above techniques into different decades as follows:

(1) 1950s: Discounted cash flow (DCF), total quality management (TQM), CUSUM charts, and optimum transfer pricing.

(2) 1960s: Computer technology, opportunity cost budgeting, zero-base budgeting (ZBB), decision trees, critical path scheduling, and management by objectives.

(3) 1970s: Information economics and agency theory, JIT scheduling, strategic business units, experience curves, portfolio management, materials resource planning, diversification, matrix organization, and product repositioning.

(4) 1980s: Activity-based costing (ABC), activity-based management (ABM), strategic management accounting (SMA), activity management (AM), life cycle costing (LCC), target costing (TC), value-added management, theory of constraints, vertical integration, private labels, and benchmarking.

(5) 1990s: Business process reengineering, quality functional deployment, balanced scorecard (BSC), outsourcing, gain sharing, core competencies, time-based competition, and learning organization.

According to Dugdale and Colwyn (1998), the application of TOC which is one of the developments of 1980s is usually labeled as "throughput accounting". Completing the above list, we can also include "lean accounting" as one of the developments of 1990s (Maskell & Baggaley, 2006). The main purpose of lean accounting is to reduce steps in transaction processing, eliminate standard costs in favor of actual costs and discontinue cost allocations (Kennedy & Widener, 2008). In describing lean accounting, Kennedy and Widener (2008) considered this technique as continuous improvement and reducing time by eliminating waste and reduction of costs which are the main principles of lean accounting.

Updating the above techniques, we can expand the above list including the Second Generation BSC and the Third Generation BSC as further developments of management accounting innovations in 1990s (Lawrie & Cobbold, 2004). Expanding the above management accounting innovations, we may also add time-driven activity-based costing as another management accounting development in 2000s (Kaplan & Anderson, 2007).

The study further explored the level of organizational satisfactions with their implemented management accounting techniques (as a proxy for organizational performance) to see if the adoption of management accounting changes has contributed to organizational performance. It was expected that increasing organization satisfaction as a consequence of implementation of management accounting changes can be considered as an encouraging factor promoting the implementation of management accounting changes in organizations. Table 4 reveals the level of satisfaction of Australian firms with their implemented cost and management accounting systems as follows.

Table 4

The Level of Organizational Satisfaction With Implemented Management Accounting System

Level of satisfaction	Percentage (%)	Cumulative percentage (%)
Very dissatisfied	7	7
Dissatisfied	13	20
Needs improvement	39	59
Moderately satisfied	32	91
Very satisfied	9	100
Total	100	100

The findings indicate that the majority (59%) of establishments were either dissatisfied with their adopted cost and management accounting systems or believed that their systems need improvement. Only 9% were very satisfied and 32% moderately satisfied with their current system.

Table 5 reveals the significance of association between organizational satisfaction and the levels of implementation of six management accounting techniques in Australia.

Table 5
The Significance of the Association Between Organizational Satisfaction and the Levels of Implementation of Six Management Accounting Techniques in Australia

	ABC	ABM	BSC	Benchmarking	SMA	TC
Satisfaction with current systems	0.851	0.294	0.617	0.767	0.734	0.333

According to Kendall's tau-b, the level of association between the organizational satisfaction and the extent of implementation of ABC has a value of 0.016 (standard error 0.085), which is statistically significant only at the 0.851 level. Thus the findings do not support the notion that the higher the levels of adoption of ABC, the higher the levels of organizational satisfaction. Though the above findings are not in line with what advocates of ABC (e.g., Adam & Fred, 2008) believe, the results are consistent with those findings (e.g., Banker, Bardhan, & Chen, 2008) which suggested that ABC adoption by itself does not improve organizational performance.

Kendall's tau-b for the level of association between the organizational satisfaction and the extent of implementation of ABM has a value of 0.092 (standard error 0.087), which is statistically significant only at the 0.294 level. Thus as with the ABC, the findings do not support the notion that the higher the levels of implementation of ABM, the higher the levels of organizational satisfaction.

Kendall's tau-b for the level of association between the organizational satisfaction and the extent of implementation of BSC has a value of 0.042 (standard error 0.084), which is statistically significant only at the 0.617 level. So, similar to ABC and ABM, the findings do not support the notion that the higher the levels of adoption of BSC, the higher the levels of organizational satisfaction.

According to Kendall's tau-b, the level of association between the organizational satisfaction and the extent of implementation of benchmarking has a value of 0.025 (standard error 0.086), which is statistically significant only at the 0.767 level. Thus these findings also do not support the notion that the higher the levels of adoption of benchmarking, the higher the levels of organizational satisfaction.

Kendall's tau-b for the level of association between the organizational satisfaction and the extent of implementation of SMA has a value of 0.029 (standard error 0.084), which is statistically significant only at the 0.734 level. So, similar to other four techniques, the findings do not support the notion that the higher the levels of adoption of SMA, the higher the levels of organizational satisfaction.

And finally, Kendall's tau-b for the level of satisfaction with implemented accounting systems and the diffusion of target costing has a value of -0.078 (standard error 0.080), which is statistically significant only at the 0.333 level. As with other five management accounting changes, the findings are not supporting that the implementation of target costing increases the level of organizational satisfaction in organizations.

According to the findings, the extent of organizations satisfactions with their implemented management accounting systems is not significantly related to the adoption of any of six management accounting innovations (addressed in this study). This might appear to be at odds with the literature (especially the ABC

literature), which considers "organizational dissatisfaction with their implemented traditional accounting systems" as a major motivation for the diffusion of new management accounting techniques (Beng, Schoch, & Yap, 1994; Bork & Morgan, 1993; Gosselin, 1997).

Exploring other contextual factors (from organizations points' of view), we asked our targeted respondents to identify the "strengths" and the "weaknesses" of their implemented management accounting techniques as potential hindering or facilitating factors influencing their decision to implement new management accounting changes and innovation in their organizations.

Tables 6 and 7 list the "strengths" and the weaknesses' of management accounting techniques (implemented by organizations). These tables also show the levels of association between these factors (listed under the strengths and the weaknesses of management systems) and the implementation of relatively new management accounting techniques respectively. According to Table 6, the level of association between "simplicity" (as one of the of strengths of the implemented systems) and the implementation of benchmarking is statistically significant (significant at $p < 0.062$), while the findings provide no support for a significant association between "simplicity" and the other five management accounting techniques addressed in this study. Likewise, there are some relatively significant individual relationships between other factors (listed as strengths of implemented accounting systems) and six management accounting changes addressed in this study as follows: between "widely understood" and the diffusion of the BSC (significant at $p < 0.036$); between "tailored to demand" and ABM (significant at $p < 0.005$); between "accurate (reliable)" and SMA (significant at $p < 0.017$); between "flexible, reconcile and links well to other parts of business" and the BSC (significant at $p < 0.037$) and finally between "easy to maintain, follow, and use" and target costing (significant at $p < 0.076$).

Table 6

The Significance of the Association Between Management Accounting Techniques and the Strengths of Implemented Accounting Systems

The major strengths of implemented accounting system	ABC	ABM	BSC	Benchmarking	SMA	TC
Simplicity	0.904	0.562	0.220	0.062	0.819	0.784
Widely understood	0.238	0.963	0.036	0.744	0.535	0.141
Tailored to demand	0.297	0.005	0.877	0.772	0.198	0.520
Up to date information	0.611	0.786	0.795	0.642	0.128	0.216
Cost effective	0.240	0.907	0.112	0.932	0.658	0.832
Accurate (reliable)	0.195	0.193	0.430	0.135	0.017	0.794
Detailed	0.914	0.761	0.132	0.619	0.551	0.145
Relevant, meaningful, stable, and standard	0.452	0.201	0.211	0.359	0.776	0.777
Flexible, reconcile, and links well to other parts of business	0.641	0.383	0.037	0.140	0.891	0.591
Easy to maintain, follow, and use	0.132	0.315	0.461	0.175	0.186	0.076

According to Table 7, as with the preceding factors, the associations between factors constituting the weaknesses of implemented accounting systems and all six management accounting innovations/changes vary significantly. As Table 7 shows, the association between the weakness termed as "arbitrary, not consistent, open to interpretation" and the diffusion of ABC is statistically significant (significant at $p < 0.010$), while the finding provide no support for a significant association between this factor and any of the other five management accounting techniques addressed in this study. Likewise, there are some significant individual relationships between other weaknesses of implemented accounting systems and the remaining five cost and management accounting innovations as follows: between "difficult to trace costs" on one hand and the

diffusion of ABC (significant at $p < 0.007$) and ABM (significant at $p < 0.078$) respectively; between "complex, complicated, and diversified" and benchmarking (significant at $p < 0.043$); between "inaccurate" and ABC (significant at $p < 0.067$); between the BSC on one hand, and "needs regular fine tuning and resources" (significant at $p < 0.096$) and "lack of understanding by the business" (significant at $p < 0.026$) on the other hand respectively.

Table 7
The Significance of the Association Between Management Accounting Techniques and Weaknesses of Implemented Accounting Systems

Major weaknesses of implemented accounting system	ABC	ABM	BSC	Benchmarking	SMA	TC
Arbitrary, not consistent, open to interpretation	0.010	0.916	0.403	0.225	0.521	0.251
Difficult to trace costs	0.007	0.078	0.461	0.744	0.779	0.395
Complex, complicated, and diversified	0.208	0.738	0.559	0.043	0.781	0.529
Time consuming	0.650	0.401	0.270	0.847	0.160	0.346
Not easy to analyze variances and report	0.342	0.318	0.582	0.317	0.34	0.494
Inaccurate	0.067	0.853	0.683	0.923	0.530	0.778
Out of date (not detailed)	0.810	0.244	0.257	0.906	0.654	0.918
Lack of integration with other parts of the system	0.339	0.429	0.407	0.457	0.890	0.206
Not flexible	0.402	0.898	0.835	0.356	0.613	0.670
Needs regular fine tuning and resources	0.211	0.639	0.096	0.366	0.923	0.912
Lack of understanding by the business	0.795	0.445	0.026	0.220	0.526	0.370

The above results show that individual management accounting changes/innovations may have different reactions to different influencing factors. However, the above contextual factors (listed as the strengths and the weaknesses of management accounting systems) explored in this study are likely to influence the decisions to implement (or not) any new management accounting change in organizations. Further studies are recommended to examine the impact of above contextual factors (explored in this study) on the implementation of recently developed management accounting changes/innovations in larger scales.

Conclusion and Limitations

The current exploratory study confirms the exposure of Australian practitioners to a variety of management accounting changes/innovations through professional journals, conferences, workshops, and professional development programs. The findings suggest that most prevalent cost and management accounting changes/innovations introduced to Australian organizations during the past few decades include: performance measurement and BSC techniques, ABC, valued added concepts, ABM, TQM, strategic management, risk management, benchmarking, re-engineering, EVA, and target costing. However, from implementation perspective, the findings of current study suggest that recent management accounting innovations/changes (addressed in this study) are not widely implemented in Australia.

The study further explored the level of organizational satisfactions with their implemented management accounting techniques to see if the adoption of management accounting changes has contributed to organizational satisfaction. The findings show no significant association between organizational satisfaction and the implementation of any management accounting changes/innovations addressed in this study. Considering the cost and benefit of any changes (or implementation of a new technique), this might imply that perceived advantages of these relatively new management accounting changes are not adequate enough to make

a fundamental changes in organizational performance.

Exploring contextual factors (from organizations points' of view) influencing the implementation of management accounting changes, we asked our targeted respondents to list the "strengths" and the "weaknesses" of their implemented management accounting techniques as potential hindering or facilitating factors influencing their decision to implement new management accounting changes or innovation in their organizations. The respondents listed the following factors as some of the strengths of management accounting systems which could influence their decisions to implement (or not) a new management accounting change: simplicity; widely understood; tailored to demand; up to date information; cost effective; accurate (reliable); detailed; relevant, meaningful, stable, and standard; flexible, reconcile and links well to other parts of business; easy to maintain, follow, and use.

The respondents further listed the following factors as some of the weaknesses of management accounting systems which could influence their decisions to implement (or not) a new management accounting change: being arbitrary, not consistent, open to interpretation; difficult to trace costs; complex, complicated and diversified; time consuming; not easy to analyze variances and report; inaccurate; out of date (not detailed); lack of integration with other parts of the system; not flexible ; needing regular fine tuning and resources; and lack of understanding by the business.

However, the findings suggest that individual management accounting changes/innovations may have different reactions to the above factors. Further studies are recommended to examine the impact of the above contextual factors (explored in this study) on the implementation of recently developed management accounting changes/innovations in larger scales.

The findings, conclusions and the implications of this study should be interpreted based on the normal limitations of mail surveys, such as lack of researcher interaction with respondents and follow up interviews. Caution should be exercised for generalizing the findings of current study (especially due to the relatively low response rate of 20%, though associated tests for non-response bias yielded satisfactory outcomes).

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Fair Value Disclosure, External Appraisers, and the Reliability of Fair Value Measurements*

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By developing an analytical model, this paper examines the role of the "external appraiser" as a tool to face the informational asymmetry issue related to fair value measurements. A comparison between such a signaling mechanism and a "full fair value disclosure" is firstly carried out, highlighting variables affecting the efficiency and the effectiveness of both information strategies. Then, recovering the traditional distinction between "protective disclosure" (hard information) and "informative disclosure" (soft information), this paper demonstrates how the former could significantly increase the positive effects associated to an employment of an independent valuer, reaching some conclusions useful to the standard setting process.

Keywords: fair value accounting (FVA), information asymmetry, external appraiser, informative disclosure, protective disclosure

Introduction

Since the 1970s, the academic literature has been well aware of the political and economic reasons lying behind the setting of the accounting standards, examining the impact exerted by different accounting policies on the relationships between the parties involved in the corporate reporting "supply chain" (Horngren, 1973, 1976; Armstrong, 1977; Gellein, 1978; Solomons, 1978; Zeff, 1978). Indeed, the implementation of a new accounting policy depends on the acceptance of its effects by the three main actors of the market: the preparers of financial statements (corporations), the "users" of financial statements and the "accounting profession" (auditors) (Ronen, 2008). The above intuitions were very well synthesized by Cyert and Ijiri (1974). Area I of Figure 1 represents the set of information that, being useful for users, can be effectively standardized by an accounting rule as corporations agree to disclose and auditors are able to attest conveniently.

Following a "user oriented approach", the standard setters of many jurisdictions let their rules being driven mainly by the users' needs. According to the Cyert and Ijiri (1974) model, such an accounting policy means to fix Circle U, moving Circle P and Circle C towards it, as shown in Figure 2.

The introduction of Fair Value Accounting (hereafter FVA) seems to be one of the most important results of this process. In fact, the value relevance of the disclosed and recognized fair values for tangible, intangible, and financial assets/liabilities has been widely proven (Easton, Eddey, & Harris, 1993; Barth, 1994; Eccher, Ramesh, & Thiagarajan, 1996; Barth, Beaver, & Landsman, 1996; Aboody, Barth, & Kasznik, 1999).

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Moreover, by reducing the practice of timing assets sales for earnings management purpose, FVA also increases the accountability quality of financial information, allowing the *principal* to exert an effective control activity on the behavior of the *agent* (Barlev & Haddad, 2003).

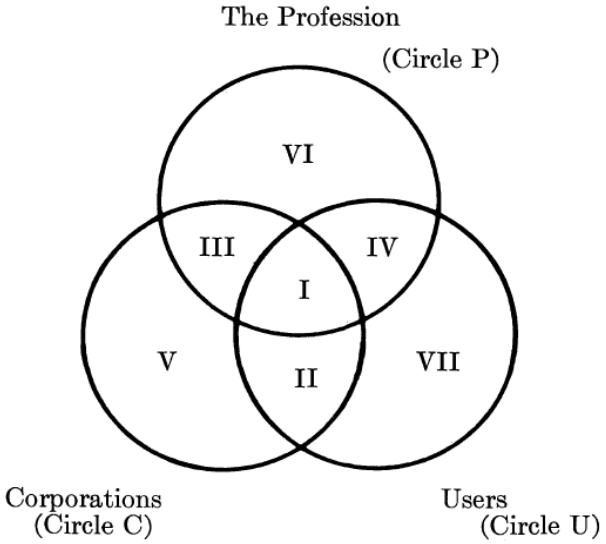

Figure 1. Constituents of financial statements. Source: Cyert and Ijiri (1974).

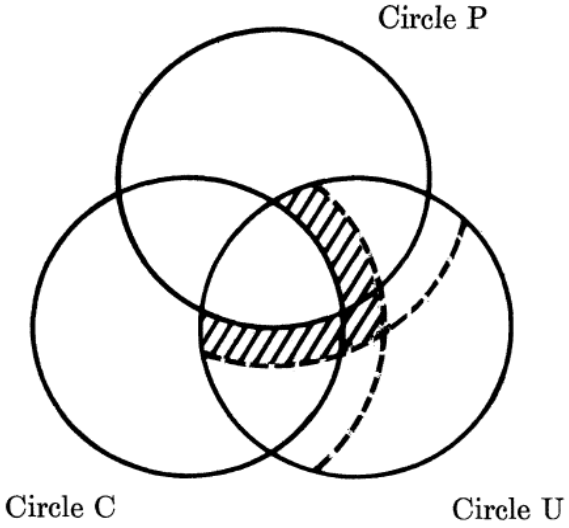

Figure 2. The impact of a "user oriented approach". Source: Cyert and Ijiri (1974).

However, a widespread use of a FVA obliges to shift from a simple *mark-to-market* to a more complicated *mark-to-model fair value*. Extremely articulated valuation techniques have to be used to elaborate input data useful in evaluating the fair value of several balance sheet items, and reliability concerns arise about the reached outcomes (especially with Level 3 inputs) (Landsman, 2007; Penman, 2007).

The great attention that the main standard setters have paid on the fair value disclosure can be interpreted as an effort to alleviate these problems. Indeed, corporate disclosure can mitigate the informational asymmetry problem by leveling the playing field between investors (Verrecchia, 2001).

The hiring of an external appraiser has also been considered by boards and scholars as an alternative tool to face informational asymmetry problems. In fact, it has been empirically tested the higher quality of asset revaluations estimates made by external appraisers relative to those made by internal valuers (Muller & Riedl, 2002). Consequently, the most important standard setters encourage an entity to determine fair value on the basis of a valuation by an independent valuer (see, for example, International Accounting Standards [IAS] No. 40, par. B56). Many auditing practices also recommend the adoption of the Valuation Standards to evaluate the fair value of assets/liabilities (Deloitte & Touche [D&T], 2003; PricewaterhouseCoopers [PWC], 2003).

However, it is noteworthy to point out that the academic literature often describes the independent valuer as an exogenous actor. In other words, the appraisers' interests never conflict with those of the three other parties involved; he never arranges secrete side contracts with managers to satisfy his own interests (i.e., he never adopts a "collusive" behavior). The independent valuer is simply seen as a corporate governance mechanism able to strengthen the quality of the measurement process and the reliability of the estimates.

As it will be showed in the next sections, holding these assumptions does not allow to explain the evidence collected by the related literature about the hiring policy of external appraisers. In particular, a simple neutral view of the external appraiser does not help to understand why he is mainly involved in measuring fair value of the more liquid assets (land and building), albeit it would be more effective (in terms of higher reliability) to request his consultancy activity for assessing fair value of more complex assets (property, plant, and equipment or identifiable intangible assets) (Cotter & Richardson, 2002).

Therefore, this paper considers the external appraiser as a fourth category among those cited above, whose interests and incentives have to be explicitly taken in account in order to evaluate the economic consequences associated to the FVA. In particular, through the development of an analytical model, this paper firstly shows how the introduction of the probability of a "collusive behavior" between the manager and the external appraiser (due to "reappointment concerns") increases the costs of FVA and analyzes the extent to which this event affects the use of external appraisers in order to alleviate the informational asymmetry issue.

Secondly, this paper offers some suggestions about the disclosure that should be issued whenever an external appraiser is involved in the measurement process. In fact, albeit the International Accounting Standards Board [IASB] encourages the hiring of a third independent valuer, the high proprietary costs borne by the appraiser in delivering the required disclosure (in this paper called "*informative disclosure*") clearly contrast the external appraisers' interests and lower the efficiency of the measurement process. The hypothesis about the introduction of a "*protective disclosure*" (based on hard information useful to improve the accountability process) is therefore evaluated as an alternative tool to increase the transparency of the measurement process.

The article proceeds as follows. The next section briefly examines the measurement process generally adopted to estimate fair value and analyzes the importance of the external appraisers for the implementation of FVA. The third section develops a simple analytical model to demonstrate how the "reappointment concerns" issue affects the hiring choice of an independent valuer. The fourth section aims to describe the impact of the required fair value disclosure on the overall costs and benefits associated to the involvement of an external appraiser in the measurement process, comparing the results associated with the informative disclosure with those related to a protective one. The fifth section concludes the study.

Institutional Background and the Role of External Appraisers

FVA is a common characteristic of the financial statements. In 2006, the Financial Accounting Standards Board [FASB] issued the first comprehensive framework for measuring fair value (Statement of Financial Accounting Standards [SFAS] 157). On May 2011, the IASB issued the International Financial Reporting Standards [IFRS] 13, *Fair Value Measurement*, in order to guide the preparers of financial statements in estimating fair value.

In its latest documents, the IASB defines fair value as the amount for which an asset or liability could be exchanged (*exit price*) between market participants in an orderly transaction. Although derived from the neutral expectations of independent, knowledgeable, willing parties, the measurement process is often influenced by the personal opinions of the valuer and reliability concerns inevitably arise. Both the qualitative "*nonvalue appraisals*" phases of the valuation procedure (Reynolds, 1984) [1] and the quantitative considerations relating to the valuation techniques are strongly affected by the subjective believes of the valuer, letting important value-affecting-properties of the items being at least partially shaped by the appraiser's estimations (King, 2009).

Therefore, the reliability of the disclosed and recognized fair value depends on the suitability of the information sources. Observable inputs from quoted prices of identical items traded in active markets (*Level 1 inputs*) represent the ideal information, embodying the neutral expectations of independent market participants. However, because of the particular characteristics of the object of the valuation or of the subjects involved in the transaction, the fair value is often only indirectly estimated. In this case, quoted prices of comparable items, market prices of identical items traded in inactive markets or other market-related information (interest rates, yield curves, credit risks and default rates, etc.) represent the only available data to price assets/liabilities (*Level 2 inputs*). Sometimes (for example for fixed tangible assets or for identified intangible assets), observable inputs do not exist and the valuation procedure has to be based on unobservable, firm-generated inputs reflecting market participants' assumptions (*Level 3 inputs*).

In the presence of Level 2 or Level 3 inputs, the fair value measurement results from appropriate valuation techniques used to elaborate the available data. Using the traditional valuation approaches (market approach, cost approach, or income approach), the valuer will develop an appraisal model to estimate fair value (*mark-to-model fair value*) whose reliability will depend mainly on the quality of the inputs adopted (Laux & Leuz, 2009).

As a result, estimation errors or intentional data manipulations could hide even behind valuation techniques apparently based on direct observations of the markets[2], introducing some reliability costs that deflate the opportunities of a FVA. Indeed, the higher complexity of financial statement figures measured at their fair value boosts the *informational asymmetry* issue among preparers, auditors and users of the accounting information, reducing funding, and investment opportunities, and contrasting an efficient allocation of the resources (Benston, Bromwich, Litan, & Wagenhofer, 2006).

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[1] "Nonvalue appraisals" phases particularly concern the identification of the "unit of account" and the choice of its "highest and best use".

[2] In fact, although the *market approach* can be considered the "most direct and systematic approach in estimating market value" (IVSC, par. 5), the uncertainties produced by the adjustments made on several variables characterizing only partially comparable past transactions could be even greater than those resulting from the discounting of future payoffs (*income approach*) or from the estimate of the costs necessary to replace the service capacity of the item (*cost approach*). See Colwell, Cannaday, and Wu (1983).

In order to alleviate informational asymmetry costs, firms with better investment projects could find worthy to send a costly signal to the market about the quality of their fair value estimates. Such a strategy allows identifying the profitable businesses that, on the contrary of their less brisk competitors, can cover the expenditures due to the signal production with the positive effects on liquidity and cost of capital.

A full disclosure has been considered as an efficient tool to reach this purpose. The academic literature has already showed an association between a wider disclosure and a lower bid-ask spread or a higher trading volume (Healy, Hutton, & Palepu, 1999; Leuz & Verrecchia, 2000). Moreover, researches documented a positive link between capital-rising activity and disclosure (Frankel, McNichols, & Wilson, 1995; Lang & Lundholm, 2000) as well as a significant negative relation between cost of equity capital and financial disclosure (Botosan, 1997; Botosan & Plumlee, 2002). More recently, the usefulness of information about the valuation assumptions adopted by the managers in evaluating the fair value of firms' assets/liabilities has been showed (Barth, 2006). Both market participants and firms benefit from a detailed disclosure about the input used to develop fair value model. A higher transparency on the valuation procedures reduces the noise in the financial information and decreases the required rate of return on the investment project (Bhat, 2008).

However, the issue of a *full fair value disclosure* could not completely solve the informational asymmetry problem. A few investors, in fact, are sophisticated enough to understand the value implications of data regarding very complex valuation techniques. Because of cognitive costs or limitations, most of the market participants could be partially unable to process footnote disclosure (Hodge, Kennedy, & Maines, 2004). The informational asymmetry previously hypothesized between informed and uninformed market participants is now suggested again distinguishing naïve against sophisticated investors.

For this reason, the recruitment of an independent valuer can be considered as an alternative mechanism to the fair value disclosure. In fact, several reasons can be alleged to assume a frequent use of such corporate governance tool.

First, the professional skills of the accountants are traditionally oriented in recording what has been done in the past (writing down the historical cost of the balance sheet items), rather than in estimating asset/liability's market price (Paton & Littleton, 1940; Goldberg, 1965). Accountants have traditionally been "*costers*" not valuers (Liang, 2001). Therefore, the costs incurred in obtaining the appraisal knowledge could be higher than the benefits potentially associated with the new accounting model, especially when the unavailability of Level 1 input leads towards the use of very complex valuation techniques[3]. Indeed, empirical evidence support the above intuitions: appraisals conducted by external appraisers, albeit not audited by one of the Big 4 firms, exhibit greater accuracy than those conducted by internal appraisers and attested by the most important auditors (Dietrich, Harris, & Muller, 2001).

Second, an extensive involvement of external appraisers for financial reporting purposes could result from the intense lobbying activity engaged by national and international appraisal institutes. Since the beginning of 1990s, the introduction of fair value accounting in financial statements has been considered as a new business

[3] In responding to the IASB ED—*Fair Value Measurements*, the IVSC lists the following reasons to explain why the accounting standard setters should not provide any guidance to measure the fair value of financial items: (1) valuation involves the exercise of professional judgment. Arriving at the most appropriate fair value estimate can be a complex exercise employing a range of stochastic and heuristic approaches; (2) there is a significant body of knowledge on valuation techniques and theory that is constantly evolving; and (3) providing a superficial summary of valuation methods and techniques in the body of a standard may encourage those with insufficient understanding to treat the standards as a "recipe book" which can be used to produce the desired results.

opportunity for the appraisal community (Behrens, 1994). A concrete contribution in solving some problems linked to the introduction of a new valuation paradigm constantly comes from the academic (see, for example, Dorchester, 2004) as well as the professional appraisal world (the Appraisal Institute and the International Valuation Standards Council [IVSC] issued several documents to comment on the FASB/IASB fair value projects). Considerations about the role of the independent valuer included in the accounting documents of important standard setters seem to testify the effectiveness of the appraisers' strategy. The IASB and many auditing practices support the use of an independent valuer to determine fair value. At the same time, the Canadian Accounting Standards Board emphasizes that valuation is a field of knowledge and expertise apart from traditional financial accounting and deems to be useful for a thorough understanding of IVSC documents (Canadian Accounting Standard Board [CASB], 2005); the Accounting Standards Board [ASB], instead, requires investment property to be appraised by external valuer at least every five years (Statement of Standard Accounting Practice [SSAP] No. 19).

However, the involvement of an external appraiser generates a new agency relationship whose costs could totally cancel out the expected benefits. In fact, concerns about the real independence of the external valuer have been raised by the appraisers' community itself. As a consequence of the client pressure and the resulting "reappointment concerns", the external appraiser could be tempted to validate the price suggested by the manager, drawing up a "made as instructed" appraisal report in order to meet the client's requirements (Kinnard, Lenk, & Worzala, 1997; Worzala, Lenk, & Kinnard, 1998; Wolverton & Gallimore, 1999; Wolverton, 2000; Gallimore & Wolverton, 2000; Amidu & Aluko, 2007; King, 2008).

Indeed, the "lack of independence" problem seems to be implicitly proved by the evidence collected in the accounting literature and offers an incisive explanation to the observed hiring strategy of the external appraisers adopted by the firms. For this reason, the analytical model developed in the next section formalizes the role played by the perceived probability of a "collusive" deal settled between the manager and the external valuer. Then, the function of a detailed disclosure as a tool to minimize the costs associated to this new agency relationship will be examined, comparing the effectiveness related to an "informative disclosure" with the outcomes derivable from a "protective" one.

A Simple Analytical Model

A simple analytical model is presented in this paragraph (based on Acemoglu & Gietzmann, 1997). The aim is to show the role played by the "reappointment concerns" issue—with a possible collusive deal between the manager and the independent valuer—in describing external appraisers hiring strategy adopted by the firm and the economic consequences associated to the implementation of the FVA.

To achieve this goal, a "simple world" is initially considered, where the external appraiser is depicted as an exogenous actor that never arranges secret side contracts with the manger. Some logical deductions are then derived from this scheme and joined to the empirical evidence collected by the accounting literature, reaching some counterintuitive conclusions that highlight the need to develop a more realistic model. For this reason, the probability that the appraiser could simply validate the price suggested by the manager in order to earn a future reappointment is introduced. This allows us to draw a more realistic picture about the function of the independent valuers and the variables that affect the perceived probability of a collusive behavior between them and their clients.

Description of the Model Without "Reappointment Concerns"

Consider the following three-date model with risk neutral agents, see Figure 3:

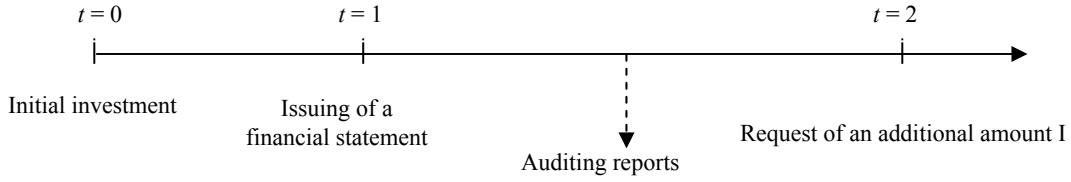

Figure 3. Sequence of events.

In $t = 0$, the managers choose to carry out a new investment project. In $t = 1$, a financial statement is issued to communicate an early signal about the success of the project. In $t = 2$, an additional amount I is requested to the shareholders in order to continue the project.

The sign δ_i delivered in $t = 1$ could be either *good* ($i = g$) or *bad* ($i = b$). The project, in fact, can succeed and yield a global π_g, or fail and yield π_b. Assuming that $\pi_b < I < \pi_g$, it will be convenient to refinance the company only if the good state g is verified[4], otherwise the project is dropped at a liquidation value which is normalized to zero. The information delivered in $t = 1$ influences the investors' decision, but it cannot be considered as a decisive factor to discriminate a brisk project from an unprofitable one. In fact, the shareholders do not completely rely upon the information produced by managers, and—notwithstanding the interim results are *good*—they do not immediately transfer the required amount I. In other words, $p(\pi_b/\delta_g) > 0$. Indeed, the sign could be misleading because of the inability of the Historical Cost Accounting (HCA) system to represent a "true and fair view" of the operations [with probability $p'(\pi_b/\delta_g)$]. Moreover, in a classic agency setting (Jensen & Meckling, 1976), managers might manipulate accounting data in order to collect I whatever the quality of the project is [with probability $p''(\pi_b/\delta_g)$][5]. For this reason, after analyzing and processing accounting data, the shareholders interpret the future state of the world as a discrete random variable, assigning a subjective probability $p(\pi_b/\delta_g) = p'(\pi_b/\delta_g) + p''(\pi_b/\delta_g) - p'p''(\pi_b/\delta_g)$ to state b occurring even if the drawn up financial statement shows positive results, and a probability $[1 - p(\pi_b/\delta_g)]$ to state g. They transfer the amount I whenever[6]:

$$p(\pi_b / \delta_g)\pi_b + [1 - p(\pi_b / \delta_g)]\pi_g > I \tag{1}$$

In such a setting, an external auditor could play a fundamental role. By acting as a guardian of shareholders interests (Kofman & Lawarrée, 1993), the auditor could detect accounting manipulation and allow a better assessment of the probability $p''(\pi_b/\delta_g)$ pertaining to the existence of a misleading sign caused by earnings management. In fact, the auditing process causes a decreasing of $p''(\pi_b/\delta_g)$ in case of genuine good projects, favoring a more efficient resource allocation. In particular, if it is assumed that the external auditor is able to report without any bias about the results showed by an HCA financial statement, in case of good project $p''(\pi_b/\delta_g) = 0$ and the expected payoff of the investment project rises of an amount equal to $p''(\pi_b/\delta_g)(\pi_g - \pi_b) - p'p''(\pi_b/\delta_g)(\pi_g - \pi_b) \geq 0$, increasing the chances that managers succeed in raising funds (I) in order to continue a good project.

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[4] It is indifferent whether this cash infusion is contributed by the initial shareholders or by new shareholders.

[5] Although several theories leading to a conflict of interest between the manager and the shareholders would be appropriate, the "empire building" assumption (Hart & Moore, 1990; Hart, 1993) could explain the manager's opportunistic behavior described above. The "empire building" assumption allows also to suppose that $p(\pi_g/\delta_b) = \phi$.

[6] Assuming the riskless interest rate normalized to zero.

However, it will be worthy to hire an auditor between $t = 1$ and $t = 2$ as long as the value of the auditing report (that is equal to the higher expected payoff of the investment) exceeds the costs of its services (K). In other words, the involvement of an external auditor leads to a more efficient resource allocation whenever the following inequality is verified:

$$p''(\pi_b / \delta_g)(\pi_g - \pi_b) + p' p''(\pi_b / \delta_g)(\pi_g - \pi_b) > K \tag{2}$$

The adoption of a FVA, instead, could decrease the probability $p'(\pi_b/\delta_g)$ of a misleading sign caused by the inability of an HCA model to communicate a true and fair view of the financial performance. By assuming that, as a result of the implementation of FVA, $p'_{FVA}(\pi_b/\delta_g) = 0$, the net present value of the project further increases of an amount equal to $p'_{HCA}p''(\pi_b/\delta_g)(\pi_g - \pi_b) > 0$.

However, the impact of the introduction of FVA in the information delivered to the shareholders is not obvious. In fact, on one hand the well attested relevance of market based measurement accounting model might facilitate the estimates on future financial equilibrium, allowing an efficient allocation of the resources. On the other hand, the informational asymmetry among managers, auditors and uninformed investors, associated with the risk of manipulations of the accounting figures originated from *mark-to-model fair value*, could introduce reliability that might compensate the expected benefits.

Although characterized by an *information content*, FVA might be followed by a negative *information value*. In particular, it is possible to show the negative impact of reliability costs in terms of: (1) reduction of the auditors' report value, due to a higher probability of a mistake in the auditing process; and (2) an increase of the auditing costs.

If $0 < \vartheta_{FVA} \leq 1$ is the probability that the auditor will not be able to assess the quality of fair value measurements[7], the negative variation in the value of audited information is measured as:

$$\omega = -\vartheta_{FVA} p''(\pi_b / \delta_g)(\pi_g - \pi_b) < 0 \tag{3.a}$$

The introduction of $0 < \vartheta_{FVA} \leq 1$ induces also to consider the probability $q_g = f(\vartheta_{FVA})$, $q'_g(\vartheta_{FVA}) > 0$ perceived by the auditor to be mistakenly found to have misreport[8]. For this reason, the auditing costs are obtained by adding to the required auditing fee K the fine α that the auditor is obliged to pay whenever—the firm going bankrupt with probability λ_b—he is mistakenly found (with probability q_g) to have misreported. Moreover, considering that the shareholders will receive only a portion $\phi < 1$ of α, the auditing costs associated to the introduction of a FVA model will equal $K + (1 - \phi)\lambda_b q_g \alpha$, increasing the auditing fees of an amount equal to:

$$\omega' = \lambda_b q_g (1 - \phi)\alpha > 0 \tag{3.b}$$

The overall negative impact associated to the introduction of FVA and to the auditing process of fair value measurements is given by $\omega + \omega' = \Omega = f(\vartheta_{FVA}; q_g)$.

Therefore, the implementation of the historical data with the current value of the resources involved in the project might be an inefficient process. In particular, the FVA has an *information value* only if:

$$p'_{HCA}\, p''(\pi_b / \delta_g)(\pi_g - \pi_b) > \Omega \tag{4}$$

Firms adopting FVA need to signal the quality of their measurement process in order to declare the goodness of their projects and to reduce Ω.

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[7] The probability ϑ equals zero whenever the HCA system is used to draw up financial statements.

[8] The probability q_g equals zero whenever the financial information is based on the Historical Accounting model.

A traditional solution to solve the information asymmetry problem is represented by a full disclosure about the valuation assumptions adopted in the measurement process. Managers will issue a *full fair value disclosure* if the negative consequences due to errors in the measurement process and to the informational asymmetry (with moral hazard and adverse selection results) will be higher than the costs sustained for preparing, certifying and disseminating fair value disclosure: $\Omega > C_D$. However, the issue of a *full fair value disclosure*—because of the inability of the unsophisticated investors to conveniently process data regarding very complex valuation techniques—will not completely remove the costs associated to the informational asymmetry problem, and a portion $\gamma \in [0, 1]$ of Ω has to be added to C_D to assess the total disclosure costs. As a result, it will be worthy to adopt the *fair value disclosure* strategy if:

$$\Omega > \frac{C_D}{1-\gamma} \tag{5}$$

An alternative answer to the above mentioned problem is represented by a selection of a costly ($\hat{K}$) external appraiser to measure the fair value of assets and liabilities. Hiring an external appraiser could increase the wellness of shareholders. The cost of fair value disclosure (C_A), after having externalized the measurement process, will decrease. At the same time, the error and the informational asymmetry problems could be lower (with $\hat{\gamma} < \gamma$) because the unsophisticated investors and auditors could now rely on the assumptions made by a third independent party (Muller & Riedl, 2002; Cotter & Richardson, 2002). It is worthy to hire an external appraiser, instead of applying a *full fair value disclosure* strategy, if:

$$\begin{aligned} &\text{a)} \quad [(C_D - C_A) + (\gamma - \hat{\gamma})\Omega] > \hat{K} \\ &\text{b)} \quad \Omega > \frac{C_A + \hat{K}}{1-\hat{\gamma}} \end{aligned} \tag{6}$$

In fact, the preparers will measure assets/liabilities at their fair value only when Equations (5) or (6.b) are verified, choosing between internal or external appraisal according to the result given by (6.a).

In particular, if it is assumed that:

(1) Ω becomes higher for more complex assets/liabilities;

(2) $\hat{K} = f(\Omega),\ \hat{K}'(\Omega) > 0,\ \hat{K}''(\Omega) < 0;$

(3) $(C_D - C_A)$ and $(\gamma - \hat{\gamma})$ do not change regardless of the complexity of fair value measurement.

It is expected to assist to the assessment by independent third-parties especially for assets whose fair value has to be drawn from processing Level 3 inputs. In fact, in this case Ω is supposed to be higher than Level 2 or 1 inputs and Equation (6.a) is more likely to be confirmed.

However, the literature review does not seem to support our expectations.

In actual fact, internally generated revaluation estimates are more likely for identifiable intangibles and property, plant and equipment than for land and buildings (Cotter & Richardson, 2002; Christensen & Nikolaev, 2010). For this reason, firms seem to choose the more costly alternative between the full fair value disclosure and external appraiser[9]. Moreover, there is little evidence to indicate that director-based and independent

[9] A possible explanation of such a choice could be found in the benefits deriving from directors' private information about asset/liability value (Barth & Clinch, 1998). However, this conclusion contrasts with the intrinsic nature of fair value measurement which is deemed to be more relevant than alternative measurement bases as it origins from market-based inputs and not from specific-entity characteristics.

appraiser-based valuations have a different value-relevance impact on investors (Barth & Clinch, 1998), while independent revaluations of plant and equipment seems to be more reliable than director-based revaluations (Cotter & Richardson, 2002).

Given the above considerations, it is possible to derive the following conclusions:

Proposition 1: Let managers choose: (1) whether to revalue or not; and (2) who undertakes the revaluation, should allow an efficient use of FVA, strengthening the stability of the equilibrium point reached among the interests of the different parties involved.

Proposition 2: Firms adopt solutions which are at the same time more costly and less reliable, without gaining any benefits in terms of higher relevance.

Proposition 2 clearly represents a counterintuitive statement, showing the inability of the setting considered so far to explain the firms' behavior. By introducing appraisers' reappointment concerns, the next session will give some instruments useful to reject Proposition 2 and to clarify the rationale behind the resource allocation between full fair value disclosure and external appraisers.

Description of the Model With "Reappointment Concerns"

A rational explanation to reject the above conclusion could be found in the "lack of independence" concerns. Even if external appraisers have reputation and litigation concerns that would prompt them to make reliable and unbiased estimates of fair value, their final outcomes are also driven by "reappointment concerns". For this reason, the valuation statements issued by external appraisers could be perceived by investors as a tool to validate prices already suggested by managers rather than an instrument to offer objective opinions about the fair value of assets/liabilities.

With:

(1) $\hat{B}$: benefits from reappointment;

(2) $\hat{\alpha}$: fine that the appraiser has to pay, whose value equals $\beta \times \hat{B}$, with $\beta \in [0,\ 1]$ representing the percentage of benefits embezzled by the appraiser because of the collusive behavior and returned to the shareholders when he is found to have misreport;

(3) $\hat{q}_b$: probability that the appraiser is found guilty when he intentionally misreports;

(4) $\hat{q}_g$: probability that the appraiser is mistakenly found to have misreported when the firm (with probability λ_b) goes bankrupt.

The perceived probability with regard to a secret renegotiation/side contract between the manager and the external appraiser equals:

$$\tau = \frac{\hat{B} - \lambda_b(\hat{q}_b - \hat{q}_g)\hat{\alpha}}{\hat{B}} \tag{7}$$

For the same reasons already analyzed with regard to the auditing fees, the costs directly incurred to hire an external appraiser equals $\hat{K} + \lambda_b \hat{q}_g (1-\hat{\phi})\hat{\alpha}$, while the existence of "lack of independence" concerns affects the indirect costs of external appraisal, reducing the implicit benefits associated to the hiring of an independent valuer instead of a full fair value disclosure.

This means that Equation (6) has to be re-written in the following form:[10]

$$\begin{aligned} &\text{a)} \quad \underbrace{\{(C_D - C_A) + [\gamma - (\hat{\gamma} \cup \tau)]\Omega\}}_{\text{Implicit benefits}} > \underbrace{\hat{K} + \lambda_b \hat{q}_g (1-\hat{\phi})\hat{\alpha}}_{\text{Explicit costs}} \\ &\text{b)} \quad \Omega > \frac{C_A + \hat{K} + \lambda_b \hat{q}_g (1-\hat{\phi})\hat{\alpha}}{1-(\hat{\gamma} \cup \tau)} \end{aligned} \tag{8}$$

The introduction of τ and $\hat{q}_g$ allows us to give an explanation for Proposition 2. In fact, Proposition 1 continues to be confirmed, with the implementation of a FVA when Equations (5) or (8.b) are verified. However, the selection between internal or external appraisal is now driven by (8.a), which is more likely to be denied when the fair value of Level 3 inputs assets/liabilities is measured. In fact, the implementation of a *mark-to-model fair value* increases $\hat{q}_g$, boosting the explicit costs associated to an independent valuer hiring strategy and increasing, at the same time, the probability τ of a collusive behavior between external appraisers and managers.

Fair Value Disclosure and External Appraisers in a Regulated Setting: Informative vs. Protective Disclosure

In the previous sections, the "fair value disclosure" and the "external appraiser" have been described as alternative communication strategies voluntary implemented by entities in order to alleviate the information asymmetry problem. However, whenever a company involves an independent valuer in the measurement process, the mandatory fair value disclosure required by the IAS/IFRS implies the coexistence between such signaling mechanisms. Indeed, regardless of the choice to hire an external appraiser, entities have to provide a detailed disclosure about valuation techniques and inputs employed to assess the fair value of assets/liabilities[11].

Apparently, the delivery of information regarding the techniques and the inputs used in the fair value measurement and the methods used to develop those inputs—certainly helpful to decrease information asymmetry in the event of internal appraisal—could also enhance the effectiveness of a measurement process carried out by an independent valuer. A higher transparency about the assumptions and the techniques used by the external appraiser could positively affect the probability $\hat{q}_b$ perceived by the appraiser to be found guilty

[10] The factors that affect τ and $\lambda_b \hat{q}_g (1-\hat{\phi})\hat{\alpha}$ can be identified in:

(1) The size (*S*) of the appraiser relative to that of his customers. The smaller is *S* the greater is $\hat{B}$ and the greater is the probability of a secret side contract;
(2) The quality of the professional association which the appraiser belongs to. The better is the reputation of the organization, the lower is the probability $\hat{q}_g$ to be found mistakenly guilty of misreporting;

(3) The difficulty of the measurement process. The higher is the difficulty to measure fair value, the greater is the probability $\hat{q}_g$ to be found mistakenly guilty of misreporting;
(4) The strength and the efficiency of corporate governance mechanisms and legal systems. The weaker and the less efficient are the corporate governance and legal constraints, the lower are β, $\hat{\phi}$, and the probability $\hat{q}_g$ to be judged guilty of intentionally misreporting.

[11] "For assets and liabilities measured at fair value, an entity shall disclose information that enables users of its financial statement to assess the methods and inputs used to develop those measurements and, for fair value measurements using significant unobservable inputs (Level 3), the effect of the measurements on profit or loss or other comprehensive income for the period" (IASB, *Fair Value Measurement*, ED/2009/5).

when he intentionally misreports. A higher $\hat{q}_b$ should lower the probability τ of a collusive behavior between the manager and the external appraiser, and consequently increases the implicit benefits associated to the hiring of an external appraiser.

However, this is only part of the story. In fact, the compliance with the accounting standards by the reporting entity forces the independent valuer to disseminate relevant information about his skills, competencies and knowledge that could be used by his competitors in order to improve the quality of their consultancy activity, with a consequent decreasing in his net pay-off. For this reason, the existence of "proprietary costs" (C_p) (Verrecchia, 1983; Dye, 1986; Darrough & Stoughton, 1990; Wagenhofer, 1990) associated to the publication of information regarding the measurement process might cause an increasing in the appraiser's fee, with a negative impact on the explicit costs that could finally offset or even exceed the positive variation in the implicit benefits described above (especially with Level 3 inputs fair value estimates).

Because of the introduction of C_p, Equation (9) has to be re-written in the following form:

$$\begin{aligned} &\text{a)} \quad \underbrace{\{(C_D - C_A) + [\gamma - (\hat{\gamma} \cup \tau)]\Omega\}}_{\text{Implicit benefits}} > \underbrace{\hat{K} + C_p + \lambda_b \hat{q}_g (1 - \hat{\phi})\hat{\alpha}}_{\text{Explicit costs}} \\ &\text{b)} \quad \Omega > \frac{C_A + \hat{K} + C_p + \lambda_b \hat{q}_g (1 - \hat{\phi})\hat{\alpha}}{1 - (\hat{\gamma} \cup \tau)} \end{aligned} \tag{9}$$

Standard setters encouraging the involvement of an independent valuer in order to enhance the usefulness of fair value measurements should consider the overall impact of the required disclosure, analyzing variables affecting both (τ)Ω and C_p and pointing out the nature of the information that can be theoretically made available to the market participants in order to maximize the probability that Equations (9.b) and (9.a) are verified.

The specification of such a disclosure is fundamentally an empirical question. However, by comparing the current IASB fair value disclosure with the information required by the appraisers' professional bodies, it is possible to identify two broad "disclosure categories" (*informative disclosure* and *protective disclosure*)[12] and to express some preliminary considerations on their effectiveness in facing the informational asymmetry problem, whenever an external appraiser is involved.

In fact, as already mentioned before, the IASB fair value disclosure mainly focuses on methods and assumptions applied in determining fair value (*informative disclosure*). Consistently with the objectives stated in its conceptual framework, the IASB requires *soft information* useful to capital providers in assessing entities' future earning power, while no particular attention is given to the nature of the relationship between the independent valuer and his client (the reporting entity).

A *protective disclosure* (Mautz & Sharf, 1961; Wolk, Dodd, & Tearney, 2004), instead, is required by most of the appraisal guidance (Royal Institution of Chartered Surveyors [RICS] Valuation Standards; American Society of Appraisers [ASA] Business Valuation Standards; IVSC Valuation Standards). Rather than describing phases and assumptions of the measurement process carried out by the independent valuer, appraisal

[12] The distinction between *informative* and *protective* disclosure can be drawn by examining the evolution of SEC disclosure requirement. The traditional disclosure policy of the Commission, in fact, was to allow only "hard information" in order to protect unsophisticated investors from unfair treatments (*protective disclosure*). However, since the early 1970s, the SEC appears to have shifted its emphasis toward *informative disclosure*, stressing the importance of *soft information* useful for investment analysis purposes in order to assess future earning power of the companies.

handbooks require *hard information* such as the name of the appraiser, the dates of the valuation, the extent and duration of the relationship with his client, the proportion of the total fees payable by the client to the valuer's total fee income, the existence of a link between the valuer's fees and some aspect of the valuation report.

Such a brief examination of the differences between the disclosure required by the IASB and by the appraisers' professional bodies has some important implications. In fact, it is reasonable to assume that the external appraisers' proprietary costs associated to the delivery of a *protective disclosure* are lower than those due to the publication of an *informative* one. At the same time—because of the higher costs borne by investors and auditors to process an *informative disclosure* rather than a *protective* one—whenever the measurement process is carried out by an external appraiser, the *sensitivity* of τ with respect to the fair value disclosure is probably higher when a *protective disclosure*, rather than an *informative* one, is delivered. Consequently, the probability that Equations (9.b) and (9.a) are verified is higher when the choice to involve an external appraiser in the measurement process is followed by a *protective disclosure*.

These results have some important consequences with regard to the standard setting process. Indeed, the purpose of the IASB to enhance the role played by independent valuers in measuring fair value is more likely to be reached by replacing an *informative disclosure* with a *protective* one, whenever managers choose to rely on an external appraiser's consultancy. The introduction of a *differential disclosure* according to the source of the valuation process (internal or external assessment) could allow a more efficient and effective involvement of independent valuers, with a positive effect on the quality of financial information and a significant decreasing of the information asymmetry costs associated to the fair value measurements.

Conclusions

Preparers, auditors, and users of financial information have been often described as the constituencies of financial statements whose interests have to be taken in account before issuing a new accounting rule. A successful implementation of FVA requires also an explicit assessment of external appraisers' incentives and interests.

In fact, the empirical evidence collected by the academic literature shows that the involvement of an independent valuer in the measurement process plays a fundamental role in alleviating the information asymmetry issues associated to the adoption of a mark-to-model fair value. However, the risk of a collusive behavior between managers and external appraisers decreases the ability of such a governance tool to alleviate the reliability costs of FVA (especially with Level 3 inputs fair value estimates). Moreover, the indirect costs (proprietary costs) that the external appraisers bear as a result of the fair value disclosure required by the accounting standards negatively affect the efficiency of the measurement process, so threatening the potential benefits associated to the implementation of a FVA.

As a consequence, standard setters encouraging the involvement of an independent valuer in order to enhance the usefulness of fair value measurements should consider the overall impact of the required disclosure, analyzing variables affecting both the reliability costs and the proprietary costs, in order to identify the information that can be made available to the market participants in order to maximize the efficiency of an external appraiser hiring strategy.

Therefore, after having introduced variables measuring the risk of a collusive behavior between managers and independent valuers, and having stressed the existence of proprietary costs borne by the appraisers because of the delivery of relevant information associated to the fair value disclosure, this paper proposes a differential

disclosure (*informative* vs. *protective disclosure*) to minimize the overall costs (reliability costs and hiring costs) associated to the FVA. In particular, whenever an external appraiser is involved in the measurement process, information required by the IASB about the assumptions, inputs and valuation techniques used to measure fair value (*informative disclosure*) should be replaced by hard information pertaining to the relationship between the independent valuer and his client (*protective disclosure*). In fact, such a disclosure should negatively affect the probability of a collusive behavior between managers and external valuers, without having a significant impact on the appraisers' proprietary costs.

These results, which have to be empirically investigated in future research projects, contribute to the current debate on the reliability of fair value measurements and provide a theoretical framework useful to enhance the effectiveness and efficiency of such a new accounting paradigm.

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Using SEM to Verify the Impacts of Accumulated Intellectual Capital on Organizational Performance of Taiwan Listed Biotechnology Companies With the Moderator of Brand Equity

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The main purpose of this study is to verify the influence of accumulated Intellectual Capital (IC) on the organizational performance of biotechnology companies listed on the Taiwan Stock Exchange, with brand equity being the moderating variable. Financial and marketing section chiefs or employees of higher levels at Taiwan listed biotechnology companies were interviewed, with the companies' ROE (return on equity) data obtained from the Taiwan Economic Journal (TEJ) database. While convenience sampling was used to yield knowledge from the population, the linear Structural Equation Modeling (SEM) was adopted to verify the goodness-of-fit effects among the overall model, structural model, and measurement model. Findings from this study show that, at Taiwan listed biotechnology companies, IC accumulation and increased brand equity have significantly interactive influences on organizational performance.

Keywords: intellectual capital (IC), organizational performance, brand equity

Introduction

Biotechnology is considered one of the "star industries" of the 21st century due to its limitless business opportunities, as well as the noticeable progress in applying biotechnologies in such fields as medicine, agriculture, and environmental protection, among others (Chen & Li, 2001; Chen, 2009). In other words, the 21st century is dominated by biotechnology. While offering investment incentives is the pre-requisite for a thriving biotechnology industry in Taiwan, the top priority for a biotech firm to lure investors is enhancing Intellectual Capital (IC) accumulation and bolstering its operating performance, which will in turn create Enterprise Value (EV). Given the nature of biotechnology industry, the value of a biotech company, IC in particular, does not always show in the financial reports and consequently is often overlooked. As a matter of fact, IC is an important intangible corporate asset that helps increase EV by lifting a company's current *market value* far above the initial *book value*. That is, a company should enhance operating performance by accumulating IC, in order to improve its EV as well as the potential of nonstop growth and sustainable corporate development. How IC accumulation is connected to organizational performance, therefore, is a topic

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worth discussing when it comes to business practices.

Another topic worth addressing is how a company facing a competitive market is supposed to identify and accumulate brand equity as a corporate asset through market segmentation, innovation, and competitive advantages, to ensure sustainable operations and development by establishing the customer lifetime value (CLV), and to eventually improve operating performance.

A company wishing to stay competitive in a treacherous business environment, therefore, has to step up IC accumulation efforts and bolster organizational performance through brand equity, so as to ensure sustainable operations and development. This present study is mostly intended to examine whether IC accumulation interacts with increased brand equity to generate synergic effects on organizational performance. It consequently scrutinized Taiwan listed biotech companies in a research model built on previous literature to verify its goodness-of-fit effects. The specific purposes of this study are listed as follows:

(1) To verify and understand whether IC accumulation has a positive and significant influence on organizational performance at Taiwan listed biotech companies;

(2) To verify and understand whether brand equity has a positive and significant influence on organizational performance at Taiwan listed biotech companies;

(3) To verify and understand whether IC accumulation and increased brand equity have positive and significant interactive influence on the organizational performance of Taiwan listed biotech companies.

Literature Review

Not only does this section explore how findings from previous studies are linked to the topic of this present study, but it also infers hypotheses from literature review while establishing a research framework. The relevant theories and studies are stated as follows.

IC Accumulation

In 1997, Stewart published *Intellectual Capital: The New Wealth of Organizations*, a book that mentioned numerous case studies of companies in a bid to explain the three elements of IC: human capital, structural capital and customer capital. Stewart (1997) argued that IC includes human capital, structural capital, and customer capital, with *human capital* being the sum of innovations, employees' mindsets, seniority, turnover rate, experiences, and status of learning; *structural capital* being the existing knowledge collected using a highly efficient method and tested, organized, integrated, with the irrelevant parts sifted out for diffusion; *customer capital* being the relationships a specific organization forges with all those who deal with it, which involves customer satisfaction, customer retention rate, and customer loyalty.

In their book entitled *Intellectual Capital: Realizing Your Company's True Value by Finding Its Hidden Brainpower*, Edvinsson and Malone (1997) explained the IC implementation process and measurement indicators adopted by Scandia Inc. They said IC consists of human capital, structural capital and customer capital, with *human capital* being the sum of personal competencies, knowledge, technologies, and experiences of a company's entire staff and managers, including creativity and innovation capabilities of the organization/ company. The *structural capital*, as they noted, is a supportive framework that gives human capital a physical form and power, as well as an organized capacity that includes the tangible system used to communicate/store intellectual materials. They went on to define *customer capital* as the sum of customer satisfaction, durability, price sensitivity, and the long-term customers' financial conditions.

Sveiby (1998) noted that IC comprises individual competence, internal/external structure, with the *individual competence* being an employee's ability to take actions under various situations, which involves explicit knowledge, skills, experiences, value-related judgments, and social networks; *internal structure* being the sum of patents granted, concepts, patterns, computer and management systems; *external structure* being the relations with customers and suppliers, which involves the brands, reputation and trademarks.

Johnson (1999) argued that intellect, or wisdom, is made of human capital, structural capital and relationship capital, with *human capital* being the idea capital (i.e., the human resources for knowledge-based duties and employees' gifts/attitude) combined with leadership capital (i.e., the qualities of an expert and manager); *structural capital* being the innovation capital (i.e., patents, trademarks, copyrights, and knowledge database) combined with process capital (i.e., work procedures and trade secrets); *relationship capital* being the sum of relationships with customers, suppliers, and network-community members.

As defined by Knight (1999), IC is made of human capital, structural capital, external capital, and financial performance, with *human capital* involving the employee turnover rate, employee satisfaction, the quantity of new products/ideas, and the recommended quantity of delivery/reception; *structural capital* being the turnover rate of operating capital, the ratio of salespersons to general and administrative staff, and the launch time of a new product; *external capital* being the customer persistency, customer satisfaction, the most lucrative customer list, the indicators of suppliers' product quality/reliability; *financial performance* being the sum of Economic Value Added (EVA), 90-day accounts receivable, and the value added by each employee.

Chen (2001) said not only is intangible IC an important reference indicator for evaluating the EV; but it also consists of human capital, structural capital, and relationship capital. Chen defined IC as "all the skills, knowledge, information, experiences, problem-solving ability, and wisdom displayed by a company as a whole and incorporated into the human capital, structural capital, and relationship capital". The so-called *human capital*, according to Chen, is "the knowledge, skills, and experiences of a company's entire staff and managers"; the *structural capital* is "the overall system and procedures adopted by a company to solve problems and create values"; the *relationship capital* is "the initiation, maintenance and development of an organization's external relationships, including the relationships with customers, suppliers and business partners".

Edvinsson (2003) gave a simple description of IC, saying it would become what supports any company in the future and also an indicator of whether a company will be operated effectively. It is impossible for a company to gain momentum for reforms unless it invests in intangible assets (Tsen & Hu, 2010).

To sum up, this present study adopted the conceptual definition of IC proposed by Chen (2001): "all the skills, knowledge, information, experiences, problem-solving ability, and wisdom/intellect displayed by a company as a whole and incorporated into the human capital, structural capital and relationship capital". The operational definition is briefly described below:

(1) Human capital: The knowledge, skills, and experiences of a company's entire staff and management;

(2) Structural capital: The overall system and procedures adopted by a company to solve problems and create values;

(3) Relationship capital: The initiation, maintenance, and development of an organization's external relationships, including the relationships with customers, suppliers, and business partners.

Brand Equity

The Marketing Science Institute (1988) defined brand equity as "the set of associations and behaviors on

the part of the brand's customers, channel members, and parent corporations that permit the brand to earn greater volume or greater margins than it could without the brand name and that gives the brand a strong, sustainable, and differentiated advantage over competitors". As brand equity is defined, brand value is a long-term goal for many companies because brand is a name that differentiates a company's products from those of the others (Chernatony & Riley, 1998). Brand equity represents the value added by a brand name, and Morgan (2000) defined it as the consumer's awareness of how valuable a brand is to him/her. The measurable brand value is one of a company's most powerful resources: it creates potential cash flow while indicating how consumers perceive, form attitudes and behave toward that company. As a result, brand equity is an important concept and component of corporate-performance measurements; it is more than just an intangible corporate asset. It is therefore imperative that a company focus on tangible factors such as sales results and market share, as well as on the establishment of CLV by accumulating brand equity, so as to reach sustainable operations. Aaker (1991) proposed five assets of brand equity as the sources of brand-value creation, namely "brand loyalty", "brand awareness", "perceived quality", "brand associations", and "other proprietary brand assets". Keller (1993) defined brand equity as a result of a brand's marketing effect that depends on consumers' brand knowledge, which consists of associations linked to "brand awareness" and "brand image". Since each asset of brand equity is able to create value for customers and suppliers, a manager of brand equity is required to understand how such value is created, so as to improve the efficiency of management. A majority of previous studies are applications or adaptations of the brand equity models proposed by Aaker (1991) and Keller (1993) (Yoo & Donthu, 2001; Fang, 2004; Guo, 2006; Raggio & Leone, 2007; Lee & Back, 2008).

This present study adopted the conceptual definition of brand equity as "the effort of a company facing a competitive market to identify and accumulate brand equity as a corporate asset through market segmentation, innovation and competitive advantages, in order to ensure sustainable operations and development by establishing CLV". Based on the brand equity models proposed by Aaker (1991) and Keller (1993) along with their applications or adaptations presented by many other scholars, this study discusses brand equity in three sub-dimensions namely "brand loyalty and brand associations", "brand awareness and perceived brand", and "brand innovation and other proprietary brand assets".

Organizational Performance

Originally indicating how well the results of an effort are shown, the phrase "performance" is a concept of two tiers, namely efficiency and effectiveness. While efficiency is the ratio between output and input, effectiveness is the degree of goal achievement for an organization. Organizational operations are pursuits of successful outcomes that combine efficiency with effectiveness. According to the motivation theory in management science, it is interpreted as "a piece of work completed by an employee" (Wang, 1997). The science of organizational behavior, nevertheless, refers to performance as "an integrated success consisting of efficiency, effectiveness, and efficacy" (Xie, 2006).

There are a massive number of previous studies addressing the measurement dimensions of organizational performance. Since the benefits of organizational performance will eventually be fed back to the financial dimension, most scholars in this field adopt financial performance as one of the measurement indicators. In an environment characterized by convenient means of information delivery and fast-changing markets, nevertheless, a company nowadays should never solely rely on financial performance for survival and competitiveness. That is to say, it is impossible to sufficiently gauge the organizational performance using

financial performance as the sole indicator (Ling & Hong, 2010).

Moreover, Ling and Hong (2010) argued that organizational performance is the sum of accomplishments attained by all businesses/departments involved with an organizational goal during a determined period of time, with the goal either meant for a specific stage or on the overall extent.

This present study is patterned after the research projects conducted by Daft (1978), Delaney and Huselid (1996), G. Johnes and J. Johnes (1993), Wu (1998), Ling and Hong (2010). In order to measure both the financial and non-financial aspects of organizational performance and to correctly gauge the influence of IC and/or brand equity on organizational performance, this paper defines financial performance as the output in terms of financial *accounting that* can be measured by indices regarding growth and profitability. For example, a company with satisfying financial performance is expected to exceed the average in the same sector regarding the earnings per share (EPS), return on equity (ROE), and/or return on assets (ROA) (Huang, 2008). The non-financial aspect of organizational performance, on the other hand, is measured by means of innovation-related performance, which in turn is gauged from the multiple perspectives of organizational innovation that involves both technological and managerial innovations. The technological innovation here refers to technologies required by an organization for manufacturing products or providing services, while a managerial innovation occurs in the organization's social system and is related to the hiring/management processes and the organizational structure (Daft, 1978; Damanpour & Evan, 1984; Johns, 1993; Kimberly & Evanisko, 1981; Ling & Hong, 2010).

The "influence of IC accumulation on organizational performance" discussed in this present study mostly involves two components of organizational performance: *innovation performance* and *ROE*.

The Influence of IC Accumulation on Organizational Performance

Young (2006) examined 211 Taiwan listed companies (including those listed on the over-the-counter market) and found that IC contributes substantially to an organization's attempt to create values and competitive advantages. That contribution, he noted, becomes more noticeable through the interactions among human resources, structural and customer capitals. In their study, Rudez and Mihalic (2007) said it is imperative that the hotel industry enhance IC development in order to stay competitive. They also mentioned that the interaction between human capital and information technologies (IT) has the potential of bolstering the organization's financial performance. IC significantly influences the performance of organizations in IT, bio-tech, high-tech, or emerging industries (Chen, Shaw, Lai, & Chang, 2008). Among others, international tourist hotels and the other service providers offer both tangible products and intangible services that constitute organizational IC, including employees' knowledge and the organization's management procedures. According to Tsen and Hu (2010), IC is made of *human capital*, *structural capital*, and *social capital*. Therefore, it is imperative that an organization develop a *human capital* hardly replicable by competitors, transform the accumulated wisdom and capacity into its core capability, utilize the functions of *structural capital* to establish distinctiveness, and forge irreplaceable external relationships to reinforce its *social capital*. Moreover, Tsen and Hu (2010) noted that the synergy resulted from interactions among human, structural and social capitals is crucial to an organization's effort to build competitiveness. Chen (2001), on the other hand, noted the significantly positive influence of IC on an organization's performance.

We may derive the following hypothesis from the afore-mentioned analyses even if they do not address biotech companies:

H1: IC accumulation has a positive and significant influence on organizational performance.

The Influence of Increased Brand Equity on Organizational Performance

Citing empirical evidence, Zhang (1990) said both the brand and channel strategy affect marketing performance in a positive and significant way. Horng and Wu (1998) said that there is a positive and significant influence of a host country's characteristics on the performance of internationally marketed own brands. Lee (2003) concluded in an empirical study that a company's performance is positively and significantly affected by internal and external determinants, as well as by decisions concerning own-brand establishment. Wen (2006) noted the positive and significant influence of brand equity, brand strategy and channel strategy of brand-name cell phones on channel performance. Ding (2006) proved the positive influence of brand strategy and channel strategy on channel performance at a provider of desktop core-computer systems. Citing empirical evidence, Zhang (2006) said cosmetics firms' brand equity, brand strategy and channel strategy all affect their brand performances in a positive and significant manner. Yie (2006) in an empirical study proved that how a farmer's association deals with locally produced brand-name fruits affects the marketing performance. Wu (2007) found positive and significant influence of corporate mergers/acquisitions, brand equity, and channel strategy integration on brand performance. Lin (2007) presented empirical evidence to support her finding that brand strategy affects performance in a significantly positive way. In an empirical study of beverage providers, Lin (2009) concluded that a beverage provider's brand image, perceived value, and relationship quality have a positive and significant influence on performance.

We may boldly derive the following hypothesis from the studies mentioned above even if they did not address Taiwan listed biotechnology firms and most of them belong to marketing studies:

H2: Increased brand equity has a positive and significant influence on organizational performance.

And yet, whether or not IC accumulation and increased brand equity exert a synergetic effect, or synergy, on the organizational performance is an issue worth discussing, hence the third derived hypothesis:

H3: IC accumulation and increased brand equity at Taiwan listed biotech companies have significant interactive influence on organizational performance.

Research Method

Research Framework

Based on the research motives, purposes and literature reviews described above, we derived the research hypotheses and established a conceptual research framework, as shown in Figure 1.

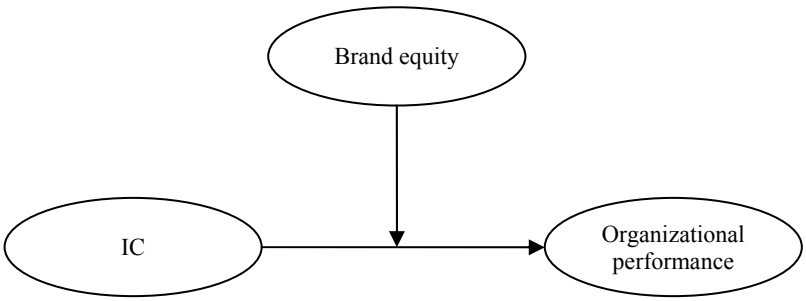

Figure 1. Research framework.

Designing the Questionnaire

The questionnaire in this study was designed on the basis of Multi-Dimension Measurement according to each observable dimension. It uses a 7-point Likert Scale to measure each answer, with 7 being strongly agree and 1 being strongly disagree. A higher point represents a higher degree of agreement, and vice versa. Data collected from the samples was "centralized", so the sum of scores given to all questionnaire items after deducting the average is zero. That way, the multicollinearity between independent and extraneous variables is erased to better test the interaction between independent and extraneous variables. The following mathematical equation illustrates the "centralization" concept:

$$\sum (X_i - \bar{x}) = \sum Y_i = 0$$

The questionnaire of IC was designed in line with the IC theories proposed by Chen (2001), Tsen and Hu (2010), with the "human capital", "structural capital", and "relationship capital" being the three dimensions. This questionnaire contains 12 items in total.

The questionnaire of brand equity was designed in line with the theories proposed by Aaker (1991), Keller (1993), and Wei (2011) with the "brand loyalty and brand associations", "brand awareness and perceived brand", and "brand innovation and other proprietary brand assets" being the three dimensions. This questionnaire contains 12 items in total.

The organizational performance is measured using two indicators, namely the "innovation-related performance" and "ROE"; the former was obtained from the study of Ling and Hong (2010) and the latter from TEJ database.

Sampling Method

This study surveyed financial and marketing section chiefs or employees of higher levels at Taiwan listed biotech companies, selected using the convenience sampling method. Of expert questionnaire, 30 copies were given out in a pilot-test. A post-test was conducted after modifying the questionnaire in accordance with expert suggestions. Of the official questionnaire, 300 copies were given out, with 230 valid copies returned at a return rate of 76.7%.

Data Obtained From Questionnaire and the Measurement Model

Table 1

Number of Questionnaire Items for "Implicit Variables" and "Observable Variables"

Implicit variables	Explicit variables	Total number of questionnaire items	Literature
IC (*X*)	Human capital	4	Chen (2001); Tsen and Hu (2010)
	Structural capital	4	
	Relationship capital	4	
Brand equity (*Mo*)	Brand loyalty and brand associations	4	Wei (2011); Aaker (1991); Keller (1993)
	Brand awareness and perceived brand	4	
	Brand innovation and other proprietary brand assets	4	
Organizational performance (*Y*)	Innovation-related performance	4	TEJ database; Ling and Hong (2010)
	ROE	4	

To verify the research framework proposed, this study applied linear Structural Equation Modeling (SEM) to a Confirmatory Factor Analysis (CFA) of that framework. It divides the questionnaire into three implicit/

latent variables (i.e., IC, brand equity, and organizational performance), each containing observable/explicit variables as stated below. The survey was conducted using these observable/explicit variables, with several questionnaire items categorized under them each. After processing data collected in the survey, files were created for the primary data. Although the questionnaire design was based on Multi-Dimension Measurement, "Duel Measurement" was adopted to make sure the computer software-aided data processing goes as expected (Chen, 2010). Table 1 shows the number of questionnaire items under implicit and explicit variables in this study, along with their reference resources.

Results and Analysis

Linear Structure Model Analysis

The CFA is an analytical approach opposite to the Exploratory Factor Analysis (EFA). This study conducted a CFA of three unobservable/implicit variables (i.e., IC, brand equity, and organizational performance). Consisting of the Structural Model and Measurement Model, a SEM provides an effective solution to the cause-effect relation between implicit/latent variables. The models verified in this study are divided into three parts: (1) verifying the goodness-of-fit of Measurement Model; (2) verifying the goodness-of-fit of Structural Model; and (3) verifying the overall model's goodness-of-fit to make sure it conforms to the goodness-of-fit indices. That is, the goodness-of-fit of the overall SEM was judged with related goodness-of-fit indices (Diamantopoulos & Siguaw, 2000).

Analyzing Fit of Measurement Model

The factor loadings of latent/implicit variables and manifest/explicit variables mainly measure the intensity of linear correlation between explicit and implicit variables. A factor loading close to 1 indicates the explicit variable is relatively capable of measuring the implicit one. In this study, all explicit variables' factor loadings are between 0.8 and 0.9, hence the satisfying reliability. Consequently, all explicit/manifest variables in the model's measurement system are capable of appropriately measuring the implicit/latent variables. Moreover, the Average Variance Extracted (AVE) is used to calculate the explanatory power of variance between implicit/latent variables versus explicit/manifest ones; the higher the VE value, the greater the reliability and convergent validity of a latent/implicit variable. Usually, the VE value must be larger than 0.5 to indicate the explanatory variance of an explicit variable is larger than measurement error (Fornell & Larcker, 1981). In this study, all AVEs are larger than 0.5, hence the explicit variables' excellent reliability and convergent validity (See Table 2 and Figure 2).

Table 2

Judgment Indicators of Measurement System in the Model

Unobservable/implicit variables	Observable variables: centralized dual measurement	Factor loading	Variance extracted (VE)
IC (X)	X_1C	0.86	0.66
	X_2C	0.85	0.65
Brand equity (Mo)	M_1C	0.82	0.63
	M_2C	0.81	0.64
$X \times Mo$	X_1M_1C	0.83	0.67
	X_2M_2C	0.83	0.68
Organizational performance (Y)	Z_1C	0.85	0.69
	Z_2C	0.84	0.68

Analyzing Fit of Structure Model

Path analysis results of structure model. After the overall model passed the goodness-of-fit test, Table 3 shows such results as the parameter estimates, S.E. and Critical Ratio (C.R.) between implicit variables. At Taiwan listed biotech firms, IC and brand equity ($X \times Mo$) have significant interactive influence on organizational effectiveness (Y) ($c = 0.686$). That is, a company planning to accumulate IC in order to bolster organizational performance should increase brand equity at the same time for synergy.

Table 3

Path Analysis Results of the Structural Model

Path coefficients between implicit variables			Estimate	S.E.	C.R.	*P*	Label
IC (*X*)	→	Organizational performance (*Y*)	0.481	0.073	6.589	***	a
Brand equity (*Mo*)	→	Organizational performance (*Y*)	0.296	0.041	7.220	***	b
$X \times Mo$	→	Organizational performance (*Y*)	0.686	0.023	29.826	***	c

Note. *** indicates $P < 0.001$.

Coefficient of determination. Also known as Squared Multiple Correlation (SMC), the Coefficient of Determination is the degree of explanatory power of "independent variable" regarding "dependent variable" under each implicit variable. In other words, the R^2 value shown in Tables 4 and 5 (Table 5 was derived from Table 4) indicates that the implicit independent variable has adequate explaining ability on the implicit dependent variable respectively.

Table 4

Coefficients [a, b]*, Hierarchical Regression*

Model	*R*	*R* square	Adjusted *R* square	Std. error of the estimate	Change statistics				
					R square change	*F* change	df1	df2	Sig. *F* change
1	0.887[a]	0.788	0.773	0.317	0.787	179.218	2	97	0.000
2	0.895[b]	0.814	0.785	0.512	0.015	7.024	1	96	0.003

Notes. [a] Predictors: (Constant), *Mo*, and *X*; [b] Predictors: (Constant), *Mo*, *X*, and $Mo \times X$.

Table 5

Coefficients of Determination

	R^2
IC (*X*), Brand equity (*Mo*) versus Organizational performance (*Y*)	0.788
IC (*X*), Brand equity (*Mo*), and $X \times Mo$ versus Organizational performance (*Y*)	0.814

The Indices of Fit of the Overall Model

The purpose of adopting SEM in the modeling phase of this study is to explore the relationship between unobservable variables within the Structural Model, to examine whether the Measurement Model has measurement reliability or not, and also to measure the overall goodness-of-fit effects of this study using such indices as χ^2, d.f., GFI (goodness-of-fit index), AGFI (adjusted goodness-of-fit index), NFI (normed fit index), CFI (comparative fit index), RMR (root mean square residual), and RMSEA (root mean square error of approximation). In most cases, it is required that $\chi^2/d.f. < 5$, $1 > GFI > 0.9$, $1 > NFI > 0.9$, $1 > CFI > 0.9$, $RMR < 0.05$, and $RMSEA < 0.05$ (Bagozzi & Yi, 1988). The goodness-of-fit of the overall model in this study is

satisfying, given the fact that $\chi^2/d.f. < 5$ and *GFI*, *AGFI*, and *NFI* are all larger than 0.90, with the *RMR* value smaller than 0.05, as shown in Table 6.

Table 6

Assessment of Fit of the Overall Model

Determination index	χ^2	*DF*	*GFI*	*AGFI*	*NFI*	*CFI*	*RMR*	*RMSEA*
Fit value	12.705	14	0.916	0.902	0.905	0.906	0.025	0.026

Standardized Results of SEM Analysis

Figure 2 indicates the result of computer-aided standardization of the model's overall framework:

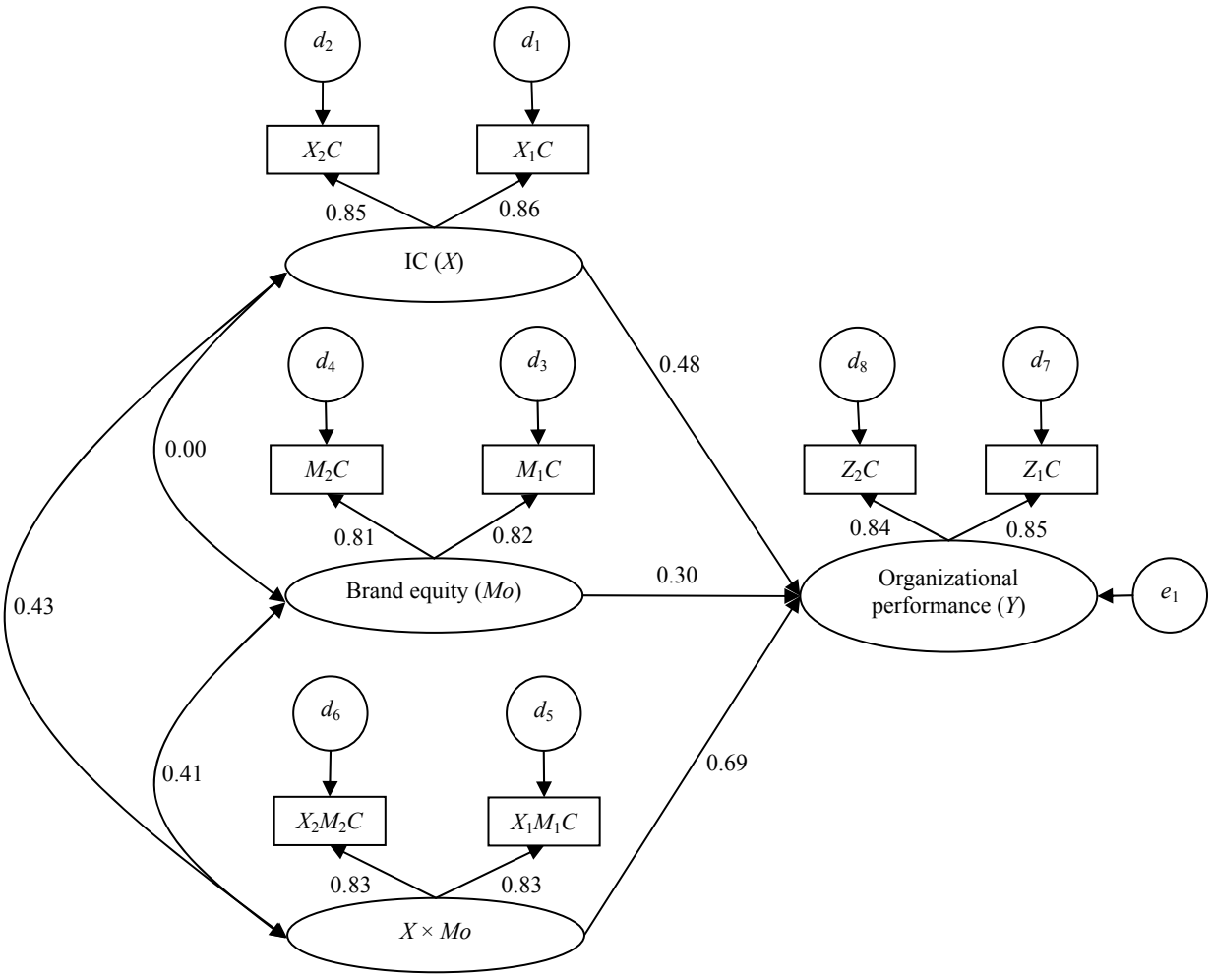

Figure 2. Standardized results of SEM analysis.

Analytical Testing of Path Effect for the Structural Model

For the test of extraneous variable, this study performed a hierarchical regression analysis (see Table 4), followed by centralized hierarchical regression analyses and *t*-tests of *Y* versus *X*, *Mo*, and $X \times Mo$. These analyses were intended to test whether the significance of partial-regression coefficient *c* is substantiated (i.e., whether *c* is zero or not). The test results are shown in Table 7.

Table 7

Coefficients

Model	Unstandardized coefficients		Standardized coefficients	*t*	Sig.
	B	Std. error	Beta		
1 (Constant)	3.817	4.181	0.455	4.913	0.000
X	9.754	0.902	0.481	10.936	0.000
Mo	6.885	0.422	0.296	13.343	0.000
2 (Constant)	5.036	5.561	0.451	4.913	0.000
X	9.197	0.625	0.481	10.936	0.000
Mo	6.373	0.116	0.296	13.343	0.000
X × *Mo*	15.407	0.531	0.686	27.966	0.000

Note. Dependent variable: Organizational effectiveness(*Y*).

From Table 7 we know that the Path Coefficient of *Mo* × *X* versus *Y* is $c = 0.686$ instead of 0, indicating the extraneous effect of *Mo* × *X* on *Y*.

The above-mentioned analysis generated the following verified results:

(1) IC accumulation exerts a positive and significant effect on organizational performance at Taiwan listed biotech firms with a 0.48 standardized path coefficient that supports H1;

(2) The increased brand equity exerts a positive and significant effect on organizational performance at Taiwan listed biotech firms with a 0.30 standardized path coefficient that supports H2;

(3) IC accumulation and increased brand equity have positive and significant interactive influence on organizational performance, with a 0.69 standardized path coefficient that supports H3.

Conclusion and Suggestions

The following specific conclusions are derived from the afore-mentioned data analyses and results:

(1) As for SEM verification, the SEM established in this study has a satisfying goodness-of-fit in terms of the Measurement Model, Structural Model and the overall structure, hence a good model fitting.

(2) Conclusions with regard to the verification of practices at Taiwan listed biotech firms:

IC accumulation and increased brand equity at Taiwan listed biotech companies have significant interactive influence on the organizational performance, which in turn signifies the positive extraneous effect of *brand equity* in this present study. According to Chen (2010), when both the extraneous and independent variables exert a significant interactive influence on the dependent variable, then neither the independent nor the extraneous variable will affect that dependent variable significantly.

Contributions of This Present Study

(1) Contributions to the business practices at Taiwan listed biotech companies.

While the previous studies of biotechnology firms tend to focus on EFA, this present study performed modeling on the summarized results of previous literature in related fields. It also verified the model's goodness-of-fit to find out if this model has satisfying fit-of-goodness effects. Consequently, this study is a CFA-based one that addresses a crucial topic regarding business practices. Not only this topic worth further research in relevant fields, but the research results also provide a reference for decision makers at Taiwan listed biotech companies in terms of business administration.

(2) Innovative applications of methodology.

The previous literature pertaining to Taiwanese biotech companies almost always conducted exploratory research using the multi-regression analysis and rarely used the CFA-based research framework that takes into consideration the implicit variables' extraneous effects. But since the chief dimensions of this present study are implicit variables, CFA and linear SEM appear suitable as the measurement tool and model framework, respectively. That explains why this study is relatively innovative in terms of methodology.

Limitations and Suggestions

(1) As this study adopted the "one cause, one effect, and one extraneous variable" pattern with the sole focus on the CFA of Taiwan listed biotech companies, future studies may consider either extending the scope of research or verifying the goodness-of-fit of companies in various other industries, so as to find out if the goodness-of-fit varies among industries in the same model;

(2) Given the limited amount of research resources, this study adopted the non-probability, convenience sampling method for convenience purposes, with samples selected only on the "proximity" and "easy-to-measure" bases. That resulted, however, in a substantial sampling bias and weakened reliability. Therefore future studies should use simple random sampling or stratified random sampling instead;

(3) During the model-building process, this CFA-based study should ensure the verification model is as simple as possible and avoid complicated ones with a poor goodness-of-fit (Chen, 2010). That is why this study focuses solely on how IC accumulation affects the organizational performance, with increased brand equity being the extraneous variable.

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Cost of Production at Business Unit in Aquaculture Industry: Study at Aquafarm Nusantara Company

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Types of industry are manifold, patterns used in the determination of the cost of production can also vary. Elements of the cost of production are raw materials, direct labor, and factory overhead. Value of raw materials used in aquaculture industry in particular needs to calculate the cost of feed consumed by fish, thus greatly affect the price of fish feed cost of production. The calculation of the value of raw materials in fish production cost element to consider is the calculation of the value of raw material components, namely, (1) biomass of harvestable fish as the basic multiplication cost of production per kilogram or per fish harvested fish; (2) the ratio of fish feed intake by the amount of fish produced or often called the Feed Conversion Ratio (FCR); and (3) the average purchase price of feed on fish harvest period is used as the basis for calculating the cost of production as well. This research is applied research that uses data archive aquaculture companies. The results in the observed period, the value FCR is 0.80, which means to fish have been consumed as much as 0.80 kg of fish feed. Biomass of fish that are harvested at 47,399.95 kg or 1,869,647 individuals. The average purchase price of fish feed on the observation period amounted to IDR 4,855.79. So the price of raw materials contained in harvested fish in the observation period calculates the value of multiplying all the components of raw materials (i.e., IDR 184,131,362.57). Method of calculating the cost of production companies is process method and charging method used is the full costing method.

Keywords: aquaculture industry, cost of production, feed conversion ratio (FCR), biomass, fish feed

Introduction

Management of a business enterprise must have a wide variety of information for decision-making to achieve the goal. Quite a lot must be considered as a manager in making decisions and one of them is considering the cost of production, where production costs are enough to influence survival of the company mainly in producing products with the purpose of obtaining profits.

Given the form of a company that quite a lot of variety, of patterns used in determining the cost of production at the company is different but basically the same as the sorting costs contained in the products. Likewise with aquaculture companies, management is required to produce a superior product to minimize the cost of production, so that may be obtained profits for the company.

In aquaculture companies, cost of goods is not much different when compared with other manufacturing companies. Aquaculture companies calculate the cost to produce fish with a view of the amount of fish feed

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consumed by fish that are kept, where the fish feed used in aquaculture companies has two types: (1) wet feed that can be produced in the local farming area, and pellets are produced commercially, so must be purchased from feed mills (Sim et al., 2005); (2) high-quality feed that affect the growth of fish faster. Thus the quality of feed, the price of fish feed, and the fish feed ratio of the amount consumed (feed conversion ratio/FCR) greatly affect the value of the cost of production, the higher the value of production at harvest period, the higher the value of the raw materials used. Djarijah (1998) and Tjakrawijaya (2001) found that the lower the value of production of FCR, the better use of feed, and production costs can be lower. To avoid the high cost of fish feeds resulting from the purchase of feed mills, Sriharti and Sukirno (2003) found that to meet the needs of fish feed can be used local raw materials including agricultural waste using simple technology. The calculation of the cost of production is also direct labor costs and overhead costs (indirect costs) as costs of maintenance done by the company, depreciation on equipment associated with the production, indirect labor cost, and other costs.

Theoretical Review

Elements of Cost of Production

Elements of the cost of production are intended to the cost. Prawironegoro and Purwanti (2008) found that the costs are cash, and cash equivalents are sacrificed to produce or obtain goods or services that are expected to obtain benefits or benefits in the future. Mulyadi (2003) found that the cost is the sacrifice of economic resources, measured in units of money, which has occurred or that may occur for a particular purpose. Book of Financial Accounting Standards applicable as basic bookkeeping in Indonesia (Ikatan Akuntan Indonesia [IAI], 2007), the cost is defined as:

> All the charges cover both losses and expenses incurred in conducting activities ordinary company. Expenses incurred in the ordinary activities of a company that covers expenses such as cost of goods sold, salaries, and depreciation. These expenses are usually in form of outflow or decrease in assets such as cash immediately (cash equivalents), inventory, and fixed assets.

The elements of the cost of production are:

(1) Raw Materials, namely all of the materials that form an integral part of finished products and explicitly included in the calculation of product cost (Carter & Usry, 2004; Blocher, Chen, & Lin, 2000).

In aquaculture companies, which have become so are the fish itself, and therefore in determining the value of finished goods necessary cost calculations are contained in fish produced. In other industries, the material used is certain it will be made the value of their raw materials without any special calculation except the calculation of inventory valuation. At the company's aquaculture industry, to determine the value of raw materials required special calculations in order to know how the value of fish produced was for sure. The calculation used is:

$$\text{Fish Prices} = \text{Biomass} \times \text{FCR} \times \text{Average Purchase Price Feed}$$

Biomass production is a calculation based on the number of fish which was initially spread in a cage (pool), the approximate level of fish that survive are often referred to as survival rate (survival ratio) and size of fish harvested and sold as (Sim et al., 2005).

FCR is the amount of feed consumed fish during the production period compared with a total weight of fish produced (Sim et al., 2005).

(2) Direct Labor, labor that converts raw materials into finished products directly and can be reasonably charged to a specific product (Carter & Usry, 2004; Letricia, 1999).

(3) Overhead costs, costs incurred by the business entity to produce a product outside of the cost of raw materials and direct labor costs (Garrison & Noreen, 2007; Blocher et al., 2000).

Calculation Method of Cost of Production

There are two methods of collecting fees in determining the cost of production (Garrison & Noreen, 2007; Hansen & Mowen, 1999; Carter & Usry, 2004):

(1) The calculation of costs based on order. In this method, costs of production are collected for specific orders and production cost per unit is calculated by dividing the total cost of production for those orders with the number of product units in the respective orders.

(2) The calculation of costs based on the process. Cost calculation method based on the process normally used to collect production costs for companies that produce continuously and intended to meet the production of finished goods inventory. In this method, the company's production activities are determined by the production budget or just a certain time unit of production as well as serving as a base by the production to carry out production.

In calculating the cost of production is known there are two methods of charging fees based on the types of costs, full costing and the method of variable costs (variable costing) (Carter & Usry, 2004; Mulyadi, 2003):

(1) The full costing method is a method of determining the cost of the product by incorporating all components of production costs as the price of goods, including raw materials, direct labor costs, factory overhead, variable overhead costs, and fixed factory.

(2) The method of variable costing is a pricing method that incorporates principal component costs are variable only as an element of cost of goods, including raw material costs, direct labor costs and factory overhead cost variables.

Research Method

Research Type

This research is an applied research (Indriantoro & Supomo, 2002), research that aimed at solving practical problems faced by a particular institution or organization which is generally done within government or business, this study will conduct empirical research and archival research. The object of this research is P.T. Aquafarm Nusantara, is engaged in the fishing industry that have several working units, namely Hatchery Unit, Enlargement Unit, Processing Unit, and Feed Mill Factory Unit. Focus on the problem under study is using data cost of production hatchery unit and price calculation of basic seed which has been harvested tilapia.

Data Collection and Analysis Techniques

The data used are secondary data obtained directly from the company that became the object of research or the sample (i.e., the cost of data production), seed production data generated by the unit at the seedling period, the data obtained in 2006. The data analysis used to determine how to calculate the cost of production in the aquaculture industry, in particular by:

(1) Collecting production data, seed data in the form of fish, good fish that feed data feed purchases and use of fish feed and fish feed supply calculations;

(2) Collecting cost data associated with the cost of production, such as labor costs and overhead costs;

(3) Conducting an interview about the business viability of aquaculture.

Results and Discussion

Inventory Cycle Produced Tilapia

The following cycle is a cycle as a whole tilapia from automation business, which represents the flow of seed production of tilapia. The cycle is shown in Figure 1.

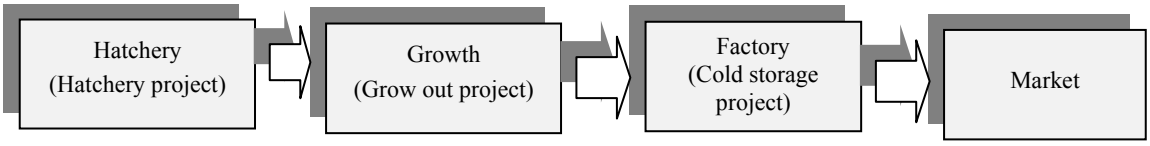

Figure 1. Inventory cycle tilapia.

Description of the picture:

(1) Hatchery project: Tilapia hatcheries are managed intensively to produce a superior tilapia, ranging from determining a good parent to a healthy seed must be monitored so as not to cause further delays in production. Hatchery unit is the object of this study, it can be explained again how the cycle of tilapia seed supply is produced until the exit to the growth project, namely, seeds produced from the cultivated parent will be maintained or moved to a place that has been provided, after a time will be moved to growth project. The time required for + three months or achieving proper seed crop size ± 20 grams to 30 grams.

(2) Growth project: This growth project is a continuation of the cycle of tilapia supplies to be raised during the breeding units ± six months or has reached a decent size ± average harvest 800 grams, after which it flows the fish will be diverted to the factory project (Cold Storage Project).

(3) Factory project: The factory unit is the end of the supply of tilapia that will be processed into products that are expected by the market, namely the Meat Frozen Tilapia.

Calculate the Cost of Tilapia That Came Out/Harvest

Total supply of fish feed used will be a total inventory value of tilapia, it has become a sure thing, and after a certain time, tilapia stocks will be harvested or will be transferred to growth units. This company obtained the fish feed by purchasing the commercial feed mill. Calculating the value of inventories of harvested tilapia, should know the components that affect the calculation.

Calculation of raw materials or of harvested fish stocks. To determine the value of the raw materials contained in harvested fish stocks need to be calculated Nila the following elements:

Table 1

Biomass Harvest

Species	Total tail fish	Average weight (gram)	Biomass
Mersi	0		0
Gift	8,372	29.32	245.47
Mernia	26,573	25.21	669.96
Nifi	2,800	38.22	107.02
White Aurea	2,860	34.43	98.47
Nero GS	0	0	0
Giftsi	1,829,042	25.30	46,279.03
Total	1,869,647	25.35	47,399.95

(1) Biomass and total of fish harvested tilapia. Biomass is the weight of tilapia harvested in a month which is calculated in kilograms and the amount of seed harvested fish tail. The data obtained in August 2006, counted 1,869,647 harvest tilapia fish weighing a total of 47,399.95 kg, average weight of 25.35 grams of fish, as seen in Table 1.

(2) FCR Tilapia. To calculate the value of fish feed conversion (*FCR*) is required data as shown in Tables 2 and 3.

Table 2

Number of Planted Seed Tilapia

Species	Planted			Planting
	N (Tnm)	W (Tnm)	BIM (Tnm)	Time
Nifi	11,750	0.77	9	27
Gtgt	18,000	8.00	144	18
Msnf	44,626	9.43	421	35
Giftsi	3,142,371	4.21	13,215	53
Total	3,216,747	4.29	13,789	53

Table 3

Seed Production in Growing

Species	Big size					Small size			
	N (bs)	W (bs)	BIM (bs)	ADG	UB (%)	N (ss)	W (ss)	BIM (ss)	SR (%)
Nifi	2,800	38.21	107	1.41	24	0	-	0	24
Gtgt	14,372	29.29	421	1.22	80	0	0	0	80
Msnf	31,785	25.01	795	0.45	71	12,000	8.00	96	98
Giftsi	2,016,606	28.30	57,068	0.46	64	666,500	8.12	5,412	85
Total	2,065,563	28.27	58,391	0.46	64	678,500	8.12	5,508	85

Table 2 shows the number of tilapia seed to be planted or spread over a period of observation and Table 3 shows the description of the total tilapia seed production during the late harvest period by seeding unit. BIM (big size) and BIM (small size) is the amount of production growth totally 63,899 kg. Furthermore, to calculate the value of FCR of fish harvested in the period of data required the use of feed, as shown in Table 4.

Table 4

The Use of Feed and FCR

Species	The used of feed							
	NSA (2)	NGA 10 (3)	788 (2)	NS A-2 (C)	788 (3)	PSC-22	Total	FCR
Nifi	134	79	75	14	-	-	302	2.82
Gtgt	-	268	-	-	-	-	268	0.64
Msnf	345	547	-	91	-	-	983	1.10
Giftsi	8,967	26,741	4,831	8,146	351	319	49,355	0.79
Total	9,446	27,635	4,906	8,251	351	319	50,908	0.80

FCR is the ratio between the amounts of feed used on the amount of fish produced in the harvest period. Sample period of observation in August 2006, the feed used by as many as 50,908 kg, weight of seeds during the growth was estimated 63,900 kg, the FCR of the hatchery project in the month of August 2006 amounted to 50,908 kg : 63,899 kg = 0.80 (rounded to two decimal).

(3) The average price of feed. The average price of feed derived from a list or inventory report fish feed in a month, the average purchase value per kilogram of seed of all types of feed tilapia. In August, 2006 (observation period) the total purchase as many as 42,330 kg of feed with total purchases amounting to IDR 205,545,511.48, it can calculate the average purchase price of seed food in August 2006 amounted to IDR 4,855.79 per kilogram (IDR 205,545,511.48 : 42,330 kg).

Wage labor. Wage labor is one component of costs to calculate the cost of fish seed overall. Wage labor is the direct labor. Direct labor includes salary, overtime pay, production bonuses, and table money. Provision of basic salary and overtime pay has become imperative for companies to comply with the government, namely by following the minimum wage in North Sumatera Province, for production bonuses granted to employees each month is calculated from the amount of production that resulted. In the period of observation in this study the total direct labor wages paid to employees amounted to IDR 156,081,397.00.

Overhead costs. Overhead costs in the cost of production of tilapia are the cost incurred other than the price of raw materials and direct labor. Overhead costs are accounted for and recognized by the company consists of indirect labor, electricity costs, water costs, the cost of gas, cost of supplies, maintenance costs, insurance premium costs, depreciation costs, rental fees, licensing fees, the cost of business travel accommodation, transportation costs, and other costs incurred in addition to an existing cost component. Of all the components of the overall production costs will become an addition to the cost of production value of fish harvested. Total overhead expenses in the period of observation in August 2006 amounted to IDR 338,152,632.08.

Cost of Production Analysis

From the results, it can be calculated that the cost of production of fish harvested in the period of observation in accordance with the elements contained in the calculation of the cost of production as follows:

(1) Raw Materials:

FCR = 0.80;

Total weight of seed sent = 47.399.95 kg;

Total weight of seed sent = 1,869,647 tail;

Average purchase price of feed = IDR 4,855.79.

The value of raw materials on the seeds that were harvested tilapia at:

The raw materials of fish harvested = Biomass × FCR × Average purchase price of feed = 47,399.95 kg × 0.80 × IDR 4,855.79 = IDR 184,131,362.57.

The price of fish per head is IDR 98.48, and the price per kilogram of IDR is 3,884.63.

(2) Direct labor costs in the period of observation amounted to IDR 156,081,397.00.

(3) Overhead costs on the observation period amounted to IDR 338,152,632.08.

(4) Total cost of production of fish that are harvested:

Raw materials = IDR 184,131,362.57;

Direct labor = IDR 156,081,397.00;

Overhead costs = IDR 338,152,632.08;

Total cost of production = IDR 678,365,391.65.

The results of research conducted showed that companies use the cost method with process method, the company does not accept orders from outside parties, but in accordance with the budget of the fish producing

companies that want to produce as much as possible in order to achieve the needs of raw materials in fish processing factories, while charging method used is the method of loading the full costing.

The percentage of the cost of materials contained in cost of production reached 27.14%, labor costs amounted to 23.01%, and overhead costs amounted to 49.85%. To avoid the increased costs of raw materials, it is worth noting that the FCR of fish are harvested, the higher the value of FCR production at harvest period, the higher value of raw materials, it is to be considered by the management is to minimize the consumption of fish feed when the fish have been feasible harvest, a decent harvest of fish weighing between 20 grams and 30 grams. Djarijah (1998) and Tjakrawidjaja (2001) found that the lower the value the better use of production of feed and production costs would decrease. While Christensen (1989) asserted that had the highest FCR value standard as follows:

(1) FCR above 4.5 is low;

(2) FCR ranging from 2 to 4.5 is high quality;

(3) FCR up to 1 indicates very good quality feed, to boost growth of 1 kg of fish, fish eat only needed one kg of fish feed.

The experimental results show that the value 0.80 can be considered to be very good, where to raise the growth of fish weighing 1 kg is required to consume only 0.80 kg. If the calculated value of the price of feed consumed weighing 0.80 kg with an average price of feed purchased for IDR 4,855.79, then for each kilogram of fish are harvested worth IDR 3,884.63. For overhead costs are the biggest cost in the cost of production, where the period of observation there are maintenance costs for fish cages, therefore the values are quite large. To avoid a buildup of overhead costs in a particular month, the management plans to invest not only focused on a particular month.

In manufacturing companies and aquaculture industries, the cost of production is needed by the leadership in making decisions on business continuity in the product, for the purpose of determining the cost of production are:

(1) As a basis for determining the price of the product;

(2) As a cost control;

(3) As a basis for planning and performance measurement company;

(4) To calculate the gross profit or loss on a particular period;

(5) Determining the cost of products and product process presented at the balance sheet.

Conclusions

(1) There is a difference between the calculation of the cost of production in the fishing industry and other manufacturing industries, which distinguishes in determining the value of the raw materials contained in the products. If the manufacturing industry in general, calculates the raw materials in accordance with the value of the incoming raw materials without any special calculations, but the fishing industry determines the value of the raw materials of the products in its own calculation, namely:

a. Determining the biomass of fish harvested;

b. Determining the value of the fish consumed the feed conversion;

c. Calculates the average purchase price of food at harvest period.

(2) To avoid a high increase in raw materials, the management must be able to minimize the value of

production, how to minimize the use of fish feed on fish that have decent harvest, the reason is that a decent harvest of fish no longer need to consume excess food for growth, but feed consumption serve only to preserve life during the waiting time of harvest.

(3) FCR decrease in value was due to good quality feed, whereby the better the feed consumed, it will accelerate the growth of fish. Rapid growth of fish will minimize amount of feed consumed by fish, so the cost of feed would be small.

(4) Other cost elements that existed at the cost of production calculations are not experiencing the difference between other manufacturers with the aquaculture industry, namely the cost of direct labor and overhead costs, whereas the cost of goods used, method of cost distribution processes, and methods of using full cost method.

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Estimating the Three-Stage Cost Malmquist Productivity Index in the Taiwan Biotech and Biopharmaceutical Industry*

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This paper estimates and decomposes the output-oriented three-stage cost Malmquist productivity index of the Taiwanese biotech and biopharmaceutical (B&BP) industry in 2004-2007 periods. The empirical estimations proceed in three stages. Following the methodology of Yang and Huang (2009) with the assumption of variable return to scale (VRS) in the first stage, the original cost Malmquist productivity index (CM) is decomposed into five sources of productivity change: pure technical efficiency change, technical change, allocative efficiency change (AEC), input-price effect, and cost scale efficiency change. The method of Yang and Huang (2009) is an excellent contribution, but it did not deal with the exogenous environmental variables and noises. In the second stage, the original input variables are adjusted by the exogenous environmental variables. Finally, adjusted input variables produced by the second stage are reused for obtaining the reality of CM in the third stage.

Keywords: cost Malmquist productivity index, Taiwan biotech and biopharmaceutical (B&BP) industry

Introduction

Over the past decades, a new era characterized by an explosion of advanced biotechnology is emerging worldwide. The Global Biotechnology Report 2008 published by Ernst & Young indicates a tremendous growth in the global biotech industry from 2005 to 2007. The world-wide revenue of the 4,414 biotech companies rose 22% to $78.4 billion in year 2006, and 8% to $84.8 billion in year 2007, while it rose 8% in 2008 in the United States.

Increased competition and regulatory changes have also fostered a wave of fast growth of biotech and biopharmaceutical (B&BP) industry in Taiwan. More than 400 B&BP firms were established or incorporated from 2003 to 2007. In a highly competitive environment, the sources of the improvement in efficiency and productivity are very critical to the success of the industry. Therefore, a study of the above issues is very important for both academic and industry.

Numerous studies have put efforts to investigate efficiency and productivity of the sample industry. Chiu, Hu, and Tsao (2003) adopted Battese and Coelli's (1995) model of stochastic frontier analysis (SFA) function to evaluate the cost inefficiency and inefficiency model simultaneously. Chen, Hu, and Ding (2005) used data envelopment analysis (DEA) and Malmquist productivity models to evaluate the productivity and efficiency of

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Taiwan's biotech industry. Chiu, Chen, and Tsao (2005) adopted the DEA method and Malmquist total factor productivity (TFP) index to compare the differences of their efficiency and productivity index's results in biotech industry and non-biotech industry. Hsieh, Wann, and Lu (2007) applied three-stage DEA method to estimate the innovation efficiency of Taiwan agricultural biotechnology industry, and gauged the main factors of causing innovation efficiency. Liang, Jiang, and Lai (2008) used DEA to investigate production efficiency in the biotech industry before and after integration and indicated that the integration of companies through mergers, alliances, or acquisitions as a strategy for improving production is relatively new in the biotech industry. Chueh (2009) applied two-stage DEA and Malmquist productivity index method to estimate the technical efficiency of Taiwan's biopharmaceutical firms, gauged the impact of the environmental factors to firms' efficiency, and investigated the firms' efficiency performance.

Most efficiency and productivity in literature focuses on the examination of sources of productivity change. However, none of the above mentioned methods focus on how to capture the allocative efficiency—one of the most important aspects of managements. According to Maniadakis and Thanassoulis (2004), the distance between the actual and minimum cost at which a production unit may secure its outputs once any technical inefficiency of the unit has been eliminated. Thus, the impact of allocative efficiency change (AEC) on productivity change should be accounted for in the model. In addition, the cost Malmquist productivity index proposed by Maniadakis and Thanassoulis (2004) has become a favorite approach in estimating the productivity index. Although, previous literature has well documented that the variable return to scale (VRS) analysis is more flexible and envelops the data in a tighter way than the constant returns to scale (CRS) in estimation of the efficiency under a DEA method. Nevertheless, most of previous research estimates the productivity index under the assumption of the CRS. An examination of the relevant literature reveals that with few exceptions, no research appears to account for the variable returns to scale. Yang and Huang (2009) developed an alternative model based on the variable return to scale to measure the cost Malmquist index (CM). The overall CM productivity change is further decomposed into pure technical efficiency change (ΔPTE), technical change (ΔT), allocative efficiency change (ΔAE), input-price effect (ΔPE), and cost scale efficiency change (ΔCSE) to capture the sources of productivity changes and the shift of relative price change. More recent literature has suggested that the cost Malmquist index approach has been evolved as a preferred approach. In fact, in a highly competitive industry, the cost saving detect by CM approach is much important to the strategic planning of top management in the industry.

The review of above literature portrays that our results would be interest to both the investing public and management, as well as to regulator of the industry and also extends the scope of productivity literature. To consider the interference from the exogenous environmental variables, the methodology of the traditional cost Malmquist index approach is necessary to be improved for removing the exogenous environmental noise. To the knowledge of authors, none of previous literature has using the three-stage cost Malmquist productivity approach to examine the productivity change of the Taiwan B&BP industry.

The empirical estimations of this study proceed in three stages. In the first stage, departing from the standard modeling of cost Malmquist productivity index, this study follows the model of Yang and Huang (2009) with the assumption of variable return to scale to measure the original cost Malmquist index (CM) of Taiwan B&BP industry. In the second stage, the input slacks, the outcomes from the first stage, are regressing against a set of environmental variables. Because of the regression, the original input variables are then

adjusted by the exogenous environmental variables. Finally, adjusted input variables produced by the second stage are reused in the measurement of the cost Malmquist index (CM). The reality of CM would be obtained by removing the exogenous environmental noise in the third stage.

The reminder of this paper is organized as follows: Section 2 describes the technical background of our methodology and specifies the source and characteristics of data set. Section 3 presents the empirical result. The paper then concludes with a summary of the findings for Taiwan's B&BP firms in Section 4.

Technical Background and Data Set

For estimating the reality of the cost Malmquist productivity index in the Taiwan (B&BP) industry, we apply a three-stage method. The reality of CM would be obtained by removing the exogenous environmental noise by the method.

Stage One: Estimate the Original Cost Malmquist Index

In the stage one, we use the method introduced by Yang and Huang (2009) and decompose of cost Malmquist productivity index under the assumption of the variable return to scale. The cost Malmquist productivity index measures the change over time in cost efficiency. Parallel to the decomposition of production Malmquist productivity index, the CM may be decomposed into the effects due to the improvement in production technology, in production efficiency, due to variation in input prices and production scale. We further extend the decomposition of the cost Malmquist productivity index under the variable returns to scale. The overall the decomposition of the cost Malmquist productivity index is as follows:

$$CM = \Delta PTE \times \Delta T \times \Delta AE \times \Delta PE \times \Delta CSE \tag{1}$$

where ΔPTE = pure technical efficiency change; ΔT = technical change; ΔAE = allocative efficiency change; ΔPE = price effect change; and ΔCSE = cost scale efficiency change. Values of the above five components greater than unity suggest deterioration, while values less than 1 suggest the improvement.

Computing and decomposing the cost Malmquist productivity index CM requires the computation of the minimum cost function under both VRS and CRS technologies. For the *k*th decision making unit (DMU) or the B&BP firm $C_V^t(y^t, w^t)$ is computed from the following linear programming problems:

$$\min_{x,\lambda} w_{k_n}^t x_n = C_V^t(y^t, w^t) \tag{2}$$

Subject to $\sum_{j=1}^{J} \lambda_j y_{j_m}^t \geq y_{k_m}^t, \quad m = 1, 2, \ldots M$; $\sum_{j=1}^{J} \lambda_j x_{j_n}^t \leq x_{k_n}, \quad n = 1, 2, \ldots N$;

$\sum_{j=1}^{J} \lambda_j = 1, \ \lambda_j \geq 0, \ x_n \geq 0$.

For the minimum cost function $C_C^t(y^t, w^t)$ under the constant returns to scale technology, it can be calculated by relaxing the constraint $\sum_{j=1}^{J} \lambda_j = 1$ from Equation (3). As for the mixed-period cost function $C_V^t(y^{t+1}, w^{t+1})$, it can be similarly computed as follows:

$$\min_{x,\lambda} w_{k_n}^t x_n = C_V^t(y^{t+1}, w^{t+1}) \tag{3}$$

Subject to $\sum_{j=1}^{J} \lambda_j y_{j_m}^t \geq y_{k_m}^{t+1}, \quad m = 1, 2, \ldots M$; $\sum_{j=1}^{J} \lambda_j x_{j_n}^t \leq x_{k_n}, \quad n = 1, 2, \ldots N$;

$\sum_{j=1}^{J} \lambda_j = 1,\ \lambda_j \geq 0,\ x_n \geq 0$.

Other cost functions, $C_V^{t+1}(y^{t+1}, w^{t+1})$, $C_V^{t+1}(y^t, w^{t+1})$, $C_C^{t+1}(y^{t+1}, w^{t+1})$, and $C_C^{t+1}(y^t, w^{t+1})$ are similarly obtained with and without the constraint $\sum_{j=1}^{J} \lambda_j = 1$.

The method of Yang and Huang (2009) is an excellent contribution, but it did not deal with the exogenous environmental variables and noises.

Stage Two: Adjust the Original Input Variables by the Exogenous Environmental Variables

In the second stage, the input slacks, the outcomes from the first stage, are regressing against a set of environmental variables. Because of the regression, the original input variables are then adjusted by the exogenous environmental variables. Accounting for environmental effects and statistical noise in cost Malmquist productivity index, this stage is the same as the stochastic frontier analysis (SFA). It can be shown as:

Cost Efficiency = managerial efficiency + non-discretionary impacts + random noise

$$CE = CE^A + g(z) + v$$

Adjusted (managerial) cost efficiency is $CE^A = CE - [g(z) + v]$. The input slacks shown in the Equation (4) were obtained from the CM in the first stage. The slack variable could be the results of environmental factors, random errors, and management errors.

$$S_{ik} = X_{ik} - X_{ik}\lambda \geq 0 \tag{4}$$

where X_{ik} = the ith input of the kth DMU; S_{ik} = the ith input slack of the kth DMU.

The concepts and ideas of stochastic frontier production approach developed by Battese and Coelli (1988) could be introduced.

$$S_{ik} = f^i(Z_k, \gamma^i) + E_{ik} \tag{5}$$

$$E_{ik} = V_{ik} - U_{ik} \tag{6}$$

where:

S_{ik} = the ith input of the kth DMU;

Z_k = the exogenous variables;

γ^j = unknown parameters;

V_{ik} = the random error of ith input on output of the kth DMU;

U_{ik} = the technical inefficiency, nonnegative error of ith input on output of the kth DMU;

V_{ik} and U_{ik} are independent; i = 1, 2, 3, …, I, and k = 1, 2, …, K.

In Equation (5), the $f^i(Z_k, \gamma^i) = Z_k\gamma^i$ is a frontier production function. Assume $V_{ik} \sim N(0,\ \sigma_{vi}^2)$ and U_{ik} to be set as truncations at zero of $N(u^i,\ \sigma_{ui}^2)$. The parameters of $\hat{\gamma}^i$, $\hat{\sigma}_{vi}^2$, $\hat{\mu}^i$, and $\hat{\sigma}_{ui}^2$ are the estimators of γ^i, σ_{vi}^2, μ^i, and σ_{ui}^2 (Battese & Broca, 1997; Charnes, Cooper, & Rhodes, 1978; Park & Simar, 1994). Due to the estimator of U_{ik} is $\hat{E}[U_{ik} \mid E_{ik}]$, the estimator of V_{ik} could be determined by following Equation (7):

$$\hat{E}[V_{ik} \mid E_{ik}] = S_{ik} - Z_k\hat{\gamma}^i + \hat{E}[U_{ik} \mid E_{ik}] \tag{7}$$

The inputs of kth DMU could be adjusted by the following Equation (8):

$$X_{ik}^{*} = X_{ik} + [\max_k(Z_k\hat{\gamma}^i) - Z_k\hat{\gamma}^i] + [\max_k(\hat{V}_{ik}) - \hat{V}_{ik}] \quad (8)$$

Finally, the technical efficiency will be obtained from the adjusted inputs X_{ik}^{*}, and output by introducing the traditional CM.

Stage Three: Estimate the Adjusted Cost Malmquist Index by Reusing the Adjusted Inputs

Finally, adjusted input variables produced by the second stage are reused in the measurement of the cost Malmquist index (CM). The reality of CM would be obtained by removing the exogenous environmental noise in the third stage.

The Source and Characteristics of Data Set

The study is listed in the period of National Development Plan, "Challenging 2008", from 2004 to 2007, and the samples include 13 firms in the listed stock market and 15 firms in the over-the-counter stock market. All raw data are from Taiwan Economic Journal Data Bank (TEJ). Two outputs, net revenue (Y_1) and market value (Y_2), and three inputs, labors (X_1), capital (X_2), and materials and purchase (X_3) are adopted and accounted by this study. The input prices of X_1, X_2, and X_3 are respectively showed as *PL*, *PK*, and *PM*. The variables of outputs, inputs, and input prices are specified and described below.

(1) Outputs: Net revenue (Y_1) is defined as the value accrued from a firm's regular business activities, such as selling the goods and providing services. Market value (Y_2) of a firm is defined as the total value of common stocks traded in the stock market, suggesting how a company is valued by its stockholders.

(2) Inputs and input prices: Because the B&BP industry in Taiwan has the properties of high entrance barriers, high material value-added features or low material costs, high technology-oriented features and high R&D expenditures, it is assumed in the present study that contains multiple inputs, labors (X_1), capital (X_2) and materials and purchase (X_3). *PL*, *PK*, and *PM* respectively represent the input prices of X_1, X_2, and X_3. These inputs and their prices are described below.

a. Labors (X_1) and its input price (*PL*): Following Chiu et al. (2003), the input labor (X_1) is defined as the number of employees in a firm.

b. Capital (X_2) and its input price (*PK*): The input capital (X_2) is defined as the value of fixed assets as recorded in the balance sheet of an annual report. Following Chiu et al. (2003), the input price of capital (*PK*) in Taiwan B&BP industry is obtained via dividing the depreciation and interest expenses by the book value of the physical assets, or fixed assets.

c. Materials and purchase (X_3) and its input price (*PM*): Considering that the B&BP industry has a high material value-added feature, the input of material and purchase (X_3) is also deemed a significant input factor. The input price of materials and purchase (*PM*) is measured by dividing the total expenditure of materials and purchases with net revenue.

Table 1 represents a definition and a description of the variable of outputs, inputs, and input prices. Table 2 shows descriptive statistics of variables. In the full sample period, the means of outputs Y_1 (net revenue) and Y_2 (market value) are respectively more than 1.6 and 3 billion NT dollars and both show the trend on the increase. The mean of input X_1 (number of employees) is 380. The means of inputs X_2 (capital) and X_3 (material & purchase) are respectively more than 684 and 841 million NT dollars. All of inputs also show the trend on the increase from 2004 to 2007.

Table 1

Definition and Description of the Variables

Variables	Definition	Description	Unit
Y_1	Net revenue	Net revenue from the income statement	NT dollars
Y_2	Market value	Number of shares × Average stock price	NT dollars
X_1	Labor	Number of employees	Numbers
X_2	Capital	Fixed assets from the balance sheet	NT dollars
X_3	Material & purchase	Material and purchase expenditure from statement of cash flows	NT dollars
P_L	Input price of labor	$P_L = \frac{\text{Total Wages}}{\text{Number of Employees}}$	NT dollars
P_K	Input price of capital	$P_K = \frac{\text{Depreciation} + \text{Interest Expense}}{\text{Fixed Assets}}$	%
P_M	Input price of M&P	$P_M = \frac{\text{Material and Purchase Expenditure}}{\text{Net Revenue}}$	%

Notes. Besides Y_2, NT dollars is accounted in thousands of dollars. Y_2 is accounted in millions of NT dollars.

Table 2

Descriptive Statistics by Taiwan B&BP Industry for the Time Period 2004-2007

Year	Variables	Y_1	Y_2	X_1	X_2	X_3	P_L	P_K	P_M
Full period	Mean	1,663,281	3,022.42	380	684,611.5	841,854.7	611.33	0.12	0.42
	Median	1,127,171	1,499	214	452,944	353,712.5	579.73	0.10	0.39
	Max	10,213,146	37,069	1,995	3,004,534	6,912,990	1,733	0.57	0.83
	Min	10,989	95	7	5,351	3,077	347.24	0.01	0.02
	Std. Dev.	1,898,636	4,573.06	420.25	732,615.8	1,288,283	198.51	0.09	0.18
2004	Mean	1,558,149	2,196.71	348.57	650,697.5	743,606.5	591.89	0.12	0.41
	Median	970,840	1,087	204.5	374,710.5	264,996	581.67	0.10	0.37
	Max	8,902,689	10,744	1,952	3,004,534	6,030,386	1,014.43	0.34	0.68
	Min	32,078	112	53	17,427	11,399	358.78	0.02	0.03
	Std. Dev.	1,865,179	2,594.56	404.81	786,748.5	1,249,001	167.42	0.07	0.17
2005	Mean	1,619,691	2,563.29	365.18	678,131.8	839,640.8	597.74	0.12	0.42
	Median	1,082,819	1,044	210	453,102	385,729.5	568.40	0.10	0.40
	Max	8,861,877	19,662	1,995	2,755,970	5,824,109	1,000.45	0.38	0.69
	Min	10,989	95	30	11,884	4,358	365.9	0.01	0.12
	Std. Dev.	1,854,195	3,969.45	415.96	747,251.1	1,242,530	149.41	0.08	0.16
2006	Mean	1,654,371	3,635.68	388.07	689,582.8	832,590.6	606.94	0.12	0.43
	Median	1,146,822	1,115	214	456,276	378,933	586.62	0.10	0.40
	Max	9,315,879	37,069	1,942	2,613,682	6,122,643	1,098.84	0.48	0.70
	Min	15,319	205	38	9,062	6,990	370.31	0.03	0.13
	Std. Dev.	1,885,741	7,038.29	428.94	723,524.6	1,260,154	175.98	0.09	0.17
2007	Mean	1,820,912	3,694	418.18	720,033.9	951,580.9	648.76	0.11	0.40
	Median	1,296,322	2,355.5	221	456,108.5	384,576.5	567.12	0.08	0.39
	Max	10,213,146	14,696	1,957	2,501,473	6,912,990	1,733	0.57	0.83
	Min	16,058	287	7	5,351	3,077	347.24	0.03	0.02
	Std. Dev.	2,075,470	3,487.97	449.84	709,317.6	1,452,115	280.42	0.10	0.23

According to Chiu et al. (2003), William and Michael (2004), Chiu et al. (2005), and Sheng (2009), the Taiwan B&BP industry could be defined as a technology-integrated and R&D-orientated industry with highly material value-added feature and is driven by diversification strategy. We define several firm-specific determinant factors for the cost Malmquist productivity index as annual R&D expenditure (RD), market risk (BETA), the number of total subsidiary companies (SC) and foreign subsidiary companies (FSC). In other words, these variables are regarded as the exogenous environmental variables and noises and should be adjusted in stage two and stage three.

Empirical Results

Table 3 represents the first-step statistical results of *TE*, *AE*, and *CE* index and component values by Taiwan B&BP industry. Table 4 summarizes the results of the first step of the input Malmquist (IM) and the cost Malmquist (CM) productivity indexes and component values for the entire Taiwan B&BP industry. The results were computed for using the models presented in step 2 and step 3.

Table 3

The First-Step Statistical Results of TE, AE, and CE Index and Component Values by Taiwan B&BP Industry

Year	*TE*	*AE*	*CE*
2004	0.2511	0.5915	0.1486
2005	0.2572	0.5752	0.1480
2006	0.2658	0.6021	0.1600
2007	0.3531	0.5245	0.1853
Full period	0.2790	0.5725	0.1598

Note. $CE = TE \times AE$.

Table 4

The First-Step Statistical Results of IM and CM Index and Component Values by Taiwan B&BP Industry

Year	*IM*	*CM*	ΔPTE	ΔT	ΔSE	ΔAE	ΔPE	ΔCSE
Base year	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2004-2005	0.9663	1.0235	1.7201	0.5655	0.9934	0.2669	4.0194	0.9808
2005-2006	1.1141	0.8748	0.9477	1.1432	1.0284	1.0818	0.8035	0.9289
2006-2007	1.2019	0.8934	1.0560	1.1657	0.9764	0.9937	0.7097	1.0290
Full period	1.0897	0.9283	1.1985	0.9100	0.9992	0.6596	1.3185	0.9787

Note. $IM = \Delta PTE \times \Delta T \times \Delta SE$.

As shown in Table 4, it is significant that the *IM* index of 28 Taiwan B&BP firms is 1.0879 and larger than 1, declining 8.79% for the full sample period. *CM* index is 0.9283 while value of less than 1 suggests the improvement, and indicates 7.17% productivity growth. It is clear that *IM* and *CM* indexes indicate different trends at overall industry level. However, a complete picture of the productivity change in the changing business environment should be estimated not only by the *IM* index but also by the *CM* index (Maniadakis & Thanassoulis, 2004; Yang & Huang, 2009). The results clearly indicate that 7.17% *CM* index growth is significantly caused by ΔT (technical change), ΔAE, and ΔCSE (cost scale efficiency change). *CM* under the assumption of VRS responds not only ΔPTE and ΔT but also ΔAE, ΔPE, and ΔCSE. For *CM*, the effects of ΔAE and ΔCSE offset the decline of ΔPTE that makes *IM* on the decrease.

Table 5 indicates the third-step statistical results of *TE*, *AE*, and *CE* index and component values. Table 6 shows the third-step statistical results of *IM* and *CM* index and component values by Taiwan B&BP industry for the time period 2004-2007. After adjusting in stage two and stage three, the empirical results are significantly different with the results from the original cost Malmquist method. *IM* index of 28 Taiwan B&BP firms still significantly shows 1.1151 and larger than 1, declining 11.51% for the full sample period. *CM* index is 0.8862 while value of less than 1 suggests the improvement, and indicates 11.38% productivity growth. The results are similar with them shown as Table 4. Other values of ΔPTE, ΔT, ΔAE, ΔPE, and ΔCSE are also changed. It is clear that *CM* is significantly improved by ΔPE and ΔCSE after adjusting in stage two and re-measuring in stage three. In other words, ΔPE and ΔCSE are the major factors that make the value of *CM* less than 1. We can also find that the empirical results shown in Table 6 are more reasonable than in Table 4.

Table 5

The Third-Step Statistical Results of TE, AE, and CE Index and Component Values by Taiwan B&BP Industry

Year	*TE*	*AE*	*CE*
2004	0.9992	0.9867	0.9860
2005	0.9991	0.9932	0.9923
2006	0.9990	0.9935	0.9925
2007	0.9985	0.9825	0.9811
Full period	0.9990	0.9890	0.9880

Note. $CE = TE \times AE$.

Table 6

The Third-Step Statistical Results of IM and CM Index and Component Values by Taiwan B&BP Industry

Year	*IM*	*CM*	ΔPTE	ΔT	ΔSE	ΔAE	ΔPE	ΔCSE
Base Year	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2004-2005	1.0328	0.9757	1.0000	0.9959	1.0371	1.0005	1.0108	0.9687
2005-2006	1.2154	0.8252	1.0000	1.0154	1.1970	1.0041	0.9733	0.8315
2006-2007	1.1045	0.8645	0.9989	1.0096	1.0952	1.0572	0.9694	0.8363
Full period	1.1151	0.8862	0.9996	1.0069	1.1078	1.0203	0.9844	0.8766

Notes. $IM = \Delta PTE \times \Delta T \times \Delta SE$; $CM = \Delta PTE \times \Delta T \times \Delta AE \times \Delta PE \times \Delta CSE$.

Conclusions

The study adopts the approach introduced by Yang and Huang (2009) to estimate both input-oriented (IM) and cost Malmquist (CM) productivity index and their components of 28 Taiwan B&BP sample firms for the time period of National Development Plan, “Challenging 2008”, from 2004 to 2007. In the second stage of the methods, the original input variables are adjusted by four exogenous environmental variables, annual R&D expenditure (RD), market risk (BETA), the number of total subsidiary companies (SC) and foreign subsidiary companies (FSC). Finally, adjusted input variables produced by the second stage are reused for obtaining the reality of CM in the third stage. Empirical results provide deeply inside on the root sources of productivity changes. The empirical results show more reasonable values after adjusting the four exogenous environmental variables. The results also show that the method of the three-stage cost Malmquist productivity index could rationally explain the reality of the Taiwan (B&BP) industry.

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Board Characteristics and Firm Performance

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Based on agency theory, the importance of corporate governance is to reduce agency conflicts between those who control and those who own the residual claims in a firm. In other words, corporate governance as a mechanism helps to align management's goals with those of the stakeholders that are to increase firm performance. Since, the value creation of corporate governance can be measured through the firm performance; the aim of this study is to answer this question: "is there any relationship between corporate governance and firm performance?" Therefore, the four board characteristics that are of interest in this study are board independency, CEO duality, ownership structure, and board size. Based on a randomly selected sample of companies listed on Bursa Malaysia and applying the linear multiple regression as the underlying statistical tests, it is found that CEO duality has a negative relationship with firm performance—Return on Equity (ROE) and Return on Asset (ROA), but there is no significant relationship among board independency, board size, and ownership structure as independent variables and firm performance as dependent variable.

Keywords: corporate governance, board of directors, firm performance

Corporate Governance

Shleifer and Vishny (1997) defined corporate governance as a way in which suppliers of finance to corporations assure themselves of getting a return on their investment. Irrespective of the particular definition, the importance of corporate governance arises in a firm because of the separation between those who control and those who own the residual claims (Epps & Cereola, 2008). Furthermore, agency theory assumes an opportunistic behavior that is individuals want to maximize their own expected interests and are resourceful in doing so (McCullers & Schroeder, 1982). Therefore, there will be a conflict of interest between managers and stakeholders. Macus (2008) argued that the basic issue from an agency perspective is how to avoid such opportunistic behavior. Since, stakeholders hire managers to apply their investment in firm's activity, an information asymmetry occurs because management have the competitive advantage of information within the company over that of the owners (Zubaidah, Nurmala, & Kamaruzaman, 2009). It can provide management with the opportunity to expropriate firm wealth in their benefit. Hence, agency theory suggests corporate governance as a mechanism to reduce these conflicts by monitoring managers' performance and aligning management's goals with those of the stakeholders (Brickley & James, 1987).

The corporate governance model in Malaysia has closely followed the Anglo-American approach, which is generally referred to as the "shareholder model", where the governance concept is based on the agency relationship (Abdullah, 2004). This corporate governance model is a one-tier system where the board of directors is the highest governing body in the company because the shareholders do not have a complete control

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on management's decisions. In a balance sheet model of the firm, Gillan (2006) argued that the board of directors is the apex of internal governance system and is responsible to monitor and compensate management. Managers are more likely to act against shareholders' interests when they do not earn their desirable interests (Jensen & Meckling, 1976). This opportunistic behavior of management can lead to reduce the value of the firm. Therefore, the board's success in discharging its fiduciary duties and monitoring roles would be predicted to increase the value of the firm and enhance the shareholders' wealth (Abdullah, 2004). The purpose of this study is also to examine the relationship between corporate governance and firm performance. Therefore, four main characteristics for a good board of directors that are of interest in this study are related to board independency, CEO duality, ownership structure, and board size.

Since the board of directors is the most important device to monitor the management, independency of board members become a significant issue (Abdullah, 2004). Board independency means the proportion of independent non-executive directors relative to the total number of directors. It is argued that boards with the more non-executive directors will control the opportunistic behavior of managers and protect the shareholders interests better than boards with dependent members (Zubaidah et al., 2009). In addition, Dahya and McConnell (2005), Dehaene, De Vuyst, and Ooghe (2001) found a significant positive relationship between the ratio of independent directors and return on equity (ROE) among Belgian companies.

Another crucial monitoring mechanism based on agency perspective is the separation of the roles of CEO from chairman (Judge, Naoumova, & Koutzevol, 2003). When there is no separation, the CEO also serves as chairman. This situation, known as "CEO duality", is problematic from an agency perspective where the CEO chairs the group of people in charge of monitoring and evaluating the CEO's performance. In companies with CEO duality approach, the crucial question is "who monitors management?" or "who will watch the watchers?" (Zubaidah et al., 2009). This situation provides CEOs with the opportunity to have a dominant influence on the board's decisions. Therefore, CEO duality will weaken board's independency and make them unable to monitor management effectively.

In addition, the basic problem discussed in agency theory is the separation of ownership from control and different mechanisms are suggested to mitigate the costs associated with the conflict of interests among this separation (Alberto, Pindado, & Chabela, 2005). When the board of directors owns part of the firm's share, their interests align the interests of other shareholders and they are less likely to engage in opportunistic behavior (Zubaidah et al., 2009). Therefore, it can be concluded that directors' ownership has a negative relationship with agency conflicts and, as a consequence, a positive relationship with firm performance. Board size refers to the number of directors on the board. Cheng (2008) in his article suggested that larger boards are less efficient and slower in decision-making, because it is more difficult for the firm to arrange board meetings and for the board to reach a consensus. He also argued that when the board size is bigger, it will be easier for CEO to have a dominant on the board and increase the CEO power in decision-making (Jensen, 1993). In addition, some studies document a negative association between board size and firm performance (Yermack, 1996; Eisenberg, Sundgren, & Wells, 1998).

Firm Performance

Empirical researches on corporate governance use either market-based measures or accounting-based measures to assess firm performance. Klein (1998) used return on assets (ROA) and Lo (2003) used ROE as an operating performance indicator. Brown and Caylor (2005) used ROE and ROA as their two operating

performance measures. We can measure the operating performance of a firm through the ROA ratio which shows the amount of earnings have generated from an invested capital assets (Epps & Cereola, 2008). Managers are directly responsible for the operations of the business and therefore the utilization of the firms' assets. Thus, ROA allows users to assess how well a firms' corporate governance mechanism is in securing and motivating efficient management of the firm. In the present study, ROA is defined as net income before interest expense for the fiscal period divided by total assets for that same period. One of the primary reasons for operating a corporation is to generate income for the benefit of the common stockholders (Epps & Cereola, 2008). ROE is a measure that shows an investor how much profit a company generates from the money invested from its shareholders. In this study, ROE is defined as the income before interest expense for the fiscal period divided by total shareholders' equity for that same period.

Theoretical Framework

Based on the literature, four board characteristics have been identified as possibly having an impact on firm performance and these characteristics are set as the independent variables in the framework. Two control factors, leverage, and firm size, are included in the theoretical model designed for this study. These factors have been known to have an impact on firm performance, and hence need to be controlled in the study. The dependent variables are the ROA and ROE, which are used to measure the firm performance. The relationship between each of these independent variables and firm performance are hypothesized as follows:

H1: There is a positive relationship between the percentage of independent non-executive directors and the firm performance.

H2: There is a negative relationship between CEO duality and the firm performance.

H3: There is a positive relationship between directors' ownership and the firm performance.

H4: There is a negative relationship between board size and the firm performance.

Sample Selection

From the "Construction & Materials" industry, the biggest industry, on the main board of Bursa Malaysia, 30 companies are randomly selected. The convenient sampling technique is also applied in this study, where the availability of the annual reports of the chosen companies on the Bursa Malaysia website also plays a determining role in the inclusion of the company in the final list. In other words, companies that have been chosen by the random sampling function but do not have annual reports readily available on the Bursa Malaysia website are eliminated from the sample list and the random sampling technique is repeated to replace these companies. The data required for the purpose of this study is collected from 2007 fiscal year annual reports of the firms. The data collection technique is mainly manual search on the annual reports of the companies.

Theoretical Model

For the purpose of empirical analysis, this study uses descriptive analysis and linear multiple regression as the underlying statistical tests. A descriptive analysis of the data is conducted to obtain sample characteristics. The multiple regression analysis is performed on the dependent variables, ROA and ROE, to test the relationship between the independent variables with firm performance. Table 1 shows the variables and their description in this study. The regression models utilized to test the relationship between the board characteristics and firm performance are as follows:

$$ROE = \alpha_0 + \alpha_1 Bind + \alpha_2 Dual + \alpha_3 OwnS + \alpha_4 Bsize + \alpha_5 Fsize + \alpha_6 Lev + \varepsilon \quad (1)$$

$$ROA = \alpha_0 + \alpha_1 Bind + \alpha_2 Dual + \alpha_3 OwnS + \alpha_4 Bsize + \alpha_5 Fsize + \alpha_6 Lev + \varepsilon \quad (2)$$

Table 1

Variables and Descriptions

Variables	Descriptions	Measurement
Bind	% of independent non-exe directors	(No. of outside directors)/(Total No. of directors)
Dual	CEO duality	1 = Yes, 0 = No
OwnS	% of outstanding shares owned by directors	(No. of ordinary shares owned)/(Total No. of ordinary shares)
Bsize	Board size	Number of directors on the board
Fsize	Firm size	Natural log of total assets as reported in 2007 annual report
Lev	Leverage	Total debt/Total equity
ROE	Return on equity	Net income + Interest expense (1 − Tax rate)/Total equity
ROA	Return on assets	Net income + Interest expense (1 − Tax rate)/Total assets

Finding and Discussion

Based on analysis of data, 63.3% of the companies comply with the recommendations of the Malaysian Code on Corporate Governance (MCCG) (2000) by separating the roles of the chairman and the CEO of the company. The level of duality of 36.7% of the sample data in this study is higher than a previous finding (11.8%) in the Malaysian setting over a period of five years from 1996 to 2000 by Rahman and Haniffa (2002). The descriptive statistics in Table 2 for the independent variables indicate that the average number of directors on the board in the selected companies is about eight persons. It is consistent with the study by Zubaidah et al. (2009) in Bursa Malaysia based on the data from 2003. The average percentage of independent directors on board (42.62%) shows that the companies comply with the recommendations of the MCCG (2000) that one third of the board members should be independent. Consistent with expectation, the mean for directors' ownership suggests that directors of publicly listed firms in Malaysia generally have sizeable ownership stakes in the company compared to their counterparts in Western developed economies, such as the Sweden and the United Kingdom (Ho & Williams, 2003). This is perhaps due to the higher number of family-owned and managed companies in Malaysia.

Table 2

Descriptive Statistics

	Min.	Max.	Mean	Std. deviation
Board size	5	15	8.23	2.208
% of independent directors	28.6	66.7	42.620	9.3348
Directors own	0.0	74.0	14.233	17.6962
ROA	-4.7	21.2	5.194	5.8436
ROE	-12.2	52.9	11.448	12.2487
Leverage ratio	5.7	688.0	149.160	159.9583
LOGTASS	8.07	10.08	8.7290	0.45863

A Pearson correlation analysis is performed on the variables to check for the degree of multicollinearity among the variables (Table 3). Even though there are significant correlations among some of the variables,

none of the coefficients exceeds 0.8, which is used as an indicator of serious multicollinearity (Gujarati, 1992). Hence, it may be concluded that multicollinearity is not a serious problem in this case.

The results of the regression analysis in Table 4 show that the coefficients for CEO duality are significant at the 10% level. It means that there is a significant difference in the performance between firms that separate the roles of the CEO and the chairman and those that practice CEO duality. It is in consistent with the expectation. Thus, H2 is supported. Another study in Malaysia by Rahman and Haniffa (2002) supported these results. However, Zubaidah et al. (2009) documented that CEO duality can increase the effectiveness of the board. Anyway, they used value added intellectual capital as proxies for firm performance which may account for the difference in the outcomes. The coefficients for percentage of independent non-executive directors on the board are insignificant even at the 1% level and contrary to the expectation the coefficient is negative. Hence, H1 is rejected. However, it can be inferred that some directors seems to be independent non-executive but do not have an effective and complete role in controlling the opportunistic behavior of management.

Table 3

Pearson Correlation Analysis Results

	Board size	% of IND non directors	Directors ownership	CEO duality	ROA	ROE	Leverage ratio	LOGTASS
Board size	1.000							
% of IND directors	-0.214	1.000						
Directors own	-0.145	0.101	1.000					
CEO duality	-0.209	0.168	0.204	1.000				
ROA	0.042	-0.073	0.009	-0.505**	1.000			
ROE	0.047	-0.062	0.157	-0.458*	0.783**	1.000		
Leverage ratio	0.100	-0.086	0.219	0.005	-0.215	0.216	1.000	
LOGTASS	0.114	0.041	-0.258	-0.301	0.078	0.310	0.354	1.000

Notes. ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed).

Table 4

Regression Analysis

	Un-std. coefficients				Std. coefficients		T		Sig.	
	B		Std. error		Beta					
Dependent variables	ROE	ROA	ROE	ROA	ROE	ROA	ROE	ROA	ROE	ROA
Constant	-33.934	1.582	49.145	23.817			-0.690	0.066	0.497	0.948
Board size	-0.489	-0.107	1.050	0.509	-0.088	-0.040	-0.466	-0.211	0.646	0.835
% of IND directors	-0.087	-0.032	0.247	0.120	-0.067	-0.052	-0.354	-0.270	0.727	0.790
Directors own	0.229	0.070	0.140	0.068	0.331	0.211	1.640	1.030	0.115	0.314
CEO duality	-12.043	-6.302	4.783	2.318	-0.482	-0.529	-2.518	-2.719	0.020*	0.013*
Leverage ratio	0.005	-0.010	0.015	0.007	0.071	-0.286	0.356	-1.409	0.725	0.173
LOGTASS	6.301	1.029	5.562	2.695	0.236	0.081	1.133	0.382	0.269	0.706

Note. * Significant at 10% level.

The coefficients for directors' ownership are insignificant even at the 10% level. This reveals that there is insufficient evidence to infer that there is a linear relationship between directors' share ownership in the

company and the performance. Hence, H3 is rejected. Nevertheless, the coefficient is positive which is in consistent with the expectation in the theoretical model. The coefficients for board size are insignificant even at the 10% level. Hence H4 is rejected. However, the coefficients are negative which is in consistent with the theoretical model. The results of regression analysis for ROA in Table 4 show that the relationship between leverage Ratio and ROA is negative while this relation for ROE is positive. Of course, the coefficient in this case, same as ROE, is insignificant.

Conclusions

The purpose of this study is to examine the importance of one of corporate governance aspects, namely board structure. In general, the results of this study provide evidence that the CEO duality has a negative impact on firm performance (ROE and ROA). In other words, CEO duality is found to decrease the effectiveness of the board of directors. Other three hypotheses are rejected in this study because the coefficients are not significant. It means that there is no significant relationship between these variables (board independency, board size, and ownership structure) and firm performance (ROE and ROA). In effect, there exists a high concentration of ownership among public listed companies in Malaysia and Cross-holdings of share ownership or pyramiding is more common in this country (Haniffa & Hudaib, 2006). The problem with ownership concentration in Malaysian companies is the authority of large shareholders who exercise control rights and may try to expropriate the company's assets resulting in beating minority shareholders. Therefore, the protection of minority shareholders' rights remains a key issue in Malaysia as controlling shareholders exercise dominant control via ownership concentration and representation on company board and management. However, we should consider the limitations of this study because small sample size and a special industry may not render the results of the study to be generalized. In addition, the duration of study should be more than one year because the effect of independent variables will be during subsequent periods.

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Study on Transnational Business Operation Strategy of China Xinhua News Network

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The paper firstly discussed the strategic implication of the establishment of China Xinhua News Network Co. Ltd. (referred to as CNC in the paper). Then, the paper explored the opportunity and threat in the CNC's competitive environment, and evaluated the news TV competitiveness of CNC compared with world main news network media based on Delphi method. Based on the strategic management framework of SWOT (strength, weakness, opportunity, and threat), the paper proposed the developmental strategies of transnational business operation for CNC from the following three area: further expand the coverage and the number of countries entered by CNC, enhance brand effects across the world, and build more new technology experience in the world.

Keywords: China Xinhua News Network Co. Ltd. [CNC], transnational business operation, SWOT (strength, weakness, opportunity, and threat)

Introduction

In the contemporary world with the highly information-oriented, news media has been an important tool to reflect and strengthen the country "soft power", and bear "soft power transmission" task for its function of information transmission and public opinion guide (Elzinga & Hogarty, 1973). It can be said that the ability of international communication is directly related to the shaping and maintenance of the country's image.

From the international influence of the media, independent television news media, as the most influential form of transmission, plays a critical role in shaping the image of the state, which is the important means to enhance the international influence and international discourse right (United Nations Conference on Trade and Development [UNCTAD], 2005). Especially the creation and transnational dissemination of news television with high-cost, high-input access threshold, therefore, has also become the main tool of the strong states influencing and controlling the international public opinion. So building the wide coverage, advanced technology and international communication and business news television channels, and forming the international communication ability compatible with the level of China's economic and social development and international status, have become an urgent task (Liu, 1999; Li & Zhou, 2005).

It is in this context, the Xinhua News agency founded China's first transnational dissemination and business News TV media—China Xinhua News Network Co. Ltd. [CNC]. CNC tries to break through the traditional state media business philosophy and taboos, respect the market rules, and rely on the establishment of a modern media organization management system, carry out business activities in accordance with international news television channel operating mode, improve its profitability, and form the economic basis for

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sustainable development.

The aim of the paper is to make the transnational business strategy proposals with the strategic management framework of SWOT (strength, weakness, opportunity, and threat). The reminder of the paper is organized as follows: Section 2 makes analysis on competitive environment, Section 3 evaluates the current competitiveness of CNC compared with other news media, and Section 4 makes development strategies proposals.

Analysis of Competitive Environment of CNC

Throughout the world media development trend, the world media structure and its management environment is occurring unprecedented adjustment and reform, which brought both huge challenges and new opportunities for newborn CNC international operations.

The Development of New Media Provides Broader Market Space for International Communication

The emergence of new media, which is represented by network media and hand-held terminal, brought about a great revolution to the global media industry, and it provides greater market space for International communication.

In the past two years, the most noticeable network media development is the rapid popularization of socialized media, including social network and micro blog. For example, in February 2004, Facebook was formally pushed forward, and it has more than 500 million active users by July 21, 2010 (Shejiao.com, 2010).

The cell phone is the most influential device of hand-held terminals. In recent years, the total amount of cell phone users is expanding rapidly. The main media phone features include: short messaging service (SMS), multimedia messaging service (MMS), mobile phone news, and mobile phone TV, etc., especially with the development and maturity of the mobile phone TV technology, mobile phone TV has more obvious influences on traditional TV because of its portability and timeliness.

The number of new media audiences is growing rapidly, it not only extend the influence of International communication, but also provide more market space for the International communication.

The Global Financial Crisis Change the Strength Contrast of the Chinese and the Foreign Media

Under the impact of the financial crisis, many western media management have been severally affected. In the U.S., for example, since 2008, 200 newspapers and 500 magazines have stopped publication, and several newspaper groups declared bankruptcy or filed for bankruptcy protection. Many famous International media have to resell to others because of their heavy losses, including the well-known “Business Week”. On August 2, 2011, the USA Harman International group bought this old brand for one dollar.

Since China has less financial crisis impact than the developed countries, and it has faster recovery speed than them, global financial crisis has smaller influence on Chinese media industry. As a result, Chinese media industry suffered slight impact. In other words, the financial crisis brought subtle change for the strength contrast between Chinese media and foreign media, which provides new opportunities to Chinese media to improve international business management ability.

The Fallen Cost of International Communication Operation Will Strengthen the Construction of Overseas Positions

In the new media era, people can send his message to every corner of the world by depending on modern communication techniques. In some places where have no reporters, the common people can also gather news

information. This will ensure news organizations have the first-hand reports when any place of the world produces major news. In western countries, where labor cost are expensive, free "citizen journalists" create amazing market value.

On the other hand, under the impact of financial crisis, developed countries experienced sever demand atrophy, commodity price decline, rising unemployment rate, which lead to consumption level and labor cost decrease. This situation is very good for the construction of international communications positions, especially good to overseas expansion of network communication, including construct additional overseas branches, absorb overseas collecting-and-categorizing talents, update technology systems and equipment, etc.

Development Space Become More Saturated

From Cable News Network [CNN] to CNC, the development of international television news has become saturated. At present, the well-known multinational news channel has amounted to more than 10. For a person who wanted to know the international news, the existing news channels are beyond the need. In some countries especially in English speaking countries like the U.S. and England, there are dozens of English TV channels can be chosen. From the market supply and demand aspect, it is a fact that supply has exceeded demand in news television channel market. Moreover, private TV channels leading by Chinese news have had a satisfied development, and it also add some pressure to CNC business.

Strict Industrial Regulation

The ideology characteristic of culture causes the wary of entry of Chinese media in some western countries who usually make invisible policy barriers to prevent and exclude Chinese media in quite long time. Even in the seemingly open media industry of USA, the government also makes many restrictions on the entry of foreign media. These ideological barriers have brought a lot of resistance on Chinese media's operations oversea.

Evaluation of Competitiveness of CNC

Establishment of Competitiveness Evaluation Indicator System

This research established news network media competitiveness evaluation system, based on the theory of comprehensive firm competitiveness and media firms' management (Pan, 2003; Zhang, 2011; Wu, 2009), following the principles of objectivity, feasibility, relativity, and comparability. It reflects the competitiveness of news network media in seven areas as below:

(1) Use of internationally accepted language (defined as A1), which determines the ability of the channel to make sounds in the world. The more the internationally accepted language is used, the higher the localization of the program is realized, the more capable the program is of meeting the different needs of different audiences, and the greater influence the program can achieve in the world.

(2) Coverage area of population and the number of countries and regions entered (defined as A2). In order to have a broad impact in the world, news network media must firstly ensure that the channel meet the audience around the world. The greater coverage the channel signal is made, the larger the number of the potential audience can be achieved, the higher the contact probability with audience becomes, and the higher is the likelihood of producing influence around the world.

(3) News premier (defined as A3), the function of news programs lies in the role of information dissemination and directing public opinion, the greater the amount of news is broadcasted firstly, the more obvious the first-move advantage the news media can achieve, the stronger the first effect of media is realized.

(4) The ratio of news programs accounted for in to the all programs of the channel (defined as A4), which measures the news productivity of media.

(5) Brand programs (defined as A5) and number of famous presenters (defined as A6), The channel brand effects in terms of the number of brand programs and the number of famous presenters play great role in establishing the channel's international image and enhancing the channel's influence in the world.

(6) Profitability (defined as A7), which measures the financial resources of news network media.

Evaluation Method and Evaluation Results

"Delphi method" is a structured communication technique, originally developed as a systematic, interactive market research method which relies on a panel of experts. The maximum score for each indicator in the overall evaluation system is set to be 5 and the minimum score is 1. The "Delphi method" is used to determine the weight coefficient of each indicator. Choosing seven news channel as research sample including three commercial channels and four public channels, we use the "Delphi method" to obtain the score value of each indicator, and calculate the weighted average score of seven news channels. The weights of each indicator and the evaluation results are shown in Table 1.

Table 1

Evaluation Results of Competitiveness of World Main News Media

Classification of channel	Ranking	Name of channel	Weighted average score	Weights (%)						
				A1 (20)	A2 (20)	A3 (15)	A4 (10)	A5 (15)	A6 (10)	A7 (10)
Commercial	1	CNN	4.55	5	5	4	5	3	5	5
	2	BBC World News	3.05	4	3	2	4	3	4	1
	3	Phoenix Satellite Info-news Channel	2.05	0.5	1	2	5	3	4	1
Public	1	Deutsche Welle	2.75	4.5	3	3	4	2	1	-
	2	France 24	2.5	4	3	2	4	2	1	-
	3	Russia Today	2.4	4	1	4	4	2	1	-
	4	NHK News	2.3	3.5	2	2	3	2	3	-
	5	Jazeera Network	2.25	3.5	1	4	5	1	1	-
	6	CNC	2.15	3.5	1	4	5	1	0	-

From the evaluation results in Table 1, it can be concluded the following points:

(1) Compared with world-leading news media network, the main weakness of CNS lies in the following four areas: firstly, the current coverage area of population is rather narrow and the number of countries and regions the CNC has already entered into is quite limited; secondly, the CNC's ability to produce brand program is weak; thirdly, CNC has shortage of famous presenters, which leads to its low brand effects; fourthly, the lack of profitability cause the CNC's low financial resource available.

(2) The main strength of CNC is its focus on news production, which will constitutes its core competitiveness.

Transnational Business Operation Strategy Suggestion of CNC

From the above competitive environment analysis and competitiveness evaluation of CNC, the SWOT analysis can be arranged in Table 2.

Based on the strategic management framework of SWOT, the transnational business development strategy is proposed as follows:

Table 2

SWOT Analysis of CNC

Strength (S)	(1) Use of internationally accepted language; (2) Ratio of news programs accounted for in to the all programs of the channel; (3) The ability to broadcast news firstly.
Weakness (W)	(1) Narrow coverage area of population and limited number of countries entered into; (2) Short of brand program; (3) Short of famous presenters; (4) Lack of profitability.
Opportunity (O)	(1) Development of new media; (2) Global financial crisis change the strength contrast of the Chinese and the foreign media; (3) Fallen cost of international communication operation will strengthen the construction of overseas positions.
Threats (T)	(1) Saturated development space; (2) Strict market entry regulation.

Use Various Foreign Channel Landing Modes to Expand the Coverage Area of CNC

In short term, in order to strengthen its advantage in news production, considering the saturated market with strict industrial regulation, it is necessary for CNC to modify its weakness of narrow coverage area of population and limited number of countries entered into. This requires CNC flexibly using various kinds of channels landing modes to enter the foreign market.

Channel lease. In this mode, CNC makes channel lease agreements with foreign channel owner. Under the agreement, CNC pays rent to foreign channel lesser; in return, all CNC programs are permitted to play on this foreign channel, and the foreign channel ownership shall not spot any content except "disaster emergency radio" and "propaganda on their own platform". Such landing mode requires low cost and ensures the quick entry into these foreign markets.

Copyright sell or subscription-sharing. In this mode, CNC provides programs to foreign operators. Foreign operators can place commercial advertisement at interval in CNC channel in the constraints of contract, and in return, the foreign operators are required to pay royalties or subscriptions fees to CNC party.

The benefit of this model is that foreign operators must increase efforts to promote the CNC in order to make money; the difficulty of this model lies in the operation process. CNC should make suitable contract to restrain the foreign operator's spot content. Not only must the advertisement inserted by foreign operators be in comply with local laws, but also do not harm the interests of the People's Republic of China. At the same time, the duration of advertisement inserted need be fixed, generally no more than 12 seconds every hour. In addition, this mode requires little sunk cost and the exposure of risk is low, but it is feasible on the condition that the CNC's programs seem to attract the audience in foreign target market.

Resource exchange. In this operating mode, the two parties, CNC and foreign channel operators, swap and use resource between each other freely, CNC provides programs without accepting a royalty fee, and foreign channel owners provide broadcasting channel without demanding channel fee; the CNC program is broadcast on the channel throughout the day, but only provide the equipment to the foreign operators which are used to receive satellite signals, and equipment property is owned by CNC. While CNC must make commitment that it not interfere the foreign party's way to promote CNC, it is necessary to ask the foreign side to put CNC into basic package rather than into charge bags.

Establishment of cooperative set. This mode means that CNC has entered local transmission platform by setting cooperation set with local partner. Under this mode, CNC require its partner to play CNC programs in their channel, should fix the duration of program, and should not interfere with the integrity of CNC program. Cooperate partner can replace CNC's add-in advertisements, but no more than 12s/hr. Also, CNC has the final adjudication about the content of advertisements. The profit sharing is limited to CNC local profits.

Direct purchase channel. With the suitable conditions, CNC can purchase directly the foreign channel. The advantage of this model is obvious: such ownership of foreign channel can definitely form valuable assets in the long-run. CNC has larger decision power in the operation of their programs in foreign target markets. When CNC changes another broadcasting platform in the future, it can resale this channel signal or rent to the third party, so this mode has some flexibility. The difficulties of this model are the high threshold for market access and high operating costs. It applies only to countries with higher market value for development, as well as the important target country.

Build Its Brand Effects Across the World

In long term, in order to achieve core sustainable competitiveness, CNC must cultivate and strength its brand effects across the world in terms of production of brand programs and fostering the famous presenters. Both the cultivation of brand programs and fostering presenters require the large investment of money and the high technology resources. As a result, the CNC should accelerate its restructuring pace into corporation and operate on the rule of market system with the aim of profit maximization. Only with quality of legalized corporation and strong profitability, can CNC have financial resources available for enhancing brand effects.

Build New Technology Experience Across the World

In order to seize the opportunity of the development of new media, it is also urgent for CNC to accumulate the new media experience. CNC can make more breakthrough in the use of new media channels to expand the global spread, for example, adding interactive functionalities of blog or micro blog in the internet news channel or mobile phone news channel, making jointly product research and launch on innovative product terminals like Apple with world terminal producers, etc.

Conclusions

The establishment of China Xinhua News Network Co. Ltd. [CNC] is of greatest strategic implication. Based on the analysis of CNC's competitive environment, the paper explored the opportunity and threat. On one hand, the major three opportunities lie in the development of new media, the strength building compared with foreign counterpart in the global financial crisis, and also the falling international communication cost. On the other hand, saturated development space and strict market entry restriction constitute two major opportunities.

Based on Delphi method, the paper evaluated the news TV competitiveness of CNC compared with world main news network media. It is found out that the main strength of CNC is its focus on news production, which will constitutes its core competitiveness. And for the weaknesses, they lie in the narrow coverage, lack of brand, and also short of profitability.

Based on the strategic management framework of SWOT, the paper proposed the developmental strategies of transnational business operation for CNC from the coverage expanding, brand effect enhancement and new technology experience building.

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The Information Risk in the Latest Crisis: A Driver or a Driven Factor for Global Financial Markets Equilibrium?

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The latest financial crisis has been impressive for strength, impact, duration, and reduced efficacy of the economic and financial policies adopted by the authorities. We use an original information risk model to contribute to the analysis of the crisis and to suggest some approaches for a possible early diagnosis. Using data referred to the three main financial markets and comparing the latest crisis with the previous one and with long-term quantitative evidence, we find out that the 2007-2009 crisis was very different in the information risk quality. That gap affected the market risk aversion and its equilibrium, reducing the efficacy of the authorities' intervention tools mainly based on payoff risk control and efficient market restoration. Since information risk is an endogenous element of the market dynamics that can be independent form contingent levels of market efficiency. Drivers of information risk in the European Markets differed strongly from the US and Japanese ones; that is why some global decisions had low impact while opportunities of local intervention were missed.

Keywords: financial crisis, information asymmetries, risk premium

Introduction

The economic system is recovering from one of the most intense and contagious crisis. Empirical evidence is showing an increase in the crisis frequency; that phenomena can be dangerous for a harmonic development. Several authors challenged to explain the crisis; some of them suggested very interesting approaches, but none of them was able to fully explain the latest, since a "grey fog" still seems to protect a clear sight. For sure, the dynamics and the topics of the latest crisis were very specific: Problems seemed to arise from financial markets (instead of from real ones); several tools widely used in the previous crisis seemed to be useless (even dropping more the crisis); the recovery timing seems to be infinite for several economies. Economic behavior is not reacting in the expected mode, so many authorities can be perceived powerless.

Trying to complete the puzzle, we suggest to take a look at the impact of information over the crisis. We suppose that bad information may force the risk aversion of investors and, in that way, change the mechanics of the transmission tools insight the economies. The final result can be a market equilibrium system that is far away from that suggested by the orthodox theory; thus, reducing the power of weapons to be used by policy makers. Our proposal is to use the information risk framework to complete the detection of the financial crisis. Should information have difficulties in spreading into the economic system, agents may act on biased expectations on risk; the final result is an artificial forcing of their risk aversion that does impact over the market price of risk.

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Based on our previous studies (Mantovani, 2008; Mantovani & Bertinetti, 2010, Bagnoli & Mantovani, 2009; Mantovani, 2010), we propose to unbundle risk into payoff risk and information risk (Allen & Gale, 1994). For any level of market efficiency, information risk may arise from: (1) the timing of the information spreading in the market (i.e., risk of information timing); (2) a bias in risk-return estimations (i.e., risk of information error); and (3) the ways of information transmission to the market (i.e., risk of financial communication). The three sources of information risk originate both at systematic and idiosyncratic level, defining by this way six information-risk-classes (Bertinetti, Mantovani, Salvi, & Rosto, 2004). A basic model of proxy estimation of information risk premium at systematic and idiosyncratic level has been developed (Mantovani, 2004) and tested referring to several firm-specific facts (Bertinetti, Mantovani, & Salvi, 2004; Mantovani, 2004) or to discover a possible pricing model of information risk premium. Links between information risk and risk aversion have been identified in a behavioral finance framework (Gardenal, 2007).

Investment policies are mainly based on original ways of dealing asset classes; if information-risk is a economic relevant element, they could be conducted even using risk as a determinant of the asset classes and building up profitable alternative investment rules dealing with risk classes and related risk aversions. Is it possible to generate positive performance by managing assets through rules manipulating the information risk premium? This is the research question that the proposed paper will focus on and try to investigate possible drivers of the information risk to be used to fix an information-risk-premium model in the future.

We act by estimating and comparing the information risk components during the latest crisis (2007-2009) and the previous one (2000-2003) along with the long-term information risk level for the three main financial markets (Europe, USA, and Japan) along with their industries. And find out that information risk may actually contribute to explain the crisis and, maybe, prevent the coming ones reducing their frequency.

The paper is deployed as follows: Section 2 reports literature referring to markets efficiency and information risk premium modeling. In Section 3, the model is applied to a wide range of data from the three main financial markets (i.e., Europe, USA, and Japan), in order to have data about the information risk during the crisis along with a long-term benchmark. In Sections 4 and 5, results about the levels of information risk are discussed, particularly for impact over asset allocation choices and industry rotation of investments. Section 6 shows some concluding remarks.

Literature Review and the Information Risk Framework

Market equilibriums are based on expectation. Higher quantity of information generates higher quality of expectation making financial markets a good instrument to allocate capital allowances. In standard financial market models, the inner problem is concerned with the quantity of information that is incorporated in asset prices given a certain set of existing information. Another very important subject is the quantity of traders having information at their disposal, thus defining information asymmetries. Fully efficient markets exist when the entire set of information is considered in price setting, so that information gets available for any trader. Several degrees of efficiency can be found at empirical level according to the kind of information that is actually included in asset prices: Weak forms are found in the case of historical-only information is considered; semi-strong forms are in the case of partial information inclusion; strong forms can be found in the case of entire set included.

From the seminal work of Fama (1970) stating the above framework for market efficiency analysis, several studies try to verify both the levels of efficiency that can be achieved in real markets and the conditions

for markets to reach higher efficiency. Studying degrees of efficiency are of interest for regulators aiming to protect market investors, while deeper knowledge of markets dynamics between different states of efficiency can help market traders to gain excess-return, both in long and short term.

De Bondt and Thaler (1985) suggested that stock markets tend to have endogenous overreaction, so that historical level of excess return may infer about price trends in future times. This being the case a "contrarian strategy" may generate positive extra-returns (Alphas) for investors. Jointing this approach with Fama, one would be like to sustain that efficiency is weak as far as time correlation of extra-return is concerned while efficiency may be higher at a static time.

Fama and French (1988a, 1988b) suggested that stock returns are mean reverting, at least in a long term, so that a stable Security Market Line (according to Capital Asset Pricing Model) can be found. Lo and MacKinlay (1988) suggested alternatives to random walk approach in terms of auto-correlated price path that can be used for gaining excess return.

Other authors try to study market efficiency related to specific classes of information getting available for the market. Basu (1977) showed the anomalies that can be generated by Price-to-Earning ratio: Companies with lower P/E tend to generate higher return for the investors. Contrarian evidence is shown in Fama and French (1992) that fix the Cross-section of the Expected Stock Return suggesting a positive relationship between returns and P/E ratios. Asquith and Mullins (1986) and Masulis and Korwar (1986) offered indication in the case of equity issues; in this case, equity issuing signals to the market a possible information asymmetry so that the market drop in prices.

Some technical explanation may support the actual degree of market efficiency too. Lakonishok and Smitd (1988) gave evidence of the relationship between seasonal effect and excess-return that are well known by market timers. De Long, Shleifer, Summers, and Waldmann (1990) showed evidence that persistence in price gaps versus their fundamental values can be explained in terms of trade-off between costs and profit arising from market transaction.

In latest analysis, the research interest has focused more on the availability of the entire information-set and on the quality of information that can be available to traders. Efficiency is no more a simple "state of the market" but gets more and more a "quality of the market". Fama (1991) showed that biases in return estimation due to incorrect (use of a) model may generate market inefficiency in terms of self-correlation of prices and signaling information arising from Price-to-Earning and Price-to-Book value ratios. In our opinion, this Fama's work is as seminal as the 1970s one, since it is fixing the problem referring to the process by which information is processed inside the markets: The same hypothesis we will start from. Still, Fama (1998) tried to find a possible explanation to market inefficiency in terms of behavioral components that are anyway found to be casualty in over/under reaction and, again, biases in estimations. The same logical framework are Diether, Malloy, and Scherbina (2002), stating that wide differences in analyst opinion can source lower return. Bertinetti et al. (2004) demonstrated the existence of an information risk in financial markets due to sub-optimal standards in information spreading into the market that may generate over-volatility. They suggested that financial communication may generate contingent state of inefficiency and that governance models adopted may modify the impact of the information risk to market equilibrium.

We move from the idea that information is a dynamic component of the market that may affect market equilibrium independently from the efficiency status of the market. Extra-volatility can be either an indication of low-efficient market, or the suggestion that markets are moving toward a new long-term equilibrium. Our

research question is to infer about the determinants of the information risk in order to support a model for fixing an information risk premium, if any.

In standard Capital Asset Pricing Model, residuals in return have zero expected value. In our approach, we suggest that residuals should be split into two parts, the former having zero expected value (Fama's orthodox-1970 approach to market efficiency) while the latter having expected value that can differ from zero that can be explained by the drivers of the economic value of information (Fama's new post-1991 approach to efficiency).

Focusing on the financial effects of better information circulation, we may find a couple of possible explication of cost of capital reduction (Healy & Palepu, 2001). The former is due to the increase of liquidity of the security, thus reducing the equity cost of capital by an increase in the demand of the security (Diamond & Verrecchia, 1991) and a reduction in the expected value of losses due to transaction against informed traders (Easley & O'Hara, 2004). The reduction of transaction costs might also affect the bid-ask spread in security trading (Amihud & Mendelson, 1986). Some authors strike out a possible positive relationship among voluntary disclosure, information asymmetries, and equity cost of capital (Kim & Verrecchia, 1994; Zhang, 2001), even if several empirical evidences support a negative correlation (Welker, 1995; Coller & Yohn, 1997; Healy, Hutton, & Palepu, 1999; Leuz & Verrecchia, 2000; Heflin, Shaw, & Wild, 2005; Brown & Hillegeist, 2007). Not all the empirical researches seem to be consistent (Francis, 2008). The latter, is connected to the assumption that when the disclosure is imperfect, investors are charged with a further information risk due to wider uncertainty in expectations concerning payoffs. If this kind of risk is systematic (Barry & Brown, 1985; Handa & Linn, 1993; Coles, Loewenstein, & Suay, 1995), many investors will require a further return to bear such a risk; more recently (Mantovani, 2008) information risk premium link to firm-specific risk has been discovered. In fact, there seems to be no full consensus about the effective possibility to diversify the information risk (Clarkson, Guedes, & Thompson, 1996) and how disclosure might reduce it, having redundant evidence about this (Botosan, 2006). Some authors showed a significant relationship only in the case of securities generating low interest for analyst (Botosan, 1997) or corporation carrying on aggressive accounting strategies (Gietzmann & Ireland, 2005), or carrying on *disclosure* strategies only through the annual report (Botosan & Plumblee, 2002).

For sure, results from empirical evidence might be connected to the choices made by researchers for measuring disclosure: Self-made ratios can overweight some subjects according to the researcher point of view, while independent index (such as the AIMR one) may be inefficient to describe the specific problem to be investigated. Healy and Palepu (2001) supported the use of self-made ratios because of their better support to a specific disclosure investigation, but they strike out the higher costs of their computation in terms of reduces samples that can be analyzed. That is why several research based on self-made ratios do not attribute relative weight to the importance of specific items (Ahmed & Courtis, 1999). In our opinion, the real problem is connected to the choice of only measuring the level of disclosure, thus making the hypothesis that quality and quantity of disclosure will be strongly related (Botosan, 1997). We suggest, instead, a disclosure index will not be able to consider all the relationships between the different components of the items to be communicated, just like the strategy of disclosure should suggest to corporations. Thus, we support the idea of reject the mere quantitative approach to adopt a more systemic one (Drazin & Van de Ven, 1985) or a configurative one (Meyer, Tsui, & Hinings, 1993) as usually done in the analysis of strategies of production, organization and competition (Dess, Newport, & Rasheed, 1993; Miller, 1986; Milgrom & Roberts, 1995), just like a paper of Chavent, Ding, Fu, Stolowy, and Wang (2006) proposed.

Referring now to the measurement of information risk, we must first distinguish between risk existence and the effective impact, it may have on the financial markets equilibrium (so, the existence of an actual information risk premium). This separation is required in order to find an economic support to the choices in terms of disclosures; in fact, as a paradox, in a world without information risk premium, no economic incentive would exists to carry on strategies of voluntary disclosure. The question is still more complicated from the necessity to standardize the information flows to the investors (thus increasing the information efficiency of the markets) against the possibility that highly standardized information flows can impede to diffuse very specific pieces of information, particularly those connected to the competitive advantage of the corporation (thus impacting on the value creation process). That is why it is technically possible that an increase in the quantity of information could reduce its quality and, in that way, the appetite for a specific investment. Allen and Gale (1994) proposed to split the total risk of an investment into two components: The "payoff risk", representing the actual risk embedded in cash flows and the "information risk" being it the gap between the risks perceived from investors and the payoff one. The actual investment behavior will be based on the sum of the two risks and, in this way, the actual level of the prices of the securities. Bertinetti et al. (2004) tried to analyze the possible sources of information risk and found out that some of them are endogenous to the financial markets so are of systematic source. Two classes of systematic information risk have been identified: (1) Those generated by the information timing (i.e., connected to the natural quantity of time required to widespread information into the markets); (2) those generated by the so called "information error" (i.e., related to biases in perception of risk due to the application of specific techniques). A third possible source of information risk may be the financial communication processes (Bertinetti, 2006) mainly connected to the firm-specific part of it.

Based on Bertinetti et al. (2004), Mantovani (2004) proposed an original methodology to indentify some proxies of the information risk that entitle to distinguish between systematic and firm specific components of it. The methodology is based on the idea that in financial markets evolving toward efficiency (even in a weak form), the information risk can be proxy by the spread existing between long-term and short-term volatility of stock returns. In fact, investors will choose investments on the base of biased short-term volatility while the action of the information traders will contribute to widespread information inside the market (Grossman & Stigliz, 1980), thus fixing the volatility to the long-term value (i.e., to the payoff risk only). The wider is the time window used to compute the short-term volatility the lower will be the gap between long-term and short-term computation. Bertinetti et al. (2004) tried to test the model by detecting the information risk premium in special events in the financial markets such as the sale of newly issued shares, comparing the experience in different European Countries (Italy, France, and Spain); relevant results were found, thus trusting the methodology. Gardenal (2007) tried to detect the connections between the information risk and the risk aversion of investors in a behavioral finance context, while Mantovani (2008) proposed a very long-term analysis (15 years) for the information risk to find out the possible drivers of an information risk premium model.

Suppose a security having an initial price at 100 and an actual annual return at 10% (0.042% daily expected return). Considering a three month of analysis (66 trading days) and supposing that the security will not pay dividends during that period, we can expect the price at the end of the period to be 102.7791. In case of no new information, the relationship between time and price will be linear, so that daily return for investors will be effectively 0.042% and their standard deviation will be 0% (this naive world is suggest only to benchmark what will actually happen in real terms).

Consider now the case where after 33 trading days, a piece of information is available and immediately

incorporated in the market prices, generating an abnormal return at 6% (this abnormal return is due to the payoff risk according to Allen and Gale, 1994). The problem is how this new information will widespread into the market. According to an orthodox approach (i.e., in case of no information risk), the impact over price will be immediate, thus observing a 6% price-jump only on day 33. The final price on day 66 will be fixed in 108.9433; daily average return will grow up to 0.1345% (from 0.042%) showing a 0.0923% increase due to the abnormal return. Figure 1 below shows the price path.

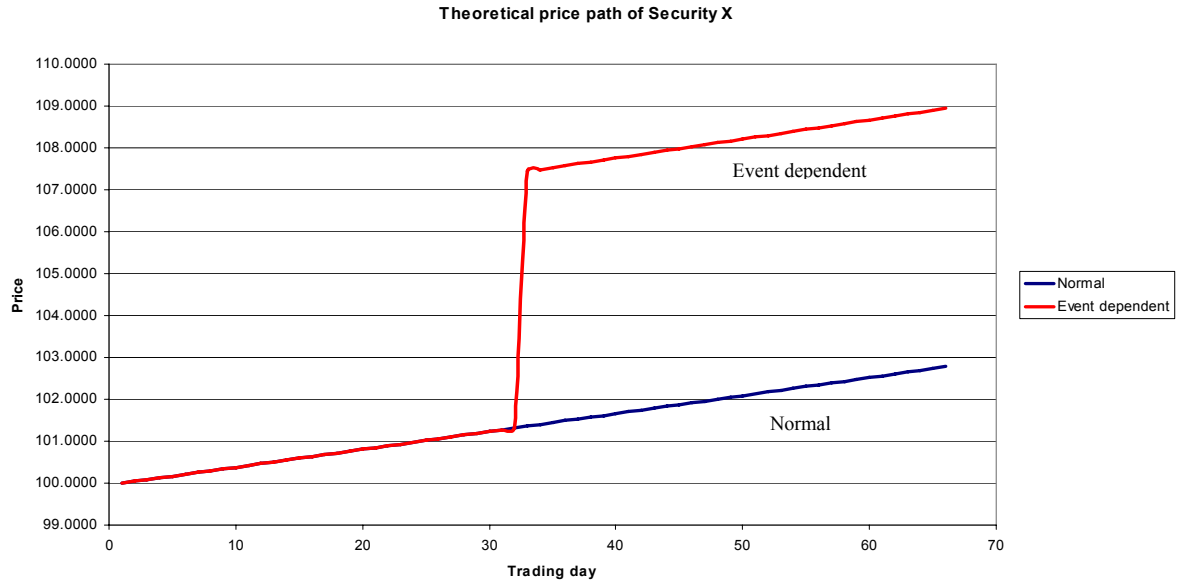

Figure 1. Theoretical price path of Security X. Source: Mantovani (2008).

The daily standard deviation of returns will grow from zero to 0.7385%, even if you have to strike out that its level during the 32 trading days before and after the new information diffusion will still be at zero level (since daily return will converge to the average level 0.042%). The impact of the abnormal return and risk over the average risk will be diluted, approaching zero.

No jumps will be observed in real financial markets. The actual price path will evolve between a floor level determined at the "no information" path and the "fully received information" cap. Timing and dynamics of prices will be more volatile and anticipated according to the actual level of market efficiency (Bertinetti et al., 2004, in the case on sales of newly issued shares). The action of information traders, of stock pickers, and market timers could further increase the actual volatility because of the overreaction they generate. In the particularly price path showed in Figure 2, the standard deviation of daily return will increase up-to 1.2463%; such a figure could be reduced next-to-zero in case of wider time horizon of computation, as explained in the previous example.

As shown in Table 1, 1.2463% standard deviation can be thus split into three blocks: (1) Basis volatility, 0% in the example; (2) 0.7385% volatility due to specific information about the corporation; and (3) 0.5078% volatility (1.2463%-0.7385%) due to the market mechanism, thus generated by a systematic information risk. Similarly, even the average daily return increase from 0.042% to 0.1345% in case of jump in prices, and to higher level more in case of different paths. The existence of a systematic source of risk let us conclude that special return will be expected (Mantovani, 2008), while the actual dimension of the risk premium will be dependent from the actual level or risk aversion (Gardenal, 2007).

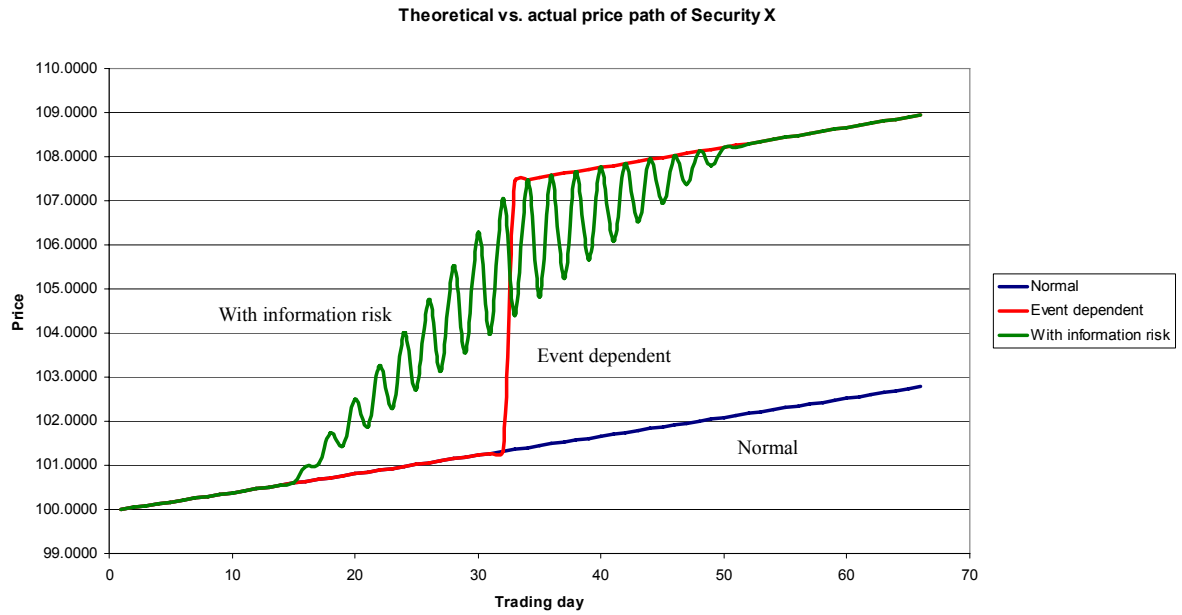

Figure 2. Theoretical vs. actual price path of Security X. Source: Mantovani (2008).

Table 1

Summary of the Example Data

	No information case (%)	Information case with fully efficient markets (%)	Information case with information risk (%)
Average daily return	0.0422	0.1345	0.1396
Abnormal return	0.0000	0.0923	0.0974
New-information-driven	0.0000	0.0923	0.0923
Info-risk-driven	0.0000	0.0000	0.0051 (for 66 days)
Standard deviation			
Daily return of 66 days	0.0000	0.7385	1.2463
Daily return of 240 days	0.0000	0.3857	0.6487
Daily return of 480 days	0.0000	0.2739	0.4603
Daily return of $T \rightarrow \infty$	0.0000	0.0000	0.0000
Abnormal 66-days volatility			
New-information-driven	n.r.	0.7385	0.7385
Info-risk-driven	n.r.	0.0000	0.5078

According to the above example, we may conclude that the information risk:

(1) Is not simply linked to the "quantity of information" diffused to investors (if information cannot be elaborated the acknowledge does not increase) but also by their "quality";

(2) Must be split into two parts: The systematic one, due to the mechanism that in a concrete way the market use to process information (both quantity and quality); and the firm-specific one, strictly connected to the disclosure strategies adopted by corporations.

The Model, the Sample Selection, and the Methodology

To estimate the information risk proxies we use the original model of the authors (Mantovani, 2010). In fully efficient financial markets, new information is immediately incorporated in securities prices. Prices (P) are fixed as the present value of expected cash-flows for investor at any time-t [$E(CF_t)$], to be computed

according to the expected risk adjusted rate of return for the investment (k) as detailed in Equation (1). The impact of new information may arise from both items (i.e., CF_t and "k"), at least at the theoretical concept, thus affecting price levels and their volatility.

$$P = \sum \frac{E(CF_t)}{(1+k)^t} \tag{1}$$

At empirical level, we can observe discrete price paths so that any jump reflects new pieces of information that are available to the market. According to Equation (1), the "new-information-generated-jumps" (IGJ) could be divided into the flow-driven ones (i.e., those arising from information that does impact on the expected level of cash-flows) and the risk-driven ones (i.e., those arising from information that does impact the expected level of risk embedded in the expected level of cash flows).

Any jump at time-t generates an over(excess)-return [OrT = (IGJ)/P] for the investor, so that the total short-term return ("r") from the investment will differ from the equilibrium level (k) stated in models such as the CAPM or the APT.

$$r = k + OrT \tag{2}$$

$$k = R_f + \beta \times ERP \tag{3}$$

where:

k = expected return for the investments;

R_f = relevant risk free rate;

β = beta of the investment;

ERP = relevant equity risk premium.

Substituting Equation (3) into Equation (2), we can find an equation for the total return at time-t as the following:

$$r_t = R_f + \beta \times ERP + OrT \tag{4}$$

At this point, it is of inner importance to keep in mind that r_t contains necessary return to pay the information risk premium. So, actual level of r_t estimated in terms of total return from the investment are the basis to make an estimation of the risk premium. In the case of the price (P) being a return index, the equation for the ex-post return at time-t will be:

$$r_t = \frac{P_t - P_{t\text{-}1}}{P_{t\text{-}1}} \tag{5}$$

In the case of the price not being a return index, the Equation (5) has to be completed adding the current yield component, being it either a dividend or coupon yield.

Empirically measured levels of "r" using Equation (5) and their volatility can help us to infer about the total investment risk, only if the average impact of OrT is negligible (i.e., next to zero) for the time horizon of the analysis. If this should be the case, covariance between "r" and the market-portfolio-r will perfectly track the level of β of the investment, thus let us inferring the market measure of risks for any investment. But when OrT does impact over "r" and its volatility, we can deduce that new drivers of the price jumps (IGJ) must be added to those linked to flows and risks as included in Equation (1): we define this as "information risk".

Information risk (IR) is generated by the market difficulties to intercept the correct levels of the expected cash flows and risks, thus generating an adjustment path of prices toward their fair level at stabilized expectations. After an information spreading, each time the market gets aware of over(under)-estimates a price

jump will arise; but the jump itself is a new piece of information to be used by market traders until the estimations will not be assessed to the fair values, thus preparing a new jump.

The relevance of IR should be time sensitive, since the ratio between the number of jumps driven by IR and the total number of jumps is decreasing while the number of observed *OrT* is increasing. *OrT* impact over the average level of observed-r_t is then time dependent: the longer is the time horizon "*T*" of the analysis, the lower is the impact.

According to this framework, we define a proxy of IR by calculating the standard deviation of "*r*", as defined in Equation (5), over two time horizons series: *LT*, the wider range, and *ST*, the narrower. Here are the equations:

$$\sigma LT = \sqrt{\sum_{t=1}^{1+LT} \frac{(r_t - \overline{r}_t)^2}{LT}} \tag{6}$$

$$\sigma ST = \sqrt{\sum_{t=1}^{1+ST} \frac{(r_t - \overline{r}_t)^2}{ST}} \tag{7}$$

Subtracting Equation (6) from (7), we fix a possible measure of the comprehensive (total) information risk (TIR):

$$TIR = \sigma ST - \sigma LT \tag{8}$$

We have previously mentioned the double nature of IR:

(1) At systematic level, IR (SIR) is generated by a structural lack of capability of the financial market in processing information, usually generated from a lack of information or lack of spreading mechanism;

(2) At idiosyncratic level, IR (DIR) is generated by inefficient standards of financial communication between specific groups of market actors thus increasing biases in risk-return assessments and useless trading volumes.

To separate (inside TIR) the idiosyncratic part (DIR) we are required to fix a proxy-measure for the systematic part, or the information risk (SIR). First, we require to compute the beta (β) of the stream of specific-investment-"*r*", as defined in Equation (5), against the stream of market-return (r_m). Such computation will still have to be done over two time horizons: *LT*, the wider range and *ST*, the narrower.

$$\beta LT = \frac{\mathrm{cov}_{t=LT}(r_t; r_m)}{\mathrm{var}_{t=LT}(r_m)} \tag{9}$$

$$\beta ST = \frac{\mathrm{cov}_{t=ST}(r_t; r_m)}{\mathrm{var}_{t=ST}(r_m)} \tag{10}$$

In order to have a measure expressed in the same unit of TIR, we can use the following equations to split the standard deviation of return r_t. The variance of the return for a specific asset can be divided as follows:

$$\mathrm{var}(r_t) = \beta^2 \, \mathrm{var}(r_m) + \varepsilon^2$$

Similarly, the standard deviation can be split as follows:

$$\sigma(r_t) = \beta \times \sigma(r_m) + \delta \tag{11}$$

Using Equation (11), we can identify: the systematic part of the risk of r_t as:

$$\gamma = \beta \times \sigma(r_m) \tag{12}$$

the non-systematic part of the risk embedded in r_t can be computed as difference:

$$\delta = \sigma(r_t) - \gamma \tag{13}$$

We can compute γ and δ over the longer time horizon (*LT*):

$$\gamma LT = \beta LT \times \sigma LT(r_m) \tag{14}$$

$$\delta LT = \sigma LT(r_t) - \gamma LT \tag{15}$$

and the shorter one (*ST*):

$$\gamma ST = \beta ST \times \sigma ST(r_m) \tag{16}$$

$$\delta ST = \sigma ST(r_t) - \gamma ST \tag{17}$$

Subtracting Equation (14) from (16), we compute a possible measure of the systematic part of the information risk:

$$SIR = \gamma ST - \gamma LT \tag{18}$$

And the investment specific part:

$$DIR = TIR - SIR \tag{19}$$

According to Mantovani and Bertinetti (2010), we will use as shorter term a week (five-trading-days) and as longer term six month (150 trading days), since such a periods are those producing affordable results. We investigate the information risk levels in three markets: USA, Europe, and Japan. The dataset was defined updating data already used in our previous studies (Mantovani, 2008; Mantovani & Bertinetti, 2010; Bagnoli & Mantovani, 2009, Mantovani, 2010).

Data have been taken from the Thompson-Datastream database and refers to:

(1) Europe, to the Dow Jones EuroStoxx (return) index, along with 18 industries indexes;

(2) USA, to the S&P 500 (return) index, along with 118 industries indexes;

(3) Japan, to the TOPIX (return) index, along with 33 industries indexes.

The time length of the data set starts on January 1, 1992 ending on December 31, 2009. We applied the previously exposed methodology (Mantovani, 2010) to compute proxies of the information risk both at market and industry levels. Differing from previous analysis we computed data for all industries composing the three market indexes and compared them.

Daily returns of the 19 time-series have been computed. Referring to Equation (5), these are the analytics actually used:

$$r_t = \frac{P_{5+t} - P_t}{P_t} \tag{5*}$$

All computations have been done in an ex-ante context. The hypothesis of a fully efficient market that underlines computations will allow us to better proxy the IR with the above explained model.

A similar approach has been used to estimate a long-term (*LT* = 150 observations) and a short-term (*ST* = 5 observations) standard deviation of returns. Referring to Equations (6) and (7), these are the analytics actually used:

$$\sigma LT = \sqrt{\sum_{t=1}^{1+150} \frac{(r_t - \bar{r}_t)^2}{150}} \tag{6*}$$

$$\sigma ST = \sqrt{\sum_{t=1}^{1+5} \frac{(r_t - \bar{r}_t)^2}{5}} \tag{7*}$$

Computations range for Equation (6*) has been possible for any trading day having at least 151 observations after T: the last σLT computed is reported for May 4, 2009. Computation range for Equation (7*) is between January, 1992 and November 23, 2009. We used data from both time series up to March 31, 2009 according to the reported sentiment of a consolidated recovery of stocks exchanges indicated by the main analysts.

Again, the same approach was used to estimate a long-term (LT = 150 observations) and a short-term (ST = 5 observations) beta of returns for all the above indicated industry indexes. We have to refer to Equations (9) and (10), so that these are the analytics actually used:

$$\beta LT = \frac{\mathrm{cov}_{t=150}(r_t; r_m)}{\mathrm{var}_{t=150}(r_m)} \tag{9*}$$

$$\beta ST = \frac{\mathrm{cov}_{t=5}(r_t; r_m)}{\mathrm{var}_{t=5}(r_m)} \tag{10*}$$

Computation ranges for Equation (9*) are the same as for Equation (6*), while Equation (10*) are the same as for Equation (7*): From January, 1992 to March 30, 2009.

After the above exposed computations, a starting-up database was created considering the full time length (i.e., from 1-2, 1992 to 3-30, 2009)—contains 4,500 observations for any of the computed time series (18 + 1 for Europe, 118 + 1 for USA, 33 + 1 for Japan). Table 2 reports the average level of the usable data.

Table 2

Yearly Return and Risks in the Long Run

		Average return (%)	Payoff risk (%)	Total risk (%)	Beta-ST	Beta-LT
European Market						
DJE	Dow Jones EuroStoxx	10.82	10.22	17.72	1.0000	1.0000
1	Oil & gas	12.87	11.64	20.11	0.8088	0.7952
2	Technology	13.44	16.35	28.33	1.3502	1.3130
3	Automobiles & parts	13.47	14.42	26.48	1.1114	1.1424
4	Basis resources	13.46	13.61	24.86	0.9066	0.9664
5	Retail	9.01	10.27	18.07	0.8497	0.8002
6	Insurance	9.37	13.87	24.56	1.1562	1.1705
7	Food & beverage	10.54	9.13	15.96	0.6326	0.6058
8	Travel and leisure	8.67	12.78	22.82	0.8183	0.8842
9	Financial services	10.76	11.19	20.22	0.8656	0.9246
10	Personal & household goods	11.39	12.66	21.36	1.0785	1.0401
11	Media	7.46	12.08	21.17	0.9436	0.9505
12	Banks	11.27	11.92	21.21	1.0093	1.0309
13	Construction and materials	11.84	11.00	19.47	0.9188	0.9543
14	Industrial goods and services	14.70	11.35	20.29	0.9708	0.9990
15	Chemicals	17.65	11.65	20.43	0.8970	0.9223
16	Health care	14.58	11.64	19.24	0.7654	0.6420
17	Telecommunications	17.51	14.08	24.89	1.0875	1.1178
18	Utilities	13.51	9.82	17.40	0.7835	0.7993
US Market						
SPX	S&P 500	9.980	9.1808	15.3509	1.0000	1.0000
1	Advertising	10.478	16.1931	28.3429	0.9455	1.0560
2	Aerospace & defense	15.996	10.8289	19.0254	0.8363	0.8726

(Table 2 continued)

		Average return (%)	Payoff risk (%)	Total risk (%)	Beta-ST	Beta-LT
US Market						
3	Agricultural products	22.355	16.8593	28.6630	0.7071	0.7143
4	Air freight & couriers si	20.166	15.4564	26.4033	0.9250	1.0194
5	Airlines si	4.089	18.1630	30.7899	1.0613	1.1110
6	Aluminum	10.671	19.1136	33.2379	1.1140	1.1578
7	Apparel & accessories	7.917	13.8933	23.9933	0.9097	0.9209
8	Apparel retail	16.277	18.0520	30.9708	1.1025	1.1498
9	Application software	10.761	24.5301	42.5177	1.5098	1.5163
10	Auto parts & equip	9.308	13.7524	24.4916	1.0038	1.0548
11	Automobile manufacturers	11.516	19.6129	34.8867	1.1690	1.2965
12	Div banks	15.558	14.9832	25.6739	1.1573	1.1387
13	Biotechnology	26.100	18.7239	31.0437	1.1139	0.9643
14	Brewers	15.330	10.8804	17.8129	0.5069	0.4687
15	Broadcasting & cable TV	19.960	16.8354	28.7936	1.0852	1.1582
16	Building products	11.044	15.6871	27.5362	1.0411	1.0648
17	Casinos & gaming	30.878	20.9668	36.6990	1.0347	1.0905
18	Commercial printing	3.132	13.1993	24.0966	0.7873	0.8519
19	Computer & electr retail	22.535	22.0956	38.7757	1.3720	1.3794
20	Computer hware	20.574	15.6733	27.1445	1.1487	1.1976
21	Comp storage & peripherals	31.509	25.1942	42.1597	1.6667	1.6106
22	Construction & engineering	13.325	18.5912	32.8293	1.0250	1.1161
23	Construction & farm machine	23.080	15.5848	26.9243	1.1320	1.1815
24	Construction materials	8.812	18.3034	32.2826	1.1196	1.1821
25	Department stores	10.378	15.1492	26.0693	1.1025	1.0924
26	Distributors	8.234	11.4520	20.0300	0.9219	0.8950
27	Diversified chemicals	9.225	13.2331	22.9560	0.9610	0.9957
28	Div comm & prof serv	4.494	12.3645	21.7375	0.9479	0.9945
29	Div finsvs	-0.223	18.7375	32.5818	1.3358	1.3414
30	Diversified metals & mining	27.546	19.9441	34.9865	1.0772	1.1590
31	Drug retail	18.446	13.5669	22.8240	0.7764	0.7346
32	Electric utilities	6.409	9.2231	16.4470	0.5684	0.5192
33	Electrical comp & equip	15.864	12.6249	21.4255	1.0226	1.0490
34	Elec eq manuf.	15.910	18.5728	32.4627	1.3872	1.4178
35	HR & employment serv	8.071	22.0676	38.2466	1.6183	1.6930
36	Envr & facilities serv	3.821	15.3073	27.2070	0.7613	0.8737
37	Fertiliser & agri chemicals	68.848	20.2592	33.9185	1.0689	1.2149
38	Food distributors	13.682	12.0619	20.9915	0.6470	0.6378
39	Food retail	4.990	12.4908	21.6220	0.7121	0.7304
40	Footwear	20.894	16.6219	29.1267	0.8425	0.8639
41	Forest products	9.760	17.2238	29.1909	1.0509	1.0533
42	Gas utilities	12.551	11.8604	20.8354	0.7332	0.7554
43	General merch stores	19.038	15.6471	26.2395	1.0644	1.0272
44	Gold	14.821	21.0570	36.0048	0.2330	0.3041
45	H/care dist	12.831	15.2780	27.1588	0.8908	0.8656
46	Health care equip	14.553	11.8251	20.1684	0.8605	0.8687
47	Health care facilities	16.558	17.4188	31.9801	0.7755	0.8213
48	Health care supplies	13.088	13.7850	26.9088	0.6785	0.7397

(Table 2 continued)

		Average return (%)	Payoff risk (%)	Total risk (%)	Beta-ST	Beta-LT
US Market						
49	Home furnishings	6.688	15.4115	28.0552	0.9380	0.9829
50	Home improve retail	21.334	17.4879	29.7330	1.3064	1.2723
51	Homebuilding	20.169	21.6722	37.4173	1.5086	1.5406
52	Hotels	18.346	16.3138	28.3672	1.1693	1.2343
53	Household appliances	12.366	13.6199	24.3649	0.9708	1.0628
54	Household products	15.890	10.4331	17.5421	0.6648	0.5962
55	House wares & specialties	2.319	11.9277	21.3434	0.8555	0.8808
56	Industrial conglomerates	12.288	12.9148	22.1055	1.0254	1.0671
57	Industrial gases	21.542	14.4227	24.7001	0.9582	0.9866
58	Industrial machinery	15.766	11.8084	20.3187	0.9584	1.0082
59	Insurance brokers	9.693	12.9206	23.3846	0.8104	0.9139
60	Integrated oil & gas	15.951	11.6296	19.2302	0.7116	0.6893
61	Integrated telecom serv	5.858	11.8444	20.1984	0.8845	0.8513
62	Internet retail	58.125	21.5348	38.8748	1.3767	1.4765
63	Internet software & serv	31.688	27.3400	47.7645	1.6772	1.7568
64	IT cons & o/svs	13.654	20.1082	35.7342	1.0910	1.1930
65	Leisure products	9.213	13.9717	24.6345	0.8542	0.8936
66	Life & health ins	13.615	13.5808	23.9229	0.9808	1.0524
67	Managed health care	19.250	17.5415	31.5671	0.7622	0.8196
68	Metal & glass cont	6.487	14.2786	25.0307	0.8346	0.8561
69	Motorcycle manufacturers	9.286	20.3900	35.8808	1.1638	1.2489
70	Movies & entertainment	10.845	15.1084	25.4160	1.1431	1.1647
71	Multi-line insurance	7.511	16.3138	28.6038	1.1498	1.2055
72	Multi utilities	-12.389	16.6001	30.1183	0.8762	1.0216
73	Office electronics	-1.740	22.9979	41.0035	1.0710	1.2383
74	Office serv & supplies	8.892	11.9856	20.7392	0.8926	0.8819
75	Oil & gas drilling	28.149	22.4505	37.6763	0.9763	0.9889
76	Oil & gas equip & serv	19.851	19.1813	31.7580	0.9192	0.9230
77	Oil & gas explor & prod	16.542	17.1121	28.6580	0.8211	0.8281
78	Oil & gas refing & mark	12.516	16.6043	28.8609	0.8204	0.9206
79	Packaged foods	8.431	8.3722	14.4391	0.6219	0.5745
80	Paper packaging	6.594	14.0501	24.8887	0.9772	1.0225
81	Paper products	10.060	15.2888	27.1708	0.9395	1.0455
82	Personal products	18.527	13.1007	22.7750	0.7254	0.7033
83	Pharmaceuticals	10.442	11.2476	19.1473	0.8074	0.7761
84	Photographic products	-6.253	18.6596	33.8275	0.9388	0.9937
85	Property & casualty insur	10.272	12.1080	21.1811	0.8943	0.9057
86	Publishing & printing	7.291	10.8200	18.4060	0.7733	0.8149
87	Railroads	18.551	13.6430	22.6959	1.0065	0.9732
88	Real estate invst trusts	5.854	15.8023	27.3475	1.0346	1.0216
89	Restaurants	19.251	12.5201	21.1163	0.7982	0.8344
90	Soft drinks	12.472	11.2590	19.3528	0.6778	0.6628
91	Specialty chemicals	14.853	10.8429	19.2989	0.8148	0.8562
92	Specialty stores	6.592	15.5639	26.6040	1.1397	1.1427
93	Steel-price index	16.743	18.8526	32.6922	1.1700	1.2983
94	Systems software	27.172	16.4492	27.5679	1.2733	1.2256

(Table 2 continued)

		Average return (%)	Payoff risk (%)	Total risk (%)	Beta-ST	Beta-LT
US Market						
95	Tires & rubber	8.218	20.4038	36.4537	1.1728	1.3787
96	Tobacco	15.572	14.1698	25.5493	0.6592	0.6816
97	Trading comp & distributors	11.121	13.4976	24.3533	0.8517	0.9339
98	Wireless telecom serv	17.262	22.4583	38.7363	1.2809	1.2701
99	Hyp mkts & sup cnt	3.070	11.0144	18.3946	0.7596	0.7003
100	H/C services	38.350	11.8235	20.3246	0.6869	0.6727
101	Regional bnks	-5.781	17.9670	29.6809	1.2710	1.1450
102	Thrfts/mge fin	-37.429	19.3461	34.0053	1.3550	1.3282
103	Spec finance	7.332	17.1711	29.1646	1.2122	1.1930
104	Cons finance	22.899	17.6279	30.3407	1.2777	1.3397
105	Ass mgt & cust bnk	12.122	16.6685	26.9025	1.4211	1.3684
106	Inv bnk & brok	10.285	20.3912	33.3718	1.6966	1.6309
107	Data pro & out svs	7.910	10.4532	17.5963	0.9110	0.9110
108	Hm ent s/ware	-3.398	20.7212	34.6504	1.3140	1.1707
109	Comm. equipment	11.931	19.2187	33.3657	1.4899	1.5195
110	Elec manu svs	2.355	18.3754	31.5406	1.3979	1.5031
111	S/con equipment	31.006	28.0346	46.1600	1.7201	1.6513
112	Semiconductors	30.289	21.1857	35.3978	1.6129	1.5343
113	Oil & gas storage & transp	9.387	17.3667	31.1175	1.0349	1.1276
114	Education services si	9.177	22.8985	43.2698	0.9100	0.8109
115	Spl. Cons. Services si	1.059	18.0962	32.2955	1.0087	0.9657
116	Automotive retail si	20.232	14.2777	26.3394	0.8904	0.9651
117	Home furnish Retail Si	9.574	19.0021	33.2179	1.2367	1.1683
118	Ind. Power prod & energy tr	-1.887	16.2937	30.3612	0.9590	0.8662
Japanese Market						
TPX	TOPIX	-1.959	11.4731	19.9466	1.0000	1.0000
1	Fisheries	-6.276	12.8139	22.7535	0.7554	0.7609
2	Mining	-0.524	16.9402	30.3507	0.8709	0.8989
3	Construction	-8.107	12.8726	24.2043	0.9584	0.9708
4	Foods	-0.661	8.9215	15.5475	0.5821	0.5837
5	Textiles	-3.458	11.9073	21.2193	0.8611	0.8739
6	Pulp & paper	-3.968	14.0704	25.2454	0.7802	0.7998
7	Oil & coal prods	-3.258	14.9325	25.8154	0.8130	0.8090
8	Rubber products	5.288	15.6410	26.4365	0.8308	0.8153
9	Glass & ceramics	1.000	14.1648	24.7677	0.9958	1.0082
10	Iron & steel	3.830	16.4230	29.5850	1.1204	1.1253
11	Non-ferrous mets	2.212	15.8064	28.3442	1.1752	1.1904
12	Metal products	-3.683	12.2193	21.5223	0.8123	0.8259
13	Machinery	2.674	12.9703	23.3821	1.0483	1.0587
14	Electric machine	3.753	14.2746	25.0589	1.0746	1.0736
15	Transport equip.	8.066	13.8115	23.6457	0.9530	0.9349
16	Precision instr.	9.167	13.6167	23.2168	0.9336	0.9277
17	Other products	0.348	12.5304	21.5060	0.8271	0.8439
18	Real estate	5.937	18.9282	33.0836	1.2801	1.2725
19	Land transport	-0.895	9.9753	16.7802	0.6442	0.6408
20	Marine transport	2.870	17.8984	31.4436	1.0671	1.0604

(Table 2 continued)

		Average return (%)	Payoff risk (%)	Total risk (%)	Beta-ST	Beta-LT
Japanese Market						
21	Air transport	-9.414	14.2501	25.0342	0.7731	0.7826
22	Warehouse	-1.497	13.4113	23.9448	0.8698	0.8813
23	Info & communication	3.005	16.2758	28.7693	1.0822	1.1061
24	Elec. power & gas	-1.013	8.9829	15.7749	0.3357	0.3303
25	Service	-1.773	12.0456	22.1707	0.9176	0.9450
26	Pharmaceutical	4.974	10.0221	17.4199	0.5621	0.5488
27	Wholesale	5.377	15.3132	28.1841	1.1790	1.2072
28	Retail	-1.601	12.0492	21.9980	0.8483	0.8669
29	Securities	3.733	21.6953	38.9200	1.6810	1.6726
30	Insurance	2.278	15.7114	26.7776	0.9718	0.9643
31	Other financials	-3.932	16.6174	29.2840	1.1083	1.1031
32	Chemical	1.515	11.1952	19.6631	0.8836	0.8847
33	Banks	-7.379	17.3766	30.7191	1.2595	1.2394

We search for the existence of IR using Equation (8) to compute TIR as follows:

$$TIR = \sigma_{ST=5} - \sigma_{LT=150} \tag{8*}$$

To split data into systematic and idiosyncratic risk Equations (18) and (19) are used through the start-up database to fix the systematic level of IR:

$$SIR = \gamma_5 - \gamma_{150} \tag{18*}$$

Finally, Equation (19) is used for *DIR* estimation (= *TIR* – *SIR*).

From the start-up database, it is possible to extract specific sub-periods of time and average data computed over them for any of the time series. We considered in deeper detail the time period of the latest crisis (from the top peak of July 3, 2006 up to March 31, 2009) and compare it with the previous one (from November 1, 1999 up to March 31, 2003).

The Information Risks (and the Asset Allocation Puzzle) During the Financial Crisis

It is easy to get similarities while taking a look at the dynamics of the price index for the three stock exchanges. Figure 3 depicts how S&P 500 and DJ-EuroStoxx indexes are very tracking, having a strong correlation in their path.

In Table 3, relations between risks and returns in the three markets are shown. The return-to-risk rate is lower in the European Market than in the USA Market: This evidence is due to the relative gap in standard deviations (+15.45% in Europe over USA), twice than the relative gap in the return (+7.48%, only). Computing the same ratio but excluding the information risk, more equilibrated results are found: The return per unit of payoff-risk is quite the same in the two markets (10.15% vs. 10.48%). The higher return per unit of total-risk in the USA is due to the compression of the information risk. The two markets are very similar in the mechanism of risk pricing but are very different as per information risk, its tolerance and, finally, its pricing.

The previous figures can now be computed for time length of the latest crisis (July 3, 2006 to March 31, 2009) and for the previous one (November 1, 1999 to March 31, 2003). Since the periods are chosen from a top-peak to a floor-drop, returns are obviously negative.

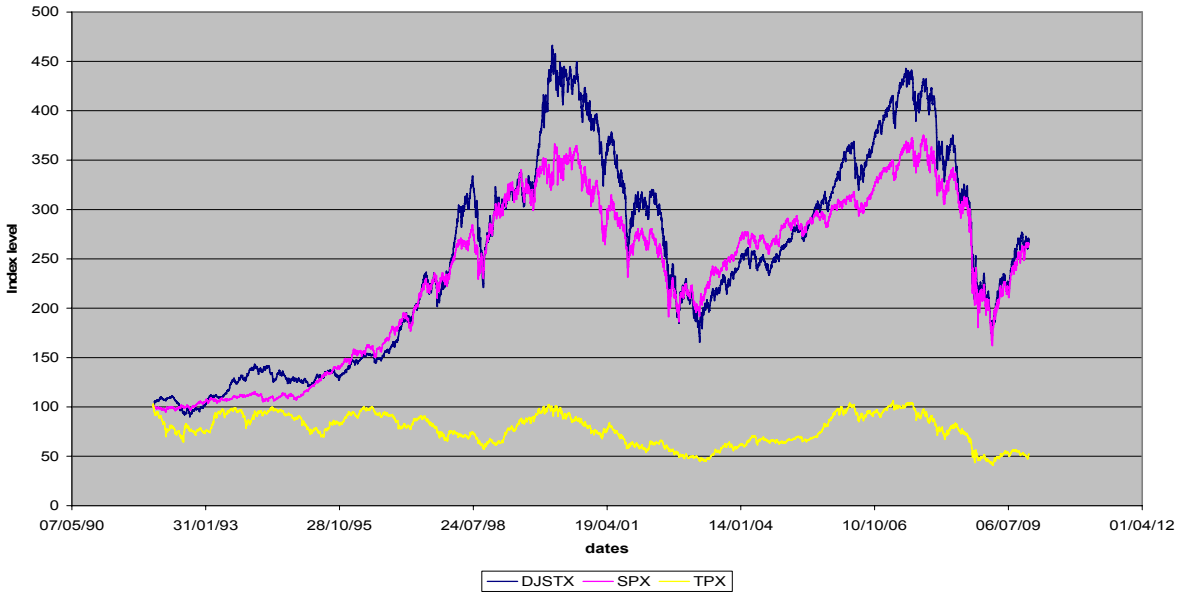

Figure 3. Long-term stock indexes compared (Jan 2, 1992 = 100).

Table 3

Return and Risks for Financial Markets in the Long Run

	A	B	A/B	C	D = B – C	A/D
	Weekly return (%)	Std. D (%)	(%)	Total IR (%)	Payoff risk (%)	(%)
SXXE Index	0.1428	2.4578	5.8084	1.0511	1.4066	10.1489
SPX Index	0.1328	2.1288	6.2394	0.8610	1.2678	10.4769
TPX Index	-0.0288	2.7661	-1.0403	1.1698	1.5963	-1.8026

Table 4 shows the results for the latest crisis. The payoff risk was quite equilibrated between the European and the USA Market. The lower level of information risk let the USA Market have a smaller standard deviation of returns, thus allowing a reduced level of average negative performance.

Table 4

Return and Risks for Financial Markets in the 2006-2009 Crisis

	A	B	A/B	C	D = B – C	A/D
	Weekly return (%)	Std. D (%)	(%)	Total IR (%)	Payoff risk (%)	(%)
SXXE Index	-0.3050	3.2114	-9.4977	1.4357	1.7757	-17.1769
SPX Index	-0.241	3.0486	-7.9332	1.2882	1.7603	-13.7389
TPX Index	-0.3823	3.5722	-10.7007	1.5306	2.0417	-18.7226

A very different story took place in the previous crisis, as you can see in Table 5. The absolute level of European risk was quite the same of the latest crisis (3.242% vs. 3.211%), but the impact of information risk was very lower (1.298% vs. 1.436%) and higher payoff risk emerged (1.944% vs. 1.776%). In the case of the USA risk, the situation is completely different: The information risk increase to level very next to those observed in the latest crisis (1.701% vs. 1.760%) while the payoff risk was lower (1.105% vs. 1.288%).

Some conclusions can be stroke out about the latest crisis:

(1) The return-to-payoff risk ratio tends to be stable across the markets;

(2) The return-to-risk ratio is diverting across the markets (along with risk aversions);

(3) Total risk increases in a homogeneous way during all the crises;

(4) The information risk increases during the crisis, but have a stronger impact in Europe;

(5) The information risk was a significant driver of latest crisis in Europe (but not in USA).

Table 5

Return and Risks for Financial Markets in the 1999-2003 Crisis

	A	B	A/B	C	D = B – C	A/D
	Weekly return (%)	Std. D (%)	(%)	Total IR (%)	Payoff risk (%)	(%)
SXXE Index	-0.5019	3.2419	-15.4804	1.2979	1.9440	-25.8162
SPX Index	-0.2608	2.8056	-9.2967	1.1051	1.7005	-15.3381
TPX Index	-0.3333	2.9404	-11.3349	1.1938	1.7466	-19.0824

The difficulties we all had in challenging the crisis can be explained: (1) We do require tools to control the information risk but we mainly have tools to manage payoff risk; and (2) payoff risk is a global driver but the opposite is true for information risk, requiring more local policies. Global asset allocation might be affected by the localized impact of the information risk.

In previous computations, we observed that in the long run, the smaller average excess return of the European market over the USA one reflects the higher standard deviation of its from the price path due to excess in information risk. But the higher return is probably insufficient to repay the information risk. Correlation between returns could explain the apparently unfair price of the information risk. The average-long-term correlation index between the weekly returns in the two markets is very high: 73.16%. The correlation with the Japanese Market is much lower, being 41.13% for the European Market and 41.95% for the USA one. The figure for the latest crisis is 79% while for the previous crisis is 84.57%.

To understand how information risk may affect the correlation index of the returns, we can analyze the relationship existing between the riskiness of the two markets, very correlated indeed: The correlation between their short-term standard deviation is 76.5%. A completely different story can be found for the TOPIX index: Its risk is low correlated both with the USA market (19.37%) and the European one (20.36%). The above correlations are computed over gross risk data, thus including the total information risk (TIR). If we compute the same correlations moving from net payoff risk data, the final results are quite different: the correlation between USA and Europe is declining while both correlations with Japanese markets are increasing. See Table 6.

Table 6

Correlation Index Between Short-Term Total Risks and Payoff Risks in the Market Price Indexes

	SXXE index	SPX index	TPX index
Short-term total risks			
SXXE index	1		
SPX index	0.765436323	1	
TPX index	0.203570156	0.193706112	1
Short-term payoff risks			
SXXE index	1		
SPX index	0.700644861	1	
TPX index	0.387053565	0.392275612	1

Our conclusion is simple: The information risk might affect the asset allocation decision. The actual relative weight of the Japanese investment can be overstated by undue benefits.

The same evidence cannot be found during last crisis. Table 7 computes the same correlation indexes in the time length of the latest crisis (July 2006-March 2009). Two evidences emerge from figures are impressive:

(1) The absolute level of risk-correlation in markets increase, due to contagion effects;

(2) No relevant changes can be observed between computation in "gross" and "net" computation for the correlation between USA and European markets.

Table 7

Correlation Index in Short-Term Risks During the 2006-2009 Crisis

	SXXE Index	SPX Index	TPX Index
Total short-term risk (includes TIR)			
SXXE Index	1		
SPX Index	0.872067535	1	
TPX Index	0.406069346	0.406818269	1
Short-term payoff risk (TIR excluded)			
SXXE Index	1		
SPX Index	0.872372865	1	
TPX Index	0.323675751	0.267942158	1

If we compare the computed results with those referred to the previous crisis (i.e., November 1999-March 2003), see Table 8, a very different story can be found:

(1) The absolute level or risk correlation in markets decrease below long-term level;

(2) No relevant changes can be observed between computation in "gross" and "net" computation for the correlation involving the Japanese market.

Table 8

Correlation Index in Short-Term Risks During the 2000-2003 Crisis

	SXXE Index	SPX Index	TPX Index
Total short-term risk (includes TIR)			
SXXE Index	1		
SPX Index	0.718262213	1	
TPX Index	0.30082362	0.289777384	1
Short-term payoff risk (TIR excluded)			
SXXE Index	1		
SPX Index	0.763653835	1	
TPX Index	0.298309741	0.282029918	1

Our second conclusion is still simple: The 2000-2003 crisis cleaned the information risk in the global financial markets, while the 2007-2009 was unable to reach such a result. The information risk was an important driver of the latest financial crisis and no affordable comparisons can be done without considering the impact of the sources of information risk.

In our previous discussion, we have seen that the information risk can be separated into a systematic and a diversifiable quota. Such a split can be of inner relevance for better understanding of the impact over financial markets equilibrium and trends during the crisis. In that way, even some suggestions can be exploited for policy makers since tools to use for reducing the risk level are quite different: in case of systematic risk, you have to act over the market as a whole particularly on the wide spreading mechanism of information; while in the case of diversifiable risk, the main problem is to avoid the hidden information in the source.

Figure 4 depicts the average percentage composition of the TIR in the three markets already presented in the previous paragraphs of the paper. The USA case is clear.

The specific case of USA is clear. The higher relevance of the average DIR explains why the information risk impacts markets equilibrium in a different way than in Europe. At the same time, different tools are required to challenge the information risk: Hidden information is more relevant in the USA while information distribution must be focused in Europe.

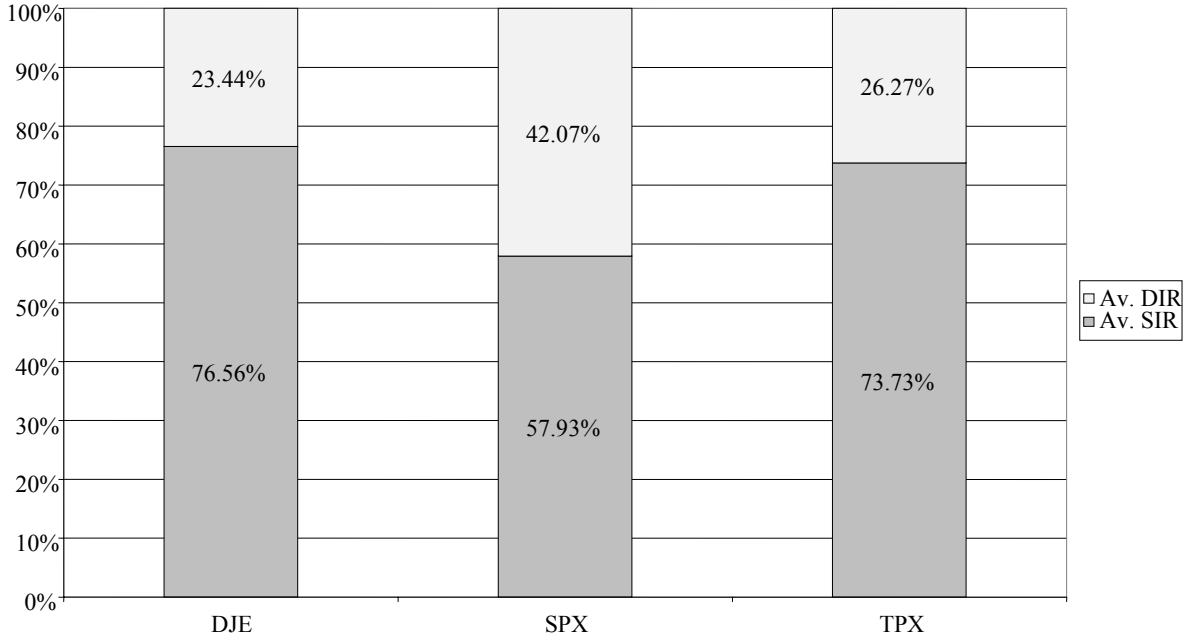

Figure 4. Long-term TIR in stock indexes compared and split between SIR and DIR.

Now let us examine data in the two crisis reported in Table 9. The increase of systematic sources of information risk during the latest crisis is evident in all markets, telling us that the mechanism of information distribution is to be improved in next regulator activities.

Table 9

TIR Composition During the Crisis

		Average weight % SIR	Average weight % DIR
DJE	Full 1992-2009	76.5643	23.4357
	Crisis 2006-2009	78.8162	21.1838
	Crisis 1999-2003	70.2496	29.7504
SPX	Full 1992-2009	57.9264	42.0736
	Crisis 2006-2009	68.3094	31.6906
	Crisis 1999-2003	53.6056	46.3944
TPX	Full 1992-2009	73.7340	26.2660
	Crisis 2006-2009	77.6875	22.3125
	Crisis 1999-2003	58.8941	41.1059

In the case of the European market, the increase was smaller because the higher long-term relevance of SIR. In the case of US market, the increase was strong; the efficiency of the markets was hit by the higher relevance of SIR. In both cases, this evidence can explain the less efficiency of the authorities' action: legal

tools are mainly based on payoff risk (e.g., interest rate policies) and on information asymmetries (e.g., DIR). A very different story took place in the previous crisis: The SIR levels were generally lower than the long-term one in all the markets, particularly in Japan and Europe. This can help us to understand why the experience of the 1999-2003 crisis was quite useless to challenge the 2006-2009 crisis (i.e., late detection, low efficacy of tools, and high contagion effects, etc.).

The Information Risks (and the Sector Rotation Puzzle) During the Financial Crisis

Similarities in the stock tracking can be found even at the industry level? We can use data from our start-up database to find out some empirical evidence about this problem.

Table 10 shows computations referring to the latest crisis for the European markets. The payoff risk, the total one is reported along with TIR, its relative weight for any of the 18 + 1 time series. For the 18 industries the relative weight of SIR and DIR are reported, while figures (green highlighted) for the market are the average level of the industry data.

Table 10

TIR Composition During the Crisis in the European Market

	Full samples							Latest crisis (2006-2009)						
	Payoff (%)	Total (%)	TIR (%)	% TIR	SIR (%)	% SIR	% DIR	Payoff (%)	Total (%)	TIR (%)	% TIR	SIR (%)	% SIR	% DIR
Dow Jones EuroStoxx	1.4167	2.4578	-1.0511	42.7679	-1.0511	76.56	23.44	1.7757	3.2114	-1.4357	44.7070	-1.4357	78.82	21.18
Oil & gas	1.6138	2.7891	-1.1831	42.4189	-0.7908	66.84	33.16	2.0575	3.7610	-1.7035	45.2943	-1.4042	82.43	17.57
Technology	2.2675	3.9291	-1.6541	42.0993	-1.3361	80.78	19.22	2.2531	3.8765	-1.6234	41.8773	-1.3198	81.30	18.70
Automobiles & parts	2.0002	3.6728	-1.7098	46.5538	-1.2511	73.17	26.83	2.9135	6.0519	-3.1385	51.8590	-1.5940	50.79	49.21
Basis resources	1.8867	3.4478	-1.6094	46.6787	-1.1565	71.86	28.14	3.0303	5.5829	-2.5525	45.7205	-2.1258	83.28	16.72
Retail	1.4244	2.5057	-1.0780	43.0199	-0.8038	74.56	25.44	1.7626	3.0955	-1.3330	43.0605	-0.9453	70.92	29.08
Insurance	1.9234	3.4054	-1.4953	43.9116	-1.2877	86.11	13.89	2.6162	4.8571	-2.2409	46.1367	-2.0036	89.41	10.59
Food & beverage	1.2656	2.2128	-0.9438	42.6539	-0.5638	59.73	40.27	1.5184	2.6445	-1.1261	42.5834	-0.7448	66.14	33.86
Travel and leisure	1.7718	3.1652	-1.3954	44.0861	-1.0178	72.94	27.06	2.0704	3.7559	-1.6855	44.8769	-1.3377	79.36	20.64
Financial services	1.5515	2.8042	-1.2699	45.2844	-1.0807	85.10	14.90	2.2851	4.2008	-1.9157	45.6033	-1.7651	92.14	7.86
Personal & household goods	1.7560	2.9622	-1.2056	40.6990	-1.0324	85.64	14.36	1.7558	3.1357	-1.3799	44.0053	-1.2312	89.23	10.77
Media	1.6746	2.9362	-1.2496	42.5575	-0.9873	79.01	20.99	1.5518	2.7329	-1.1810	43.2158	-0.9535	80.73	19.27
Banks	1.6531	2.9418	-1.3142	44.6744	-1.1770	89.56	10.44	2.6504	4.9733	-2.3230	46.7082	-2.0772	89.42	10.58
Construction and materials	1.5259	2.7004	-1.2028	44.5427	-1.0323	85.82	14.18	2.4407	4.3469	-1.9062	43.8526	-1.6731	87.77	12.23
Industrial goods and services	1.5735	2.8140	-1.2582	44.7102	-1.1016	87.56	12.44	2.2275	4.0968	-1.8693	45.6282	-1.7301	92.55	7.45
Chemicals	1.6160	2.8338	-1.2339	43.5424	-0.9942	80.57	19.43	1.8765	3.5284	-1.6519	46.8172	-1.4570	88.20	11.80
Health care	1.6147	2.6681	-1.0457	39.1910	-0.5135	49.11	50.89	1.6862	2.9295	-1.2433	42.4414	-0.6421	51.64	48.36
Telecomunications	1.9530	3.4521	-1.4786	42.8328	-1.0822	73.19	26.81	1.6432	2.7666	-1.1233	40.6033	-0.6767	60.24	39.76
Utilities	1.3618	2.4125	-1.0569	43.8082	-0.8095	76.60	23.40	1.7772	3.3321	-1.5549	46.6645	-1.2926	83.13	16.87

An absolute TIR reduction took place only in three industries: technology, banks, and telecommunications. These same industries jointly showed a reduction in the payoff risk (along with the Media industry). In the specific case of Telecommunications, an increase in the relative weight of DIR can be found. It is even interesting to observe that five industries showed a reduction in the relative weight of TIR; three of them (i.e., Basis Resources, Food and Beverage, and Industrial Goods and Services) are not overlapped with the previous three and showed an increase in payoff risk anyway. In the case of Telecommunication, an increase in the

relative weight of DIR can be observed, the other three cases take place along with an increase of the absolute level of TIR.

The same computations for the US Market are reported in Table 11. 118 + 1 are the time series analyzed. Still, the green highlighted figures for the market are the average level of the industry data.

Table 11

TIR Composition During the Crisis in the USA Market

	Full samples							Latest crisis (2006-2009)						
	Payoff (%)	Total (%)	TIR (%)	% TIR	SIR (%)	% SIR	% DIR	Payoff (%)	Total (%)	TIR (%)	% TIR	SIR (%)	% SIR	% DIR
S&P 500	1.2731	2.1288	-0.8610	40.4456	-0.8610	57.93	42.07	1.7603	3.0486	-1.2882	42.2575	-1.2882	68.31	31.69
Advertising	2.2456	3.9305	-1.6880	42.9479	-1.2123	71.82	28.18	2.1813	3.9873	-1.8060	45.2932	-1.2975	71.85	28.15
Aerospace & defense	1.5017	2.6383	-1.1455	43.4181	-0.8070	70.45	29.55	1.7513	3.2719	-1.5205	46.4733	-1.3063	85.91	14.09
Agricultural products	2.3380	3.9748	-1.6298	41.0021	-0.5715	35.07	64.93	3.1167	5.3338	-2.2172	41.5677	-1.0535	47.52	52.48
Air freight & couriers si	2.1434	3.6615	-1.5144	41.3600	-0.9147	60.40	39.60	2.0845	3.6057	-1.5212	42.1877	-1.1302	74.30	25.70
Airlines si	2.5188	4.2698	-1.7707	41.4702	-1.0248	57.88	42.12	2.9504	5.0745	-2.1241	41.8581	-0.9127	42.97	57.03
Aluminum	2.6506	4.6093	-1.9954	43.2910	-1.1432	57.29	42.71	4.1207	7.7335	-3.6129	46.7168	-2.8610	79.19	20.81
Apparel & accessories	1.9267	3.3273	-1.4182	42.6238	-0.8744	61.66	38.34	3.1022	5.5011	-2.3989	43.6081	-1.7382	72.46	27.54
Apparel retail	2.5034	4.2949	-1.7766	41.3664	-1.0375	58.40	41.60	2.5742	4.3780	-1.8038	41.2021	-1.3939	77.27	22.73
Application software	3.4017	5.8961	-2.4493	41.5409	-1.2641	51.61	48.39	2.3414	4.0344	-1.6930	41.9649	-1.3981	82.58	17.42
Auto parts & equip	1.9071	3.3964	-1.5408	45.3666	-1.0019	65.03	34.97	3.3200	6.1331	-2.8131	45.8674	-1.9672	69.93	30.07
Automobile manufacturers	2.7198	4.8379	-2.1474	44.3864	-1.2753	59.39	40.61	4.6446	9.6796	-5.0350	52.0165	-3.0242	60.06	39.94
Div banks	2.0778	3.5603	-1.5079	42.3525	-1.0153	67.34	32.66	3.9816	7.4701	-3.4885	46.6993	-2.1886	62.74	37.26
Biotechnology	2.5965	4.3050	-1.6775	38.9655	-0.6283	37.46	62.54	1.8426	3.2345	-1.3918	43.0312	-0.6150	44.19	55.81
Brewers	1.5088	2.4702	-0.9615	38.9252	-0.3274	34.05	65.95	1.5949	3.0824	-1.4875	48.2582	-0.5962	40.08	59.92
Broadcasting & cable TV	2.3346	3.9929	-1.7554	43.9632	-1.2325	70.21	29.79	2.9057	6.5726	-3.6669	55.7908	-2.8683	78.22	21.78
Building products	2.1754	3.8186	-1.7158	44.9337	-1.0466	61.00	39.00	3.0820	6.4979	-3.4159	52.5696	-2.2324	65.35	34.65
Casinos & gaming	2.9076	5.0892	-2.2141	43.5057	-1.0526	47.54	52.46	3.0839	6.0786	-2.9947	49.2659	-2.1415	71.51	28.49
Commercial printing	1.8304	3.3416	-1.5543	46.5123	-0.9098	58.54	41.46	2.6399	5.5793	-2.9394	52.6846	-2.3732	80.73	19.27
Computer & electr retail	3.0641	5.3772	-2.2880	42.5498	-1.3566	59.29	40.71	2.9626	5.1842	-2.2216	42.8540	-1.5328	69.00	31.00
Computer hware	2.1735	3.7643	-1.5691	41.6832	-1.0663	67.96	32.04	2.0931	3.6715	-1.5784	42.9898	-1.2153	77.00	23.00
Comp storage & peripherals	3.4938	5.8465	-2.2894	39.1593	-1.4399	62.89	37.11	2.5583	4.5028	-1.9445	43.1842	-1.4487	74.50	25.50
Construction & engineering	2.5781	4.5526	-1.9846	43.5918	-1.0489	52.85	47.15	3.7406	6.6536	-2.9131	43.7817	-2.0824	71.49	28.51
Construction & farm machine	2.1612	3.7337	-1.6035	42.9469	-1.0616	66.21	33.79	3.0056	5.5126	-2.5070	45.4776	-2.1652	86.36	13.64
Construction materials	2.5382	4.4768	-1.9802	44.2332	-1.2115	61.18	38.82	3.5145	6.5358	-3.0213	46.2267	-1.8874	62.47	37.53
Department stores	2.1008	3.6152	-1.5327	42.3965	-0.9938	64.84	35.16	3.1650	5.8969	-2.7318	46.3269	-2.0027	73.31	26.69
Distributors	1.5881	2.7777	-1.2107	43.5873	-0.7550	62.36	37.64	2.0049	3.5826	-1.5777	44.0389	-1.0344	65.56	34.44
Diversified chemicals	1.8351	3.1834	-1.3776	43.2754	-0.9149	66.41	33.59	2.2550	4.2473	-1.9922	46.9067	-1.6259	81.61	18.39
Div comm & prof serv	1.7147	3.0144	-1.3119	43.5200	-0.8585	65.44	34.56	1.5273	2.6009	-1.2635	48.5784	-0.9214	72.93	27.07
Div finsvs	2.5984	4.5183	-1.9251	42.6067	-1.3374	69.47	30.53	4.0550	7.5406	-3.4856	46.2247	-2.5122	72.07	27.93
Diversified metals & mining	2.7657	4.8517	-2.1327	43.9568	-1.1098	52.04	47.96	4.5188	8.2101	-3.6913	44.9605	-2.5603	69.36	30.64
Drug retail	1.8814	3.1651	-1.2774	40.3592	-0.5874	45.98	54.02	2.0980	3.4712	-1.3733	39.5615	-0.8496	61.87	38.13
Electric utilities	1.2790	2.2808	-1.0043	44.0324	-0.3977	39.60	60.40	1.7216	3.0408	-1.3192	43.3825	-0.8587	65.09	34.91
Electrical comp & equip	1.7508	2.9712	-1.2388	41.6951	-0.9095	73.42	26.58	2.3421	4.0697	-1.7276	42.4498	-1.4003	81.06	18.94
Elec eq manuf.	2.5756	4.5018	-1.9173	42.5890	-1.2396	64.66	35.34	2.4381	4.4536	-2.0155	45.2552	-1.3896	68.94	31.06
HR & employment serv	3.0602	5.3038	-2.2660	42.7231	-1.6173	71.37	28.63	3.1376	5.4212	-2.2836	42.1233	-1.6636	72.85	27.15
Envr & facilities serv	2.1227	3.7729	-1.6362	43.3669	-0.7414	45.31	54.69	2.0926	3.4615	-1.3689	39.5467	-0.8610	62.89	37.11
Fertiliser & agri chemicals	2.8094	4.7037	-1.8448	39.2213	-1.0631	57.62	42.38	3.5683	5.9483	-2.3801	40.0125	-1.5162	63.71	36.29
Food distributors	1.6727	2.9110	-1.2347	42.4151	-0.5626	45.57	54.43	1.9520	3.5206	-1.5686	44.5546	-1.0166	64.81	35.19

(Table 11 continued)

	Full samples							Latest crisis (2006-2009)						
	Payoff (%)	Total (%)	TIR (%)	% TIR	SIR (%)	% SIR	% DIR	Payoff (%)	Total (%)	TIR (%)	% TIR	SIR (%)	% SIR	% DIR
Food retail	1.7322	2.9984	-1.2626	42.1091	-0.5997	47.50	52.50	2.0635	3.3218	-1.2584	37.8818	-0.7653	60.82	39.18
Footwear	2.3050	4.0391	-1.7269	42.7534	-0.7597	44.00	56.00	2.4945	4.3937	-1.8992	43.2250	-1.2155	64.00	36.00
Forest products	2.3885	4.0480	-1.6880	41.6991	-0.9631	57.05	42.95	3.2758	5.9988	-2.7230	45.3925	-1.7843	65.52	34.48
Gas utilities	1.6447	2.8894	-1.2703	43.9641	-0.7579	59.66	40.34	2.6594	4.9402	-2.2809	46.1691	-1.6395	71.88	28.12
General merch stores	2.1699	3.6388	-1.4599	40.1218	-0.8747	59.91	40.09	2.9190	4.9048	-1.9858	40.4861	-1.3758	69.29	30.71
Gold	2.9201	4.9930	-2.0764	41.5874	-0.3875	18.66	81.34	3.4621	6.1653	-2.7033	43.8463	-1.1353	42.00	58.00
H/care dist	2.1187	3.7662	-1.6279	43.2221	-0.6799	41.77	58.23	1.8242	3.3199	-1.4957	45.0526	-0.8184	54.72	45.28
Health care equip	1.6398	2.7969	-1.1481	41.0508	-0.7149	62.27	37.73	1.5526	2.7886	-1.2360	44.3226	-0.9309	75.31	24.69
Health care facilities	2.4156	4.4348	-2.1188	47.7763	-0.7929	37.42	62.58	3.6157	8.5502	-4.9345	57.7123	-1.9955	40.44	59.56
Health care supplies	1.9116	3.7316	-1.8244	48.8909	-0.7318	40.11	59.89	1.6233	5.1581	-3.5348	68.5296	-1.3182	37.29	62.71
Home furnishings	2.1372	3.8906	-1.7672	45.4216	-0.9113	51.57	48.43	2.8041	5.0990	-2.2949	45.0068	-1.3693	59.67	40.33
Home improve retail	2.4251	4.1232	-1.6876	40.9286	-1.0648	63.10	36.90	2.8592	4.8498	-1.9906	41.0452	-1.3631	68.48	31.52
Homebuilding	3.0054	5.1888	-2.2043	42.4818	-1.3286	60.27	39.73	5.4241	9.3761	-3.9519	42.1490	-2.4606	62.26	37.74
Hotels	2.2623	3.9338	-1.6948	43.0836	-1.1562	68.22	31.78	3.0381	5.5493	-2.5112	45.2521	-1.9020	75.74	24.26
Household appliances	1.8887	3.3788	-1.5212	45.0209	-1.0476	68.86	31.14	2.6558	5.0228	-2.3670	47.1245	-1.7485	73.87	26.13
Household products	1.4468	2.4327	-0.9807	40.3157	-0.3947	40.24	59.76	1.3179	2.3087	-0.9908	42.9159	-0.5213	52.62	47.38
House wares & specialties	1.6541	2.9598	-1.3344	45.0835	-0.8708	65.26	34.74	2.3291	4.8181	-2.4891	51.6606	-1.8323	73.61	26.39
Industrial conglomerates	1.7910	3.0655	-1.3020	42.4725	-1.0441	80.19	19.81	2.2699	4.4875	-2.2176	49.4168	-1.7076	77.00	23.00
Industrial gases	2.0001	3.4253	-1.4196	41.4439	-0.8404	59.20	40.80	2.3897	4.1894	-1.7997	42.9589	-1.4270	79.29	20.71
Industrial machinery	1.6375	2.8177	-1.1981	42.5210	-0.8929	74.52	25.48	2.1146	3.7345	-1.6199	43.3764	-1.4320	88.40	11.60
Insurance brokers	1.7918	3.2429	-1.4422	44.4727	-0.8655	60.01	39.99	1.8963	3.1876	-1.2913	40.5099	-0.7101	54.99	45.01
Integrated oil & gas	1.6127	2.6668	-1.0562	39.6053	-0.5806	54.97	45.03	2.2800	3.8031	-1.5231	40.0491	-1.2426	81.58	18.42
Integrated telecom serv	1.6425	2.8010	-1.1561	41.2730	-0.6804	58.86	41.14	2.0557	3.4133	-1.3575	39.7725	-0.9505	70.02	29.98
Internet retail	2.9863	5.3910	-2.4459	45.3702	-1.2351	50.50	49.50	3.5258	6.1363	-2.6104	42.5411	-1.4733	56.44	43.56
Internet software & serv	3.7914	6.6237	-2.7283	41.1899	-1.7273	63.31	36.69	2.4602	4.2294	-1.7692	41.8303	-1.2426	70.23	29.77
IT cons & o/svs	2.7885	4.9554	-2.1610	43.6082	-1.1655	53.93	46.07	3.4794	6.0831	-2.6037	42.8026	-1.8762	72.06	27.94
Leisure products	1.9375	3.4162	-1.4906	43.6329	-0.7896	52.97	47.03	2.2990	4.3337	-2.0347	46.9513	-1.2203	59.97	40.03
Life & health ins	1.8833	3.3175	-1.4766	44.5086	-1.1279	76.39	23.61	3.4442	6.7812	-3.3370	49.2098	-2.9322	87.87	12.13
Managed health care	2.4326	4.3776	-1.9479	44.4971	-0.7944	40.79	59.21	2.6070	5.1997	-2.5926	49.8616	-1.5431	59.52	40.48
Metal & glass cont	1.9801	3.4711	-1.5018	43.2666	-0.8063	53.69	46.31	2.3366	4.1487	-1.8121	43.6785	-1.4072	77.66	22.34
Motorcycle manufacturers	2.8276	4.9758	-2.2009	44.2318	-1.5123	68.71	31.29	3.6786	7.1012	-3.4225	48.1969	-2.6637	77.83	22.17
Movies & entertainment	2.0952	3.5246	-1.4378	40.7949	-1.0906	75.85	24.15	2.0975	3.9760	-1.8785	47.2457	-1.6605	88.39	11.61
Multi-line insurance	2.2623	3.9666	-1.7446	43.9807	-1.2148	69.63	30.37	3.7499	7.4189	-3.6690	49.4550	-2.6442	72.07	27.93
Multi utilities	2.3020	4.1767	-1.8146	43.4467	-1.1972	65.98	34.02	1.5222	2.7614	-1.2392	44.8766	-0.8839	71.32	28.68
Office electronics	3.1892	5.6862	-2.4973	43.9180	-1.5321	61.35	38.65	2.7203	5.4557	-2.7353	50.1374	-2.1394	78.21	21.79
Office serv & supplies	1.6621	2.8760	-1.2371	43.0140	-0.7929	64.09	35.91	1.9137	3.8615	-1.9478	50.4412	-1.4917	76.59	23.41
Oil & gas drilling	3.1133	5.2248	-2.1131	40.4434	-0.9306	44.04	55.96	3.4141	5.7181	-2.3040	40.2924	-1.7045	73.98	26.02
Oil & gas equip & serv	2.6600	4.4040	-1.7592	39.9454	-0.8624	49.02	50.98	3.3619	5.7095	-2.3477	41.1182	-1.7619	75.05	24.95
Oil & gas explor & prod	2.3730	3.9741	-1.6184	40.7240	-0.7530	46.53	53.47	3.1109	5.4463	-2.3354	42.8804	-1.7761	76.05	23.95
Oil & gas refing & mark	2.3026	4.0023	-1.7307	43.2437	-0.9865	57.00	43.00	3.6009	6.2258	-2.6250	42.1623	-1.8636	70.99	29.01
Packaged foods	1.1610	2.0023	-0.8351	41.7083	-0.3988	47.75	52.25	1.2672	2.2615	-0.9943	43.9654	-0.7296	73.38	26.62
Paper packaging	1.9484	3.4514	-1.5089	43.7181	-0.8694	57.61	42.39	2.3002	4.2203	-1.9201	45.4967	-1.1434	59.55	40.45
Paper products	2.1202	3.7679	-1.6859	44.7423	-1.0556	62.62	37.38	2.8731	5.9993	-3.1262	52.1098	-2.1982	70.32	29.68
Personal products	1.8167	3.1583	-1.3528	42.8336	-0.6067	44.85	55.15	2.2641	4.4549	-2.1908	49.1779	-1.4762	67.38	32.62
Pharmaceuticals	1.5598	2.6553	-1.0813	40.7225	-0.6001	55.50	44.50	1.4918	2.5967	-1.1049	42.5496	-0.7237	65.50	34.50
Photographic products	2.5876	4.6910	-2.2211	47.3481	-0.9299	41.87	58.13	3.6751	7.4065	-3.7314	50.3797	-1.6627	44.56	55.44

(Table 11 continued)

	Full samples							Latest crisis (2006-2009)						
	Payoff (%)	Total (%)	TIR (%)	% TIR	SIR (%)	% SIR	% DIR	Payoff (%)	Total (%)	TIR (%)	% TIR	SIR (%)	% SIR	% DIR
Property & casualty insur	1.6791	2.9373	-1.2596	42.8822	-0.8064	64.02	35.98	2.4368	4.1311	-1.6943	41.0131	-1.3727	81.02	18.98
Publishing & printing	1.5005	2.5525	-1.0991	43.0592	-0.8071	73.44	26.56	2.4457	4.6773	-2.2316	47.7110	-1.7946	80.42	19.58
Railroads	1.8919	3.1474	-1.2874	40.9040	-0.7826	60.79	39.21	2.7195	4.5972	-1.8778	40.8458	-1.4284	76.07	23.93
Real estate invst trusts	2.1914	3.7924	-1.6214	42.7534	-1.1161	68.84	31.16	3.4503	5.8892	-2.4388	41.4123	-1.8809	77.12	22.88
Restaurants	1.7362	2.9283	-1.1821	40.3686	-0.6980	59.05	40.95	1.8520	3.0571	-1.2051	39.4202	-0.9326	77.38	22.62
Soft drinks	1.5613	2.6838	-1.1142	41.5162	-0.5293	47.50	52.50	1.4039	2.5582	-1.1543	45.1218	-0.6687	57.93	42.07
Specialty chemicals	1.5036	2.6763	-1.1724	43.8085	-0.7229	61.66	38.34	1.8391	3.2799	-1.4408	43.9285	-0.8953	62.14	37.86
Specialty stores	2.1583	3.6893	-1.5347	41.5991	-1.0138	66.06	33.94	3.0479	5.1929	-2.1449	41.3056	-1.6036	74.76	25.24
Steel -price index	2.6144	4.5336	-1.9396	42.7827	-1.2028	62.01	37.99	4.1002	7.0645	-2.9643	41.9605	-2.4080	81.23	18.77
Systems software	2.2811	3.8230	-1.5226	39.8279	-0.9730	63.90	36.10	2.1455	3.6424	-1.4969	41.0968	-0.9840	65.74	34.26
Tires & rubber	2.8295	5.0552	-2.2765	45.0319	-1.4048	61.71	38.29	4.7630	8.9781	-4.2151	46.9489	-2.9483	69.95	30.05
Tobacco	1.9650	3.5431	-1.5588	43.9951	-0.5319	34.12	65.88	1.6526	2.9119	-1.2594	43.2490	-0.7504	59.59	40.41
Trading comp & distributors	1.8718	3.3772	-1.5065	44.6067	-0.9631	63.93	36.07	2.5080	4.2898	-1.7819	41.5368	-1.3983	78.47	21.53
Wireless telecom serv	3.1144	5.3718	-2.2398	41.6963	-1.1625	51.90	48.10	3.2227	6.0240	-2.8013	46.5021	-1.7919	63.97	36.03
Hyp mkts & sup cnt	1.5274	2.5509	-0.9882	38.7387	-0.4390	44.42	55.58	1.9417	2.9838	-1.0421	34.9244	-0.5654	54.26	45.74
H/c services	1.6396	2.8185	-1.1571	41.0539	-0.5669	49.00	51.00	1.9844	3.4165	-1.4321	41.9175	-0.9056	63.23	36.77
Regional bnks	2.4916	4.1160	-1.6637	40.4210	-0.9260	55.66	44.34	3.8543	6.9418	-3.0875	44.4768	-1.7722	57.40	42.60
Thrfts/mge fin	2.6828	4.7157	-1.9332	40.9955	-0.9748	50.43	49.57	4.4292	7.7860	-3.3569	43.1141	-1.6580	49.39	50.61
Spec finance	2.3812	4.0444	-1.6586	41.0101	-1.0446	62.98	37.02	3.5223	6.0518	-2.5296	41.7980	-1.6975	67.11	32.89
Cons finance	2.4446	4.2075	-1.7898	42.5384	-1.3339	74.53	25.47	3.5027	6.6075	-3.1049	46.9897	-2.3811	76.69	23.31
Ass mgt & cust bnk	2.3115	3.7307	-1.4160	37.9549	-1.1485	81.11	18.89	3.3024	5.4498	-2.1474	39.4027	-1.8146	84.50	15.50
Inv bnk & brok	2.8278	4.6278	-1.7450	37.7076	-1.2731	72.96	27.04	4.3751	7.1417	-2.7666	38.7391	-2.0019	72.36	27.64
Data pro & out svs	1.4496	2.4402	-0.9996	40.9641	-0.7890	78.93	21.07	1.7698	3.1365	-1.3667	43.5738	-1.1783	86.22	13.78
Hm ent s/ware	2.8735	4.8051	-1.9279	40.1220	-0.8342	43.27	56.73	3.3572	5.4159	-2.0588	38.0130	-1.0587	51.42	48.58
Comm. equipment	2.6651	4.6270	-1.9353	41.8255	-1.2545	64.82	35.18	2.3202	3.8146	-1.4943	39.1746	-1.1974	80.13	19.87
Elec manu svs	2.5482	4.3739	-1.8826	43.0412	-1.4327	76.11	23.89	2.6065	5.0705	-2.4640	48.5949	-1.8915	76.76	23.24
S/con equipment	3.8877	6.4012	-2.4582	38.4026	-1.5119	61.51	38.49	2.9359	4.8367	-1.9008	39.2988	-1.2735	67.00	33.00
Semiconductors	2.9379	4.9088	-1.9453	39.6289	-1.1659	59.93	40.07	2.5613	4.2780	-1.7167	40.1289	-1.2678	73.85	26.15
Oil & gas storage & transp	2.4083	4.3152	-1.9467	45.1127	-1.4776	75.90	24.10	2.4862	4.7096	-2.2234	47.2103	-1.8760	84.38	15.62
Education services si	3.1754	6.0004	-2.7376	45.6238	-0.5766	21.06	78.94	3.6896	6.5572	-2.8676	43.7320	-0.4638	16.17	83.83
Spl. cons. services si	2.5095	4.4786	-1.9316	43.1300	-1.0136	52.47	47.53	2.8549	5.0334	-2.1785	43.2803	-1.3295	61.03	38.97
Automotive retail si	1.9800	3.6526	-1.6467	45.0822	-1.0667	64.78	35.22	2.4038	4.3700	-1.9662	44.9932	-1.3266	67.47	32.53
Home furnish retail si	2.6351	4.6065	-1.9618	42.5883	-1.0978	55.96	44.04	2.8941	5.0909	-2.1969	43.1525	-1.3349	60.76	39.24
Ind. power prod & energy tr	2.2595	4.2103	-2.0278	48.1616	-1.0825	53.38	46.62	2.4170	4.9192	-2.5022	50.8659	-1.4289	57.11	42.89

In the USA market, a reduction in the absolute level of TIR can be reported in 16 industries: Application Software, Biotechnologies, Computer and Electrical Retail, Computer Storage and Peripherals, Div. Comm. and Professional Services, Environment and Facility Service, Food Retail, Healthcare Distribution, Insurance Brokers, Internet Software and Services, Multi-utilities, Systems Software, Tobacco, Commercial Equipments, Semi-Conductor Equipments, and Semiconductors. The reduction of the relative level of TIR to the total take place in 27 industries but only five cases were overlapped with the previous 16 (i.e., Environment and Facility Service, Food Retail, Insurance Brokers, Tobacco, and Commercial Equipments). Only eight industries showed an increase in the relative weight of DIR; only Insurance Brokers is included in the latest list. In 24 industries, a reduction in payoff risk during the latest crisis was observed. Fourteen cases are overlapped with a reduction in

absolute TIR, while three are the overlaps with a reduction in relative weight.

Our conclusion is simple: No clear overlaps can be found with Europe except the case for the "technology" case.

Finally, Table 12 is reporting data computed for the Japanese market during the latest crisis period.

Table 12

TIR Composition During the Crisis in the Japanese Market

	Full samples							Latest crisis (2006-2009)						
	Payoff (%)	Total (%)	TIR (%)	% TIR	SIR (%)	% SIR	% DIR	Payoff (%)	Total (%)	TIR (%)	% TIR	SIR (%)	% SIR	% DIR
TOPIX	1.5910	2.7661	-1.1698	42.2895	-1.1698	73.73	26.27	2.0417	3.5722	-1.5306	42.8461	-1.5306	77.69	22.31
Fisheries	1.7770	3.1553	-1.3554	42.9550	-0.8909	65.73	34.27	2.0140	3.5886	-1.5746	43.8789	-1.2278	77.97	22.03
Mining	2.3492	4.2089	-1.8660	44.3355	-1.1010	59.00	41.00	3.3935	5.9187	-2.5252	42.6651	-1.7623	69.79	30.21
Construction	1.7851	3.3565	-1.5696	46.7611	-1.1462	73.03	26.97	2.4238	4.2231	-1.7992	42.6050	-1.5580	86.59	13.41
Foods	1.2372	2.1560	-0.9144	42.4101	-0.6936	75.85	24.15	1.6027	2.8521	-1.2494	43.8052	-0.9470	75.80	24.20
Textiles	1.6512	2.9426	-1.3001	44.1823	-1.0274	79.03	20.97	2.0728	3.6838	-1.6110	43.7326	-1.3596	84.39	15.61
Pulp & paper	1.9512	3.5009	-1.5350	43.8451	-0.9502	61.90	38.10	2.1428	3.9502	-1.8074	45.7541	-1.2316	68.15	31.85
Oil & coal prods	2.0708	3.5800	-1.5078	42.1189	-0.9609	63.73	36.27	2.5397	4.6500	-2.1104	45.3839	-1.6337	77.41	22.59
Rubber products	2.1690	3.6661	-1.4986	40.8767	-0.9546	63.70	36.30	2.9346	4.9165	-1.9819	40.3106	-1.3727	69.26	30.74
Glass & ceramics	1.9643	3.4347	-1.4814	43.1311	-1.2082	81.56	18.44	2.7224	4.7773	-2.0549	43.0138	-1.8793	91.45	8.55
Iron & steel	2.2775	4.1027	-1.8389	44.8215	-1.3500	73.42	26.58	3.1869	5.8897	-2.7028	45.8907	-2.1132	78.19	21.81
Non-ferrous mets	2.1920	3.9306	-1.7513	44.5551	-1.4226	81.23	18.77	2.9105	5.3092	-2.3987	45.1792	-2.0073	83.68	16.32
Metal products	1.6945	2.9846	-1.2879	43.1528	-0.9981	77.49	22.51	2.2418	3.8889	-1.6471	42.3549	-1.5042	91.32	8.68
Machinery	1.7987	3.2425	-1.4537	44.8323	-1.2722	87.52	12.48	2.7298	4.9290	-2.1992	44.6175	-1.9273	87.64	12.36
Electric machine	1.9795	3.4751	-1.4969	43.0756	-1.2952	86.53	13.47	2.4243	4.2923	-1.8680	43.5193	-1.8189	97.37	2.63
Transport equip.	1.9153	3.2791	-1.3696	41.7669	-1.1054	80.71	19.29	2.7677	4.8770	-2.1093	43.2499	-1.8755	88.92	11.08
Precision instr.	1.8883	3.2196	-1.3417	41.6726	-1.1092	82.67	17.33	2.3434	4.0735	-1.7301	42.4717	-1.5819	91.43	8.57
Other products	1.7377	2.9823	-1.2356	41.4309	-1.0146	82.11	17.89	2.6203	4.5029	-1.8826	41.8079	-1.5500	82.34	17.66
Real estate	2.6249	4.5879	-1.9712	42.9647	-1.4728	74.72	25.28	3.5983	6.2807	-2.6824	42.7087	-2.0481	76.35	23.65
Land transport	1.3833	2.3270	-0.9420	40.4824	-0.7278	77.26	22.74	1.5646	2.6425	-1.0779	40.7897	-0.7601	70.52	29.48
Marine transport	2.4821	4.3604	-1.8903	43.3522	-1.2298	65.06	34.94	3.4779	6.3210	-2.8432	44.9795	-1.9370	68.13	31.87
Air transport	1.9761	3.4716	-1.5009	43.2324	-0.9117	60.75	39.25	1.8077	3.2105	-1.4028	43.6950	-0.8033	57.26	42.74
Warehouse	1.8598	3.3205	-1.4524	43.7404	-1.0044	69.15	30.85	2.2116	3.7981	-1.5865	41.7710	-1.2302	77.54	22.46
Info & communication	2.2570	3.9896	-1.6983	42.5693	-1.3159	77.48	22.52	1.8385	3.1720	-1.3336	42.0410	-1.0320	77.39	22.61
Elec. power & gas	1.2457	2.1876	-0.9348	42.7331	-0.3806	40.72	59.28	1.8363	3.2537	-1.4173	43.5612	-0.4762	33.60	66.40
Service	1.6704	3.0745	-1.3859	45.0768	-1.1207	80.87	19.13	1.5786	2.8194	-1.2408	44.0083	-1.0165	81.93	18.07
Pharmaceutical	1.3898	2.4157	-1.0179	42.1348	-0.6485	63.71	36.29	1.7871	3.0282	-1.2411	40.9844	-0.9098	73.30	26.70
Wholesale	2.1236	3.9084	-1.7852	45.6769	-1.4526	81.37	18.63	2.8800	5.1930	-2.3130	44.5409	-1.8588	80.36	19.64
Retail	1.6709	3.0506	-1.3679	44.8421	-1.0173	74.37	25.63	1.9666	3.5422	-1.5756	44.4814	-1.1047	70.11	29.89
Securities	3.0086	5.3972	-2.3973	44.4165	-1.9353	80.73	19.27	3.4124	6.1470	-2.7346	44.4862	-2.1143	77.32	22.68
Insurance	2.1788	3.7134	-1.5399	41.4689	-1.1323	73.53	26.47	3.4549	5.9713	-2.5165	42.1425	-1.8994	75.48	24.52
Other financials	2.3044	4.0610	-1.7811	43.8590	-1.3338	74.89	25.11	3.6825	6.7368	-3.0543	45.3373	-2.1998	72.02	27.98
Chemical	1.5525	2.7268	-1.1783	43.2133	-1.0435	88.55	11.45	1.9316	3.4418	-1.5102	43.8775	-1.4057	93.08	6.92
Banks	2.4097	4.2600	-1.8465	43.3455	-1.3825	74.87	25.13	3.1438	5.5844	-2.4406	43.7038	-1.8936	77.59	22.41

Just like in the European case, we observe an absolute TIR reduction in three industries: Air Transport, Info and Communication, Service. A stronger overlap with the American case is clear; moreover, it is interesting to notice that all the three industries jointly show a reduction in the payoff risk (and total risk as well). Analyzing the relative weight of TIR over the total risk, the reduction is more frequent: 14 cases, two are

overlapped with the previous ones, except Air Transport. In nine industries, an increase in the percentage of DIR can be observed. In the Service industry, the absolute reduction in TIR joined a reduction in DIR weight.

Finally, we can try to compare the two crises in terms of impact over the information risk in the three analyzed markets in Tables 13-15.

Table 13

TIR Composition Compared in the Two Crisis: The Japanese Market

	The latest crisis (2006-2009)							The previous crisis (1999-2003)						
	Payoff (%)	Total (%)	TIR (%)	% TIR	SIR (%)	% SIR	% DIR	Payoff (%)	Total (%)	TIR (%)	% TIR	SIR (%)	% SIR	% DIR
TOPIX	2.0417	3.5722	-1.5306	42.8461	-1.5306	77.69	22.31	1.7466	2.9404	-1.1938	40.6004	-1.1938	58.89	41.11
Fisheries	2.0140	3.5886	-1.5746	43.8789	-1.2278	77.97	22.03	1.7499	2.9917	-1.2418	41.5081	-0.6803	54.78	45.22
Mining	3.3935	5.9187	-2.5252	42.6651	-1.7623	69.79	30.21	2.3421	4.1104	-1.7682	43.0192	-0.5241	29.64	70.36
Construction	2.4238	4.2231	-1.7992	42.6050	-1.5580	86.59	13.41	1.7038	3.0424	-1.3385	43.9961	-0.7918	59.15	40.85
Foods	1.6027	2.8521	-1.2494	43.8052	-0.9470	75.80	24.20	1.1871	2.0045	-0.8174	40.7790	-0.4209	51.49	48.51
Textiles	2.0728	3.6838	-1.6110	43.7326	-1.3596	84.39	15.61	1.7122	2.9997	-1.2875	42.9213	-0.7701	59.81	40.19
Pulp & paper	2.1428	3.9502	-1.8074	45.7541	-1.2316	68.15	31.85	2.4155	4.0277	-1.6122	40.0272	-0.6577	40.79	59.21
Oil & coal prods	2.5397	4.6500	-2.1104	45.3839	-1.6337	77.41	22.59	2.4235	3.9525	-1.5290	38.6847	-0.5253	34.35	65.65
Rubber products	2.9346	4.9165	-1.9819	40.3106	-1.3727	69.26	30.74	2.8771	4.6857	-1.8086	38.5991	-0.7626	42.16	57.84
Glass & ceramics	2.7224	4.7773	-2.0549	43.0138	-1.8793	91.45	8.55	2.1554	3.7528	-1.5974	42.5647	-1.0915	68.33	31.67
Iron & steel	3.1869	5.8897	-2.7028	45.8907	-2.1132	78.19	21.81	2.1631	3.8961	-1.7330	44.4810	-0.9442	54.49	45.51
Non-ferrous mets	2.9105	5.3092	-2.3987	45.1792	-2.0073	83.68	16.32	2.6052	4.6382	-2.0330	43.8310	-1.5004	73.80	26.20
Metal products	2.2418	3.8889	-1.6471	42.3549	-1.5042	91.32	8.68	1.8604	3.1102	-1.2498	40.1845	-0.7198	57.59	42.41
Machinery	2.7298	4.9290	-2.1992	44.6175	-1.9273	87.64	12.36	1.7818	3.1562	-1.3744	43.5463	-1.1255	81.89	18.11
Electric machine	2.4243	4.2923	-1.8680	43.5193	-1.8189	97.37	2.63	2.5372	4.4304	-1.8932	42.7326	-1.5832	83.62	16.38
Transport equip.	2.7677	4.8770	-2.1093	43.2499	-1.8755	88.92	11.08	2.1328	3.5678	-1.4350	40.2212	-0.9600	66.90	33.10
Precision instr.	2.3434	4.0735	-1.7301	42.4717	-1.5819	91.43	8.57	2.2655	3.7131	-1.4476	38.9865	-1.1976	82.73	17.27
Other products	2.6203	4.5029	-1.8826	41.8079	-1.5500	82.34	17.66	1.9905	3.3755	-1.3850	41.0300	-1.0360	74.80	25.20
Real estate	3.5983	6.2807	-2.6824	42.7087	-2.0481	76.35	23.65	2.6224	4.4718	-1.8494	41.3567	-1.0496	56.75	43.25
Land transport	1.5646	2.6425	-1.0779	40.7897	-0.7601	70.52	29.48	1.4733	2.3099	-0.8365	36.2149	-0.4909	58.68	41.32
Marine transport	3.4779	6.3210	-2.8432	44.9795	-1.9370	68.13	31.87	2.6394	4.4591	-1.8197	40.8093	-0.8083	44.42	55.58
Air transport	1.8077	3.2105	-1.4028	43.6950	-0.8033	57.26	42.74	2.3828	4.2176	-1.8348	43.5029	-0.9180	50.04	49.96
Warehouse	2.2116	3.7981	-1.5865	41.7710	-1.2302	77.54	22.46	1.9633	3.4906	-1.5274	43.7566	-0.6626	43.38	56.62
Info & communication	1.8385	3.1720	-1.3336	42.0410	-1.0320	77.39	22.61	3.3686	5.8012	-2.4326	41.9323	-1.8199	74.81	25.19
Elec. power & gas	1.8363	3.2537	-1.4173	43.5612	-0.4762	33.60	66.40	1.3253	2.2102	-0.8849	40.0363	-0.0869	9.82	90.18
Service	1.5786	2.8194	-1.2408	44.0083	-1.0165	81.93	18.07	2.6072	4.7914	-2.1842	45.5857	-1.6401	75.09	24.91
Pharmaceutical	1.7871	3.0282	-1.2411	40.9844	-0.9098	73.30	26.70	1.5847	2.7588	-1.1741	42.5590	-0.4829	41.13	58.87
Wholesale	2.8800	5.1930	-2.3130	44.5409	-1.8588	80.36	19.64	2.6865	4.9415	-2.2551	45.6347	-1.6139	71.57	28.43
Retail	1.9666	3.5422	-1.5756	44.4814	-1.1047	70.11	29.89	2.2568	4.0570	-1.8002	44.3728	-1.1792	65.50	34.50
Securities	3.4124	6.1470	-2.7346	44.4862	-2.1143	77.32	22.68	3.6632	6.5120	-2.8488	43.7467	-2.1807	76.55	23.45
Insurance	3.4549	5.9713	-2.5165	42.1425	-1.8994	75.48	24.52	1.9388	3.3127	-1.3739	41.4743	-0.6614	48.14	51.86
Other financials	3.6825	6.7368	-3.0543	45.3373	-2.1998	72.02	27.98	2.4058	4.2571	-1.8513	43.4878	-1.3612	73.53	26.47
Chemical	1.9316	3.4418	-1.5102	43.8775	-1.4057	93.08	6.92	1.6547	2.7822	-1.1275	40.5254	-0.8773	77.81	22.19
Banks	3.1438	5.5844	-2.4406	43.7038	-1.8936	77.59	22.41	2.6113	4.5294	-1.9181	42.3481	-1.1498	59.95	40.05

With start from the simplest case, Japan: 27 industries show an increase in both absolute and relative TIR; only in the Pulp and Paper industry the contraction in payoff risk could offset the TIR trend. Only the Other Financial registered an increase in the percentage of DIR.

Table 14

TIR Composition Compared in the Two Crisis: The European Market

	The latest crisis (2006-2009)							The previous crisis (1999-2003)						
	Payoff (%)	Total (%)	TIR (%)	% TIR	SIR (%)	% SIR	% DIR	Payoff (%)	Total (%)	TIR (%)	% TIR	SIR (%)	% SIR	% DIR
Dow Jones EuroStoxx	1.7757	3.2114	-1.4357	44.7070	-1.4357	78.82	21.18	1.9440	3.2419	-1.2979	40.0360	-1.2979	70.25	29.75
Oil & gas	2.0575	3.7610	-1.7035	45.2943	-1.4042	82.43	17.57	2.1214	3.5474	-1.4260	40.1977	-0.6934	48.63	51.37
Technology	2.2531	3.8765	-1.6234	41.8773	-1.3198	81.30	18.70	3.7592	6.3397	-2.5805	40.7040	-2.1362	82.78	17.22
Automobiles & parts	2.9135	6.0519	-3.1385	51.8590	-1.5940	50.79	49.21	2.2961	4.0434	-1.7473	43.2132	-1.3312	76.19	23.81
Basis resources	3.0303	5.5829	-2.5525	45.7205	-2.1258	83.28	16.72	2.1823	4.3311	-2.1488	49.6135	-1.2618	58.72	41.28
Retail	1.7626	3.0955	-1.3330	43.0605	-0.9453	70.92	29.08	1.8902	3.3276	-1.4374	43.1950	-1.0808	75.20	24.80
Insurance	2.6162	4.8571	-2.2409	46.1367	-2.0036	89.41	10.59	2.5481	4.4601	-1.9120	42.8691	-1.5490	81.01	18.99
Food & beverage	1.5184	2.6445	-1.1261	42.5834	-0.7448	66.14	33.86	1.5808	2.7055	-1.1247	41.5712	-0.2248	19.98	80.02
Travel and leisure	2.0704	3.7559	-1.6855	44.8769	-1.3377	79.36	20.64	2.0016	3.6579	-1.6562	45.2790	-1.2807	77.33	22.67
Financial services	2.2851	4.2008	-1.9157	45.6033	-1.7651	92.14	7.86	2.0113	3.5094	-1.4981	42.6880	-1.1164	74.52	25.48
Personal & household goods	1.7558	3.1357	-1.3799	44.0053	-1.2312	89.23	10.77	2.4086	3.8770	-1.4685	37.8762	-1.2608	85.86	14.14
Media	1.5518	2.7329	-1.1810	43.2158	-0.9535	80.73	19.27	2.8872	5.0605	-2.1733	42.9460	-1.7720	81.54	18.46
Banks	2.6504	4.9733	-2.3230	46.7082	-2.0772	89.42	10.58	2.0010	3.4751	-1.4740	42.4175	-1.2726	86.34	13.66
Construction and materials	2.4407	4.3469	-1.9062	43.8526	-1.6731	87.77	12.23	1.6485	2.9330	-1.2845	43.7942	-1.0336	80.47	19.53
Industrial goods and services	2.2275	4.0968	-1.8693	45.6282	-1.7301	92.55	7.45	2.0517	3.5159	-1.4642	41.6444	-1.1694	79.87	20.13
Chemicals	1.8765	3.5284	-1.6519	46.8172	-1.4570	88.20	11.80	2.1086	3.6831	-1.5745	42.7485	-1.1093	70.45	29.55
Health care	1.6862	2.9295	-1.2433	42.4414	-0.6421	51.64	48.36	2.2658	3.6364	-1.3705	37.6891	-0.5641	41.16	58.84
Telecommunications	1.6432	2.7666	-1.1233	40.6033	-0.6767	60.24	39.76	2.9384	4.9996	-2.0612	41.2266	-1.5617	75.77	24.23
Utilities	1.7772	3.3321	-1.5549	46.6645	-1.2926	83.13	16.87	1.5895	2.6600	-1.0706	40.2469	-0.7353	68.69	31.31

Table 15

TIR Composition Compared in the Two Crisis: The American Market

	The latest crisis (2006-2009)							The previous crisis (1999-2003)						
	Payoff (%)	Total (%)	TIR (%)	% TIR	SIR (%)	% SIR	% DIR	Payoff (%)	Total (%)	TIR (%)	% TIR	SIR (%)	% SIR	% DIR
S&P 500	1.7603	3.0486	-1.2882	42.2575	-1.2882	68.31	31.69	1.7005	2.8056	-1.1051	39.3885	-1.1051	53.61	46.39
Advertising	2.1813	3.9873	-1.8060	45.2932	-1.2975	71.85	28.15	3.0755	5.2634	-2.1879	41.5684	-1.5751	71.99	28.01
Aerospace & defense	1.7513	3.2719	-1.5205	46.4733	-1.3063	85.91	14.09	2.1282	3.6702	-1.5420	42.0138	-0.9638	62.50	37.50
Agricultural products	3.1167	5.3338	-2.2172	41.5677	-1.0535	47.52	52.48	2.2818	4.0528	-1.7710	43.6988	-0.4316	24.37	75.63
Air freight & couriers si	2.0845	3.6057	-1.5212	42.1877	-1.1302	74.30	25.70	3.0073	4.7614	-1.7540	36.8393	-1.0747	61.27	38.73
Airlines si	2.9504	5.0745	-2.1241	41.8581	-0.9127	42.97	57.03	3.0461	5.1244	-2.0784	40.5583	-1.4884	71.61	28.39
Aluminum	4.1207	7.7335	-3.6129	46.7168	-2.8610	79.19	20.81	3.0403	5.2696	-2.2292	42.3040	-1.2202	54.74	45.26
Apparel & accessories	3.1022	5.5011	-2.3989	43.6081	-1.7382	72.46	27.54	2.2391	3.7875	-1.5484	40.8826	-0.9343	60.34	39.66
Apparel retail	2.5742	4.3780	-1.8038	41.2021	-1.3939	77.27	22.73	3.5760	5.8580	-2.2820	38.9553	-1.4627	64.10	35.90
Application software	2.3414	4.0344	-1.6930	41.9649	-1.3981	82.58	17.42	5.0329	8.1280	-3.0952	38.0802	-1.8247	58.95	41.05
Auto parts & equip	3.3200	6.1331	-2.8131	45.8674	-1.9672	69.93	30.07	2.0681	3.8592	-1.7911	46.4112	-1.0355	57.81	42.19
Automobile manufacturers	4.6446	9.6796	-5.0350	52.0165	-3.0242	60.06	39.94	2.5494	4.4359	-1.8864	42.5267	-1.1697	62.01	37.99
Div banks	3.9816	7.4701	-3.4885	46.6993	-2.1886	62.74	37.26	2.2238	3.7743	-1.5504	41.0795	-1.0743	69.29	30.71
Biotechnology	1.8426	3.2345	-1.3918	43.0312	-0.6150	44.19	55.81	3.6679	5.7441	-2.0762	36.1450	-0.8148	39.25	60.75
Brewers	1.5949	3.0824	-1.4875	48.2582	-0.5962	40.08	59.92	2.0871	3.2771	-1.1900	36.3133	-0.3031	25.47	74.53
Broadcasting & cable TV	2.9057	6.5726	-3.6669	55.7908	-2.8683	78.22	21.78	2.9382	4.8267	-1.8885	39.1264	-1.4102	74.68	25.32
Building products	3.0820	6.4979	-3.4159	52.5696	-2.2324	65.35	34.65	2.7327	4.7238	-1.9911	42.1505	-0.9316	46.79	53.21
Casinos & gaming	3.0839	6.0786	-2.9947	49.2659	-2.1415	71.51	28.49	2.9182	4.8745	-1.9562	40.1319	-0.9188	46.97	53.03
Commercial printing	2.6399	5.5793	-2.9394	52.6846	-2.3732	80.73	19.27	2.1593	3.8472	-1.6879	43.8736	-0.7464	44.22	55.78

(Table 15 continued)

	The latest crisis (2006-2009)							The previous crisis (1999-2003)						
	Payoff (%)	Total (%)	TIR (%)	% TIR	SIR (%)	% SIR	% DIR	Payoff (%)	Total (%)	TIR (%)	% TIR	SIR (%)	% SIR	% DIR
Computer & electr retail	2.9626	5.1842	-2.2216	42.8540	-1.5328	69.00	31.00	4.2058	7.1503	-2.9446	41.1809	-1.6258	55.21	44.79
Computer hware	2.0931	3.6715	-1.5784	42.9898	-1.2153	77.00	23.00	3.1291	5.0905	-1.9614	38.5308	-1.4574	74.30	25.70
Comp storage & peripherals	2.5583	4.5028	-1.9445	43.1842	-1.4487	74.50	25.50	5.1858	8.2171	-3.0313	36.8902	-1.7588	58.02	41.98
Construction & engineering	3.7406	6.6536	-2.9131	43.7817	-2.0824	71.49	28.51	3.1932	5.6416	-2.4484	43.3991	-0.9562	39.05	60.95
Construction & farm machine	3.0056	5.5126	-2.5070	45.4776	-2.1652	86.36	13.64	2.4779	4.1554	-1.6775	40.3699	-0.9626	57.38	42.62
Construction materials	3.5145	6.5358	-3.0213	46.2267	-1.8874	62.47	37.53	2.2636	4.0644	-1.8008	44.3067	-1.0283	57.10	42.90
Department stores	3.1650	5.8969	-2.7318	46.3269	-2.0027	73.31	26.69	2.5756	4.2981	-1.7225	40.0750	-1.2288	71.34	28.66
Distributors	2.0049	3.5826	-1.5777	44.0389	-1.0344	65.56	34.44	1.7055	2.6095	-0.9040	34.6431	-0.4321	47.80	52.20
Diversified chemicals	2.2550	4.2473	-1.9922	46.9067	-1.6259	81.61	18.39	2.4335	4.1763	-1.7428	41.7310	-1.0068	57.77	42.23
Div comm & prof serv	1.5273	2.6009	-1.2635	48.5784	-0.9214	72.93	27.07	2.1210	3.6679	-1.5469	42.1738	-1.2004	77.60	22.40
Div fin svs	4.0550	7.5406	-3.4856	46.2247	-2.5122	72.07	27.93	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Diversified metals & mining	4.5188	8.2101	-3.6913	44.9605	-2.5603	69.36	30.64	2.8441	4.9572	-2.1131	42.6273	-0.9681	45.81	54.19
Drug retail	2.0980	3.4712	-1.3733	39.5615	-0.8496	61.87	38.13	2.5988	4.3492	-1.7504	40.2471	-0.6104	34.87	65.13
Electric utilities	1.7216	3.0408	-1.3192	43.3825	-0.8587	65.09	34.91	1.7734	3.1724	-1.3990	44.0984	-0.4918	35.15	64.85
Electrical comp & equip	2.3421	4.0697	-1.7276	42.4498	-1.4003	81.06	18.94	2.3920	3.9906	-1.5985	40.0577	-1.1395	71.28	28.72
Elec eq manuf.	2.4381	4.4536	-2.0155	45.2552	-1.3896	68.94	31.06	3.9760	6.7219	-2.7459	40.8499	-1.8961	69.05	30.95
HR & employment serv	3.1376	5.4212	-2.2836	42.1233	-1.6636	72.85	27.15	3.5870	6.5965	-3.0096	45.6234	-2.2838	75.89	24.11
Envr & facilities serv	2.0926	3.4615	-1.3689	39.5467	-0.8610	62.89	37.11	3.0601	5.5036	-2.4436	44.3992	-0.8087	33.10	66.90
Fertiliser & agri chemicals	3.5683	5.9483	-2.3801	40.0125	-1.5162	63.71	36.29	3.2269	4.7243	-1.4974	31.6948	-0.7559	50.48	49.52
Food distributors	1.9520	3.5206	-1.5686	44.5546	-1.0166	64.81	35.19	2.1493	3.7617	-1.6124	42.8632	-0.7308	45.32	54.68
Food retail	2.0635	3.3218	-1.2584	37.8818	-0.7653	60.82	39.18	2.4393	4.4346	-1.9953	44.9945	-0.8133	40.76	59.24
Footwear	2.4945	4.3937	-1.8992	43.2250	-1.2155	64.00	36.00	3.2814	5.5209	-2.2395	40.5645	-0.8582	38.32	61.68
Forest products	3.2758	5.9988	-2.7230	45.3925	-1.7843	65.52	34.48	2.9003	4.7417	-1.8414	38.8344	-1.1065	60.09	39.91
Gas utilities	2.6594	4.9402	-2.2809	46.1691	-1.6395	71.88	28.12	2.0655	3.6328	-1.5673	43.1434	-0.8408	53.65	46.35
General merch stores	2.9190	4.9048	-1.9858	40.4861	-1.3758	69.29	30.71	2.8090	4.5238	-1.7147	37.9050	-1.1574	67.49	32.51
Gold	3.4621	6.1653	-2.7033	43.8463	-1.1353	42.00	58.00	3.2390	5.3838	-2.1448	39.8385	0.0335	-1.56	101.56
H/care dist	1.8242	3.3199	-1.4957	45.0526	-0.8184	54.72	45.28	2.5122	4.4063	-1.8941	42.9862	-0.6893	36.39	63.61
Health care equip	1.5526	2.7886	-1.2360	44.3226	-0.9309	75.31	24.69	2.1522	3.4858	-1.3336	38.2587	-0.7953	59.63	40.37
Health care facilities	3.6157	8.5502	-4.9345	57.7123	-1.9955	40.44	59.56	2.5512	4.6618	-2.1106	45.2749	-0.3732	17.68	82.32
Health care supplies	1.6233	5.1581	-3.5348	68.5296	-1.3182	37.29	62.71	2.7420	4.9355	-2.1935	44.4428	-0.8363	38.13	61.87
Home furnishings	2.8041	5.0990	-2.2949	45.0068	-1.3693	59.67	40.33	2.4732	4.5513	-2.0781	45.6588	-1.2705	61.14	38.86
Home improve retail	2.8592	4.8498	-1.9906	41.0452	-1.3631	68.48	31.52	3.2819	5.5613	-2.2794	40.9864	-1.4789	64.88	35.12
Homebuilding	5.4241	9.3761	-3.9519	42.1490	-2.4606	62.26	37.74	3.2291	5.5576	-2.3285	41.8975	-1.3142	56.44	43.56
Hotels	3.0381	5.5493	-2.5112	45.2521	-1.9020	75.74	24.26	2.8333	4.8965	-2.0632	42.1368	-1.4912	72.27	27.73
Household appliances	2.6558	5.0228	-2.3670	47.1245	-1.7485	73.87	26.13	2.4122	4.4091	-1.9969	45.2912	-1.3335	66.78	33.22
Household products	1.3179	2.3087	-0.9908	42.9159	-0.5213	52.62	47.38	1.9599	3.3167	-1.3568	40.9089	-0.2437	17.96	82.04
Housewares & specialties	2.3291	4.8181	-2.4891	51.6606	-1.8323	73.61	26.39	1.9345	3.5246	-1.5902	45.1162	-0.8890	55.90	44.10
Industrial conglomerates	2.2699	4.4875	-2.2176	49.4168	-1.7076	77.00	23.00	2.5986	4.2869	-1.6883	39.3822	-1.4384	85.20	14.80
Industrial gases	2.3897	4.1894	-1.7997	42.9589	-1.4270	79.29	20.71	2.6199	4.4971	-1.8773	41.7436	-0.8814	46.95	53.05
Industrial machinery	2.1146	3.7345	-1.6199	43.3764	-1.4320	88.40	11.60	2.0701	3.5244	-1.4543	41.2636	-0.9533	65.55	34.45
Insurance brokers	1.8963	3.1876	-1.2913	40.5099	-0.7101	54.99	45.01	2.6108	4.6134	-2.0025	43.4072	-1.3573	67.78	32.22
Integrated oil & gas	2.2800	3.8031	-1.5231	40.0491	-1.2426	81.58	18.42	1.8802	3.0633	-1.1832	38.6237	-0.5968	50.44	49.56
Integrated telecom serv	2.0557	3.4133	-1.3575	39.7725	-0.9505	70.02	29.98	2.3076	3.9384	-1.6309	41.4089	-0.9118	55.91	44.09
Internet retail	3.5258	6.1363	-2.6104	42.5411	-1.4733	56.44	43.56	2.5991	3.6881	-1.0890	29.5271	-0.4745	43.57	56.43

(Table 15 continued)

	The latest crisis (2006-2009)							The previous crisis (1999-2003)						
	Payoff (%)	Total (%)	TIR (%)	% TIR	SIR (%)	% SIR	% DIR	Payoff (%)	Total (%)	TIR (%)	% TIR	SIR (%)	% SIR	% DIR
Internet software & serv	2.4602	4.2294	-1.7692	41.8303	-1.2426	70.23	29.77	5.8243	9.9007	-4.0764	41.1725	-2.6918	66.03	33.97
IT cons & o/svs	3.4794	6.0831	-2.6037	42.8026	-1.8762	72.06	27.94	2.8902	5.3977	-2.5074	46.4543	-1.4181	56.56	43.44
Leisure products	2.2990	4.3337	-2.0347	46.9513	-1.2203	59.97	40.03	2.4612	4.2841	-1.8228	42.5493	-0.7654	41.99	58.01
Life & health ins	3.4442	6.7812	-3.3370	49.2098	-2.9322	87.87	12.13	2.1442	3.7291	-1.5849	42.5011	-1.0733	67.72	32.28
Managed health care	2.6070	5.1997	-2.5926	49.8616	-1.5431	59.52	40.48	2.4065	4.0565	-1.6500	40.6744	-0.3328	20.17	79.83
Metal & glass cont	2.3366	4.1487	-1.8121	43.6785	-1.4072	77.66	22.34	2.3720	4.2062	-1.8342	43.6071	-0.8106	44.20	55.80
Motorcycle manufacturers	3.6786	7.1012	-3.4225	48.1969	-2.6637	77.83	22.17	2.8841	4.8471	-1.9629	40.4977	-1.2692	64.66	35.34
Movies & entertainment	2.0975	3.9760	-1.8785	47.2457	-1.6605	88.39	11.61	3.2081	5.3678	-2.1597	40.2340	-1.7684	81.88	18.12
Multi-line insurance	3.7499	7.4189	-3.6690	49.4550	-2.6442	72.07	27.93	2.6899	4.4714	-1.7814	39.8408	-1.2821	71.97	28.03
Multi utilities	1.5222	2.7614	-1.2392	44.8766	-0.8839	71.32	28.68	3.9371	7.2522	-3.3150	45.7110	-2.1643	65.29	34.71
Office electronics	2.7203	5.4557	-2.7353	50.1374	-2.1394	78.21	21.79	4.7071	8.3289	-3.6218	43.4844	-1.9343	53.41	46.59
Office serv & supplies	1.9137	3.8615	-1.9478	50.4412	-1.4917	76.59	23.41	2.1393	3.6913	-1.5520	42.0452	-0.7989	51.48	48.52
Oil & gas drilling	3.4141	5.7181	-2.3040	40.2924	-1.7045	73.98	26.02	4.0527	6.4518	-2.3991	37.1844	-0.8125	33.87	66.13
Oil & gas equip & serv	3.3619	5.7095	-2.3477	41.1182	-1.7619	75.05	24.95	3.3922	5.3149	-1.9227	36.1754	-0.7877	40.97	59.03
Oil & gas explor & prod	3.1109	5.4463	-2.3354	42.8804	-1.7761	76.05	23.95	2.7197	4.4050	-1.6853	38.2588	-0.5561	32.99	67.01
Oil & gas refing & mark	3.6009	6.2258	-2.6250	42.1623	-1.8636	70.99	29.01	1.9123	3.3100	-1.3977	42.2263	-0.6849	49.00	51.00
Packaged foods	1.2672	2.2615	-0.9943	43.9654	-0.7296	73.38	26.62	1.4919	2.5426	-1.0507	41.3247	-0.2692	25.62	74.38
Paper packaging	2.3002	4.2203	-1.9201	45.4967	-1.1434	59.55	40.45	2.2896	4.0954	-1.8058	44.0931	-1.0042	55.61	44.39
Paper products	2.8731	5.9993	-3.1262	52.1098	-2.1982	70.32	29.68	2.6672	4.5108	-1.8436	40.8708	-1.1579	62.81	37.19
Personal products	2.2641	4.4549	-2.1908	49.1779	-1.4762	67.38	32.62	2.2689	3.7201	-1.4512	39.0087	-0.3658	25.21	74.79
Pharmaceuticals	1.4918	2.5967	-1.1049	42.5496	-0.7237	65.50	34.50	2.0779	3.4763	-1.3984	40.2263	-0.6834	48.87	51.13
Photographic products	3.6751	7.4065	-3.7314	50.3797	-1.6627	44.56	55.44	2.6130	5.1537	-2.5407	49.2990	-1.2105	47.64	52.36
Property & casualty insur	2.4368	4.1311	-1.6943	41.0131	-1.3727	81.02	18.98	2.1427	3.9861	-1.8434	46.2452	-0.9976	54.12	45.88
Publishing & printing	2.4457	4.6773	-2.2316	47.7110	-1.7946	80.42	19.58	1.7664	2.8966	-1.1301	39.0167	-0.7969	70.51	29.49
Railroads	2.7195	4.5972	-1.8778	40.8458	-1.4284	76.07	23.93	2.2803	3.8168	-1.5365	40.2565	-0.8564	55.74	44.26
Real estate invst trusts	3.4503	5.8892	-2.4388	41.4123	-1.8809	77.12	22.88	1.0316	2.3334	-1.3018	55.7911	-0.9725	74.70	25.30
Restaurants	1.8520	3.0571	-1.2051	39.4202	-0.9326	77.38	22.62	2.1484	3.7420	-1.5936	42.5860	-0.8731	54.79	45.21
Soft drinks	1.4039	2.5582	-1.1543	45.1218	-0.6687	57.93	42.07	2.0683	3.4434	-1.3751	39.9332	-0.4485	32.62	67.38
Specialty chemicals	1.8391	3.2799	-1.4408	43.9285	-0.8953	62.14	37.86	2.0896	3.6925	-1.6029	43.4090	-0.8353	52.11	47.89
Specialty stores	3.0479	5.1929	-2.1449	41.3056	-1.6036	74.76	25.24	3.0112	4.9597	-1.9485	39.2875	-1.2783	65.60	34.40
Steel -price index	4.1002	7.0645	-2.9643	41.9605	-2.4080	81.23	18.77	2.6024	4.4070	-1.8046	40.9489	-1.1217	62.16	37.84
Systems software	2.1455	3.6424	-1.4969	41.0968	-0.9840	65.74	34.26	3.3129	5.3445	-2.0316	38.0130	-1.4432	71.04	28.96
Tires & rubber	4.7630	8.9781	-4.2151	46.9489	-2.9483	69.95	30.05	3.1755	5.8258	-2.6502	45.4917	-1.3378	50.48	49.52
Tobacco	1.6526	2.9119	-1.2594	43.2490	-0.7504	59.59	40.41	2.6862	4.8825	-2.1963	44.9832	-0.4670	21.26	78.74
Trading comp & distributors	2.5080	4.2898	-1.7819	41.5368	-1.3983	78.47	21.53	1.9765	3.6589	-1.6823	45.9797	-1.0220	60.75	39.25
Wireless telecom serv	3.2227	6.0240	-2.8013	46.5021	-1.7919	63.97	36.03	4.9842	8.4443	-3.4601	40.9755	-1.5181	43.87	56.13
Hyp mkts & sup cnt	1.9417	2.9838	-1.0421	34.9244	-0.5654	54.26	45.74	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
H/c services	1.9844	3.4165	-1.4321	41.9175	-0.9056	63.23	36.77	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Regional bnks	3.8543	6.9418	-3.0875	44.4768	-1.7722	57.40	42.60	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Thrfts/mge fin	4.4292	7.7860	-3.3569	43.1141	-1.6580	49.39	50.61	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Spec finance	3.5223	6.0518	-2.5296	41.7980	-1.6975	67.11	32.89	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Cons finance	3.5027	6.6075	-3.1049	46.9897	-2.3811	76.69	23.31	3.2148	5.4594	-2.2446	41.1147	-1.7597	78.40	21.60
Ass mgt & cust bnk	3.3024	5.4498	-2.1474	39.4027	-1.8146	84.50	15.50	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Inv bnk & brok	4.3751	7.1417	-2.7666	38.7391	-2.0019	72.36	27.64	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Data pro & out svs	1.7698	3.1365	-1.3667	43.5738	-1.1783	86.22	13.78	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.

(Table 15 continued)

	The latest crisis (2006-2009)							The previous crisis (1999-2003)						
	Payoff (%)	Total (%)	TIR (%)	% TIR	SIR (%)	% SIR	% DIR	Payoff (%)	Total (%)	TIR (%)	% TIR	SIR (%)	% SIR	% DIR
Hm ent s/ware	3.3572	5.4159	-2.0588	38.0130	-1.0587	51.42	48.58	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Comm. equipment	2.3202	3.8146	-1.4943	39.1746	-1.1974	80.13	19.87	4.1612	6.8788	-2.7177	39.5080	-1.6200	59.61	40.39
Elec manu svs	2.6065	5.0705	-2.4640	48.5949	-1.8915	76.76	23.24	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
S/con equipment	2.9359	4.8367	-1.9008	39.2988	-1.2735	67.00	33.00	5.3168	8.3873	-3.0705	36.6089	-1.8172	59.18	40.82
Semiconductors	2.5613	4.2780	-1.7167	40.1289	-1.2678	73.85	26.15	4.4435	7.1286	-2.6851	37.6669	-1.7457	65.01	34.99
Oil & gas storage & transp	2.4862	4.7096	-2.2234	47.2103	-1.8760	84.38	15.62	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Education services si	3.6896	6.5572	-2.8676	43.7320	-0.4638	16.17	83.83	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Spl. cons. services si	2.8549	5.0334	-2.1785	43.2803	-1.3295	61.03	38.97	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Automotive retail si	2.4038	4.3700	-1.9662	44.9932	-1.3266	67.47	32.53	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Home furnish retail si	2.8941	5.0909	-2.1969	43.1525	-1.3349	60.76	39.24	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Ind. power prod & energy tr	2.4170	4.9192	-2.5022	50.8659	-1.4289	57.11	42.89	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.

The European case shows only nine industries having higher payoff risk in the latest crisis if compared with the previous one; 12 sectors showed higher level of absolute TIR. The relative weight of TIR increased in 14 industries, while only five industries showed an increase in the relative weight of DIR. These evidences are strongly coherent with data for the entire market: the impact of the information risk was very important and was usually of systematic source.

In the American case, 48 industries indicate an increase in the payoff risk. 75 is the number of industries having a higher absolute level of TIR, while 82 show an increase in the relative indicator. Still in this case, the main source of information risk is the systematic on (87 cases) while DIR increases its impact only on 14 industries. Even in the American evidence TIR is significant for the crisis, especially at systematic level.

Conclusions

The paper aims to demonstrate that observing the information risk in financial markets can help policy makers in acting to prevent the financial crisis and the contagion that may take place. Comparing data of the three inner financial markets during the latest two financial crises (2007-2009 and 2000-2003) along long-term benchmark (1992-2009) we found out some interesting point:

(1) The two crises were similar in trends but not in quality of risk. The latest crisis was deeply influenced by the information risk, while the previous one was generated by the payoff risk;

(2) Financial markets are global if we refer to the payoff risk but are more segmented as per the information risk. In the European markets, the information risk is more systematic, but in the US, the main source of information risk is the diversifiable one;

(3) Regulators should act globally to control the payoff risk contagion, but must take local action to prevent dangerous effect from information risk. European Regulators should focus more on improving the market mechanisms that spreads the information through economic agents, while the US-Regulator should focus more on the hidden information phenomena;

(4) The reduced efficacy of the policies adopted by authorities to contrast the dangerous effect of the latest crisis was due to the higher relevance of the information risk in market equilibrium along with a tricky inversion of the general rule, so that the systematic risk referred to the US market more than in the past experiences.

We have to exit the idea that efficiency is only a problem of quantity of information available: That was

maybe the real source of the financial side of the crisis. Market efficiency is also referring to: (1) Absolute quality of information (good information is the one generating excess return that might pay costs for good information discovery); (2) mechanisms that support the information distribution between financial markets operators (systematic information risk exists because the information is badly processed into markets); and (3) adoption of industry-specific standards of financial communication (standardizing information tools increase efficiency in financial communication, but might increase the lack of specific information increasing the diversifiable information risk quota).

Being relevant both at systematic level than at industry-specific one, the information risk treatment requires to model industry-specific standard of information flows along with general minimal information standard for the entire market. Time-flexible rules are required since changes in IR-drivers may happen. In general term, higher IR-risk is twinned with higher payoff-risk, meaning that transmission of information to financial operators is more difficult in case of risky situations: Payoff risk is difficult to concept. Similarly, industry-specific information risk seems to be a good driver of changes in the total level of information risk.

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Impact of Fiscal Policy on Economy After Accession to the Euro Area: The Case of Poland

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The impact of Polish fiscal policy on economy after accession to the euro area is analyzed in the article. It was found that government spending financed by distortionary taxation affects output in a different way than in case of government spending financed by bonds. Poland's accession to the Economic and Monetary Union will reduce the possibility of increased government spending financed by bonds, which in light of the presented model will greatly reduce the possibility of stimulating the economy through fiscal policy.

Keywords: fiscal policy, government spending, real business cycle (RBC), Euro

Introduction

The countries of the Economic and Monetary Union, in accordance with the Stability and Growth Pact, should in the medium term maintain budgetary balance or budgetary surplus. Thus, Central European countries' accession to the euro area will reduce the possibility of stimulating the economy by increased government spending financed by bonds.

According to the Keynesian approach, a higher level of government spending, whether financed by taxes or budget deficit, enhances the growth of aggregate demand and production. The demand impact of government spending financed by deficit is defined by a commonly known multiplier of government spending, while the impact of the increased government spending financed by taxes—by a balanced budget multiplier. According to the demand-side approach, after country's accession to the euro zone, it will be possible to stimulate the aggregate demand by increasing government spending financed by taxes, that is, without increasing the budget deficit. The supply-side effects of increased government spending resulting in the increased deficit or financed by taxes are less clear. Therefore, the analysis of the effect of methods of financing government spending on supply-side impact of fiscal policy on the economy has been carried out in this paper.

The analysis is based on the Real Business Cycle model (RBC model). The RBC models, assume that wages and prices are fully flexible and adjust immediately to balance supply and demand, and consequently economic fluctuations do not result from deviations of production from the potential level, but from the optimal household choices (Plosser, 1989; Stadler, 1994; McCandless, 2008). As a result, only the supply-side economy affects the real economy, allowing identification of supply-side effects of changes in government spending and taxes.

The paper is arranged as follows. The first section presents the impact of fiscal policy in RBC models. The

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assumptions of the model, developed for the Polish economy, are presented in the next section, and subsequently the results of the simulation are given in the third section. The paper ends with a summary and conclusions of the analysis.

The Impact of Government Spending in the RBC Model

RBC models were developed in the 1980s. RBC models assumed that wages and prices are perfectly flexible and adjust instantaneously to balance supply and demand and economic fluctuations are not due to deviations of production from the potential level, but the optimal household choices. The first RBC models (Kydland & Prescott, 1982; Hansen, 1985) assumed that the only source of the shocks were technological changes. In the late 1980's and early 1990's the RBC models have been supplemented with fiscal policy (models developed by Aschauer, 1988; Christiano & Eichenbaum, 1992; Baxter & King, 1993; McGrattan, 1994). In examining the impact of fiscal policy on the economy, the RBC models above all test the impact of changes in government spending. Implications concerning the impact of fiscal policy on the behavior of households are in the case of RBC models completely different than in the traditional Keynesian approach (cf. Linnemann & Schabert, 2003). Based on the traditional Keynesian approach (i.e., assuming that the expansionary fiscal policy increases aggregate demand enabling companies facing the demand barrier to increase production), we find that the exogenous growth of aggregate demand caused by expansive fiscal policy translates into increased production. The result is an increase in employment, disposable income and consumption, and through the multiplier effect the further increase in consumption. However, in RBC models the impact of fiscal policy on the economy is done by influencing optimal household choices (see e.g., Ljungqvist & Sargent, 2004).

According to the RBC models, the increased government spending resulting in the increased budget deficit or in accordance with the Ricardian equivalence—financed by lump sum tax (see Barro, 1974), produce negative wealth effects. The negative wealth effect results in decrease in the level of consumption and leisure. The decline is the result of absorption of resources from the economy by the state.

In the event of permanent increase in government spending, the increased labor supply shifts the marginal product of capital curve up, which increases the desired capital stock. In the period of adjustment, there takes place a strong increase in investment leading to a rapid convergence of the capital to the target level.

However, in the situation of a temporary increase in the government spending, unlike as in the case of a permanent change in fiscal policy, the increase is followed by decline in investment. Lowering the level of capital is intended to smooth consumption fluctuations—there is a shift of funds from investment to consumption, so as to avoid an abrupt fall in consumption during the transition period of drainage of resources from the economy. After a period of shock, there remains a slightly higher level of investment, aimed at rebuilding the capital, and consumption and leisure time over a period of adjustment are below the level before the shock, heading for baseline levels. Furthermore, due to temporary changes in government spending during the shock, prices of factors of production undergo changes. Wages are reduced, while the interest rate increases. During the adjustment of the economy after the shock, wages and interest rate gradually return to baseline levels.

According to the estimates of Baxter and King (1993) for U.S economy, in the case of a temporary shock the increase in production during the first year after the shock is smaller than in the case of a permanent shock. In the case of the government spending lasting four years, production increases in the first year by about 0.6%, while in the case of a permanent shock in the first year the production growth exceeds 0.8%. The results

obtained by Baxter and King, indicating that the temporary increase in government spending has a smaller impact on production than the permanent growth of government spending, are different from earlier results obtained by Barro (1981). As pointed out by Barro, the permanent change in government spending generates wealth effect, while temporary change triggers the inter-temporal substitution of leisure. According to Barro, the inter-temporal substitution of leisure affects the GDP changes stronger than the wealth effect, so the temporary change in the government expenditure should more strongly affect the production than the permanent change.

The above-mentioned effects of fiscal policy on GDP refer to the case when the changes in government spending are followed by increased budget deficit (or are financed by a lump sum taxes). Different conclusions are reached when government spending is financed by distortionary taxation (i.e., taxes dependent on the volume of production or income). Raising the tax rate lowers production and consumption in a steady state. The increase in taxation reduces the marginal product of capital (after taxation) at the initial level of capital and employment. To restore the equilibrium the amount of capital is reduced, so that the marginal product of capital would increase to its baseline value, as defined by households preferences. Moreover, due to the fact that the increase in the tax rate negatively affects the propensity of households to invest and work, the tax base is reduced and ultimately, in order to balance the budget, the tax rate must be increased. Therefore, the multiplier effect takes place—the increase in tax rate reduces the tax base, which in turn necessitates a further increase in taxation and lowering of the tax base. Baxter and King (1993) found that the 1% GDP increase in government spending in the U.S. economy, financed by an increased tax rate has reduced the GDP by more than 2.5%.

Model Assumptions

The model presented in this paper analyses the fiscal policy on a framework of RBC theory. The study analyzed a model with indivisible labor; because it corresponds more closely to actual labor market than the model with divisible labor with strong substitution effects of labor supply which have not been confirmed by empirical research (cf. Hansen, 1985; Romer, 2000). The model was adapted to the Polish economy, by estimating the parameters based on the data for the Polish economy.

In the model fiscal shocks are caused by stochastic disturbances related to government spending:

$$g_t = (1-\rho_g)\overline{g} + \rho_g g_{t-1} + \varepsilon_{g,t}, \quad \varepsilon_{g,t} \sim N(0, \sigma_{\varepsilon,g}{}^2), \quad \rho_g \in (0,\ 1), \quad \overline{g} > 0 \tag{1}$$

where: g_t = government spending on goods and services.

The model assumes that the budget revenues consist of taxes proportional to income. In response to government spending shocks the tax rate is adjusted in order to maintain unchanged budget balance. Thus, the tax rate in consequence of government spending shocks varies according to the equation:

$$\frac{\Delta\tau_t}{\tau_t} = \frac{g_t}{\tau_t y_t}\frac{\Delta g_t}{g_t} - \frac{\Delta y_t}{y_t} \tag{2}$$

where: τ_t = income tax rate; y_t = output.

The model assumes that the budget expenditure consist of government spending and transfers. The government budget constraint is:

$$\sum_{t=1}^{\infty} \frac{1}{\prod_{j=1}^{t}\left(1+(1-\tau_j)r_j\right)}(g_t + t_t) = \sum_{t=1}^{\infty} \frac{1}{\prod_{j=1}^{t}\left(1+(1-\tau_j)r_j\right)}\tau_t y_t \tag{3}$$

where: t_t = transfers; r_t = interest rate.

In the model, capital and current government spending are analyzed. The share of public capital expenditures in government spending is constant and public capital expenditures increase the public capital stock in accordance with the equation:

$$k_{P,t+1} = (1-\delta)k_{P,t} + \varpi g_t \tag{4}$$

where:

$k_{p,t}$ = public capital;

δ = rate of depreciation of capital;

ϖ = the share of public investment in government expenditure.

It is assumed in model that households are homogeneous, and take such decisions concerning the extent of consumption and leisure, so as to maximize the expected value of the discounted sum of utilities from consumption and leisure. The utility function is invariant over time, has positive first partial derivatives with respect to consumption and leisure, and also negative second partial derivative with respect to consumption. The model assumes that households maximize the expected value of the discounted sum of household utilities, which is given by the equation:

$$U = E\left(\sum_{t=0}^{\infty} \beta^t \left(\phi h_t + \ln(c_t + \kappa(1-\varpi)g_t)\right)\right) \tag{5}$$

where:

β = discounting factor;

c_t = consumption;

κ = the marginal rate of substitution between private consumption and consumption of public goods;

ϕ = weight given to leisure;

h_t = leisure.

Thus, the utility function with indivisible labor assumes that public consumption (government current expenditure) is a substitute for private consumption and affects the amount of effective household consumption.

Firms are homogeneous, operate in conditions of perfect competition and maximize profits. The production function assumed in the model is a power function with constant returns to scale in relation to private capital and labor input, dependent on public capital stock (see Baxter & King, 1993):

$$\ln y_t = \alpha \ln k_t + \alpha_P \ln k_{P,t} + (1-\alpha)\ln l_t \tag{6}$$

where: l_t = labor supply; k_t = capital; α, $\alpha_P \in (0, 1)$.

The total available time is normalized to one, so:

$$l_t = 1 - h_t \tag{7}$$

and Equation 0 takes form:

$$\ln y_t = \alpha \ln k_t + \alpha_P \ln k_{P,t} + (1-\alpha)\ln(1-h_t) \tag{8}$$

The equation for the growth of capital is defined by the following equation:

$$\Delta k_{t+1} = i_t - \delta k_t \tag{9}$$

where: i_t = investment.

Whereas, the equation for the aggregate demand, after taking into account the Equation (9) takes the form:

$$c_t = y_t + (1-\delta)k_t - k_{t+1} - g_t \tag{10}$$

Households take capital stock level as given and make such choices that maximize the expected value of discounted utilities. While specifying the number of hours of work the households determine the amount of leisure. At the same time the choice of consumption determines how much income can be spent on investment, and this in turn determines the future capital stock. As a result, the choice of the amount of work and consumption determines the amount of free time, investment and future stock of capital.

In many cases, after having constructed the theoretical model based on statistical data it is econometrically verified. The real business cycle models often do not examine if the data resulting from the model matches empirical data. This is due in part to the fact that RBC models are very general and do not include the many distortions that occur in the real economy and significantly affect the values of variables. At the same time the levels of variables in RBC models are very sensitive to small changes in assumptions. As a result, recognizing that the model matches the actual data as the most important criterion allows estimating equations indeed well matched within the sample, but does not reflect the economic relationships and is not suitable for forecasting beyond the sample. Therefore, RBC models instead of estimation based on real data often use simulations based on artificial data, generated on the basis of the model equations. Then, the stochastic characteristics of the generated variables, such as standard deviations and correlations are evaluated. The similarity of dynamic characteristics of the generated and the real variables is the criterion for model evaluation. The values of parameters have important impact on the formation of model variables' characteristics. These values can be obtained by calibration. Calibration involves choosing such values of the parameters which are economically justified and make the model generate the data with stochastic characteristics resembling fluctuations in the real economy. The values of model parameters were calibrated based on quarterly data for the Polish economy between 1995 and 2009 and on the basis of literature. The production elasticity of labor has been set at 0.6, based on the estimate of the share of labor costs in GDP, taking into account social security contributions paid by employers, labor costs of the self-employed, and income from employment in the informal economy. The obtained production elasticity of capital was 0.4. Some dynamic stochastic general equilibrium models (DSGE) for the Polish economy apply lower capital elasticity of production. For example, in Bukowski, Kowal, Lewandowski, and Zawistowski (2005), this parameter amounts to 0.3, in Grabek, Kłos, and Utzig-Lenarczyk (2007), it is equal to 0.28, while in the work of Kolasa (2008), it was 0.33. On the other hand, Kuchta and Piłat (2010) in their RBC model for the Polish economy applied a much higher production elasticity of capital, equal to 0.54. The rate of capital depreciation according to relevant literature for the U.S. economy (starting with the pioneering articles of Kydland & Prescott, 1982), and the literature on dynamic stochastic general equilibrium model for the Polish economy (see Bukowski et al., 2005; Grabek et al., 2007; Kolasa, 2008), was adopted at 0.025 on a quarterly basis. On the other hand, the α_P parameter was assumed at the level of 0.03 (the same way as in Hulten & Schwab, 1993; see also Sturm, 1998). The standard quarterly value of 0.99 for the discount factor was used. The marginal rate of substitution in private consumption was adopted at the level of 0.23 on the basis of the literature (cf. Aschauer, 1985; Heijdra & Ligthart, 1997). The parameter that specifies the weight of leisure in relation to consumption was calculated in such a way so as to obtain the average share of working time as in the work of Bukowski et al. (2005).

The autoregressive coefficient and the variance of government spending were determined based on the

seasonally adjusted quarterly data with the trend filtered. The estimated autoregressive coefficient was 0.34. Parameter $\sigma_{\varepsilon,g}^{2}$ was obtained by equating variance of government spending in the model with the actual variance of government spending in the Polish economy. Parameter $\overline{g}$ was determined by equating the average share of government spending in GDP in the model, with the actual average share of government spending in GDP during the period. The parameter ϖ was set as equal to the share of capital expenditures in total budgetary expenditures.

Simulation Results

Based on the model assumptions the impact of a temporary increase in government spending financed by income taxes was examined. The simulated model variables and the reaction of model variables to fiscal policy shock in Polish economy were generated with Dynare software (cf. e.g., Griffoli, 2007). See Table 1.

The model shows that the increase in government spending, coupled with an increased tax rate, reduces production, consumption, private capital, and employment. The decrease in consumption and private capital is caused by the fact that higher government spending and higher tax rate have a negative effect on these variables. The decrease in production and employment as a result of the fiscal shock means that the negative impact of tax increases on the analyzed variables is stronger than the positive impact of the increased government spending.

Table 1
The Impact of a 1% of GDP Increase Carried Out Over One Year in Government Spending, Financed by a Tax Rate Increase

Variables	Temporary effects (%) (deviations from baseline after one quarter)	Permanent effects (%) (deviations from baseline after five years)
Output (*y*)	-2.3	-0.1
Consumption (*c*)	-0.8	-0.4
Capital (*k*)	-0.3	-0.6
Employment (*l*)	-4.0	0.0

On one hand, the increase in government spending through a negative wealth effect reduces the leisure time, and consequently, increases employment. Higher employment in turn affects the growth of GDP. Furthermore, the government spending in this model affects production through its influence on the development of public capital. Government investment spending over the duration of the shock increases public capital stock which through the production function affects GDP.

On the other hand, in order to finance the increased government spending, the income tax rate is increased. This reduces the after tax marginal product of capital and after tax marginal product of labor. Capital and employment fall, production too. In addition, part of the capital is replaced by consumption, so as to prevent excessive fluctuations in household consumption.

Our simulations demonstrate that the negative supply-side impact of the increased tax rate on production is stronger than supply-side impact of the increased government spending. In this case, if the decline in production and employment, resulting from the fiscal shock, lasts a relatively short time, the negative impact of the shock on private capital and consumption is more lasting.

Summary

The study presents the effects of fiscal policy in the context of country's accession the Economic and Monetary Union. The analysis was carried out for the Polish economy, based on a RBC model.

The simulation shows that in the case of financing the increase in government spending by income taxes, the employment, capital, consumption, and production have decreased. It means that analyzed fiscal policy affects production and employment in a different way than in case of higher government spending financed by budget deficit.

Therefore, the choice of the method of financing government spending has a crucial impact on the nature of the supply-side effects of fiscal policy. Moreover Poland's plan to access the euro area and keep the budget deficit under control, in light of the presented supply-side model, will significantly decrease the role of government spending as a potential tool to stimulate economy.

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Clusters as a Way of Penetration of International Market*

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The global financial and economic crisis has negatively affected all business units. Tough fight for the market position results in effort to create efficient methods to maintain company's competitiveness. Some of small and medium entrepreneurs have started to search the business allies. As an example of such possibility of cooperation the formation of clusters should be mention. The main intention of this paper is to demonstrate possibility for small and medium-sized enterprises (SMEs) to cooperatively penetrate new markets. Attention is focused mainly on a real export-oriented cluster. Ambition is to use costs and benefits analysis to test ability of the cluster to improve chances of companies to penetrate new markets. In order to link this analysis to real life as much as possible, existing cluster was used and on its accomplishments and failures costs and benefits of clustering are demonstrated.

Keywords: cluster, export, small and medium-sized enterprises (SMEs)

Introduction

Contemporary market environment is very dynamic because of the economic crisis and the process of globalization. The changing character of the markets forces small and medium-sized enterprises (SMEs) that normally have been acting on local markets to search for new export opportunities to achieve the growth. Furthermore, SMEs face difficulties such as restricted access to capital, limited sources for promotion and advertising, insufficient level of production and technological capacities, limited sources for R&D (research and development) and for skilled labor. Creating efficient strategies to confront increasing competition and maintain competitiveness are an important issue for all SMEs.

Intercompany cooperation and formation of clusters[1] could be a way how to meet challenges on international competition.

The paper aims to address following issues:

(1) Importance of intercompany cooperation for the development of SMEs, especially for those that are focused on export activities;

(2) Advantages and disadvantages of cluster concept.

This paper consists of four sections. The first part analyses crucial role of SMEs in Czech economy and their contribution to national export. The second part summarizes experiences with adoption of cluster policy in the Czech Republic. The third part describes the case study of real export-oriented cluster CREA Hydro&Energy. In the final fourth part costs and benefits analysis of intercompany cooperation is prepared and

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[1] There is no general accepted definition of a cluster. To define the cluster in this paper Porter's (1990) definition is used. Porter (1990) explained clusters as: "Geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities".

influence on increasing export performance is discussed.

The Role of SMEs in the Czech Economy

Definition of SMEs in the Czech Republic is regulated by Act No. 47/2002 Coll about the support of SMEs. The definition of SMEs is inspired by Commission Regulation (EC) No. 800/2008. The basic criteria of assessment of the business size are: the number of employees, size of annual turnover, annual balance sheet (asset size), and independence (Commission of the European Communities, 2008).

Medium enterprises are defined as enterprises that have fewer than 250 employees, have either annual turnover not exceeding EUR 50 million, or have the annual balance sheet not exceeding EUR 43 million and meet the criterion of independence.

Small business are defined as enterprises that have fewer than 50 employees, have either annual turnover not exceeding EUR 10 million, or have the annual balance sheet not exceeding EUR 10 million and meet the criterion of independence.

Micro enterprises are defined as enterprises that have fewer than 10 employees, have either annual turnover not exceeding EUR 2 million, or have the annual balance sheet not exceeding EUR 2 million and meet the criterion of independence.

SMEs represent an important segment of the national economy. They are source of innovations, they create jobs opportunities, contribute significantly to GDP, and act as a barrier against monopolistic tendencies. Their development significantly affects the development of individual regions and subsequently overall economic development of our country. Of all economically active enterprises, 99.83% represent SMEs (Ministry of Industry and Trade of the Czech Republic, 2010). See Table 1.

Table 1

Contribution of SMEs in Selected Macroeconomic Indicators (in %)[2]

Indicators	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Number of enterprises	99.80	99.71	99.81	99.85	99.81	99.84	99.85	99.84	99.84	99.84	99.83
Number of employees	58.84	59.42	59.73	61.34	61.63	61.48	61.63	61.76	61.62	61.52	62.33
Performance	53.63	51.53	51.44	52.46	52.79	52.29	52.42	52.94	51.90	51.53	53.21
Accounting value added	53.17	51.93	51.33	52.98	54.46	53.02	53.68	55.12	54.01	54.57	55.87
Wage costs (without OPC)	54.57	54.42	55.72	55.82	55.90	55.61	55.88	56.03	56.06	55.90	56.28
Investments	41.06	40.48	37.81	44.52	49.88	51.43	52.57	55.33	55.78	56.00	60.79
Export	36.54	36.15	35.74	34.16	34.0	34.3	40.7	45.2	45.41	46.04	50.7
Import	50.74	49.43	47.12	50.33	49.8	52.5	54.7	56.3	54.45	56.01	57.4
GDP	31.54	31.17	30.63	31.59	34.86	34.27	34.44	36.86	35.76	37.73	36.22

Note. Calculations of Ministry of Industry and Trade of the Czech Republic based on data of Czech Statistical Office.

According to the Ministry of Industry and Trade of the Czech Republic (2010), as of the date December 31, 2009, total 989,568 SMEs were actively carrying out their business activities providing 62.33% of total economy job opportunities, 60.79% of total investments, 57.4% of total imports, and 36.22% of GDP. Since 2003 continuous increase in SMEs contribution to total exports has been observed. In 2009, SME's exports reached 50.7% of total export.

[2] This is not a share of the whole country but the share of non-financial sector and household sector.

Products and services produced and provided by SMEs are mostly exported to local markets of our neighboring states. However, financial crisis and downfall of European markets emerge the necessity to diversify target markets for export and to start searching for new export markets outside European Union. Despite deteriorating situation of majority of companies caused by economic crisis, 45.68% of all SMEs present their intention to export their product and services outside European continent. As to the rest, 33.33% of companies do not intend to export outside European Union and 20.99% are not decided. Most attractive market to export to is Asia with 64.1% followed by North America with 38.46%, Africa (33.33%), South America (28.21%), Middle East and Central America (25.64%).[3]

To increase their export opportunities, 42.68% of companies are ready to join association of companies from similar industry such as export alliances or export clusters. Only 13.4% consider this concept as inconvenient and 38.71% do not know. About 6.1% of companies are actually members of such association. Even though there is quite significant portion of companies willing to participate in export alliance or cluster only a few companies do actually participate.[4]

Establishment and Development of Clusters in the Czech Republic

According to the Global Competitiveness Report 2010, Czech Republic reached 41st place of 139 economies in the stage of cluster development (World Economic Forum, 2010). The cluster concept was firstly introduced in the Czech Republic in 2002 when the first feasibility study was brought to public. The main aim of this study was to find potential for cooperation among engineering companies. Based on this study, first National engineering cluster was established in 2003. Since that time, cluster concept expanded to almost all regions of the Czech Republic.

Since the Czech Republic has become a member of European Union, supporting programs for cluster development were launched in two phases. Emphasize was placed on the linkages between the private and public sector. Especially creation of linkages between industry and tertiary education institutions in key sectors of economic development and elimination of the isolation of SMEs was substantial (Ministry of Industry and Trade of the Czech Republic, 2006).

Cluster development and innovation promotion were also embedded in different national strategic documents at different levels. The creation of those documents had departmental character and unfortunately it missed time and contextual coordination (Pavelková et al., 2009).

According to CzechInvest, there were 42 cluster mapping studies set up in the first phase (between 2004 and 2006). Based on those mapping studies, 12 clusters were legally established, and additionally their activities were financially supported by Structural Funds. In the second phase (since 2009 till now), establishment of new clusters and further development of previous established clusters have been financially supported by Structural Funds.

It has to be mentioned that there are several conditions that clusters have to meet to obtain subsidy. One of the conditions is number of members of the cluster. The cluster must involve at least 15 independent members. All of them have to be authorized to do business in the Czech Republic. Furthermore, 60% of members have to

[3, 4] This survey was carried out by Association of Small and Medium-Sized Enterprises and Crafts CZ (2009). Participants of this survey were 246 Czech export-oriented companies from industry with less than 250 employees. Choice of survey sample was carried with compliance to Methodology of Czech Statistical Office. According to criterion based on number of employees, the survey sample can be divided in 83.95% of companies with less than 250 employees, 14.6% of companies with less than 50 employees, and 1.23% of companies with less than 20 employees.

be SMEs and consequently at least one member of the cluster has to be a university or other research institution. Second condition is that official seat of the cluster has to be outside the capital city Prague. The last condition is that supported can be only clusters that deal with manufacturing industry, because the managing authority of subsidizing is Ministry of Industry and Trade of the Czech Republic (CzechInvest, 2008).

Almost 30 supported clusters exist in the Czech Republic nowadays. They have been emerged from different industries—engineering, automotive, wood processing, packaging technologies, furniture production, ICT, nanotech, biotech, technical textile, cleantech, safety technologies, water processing, renewable energy, and brewery. See Figure 1.

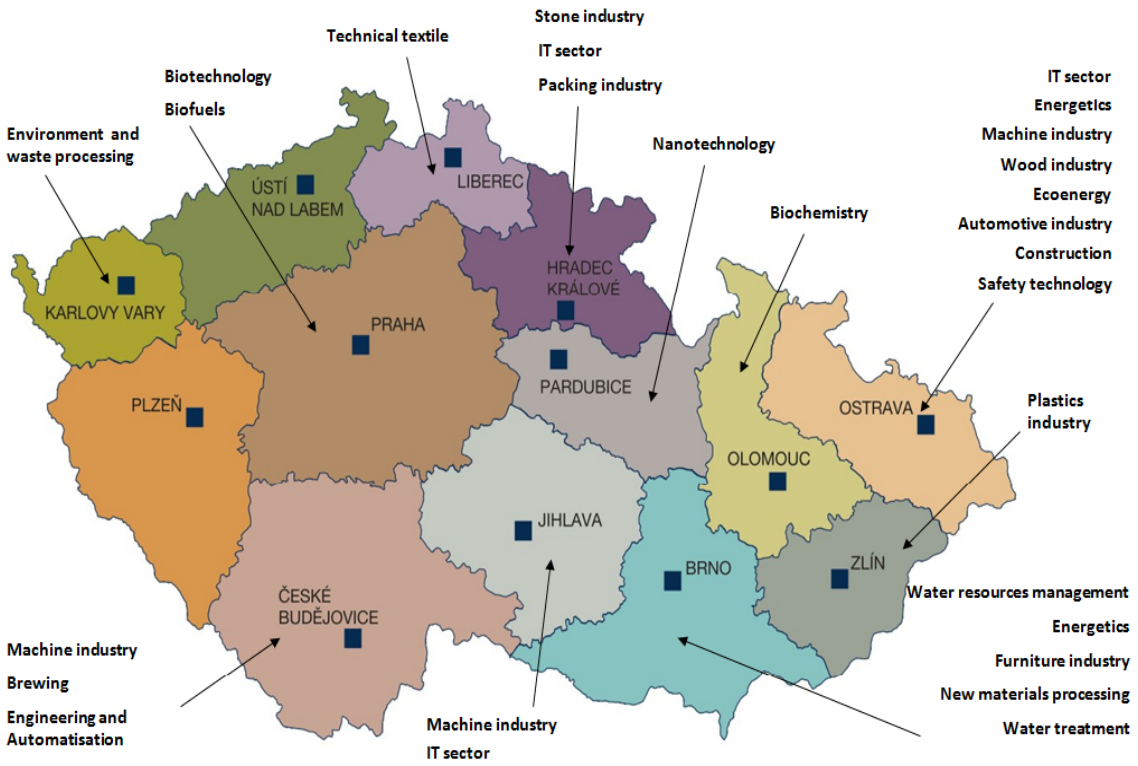

Figure 1. Map of Czech clusters according to industries and regions. Source: CzechInvest.

Members of Czech clusters cooperate usually in the field of information and communication, research and development, marketing and PR and human resource development. Although in most clusters, participating export-oriented companies joint penetration on foreign markets is not used widely. Despite this reality, there are some companies that consider this strategy useful and penetration of foreign market is carried out via export clusters. Examples of such clusters are: Cluster of Czech furniture producers, Car producers cluster, Heavy industry clusters, and CREA Hydro&Energy. Mainly CREA cluster become very successful in promotion of export outside European Union in very short period of time.

The Case Study Based on Real Example of Cluster CREA Hydro&Energy[5]

Brief Description of Cluster's History, Most Common Strategies, Visions, and Targets

The beginning of cooperation among companies from the cluster core dates back before the year 2000.

[5] This real example was prepared thanks to Mr. Bretislav Skacel—the manager of Cluster CREA Hydro&Energy.

Individual companies participated in special projects that were mostly supported by University of Technology in Brno. The first attempts to group more companies together occurred in 2002. First joint activity was participation in fairs and exhibitions. In 2004, the group of continuously cooperating companies used the opportunity proposed by Czech Trade Agency to establish export alliance called Czech Renewable Energy Alliance. This association of five later six companies carried out common marketing projects in 2004 and 2005 in total amount 124,000 EUR. Cooperation in this free alliance went on until the transformation into the cluster in 2007. New legal entity was established in 2008 and called CREA Hydro&Energy.

Currently the cluster includes 15 independent members and five affiliated entities including SMEs, large companies, universities, and R&D institutions. Their main focus area is technologies for water and waste management, and renewable energy sources. Its members participate in four common R&D projects, in one common project in the field of human resource development and in two common projects that deal with cluster promotion and penetration of international markets.

The Common Project: Penetration of International Markets

The project aims to promote Czech producers and Czech technologies international markets. Its main focus is acquiring new customers and winning contracts in development projects. Main emphasis is placed on address of representatives of regional authorities and on searching for suitable tenders for the technologies and know-how of the cluster members.

Four territories of interest have been selected: Balkans, Middle East, Southeast Asia, and Latin America. There were several reasons for selection of those areas.

(1) Poor level of local water management—especially the lack of drinking water or it is very poor quality, undeveloped concept of wastewater management, and undeveloped technology;

(2) Insufficient production capacity of electricity;

(3) Low level of waste management—incomplete system of waste collection, lack of effective separation, and subsequent utilization.

Balkans market penetration. Examples of successfully implemented joint activities:

(1) Implementation of three projects of foreign development cooperation in Bosnia and Herzegovina, Serbia and Albania;

(2) Participation in international fairs;

(3) Joint use of access to specialized server that enables to search profitable tenders in Bosnia.

Middle East market penetration. Examples of successfully implemented joint activities:

(1) Three cluster members jointly carried out project documentation preparation and engineering activities in the fields of hydraulic and geotechnical construction;

(2) Two members accomplished common projects for Ministry of Water Resources of Iraq;

(3) Memorandum of Understanding between cluster members and Ministry of Water Resources of Iraq was signed;

(4) CREA Hydro&Energy took part in international aquaculturing conference in Sulejmánia.

Southeast Asia market penetration. Examples of successfully implemented joint activities:

(1) Three cluster members jointly implement development projects in the Philippines and Vietnam;

(2) Two cluster members carried out development project on Philippines which was funded by the World Bank;

(3) Representatives of the cluster participated together with the Vietnamese partner in the hydro conference in Vietnam;

(4) Cooperation agreement between the association CREA Hydro&Energy and Research Institute of Hydro Power Centre in Vietnam was signed.

Latin America market penetration. First steps have been initiated. Interdepartmental Framework Agreement on Cooperation in Energy and Mining between the Ministry of Industry and Trade of the Czech Republic and the Ministry of Mines and Energy of Republic of Colombia was ratified. Moreover, several cluster members took part in international fair in Columbia.

The case study demonstrates the potential of local cluster to achieve the growth through penetration of new markets. The feature of tradability of cluster's know-how and developed technologies across both local and international markets is crucial.

Costs and Benefit Analysis

Cluster approach provides a new way of organizing economic development (Porter, 2000). Clusters affect competition in free broad ways: (1) By increasing the productivity of companies; (2) by driving the direction and place of innovation; and (3) by stimulating the formation of new businesses. Being a member of a cluster allows companies to operate more productively and that should enable them to overcome the crisis better than firms which stand alone (Porter, 1998).

Particularly exporting clusters (those that compete outside the local area) are considered as the primary source of area's economic growth and prosperity over the long run, because they are not limited by the size of local market (Porter, 1998). However, export expansion is a complicated and risky process combined with intensity of financial capital. This occurs because of geographic distance of foreign market, sharpening of international competition as well as different risk exposure compared with the business activities on domestic market (Černohlávková, 2005).

For export oriented SMEs, the cluster concept allows to overcome the disadvantages resulting from the insufficient size of individual firms. Please find below the list of most significant benefits of mutual cooperation within the cluster project:

(1) Reduction of costs of entering the foreign markets;

(2) Diversify of the risks linked to penetration of new foreign markets;

(3) Possibility of sharing costs (joint purchasing, logistics, staff development, research and development of new products and technologies);

(4) Increasing of specialization and the ability to offer a comprehensive product;

(5) Acquiring new customers and access to new markets through a single image or certified brand;

(6) Sharing information and experiences and joint purchasing of marketing studies on foreign markets;

(7) The possibility of unified promotion and marketing activities abroad;

(8) Improved negotiation position for smaller companies;

(9) Subsidy from local grants can be more easily attracted and obtained.

Although cluster concept is becoming recently very popular and widely used, it has to be admitted that this concept also attracted its share of criticism (e.g., Martin & Sunley, 2003). Those sharing this critical opinion point out that theoretical concept supporting this theory can be described at least as hazy and imprecise. Also strong argument for skeptic view on cluster concept is fact that there is no clear evidence of associated benefits.

One important fact also needs to be noticed. Clusters are not only growing and expanding, but they also decline and dissolute. Also, strong emphasis is put on cooperation whilst negative impacts of this strong cooperation such as domination of stronger members over smaller and weaker ones resulting in power asymmetric are often forgotten. Also, strong objections are raised against the methodologies that are used to identify the cluster. It is pointed out that these methodologies rely only on measuring industry concentration not taking into account the fact that collocation does not always result in formation of cluster. As a result, number of total clusters presented by cluster theory supporters is higher than actual count. Some critics go even further and call cluster theory as a fashion fad.

Those mentioned above are the strongest argument for skeptic approach towards cluster theory. But there can be found many others such as the fact that cluster should be formed spontaneously and it is against their nature to create them by political intervention. Moreover, strong political support of clustering can withdraw resources from other programs focused on companies that are not cooperating within the cluster and this may lead local economy right into recession (Organization for Economic Cooperation and Development [OECD], 2005).

Last but not least there are social consequences that may not be omitted. If some companies are supported according to cluster policies and some are not this inevitably leads to imbalance in wages and salaries. This situation is creating social inequality and may worsen situation within local society (OECD, 2009).

There are also specific costs related to mutual cooperation within the cluster in export activities:

(1) Inequality between cooperating members, conflict of interest, and other conflicts emerging within the cluster;

(2) Low trust in the concept among entrepreneurs, small experience with the concept of export cooperation;

(3) Rivalry among competitors;

(4) Reluctance, low motivation, and a passive approach of members towards cooperation;

(5) Small pool of relevant partners for clustering;

(6) Lack of funding for joint export activities;

(7) Leaving of a strong partner or merge with other enterprise (risk of loss of competitive advantage and information misuse);

(8) Incorrect behavior of one partner may damage reputation of the association as a whole but also its individual members.

Conclusions

As mentioned already in introduction, this paper deals with a special form of intercompany cooperation—clusters. So far, most articles and thesis describing clusters and cluster concept dealt with subject mainly on theoretical level. There was an ambition set for this thesis to link this theoretical level to real situation on contemporary markets, especially in area of penetrating new export markets. Main focus was put on SMEs as this form of entrepreneurship is currently considered the most crucial for market increase and development.

In order to achieve set ambition business case of real well established, Czech cluster was selected and methodology called costs and benefit analysis was applied to discover its strengths and weaknesses.

Based on performed costs and benefits analysis, several recommendations were pointed out.

(1) The cluster concept must not be considered as the only suitable solution for each company that decides

to expand into new geographic regions.

(2) It needs to be pointed out that intercompany cooperation can be successful, only if carried out in industries with innovative and increase potential. If this joint activity is performed in industry with no such potential and which is fully occupied by competition chance for success is minimal.

(3) One of essential conditions for successful export associations is not only unique product or service produced or provided more effectively with lower costs, but also readiness and willingness of entrepreneurs to communicate and share capacities with each other.

(4) Clusters should be formed spontaneously based on mutual trust and willingness of firms to cooperate. Of course not all clusters can be successful and let all clusters artificially survive due to subsidies is contra-productive.

Overall, summarized conclusion can be put into a phrase that cluster concept is definitely way how to successfully penetrate new foreign markets, however, this concept cannot be considered as general recipe for success and entrepreneurial goals of each potential member of cluster have to be taken into account before final decision is made.

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