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THE RELATIONSHIP BETWEEN INTERNATIONALIZATION AND CAPITAL STRUCTURES OF TAIWAN FIRMS

Yi-Chein Chiang, Feng Chia University, Taiwan
Sheng-Wei Chen, Feng Chia University, Taiwan

ABSTRACT

Using a sample of Taiwan firms over the period of 2001 to 2005, this study investigates the relationship between internationalization and a firm's capital structure, measured by the leverage ratio. Univariate tests show that multinational corporations (MNCs) are significantly less leveraged than domestic corporations (DCs). In addition, MNCs have lower business risks, lower exchange rate risks and higher agency costs, and are more profitable than DCs. The results of multivariate regressions show that some threshold of internationalization exists. The degree of internationalization is negatively associated with a firm's leverage ratio only before this threshold, and there will be a positive relationship beyond this threshold.

JEL: F23, G24, G32

INTRODUCTION

Taiwan is a small open economy, where firms have always been forced to direct most of their business operations toward foreign countries, due to the scarcity of natural resources and the small-sized home markets. Successful firms need funds in every stage of expansion, including foreign expansion. An interesting question is whether firms favor equity or debt financing when they expand abroad; this paper investigates the relationship between internationalization and a firm's capital structure.

Chen, Cheng, He and Kim (1997) and Chkir and Cosset (2001) demonstrate a positive, linear relationship between leverage ratios and internationalization. On the other hand, Lee and Kwok (1988), Burgman (1996), and Singh, Davidson and Suchard (2003) find a negative, linear relationship. Further confounding the issue are the U-shaped relationship findings of Mansi and Reeb (2002). These studies almost exclusively focus on US and other major developed countries. A general consensus of these studies is that international diversification has some effects on the capital structure of firms. However, very little is understood outside these countries.

Using a sample of Taiwan firms over the period of 2001-2005, this paper investigates the relationship between internationalization and capital structure, measured by the leverage ratio. First, we use univariate tests separately for each variable affecting the leverage ratio to examine whether MNCs and DCs are significantly different from each other. We then use multivariate analyses on five-year data to explore the relationship between internationalization and the leverage ratio, after controlling for firm sizes, business risks, exchange rate risks, agency costs and profitability.

Our results show that MNCs are significantly less leveraged than DCs. In addition, MNCs have lower business risks, lower exchange rate risks, higher agency costs and are more profitable than DCs. The results of multivariate regressions show a nonlinear U-shaped relationship between leverage ratio and internationalization. Our results are consistent with Mansi and Reeb (2002).

The remainder of the paper is organized as follows. First, we discuss the literature about capital structure. Second, we provide a description of data sources and sample selection procedures, as well as variables used in this study. Then, we present the empirical methodology and the results.

LITERATURE REVIEW

The capital structure of a firm has always been a big issue in the finance research. In a pioneering study, Modigliani and Miller (1958) proposed that under certain assumptions (perfect capital markets and no taxes), a firm's value was not affected by the proportion of debt and equity in its capital structure. Modigliani and Miller (1963) stated that a firm's value was maximized with total debt in its capital structure when the corporate income tax was taken into consideration. Corporate tax laws favor debt financing because interest paid by the company to its creditors is a tax-deductible expense while dividends and retained earnings are not. Miller (1977) extended the analyses to include personal income taxes. Other studies argued that firms do not expect to benefit from the tax deductibility feature of interest payments without incurring bankruptcy costs (Stglitz, 1972; Kraus and Litzenberg, 1973) and agency costs (Jensen and Meckling, 1976; Barnea, Haugen, and Senbet, 1981) at the same time.

Intertwined with the above are three theories about a firm's capital structure: the trade-off theory, the agency cost theory and the pecking order theory. (1) In the trade-off theory, firms choose their capital structures by trading off the tax benefits of debt with the expected bankruptcy costs (Kraus and Litzenberger, 1973). The prediction is that firms with higher bankruptcy costs or lower tax advantages should incur less debt. (2) In the agency cost theory, there are underinvestment (Myers, 1977) and asset substitution problems (Jensen and Meckling, 1976) due to the potential conflicts of interests between debtholders and stockholders. The prediction is that firms with higher agency costs should incur less debt. (3) In the pecking order theory (Myers, 1984), firms prefer not to borrow externally when internally generated funds are available. Hence, firms are expected to prefer sources of financing in the following sequence: internally generated funds, debt financing and issuance of equity. The prediction is that firms with higher profitability should incur less debt.

The capital structure of MNCs is of great interest to international finance studies. The three theories mentioned above were extended to MNCs to determine if MNCs have differing capital structure relative to DCs and the relationship between internationalization and leverage ratio.

It is often argued that MNCs should be able to support more debt than DCs, since international diversification leads to a lower volatility of earnings and lower bankruptcy costs, as MNCs have cash flows in imperfectly correlated markets (Eiteman and Stonehill, 1994; Madura, 1995; Shapiro, 1992). However, MNCs are exposed to additional risks such as political and exchange rate risks, which are not found in a domestic market (Lee and Kwok, 1988; Burgman, 1996; Chen, Cheng, He, and Kim, 1997; Chkir and Cosset, 2001). As for the taxes, Shapiro (1978) notes that if foreign taxes are higher than domestic taxes and a withholding tax exists, dividends will also lead to greater taxes. MNCs will then use more debt to get a larger benefit of debt. Rhee, Chang and Koveos (1985), Madura and Fosberg (1990), and Liu and Hsueh (1993) indicate that MNCs have greater potential tax benefits of debt relative to DCs based on the ability to borrow in multiple markets. Borrowing in countries with high tax rates leads to higher firm value. In addition, host government may provide subsidized loans to MNCs as incentives to attract foreign investments. Thus, MNCs should have greater debt in their capital structure relative to DCs. Hodder and Senbet (1990) found that corporate tax arbitrage played an important role in generating an international capital structure equilibrium. According to the trade-off theory, it's hard to predict the relationship between internationalization and leverage ratio.

On the other hand, MNCs always have greater growth opportunities (Bodnar and Weintrop, 1997) and higher profitability (Chen, Cheng, He, and Kim, 1997) than DCs. Thus, the pecking order theory predicts

a negative relationship between internationalization and the leverage ratio because of information asymmetry between managers and outside investors, and that profitable firms prefer not to raise external equity in order to avoid potential dilution of ownership.

Moreover, the fact that MNCs are more geographically diversified than DCs increases information asymmetries, and renders active monitoring more difficult and expensive for MNCs compared to DCs, due to cultural differences, higher auditing costs, differing legal systems, and language differences. Debt holders require higher interest payments on debts of MNCs that are more susceptible to information asymmetries and greater monitoring costs (Doukas, and Pantzalis, 2003). Thus, a negative relationship is predicted by the agency cost theory.

Since the three theories take different variables into account, they do not have the same prediction for the relationship between internationalization and the leverage ratio. Thus the examination of the difference in capital structures between MNCs and DCs taking the three theories into account is an empirical issue.

Chen, Cheng, He and Kim (1997) and Chkir and Cosset (2001) demonstrate a positive relationship between leverage ratios and internationalization that result from the risk reduction inherent in having operations in imperfectly correlated markets. However, Lee and Kwok (1988), Burgman (1996), and Singh, Davidson and Suchard (2003) find a negative relationship because of the increases risk from agency costs, exchange rate risks and political risks. In addition, a strictly linear specification may not fully capture the impact of firm international expansion on debt financing. Mansi and Reeb (2002) argue the capital structure of a firm may change with differing levels of internationalization and demonstrate a U-shape relationship.

Taxes are frequently a capital structure consideration. As this paper examines the capital structure of Taiwan firms, it is important to discuss the nature of taxation in Taiwan. In Taiwan, the corporate income tax rate is 25%. All income earned in Taiwan are taxed by any taxpayer, domestic or foreign corporations. As for the treatment of foreign-source incomes, all incomes earned outside Taiwan are tax-free because the territorial method of declaring a tax jurisdiction is adopted. Thus, there is no double taxation of foreign-source incomes for Taiwan's MNC. In addition, Taiwan has signed bilateral tax treaties with 19 countries to avoid double taxation for foreign firms investing in Taiwan in order to attract foreign direct investments.

METHODOLOGY, DATA AND VARIABLES

In this study, data is collected from the non-financial firms listed on the Taiwan Stock Exchange (TSE) during the period of 2001 to 2005. Firms' financial data is obtained from the Taiwan Economic Journal (TEJ) database and the website of Taiwan Securities & Futures Information Center. The frequency of data is annual. A firm is classified as a DC if its foreign sales ratio or foreign assets ratio is less than 10%, and a MNC if its foreign sales ratio or foreign assets ratio is 10% or more. This selection procedure results in 136 firms as DCs and 244 firms as MNCs under the classification criteria of the foreign sales ratio, and 252 firms as DCs and 128 firms as MNCs under the classification criteria of the foreign assets ratio. The variables considered are:

1. Leverage ratio: Total Debts / Total Assets
   The leverage ratio (DB) is treated as an endogenous variable surrogate for a firm's financing decision, measured as total debts over total assets. We use this proxy following prior studies such as Lee and Kwok (1988), Titman and Wessels (1988), and Chen, Cheng, He and Kim (1997).

2. Foreign sales ratio: Total Foreign Sales / Total Sales
   The foreign sales ratio (FS) is a proxy of the degree of firm's international activity (DOI). It provides a

measure of a firm's dependence on overseas markets for sales revenues (Gomes and Ramaswamy, 1999).

3. Foreign assets ratio: Total Foreign Assets / Total Assets
   The foreign assets ratio (FA) is another proxy of the degree of a firm's international activity. It provides a measure of a firm's dependence on overseas production (Gomes and Ramaswamy, 1999). Exports play an important role in Taiwan firms, but the high export ratio does not mean that firms have any foreign operations; hence, we use FA in addition to FS to proxy DOI.

4. Size: Ln (Total Assets)
   The size measure is the logarithm of a firm's total assets. Several studies have suggested that leverage is a function of firm size, such as Smith (1977) and Titman and Wessels (1988). Large firm sizes may have positive effects on leverages because they reduce bankruptcy risks.

5. Business risk: Standard Deviation of EBIT/Total Sales
   Following Chaplinsky (1984) and Lee and Kwok (1988), the business risk (BR) measure is a surrogate for a firm's expected costs of bankruptcy. It is often argued that, due to their ability to diversify across less perfectly correlated national economies, MNCs should have less business risks than DCs, and that MNCs should therefore be able to support more leverage.

6. Foreign exchange risk: β_2

   Like Jorion (1990) and many subsequent studies, the foreign exchange exposure (β_2) is estimated using the following equation:

$$R_{it} = \beta_{0i} + \beta_{1i} R_{mt} + \beta_{2i} R_{xt} + u_{it} \quad (1)$$

   where R_{it} is the return on stock i in period t, and R_{xt} is the percentage change in the exchange rate in period t. The exchange rate used is the U.S. Dollar (USD) in terms of the New Taiwan Dollar (NTD). We also control for market movements by including the return on the market portfolio in period t, R_{mt} (The market portfolio, TAIEX, is a market capitalization-weighted index of Taiwan) The market portfolio, TAIEX, is a market capitalization-weighted index of Taiwan. u_{it} is the error term.

   It seems natural to assume that firms operating multinationally are more exposed to exchange rate risks, and thus support less leverage. On the other hand, MNCs may not be exposed more since they can use financial and operational hedges. Furthermore, foreign debt can be used as a hedging instrument against the exchange rate risk, so MNCs may support more leverage.

7. Agency Cost: Free Cash Flows/Total Assets
   Free cash flows are defined as (Operating Income Before Depreciation – Interest Expenses – Taxes – Dividends), representing the liquidity of a firm's assets and reflect the available free cash flows that can be manipulated by shareholders at the expense of debtholders. We follow Doukas and Pantzalis (2003) to use the ratio of free cash flows over total assets as a proxy of agency costs.

   Since MNCs are more susceptible to information asymmetries and greater monitoring costs; therefore, MNCs have higher agency costs than DCs and support less leverage.

8. Profitability: Net Income / Total sales

According to the pecking order theory, leverage will be negatively related to profitability, because firms prefer to obtain financing through internally generated funds rather than from debts. We follow Doukas and Pantzalis (2003) to use the ratio to be the proxy of profitability.

Table 1: Sample Descriptive Statistics and Correlation Matrix

Panel A: Descriptive Statistics				Panel B: Correlation Matrix							
Variables	Mean	Median	S.D.	DB	FS	FA	SIZE	BR	FER	AC	PF
DB	0.4201	0.4110	0.1420	1							
FS	0.3925	0.3015	0.3250	-0.23	1						
FA	0.1091	0.0627	0.1058	-0.27	0.35	1					
SIZE	16.2019	15.7646	1.1207	0.12	0.13	0.02	1				
BR	0.1465	0.0523	0.7123	-0.11	-0.12	-0.07	0.04	1			
FER	-1.5542	-1.3830	2.4203	-0.28	0.35	0.09	-0.04	-0.09	1		
AC	0.0989	0.0820	0.15460	-0.34	0.35	0.18	0.11	-0.25	0.19	1	
PF	0.0234	0.011	0.3315	-0.21	0.13	0.10	0.01	-0.41	0.08	0.29	1

This table reports mean, median, standard deviation, and correlation coefficients of variables for all sample. DB is leverage ratio, FS is foreign sales ratio, FA is foreign assets ratio, SIZE is firm size, BR is business risk, FER is foreign exchange risk, AC is agency costs, and PF is profitability.

Panel A of Table 1 presents the descriptive statistics of each variable for the full sample. Our sample has a mean leverage ratio of about 41%. Foreign sales ratio has a mean of 39%. Foreign assets ratio, however, has a mean of about 11%, indicating that Taiwan firms are more export-oriented.

Panel B of Table 1 provides the correlation matrix for the variables in our sample. Consistent with previous studies, we find a negative relationship between leverage ratio and internationalization. The results also suggest a negative relationship between leverage ratio and business risks, exchange rate risks, agency costs and profitability. The variables are not highly correlated with one another; that is, there is no serious problem of multicollinearity. Some authors also use the Variance Inflating Factor (VIF) as an indicator of multicolinearity. The VIF of variables used in this study are all below 10. According to the rule of thumb, variables are not highly collinear.

METHODOLOGY AND RESULTS

In this section, we use univariate tests of variables affecting leverage ratio to examine the difference between MNCs and DCs. Then, we use five-year multivariate data to explore the relationship between internationalization and leverage ratio of Taiwan firms.

Univariate Tests of Variables Affecting Leverage Ratios

MNCs may have different leverage ratios from DCs since MNCs face more complicated environments. In this section, we use univariate tests of variables affecting leverage ratio to examine whether MNCs and DCs are significantly different from each other.

Table 2 presents the mean and standard deviation of various factors for the DCs and MNCs samples. T-test statistics for equal means are also presented. As shown in Panel A of table 2, Taiwan MNCs (defined as foreign sales ratio >10%) are significantly less leveraged than DCs (defined as foreign sales ratio <10%) at the 1% level. As discussed above, this result is contrary to the notion that MNCs should be able to carry a higher leverage ratio since they are able to diversify their business risks across national economies. Thus, there are other factors need to be considered.

According to Panel B of table 2, MNCs are significantly larger than DCs. Smith and Watts (1992) hypothesize that leverage ratios of larger firms are less limited by the costs of financial distress because they have more diversification than smaller firms. In addition, the trade-off theory postulates a positive relationship between firm sizes and debts, since larger firms have shown to have lower bankruptcy risks and relatively lower bankruptcy costs (Deesomsak, Paudyal, and Pescetto, 2004). Our results provide consistently supporting evidence for Smith and Watts' hypothesis and the trade-off theory of a firm's capital structure.

In addition, MNCs have significantly lower business risks and exchange rate risks than DCs. Since the operations of MNCs are geographically diversified, the business risks are expected to be lower than those of DCs, and MNCs can use operational hedges in addition to financial hedges to manage exchange rate risks. Lower risks of MNCs give them higher capacity to sustain high leverage ratio, according to the trade-off theory. However, they carry less leverage than DCs, and thus, other factors need to be considered.

MNCs with significantly higher agency costs than DCs demonstrate the fact that the geographic structure of MNCs exacerbates the inherent conflicts between shareholders and debt holders. Higher agency costs of MNCs lead to less leverage according to the agency cost theory. Furthermore, our results show that MNCs are significantly more profitable than DCs, supporting the pecking order theory, which postulates that managers prefer to finance projects internally. Therefore, the lower leverage ratio of MNCs may come from their higher agency costs and higher profitability that exceed the lower bankruptcy costs (due to lower business and foreign exchange risks) of MNCs.

Table 2: Univariate Tests of Variables Affecting Leverage Ratios

	Panel A: MNC is FS>10% and DC is FS<10%					Panel B: MNC is FA>10% and DC is FA<10%				
	MNCs (N=244)		DCs (N=136)			MNCs (N=128)		DCs (N=252)		
	Mean	S.D.	Mean	S.D.	t-value	Mean	S.D.	Mean	S.D.	t-value
DB	0.3958	0.1232	0.4547	0.3805	-3.32***	0.3657	0.1309	0.4275	0.3721	-5.23***
SIZE	15.8451	1.2046	15.6507	1.3845	1.81**	15.7161	0.9513	15.8568	1.1631	-1.31
BR	0.0739	0.0935	0.2761	0.0713	-2. 24**	0.0746	0.1845	0.1723	0.0723	-1.86**
FER	-1.1821	2.5564	-2.4371	1.1462	4.16***	-1.1205	2.4670	-1.7735	-1.1605	2.79***
AC	0.1065	0.1828	0.017	0.1283	4.35***	0.1153	0.1312	0.0891	0.1267	3.38***
PF	0.0123	0.0954	-0.0331	0.0213	1.92**	0.0189	0.0790	-0.0273	0.0123	2.15**

*This table compares the means of all variables of DC and MNC. The criterion of MNC in panels A and B are foreign sales ratio (FS) and foreign assets ratio (FA), respectively. DB is leverage ratio, FS is foreign sales ratio, FA is foreign assets ratio, SIZE is firm size, BR is business risk, FER is foreign exchange risk, AC is agency costs, and PF is profitability. * Significant at the 10% level, ** Significant at 5% level, *** Significant at 1%*

Panel B of Table 2 presents the mean and standard deviation of the various factors for DCs (defined as foreign assets ratio <10%) and MNCs (defined as foreign asset ratio >10%) sample. T-test statistics for equal means are also presented. Panel B shows the same results as panel A, except that firm sizes are not significantly different. MNCs are also significantly larger and have lower business risks, lower exchange rate risks and higher agency costs and are more profitable than DCs.

Multivariate Regressions

Four models are used to investigate the relationship between a firm's capital structure and internationalization, including linear models, diversification models, curvilinear models and piecewise linear models.

*Linear Model***:** first, we use the linear model to examine whether the degree of international activities can explain variations in capital structure, after controlling for the effects of firm sizes, business risks, exchange rate risks, agency costs and profitability. The specification is shown in the following equation:

$$\text{Leverage Ratio} = \alpha_0 + \alpha_1 (\text{DOI}) + \alpha_2 (\text{Size}) + \alpha_3 (\text{Business Risk}) + \alpha_4 (\text{Exchange Rate Risk}) + \alpha_5 (\text{Agency Cost}) + \alpha_6 (\text{Profitability}) + \varepsilon \quad (2)$$

Panel A of Table 3 reports the results of the linear models. The degree of internationalization (DOI) of equations (a) and (b) is foreign sales ratio (FS) and foreign assets ratio (FA), respectively. Standard errors are corrected for autocorrelation and heteroscedasticity using the Newey-West method. All regression models are statistically significant at the 1% level with an adjusted-R^2 of about 30 percent, indicating that the variables explain a substantial part of debt ratios across firms. The coefficients for DOI variables (FS or FA) are all negatives, and significantly negative when the DOI proxy is FA. This indicates that international activities lead to lower levels of leverage in firms' capital structures after controlling other determinants of capital structure. Hence, international activity is a significant determinant of capital structure across Taiwan firms.

As for the control variables, two equations have the same results. Firms with larger sizes, lower business risks, lower exchange rate exposures, lower agency costs and lower profitability have higher levels of leverage. Our results support the trade-off theory, the agency cost theory and the pecking order theory of a firm's capital structure.

*Diversification Model***:** in the previous model, the proxy for the degree of internationalization is just the international involvement (foreign sales ratio and foreign assets ratio). However, a firm could have a high degree of international involvement, and yet all of its foreign involvement could be in a single high-risk country. Following Burgman (1996), we define the *diversification* proxy as a combination of a firm's international involvement and the number of countries in which a firm has subsidiaries (NOC), which may be a much better indicator of international diversification.

$$\text{Leverage Ratio} = \alpha_0 + \alpha_1 (\text{DOI*NOC}) + \alpha_2 (\text{Size}) + \alpha_3 (\text{Business Risk}) + \alpha_4 (\text{Exchange Rate Risk}) + \alpha_5 (\text{Agency Cost}) + \alpha_6 (\text{Profitability}) + \varepsilon \quad (3)$$

Panel B of Table 3 reports the results of the diversification models. Standard errors are corrected for autocorrelation and heteroscedasticity using the Newey-West method. All regression models are also statistically significant at the 1% level with an adjusted-R^2 of about 30 percent, indicating that the variables explain a substantial part of debt ratios across firms.

The coefficients on *Diversification* variables (FS*NOC and FA*NOC) are all negative, and significantly negative when the *Diversification* proxy is FA*NOC. Our results are the same as those in the linear models, but the coefficients on *Diversification* variables are lower than the coefficients on *DOI* variables in the linear models. This indicates that if one firm exports to or invests in a lot of countries and other firm just exports to or invests in a few countries, then the latter has lower debt relative to the former. That is, the fewer countries a firm exports to or invests in, the lower levels of its leverage. As for the control variables, they have the same results as those in the linear models.

*Curvilinear Model***:** to test for the possibility of a non-linear relationship between debt financing and firm's international activity, we regress the firm's leverage ratio on the proxy of DOI, the square of DOI and various control measures such as firm sizes, business risks, exchange rate risks, agency costs and profitability. The specification is as the following quadratic functional form of DOI. The quadratic regression models allow the turning point to be determined endogenously.

$$\text{Leverage Ratio} = \alpha_0 + \alpha_1(\text{DOI}) + \alpha_2 (DOI)^2 + \alpha_3(\text{Size}) + \alpha_4(\text{Business Risk}) + \alpha_5(\text{Exchange Rate Risk}) + \alpha_6(\text{Agency Cost}) + \alpha_7(\text{Profitability}) + \varepsilon \quad (4)$$

Panel C of Table 3 reports the results of the curvilinear models for the total sample. Standard errors are corrected for autocorrelation and heteroscedasticity using the Newey-West method. The coefficients on DOI and DOI^2 are both significant. The negative sign of the DOI coefficient (FS or FA) suggests that in the early levels of internationalization, a decreasing level of debt financing is associated with internationalization; the positive sign of DOI^2 suggests that at later stages of internationalization, an increasing level of debt financing is associated with internationalization. That is, a nonlinear U-shaped relationship exists in the curvilinear model. Our results are consistent with Mansi and Reeb (2002).

The turning point can be computed by taking the partial derivative of regression with respect to the DOI as follows: $\partial(leverage\ ratio)/\partial DOI = \alpha_1 + 2\alpha_2 DOI$. Since this partial derivative represents the slope of the curve, it is zero at the crossover point; by substituting the α coefficients, the turning point can be obtained. It is at the 46.5% levels of FS, and 34.6% levels of FA, respectively. In early levels of internationalization, firms may not diversify enough to reduce the business risks, and firms may suffer from more exchange rate exposures and agency costs but still lack the experience to manage these problems. The increasing risks lead to lower leverage until a threshold is reached where firms may diversify enough from international activities. Their business risks then decrease, and they are more familiar with managing exchange rate exposures and agency costs. Their leverage ratios increase as they become more international. In addition, the results of control variables are the same as those in the linear models.

Table 3 Results of Three Models

	Panel A: Linear Models		Panel B: Diversification Models		Panel C: Curvilinear Models	
Variable	(a) FS	(b) FA	(a) FS	(b) FA	(a) FS	(b) FA
Constant	0.1372 (1.4224)	0.1460 (1.8101)*	0.1392 (1.1278)	0.1824 (1.3982)	0.1984 (1.6405)*	0.1729 (1.7861)*
FS	-0.0274 (-1.3645)				-0.1541 (-2.1870)**	
FA		-0.2635 (-4.8697)***				-0.2752 (-3.672)***
FS * NOC			-0.0192 (-1.2254)			
FA * NOC				-0.0645 (-2.1359)***		
FS^2					0.1656 (1.9825)*	
FA^2						0.3983 (1.8746)*
SIZE	0.0256 (3.9245)***	0.0178 (3.4523)***	0.0275 (3.5814)***	0.0256 (3.9239)***	0.0205 (3.9578)***	0.0194 (3.6512)***
BR	-0.0048 (-2.7741)***	-0.0051 (-2.5236)**	-0.0048 (-2.6231)***	-0.0047 (-2.6815)***	-0.0053 (-2.5681)***	-0.0048 (-2.2508)***
FER	-0.0068 (-2.8523)**	-0.0074 (-3.7423)***	-0.0097 (-2.8224)***	-0.0077 (-3.9845)***	-0.0069 (-2.8126)***	-0.0068 (-2.9674)***
AC	-0.4037 (-10.3612)***	-0.3665 (-10.3805)***	-0.4824 (-10.2475)***	-0.3923 (-10.5690)***	-0.4361 (-1.6372)***	-0.3740 (-10.6558)***
PF	-0.0135 (-1.4725)	-0.0186 (-1.4834)	-0.0092 (-1.4892)	-0.0094 (-1.4057)	-0.0098 (-1.4997)	-0.0086 (-1.4169)
Adjusted-R^2	0.2469	0.2454	0.2305	0.2908	0.2685	0.2665
F-statistic	45.1294***	38.9433***	51.7197***	56.1737***	50.0467***	55.3262***

*This table presents the results for a pooled regression of three models: Linear Models, Diversification Models, and Curvilinear Models. DB is leverage ratio, FS is foreign sales ratio, FA is foreign assets ratio, SIZE is firm size, BR is business risk, FER is foreign exchange risk, AC is agency costs, and PF is profitability. *, **, *** Significant at the 10%, 5%, 1% level. The figure in ( ) is t-value.*

Piecewise Linear Model

We then use a piecewise linear model to determine the turning point (switching point) again, following the method of Goldfeld and Quandt (1973). It's also a nonlinear model. By definition, the piecewise linear model uses two linear pieces to form the equation, and the switching point is also determined endogenously. Our perspective is that either the curvilinear or the piecewise linear model offers benefits beyond those of a single piece linear model.

We estimate two versions of the degree of internationalization: (i) with no switching point, (ii) with one switching point. In equation (5), only the linear effect of DOI is included. In equation (6), a piecewise linear function with one switching point (*I*) is used to express the nonlinear effect of DOI. The locations of switching points are estimated using the grid search technique, and the number and location of switching points are chosen based on the log likelihood function.

(i) With no switching point

$$\text{Leverage Ratio} = \alpha_0 + \alpha_1(\text{DOI}) + \alpha_2(\text{Size}) + \alpha_3(\text{Business Risk}) + \alpha_4(\text{Exchange Rate Risk}) + \alpha_5(\text{Agency Cost}) + \alpha_6(\text{Profitability}) + \varepsilon \quad (5)$$

(ii) With one switching point

$$\text{Leverage Ratio} = \alpha_0 + \alpha_1(DOI_1) + \alpha_2(DOI_2) + \alpha_3(\text{Size}) + \alpha_4(\text{Business Risk}) + \alpha_5(\text{Exchange Rate Risk}) + \alpha_6(\text{Agency Cost}) + \alpha_7(\text{Profitability}) + \varepsilon \quad (6)$$

$$DOI_1 = \begin{cases} DOI & if \quad DOI < I \\ I & if \quad DOI \geq I \end{cases} \qquad DOI_2 = \begin{cases} 0 & if \quad DOI < I \\ DOI - I & if \quad DOI \geq I \end{cases}$$

The log likelihood ratio test is given by $2(\log_e(L_{i+1}) - \log_e(L_i))$ where $\log_e(L_i)$ is the value of the log likelihood function with i number of switching points. The statistic is asymptotically χ^2-distributed.

Table 4 Results of piecewise linear models with FS and FA

	Panel A : FS				Panel B: FA			
	Switching Point	Log likelihood function	Likelihood Ratio statistic	P-value	Switching Point	Log likelihood function	Likelihood Ratio statistic	P-value
No switching point		641.92				661.92		
Single switching point	0.41	638.19	7.46	0.006***	0.37	659.99	3.86	0.051*

*This table presents the results for a pooled regression of the piecewise linear model.. *, **, *** Significant at the 10%, 5%, 1% level*

Panel A and B of Table 4 present the likelihood ratio tests of the piecewise linear models, indicating a switching point of 41% when DOI is FS and a switching point of 37% when DOI is FA. That is, the degree of internationalization is negatively associated with a firm's leverage only before some threshold of internationalization, and there will be a positive relationship beyond this threshold.

CONCLUSION

Using a sample of Taiwan firms over the period of 2001 to 2005, this paper investigates the relationship between internationalization and capital structure. In the univariate tests, our results demonstrate that MNCs are significantly less leveraged than DCs. In addition, MNCs have lower business risks, lower exchange rate risks and higher agency costs, and are more profitable than DCs. The lower leverage ratios of MNCs may come from the fact that higher agency costs and profitability exceed the lower bankruptcy costs, due to lower business and exchange rate risks.

In the multivariate models, we have the following results. (1)If two firms have the same size, business risks, exchange rate risks, agency costs and profitability, but one is MNC and the other is DC, then the MNC will have a lower leverage ratio than the DC (linear model). In addition, the fewer countries a firm exports to or invests in, the lower levels of its leverage (diversification model). Furthermore, the curvilinear and the piecewise linear models show that there is a turning point of the level of internationalization. Internationalization is negatively associated with a firm's leverage only before some threshold of internationalization. There will be a positive relationship beyond this threshold. (2)Our results support the trade-off theory, the agency cost theory and the pecking order theory of a firm's capital structure since firms with larger sizes, lower business risks, lower exchange rate exposures, lower agency costs and lower profitability have higher levels of leverage.

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EFFECTS OF FEDERAL FUNDS TARGET RATE CHANGES ON STOCK PRICES

E.M. Ekanayake, Bethune-Cookman University
Robin Rance, Bethune-Cookman University
Mihalis Halkides, Bethune-Cookman University

ABSTRACT

It is well-known that financial markets respond quickly to the announcements of changes in the Federal Funds target rate. This paper examines the stock price reaction of individual stocks listed under the Dow Jones Industrial Average (DJIA) to Federal Funds target rate change announcements using daily stock returns over the period 1996-2007. We measure such reactions using an event-study methodology to analyze the impact of changes in the Federal Funds target rate on individual stock returns using several event windows. We group the DJIA 30 individual stocks into 8 sectors and analyze the reaction of each sector to changes in the Federal Funds target rate. Results indicate that, on average, the impact of a Federal Funds target rate decrease on stocks is positive while the reaction of a Federal Funds target rate increase is negative.

JEL: G14

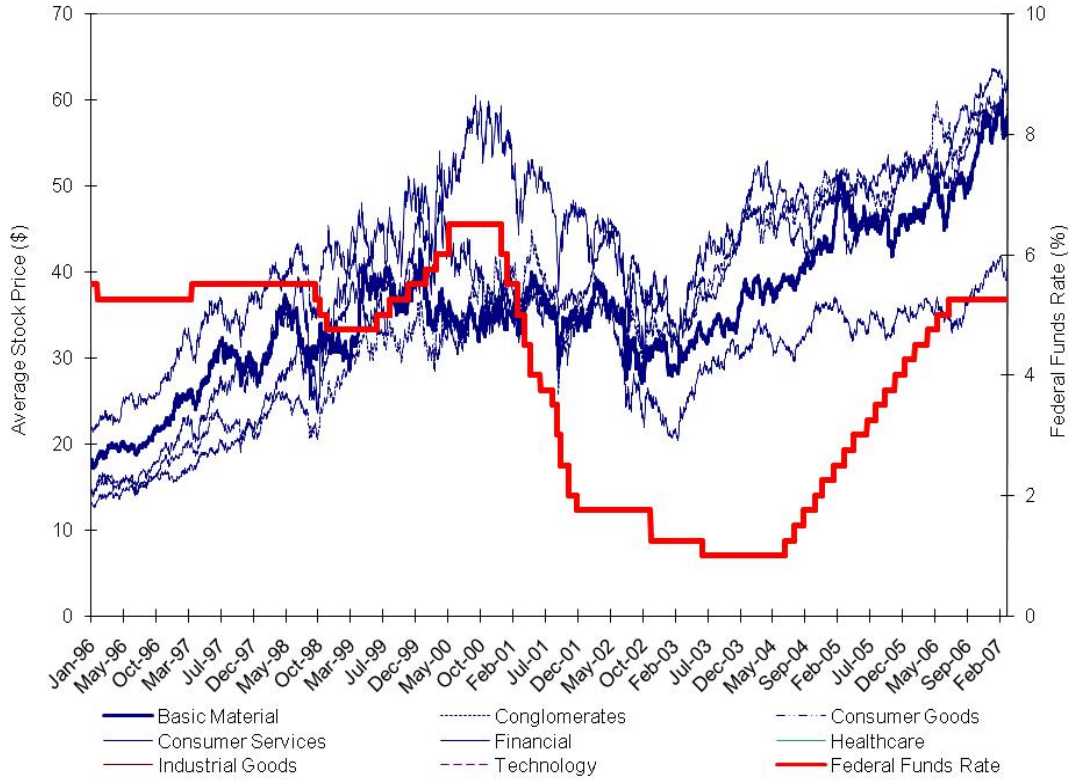
INTRODUCTION

This study investigates the effects of Federal Funds target rate changes on the stock performance of 30 companies listed under the Dow Jones Industrial Average (DJIA) over the years 1996-2007. Using an event-study framework, this study examines how the stock market responds to the expected financial performance of the firm at the announcement of Federal Funds target rate changes.
According to Rigobon and Sack (2002), the relationship between Federal Funds target rate changes and stock prices is an important topic for both monetary policy makers and financial market participants. From the perspective of monetary policymakers, having reliable estimates of the reaction of asset prices to the policy instrument is a critical step in formulating effective policy decisions. Much of the transmission of monetary policy comes through the influence of short-term interest rates on other asset prices, as it is the movements in these other asset prices including longer term interest rates and stock prices that determine private borrowing costs and changes in wealth, which in turn importantly influence real economic activity. From the perspective of financial market participants, monetary policy has a considerable influence on financial markets, as evidenced by the extensive attention that the Federal Reserve receives in the financial press. Thus, having accurate estimates of the responsiveness of asset prices to monetary policy is an important component of making effective investment decisions and formulating appropriate risk management strategies.

The Federal Open Market Committee (FOMC) is the main monetary policymaking arm of the Federal Reserve. This study considers the relationship between monetary policy and daily stock market volatility from both days around regularly scheduled meetings of FOMC and days of actual policy decisions involving the target level of the Federal Funds target rate. Since 1981, there have been eight regularly scheduled meetings of the FOMC per year, generally with six to eight weeks between meetings. Meeting dates for each year are announced to the public during the second half of the previous year. In this study we define the event day as the meeting day of the FOMC, regardless if a rate change is announced or not. Therefore, we examine whether the existence of regularly scheduled policy meetings per se has a measurable effect on stock market volatility.

Figure 1 shows the relationship between the Federal Funds target rate and the stock prices of eight major sectors of the 30 companies listed under the Dow Jones Industrial Average (DJIA) over the years 1996 though 2007. These eight sectors are defined in Appendix Table 1. It is not easy to identify any specific relationship between the Federal Funds target rate and the stock prices from Figure 1, although the correlation coefficient between the two variables is mostly negative and low. The correlation coefficients for the eight sectors are: Basic Material (-0.1085), Conglomerates (-0.3345), Consumer Goods (-0.2054), Consumer Services (0.0065), Financial (-0.1526), Healthcare (-0.2062), Industrial Goods (0.1608), and Technology (-0.0316).

Figure 1: Stock Prices and Federal Funds Target Rate, January 1996-March 2007



As Bernanke (2003) points out, there are two essentially equivalent ways of understanding why expectations of higher short-term real interest rates should lower stock prices. First, to value future dividends, an investor must discount them back to the present value; as higher interest rates make a given future dividend less valuable in today's dollars, higher interest rates reduce the value of a share of stock. Second, higher real interest rates make investments other than stocks, such as bonds, more attractive, raising the required return on stocks and reducing what investors are willing to pay for them. Under either interpretation, expectations of higher real interest rates are bad news for stocks.

The remainder of the paper is organized as follows: Section 2 briefly discusses the Federal Funds Target Rate. Section 3 provides a review of the existing literature on this topic. Section 4 gives a brief description of the event-study methodology. Section 5 outlines the data used and data sources. Section 6 discusses our analysis and findings while Section 7 offers some conclusions.

LITERATURE REVIEW

The Federal Reserve System is a federal agency established in 1913 to give the government some control over banking, which at that time was mostly unregulated. The Fed is a system of twelve district banks and twenty-five regional branches located across the United States. By law, the Fed is supposed to "promote effectively the goals of maximum employment, stable prices and moderate long-term interest rates" and this is accomplished through its influence over monetary policy. The most important tool for this objective is setting the Federal Funds target rate, which is the interest rate at which depository institutions lend balances at the Federal Reserve to other depository institutions overnight. As such, it is a market interest rate. The fed does not directly set the actual interest rate but rather establishes a target rate and performs open market operations to achieve the target.

Open market operations are the purchases and sales of U.S. Treasury and federal agency securities, and the short-term objectives are specified by the Federal Open Market Committee (FOMC). The Federal Reserve's objective for open market operations has varied over the years. During the 1980's, the focus gradually shifted toward attaining a specified level of Federal Funds target rate, but in 1995 the FOMC began to explicitly state its target level for the Federal Funds target rate. Since February 2000, the statement issued by the FOMC shortly after each of its meetings has included the Committee's assessment of the risks to the attainment of its long-run goals of price stability and sustainable economic growth. This transparency of objectives fuels speculation about future actions by the FOMC. If the FOMC is concerned about inflation and chooses to cool down the economy, it does so by increasing the fed funds target rate. This eventually makes borrowing by consumers and businesses more expensive, and thus, slows down economic activity. To stimulate a sluggish economy or thwart a recession, the Fed can add new money to the economy by reducing the Federal Funds target rate, thus, generating more money for banks to lend to businesses and consumers.

The Federal Funds target rate fluctuates hourly and is one of the country's most volatile rates. Changes in the Federal Funds target rate have a significant impact on other interest rates in the financial system and, consequently, on securities prices. Because coupon rates on newly issued bonds tend to reflect prevailing interest rates, previously purchased bonds generally are resold at a discount or premium, their prices moving inversely with the direction of interest rates. The stock market, in competition with the bond market for investor dollars, is also affected by interest rate changes. Again, this being an inverse relationship, when investors sell stocks to move into bonds, stock prices, in general, tend to fall. Also, an increase in interest rates makes it more expensive for businesses to borrow money. That, in turn, hurts corporate profits. As a result, in theory, stock prices tend to decrease when investors anticipate that corporate profits will fall. Conversely, as interest rates fall, stocks become relatively more attractive.

As Rigobon and Sack (2002) point out, there are two considerations that complicate the identification of the responsiveness of asset prices to monetary policy. First, short-term interest rates are simultaneously influenced by movements in asset prices, resulting in a difficult endogeneity problem. Second, a number of other variables, including news about the economic outlook, likely have an impact on both short-term interest rates and asset prices. Despite these difficulties, this study attempts to identify the reaction of stock prices to changes in monetary policy.

The general economics and finance literature links issues of security, returns, and predictability to changing business conditions without disputing the notion that events surprises are associated with short run changes in equity prices i.e., Carter and Simkins (2004), Boyd, Yoganathan and Hu (2001), D'Amico and Farka (2003). Scholars agree that in the short run, stock prices are inversely associated with monetary policy decisions, mirroring basic economic theory. As a result, there is much support for the premise that markets already incorporate on their own changes that can be anticipated, including anticipated changes

in monetary policy through Federal Funds target rate adjustments. Nevertheless, some issues are not completely explored, including the effect's severity as it relates to the magnitude of the unanticipated surprise, and whether or not monetary policy is the antecedent driver affecting stock prices or visa versa—a complex relationship due to the endogenous nature of monetary policy and free market interactions.

Relatively few papers to date have attempted to measure the equity market's reaction to monetary policy. Among recent papers exploring asset price responses to monetary policy actions--as proxied by changes in the target Federal Funds rate-- are Bernanke and Kuttner (2005), Bernanke (2003), Bomfim (2003), Bomfim and Reinhart (2000), Kuttner (2000), Roley and Sellon (1998), Thornton (1998), and Reinhart and Simin (1997). Chen et al. (1999) also examined monetary policy effects on stock market volatility, by studying the effect of discount rate decisions on stock market volatility. Previously, Castanias (1979) had also examined the relationship between discount rate decisions and the volatility of stock returns.

Bomfim (2003) looking at how the actual interest rate decisions of policy makers affect stock market volatility found that the element of surprise in such decisions, in the short run, tends to boost stock market volatility significantly--with positive surprises, i.e., higher-than-expected values of the target Federal Funds rate tend to have a larger effect on volatility than negative surprises.

Bernanke (2003) and Bernanke and Kuttner (2005) analyzed the impact of changes in monetary policy on equity prices with the objective of measuring the average reaction of the stock market. They found that the effects of unanticipated monetary policy actions on expected excess returns account for the largest part of the response of stock prices. They also found some evidence of a stronger stock price response to changes in rates that are expected to be more permanent or that represent a reversal in the direction of rate changes.

In a study by Patelis (1997), analysis of the stock market reactions to monetary policy made two conclusions. First, that monetary conditions enhance the ability to explain time series variation in stock and bond returns and, second, that the significant information for security returns contained in refined monetary policy indicators is evident only when it is conditioned on a broad indicator of the Fed's overall policy stance.

Thorbecke (1997) investigated how industry stock return data respond to monetary policy shocks. Thorbecke measured monetary policy by innovations in the Federal Funds target rate and by an event study on Federal Reserve policy change. In every case, he found indications that expansionary policy increases ex-post stock returns.

Craine and Martin (2004) studied daily monetary policy data to estimate the response of security prices--bond yields and equity returns–to exogenous monetary policy surprises. Their empirical results showed a classical textbook response of the yield curve to a monetary surprise in that short maturity yields rise and long maturity yields are unaffected. They also find that the equity market, which they claim is ignored in most studies and textbooks, is quantitatively the most important channel for short run monetary policy. They conclude that the wealth effect from a monetary surprise in the equity market dwarfs the wealth effect in the debt markets.

Rigobon and Sack (2002) show that the response of asset prices to changes in monetary policy can be identified based on the increase in the variance of policy shocks that occurs on days of FOMC meetings and of the Chairman's semi-annual monetary policy testimony to Congress. The results indicate that an increase in short-term interest rates results in a decline in stock prices and in an upward shift in the yield curve that becomes smaller at longer maturities.

Gurkaynak, Sack and Swanson (2004) investigate the effects of U.S. monetary policy on asset prices using a high frequency event-study analysis and find that these effects are not adequately captured by changes in the federal funds rate target alone. They recommend using two factors, namely, a "current federal funds rate target" factor and a "future path of policy" factor, with the latter closely associated with FOMC statements. They measure the effects of these two factors on bond yields and stock prices using a new intraday dataset going back to 1990. According to their estimates, both monetary policy actions and statements have important but differing effects on asset prices, with statements having a much greater impact on longer-term Treasury yields.

Studies by Jensen and Mercer (2002, 1996) demonstrate that proxies for monetary stringency increase the explained variation in stock returns. They find that three variables, beta, size, and book-to-market equity, contribute significantly to explaining cross-sectional returns in a three-factor model that includes the monetary sector.

In a study of interest rate changes on stock prices, Lobo (2000) finds that the target change announcements convey new information to the stock market. Risk aversion increases before the announcement of a rate change, and especially before the announcement of a joint target and discount rate change. The study also finds that the volatility estimates suggest that such joint rate changes send a clearer signal to the stock market about monetary policy objectives relative to unilateral target changes. The study's findings are consistent with overreaction in the wake of bad news (rate hikes), and point to a shift in volatility from before to after the rate change announcement since the adoption of the immediate disclosure policy of the Federal Open Market Committee in February 1994.

Kuttner (2001), for example, uses daily data to measure changes in Treasury yields as he explores the surprise component of FOMC monetary policy announcements. Cochrane and Piazzesi (2002) perform variations on this analysis.

Finally, Guo (2002) confirms the notion of significant stock price reaction to unanticipated changes in the Federal Funds target rate but not to anticipated ones. His study demonstrates that, consistent with the prediction of imperfect capital market theories, the estimated impact of monetary shocks is significantly larger for small stocks than for big stocks in the 1970's when business conditions were bad, but there is no size effect present in the 1990's when business conditions were typically good. The general findings of the body of literature exploring similar relationships on international markets is also consistent with the above referenced studies i.e., Stevenson (2002).

This study while using a methodology used by few authors such as Carter and Simkins (2004), Boyd, Yoganathan and Hu (2001), and D'Amico and Farka (2003), attempts to evaluate the effects of changes in Federal Funds Target Rate on stock returns of individual companies. In terms of the coverage of industries as well as the lengthy and more recent time period, this study may shed some lights on this important yet unsolved question associated with short run changes in equity prices.

METHODOLOGY

We use an event-study analysis to assess the short-term effects of 94 Federal Funds Target rate change announcements or non-announcements on the stock market returns of all 30 companies listed under the DJIA. Taking inspiration from the initial experimentation by Fama et al. (1969), this methodology is based on the idea that the stock market reacts immediately to announcements that are supposed to affect the future performance of the company.

In order to setup the event-study methodology, we have to specify the design of the study. To this end, we have to define what constitutes an event. Furthermore, we must clarify which period of time surrounding an event is of particular interest for our purposes (that is, we have to define the event window). Finally, we must spell out how we measure the impact of the changes in Federal Funds target rate. The event-study methodology, therefore, involves the following steps:

(1) identification of the events of interest and definition of the event window;
(2) selection of the sample set of firms to include in the analysis;
(3) prediction of a "normal" return during the event window in the absence of the event;
(4) estimation of the abnormal return within the event window, where the abnormal return is defined as the difference between the actual and predicted returns; and
(5) testing whether the abnormal return is statistically different from zero.

Several methods may be used to estimate abnormal returns: among them, the single-index model (constant mean return model), the market model and the capital asset price model ($CAPM$) are the most widely used.

To calculate the effect of an event, it is necessary to estimate what the return of the stock would have been, had the event not occurred. To do this, and to control for overall market effects, the return of the stock is regressed against the return of a market index. The estimated coefficients from that regression are used to calculate the predicted value of the stock over the time window in which the stock price is adjusted. The market model assumes a linear relationship between the return of any security to the return of the market portfolio:

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + e_{i,t} \qquad \text{with } E(e_{it}) = 0 \text{ and } Var(e_{i,t}) = \sigma_i^2 \tag{1}$$

where t is the time index, i = 1, 2, ,..., N stands for stock, $R_{i,t}$ and $R_{m,t}$ are the returns on stock i and the market portfolio respectively during period t, and $e_{i,t}$ is the error term for stock i. We used the Standard and Poor's 500 as the index of the market. The S&P 500 is a capitalization-weighted index based on a broad cross-section of the market and is commonly employed in prior event studies (Campbell, et al., 1997). The coefficients α_i and β_i are firm-dependent coefficients to be estimated. The return of the stock, rather than the price of the stock, is used to control for autocorrelation.

Equation (1), the market model, is generally estimated over a period which runs between 120 and 210 days prior to the event up to 10 days prior to the event. The event window in this study is defined as the period from 3 days prior to the event to 3 days after the event. That is, the event window is $t = [-3, 3]$. In this study, we estimate the market model for event days $t = -210$ to $t = -10$ relative to the event day, $t = 0$. We have defined the event day as the Federal Open Market Committee ($FOMC$) meeting day. Although the Federal Funds target rate has not been changed at every $FOMC$ meeting, stock prices tend to react in anticipation of rate change. During the period between January 2, 1996 and March 26, 2007, there were 94 $FOMC$ meetings. Of these 94 events, Federal Funds target rate was reduced 17 times, increased 24 times, and no rate change took place in 53 times. To avoid overlapping of data, we excluded a two-week period surrounding the event days. Therefore, the time period that we selected to estimate the market model did not include any effect of Federal Funds target rate changes. To estimate the expected return we used the data from $t = [-210, -10]$, 201 days of data. We used the coefficient estimates from this regression to predict the expected return over the $t = [-3, 3]$ time frame.

With the estimates of α_i and β_i from equation (1), one can predict a "normal" return during the days covered by the event window. The prediction error (the difference between the actual return and the predicted normal return), commonly referred to as the abnormal return (AR), is then calculated as:

$$AR_{i,t} = R_{i,t} - \hat{\alpha}_i - \hat{\beta}_i R_{m,t} \tag{2}$$

The null hypothesis often set forth in an event study is that an event did not significantly impact the firm. This hypothesis can be tested using abnormal returns over a period of time. The abnormal returns are simply the prediction errors of the model over the event window. Notice here, that AR are abnormal returns, that is, they are returns over and above that predicted by the general trend of the market on a given day. The assumptions of the methodology are that the abnormal returns are the result of the Federal Funds target rate change, and not some other random event occurring on the same day.

Specifically, cumulative abnormal returns (CAR) summed throughout the event period, can be tested to determine if they are statistically different from zero (Campbell, et al. 1997). Through the use of CAR it is possible to track abnormal returns occurring over a number of trading days. Since outcomes of many events are not immediately known, the CAR allows for consideration of abnormal returns over a predefined period of time. By considering abnormal returns that coincide with an event it is possible to establish the impact on CARs over several days and to capture the impact of an event as it unfolds over time.

Under the null hypothesis, the abnormal returns will be jointly normally determined with a zero conditional mean and conditional variance, $\text{var}(AR_{i,\tau})$:

$$\text{var}(AR_{i,\tau}) = \sigma_i^2 \left[1 + \frac{1}{T} + \frac{(R_{m,\tau} - \overline{R}_m)^2}{\sum_{t=1}^{T} \left(R_{m,t} - \overline{R}_m\right)^2} \right] \tag{3}$$

where T is the estimation period length (i.e. number of days used for estimation), $\overline{R}_m$ is the mean of the market portfolio, and σ_i^2 is the variance of the error from the estimated market model. The τ indicates observations within the event window, while the t indicates observations in the estimation interval. On the day of the event $\tau = 0$ and τ runs across the event window, which is -3 to 3 in this case. Notice then, that the standard error on any given day τ of the prediction interval is a function of how far the market return on that day is from the mean market return during the estimation interval.

For each individual event, one can estimate the abnormal return and relevant test statistics at each instant in time within the event window. However, in order to draw overall inference on the abnormal return observations for the event(s) of interest, one can also aggregate the abnormal returns. For any given subset of N events, the sampled aggregated abnormal returns (AAR_t) at each instant t within the event window is computed as

$$AAR_t = \frac{1}{N} \sum_{i=1}^{N} AR_{i,t} \tag{4}$$

For large T , the variance of AAR_t can be computed as

$$Var(AAR_t) = \frac{1}{N^2}\sum_{i=1}^{N} \text{var}(AR_{i,t}) \tag{5}$$

To test for the significance of AAR_t a Z (or t) test can be derived. In order to test for the persistence of the impact of the event during a period $(\tau_2 - \tau_1)$, the abnormal return can be added to obtain the cumulated abnormal returns $CAR_{i,(\tau_2-\tau_1)}$ for stock i over the period $(\tau_2 - \tau_1)$:

$$CAR_{i,(\tau_2-\tau_1)} = \sum_{t=\tau_1}^{\tau_2} AR_{i,t} \tag{6}$$

where $\tau_a \le \tau_1 < t < \tau_2 \le \tau_b \in$ event window, and τ_a and τ_b are the lower and upper limits of the event window, respectively. The variance of the cumulative abnormal return for stock i over the period $(\tau_2 - \tau_1)$ is

$$\text{var}\left[CAR_{i,(\tau_2-\tau_1)}\right] = \sum_{t=\tau_1}^{\tau_2} \text{var}(AR_{i,t}) \tag{7}$$

From these equations we can calculate the average CAR across all event days, and the variance of CAR. The resulting equations are:

$$\overline{CAR}_\tau = \frac{1}{N}\sum_{i=1}^{N} CAR_{i,\tau} \tag{8}$$

and

$$\text{var}\left[\overline{CAR}_\tau\right] = \frac{1}{N^2}\sum_{i=1}^{N} \text{var}\left[CAR_{i,\tau}\right] \tag{9}$$

To test the null hypothesis of zero cumulative abnormal return on any given day, one can formulate a Student's t test, where under the hypothesis of zero returns, is of the form:

$$t = \frac{\overline{CAR}_\tau}{\sqrt{\text{var}[\overline{CAR}_\tau]}} \sim t_{(N-1)} \tag{10}$$

Data

The data sets to be analyzed are the daily stock prices of all 30 companies listed in the Dow Jones Industrial Average (DJIA) and the data on Federal Funds target rates. The data cover a period of eleven years from January 2, 1996 to March 26, 2007 downloaded from http://finance.yahoo.com. These 30 companies encompass large capitalized stocks and are representative of all stocks traded on the American stock exchanges. These 30 companies were grouped into 8 sectors, taking the weighted averages using shares of each company as the weight, as shown in Appendix Table 1. The data on Federal Funds target rates are from the Federal Reserve Bank.

We define the event as a Federal Open Market Committee (FOMC) meeting day. We collected the data from the minutes of the FOMC meetings in the period between January 2, 1996, and March 26, 2007. During this period, there were 94 FOMC meetings. Of these 94 events, Federal Funds target rate was

reduced 17 times, increased 24 times, and no rate change took place in 53 times. Table 1 summarizes the mean, standard deviation, minimum, and maximum of the daily trading volumes of stocks, and the prices of stocks in the sample for each of the eight sectors.

Table 1: Average Daily Trading Volumes and Average Prices of Stocks in Sample

Sector		Mean	Standard Deviation	Minimum	Maximum
Basic Material	Volume	19,325,799	8,387,428	3,138,600	85,341,300
	Price	$35.63	$8.57	$17.17	$59.92
Conglomerates	Volume	26,515,194	11,370,962	5,517,800	118,337,800
	Price	$40.55	$13.94	$15.61	$67.77
Consumer Goods	Volume	24,639,386	11,154,576	2,771,800	164,201,300
	Price	$40.20	$8.83	$21.32	$63.61
Consumer Services	Volume	29,430,051	12,088,351	4,396,000	147,969,300
	Price	$32.15	$8.48	$13.97	$49.19
Finacial	Volume	31,749,228	13,703,051	5,846,000	186,370,200
	Price	$40.58	$12.18	$13.17	$60.59
Healthcare	Volume	31,182,915	18,695,312	4,780,600	345,932,900
	Price	$40.12	$8.89	$17.14	$54.31
Industrial Goods	Volume	10,993,944	5,276,869	1,516,200	94,222,800
	Price	$38.05	$12.58	$21.46	$74.95
Technology	Volume	163,623,329	52,666,281	29,251,600	729,317,600
	Price	$45.49	$13.38	$16.00	$73.84

Notes: The results are based on daily stock prices and volumes covering the period from January 2, 1996 to March 26, 2007. Source: Yahoo Finance Website (http://finance.yahoo.com/).

ANALYSIS AND FINDINGS

In our analysis, the market's reaction to 94 FOMC meetings with 41 Federal Funds target rate change events between 1996 and 2007 was examined. In order to better investigate markets' reactions, we defined an event window as the period from 3 days prior to the event to 3 days after the event. That is, the event window is $t = [-3, 3]$. In our effort to reduce other factors which may influence the stock price, we chose event windows close to the announcement day. Figures 2, 3 and 4 show the cumulative abnormal returns on the event day ($t = 0$) for a rate decrease, rate increase, and no rate change, respectively.

Table 2 shows the estimated average abnormal returns (AARs) observed for the 94 events in the sample and the test for significance of the effects are also provided. The AARs on each of the days in the 3-day window for each sector are given in the table to identify the sectors that are reacted most to the Federal Funds target rate change. The results in Table 2 indicate that the AARs are mostly positive and significant on the days the Federal Funds target rate was reduced. They are mostly negative and significant on the days the Federal Funds target rate was increased. However, we cannot identify any clear pattern of the market's response as the Federal Funds target rate is changed, because there is also evidence that the market reacted positively or negatively even if the funds target rate remained unchanged. When we focus on the event day ($t = 0$), of the eight sectors, four sectors reacted positively when the Federal Funds target rate was decreased, three sectors reacted positively when there was no change in the funds target rate, while three sectors reacted negatively when the funds target rate was increased.

Based on the results presented in Table 2, we can analyze the reaction of each of the eight sectors to changes in the Federal funds target rate. On the event day ($t = 0$), when the federal funds target rate was reduced, the basic material, conglomerates, consumer goods, and healthcare sectors reacted negatively. The basic material sector has the lowest AAR of -0.108. Likewise, on the same day, if the federal funds target rate remained unchanged, only the consumer goods, financial, and technology sectors reacted

positively and significantly. It is interesting to note that every single sector reacted significantly to no rate change. When the federal funds target rate was increased on the event day, stock prices of the conglomerates, consumer goods, and healthcare sectors reacted negatively while the other five sectors reacted positively.

Table 2: Average Abnormal Returns Related to Federal Funds Target Rate Changes

		Funds Rate Decrease		No Funds Rate Change		Funds Rate Increase	
Sector	Day	AAR	t-statistic	AAR	t-statistic	AAR	t-statistic
Basic Material	-3	0.074	0.48	-0.110	-1.27	0.114	0.89
	-2	0.025	0.17	0.253	2.94*	-0.161	-1.26
	-1	0.121	0.80	0.175	2.03***	0.178	1.39
	0	-0.363	-2.34**	0.015	0.18	-0.198	-1.55
	1	0.127	0.83	-0.073	-0.85	-0.152	-1.19
	2	0.143	0.94	0.061	0.71	0.000	0.00
	3	0.226	1.49	0.101	1.17	0.100	0.78
Conglomerates	-3	0.489	3.21*	-0.018	-0.21	0.006	0.05
	-2	-0.035	-0.23	0.153	1.78***	-0.023	-0.18
	-1	0.163	1.07	-0.012	-0.14	0.132	1.03
	0	-0.536	-3.46*	-0.043	-0.50	0.097	0.76
	1	0.249	1.63	-0.006	-0.07	-0.181	-1.42
	2	-0.196	-1.28	0.089	1.03	0.040	0.31
	3	0.113	0.74	-0.064	-0.75	-0.088	-0.69
Consumer Goods	-3	-0.201	-1.32	0.030	0.35	-0.351	-2.74**
	-2	0.094	0.62	-0.051	-0.60	-0.089	-0.70
	-1	0.688	4.53*	0.121	1.41	-0.054	-0.42
	0	-0.652	-4.20*	-0.027	-0.32	-0.248	-1.94**
	1	-0.011	-0.07	0.200	2.31**	0.100	0.79
	2	0.251	1.65	0.163	1.89***	-0.140	-1.09
	3	0.431	2.83*	-0.041	-0.47	-0.022	-0.17
Consumer Services	-3	0.126	0.83	0.018	0.21	-0.152	-1.19
	-2	0.496	3.26*	0.301	3.50*	0.025	0.20
	-1	-0.094	-0.62	-0.060	-0.69	0.151	1.18
	0	0.274	1.77***	0.059	0.69	-0.028	-0.22
	1	0.091	0.59	-0.005	-0.06	-0.127	-1.00
	2	-0.190	-1.25	0.200	2.32**	0.137	1.07
	3	-0.329	-2.16**	0.002	0.02	0.095	0.74
Financial	-3	0.200	1.31	0.210	2.44**	0.196	1.53
	-2	0.279	1.83***	0.011	0.13	0.251	1.96**
	-1	0.003	0.02	0.170	1.97***	0.212	1.66***
	0	0.522	3.37*	0.081	0.95	-0.013	-0.10
	1	-0.228	-1.49	0.174	2.02***	-0.354	-2.77**
	2	-0.486	-3.19*	-0.068	-0.79	0.112	0.87
	3	0.254	1.67***	-0.031	-0.37	0.038	0.29
Healthcare	-3	-0.088	-0.58	0.079	0.92	-0.164	-1.28
	-2	-0.310	-2.04**	-0.224	-2.61**	-0.035	-0.27
	-1	0.426	2.80*	0.178	2.06**	-0.146	-1.15
	0	-0.625	-4.03*	-0.051	-0.59	0.350	2.74**
	1	-0.441	-2.89*	0.098	1.13	0.182	1.43
	2	-0.132	-0.86	0.252	2.93*	-0.087	-0.68
	3	0.037	0.24	-0.011	-0.12	-0.361	-2.83*
Industrial Goods	-3	0.339	2.23**	-0.203	-2.35**	0.140	1.09
	-2	-0.217	-1.43	0.083	0.96	-0.226	-1.77***
	-1	-0.222	-1.46	-0.063	-0.73	-0.112	-0.88
	0	-0.362	-2.33**	0.071	0.82	0.136	1.07
	1	-0.787	-5.15*	0.013	0.15	-0.317	-2.49**
	2	0.035	0.23	0.214	2.49**	-0.313	-2.45**
	3	-0.412	-2.70*	-0.036	-0.42	-0.041	-0.32
Technology	-3	0.044	0.29	-0.122	-1.41	-0.071	-0.55
	-2	0.099	0.65	-0.052	-0.61	-0.031	-0.24
	-1	0.417	2.74*	-0.236	-2.74**	-0.082	-0.64
	0	0.273	1.76***	0.095	1.10	-0.020	-0.16
	1	0.597	3.91*	0.067	0.77	0.047	0.37
	2	0.133	0.88	-0.191	-2.22**	0.071	0.55
	3	0.222	1.46	0.262	3.04*	0.329	2.58**

*Note: Sector definitions are given in Appendix Table 1. *, **, and *** indicate the statistical significance at the 1%, 5%, or 10% level, respectively.*

The response of stock prices of the eight sectors can further be discussed focusing purely on the event day. Figures 2, 3, and 4 present the distribution of cumulative abnormal returns on the event day for all eight sectors combined. Based on the distribution pattern of the Figures 2, it is evident that Federal Funds rate reduction increases the stock prices (and thereby the returns). The majority of the observations are positive as can be seen from the height of the bars on the positive side. However, as Figure 3 shows, when there is an increase of the Federal Funds target rate, stock prices do not drop significantly. It is interesting to note, as evident from Figure 4, that stock prices tend to increase even if there is no change in the Federal Funds target rate.

Figure 2: Frequency Distribution of Cumulative Abnormal Returns of a Rate Decrease

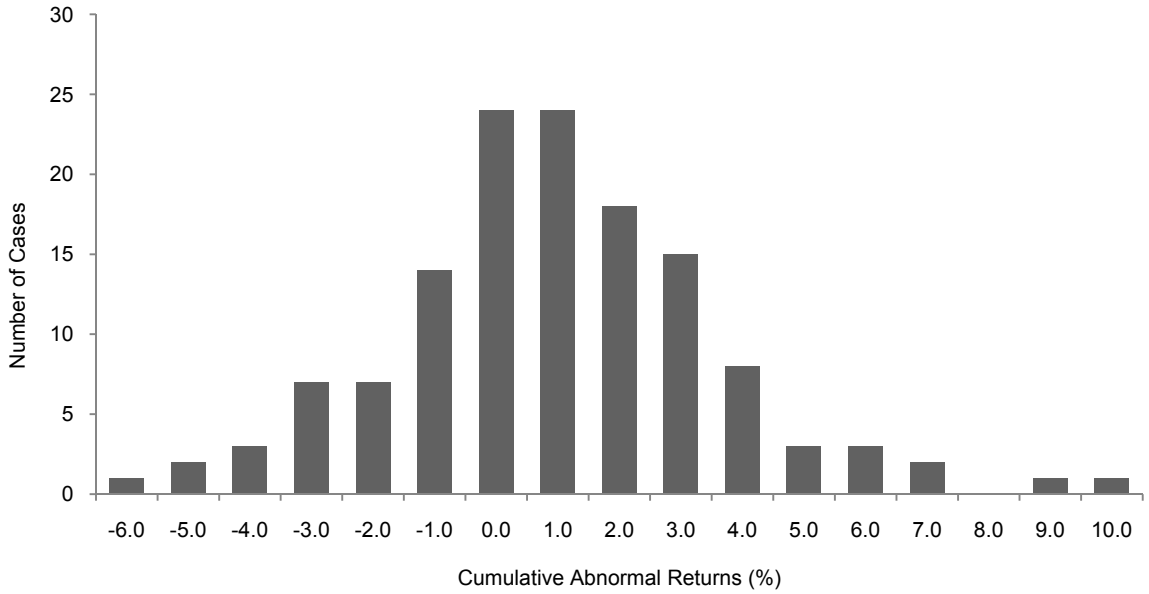


Figure 3: Frequency Distribution of Cumulative Abnormal Returns of a Rate Increase

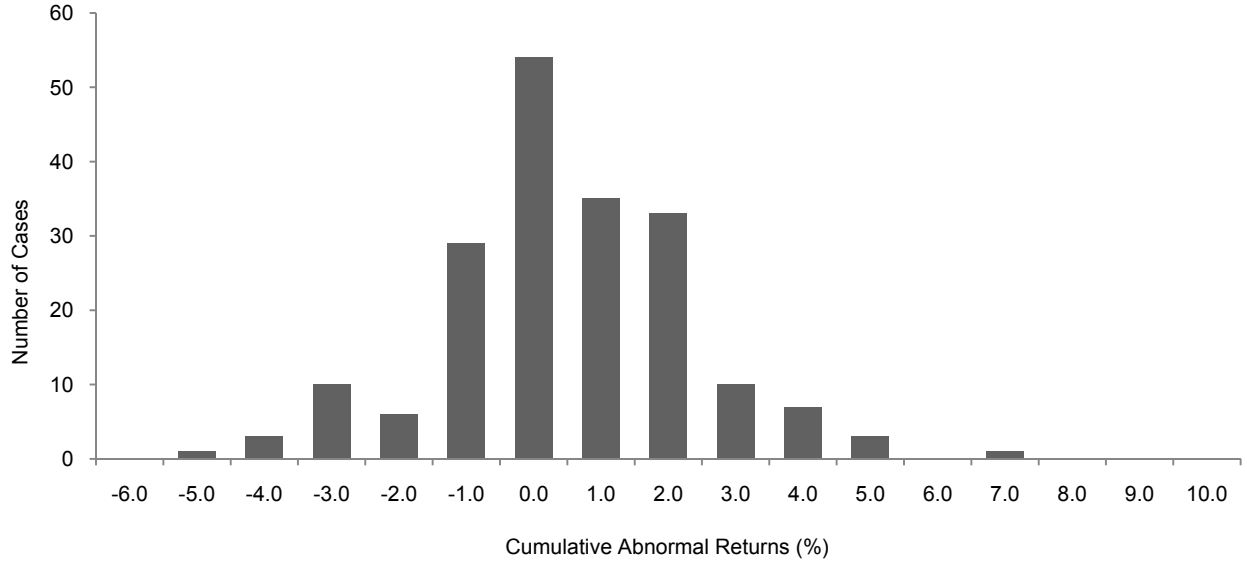
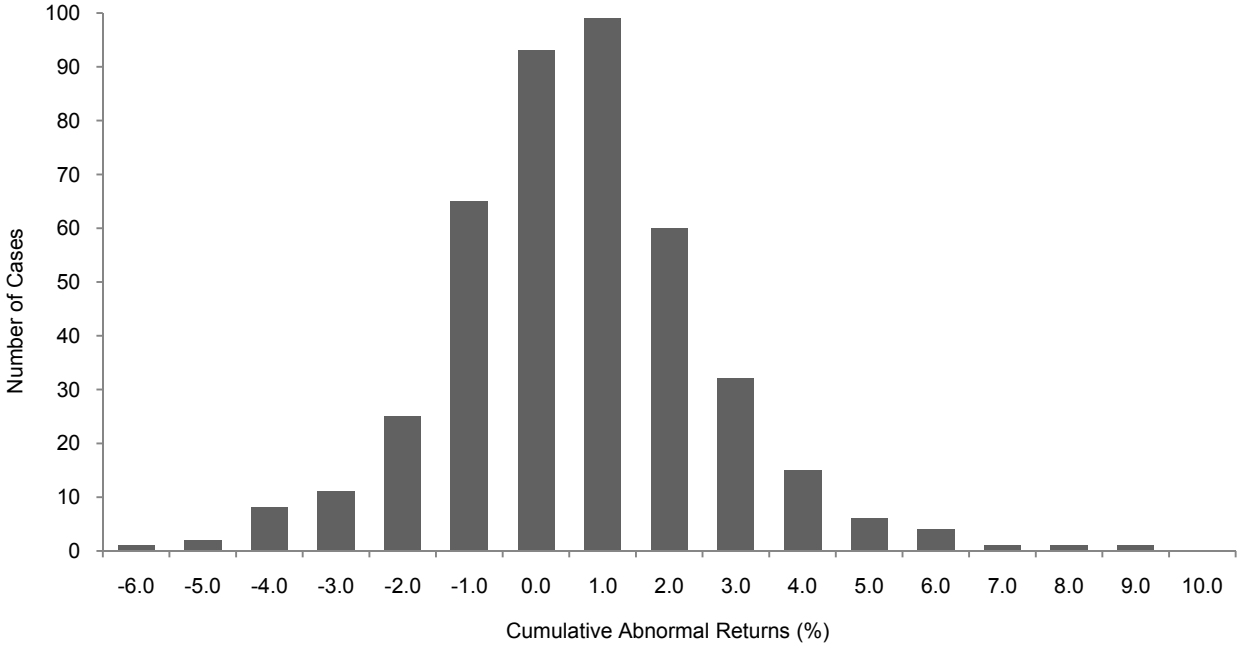


Figure 4: Frequency Distribution of Cumulative Abnormal Returns of a No Rate Change



When we focus on the event day ($t = 0$), of the eight sectors, three sectors reacted positively when the Federal Funds target rate was decreased, three sectors reacted positively when there was no change in the funds target rate, while three sectors reacted negatively when the funds target rate was increased.

Table 3 shows the estimated cumulative abnormal returns (CARs) observed for the 94 events in the sample and provides the test for significance of these effects. The CARs on each of the days in the 3-day window for each sector are given in the table to identify the sectors that are reacted most to the Federal Funds target rate change. The results in Table 3 indicate that the CARs are mostly positive and significant on the days the Federal Funds target rate was reduced. They are mostly negative and significant on the days the Federal Funds target rate was increased. However, we cannot identify any clear pattern of the market's response as the Federal Funds target rate is changed, because there is also evidence that market reacted positively or negatively even if the funds target rate remained unchanged.

SUMMARY AND CONCLUSIONS

Do the stock prices actually react to changes in the federal funds target rate? If so, how can investors and policy makers benefit from the significant relationship between the stock prices and the federal funds target rate? This study investigates the effects of Federal Funds target rate changes on the daily stock performance of 30 companies listed under the Dow Jones Industrial Average (DJIA) over the years 1996-2007. Using an event-study framework, this study examines how the stock market responds to the expected financial performance of the firm at the announcement of Federal Funds target rate changes.

Table 3: Cumulative Abnormal Returns Related to Federal Funds Target Rate Changes

		Funds Rate Decrease		No Funds Rate Change		Funds Rate Increase	
Sector	Day	CAR	t-statistic	CAR	t-statistic	CAR	t-statistic
Basic Material	-3	0.074	0.48	-0.110	-1.27	0.114	0.89
	-2	0.099	0.46	0.143	1.18	-0.046	-0.26
	-1	0.220	0.83	0.318	2.13**	0.131	0.59
	0	-0.143	-0.47	0.333	1.94***	-0.067	-0.26
	1	-0.016	-0.05	0.260	1.35	-0.218	-0.76
	2	0.127	0.34	0.321	1.52	-0.218	-0.70
	3	0.354	0.88	0.422	1.85***	-0.118	-0.35
Conglomerates	-3	0.489	3.21*	-0.018	-0.21	0.006	0.05
	-2	0.454	2.11**	0.135	1.11	-0.017	-0.10
	-1	0.617	2.34**	0.123	0.83	0.114	0.52
	0	0.081	0.26	0.081	0.47	0.212	0.83
	1	0.330	0.96	0.075	0.39	0.031	0.11
	2	0.134	0.36	0.163	0.77	0.071	0.23
	3	0.247	0.61	0.099	0.43	-0.017	-0.05
Consumer Goods	-3	-0.201	-1.32	0.030	0.35	-0.351	-2.74**
	-2	-0.107	-0.50	-0.021	-0.17	-0.440	-2.43**
	-1	0.582	2.21**	0.100	0.67	-0.495	-2.23**
	0	-0.070	-0.23	0.073	0.42	-0.743	-2.90*
	1	-0.081	-0.24	0.272	1.41	-0.643	-2.25**
	2	0.170	0.45	0.435	2.06**	-0.782	-2.50**
	3	0.601	1.49	0.394	1.73***	-0.804	-2.38**
Consumer Services	-3	0.126	0.83	0.018	0.21	-0.152	-1.19
	-2	0.622	2.89**	0.320	2.62**	-0.127	-0.70
	-1	0.528	2.00***	0.260	1.74***	0.023	0.11
	0	0.802	2.62**	0.319	1.85***	-0.005	-0.02
	1	0.893	2.61**	0.314	1.63	-0.132	-0.46
	2	0.703	1.88***	0.513	2.43**	0.005	0.02
	3	0.374	0.93	0.515	2.26**	0.100	0.30
Financial	-3	0.200	1.31	0.210	2.44**	0.196	1.53
	-2	0.478	2.22**	0.221	1.82**	0.447	2.47**
	-1	0.482	1.83***	0.391	2.62**	0.659	2.97**
	0	1.004	3.28*	0.473	2.74**	0.646	2.52**
	1	0.776	2.27**	0.647	3.36*	0.292	1.02
	2	0.290	0.78	0.578	2.74**	0.403	1.29
	3	0.544	1.35	0.547	2.40	0.441	1.30
Healthcare	-3	-0.088	-0.58	0.079	0.92	-0.164	-1.28
	-2	-0.398	-1.85***	-0.145	-1.19	-0.199	-1.10
	-1	0.028	0.11	0.033	0.22	-0.345	-1.56
	0	-0.597	-1.95***	-0.018	-0.11	0.005	0.02
	1	-1.038	-3.04*	0.080	0.41	0.187	0.65
	2	-1.170	-3.13*	0.331	1.57	0.100	0.32
	3	-1.133	-2.80**	0.321	1.41	-0.261	-0.77
Industrial Goods	-3	0.339	2.23**	-0.203	-2.35**	0.140	1.09
	-2	0.122	0.57	-0.120	-0.98	-0.087	-0.48
	-1	-0.100	-0.38	-0.183	-1.23	-0.199	-0.90
	0	-0.462	-1.51	-0.112	-0.65	-0.063	-0.25
	1	-1.249	-3.65*	-0.099	-0.52	-0.380	-1.33
	2	-1.214	-3.24*	0.115	0.54	-0.693	-2.21**
	3	-1.627	-4.03*	0.078	0.34	-0.734	-2.17**
Technology	-3	0.044	0.29	-0.122	-1.41	-0.071	-0.55
	-2	0.143	0.66	-0.174	-1.43	-0.101	-0.56
	-1	0.560	2.12**	-0.410	-2.75*	-0.183	-0.83
	0	0.833	2.72**	-0.315	-1.83**	-0.203	-0.79
	1	1.430	4.18*	-0.249	-1.29	-0.156	-0.55
	2	1.564	4.18*	-0.439	-2.08**	-0.086	-0.27
	3	1.785	4.42*	-0.177	-0.78	0.243	0.72

*Note: Sector definitions are given in Appendix Table 4. *, **, and *** indicate the statistical significance at the 1%, 5%, or 10% level, respectively.*

We define the event as a Federal Open Market Committee (FOMC) meeting day. We collected the data from the minutes of the FOMC meetings in the period between January 2, 1996, and March 26, 2007. During this period, there were 94 FOMC meetings. Of these 94 events, Federal Funds target rate was

reduced 17 times, increased 24 times, and no rate change took place in 53 times. In order to better investigate the markets' reactions, we defined an event window as the period from 3 days prior to the event to 3 days after the event. In our effort to reduce other factors which may influence the stock price, we chose event windows close to the announcement day.

The results indicate that the average abnormal returns (AARs) and cumulative abnormal returns (CARs) are mostly positive and significant on the days the Federal Funds target rate was reduced. They are mostly negative and significant on the days the Federal Funds target rate was increased. However, we cannot identify any clear pattern of the market's response as the Federal Funds target rate is changed, because there is also evidence that the market reacted positively or negatively even if the funds target rate remained unchanged. The results also indicate that the stock market reaction to changes in the Federal Funds target rate depends on the industry sector.

In conclusion, the changes in the Federal Funds target rate are found to have a significant effect on stock prices on and around the event days. This finding is consistent with the findings of previous studies on the relationship between the stock prices and the Federal Funds target rate.

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APPENDIX

Table 4: Dow Jones Industrial Average Component Weightings

Sector	Company Name	Ticker	ICB Subsector	Weight (%)
Basic Material (10.48%)	Alcoa Inc.	AA	Aluminum	2.25
	E.I. DuPont de Nemours & Co.	DD	Commodity Chemicals	3.24
	Exxon Mobil Corp.	XOM	Integrated Oil & Gas	4.99
Conglomerates (11.57%)	3 M Co.	MMM	Diversified Industrials	5.03
	General Electric Co.	GE	Diversified Industrials	2.29
	United Technologies Corp.	UTX	Aerospace	4.24
Consumer Goods (13.84%)	Altria Group Inc.	MO	Tobacco	4.52
	Coca Cola Co.	KO	Soft Drinks	3.18
	General Motors Corp.	GM	Automobiles	2.04
	Procter & Gamble Co.	PG	Nondurable Household Products	4.09
Consumer Services (10.78%)	Home Depot Inc.	HD	Home Improvement Retailers	2.44
	McDonalds Corp.	MCD	Restaurants & Bars	2.94
	Wal-Mart Stores Inc.	WMT	Broad-line Retailers	3.12
	Walt Disney Co.	DIS	Broadcasting & Entertainment	2.27
Financial (14.52%)	American Express Co.	AXP	Consumer Finance	3.63
	American International Group Inc.	AIG	Full Line Insurance	4.39
	Citigroup Inc.	C	Banks	3.34
	JPMorgan Chase &Co.	JPM	Banks	3.15
Healthcare (8.55%)	Johnson & Johnson	JNJ	Pharmaceuticals	3.94
	Merck & Co. Inc	MRK	Pharmaceuticals	2.95
	Pfizer Inc.	PFE	Pharmaceuticals	1.67
Industrial Goods (13.24%)	Boeing Co.	BA	Aerospace	5.84
	Caterpillar Inc.	CAT	Commercial Vehicles & Trucks	4.37
	Honeywell International Inc.	HON	Diversified Industrials	3.04
Technology (17.02)	AT&T Inc.	T	Fixed Line Telecommunications	2.58
	Hewlett Packard Co.	HPQ	Computer Hardware	2.66
	Intel Corp.	INTC	Semiconductors	1.25
	IBM Corp.	IBM	Computer Services	6.24
	Microsoft Corp.	MSFT	Software	1.81
	Verizon Communications Inc.	VZ	Fixed Line Telecommunications	2.48

Note: The percentages in parentheses are the sector weights as of April 15, 2007.
Source: Dow Jones Indexes (www.djindexes.com/mdsdx/index.cfm)

LONG MEMORY IN EXCHANGE RATES: INTERNATIONAL EVIDENCE

Christos Floros, University of Portsmouth

ABSTRACT

In this paper we test for the presence of fractional integration, or long memory, in the daily returns of exchange rates using ARFIMA(p,d,q) models. We consider 34 exchange rates against the US dollar (USD) covering the period April 1991 to April 2006. The results suggest that 17 exchange rates show strong evidence of long memory. This indicates that shocks to the exchange rates persist over a long period of time (this is stronger in emerging market economies). This also indicates that these markets are not stable, and hence they offer an opportunity to investors and traders to add some risk to their strategies. The lack of long memory in the daily returns of exchange rates supports the efficient market hypothesis (EMH). These findings are helpful to traders dealing with long dated assets.

JEL: C22, C52, G14

INTRODUCTION

It is widely believed that the logs of financial prices contain a unit root. However, some series evidently do not possess a further unit root, while they show signs of dependence. Such series are argued to possess long memory. Long memory in time series can be defined as autocorrelation at long lags, of up to hundreds of time periods (Tolvi, 2003). Under this phenomenon, systems are characterized by their ability to 'remember' events in the long history of time series data and their ability to make decisions on the basis of such memories. According to long memory hypothesis, what happens today affects the future.

Knowledge of the time series properties of exchange rates has important economic implications. The empirical analysis of exchange rates provides useful information that can be used to evaluate the performance of exchange rate models. The objectives of this paper are twofold: (i) to examine and justify the presence of long memory (via fractional integration) in the prices of foreign exchange rates, and (ii) to test the validity of time series models on the presence of long memory in exchange rates. Time series models are important for the determination of international trade flows, prices of tradable goods, prices of foreign exchange futures and options and international asset portfolios (Cheung, 1993).

A number of studies have tested the long memory hypothesis using data from mature and emerging financial markets. If asset returns display long memory, they exhibit significant autocorrelation between observations widely separated in time. The absence/presence of long-term dependence on the mean of financial-asset returns is used as a proxy for analyzing market efficiency. The presence of long memory in asset returns contradicts the weak form of the efficient market hypothesis (EMH), which states that, conditioning on historical returns, future asset returns are unpredictable (Barkoulas *et al*., 2000).

Previous studies on this issue have relied on ARIMA models and have examined only a few countries. We test for the presence of long memory, or fractional dynamics, using the framework of Autoregressive Fractionally Integrated Moving Average (ARFIMA) allowing for a more precise specification of the order of integration. We use daily data from 34 exchange rates over the US dollar. Our findings are important since no previous work has examined this hypothesis using daily data from a large sample of countries covering all five continents or has used the ARFIMA methodology. Thus this paper extends the literature on two fronts. The remainder of this paper is organized as follows: In the next section a Literature

Review is provided. This section is followed by a Methodology Section that presents the long memory methodology through ARFIMA (p,d,q) models. The following section discusses the data used in this study. Next, the empirical results are examined. The paper closes with some concluding comments.

LITERATURE REVIEW

A number of researchers examine the long memory hypothesis in exchange rates (Bhar, 2000; Gil-Alana, 2000; Laurini and Portugal, 2003). The exchange rate between two currencies specifies how much one currency is worth in terms of the other. Traditionally, it has been assumed that the exchange rates have a unit root implying that shocks have permanent effects on the series (Taylor, 1995). However, some authors suggest that the exchange rates are mean-reverting (Gil-Alana, 2000).

Lo (1991) tests for long-run memory in daily and monthly stock market indices and finds no evidence of long-range dependence. Cheung and Lai (1995) examine long memory in international stock market returns using the Morgan Stanley Capital International stock index data for eighteen countries. Their results provide little support for long memory. According to Cheung and Lai (1995), the findings are not sensitive to inflation adjustments in stock returns, data sources, and statistical methods used. Furthermore, Ding and Granger (1996) examine the long memory property for various speculative returns. They report evidence of long memory for S&P 500 returns and four other speculative returns. Recently, Gil-Alana (2006) uses parametric and semi-parametric methods to test for the order of integration (and fractional integration) in daily stock market indices: EOE, DAX, Hang Seng, FTSE100, S&P 500, CAC 40, Singapore All shares and the Japanese Nikkei. He reports that the order of integration of the Singapore All Shares and the Hang Seng is much higher than one. Furthermore, Gil-Alana (2006) finds conclusive evidence against mean reversion, but long memory on their returns. For S&P 500, the fractional integration (long-memory) parameter is below one, while for the remaining series the values oscillate around the unit root. Barkoulas *et al*. (2000) test for the presence of long memory in the return series for the Greek stock market (an emerging capital market). They find significant and robust evidence of positive long-term persistence. In addition, Tolvi (2003) tests the long memory hypothesis in Finnish stock market, while Vougas (2004) extends the work of Barkoulas *et al*. (2000). He analyzes long memory and volatility of returns in the Athens Stock Exchange and finds weaker evidence in favour of long memory.

Cheung (1993) finds evidence of long memory in exchange rate data. Bhar (2000) examines long memory in the Yen/dollar rate. He finds no evidence of long memory indicating efficient pricing by the market participants. Cheng (2001) examines the long memory dynamics in the daily and weekly rates of six Asia Pacific countries. His findings reveal strong evidence of long memory in the weekly series. Laurini and Portugal (2003) show that the evidence of long memory for the daily R$/US$ series after the implementation of the Rate Plan is not robust. Furthermore, Gil-Alana (2004) shows that exchange rates series have a component of long memory behaviour. Recently, Soofi *et al*. (2006) use the plug-in and Whittle methods (spectral regression analysis) to test for the long memory property in 12 Asian/dollar daily exchange rates. Their findings, based on the two different methods, are mixed.

METHODOLOGY

Previous studies used the standard Integrated Autoregressive Moving Average (ARIMA) model to study the intertemporal dynamics of exchange rates. An integrated series of order *d* must be differenced *d* times before it can be represented by a stationary and invertible ARMA process. If this ARMA representation is of order (p,q) then the original, undifferenced series is following an ARIMA(p,d,q) representation.

This paper examines the dynamics of exchange rates in the fractionally integrated autoregressive moving average (ARFIMA) framework which is a generalization of the ARIMA(p,d,q) model. The ARFIMA

model is the generalization of the concept of the order of integration used in ARIMA models, thus allowing the order of integration to be a fractional number (Laurini and Portugal, 2004). We test ARFIMA(p,d,q) models via conditional maximum likelihood (ML), following the recent work of Vougas (2004). For the returns series r_t, where $t = 1,...,T$, the ARFIMA model is given by:

$$\phi(L)(1-L)^d(r_t - \mu) = \theta(L)\varepsilon_t \tag{1}$$

L is the lag operator ($L^j r_t = r_{t-j}$ $L)(1-L)^d(r_t - \mu) = \theta(L)\varepsilon_t$ is the autoregressive polynomial, and $\theta(L) = 1 + \theta_1 L + ... + \theta_q L^q$ s the moving average polynomial. The differencing parameter *d* is not necessarily an integer (it takes real values), but integer values of *d* lead to the traditional ARIMA model. Therefore, the fractional differencing parameter $(1-L)^d$ can be defined for non-integer values by the following binomial expansion:

$$(1-L)^d = \sum_{j=0}^{\infty} \binom{d}{j} (-L)^j \tag{2}$$

We also make the assumptions that (i) the residuals $\varepsilon_t \sim NID(0, \sigma_t^2)$ and (ii) the roots of the AR and MA parameters fall outside the unit circle and do not have common roots. Significance of *d* parameter is evidence of long memory. When *d* parameter has values greater or equal to 0.5, the series does not have stationary covariance, and consequently it has infinite covariance as shown by Baillie *et al*. (1996). When *d* is between 0 and 0.5, the lag length increases the autocorrelations decay hyperbolically to zero, while when $d = 0$, decays exponentially to zero. If *d* is between -0.5 and 0, then it is usually identified as having intermediate memory, since autocorrelations are always negative. Further, we need to select a parsimonious ARFIMA(*p,d,q*) model using two information criteria: the Akaike (AIC) and Schwarz (SBC). The information criteria are given by:

$$\begin{aligned} AIC &= -2(\hat{\ell}/n) + (2(p+q+2))/n \\ SBC &= -2(\hat{\ell}/n) + ((p+q+2)\ln(n))/n \end{aligned} \tag{3}$$

where $\hat{\ell}$ is the value of the maximized likelihood. The best (selected) model has the smallest AIC or SBC value. It is known that AIC always selects a generously parameterized model, while SBC selects a less generously parameterized model (Vougas, 2004). In general, the AIC is one of the most commonly used in time series analysis. The selected ARFIMA model is a parsimonious and flexible model that can be used to study long memory and short-run dynamics simultaneously. Fractional integration is a more general way to describe long-range dependence than the unit-root specification and provides an alternative perspective to examine the unit-root hypothesis (Cheung, 1993).

Data Description

Foreign exchange markets are rather different from most financial markets. The vast bulk of trading takes place between professional foreign exchange dealers of banks. They do not meet the people they are trading with face to face, but they do their transactions over the phone or electronically. Note that foreign exchange markets are particularly rich on noise traders.

The structure of this market has two interesting implications: (i) exchange rates are moved by news. Since news is random and unpredictable, exchange rates will tend to move in a random way, and (ii) in the foreign exchange markets, there are not active cross-markets between all parts of currencies, but this does

not matter, because all currencies that have a market at all have one with the US dollar. Hence, the US dollar can be thought of as the medium of exchange of the foreign exchange markets.

The data covers the period from April 1991 to April 2006, and the main source is the Datastream International. We consider daily exchange rates from 34 countries (the total number of observations vary from 1397 to 3915), as follows: Europe (Czech Republic, Cyprus, Denmark, Hungary, Norway, Poland and UK), Asia (Bahrain, Hong Kong, India, Israel, Japan, Kuwait, Lebanon, Malaysia, Oman, Philippines, Russia, Singapore, South Korea, Sri Lanka and Turkey), Africa (Botswana, Egypt, Kenya, Mauritius, Morocco and Tunisia), America (Argentina, Canada, Mexico, Uruguay and Venezuela) and Australia. The empirical analysis is based on both developed and developing (or emerging) markets. Note that emerging countries constitute approximately 80% of the global population, representing about 20% of the world's economies (worldbank.com).

Table 1 presents the descriptive statistics for the log-exchange rates. Most series show positive skewness (the distribution is skewed to the right), while the distribution is peaked (leptokurtic) for Bahrain, Lebanon and Oman and flat (platykurtic) relative to normal for the rest. We also reject the hypothesis of normal distribution at the 5% level (for all series). The ADF tests show evidence of non-stationarity, I (1), for all series (the results are not reported here).

Table 1: Descriptive Statistics for Log-exchange Rates over the US Dollar

Country	Obs.	Mean	S.d.	Skewness	Kurtosis	Normality
Argentina	3915	-0.3	0.49	-1.01	-0.914	7358 (0.00*)
Australia	3915	-0.38	0.13	-0.78	-0.53	1540 (0.00*)
Bahrain	3915	0.97	0.0012	-9.6276	467.35	43410 (0.0*)
Botswana	3200	-1.45	0.27	0.44	-0.87	508 (0.00*)
Canada	3915	-0.313	0.094	0.298	-0.815	323 (0.00*)
Cyprus	1397	0.628	0.139	-0.3178	-1.4159	386 (0.00*)
Czech Re.	3740	-3.39	0.147	-0.389	-0.769	409 (0.00*)
Denmark	3915	-1.88	0.123	-0.633	-0.393	713 (0.00*)
Egypt	1397	-1.655	0.169	0.578	-1.209	620 (0.00*)
Hong Kong	3915	-2.0492	0.0035	-0.269	-1.4925	1120 (0.00*)
Hungary	3740	-5.16	0.412	0.683	-0.787	1347 (0.00*)
India	3915	-3.64	0.207	0.731	-0.344	1013 (0.00*)
Israel	3915	-1.279	0.2266	0.50474	-0.98699	944 (0.00*)
Japan	3915	-4.741	0.1021	0.29175	0.32928	54.5 (0.00*)
Kenya	1397	-4.3481	0.0308	0.9155	0.6655	306 (0.00*)
Kuwait	3915	1.205	0.01884	0.4014	-0.64159	363 (0.00*)
Lebanon	3915	-7.3244	0.15394	1.8736	6.6586	1824 (0.00*)
Malaysia	3915	-1.1674	0.19495	0.28252	-1.8101	2570 (0.00*)
Mauritius	1397	-3.3619	0.04427	0.77599	0.34759	220 (0.00*)
Mexico	3915	-1.9514	0.48526	0.89259	-0.89499	3684 (0.00*)
Morocco	1397	-2.2861	0.10878	-0.32073	-1.3311	330 (0.00*)
Norway	3915	-1.9694	0.11723	-0.63968	-0.35334	698 (0.00*)
Oman	1397	0.95477	0.00147	2.3933	6.7964	2582 (0.00*)
Philippines	3915	-3.6109	0.32409	0.012577	-1.7227	1372 (0.00*)
Poland	3740	-1.0961	0.35652	1.1464	0.4519	2342 (0.00*)
Russia	1397	-3.3856	0.043161	-0.3789	-1.1515	283 (0.00*)
Singapore	3915	-0.48963	0.078495	0.71816	-0.59781	1277 (0.00*)
South Korea	3915	-6.9066	0.21657	-0.0916	-1.301	539 (0.00*)
Sri Lanka	1397	-4.5698	0.05347	0.93817	0.82954	297 (0.00*)
Tunisia	1397	-0.2929	0.0634	-0.16369	-1.1314	147 (0.00*)
Turkey	3915	1.7043	1.99	0.5	-1.1419	1185 (0.00*)
UK	3915	0.48072	0.078546	0.36253	-0.53742	253 (0.00*)
Uruguay	3915	-2.2933	0.76255	0.27532	-0.79199	280 (0.00*)
Venezuela	3915	-6.0992	1.1483	0.37894	-1.0415	655 (0.00*)

This Table shows the summary statistics for log-exchange rates. Skewness is a measure of asymmetry of the distribution of the series around its mean. Kurtosis measures the peakedness or flatness of the distribution of the series. Normality (under Jarque-Bera test) is a test statistic for testing whether the series is normally distributed (probability value is in parentheses).
** indicates significance at the 5% level.*

EMPIRICAL RESULTS

We use the ARFIMA framework which allows for long memory in the data. ARFIMA(p,d.q) models are estimated via conditional Maximum Likelihood (ML) using the Ox language (PcGive software). We run various ARFIMA(p,d,q) specifications with $p+q \leq 2$ (not reported here). There is evidence of unit roots, and the selected ARFIMA model, for all samples, is ARFIMA(1,d,1). The selected ARFIMA(1,d,1) model corresponds to the smallest AIC and SBC information criteria.

The results from Europe are reported in Table 2 (Panel A). Accordingly, all models show insignificant *d* parameter. Hence, the results from the European/$US rates show weak evidence of long memory. The results for Africa (Table 2 – Panel B) show that four rates (Botswana, Egypt, Kenya and Mauritius) support the long memory hypothesis. Similarly, the results for Asian countries (Table 2 – Panel C) show evidence of long memory for ten countries (Bahrain, Hong Kong, India, Israel, Lebanon, Oman, Philippines, Russia, South Korea and Turkey). However the evidence for America and Australia is mixed. Table 2 – Panel D shows that only three rates (Argentina, Mexico and Uruguay) have long memory properties, with the remaining countries not showing the presence of long memory.

Furthermore, Figure 1 presents the variation of *d* parameter for all countries which support the long memory hypothesis. The results from Africa and Asian countries (Figures 1.1-1.2) show that $-0.1643 < d_{africa} < 0.3741$ and $-0.947 < d_{aasian} < 0.3649$, while for America (Figure 1.3) $0.144 < d_{america} < 0.2816$. More specific, for American exchange rates (Argentina, Mexico and Uruguay), empirical evidence shows that the lag length increases the autocorrelations decay hyperbolically to zero. This is also true for African exchange rates (Botswana, Egypt and Mauritius). The only exception is Kenya; there is evidence of intermediate memory, since autocorrelations are always negative. Finally, for the Asian/$US rates, the empirical evidence is mixed. Five exchange rates (India, Israel, Lebanon, Russia and Turkey) support the property that the lag length increases the autocorrelations decay hyperbolically to zero. In addition, five Asian/$US exchange rates (Bahrain, Hong Kong, Oman, Philippines and South Korea) show evidence of intermediate memory, since autocorrelations are always negative.

Table 2: Empirical Results

PANEL A. ML Estimation of ARFIMA(1,d,1) Models: EUROPE

COUNTRY	$\phi_{1\,t}$	$\theta_{1\,t}$	*d*	*AIC*	*LL*
Czech Rep	-0.138 (-0.9)	0.013 (0.08)	0.006 (0.247)	-6.9930	13078.7000
Cyprus	-0.49 (-1.22)	0.41 (0.94)	-0.029 (-0.9)	-7.1880	5021.3000
Denmark	0.04 (0.0534)	-0.07 (-0.09)	-0.00012 (-0.0048)	-7.2260	14145.4000
Hungary	-0.1866 (-1.43)	0.037 (0.264)	-0.0036 (-0.184)	-6.9790	13051.9000
Norway	0.2318 (0.1)	-0.239 (-0.104)	-0.0305 (-1.08)	-7.1205	13938.9000
Poland	-0.0971 (-2.21)*	-0.35 (-5.88)*	0.043 (1.61)	-6.3411	11858.7400
UK	0.5597 (0.6)	-0.5143 (-0.576)	-0.020 (-0.249)	-7.5624	14803.5200

* Significant at 5% Level

PANEL B. ML Estimation of ARFIMA(1,d,1) Models: AFRICA

COUNTRY	$\phi_{1\,t}$	$\theta_{1\,t}$	*d*	*AIC*	*LL*
Botswana	0.398 (4.27)*	-0.56 (-5.15)*	0.085 (1.90)*	-6.9700	11159.7000
Egypt	0.182 (2.22)*	-0.486 (-4.63)*	0.13 (2.3)*	-7.2899	5092.3600
Kenya	0.1478 (1.1)	0.04 (0.346)	-0.1643 (-4.56)*	-8.0474	5621.1300
Mauritius	-0.1615 (-4.4)*	-0.737 (-18.1)*	0.3741 (6.63)*	-8.1154	5668.5700
Morocco	-0.4215 (-1.34)	0.3466 (1.03)	-0.00323 (-0.11)	-7.7020	5380.3500
Tunisia	0.1354 (1.21)	-0.3642 (-2.65)*	0.01316 (0.241)	-7.5351	5263.5500

* Significant at 5% Level

PANEL C. ML Estimation of ARFIMA(1,d,1) Models: ASIA

COUNTRY	$_{t}\phi_{1\,t}$	$\theta_{1\,t}$	*d*	*AIC*	*LL*
Bahrain	0.175 (2.56)*	0.139 (2.61)*	-0.947 (-37.5)*	-10.6000	20754.5000
Hong Kong	-0.153 (-1.14)	-0.0196 (-0.127)	-0.156 (-5.7)*	-12.5390	24544.5000
India	0.45 (5.00)*	-0.61 (-5.81)*	0.138 (3.07)*	-8.1910	16033.9000
Israel	0.0474 (1.55)	-0.563 (-11.2)*	0.116 (2.8)*	-7.2710	14233.9000
Japan	0.0825 (0.0951)	-0.1 (-0.115)	0.0016 (0.0679)	-7.1052	13909.0700
Kuwait	0.0106 (0.199)	-0.3249 (-4.61)*	-0.0354 (-1.1)	-9.4924	18580.7000
Lebanon	0.3059 (9.40)*	-0.7177 (-20.5)*	0.3649 (7.59)*	-7.3175	14324.4500
Malaysia	-0.3849 (-3.91)*	0.2914 (2.74)*	0.0277 (1.54)	-7.4419	14567.8000
Oman	0.33192 (2.32)*	-0.465 (-3.0)*	-0.569 (-10.4)*	-10.5862	7393.1900
Philippines	-0.07 (-0.349)	0.158 (0.831)	-0.052 (-2.85)*	-7.2156	14125.1000
Russia	-0.0962 (-1.03)	-0.255 (-2.12)*	0.1062 (2.41)*	-9.3367	6521.0490
Singapore	-0.04689 (-0.26)	-0.0544 (-0.285)	0.0099 (0.410)	-8.4362	16513.6600
South Korea	0.1343 (2.1)*	0.087 (1.57)	-0.083 (-4.46)*	-6.6835	13083.7500
Sri Lanka	0.384 (2.39)*	-0.515 (-2.85)*	0.066 (1.05)	-8.5790	5992.1500
Turkey	0.432 (11.6)*	-0.8132 (-29.6)*	0.266 (5.3)*	-5.4	10571.96

* Significant at 5% Level

PANEL D. ML Estimation of ARFIMA(1,d,1) models: AMERICA & AUSTRALIA

COUNTRY	$\phi_{1\,u}$	$\theta_{1\,u}$	*d*	*AIC*	*LL*
Argentina	0.6604 (14.2)*	-0.80 (-25.9)*	0.179687 (3.97)*	-6.1700	12097.6700
Canada	0.079 (0.138)	-0.1 (-0.173)	-0.006 (-0.271)	-8.3590	16363.9000
Mexico	0.3946 (7.86)*	-0.605 (-10.1)*	0.144 (3.36)*	-6.5502	12822.7600
Uruguay	0.4754 (12.7)*	-0.8326 (-34.1)*	0.2816 (5.59)*	-6.7462	13206.3200
Venezuela	-0.00502 (-0.1)	-0.4157 (-6.49)*	0.0357 (1.18)	-4.4919	8794.7800
Australia	-0.296 (-0.76)	0.3179 (0.807)	-0.024 (-1.52)	-7.3514	14390.8500

* Significant at 5% Level

This Table shows the estimation of ARFIMA (1,d,q) models. LL indicates the log-likelihoods, d indicates the long memory parameter, and AIC is the Akaike information criterion. T-statistics are in parentheses.

Figure 1: The Variation of Long Memory Parameter (*d*) Across Countries

Figure 1.1: Africa (*d*) Parameter

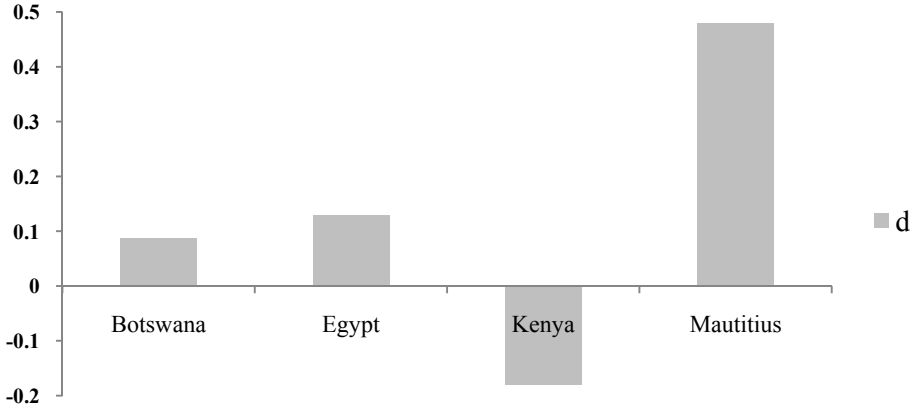

Figure 1.2: Asia (*d*) Parameter

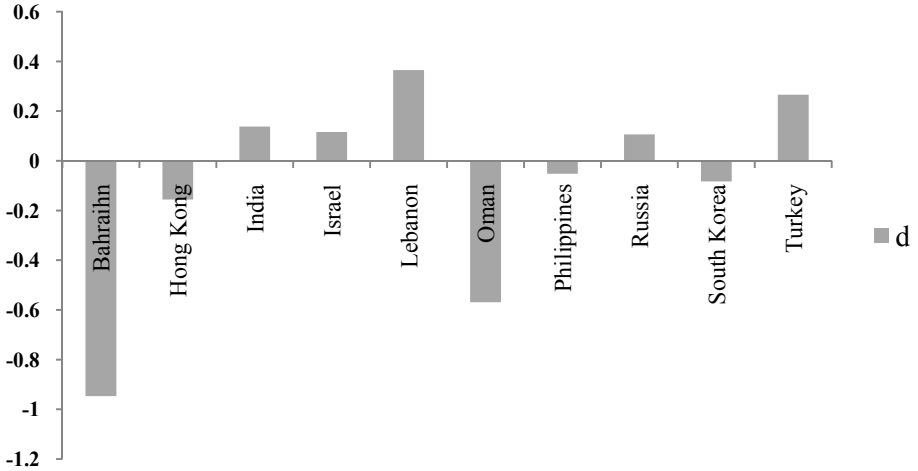

Figure 1.3: America (*d*) Parameter

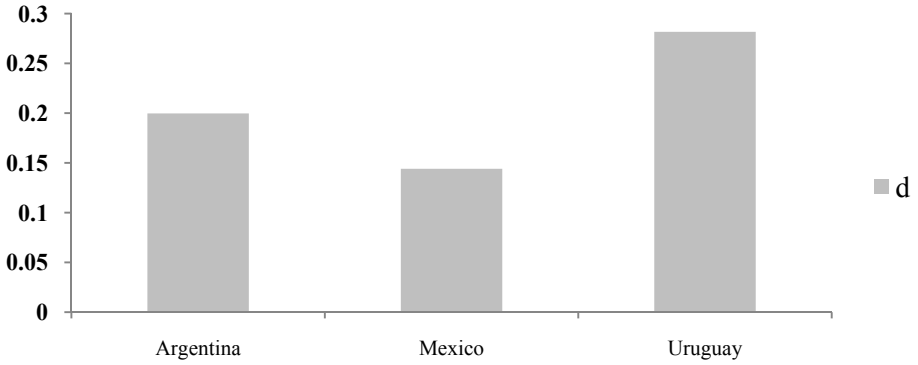

Figure 1 shows the variation of significant long memory parameter (d) across countries.

CONCLUSIONS

In this paper, conditional maximum likelihood is employed to estimate ARFIMA models and test for long memory in exchange rates. We examine the evidence of long memory in the daily exchange rates over the US dollar. Since currency trading always involves buying one currency and selling another, we consider data from 34 countries (from all five continents) covering the period April 1991 to April 2006.

The results from the selected ARFIMA(1,d,1) models show evidence of long memory in African and Asian countries. The results from the European rates show weak evidence of long memory (*d* is not significant), while the evidence from America and Australia is mixed. In general, we find that 17 exchange rates show strong evidence of long memory. This indicates that shocks to these rates persist over a long period of time. Furthermore, the long memory hypothesis is stronger in emerging market economies (economies with low-to-middle per capital income). This indicates that these transition (emerging) markets are not stable, and hence they offer an opportunity to investors and traders to add some risk to their strategies.

As an emerging market, a country should embark on an economic reform program that will lead it to stronger and more responsible economic performance levels, as well as transparency and efficiency in the capital market. An emerging market economy should reform its exchange rate system because a stable local currency builds confidence in an economy, especially when foreigners are considering investing. Exchange rate reforms also reduce the desire for local investors to send their capital abroad.

These findings are helpful to financial managers, traders and investors dealing with foreign exchange rates. Further research should (i) investigate the predictability of foreign exchange rates using ARFIMA time-series methods, and (ii) run a sensitivity analysis to ascertain the robustness and temporal stability of the long memory.

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BIOGRAPHY

Dr Christos Floros completed his first degree in Mathematics and Operational Research at Brighton University and also holds MA (Economics) and MSc (Mathematics) degrees from Portsmouth University and a PhD in Financial Economics from Swansea University. He is a lecturer in Banking and Finance at the University of Portsmouth and his research interests include financial econometrics, derivatives, e-banking and banking efficiency.

BANKING SYSTEM EFFICIENCY AND CHINESE REGIONAL ECONOMIC GROWTH: AN EMPIRICAL ANALYSIS BASED ON BANKS' MICRO-EFFICIENCY

Xianliang Tian, Hubei University
Ming Zhou, Hubei University

ABSTRACT

Based on the cost efficiency of individual banks, this paper constructs an indicator to clarify Chinese regional banking system's credit allocation efficiency in accordance with the panel data of the provinces and central-government-administered cities of China. When applying this variable into the growth equation and estimating the regression, the results demonstrate a strong positive relationship between the regional banking systems' efficiency and regional growth rate. This paper presupposes that the indicator of the banking system's efficiency bears a direct relationship with the banking system's capability of identifying promising entrepreneurs and optimizing credit allocation. Thus, it could be concluded that the banking system can exert their influences on the process of economic growth not only through capital accumulation effects but also through credit allocation effects.

JEL: G11, G14, G15

INTRODUCTION

The research in the relationship between economic growth and banking sector development can be dated back as early as Schumpeter (1934), and Goldsmith (1969). Since then, this subject has received extensive attention by economic researches. The empirical relationship between these two variables has been well documented. Most regression outcomes show that the banking system plays an important role in promoting the development of regional economies. For instance, based on cross-nation data, Rajan & Zingales (1998) conclude that in a foreign-investment-dependent nation, the higher the banking system's efficiency, the faster firms develop. King & Levine (1993a), employing historical data of nearly 80 countries, argued that a highly positive relationships between bank's development and economic growth did exist. They further inferred that bank's development could facilitate economic growth by increasing the rate of capital accumulation and economy efficiency. Referring to current domestic literature, Tan Ruyong(1999), Wang Guosong(2001) & Rao Huacun(2001) all identified the causal relationship between banking and economic growth through empirical analysis.

In most of the relevant empirical literature, the banking system's development is usually measured by the size of the banking system or the amount of bank-arranged capital. To be specific, the indicators used to depict the development of the banking system include the ratio between liquid liabilities of the banking system and GDP (King & Levine, 1993b), the proportion of bank branches to the regional resident population (Ferri & Mattesini, 1997), the ratio between domestic credit and GDP (Rajan & Zingales, 1998). However, these measurements have some inherent flaws in capturing the relationship between the banking system development and economic growth, that is, they mainly focus on the effect of banks on stimulating capital accumulation. Meanwhile, the financial intermediary theory developed since the 1980's shows that another important function of a commercial bank lies in its ability to identify optimal borrowers, alleviate the information asymmetry in the financial market, optimize capital allocation and thus promote economic growth (Diamond, 1984; Stiglitz & Weiss, 1988). However, empirical researches in this respect can hardly be found in relevant academic literature. Levine (1997) points out that, the only indicator measuring financial development in previous studies is the ratio of the loans granted to private business against the total loans. This approach is based on the premise that the private sector is more

efficient than the public one. Obviously, the hypothesis itself is subject to be question on various grounds. Besides, it should be noted that, for many developing countries, the share of credit granted to the public sector is mainly the outcome of government intervention rather than the banks' discretionary decisions. In that case, this measurement is unable to effectively reflect the banks' ability to improving the efficiency of credit allocation, if political factors are considered.

In this paper, we construct an indicator that is able to reflect the allocative efficiency of banking systems based on micro-efficiency of individual banks, and then investigate the relationship between this indicator and the rate of Chinese economic growth. In general, the higher individual banks' ability to identify the quality borrowers and optimize the allocation of financial resources, the more efficient the regional banking system is. Hence, by analyzing the relationship between this indicator and regional economic growth rates, we can substantiate that the bank's ability to identify quality borrowers indeed plays a role in facilitating economic growth. Utilizing this logic, we first calculate the cost efficiency of the 14 biggest commercial banks of China, and then we construct the banking system's efficiency index based on the weighted average of the bank's individual cost efficiency in each region. After putting this index into the growth regression model, we find that, in China, the banking system's efficiency indeed exerts a salient positive influence upon the regional growth rate; and therefore the empirical results demonstrate that the bank's economy-facilitating role can also be realized though their screening ability.

LITERATURE REVIEW

Research Method

The general model used in empirical analyses of economic growth is presented as the following (Mankiw et al, 1992):

$$y_t - y_{t-1} = \varphi y_{t-1} + \chi k_{t-1} + \psi S_{t-1} + \varepsilon_t \quad (1)$$

Where y_t denotes logarithm of GDP per capita over period t in one country (region); k_{t-1} is the logarithm of the ratio of banking credit granted to the country (region) and its GDP over the period t-1; S_{t-1}, considered as long-term potential determinants of economic growth, is a vector containing other financial and control variables in logarithmic form. ε_t is the random error term. With regard to the explanation of coefficients in formula (1), if $\varphi < 0$, then it shows the existence of conditional convergence. χ describes the effect of bank's credit supply on the economic growth, if the estimation result is $\chi > 0$, it shows that banking system could promote economic growth through the channel of capital accumulation.

K_t is defined as the ratio between bank system's credit scale and GDP in one country (region). An important hypothesis in this paper is that, for a given credit size, varied efficiency of the banking system may lead to different contributions to the economic growth. Therefore, we construct an effective credit size index $\overset{\Lambda}{K}_t$ to depict the impact of banking system's efficiency on economic growth, the specification of $\overset{\Lambda}{K}_t$ can be formulated as the following:

$$\overset{\Lambda}{K}_t = K_t(1-\mu_t)^{\rho} \quad (2)$$

Here, we use parameter μ_t ($0 \le \mu_t \le 1$) to quantify the inefficiency of the banking system. The bigger the

value of μ_t , the lower the efficiency of the banking system in one country (region), and the lower the ability the bank system has in that country(region) to screen borrowers and optimally allocate capital. Under this situation, a given capital size, K_t , can only parallel to the smaller size of effective credit, $\overset{\Lambda}{K}_t$, considering their contributions to economic growth. Therefore, in this paper, both the efficiency of banking system and the whole credit scale issued by it have the joint influence upon the growth rate of a country (region). Specifically, when the bank system's efficiency is extremely low, i.e. μ_t is close to one, the contribution of loans to economic growth will come close to zero. Finally, ρ depicts the extent to which this inefficiency exerts on economic growth.

In the following, we substitute K_t for $\overset{\Lambda}{K}_t$, yielding the regression equation as below:

$$y_t - y_{t-1} = \varphi y_{t-1} + \chi k_{t-1} + \overset{\Lambda}{\rho} \ln(1-\mu_{t-1}) + \psi S_{t-1} + \varepsilon_t \tag{3}$$

Herein, $\overset{\Lambda}{\rho} = \rho\chi$. If the diagnostic result shows that χ is positive, and $\overset{\Lambda}{\rho} = 0$, it means that the role of banking system on economic growth is mainly capital accumulative and the effect of credit allocation is not significant. Nevertheless, if both χ and $\overset{\Lambda}{\rho}$ are significantly non-zero, we then conclude that the effect of credit allocation on economic growth could not be excluded.

METHODOLOGY: A NEW INDEX MEASURING BANKING SYSTEM'S EFFICIENCY

The Estimation of Technical Efficiency of Commercial Banks

Two technical micro-efficiency concepts exist in current literature: cost efficiency and profit efficiency. In this paper, we choose the concept of cost efficiency to measure technical efficiency of individual bank for the facts that a bank's profitability may not be in line with its ability to screen quality borrowers. In some cases, banks can even make admirable profits through the manipulation of prices, which is particularly true in the Chinese banking sector for its less competitive market structure.

When the entity's technical efficiency is estimated, the following two techniques are usually applied: DEA technique (or non-parametric techniques) and stochastic frontier technique (one of the techniques of parametric estimation) (Kalirajan & Shand, 1999). The parametric technique is preferred here because the hypothesis test can be conducted under this technique and the estimation of micro-efficiency is unbiased. In this paper, stochastic frontier technique will be chosen to estimate technical efficiency of individual banks.

Berger (1993) gives the general formula for cost efficiency estimation under parametric techniques:

$$RC = C(Q, W) \cdot U \tag{4}$$

Here, RC represents real cost; $C(Q, W)$ is the theoretical minimal cost. $U \in [1, \infty)$ reflects the degree of cost ineffectiveness of commercial banks, while its reciprocal denotes the value of cost efficiency. $Q = (Q_1, Q_2 \cdots)$ is a vector of quantities for various outputs. And $W = (W_1, W_2, \cdots)$ is a vector for prices of inputs.

Taking the logarithm of equation (4), yields:

$$rc = c(Q, W) + \varepsilon + \mu \tag{5}$$

In this equation, ε random error term; and other variables in lowercase are logarithmic form of the corresponding variables in equation (4).

The inputs and the outputs of the equation (4) should be accurately defined prior to conducting the regression estimation. In equation (4), price vector takes average cost of loanable funds and average price of operation inputs as its components. As to average cost of loanable funds, it is defined as the ratio of the sum of commission and interest expenditure against average quantity of loanable funds, while the average price of operation inputs is taken as the ratio of operation expenses against average total assets. In addition, bank's outputs include three items, namely, total loans, total investment and non-interest proceeds. Finally, for limited availability of data, we only include three typical items as components of total real cost of a bank, which are commission, interest expenditure and operation expenses respectively.

Next, we begin estimating the cost efficiency of China's main commercial banks. Due to the difficulty of data collection, the sample herein just consists of 4 major state-owned banks, (three of them have recently been converted to public-listed commercial banks through the introducing of new non-government investors), and 10 middle-sized commercial banks. These 14 banks constitute the main force of Chinese banking sector, whose assets amount to nearly 75% of total assets of the whole banking industry. Taking account of data availability, banks' size or other reasons, we exclude from the sample policy banks, city commercial banks, urban and rural cooperative credit banks and branches of foreign banks in China. The time scale ranges from 1998 to 2004-a critical period for commercial banks' reform in China. Therefore, the outcome of the reform can be evaluated through assessing the change of banks' micro-efficiency. The data is mainly extracted from "Year Book of Chinese finance" and official information published in each bank's website. Since the financial data of Guangdong Development Bank in 2004 is still unavailable, we then extrapolate data for the year 2004 by adjusting each component of the sample for 2003 by the average change from 2001 to 2003. Table 1 below gives statistic description of the sample.

Table 1: Statistic Description of the Sample

Notation	Variable	Mean Value	Standard Error
RC	Real total cost	295.17	355.48
Q_1	Balance of loan	5812.32	8212.12
Q_2	Balance of investment	2205.21	3125.37
Q_3	Non-interest Proceeds	70.21	75.36
W_1	Average cost of loanable funds	0.019	0.01
W_2	Average price of operation inputs	0.018	0.007

Sources: "Year Book of Chinese Finance" (1999-2004) and official statistic data published in every bank's website. Note: Q_1 is the mean value of balance of loan in the observational year (deducted by non-performing loans). Q_2 is the mean value of balance of investment, here including short-term investment, security investment, long-term investment, deducted by reserve for loss of investment. Q_3 is calculated as yearly earning deducted by interest proceeds. W1, W2 are index having no dimension. Other variables are in hundreds of million RMB.

Giving the small size of sample , we specify $C(Q, W)$ in relatively simple form of Cobb-Douglas function for the feasibility of the estimation. Furthermore, due to insignificant differences between various inputs' price, it would easily give rise to the problem of over-identification, if more flexible forms of the cost function were applied (Berger, 1993). Then equation (5) turns into the following form:

$$rc_i = a_0 + a_1 q_{1i} + a_2 q_{2i} + a_3 q_{3i} + a_4 w_{1i} + a_5 w_{2i} + \varepsilon_i + u_i \tag{6}$$

The variables here in lowercase are the logarithmic form of the variables listed in table 1; ε_i is random error, subject to $N(0,\sigma_v^2)$ distribution. μ_t denotes the term of bank's inefficiency, which is subject to semi-normal distribution ($\left|N(0,\sigma_v^2)\right|$). Taking account the linear homogeneity of inputs, we impose a linear restriction on equation (6): $a_4 + a_5 = 1$, and reach the following form:

$$rc_i - w_{1i} = a_0 + a_1 q_{1i} + a_2 q_{2i} + a_3 q_{3i} + a_5 (w_{2i} - w_{1i}) + \varepsilon_i + \mu_i \tag{7}$$

Next, we use Frontier 4.1 package to estimate (7) with maximum likelihood method. As a customary practice in the estimation of an entity's micro-efficiency, we estimate $\sigma^2 = \sigma_u^2 + \sigma_v^2$ and $\lambda = \sigma_v / \sigma_u$ respectively, instead of directly estimating σ_u^2 and σ_v^2. The estimation results of equation (7) are given in table 2.

Table 2: Estimation Results of Frontier Cost Function

	a_0	a_1	a_2	a_3	a_5	σ^2	λ
Parameter estimated	2.03	0.76	0.17	0.015	0.41	0.017	0.7
Standard error	0.16	0.049	0.06	0.028	0.065	0.0089	0.21
T statistics	12.7	15.6	2.88	0.53	6.32	2.00	3.25

From table 2, we find that a_1 is slightly less than one, which reveals slight economies of scale in more traditional operation (loans): when the amount of loan doubled, the real total cost does not increase accordingly. a_2 is far less than one indicating apparent economies of scale in investment. It should be noted that a_3 comes close to zero and remains insignificant, demonstrating that the intermediary business has no significant impact on individual banks' real cost, which could be expounded by the facts of under-development and insignificance of intermediary business for Chinese banking sector as a whole. In order to display the evolutionary pattern of banks' cost efficiency, we divide the whole sample into 6 sub-samples, namely, 1998-1999, 1999-2000, 2000-2001, 2001-2002, 2002-2003, and 2003-2004 respectively, and conduct separate estimation on equation (7) for each sub-sample. The estimated results, to our surprise, display substantial stability, implying the slow upgrading of banks' cost technology. Moreover, the estimated λ is increasing gradually after 2002, which could be understood through the fact that Chinese banking system has proved more efficient and competitive after reform and the gap of banks' cost efficiency has been widened ever since.

Then we estimate cost efficiency of individual banks with the following formula defined as equation (8) (Jondrow et al, 1982):

$$\hat{u}_i = E(u_i|\hat{e}_i) = \frac{\sigma\lambda}{1+\lambda^2}\left(\frac{\phi(\lambda\hat{e}_i)}{\Phi(\lambda\hat{e}_i)} + \lambda\hat{e}_i\right) \tag{8}$$

$\overset{\Lambda}{u}_i$ denotes the inefficiency value of a bank, and $\overset{\Lambda}{e}_i$ represents residual of regression; $\phi(\cdot)$ and $\Phi(\cdot)$ are, respectively, the density and distribution functions of a standardized normal random variable. Some descriptive statistics on the distribution of $\overset{\Lambda}{u}_i$ across banks are given in Table 3.

Table 3: Descriptive Statistics on the Distribution of Inefficiency across Banks

	98-99	99-00	00-01	01-02	02-03	03-04
Mean value	0.088	0.070	0.081	0.072	0.068	0.077
Standard error	0.061	0.043	0.048	0.041	0.045	0.055
Median	0.083	0.055	0.062	0.056	0.050	0.066

As shown in Table 3, the variation of cost efficiency across banks has been increasing since 2001, revealing the ever-intense competition in the banking industry and keeping in line with the above-mentioned analysis. On average, during 2000-2003, cost efficiency of individual banks has gradually been improved (the value of inefficiency term decreases year by year). However, it should also be noticed that, for some unknown reason, the average cost efficiency is deteriorating after 2003.

Index for Inefficiency of Regional Banking System

We then use a weighted average to construct an index for the inefficiency of a regional banking system in which weights are the proportion of loans by a specific bank for a region to total loans issued in that region. The data for the loans of each bank at each region is mostly extracted from "Year Book of Chinese Finance". For some relatively small-sized commercial banks, the Year Book does not give regional data; we then create the regional data through multiplying total loans of that bank for one year by the proportion of regional GDP in the GDP of the whole nation.

The index we propose for the inefficiency of banking system for each region is therefore defined as follows:

$$\overset{\Lambda}{\mu}_{jt} = \sum a_{ijt} \overset{\Lambda}{u}_{it(t+1)} \tag{9}$$

$\overset{\Lambda}{\mu}_{jt}$ denotes the value of the inefficiency for banking system of region j. And $\overset{\Lambda}{u}_{it(t+1)}$ represents the value of inefficiency for bank i from year t to $t+1$; α_{ijt} is the ratio between loans of bank i issued in region j and total loans region j received in year t. Table 4 gives the results estimated for the value of inefficiency of banking system for each region in China.

From table 4, we conclude that: firstly, on average, during the former half period of 1998-2003, the efficiency of the banking system for every region is quite low, while in the latter half period the value of efficiency is high. This demonstrates that the recently launched series of reforms in the banking sector is beginning to have an effect. Secondly, in the fastest growing regions, such as Beijing, Shanghai, Guangdong Province, the efficiency of the banking system is higher, while in Hubei, Guangxi, Hunan Provinces, etc, whose growth rate is relatively lower, its banking system's efficiency is lower too.

Growth Regression-The Equation for Regression

The equation is established for the regression based on equation (3):

$$y_{it} = \alpha + \hat{\varphi} y_{i(t-1)} + \chi k_{i(t-1)} + \hat{\rho} \ln\left(1 - \hat{u}_{i(t-1)}\right) + \Psi S_{i(t-1)} + \eta_i + \varepsilon_{i,t} \tag{10}$$

Table 4: Value of Inefficiency of Banking System for Various Regions (Percentage)

	1998	1999	2000	2001	2002	2003
Beijing	6.80	5.47	6.00	5.01	4.33	4.23
Tianjing	6.45	6.60	7.80	5.91	5.93	6.53
Hebei	6.63	7.18	7.52	5.82	6.24	6.37
Shanxi	6.64	7.72	7.33	5.56	6.40	6.42
Inner Mongolia	6.37	7.39	6.77	4.96	5.89	5.77
Liaoling	6.71	7.37	7.41	6.01	6.27	6.53
Jiling	6.73	7.35	7.81	5.98	5.96	5.94
Heilongjiang	6.63	7.32	7.49	5.96	6.48	6.41
Shanghai	5.29	5.30	6.10	5.13	4.61	4.44
Jiangsu	5.93	5.53	6.56	5.38	5.16	5.21
Zhejiang	5.82	6.06	6.14	5.12	5.08	4.80
Anhui	6.46	7.42	7.43	5.95	6.34	6.97
Fujian	7.32	6.39	7.26	5.35	5.21	6.04
Jiangxi	7.66	7.49	7.53	5.66	6.04	5.95
Shandong	6.78	6.94	8.32	6.24	5.75	5.51
Henan	6.42	7.25	8.01	6.64	7.08	7.43
Hunan	6.66	6.94	8.52	6.53	6.14	6.48
Hubei	6.84	6.84	7.95	6.38	6.63	7.19
Guangdong	6.43	5.51	6.06	4.16	4.43	4.68
Guangxi	6.47	7.10	7.46	6.04	6.75	7.12
Hainan	6.96	6.32	10.67	8.95	7.39	7.51
Sichang	6.73	6.74	8.03	5.92	6.89	6.95
Guizhou	7.23	8.30	7.41	5.66	7.25	7.61
Yunnan	6.72	7.39	7.02	5.86	7.08	7.57
Tibet	7.57	7.49	6.53	5.12	8.06	8.44
Shaanxi	7.54	8.23	8.00	6.60	7.19	7.56
Gansu	7.01	7.73	6.88	5.55	6.83	7.52
Qinghai	7.12	8.02	7.05	5.37	6.70	6.88
Ningxia	7.05	7.73	7.27	5.58	6.53	6.46
Xinjiang	7.37	8.10	7.79	6.31	7.25	7.45
Chongqing	6.56	7.29	6.86	5.06	6.50	6.53

In this formula, $\overset{\Lambda}{\varphi}$ is a key variable, and $\overset{\Lambda}{\varphi} = \varphi + 1$. Only when the estimated value of $\overset{\Lambda}{\varphi}$ is significantly less than one, does conditional convergence exist in the process of economic growth. χ and $\overset{\Lambda}{\rho}$ are the same as the counterpart coefficients of equation (3). As it is mentioned in part 2, if $\overset{\Lambda}{\rho}$ is significantly positive, then the banking system's effect of credit allocation on economic growth will occur. ε_{it} is residual term. y_{it} is the logarithm of GDP per capita of i th region in the t th year. k_{it} is the logarithm of ratio between total loans received by i th region and GDP of that region in t th year. $\overset{\Lambda}{\mu}_{it}$ is the value of inefficiency of the banking system for the i th region and t th year. Table 4 lists the value of banking system's inefficiency for all the regions in China from 1998 to 2003. S_n is a vector containing various other variables, which have impacts on the steady state growth rate of a region. In this paper, $PRIV$, $CENT$, HUM, $TRADE$, and LAW are chosen as the components of vector S_n. $PRIV$ is used to denote the ratio of credit granted to the private sector in a region as a proportion of total loans

issued by that region, in an attempt to understand the influence of private sector's development on regional growth rate. $CENT$ is the proportion of non-state-owned commercial banks' issued loans in the total loans granted by the whole banking system in a specific region, which to some extent reflects the ownership structure of regional banking system. As a proxy for human capital, HUM is defined as the proportion of the population aged from 15 to 64 enrolled in middle schools and in higher education. $TRADE$ is the proportion of total value of imports and exports in regional GDP, depicting the economic openness of that region. Finally yet importantly, LAW is the ratio of closed cases against total cases received by the regional courts to indicate the efficiency of the regional judicial system.

The data for the above-mentioned variables are all extracted from selective issues of "Chinese Year Book", "Year Book of Chinese Finance" and various regional statistic yearbooks. The data about judicial cases are obtained from regional court yearbooks. The time span of the sample ranges from 1998 to 2003. All the variables in the regression equation are logarithmic.

Due to the limitation of the small-sized sample, GMM method is used to estimate equation (10) (Gaselli et al, 1996), which is less demanding regarding sample size than the alternatives. All the computations reported in the following were carried out by using Easyreg International 2.0 package developed by State University of Pennsylvania.

Unit Root Test of Variables

For time-series empirical analysis, it is required that the series are stationary, otherwise, a co-integration test needs to be conducted. The sample in this paper is a sort of time series. Because the GMM method is applied and because the very nature of GMM is to conduct regression using the series in first differences, what we need in this paper is to ensure that the relevant series in first differences are stationary. The sample used here is panel data, so we employ LLC method developed by Levin and Lin (1993) to conduct unit root test. Table 5 gives the test results.

Table 5: Unit Root Test of Variables

variables	y	k	Ln(1- $\hat{\mu}$)	Ln(PRIV)	Ln(CENT)	Ln(HUM)	Ln(TRADE)	Ln(LAW)
Level value	9.13	-30.66***	2.61	6.52	5.85	10.56	3.14	-10.23***
Value in first differences	-32.65***	-42.53***	-40.65***	-10.28***	-8.92***	-20.35***	-15.52***	-35.73***

*Note: ***(**、 *) indicates that the results are significant at 1%、(5%、10%) level of confidence.*

Table 5 shows that the level value of all variables except k and $Ln(LAW)$ have a unit root; but only at the 1% level of confidence, the value in first differences of all variables does not have unit root, so it is not necessary to conduct co-integration test for all of these variables.

ESTIMATION RESULTS

Table 6 gives the results of estimation. In regression one, the coefficient of $y(-1)$ -the value of $\hat{\varphi}$- is significantly larger than one. This outcome indicates that, if only two variables, k and the inefficiency term of banking system, are included into equation (10), the variation of growth rate for all the regions will tend to increase and the phenomenon of so-called "absolute divergence" will occur. Besides, a significantly negative coefficient of k is achieved, which is inconsistent with theoretical supposition. However, the positive coefficient of $Ln(1-\hat{u})$ coincides with our prediction despite of the fact that it is

not significant.

From regression two to eight, in most cases, the value of $\hat{\varphi}$ is significantly less than one. Therefore, when the relevant variables, which affect the steady state growth rate, are added into the growth equation, such as human capital, the economic growth of all the regions in China will show the salient feature of "conditional convergence". Besides, the coefficient of k is positive in all regressions except for regression four, indicating that for a specific region, keeping other variables constant, the larger the ratio of loans for that region and its GDP, the higher its growth rate is. In the central and western regions of China, whose growth rate is relatively lower, the economic growth is mainly impelled by investment. Consequently, compared with other regions, relatively larger ratio of banks' loans and regional GDP can be found. While in the fast growing eastern coastal areas, private business, joint ventures and foreign-funded companies are the main contributors to economic growth. In that case, the ratio of loans as a proportion of regional GDP is relatively low. Therefore, it seems that the ratio between the credit size and GDP is negatively correlated with growth rate. However, when controlling the effects of some variables, for instance, economic openness, human capital, etc, the real impact of the banking system's credit on economic growth is indeed positive. This may help explain the huge discrepancy between the estimated coefficient on k in regression one and coefficients of k in most other regressions. It is noteworthy that nearly all regressions achieve a statistically significant and positive coefficient of $Ln(1-\hat{u})$. It keeps in line with theoretical prediction in this paper: the efficiency of credit allocation of the banking system has positive impacts on regional economic growth. Therefore, our empirical evidence here demonstrates that, at least in China, not only does the widely recognized effect of capital accumulation of banking system exists, but the effect of credit allocation also exists.

Table 6: Main Results of Empirical Analysis

	One	Two	Three	Four	Five	Six	Seven	Eight
Constant	0.0612 (4.42)	0.0531 (3.93)	0.0814 (8.45)	0.0351 (3.75)	0.0695 (5.87)	0.0487 (4.29)	0.00981 (1.87)	0.0311 (2.64)
Y(-1)	1.105 (2.47)	0.941 (2.05)	0.968 (2.21)	0.934 (3.48)	0.897 (2.21)	0.355 (0.46)	0.937 (1.92)	0.940 (3.93)
K	-0.0311 (2.14)	0.0225 (2.68)	0.0317 (2.54)	-0.0154 (-0.312)	0.0519 (1.98)	0.0365 (3.75)	0.0213 (1.71)	0.0383 (4.18)
Ln(1-$\hat{\mu}$)	0.0109 (-0.54)	0.0651 (-4.67)		0.0515 (2.77)	0.0396 (5.65)	0.0387 (-1.51)	0.0525 (5.02)	0.0412 (-3.01)
Ln(PRIV)		0.0821 (7.77)	0.0781 (10.28)		0.117 (-4.45)	0.0891 (4.66)	0.0855 (7.02)	0.0799 (3.99)
Ln(CENT)		0.110 (3.06)	0.0796 (2.13)	0.109 (1.99)		0.0811 (2.41)	0.0981 (1.55)	0.0759 (2.95)
Ln(HUM)		0.0121 (6.20)	0.0237 (5.42)	0.0147 (6.18)	0.0176 (6.57)		0.0215 (5.97)	0.023 (6.53)
Ln(TRADE)		-0.0154 (1.98)	-0.0315 (2.17)	-0.0215 (2.88)	-0.0189 (2.07)	-0.0511 (3.19)		-0.0377 (3.09)
Ln(LAW)		0.00714 (1.25)	0.00915 (0.89)	0.00021 (0.173)	0.00355 (1.14)	0.0093 (1.08)	0.0102 (0.089)	
Adjusted R^2	0.237	0.551	0.364	0.417	0.501	0.492	0.355	0.587

Note：T-statistics in parenthesis

Comparing the results of regression two and three, we find that fitness of the regression is greatly improved, when the inefficiency term included into the growth equation. We conclude that the impact of banking system efficiency on regional economic growth cannot afford be neglected in this respect.

Finally, we look into the impact of other financial, control variables on economic growth. In light of Table 6, we find that, in China, human capital and private economy all exert strong, positive influence on regional growth, i.e. the bigger the stock of human capital in a region and the proportion of the loans granted to the private economy, the higher is the regional economic growth rate. Moreover, the coefficient of $Ln(CENT)$ is positive, showing that the structure of the banking system can also affect regional economic growth. More exactly, the bigger the proportion of loans issued by middle-sized non-state-owned banks to total loans for a region, the faster that region's economy grows. Recent research by Chi Guotai, Sun Xiufeng and Lu Dan (2005) shows that, in China, the average efficiency of non-state-owned banks outweighs that of four big state-owned banks. Therefore, the conclusions indirectly demonstrate that the higher efficiency of a banking system indeed facilitate economic growth. It is noteworthy that the efficiency of the judicial system barely affects regional growth, and the estimated coefficient of $Ln(LAW)$ is not significant in all the regressions. Indeed, the fitness or regression eight improves greatly after excluding this variable. This could mainly be expounded by the fact that, in China, the efficiency of the judicial system and its relevant arrangement are almost the same across regions. In addition, the estimated coefficient of $Ln(TRADE)$ is negative, in contrary to extant theories' prediction, and further explanations are needed, which are not included in this paper.

CONCLUSIONS

This paper constructs an index for the banking system's efficiency based on the micro-efficiency of individual banks, and analyzes panel data from 27 provinces and 4 cities directly under the jurisdiction of the Chinese central government. After that, we put this index into a growth equation and analyze the relationship between the banking system's efficiency and regional economic growth. The supposition in this paper is that there is some correspondence between the banking system's efficiency and its ability in screening quality borrowers and optimizing credit allocation for a region. Therefore, the research in this paper empirically investigates the impact of banks' ability in optimizing credit allocation on China's regional growth rate. The conclusion is that, in respect to the role of facilitating the economic growth, the banking system of China not only has the capital accumulation effect, but also demonstrates the credit allocation effect.

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BIVARIATE CAUSALITY BETWEEN EXCHANGE RATES AND STOCK PRICES IN MALAYSIA

Mohd Fahmi Ghazali, Universiti Malaysia Sabah-Labuan International Campus
Wahi Ismail, Universiti Teknologi MARA
Mohd Rushdan Yasoa, Universiti Malaysia Sabah-Labuan International Campus
Nelson Lajuni, Universiti Malaysia Sabah-Labuan International Campus

ABSTRACT

The main purpose of this paper is to examine the relationship between stock prices and exchange rates in Malaysia. This research considers high-frequency data of USD-MYR exchange rates and Kuala Lumpur Composite Index (KLSE) from July 22, 2005 to March 23, 2007, which is the period when the MYR was unpegged. The Johansen cointegration method suggests that there is no long-run equilibrium relationship between these two financial variables. Both Engle Granger and Toda-Yamamoto causality tests find that there is uni-directional causality running from stock prices to exchange rates.

JEL: D4, D46 G14, G15

INTRODUCTION

The interaction between exchange rates and stock prices has several important implications. First, the relationship between exchange rates and stock prices has a crucial role in the capital market development of emerging markets, particularly in those countries which have expanding corporate sectors with listed firms and growing tradable sectors that are sensitive to exchange rate policies (Abdalla and Murinde, 1997). Second, the interaction between exchange rates and stock prices is often used to predict future trends by fundamental investors (Nieh and Lee, 2001). Third, economic and financial policymakers and regulators need to know the relationship between asset prices, such as those between exchange rates and stock markets, if they are to formulate the appropriate policies (Hatemi-J and Roca, 2005).

The direction of causality between exchange rates and stock prices has been highly debated. There are two competing perspectives on whether exchange rates Granger cause stock prices or vice versa. The first is the traditional approach, which concludes that exchange rates cause stock prices. The transmission channel would be exchange rate fluctuations which affect firm's values through changes in competitiveness and changes in the value of firm's assets and liabilities, denominated in foreign currency, ultimately affecting firms' profits and therefore the value of equity. On the other hand, changes in stock prices may influence movements in exchange rates via portfolio adjustments (inflows/outflows of foreign capital). If there is a persistent upward trend in stock prices, inflows of foreign capital would rise. However, a decrease in stock prices would induce a reduction in domestic investor's wealth, leading to a fall in the demand for money and lower interest rates, causing capital outflows that would result in currency depreciation. Therefore, under the portfolio approach, stock prices would affects exchange rates with a negative correlation (Tabak, 2006).

The Malaysian economy witnessed a major financial crisis in 1997. The crisis was first felt in the foreign exchange and stock markets. Between June 1997 and December 1998, the ringgit depreciated by 33 percent against the US dollar. The immediate impact of the ringgit depreciation was on the stock market, with the Kuala Lumpur Composite Index (KLSE), the market's main indicator, declining by about 44.8 percent in the second half of 1997. As part of the policy redressal, the ringgit was fixed at RM3.80 to the US dollar in September 1998 to bring speculative currency flows against the ringgit under control. On

July 22, 2005, Malaysia abandoned the fixed exchange rate regime introduced during the Asian financial crisis and adopted a managed float exchange rate. Malaysia abandoned the ringgit peg just hours after China dropped its fixed exchange rate for the yuan. From July 22, 2005 to March 23, 2007, ringgit appreciated smoothly, from 3.7799 to 3.4565 against the US dollar, an appreciation of 8.56 percent. The KLSE, on the other hand, increased drastically from 939.69, rose two percent or 17.75 points, its highest close since May 2000 to 1235.65 on March 23, 2007. The effect on the domestic stock index is very different with exchange rates. Therefore, the Malaysian case provides an interesting arena to study the relationships between stock prices and exchange rates.

Furthermore, the KLSE is one of the fastest growing emerging stock markets. Market capitalisation and number of listed companies have increased in recent years. At the end of 1997, the market capitalisation was RM376.16 billion and the number of listed companies was 708. At the end of 2006, on the other hand, the market capitalisation had increased to RM848.7 billion and the number of companies had increased to 1027.

The rest of the paper is organized as follows. In the next section, we review some empirical studies and the main findings in emerging countries. Section three presents the data, methodology employed and the empirical results, while section four we provide concluding remarks.

LITERATURE REVIEW

A number of empirical studies have been conducted in emerging market economies. Results of these studies have been mixed. For example, Abdalla and Murinde (1997) examined the relationship between exchange rates and stock prices in Korea, Philippines, India and Pakistan over the period January 1985 to July 1994. They found that there was a long-run equilibrium relationship between exchange rates and stock prices in India and the Philippines only and that exchange rates Granger cause stock prices in Korea, India and Pakistan while stock prices Granger cause exchange rates in the Philippines.

Granger *et al*. (2000) examined the causality issue using Granger causality tests for the emerging markets for the period January 3, 1986 to June 16, 1998. He found that exchange rates lead stock prices in South Korea which are in agreement with the traditional approach. On the other hand, data of the Philippines and Hong Kong suggest the result expected under the portfolio approach, which is stock prices lead exchange rates. Data from Malaysia, Singapore, Thailand and Taiwan indicate strong feedback relations, whereas that of Indonesia and Japan fail ro reveal any recognizable pattern.

Hatemi-J and Roca (2005) used bootstrap causality tests with leveraged adjustments to examine the links between exchange rates and stock prices in Malaysia, Indonesia, Philippines and the Thailand in the periods immediately before and during the Asian Financial crisis. They found that prior to the crisis, exchange rates Granger cause stock prices in Indonesia and Thailand, while the reverse was true in Malaysia, however during the crisis there was no significant link between the variables.

Azman-Saini *et al.* (2003) found that there is a feedback interaction in Thailand for the pre-crisis period. However, the exchange rates lead stock prices during the crisis period. Recent study by Azman-Saini *et al.* (2006) in Malaysia found that there is a bi-directional causality for the pre-crisis period (January 1993 to December 1996). The results for the crisis period (January 1997 to August 1998) suggest that there is uni-directional causality running from exchange rates to stock prices. During the crisis, stock market decline was led by the ringgit depreciation.

Overall there is no consensus on the relationship between exchange rates and stock prices in emerging countries, suggesting further studies are needed to shed light on the issue. Furthermore, It would be

important and interesting to consider situations where asset market such as the foreign exchange in the period immediately during the currency unpegged.

DATA, METHODOLOGY AND RESULTS

Data

In order to perform the causality analysis, we use daily closing prices in Kuala Lumpur Composite Index (KLSE) and nominal exchange rates in terms of Malaysia ringgit relative to US dollar. The financial data set was drawn for the period from July 22, 2005 to March 23, 2007, which comprises 430 observations in total. The variables are obtained from *DataStream* and transformed into natural logarithm scale prior to analysis. Log transformation can reduce the problem of heteroskedasticity because it compresses the scale in which the variables are measured, thereby reducing a tenfold difference between two values to a twofold difference (Gujarati, 1995).

There is a problem that arises in examining integration of stock prices and exchange rates. The problem lies in the missing observations due to different stock markets and exchange rates holidays. Since the study extensively incorporates lags in the regressions, missing data is particularly troublesome. Thus, it is desirable to fill in estimate-based information from an adjacent day. This study follows the studies of Jeon and Von Furstenberg (1990) and Hirayama and Tsutsui (1998) by adopting the method of Occam's razor (just by filling in the previous day's price).

Unit Root and Cointegration Tests

The first stage involves establishing the order of integration using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP), with and without a deterministic trend. Table 1 presents the results of the unit root tests for the two variables exchange rate (*exr*) and stock price (*sp*). The results indicate that exchange rates and stock prices are not stationary in their levels. On the other hand, all data are stationary at first difference and therefore indicating that all variables are I(1).

Table 1: Results of the Unit Root Tests

Panel A: ADF and PP Unit Root Tests at Level				
	ADF		**PP**	
Variables	τ_μ	τ_τ	τ_μ	τ_τ
exr	0.5178(0)	-1.3623(0)	0.5028(2)	-1.3839(3)
sp	0.8921(1)	-1.2236(1)	1.1104(2)	-1.1537(3)
Panel B : ADF and PP Unit Root Tests at First Difference				
	ADF		**PP**	
Variables	τ_μ	τ_τ	τ_μ	τ_τ
exr	-20.2263(0)***	-20.3221(0)***	-20.2257(2)***	-20.3221(0)***
sp	-16.0808(0)***	-16.2850(0)***	-16.1563(5)***	-16.1640(7)***

Notes: The null hypothesis is that the series is non-stationary, or contains a unit root. The rejection of the null hypothesis for both ADF and PP tests is based on the MacKinnon critical values. Values in parentheses are optimal lag lengths according to the Schwarz Information Criteria and Newey-West Bandwidth. τ_μ and τ_τ are constant and trend and constant, respectively. Asterisk (***) denotes that a test statistic is significant at the 1% significance level.

Given the variables are I(1), the cointegration hypothesis between the variables is examined using the methodology developed in Johansen (1991) and Johansen (1995) in order to specify the long run relationship between the variables. According to Johansen (1988), a *p*-dimensional vector autoregression (VAR) of order *k*[VAR(*k*)] can be specified as follows:

$$Z_t = d + \prod_1 Z_{t-1} + \ldots + \prod_k Z_{t-k} + \omega_t (t = 1 \ldots T) \quad (1)$$

We can rewrite this expression as,

$$\Delta Z_t = d + \prod\nolimits_k Z_{t-k} + \sum_{i-1}^{k-1} \theta_i \Delta Z_{t-i} + \omega_t \quad (2)$$

Here Δ is the first difference operator, $\prod$ and θ are *p*-by-p matrices of unknown parameters and ω_t is a Gaussian error term. Long-run information about the relationship between exchange rates and stock prices in Malaysia is contained in the impact matrix $\prod$. When the matrix $\prod$ has full column rank, it implies that all variables in Z_t are stationary. When the matrix $\prod$ has zero column rank, the expression is a first differenced VAR involving no long-run elements. If, however, the rank of $\prod$ is intermediate meaning that $0 < rank\ (\prod) = r < p$, there will be *r* cointegrating vectors that make the linear combinations of Z_t become stationary or integrated.

There are two Johansen cointegration tests. First, the maximum likelihood estimation procedure provides a likelihood ratio test, called a trace test, which evaluates the null hypothesis of, at most, r cointegrating vectors versus the general null of *p* cointegrating vectors. A second, likelihood ratio test is the maximum eigenvalue test, which evaluates the null hypothesis of r cointegrating vectors against the alternative of $(r + 1)$ cointegrating vectors. The results of the cointegration tests are reported in Table 2. The null hypothesis of no cointegrating vector ($r = 0$) cannot be rejected. Thus, although the variables were found to be I(1), they are not cointegrated.

Table 2 : Johansen's Cointegration Tests Between Exchange Rates and Stock Prices

H_0	H_1	Eigenvalue	Trace Statistics	5% Critical Value	Max-Eigen Statistics	5% Critical Value	VAR
r = 0	*r = 1*	0.0162	10.9547	19.96	6.9926	15.67	2
r ≤ 2	*r = 2*	0.0092	3.9621	9.24	3.9621	9.24	

Notes: VAR is order of the variane. H_0 and H_1 denotes the null and alternative hypothesis respectively and r denotes the number of cointegrating vectors.

Testing for Causality

To examine the issue of causations, we employ Granger causality tests. Because all the variables were I(1) but not cointegrated, we transform the variables by taking their difference to induce stationary and test for standard Granger causality without adding an error correction term as follows:

$$\Delta exr_t = \alpha + \sum_{i=1}^{k} \zeta_i \Delta exr_{t-i} + \sum_{j=1}^{l} \varphi_j \Delta sp_{t-j} + \varepsilon_t \quad (3)$$

$$\Delta sp_t = \psi + \sum_{i=1}^{r} \chi_i \Delta sp_{t-i} + \sum_{j=1}^{s} \gamma_j \Delta exr_{t-j} + \eta_t \quad (4)$$

The lag lengths *k*, *l*, *r* and *s* are chosen using the Schwarz Information Criteria. Table 3 shows that there is statistical uni-directional Granger causality runs from stock prices to exchange rates but there is no feedback causality from exchange rates to stock prices.

Table 3: Causality Tests Between Exchange Rate and Stock Prices: Engle Granger Approach

Dependent Variables	Independent Variables	Order of Lag	Joint Test of Zero Restrictions of Variables Added in Column 2	
			***F*-Statistics**	***p*-values**
Δexr	*Δsp*	2	2.5219*	0.0815
Δsp	*Δexr*	2	0.0863	0.9174

*Notes: Δ denotes a first difference. * denotes statistically significant at the 10% level.*

In addition to the Engle-Granger approach (1987), we also used the Toda-Yamamoto (1995) method to consider the robustness of the results based upon knowledge of the order of integration. The Toda-Yamamoto approach involves using the levels of the variables as in Equations (5) and (6) even if the variables may be individually non-stationary:

$$exr_t = \alpha + \sum_{i=1}^{m} \beta_i exr_{t-i} + \sum_{j=1}^{n} \gamma_j sp_{t-j} + u_t \tag{5}$$

$$sp_t = a + \sum_{i=1}^{q} b_i sp_{t-i} + \sum_{j=1}^{r} c_j exr_{t-j} + \upsilon_t \tag{6}$$

The initial lag lengths m, n, q and r are chosen using the Schwarz Information Criteria. However, for Toda-Yamamoto the initial lag lengths are augmented with extra lag. Because exr_t and sp_t are I(1), then one extra lag is added to each variable. Wald tests are then used to test the direction of causality. For example, in Equation (5), the lags of sp_t, excluding the extra lag added to capture maximum order of integration, are tested for their significance. If the null hypothesis that the lags are jointly equal to zero is accepted, then sp_t does not cause exr_t. Testing for the joint significance of exr_t, excluding the extra lag added, in Equation (6) allows tests for uni-directional or bi-directional causality.

The results using this approach are presented in Table 4. The causality results are qualitatively the same as the results presented in Table 3. The null hypothesis that stock prices do not Granger cause exchange rate can be rejected at the 10 percent significance level. On the other hand, the hypothesis that exchange rate do not Granger causes stock prices cannot be rejected. Therefore, we find evidence that there is uni-directional causality from stock prices to exchange rates in the case of the Malaysia. This could mean that the transmission of information between foreign exchange and stock was inefficient.

Table 4: Causality Tests between Exchange Rate and Stock Prices: Toda-Yamamoto Approach

Dependent Variables	Independent Variables	Lag Structure	VAR Order	Joint Test of Zero Restrictions of Variables Added in Column 2	
				***MWALD* statistics**	***p*-values**
Δlexr	*Δlsp*	2	(3)	2.6526*	0.0716
Δlsp	*Δlexr*	2	(3)	0.1326	0.8759

*Notes: The [k+d(max)]th order level VAR was estimated with d(max)=1 since the order of integration is 1. Reported estimates are asymptotic Wald statistics. * denotes statistically significant at the 10% level.*

CONCLUSIONS

This paper examined the interaction between stock prices and exchange rates focusing on the period when Malaysia dropped its currency peg against the US dollar. We employed daily data and applied cointegration using the Johansen approach, application of standard Granger causality tests and the Toda-Yamamoto approach to study the exchange rates and stock prices interaction. Using Johansen cointegration approach, our results show no long-run association between stock prices and exchange

rates, in line with previous research in other countries (see for example Granger *et al.* (2000)). This mean that stock prices and exchange rates do not move together in the long run. However, using standard Granger causality test and Toda-Yamamoto approach, we found evidence of a uni-directional link from stock prices to exchange rates. Therefore, investors can use information obtained from stock market to predict the behaviour of currency market. Moreover, authorities in Malaysia can use the stock prices as a policy tool to attract the foreign portfolio investment by taking stabilizing measures for stock market.

The above results provide evidence support the portfolio balance models of exchange rate determination that postulate a uni-directional causation that runs from stock prices to exchange rates, but these results oppose the traditional models that hypothesized causation from exchange rates to stock prices. We, however, suggest that the significant of our results could possibly be improved upon by applying more observations. The use of more observations may better capture the dynamics of stock and currency market interrelationships.

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INVESTMENT UNCERTAINTY AND STOCK RETURNS

Chyi-Lun Chiou, National Taiwan University

ABSTRACT

This paper theoretically investigates the effect of uncertainty about future investment on expected stock returns. Based on a real options framework, we incorporate the learning-by-doing effect to analyze the irreversible investment problem. In our investment decision framework, the timing of expansion is endogenous and results from a value-maximizing decision. In addition, there are two important implications of our framework. First, we show that an increase in the relative valuation ratio, as measured by the book-to-market ratio, raises average stock returns. This positive relationship helps to explain the value premium. Second, we investigate how uncertainty about investment affects expected stock returns. Based on the closed-form solution in our framework, we suggest that less uncertainty about investment induces lower expected stock returns.

JEL: D81; G31

INTRODUCTION

Recently, a number of theorists have noted that corporate investment is critical in examining the valuation of a firm and the cross-section stock returns (Berk, Green, and Naik, 1999, Zhang, 2005, and Cooper, 2006). Meanwhile, some research finds that expansion activity and the uncertainty about investment are related (McDonald and Siegel, 1986). How the uncertainty about investment affects the dynamics of stock returns, however, remains a controversial issue. Because of irreversibility, investment decision and the value of growth options vary with the uncertainty about investment (McDonald and Siegel, 1986). According to Berk, Green, and Naik (1999), a firm has two kinds of assets: assets in place that generate cash flows now and growth options that makes positive net present value investment in the future. Thus, the average systematic risks of a firm are conditional on cash flows from existing or new projects in the subsequence periods. We suggest that if making profitable investments change a firm's systematic risks and expected returns, varying investment uncertainty should alter the value of the firm and its return dynamics.

The goal of this paper is to relate the uncertainty about future investment to average stock returns. First, by introducing a learning-by-doing effect, we identify that investment is triggered by the relative valuation ratio, which is defined as the ratio of value of existing assets to value of the new project. Moreover, we demonstrate that the level of relative valuation ratio contains crucial information about the value of growth options and the dynamics of stock returns. We prove that investment is triggered only when the profitability of existing assets reaches an upper threshold as suggested by Cooper (2006). This implies that if a firm has idle capacity, new investment is triggered easily. Consistent with Berk, Green, and Naik (1999), our model shows that the decision to invest can change a firm's systematic risks if investment is irreversible. We derive that if a firm's systematic risks are conditional on assets that it has hold, the expected stock returns are higher when the firm has higher relative valuation ratios. More specifically, undertaking profitable investment helps reduce average systematic risks of the firm's future cash flows, as suggested by Berk, Green, and Naik (1999). To finance new investment, however, we need a higher relative valuation ratio to make existing assets as profitable as new projects. Hence, when the relative valuation ratio increases, new investment becomes less profitable and thus firms face higher systematic risks as well as higher returns. In brief, our framework proposes that average stock returns increase with relative valuation ratios, as measured by the book-to-market ratio, as does the so-called value premium by means of future expansion options and the learning-by-doing effect.

Second, we examine how the uncertainty about investment affects expected stock returns in an options framework. We find that greater uncertainty about investment induces higher average stock returns. In the classical literature of investment under uncertainty (McDonald and Siegel, 1986), greater uncertainty about investment postpones the timing of expansion and increases the value of growth options. However, some research argues that when firms face financing constraint on future investment, greater volatility in cash flows reduces the value of investment options (Boyle and Guthrie, 2003). In our framework, although investment irreversibility forces firms to delay profitable investment when uncertainty is high, uncertainty about investment also destroys the value of growth options by the learning-by-doing effect. When a firm's systematic risks are conditional on assets that it holds, greater uncertainty about investment from existing and/or new assets reduce the value of growth options and increase the corresponding average stock returns. In short, we find a positive relationship between the uncertainty about investment and the expected stock returns.

In sum, our framework is close to Cooper (2006) in that the firm's investment decision does rely on the profitability of its assets in place and is thus path dependent. That is, the value of existing assets can affect investment decisions and the value of growth options. Moreover, when the firm's assets in place become more profitable, the value of growth options increase and the probability that the firm undertakes investment also increases. Most importantly, average stock returns increase with the relative valuation ratio and the uncertainty about investment.

LITERATURE REVIEW

Our study relates to two areas of research on financial economics. One relates to the issue about investment under uncertainty, and the other discusses the dynamics of stock returns by means of optimal corporate investment. More specifically, our research examines the association between uncertainty about investment and stock returns. In this section, we discuss previous literature and its implications for our investigation.

To analyze the relationship between investment and uncertainty, McDonald and Siegel (1986) apply the real options model to discuss the optimal timing of investment. In that model, the firm has perpetual rights to a new project and seeks to choose the optimal investment timing that maximizes the expected payoff. They assume both the benefits from the project and investment costs follow continuous-time stochastic process, and the investment decision is independent to the financing decision. Because the expected payoff from the new project is uncertain and the investment is irreversible, the optimal corporate policy is to invest only when the project's NPV exceeds a positive threshold. Based on their real options framework, both the value of the growth options and the investment threshold are increasing functions of the uncertainty about investment. Consistent with the McDonald and Siegel (1986) model that benefits and costs of new investment are path dependent, Hackbarth and Morellec (2006) extend this setup to allow for a linear connection between gains and costs of new expansion. They assume that after expansion the value of the firm increases by a constant fraction at a cost proportional to the valuation of new investment. According to Hackbarth and Morellec (2006), because control transactions (takeover, expansion, and disinvestment) generally create value for the firm, they can affect firm-level betas as well as stock returns.

Shleifer and Vishny (2003) and Morellec and Zhdanov (2005) apply similar linear approach to investigate the synergy from takeovers, another kind of investment. Shleifer and Vishny (2003) suggest that if two firms merge, the market value of new equity is the sum of capital stocks from target and acquiring firms. Morellec and Zhdanov (2005) extend their linear setting to allow for asymmetric information between outside investors and inside managers. They assume a part of the synergy from takeover is not observable to outside shareholders. However, investors can update their information according to the behavior of participating firms.

Recent theoretical literature have stressed the association between firm-level investment, valuation, and expected stock returns. An innovative work of Berk, Green, and Naik (1999) relates average stock returns, systematic risks, and firm properties such as firm size and book-to-market ratio. In this model, the value of the firm is composed of the value of assets in place and growth options. They suggest that making a profitable investment will reduce the average systematic risk of the firm's cash flows in subsequence periods, which in turn leads to lower stock returns. Based on Berk, Green, and Naik (1999), further studies incorporate the costly reversibility problem into investment decisions to examine the linkage between firm-level investment and stock returns. Zhang (2005) develops a neoclassical industry equilibrium framework with aggregate uncertainty about profitability and shows that firms' optimal investment can generate the observed value premium, if investment is costly reversible and the price of risk is countercyclical. More specifically, he demonstrates that the asymmetric convex adjustment costs of investment gives rise to cyclical behavior of value and growth betas. In an economic downturn, capital invested is riskier than growth options because it is difficult to disinvest, while growth options are as risky as assets in place in economic booms because growth firms invest more in this situation. Hence, assets in place are riskier than growth options especially in bad times.

Cooper (2006) develops a dynamic real options model to examine the relationship between the book-to-market ratio and investment that accounts for the value premium. If capital investment is largely irreversible, the book value of assets of a distressed firm remains constant but its market value falls when facing adverse profitability shocks. That is if a firm has idle physical capacity, it is very sensitive to the aggregate productivity shock resulting in higher book-to-market ratios. Its excess installed capital capacity allows it to gain from positive aggregate shocks without undertaking new costly investment, thus providing a high return to stockholders. In contrast, a low book-to-market firm would have to undertake investment to gain from positive shocks. Hence, it is less sensitive to economics shocks and has lower systematic risks. He suggests that a firm undertakes new investment only when profitability is sufficiently high. His model also shows that irreversibility of investment, not costly reversibility, is the driving force behind the value premium. In sum, our contribution is that we help fill the gap between expected stock returns and uncertainty about investment. Our framework shows that uncertainty about investment not only governs the optimal timing of expansion but also affects expected stock returns.

THE MODELS

In this paper, we apply the rational real-option approach to analyzing investment decisions under uncertainty for all-equity firms. In this static framework, uncertainty of the economy is from a complete probability space (Ω, F, P). Using a linear setting as our valuation benchmark (Berk, Green, and Naik, 1999, and Shleifer and Vishny, 2003), we develop a two assets model to investigate investment decision problems. In contrast to previous literature that is limited to only the value of new capital stocks, we argue that both the value of new capital and the value of existing capital have apparent effects on the expansion decision. In this section, we build our basic two assets model and briefly introduce the interaction between existing assets and investment.

According to Berk, Green, and Naik (1999), we assume that assets in place and new investment create the value of the firm in this framework. Moreover, investment is irreversible, so that it cannot be used for any other purpose. Managers can postpone the expansion options until new information about the valuation of existing and new capital is revealed. Hence, the investment decision can hinge on the valuation of both assets. We further assume that the all-equity firm only has one investment opportunity, but the optimal investment scale can be distinct among firms. In addition, we assume that the irreversible investment option is infinite-lived.

Moreover, we presume that productivity of existing and new capital stocks are different but can affect each other. This is the so-called learning-by-doing effect. The simplest case of learning-by-doing is when learning occurs as a side effect of the production of new capital. Given G_t and H_t, which represent the present value of future cash flows per unit of existing and new capital, respectively, after investment the valuation per unit of capital can be shown as :

$$\overline{G}_t = G_t + I_t^G(G_t, H_t) \quad and \quad \overline{H}_t = H_t + I_t^G(G_t, H_t) \tag{1}$$

In equation (1), $\overline{G}$ represents the valuation per unit of existing assets, and $\overline{H}$ stands for the valuation per unit of newly investing capital. Suppose that the valuation of each asset has two components. The first factor is the present value of the future cash flows generated by their original operation, G_t and H_t; the second factor is the potential extra benefits created by new investment awaiting implementation. We assert that assets in place benefit from new investment and the synergy from new investment is conditional on the valuation of existing assets. Therefore, the implicit value of each asset is dependent. In brief, if the learning-by-doing effect is under consideration, the valuations of existing and new capital stocks are related and cannot be evaluated separately. If the capital stocks of existing and new assets are K_1 and K, respectively, the value of the firm is given by

$$V(G,H) = (K_1 + K)[(\lambda + \alpha)G + (1 - \lambda - \alpha + \alpha\beta)H] \tag{2}$$

where $\lambda = K_1/(K_1 + K)$ referring to the book ratio and can be applied to capture the relative importance of existing and new capital stocks. We further assume the learning-by-doing effect is distinct among new and existing capital stock. In such a setting, it is easy to identify what kind of driving force, improvement on productivity of existing capital stocks or improvement on productivity of new capital stocks, is behind the investment decision. In our model, α and β are parameters describing the improvement on productivity from expansion for existing and new capital stocks, in which α is shared by both assets but β is only beneficial to new capital stocks. In addition, α is observable to all outside investors but β is only observable to inside managers. From equation (2), we assert that given an investment option the productivity of these two capital stocks will change in a predictable way if both α and β are observable. For simplicity, we do not discuss the heterogeneous investor problem in this model and assume that all investors have the same opinion about these changes. Thus the information parameters, α and β, are constant for all investors but can vary among firms to investigate heterogeneous productivity.

The source of investment uncertainty in our framework is the future cash flows generated by these two assets. Prior to investment, we assume the present value of these cash flows evolve as follows:

$$dG/G = \mu_G dt + \sigma_G dW_G \tag{3}$$

$$dH/H = \mu_H dt + \sigma_H dW_H \tag{4}$$

μ and σ are, respectively, the drift and volatility of the growth rate of cash flows. W_i is the standard Brownian motion on (Ω, F, P). Besides, W_G and W_H are two dependent standard Brownian motions with constant correlation ρ. Furthermore, by setting $\rho < 1$, our model captures the feature that changes in the value of existing asset can be the result of economic shocks other than those driving new investment.

When growth options are under consideration, the synergy created by the new project can be expressed as:

$$I(G,H) = V(G,H) - GK_1 - HK = \alpha(K_1 + K)[G + (\beta - 1)H] \tag{5}$$

HK is the cost of investment and it is time-varying to verify the importance of timing to investment. Once the firm undertakes new investment, it is irreversible in that the project cannot be abandoned. However, we need two additional assumptions, $\alpha > 0$ and $\beta > 1$, to make sure $I_G = \partial I/\partial G > 0$ and $I_H = \partial I/\partial H > 0$. In other words, we need the value of the firm and the value of growth options to increase with the valuation of existing and new capital stocks. Equation (5) shows that the more improvement in productivity the larger synergy that a new project can create for the company. If the synergy created by new investment is less than zero, the firm will not undertake any investment as it needs internal funds to finance new projects. This criterion is not valid, however, especially when investment is irreversible and faces uncertainty. The following proposition shows the optimal timing of investment and the corresponding value of this growth option when investment is irreversible.

Proposition 1: Suppose that the true value of the synergy parameter is $\beta = \beta^*$. The optimal investment strategy of a firm is to expand when the relative valuation ratio, $R = G/H$, is at or above this level

$$R^* = (\beta^* - 1)\eta/(1 - \eta) \quad . \tag{6}$$

Moreover, the corresponding value of this growth options is

$$O(G,H) = HAR^{\eta} = H\frac{1}{\eta}(R^*)^{-\eta}\alpha(K_1 + K)[R + (\beta^* - 1)]R^{\eta} \tag{7}$$

where η denotes the positive root of the following familiar quadratic equation

$$\frac{1}{2}(\sigma_G^2 - 2\rho\sigma_G\sigma_H + \sigma_H^2)\eta(\eta - 1) + (\mu_G - \mu_H)\eta + (\mu_H - r) = 0 \tag{8}$$

in which $\eta < 1$.

As shown in Proposition 1, a firm's optimal investment policy is governed by a constant threshold R^*. The value-maximizing expansion policy is to expand when the relative valuation ratio reaches this cutoff level. This implies that new capital is valuable only when the existing capital stocks have higher profitability or there is no idle capacity problem. Our investment decision model differs from the previous studies in which assets in place do not affect the firm's investment decisions, such as Berk, Green, and Naik (1999). However, our work is close to Cooper (2006) that the optimal timing of expansion does depend on the profitability of the firm's existing assets. He suggests that investment is triggered only when productivity is high enough relative to the stocks of existing capital, so that the benefits of adjusting the capital stock cover the costs of doing so. Prior to investment, the value of the growth options will depend on the timing of expansion and contain uncertainty. In the following sections, we will discuss the implications of this optimal investment strategy.

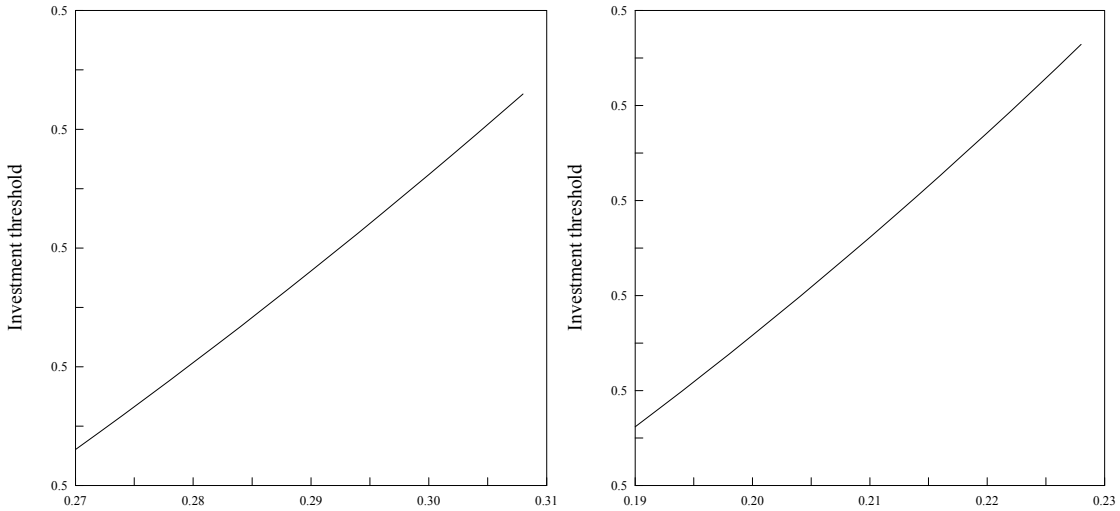
THE OPTIMAL INVESTMENT STRATEGY

This section investigates the optimal investment activity of the firm derived in Proposition 1. From equation (6), we find that the firm's investment decision involves two sources of uncertainty: the information set about improvement in productivity, and the dynamics of future cash flows. In this section, we discuss the impact of these two characteristics on optimal investment.

First, from our closed-form solution in equation (6), we find that only the unknown productivity parameter β is critical to the timing of expansion. Our intuition is that because α is observable and shared by both assets, it cannot reveal any useful information to the dynamics of relative valuation ratio R. Hence, only the unrevealed information has impact on the optimal timing of investment. In addition, because the relative valuation ratio is non-negative, the constant investment threshold should be positive. From equation (6), we can verify that $\partial R^* / \partial \beta > 0$. That is the firm that creates a large learning-by-doing effect through investment is not eager to chase profitable investments by setting a strict threshold. Our explanation is that if the improvement in productivity is large, the firm will hold the growth options to maximize the value of waiting to invest. Because β is not observable to the outside investors, managers will hold the growth options until existing capital has higher valuation. In brief, waiting becomes more valuable to managers because this growth option can make existing assets more valuable.

Next, we discuss how the dynamics of cash flows affect the investment threshold. Figure 1 shows some comparative static to discuss the effects of cash flow dynamics in our framework. First, we present a number of key model parameters used in our analysis. The mean and volatility of cash flows from new projects are 5% and 21%, respectively, from Ang and Liu (2004). The volatility of cash flows from existing capital stock is 29% to match the standard deviation of the annual earnings growth of U.S. corporate earnings in the period 1929 to 2001 as reported by Longstaff and Piazzesi (2004). The drift of existing capital stock is set to 12%. This implies that the average of equity return is 8.5%, consistent with the equity premium data from Campbell, Lo, and MacKinlay (1997). The appropriate discount rate is equal to 8% to keep firms holding the options. The investment ratio $1-\lambda$ is equal to 15% from Abel and Eberly (2001). The correlation between existing and new capital stocks is set to 0.1. The improvement on productivity of new capital stocks β is 1.3, which is consistent with the estimated reported by Hennessy (2004). Finally, because α is irrelevant to the investment threshold, we set it equal to one.

Figure 1: The Effect of Cash Flows' Volatility on the Investment Threshold



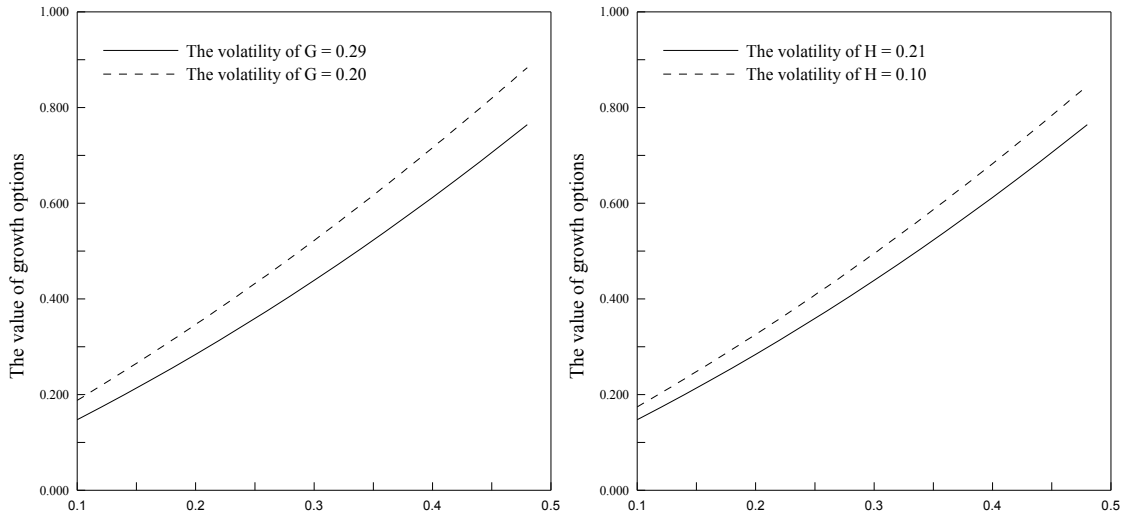
This figure shows the comparative static of investment threshold. Two driving forces are discussed here including the volatility of cash flows from existing assets (Panel A) and the volatility of cash flows from new assets (Panel B). Input parameter values are set from previous research as described in the article.

Figure 1 presents the comparative static of the investment threshold. We demonstrate that cash flow uncertainty would time investment because of irreversibility. When a firm faces a higher uncertainty

about investment, proxy by σ_H , it would prefer to hold this growth option and wait to invest. This finding is consistent with the previous research that a higher level of uncertainty will increase the critical investment trigger level (Sarkar, 2000). Greater uncertainty increases the incentive to keep the growth options in order to obtain more information about future prices and market conditions. Most importantly, we find that uncertainty about profitability from existing assets also times investment. Because of learning-by-doing, the valuation of existing assets also has impact on the synergy of expansion. When the profitability of existing capital stocks contains more uncertainty, managers will set a stricter investment threshold to expand latter.

Next, Figure 2 shows the impact of the cash flows volatility on the value of growth options. We find that the higher uncertainty about profitability from existing or new capital stocks reduces the value of growth options. This finding is opposite to the real options literature that a higher level of uncertainty increases options value (McDonald and Siegel, 1986). However, according to Boyle and Guthrie (2003), if the capital market has frictions such that a firm's investment decision is subject to its internal funds, then greater cash flow volatility reduces the value of the expansion option because the firm has to choose a suboptimal investment timing. Consistent with Boyle and Guthrie (2003), we argue that because of learning-by-doing and the assumption of an all-equity firm, the value of growth options depends on the valuation of existing and new capital stocks. Uncertainty about profitability reduces the value of a firm's investment opportunity and makes its market value go down. Thus, waiting is still optimal when investment is irreversible, but gains from delaying expansion decrease as profitability become more uncertain.

Figure 2: The Effect of Cash Flows' Volatility on the Value of Growth Options



This figure shows the comparative static of the value of growth options. Two driving forces are discussed here including the volatility of cash flows from existing assets (Panel A) and the volatility of cash flows from new assets (Panel B). Input parameter values are set from previous research as described in the article. Total amount of capital stocks, $K_1 + K$ *, is one.*

THE BEHAVIOR OF STOCK RETURNS

In this section, we derive the dynamics of the value of a firm when it has options to expand. Although there are two different sources of uncertainty in our framework, we only discuss the effect of uncertainty about profitability and assume the improvement in profitability is given. First, we derive the expected

stock returns in a closed-form expression. Based on this solution, we then do some comparative static analysis.

Consistent with Berk, Green, and Naik (1999), in our framework the value of a firm has two components, assets in place and growth options. In the previous section we derive that the optimal investment activity under uncertainty and the value of the option to invest. Thus, prior to investment the firm's intrinsic value expresses as:

$$V(G,H) = K_1 G + O(G,H) \tag{9}$$

where $O(G,H)$ is defined in equation (7). If we assume that there is no private information about profitability, the implied value of the firm depends on the market valuation of these two kinds of capital. Applying Ito's lemma, we obtain the expected rate of returns in Proposition 2.

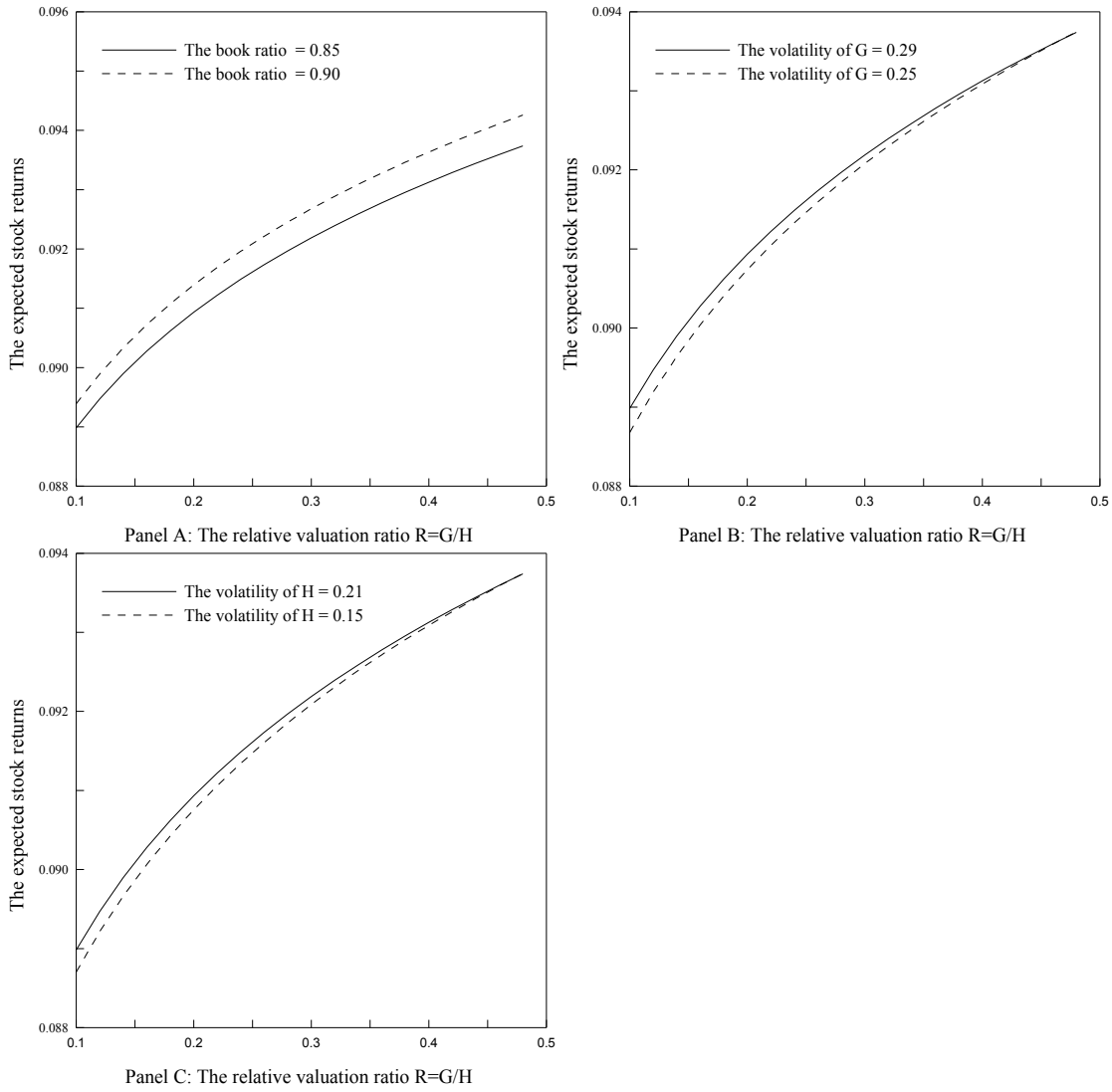
Proposition 2: Suppose that the true value of the synergy parameter is $\beta = \beta^*$. The expected rate of stock returns can be shown as:

$$E\left(\frac{dV}{V}\right) = \mu_G + \frac{O(G,H)}{V}(r - \mu_G) = r + \frac{\lambda R}{\lambda R + \bar{A} R^{\eta}}(\mu_G - r) \tag{10}$$

The first equality of equation (10) shows that the expected stock returns are the value-weighted return of two kinds of assets, existing and new capital stocks. μ_G is the expected rate of return from existing assets while r is the discounted normal rate of return from holding the growth option. Given that $\eta < 1$ from equation (8), it is easy to derive $\mu_G > r$. Given that $\mu_G > r$, we find that the expected stock returns decrease with the proportion of the value of growth options to the total value of the firm.

The second equality of equation (10) shows that the expected rate of return can be related to the firm's characteristics such as the book ratio and the relative valuation ratio. Each of them accounts for the change in the expected rate of return in a predictable way. Figure 3 shows some comparative statistics to summarize these characteristics of expected stock returns prior to investment in our framework. All parameters are identical to those in the previous section. We find the expected stock returns increase as R rises. Our explanation is that when R increases, the value of assets in place dominates the total value of the firm. Then returns from existing assets dominate the expected rate of return. Note that the relative valuation ratio is positively related to the firm's book-to-market ratio. The numerator of R, G, can be viewed as the firm's book value of assets, and the denominator of R, H, is positively related to the firm's market value of equity. Thus, if the firm has higher R or book-to-market ratio, its expected stock returns are also higher. In addition, Panel A of Figure 3 shows that the average stock returns increase with the book ratio. That is if a large proportion of the firm's capital stocks is from existing assets, its expected stock returns are also higher. Consistent with the previous research about value premiums, we find that the firm with a higher relative valuation ratio and/or higher book ratio earns higher expected stock returns.

Figure 3: The Effect of Book Ratio and Cash Flows' Volatility on the Expected Stock Returns



This figure shows the comparative static of the average stock returns. Three driving factors are discussed here, including the volatility of cash flows from existing assets (Panel A), the volatility of cash flows from new assets (Panel B), and the book ratio, which captures the ratio of the capital stocks of existing assets to that of new assets (Panel C). Input parameter values are set from previous papers as described in the article. Total amount of capital stocks, $K_1 + K$ *, is one.*

Panel B and Panel C of Figure 3 show that expected stock returns increase with uncertainty about investment. A higher volatility of cash flows from existing assets (Panel B) or new capital stocks (Panel C) produces higher average returns. Our explanation is that when uncertainty from investment is high, the value of growth options declines such that profits from existing assets dominate total value of the firm. Thus, assets in place mainly govern the firm's systematic risks. In other word, when the firm faces higher uncertainty about investment, it will postpone the expansion project so that risks from existing assets contribute a lot to its systematic risks. In brief, by introducing learning-by-doing effect and irreversible investment, we find the expected stock returns are positively related to the uncertainty about investment.

CONCLUSION

Considerable research has found corporate investment can explain the conditional dynamics in expected stock returns (Zhang, 2005, and Cooper, 2006). In addition, a number of studies state that uncertainty about investment affects the timing and the amount of investment because of irreversibility (McDonald and Siegel, 1986). Yet, despite the substantial development of these literatures, it is still unclear how the uncertainty about investment affects stock returns. This paper develops a real options model to relate the value of growth options and the value of the firm to the uncertainty about investment, in which uncertainty refers to the volatility of growth rates in cash flows and the synergy from new projects. Because investment is irreversible, the uncertainty about investment affects firms' expansion plans by changing the investment threshold. By introducing the learning-by-doing effect, the value of growth options declines with uncertainty. Our contribution is that we find a positive relationship between uncertainty about investment and expected stock returns by means of learning-by-doing.

Although our framework links asset prices to learning effects, we need some empirical research to support our theoretical findings. Another limitation of our work is that we only discuss one possible expansion option. An obvious extension of our work would analyze the more general case that the firm has many projects, in which the learning effect could alter with the number of projects. In addition, if the firm is not all-equity, debt may affect its investment decision and average stock returns. In such cases, investment would alter the distribution of future cash flows so that a firm's ability to meet its debt payment obligations. Further analysis of this complex problem has the potential to yield additional insights.

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LONG-RUN INVESTMENT DECISION IN THE TAIWAN EXCHANGE MARKET

Yin-Ching Jan, National Chin-Yi University of Technology
Su-Ling Chiu, National Cheng Kung University

ABSTRACT

Whether an investor should hold more risky assets in the long run is an issue of allocation. However, the comparison of performance between different investment horizons is not an allocation issue, but rather at timing issue. Therefore, we employ Markovian moving block bootstrap to examine the performance differences between risky portfolios and diversified portfolios over different investment horizons. The results show that Sharpe ratio estimates for all of the stock portfolios increase first and then decrease as the investment horizon lengthens. Second, the size effect only holds in the short run, but not in the long run. Third, the performances of some examined portfolios outperform that of the market portfolio in the long run, indicating an investor may be better off holding some risky assets over longer investment horizon. Fourth, balanced- and bond-fund portfolios outperform the market portfolio when the investment horizons are over 15 years, suggesting that investors can benefit from investing into these types of mutual funds in the long run.

JEL: G11

INTRODUCTION

Numerous researchers examine whether investors should hold more risky assets in long-run investment horizons. The benefit from holding more risky assets as investment horizon lengthens is often called time diversification.[1] Tobin (1965) pioneered the work on the effect of various investment horizons on portfolio allocations. Levy (1972) discovered that the Sharpe ratio tends to change with different holding periods.

The supporters of the time diversification, suggest investors should put more of their money in risky assets in the long run. Lee (1990) showed that investment horizon is irrelevant only when asset prices follow a random walk. Levy and Spector (1996) employed a myopic utility function to conduct optimum asset allocation under different degrees of risk averse and different investment horizons, and found that the weight of risky asset should increase as investment horizon lengthens. Merrill and Thorley (1996) and Levy and Cohen (1998) also proved that lengthening the holding period could reduce risk using option theory. Strong and Taylor (2001) applied stochastic dominance and suggested that investors should hold more risky asset under 10-year investment horizons. Buter and Domian (1991) and Hansson and Persson (2000) reached the same conclusion by bootstrap methodology.

The opponents however, think that investors are less likely to lose money over a long horizon however, the magnitude of the loss increases with the holding period. Samuelson (1969, 1990, 1994) and Merton (1971) concluded that the optimum asset allocation is not indifferent to investment horizon, implying that investors are better served by holding a diversified portfolio in the long-run horizon. Furthermore, Gressis, Philippatos, and Hayya (1976), Gunthorpe and Levy (1994), and Levy and Gunthorpe (1993) demonstrated that the proportion of safe assets should be increased with longer investment horizons. The work of Hodges, Taylor, and Yoder (1997) reached the same conclusion that the Sharpe ratio of bonds outperforms those of stocks with long-run investment horizons, suggesting that investors should not increase the proportion of risky asset in the long run.

In order to solve the problem of time diversification, some of those studies evaluated performance with different investment horizons and explored whether the performance were improved with longer investment horizon. On the other hand, other works explored whether the optimal holding of risky asset should increase as investment horizon lengthens by use of mean-variance optimization. The comparison of the performance between different investment horizons is not a problem of allocation, but timing.

However, whether an investor should hold more risky assets in the long run is an issue of allocation. As a result, comparing the performance between different investment horizons may not solve the problem of time diversification. Furthermore, it is also difficult for an investor to invest according to the suggestion of mean-variance optimization. Therefore, we compare the performance between risky portfolios and diversified portfolios over different investment horizons in Taiwan markets. To date, few studies examined time diversification in the Taiwan exchange market. The studies of time diversification also don't consider the time diversification of mutual funds. The motivation of this study is to examine whether investors can benefit from holding more risky assets in the Taiwan exchange market under a long-run investment horizon. Specifically, we investigate whether investors are better off holding risky portfolios or diversified portfolio in the long run. We also compare the performance of different kinds of mutual funds in the long-run investment horizon.

In order to analyze whether investors should hold more risky assets or just diversified portfolios in the long run, we examine five size-sorted and five portfolios sorted on book-to-market ratio to risky assets, and market portfolio to a diversified portfolio. Then we can compare the effect of the investment horizon on shortfall risks and Sharpe ratios of risky and diversified portfolios. We also compare these two measures for three different types of mutual funds. The shortfall risk and the Sharpe ratio are employed because they have been extensively used to evaluate portfolio risk and performance, and we can compare our result to other works.

To keep the serial dependence of returns within each generated block, the Markovian moving block bootstrap procedure of Graflund (2001) is applied. The bootstrap procedure has been used extensively in the context of time diversification, e.g., Butler and Domian (1991), Hodges, Taylor, and Yoder (1997), among others. However, their simple bootstrap approach may destroy the serial dependence of returns. As a result, Hanson and Persson (2000) applied a block bootstrap procedure, which was developed by Carlstein (1986), to examine time diversification. Nevertheless, the block bootstrap procedure may also neglect the serial correlation between successive generated blocks.

Our results show that all the shortfall risks of the examined portfolios decline with longer holding periods. Second, the Sharpe ratios of all size-sorted portfolios and the market portfolio rise at first and then fall as investment horizon lengthens, just as predicted by Lin and Chou (2003). The results of comparing the Sharpe ratio between five size-sorted portfolios with the market portfolio are mixed. However, the performance of the small-size portfolio only outperforms those of the market and large-size portfolio in the short-run investment horizon. In other words, the size effect only holds in the short run, but not in the long run. The finding may result from the fact that small firms may not survive in the long run. Third, the Sharpe ratios of book-to-market sorted portfolios show that second, third, and fourth book-to-market portfolios outperform the market portfolio consistently. Therefore, some risky portfolios may outperform a diversified portfolio in the long run.

Fourth, the Sharpe ratios of equity-fund and balanced-fund portfolios also rise at first and then fall, but the performance of the bond-fund rises consistently. Moreover, when investment horizons are more than 15 years, the equity-fund and balanced-fund are inferior to the bond-fund. Nevertheless, the performance of the market portfolio outperforms those of the fund portfolios until the investment horizon is 10-years, indicating that the volatility of the market portfolio is much larger than that of fund portfolios as the investment horizon increases over 10-years. Finally, although all of the performances of the examined fund portfolios increase as investment horizon lengthens, the market portfolio outperforms all of the examined fund portfolios when we use a downside risk measure, the semi-variance.

The nest section is literature review. Section 3 and 4 outlines the proposed method and data. Section 5 provides an analysis of the empirical results. Finally, some concluding remarks are provided.

LITERATURE REVIEW

Markowitz (1952) pioneered the foundation for asset allocation theory. He concludes that the optimal asset allocation should lie on the efficient frontier estimated from mean-variance optimization. However, Markowitz's model considers only one period. Merton (1969) extends the myopia model into continuous-time. Samuelson (1969, 1990, and 1994) showed that the optimal asset allocation is independent of the investment horizon. His arguments are conditioned on the following assumptions: (1) investors have constant relative risk aversion, (2) asset price follows random walk pattern and return is normal distribution, and (3) other income isn't considered.

However, the work of Lloyd and Haney (1980) doesn't coincide with the argument of Samuelson. Lloyd and Haney pointed out that the volatility of a portfolio's value can be reduced by lengthening the holing period. This is the concept of time diversification. Kritzman (1994) provided a clear presentation of the principle of time diversification and its application. Many academicians and practitioners have found the results supporting the reality of time diversification. Strong and Taylor (2001) and Alles and Athanassakos (2006) found that shortfall risk falls as the investment horizon lengthens. Using mean-variance optimization, Levy and Spector (1996) and Hansson and Persson (2000) concluded that the weights investing in stocks in an efficient portfolio were significantly larger for long-run investment horizons than a one-year horizon. Nevertheless, Bodie (1995) showed that investors can buy a put option to insure themselves against obtaining returns below a threshold level. Then, the price of the put option can be seen as a risk measurement. Bodie found that the put price increases as the investment horizon lengthens. Taylor and Brown (1996) contradicted the Bodie's assumption that the volatility of long-term equity's returns are constant. Releasing the assumption of constant volatility of equity's return, the results of Levy and Cohen (1998) supported time diversification.

In addition to the application of risk evaluation and option pricing, many researchers compared performance between different investment horizons. For example, Hodges, Taylor, and Yoder (1997, 2003) and Best, Hodges, and Yoder (2007) applied bootstrap method and utilize the Sharpe ratio and Treynor ratio as the performance measurement. Stochastic dominance was also applied by Strong and Taylor (2001), among others. However, they didn't reach the same conclusion.

The mean-variance optimization is employed by most researchers to examine the optimal asset allocation in the long-run investment horizon, including, e.g., Levy and Spector (1996), Gressis, Philippatos, and Hayya (1976), Krizman and Rich (1988), Gunthorpe and Levy (1994), and Levy and Gunthorpe (1993), among others. However, the results were also different between academicians. Shortfall risk is the probability of the return on an examined asset falling below a threshold value, and has been used to study the effect of long-run investment horizon. Most studies found that the shortfall risk decreased as the investment horizons lengthen, e.g., Kritzman (1994), Thorley (1995), and Butler and Domain (1991), among others. However, Milevsky (1999) showed that although shortfall risk decreases with investment horizon, the portfolio asset allocation proportions remain invariant.

According to the works of Kritzman (1994), Thorley (1995), and Kritzman and Rich (1998), the basic differences between academicians and practitioners are risk definition and return's process. The volatility of asset returns and shortfall risk decline as the investment horizons increases. However, the volatility of end-wealth increases when the investment horizons lengthen. Likewise, if risky asset's process follows mean-reversion, then investors would benefit from investing in risky asset for the long run. On the contrary, return with a random walk pattern would deteriorate the investor's end-wealth. Without the coincidence of risk measurement and asset process, the debate of time diversification may be continued.

METHODOLOGY

We apply Markovian moving block bootstrap, which was developed by Graflund (2001), to examine whether time diversification holds in the Taiwan exchange market. While the origin version of Graflund

only considered variance as governing the probability of switching between states, Sanfilippo (2003) extended the model to contain two transition governed pieces of information: the variance and expected return. Based on the works of Graflund (2001) and Sanfilippo (2003), the detailed algorithm of the Markovian moving block bootstrap is as follows:

Step 1: Determine the block length, *b* and compute the number of blocks *T/b*, where *T* is sample size.

Step 2: Compute expected return, which is predicted by the historical average return μ_i, and standard deviation σ_i. Meanwhile, find the maximum of both expected return and standard deviation, ($\mu_{\max}, \sigma_{\max}$), and Minimum ($\mu_{\min}, \sigma_{\min}$).

Step 3: Set $N = 1$, and draw a block *i*.

Step 4: Draw a block j, and compute $\mu_{ij} = (1 - \frac{|\mu_i - \mu_j|}{\mu_{man} - \mu_{\min}})$ and $v_{ij} = (1 - \frac{|\sigma_i - \sigma_j|}{\sigma_{man} - \sigma_{\min}})$. Draw a random number c from uniform distribution between zero and one. If $c < \mu_{i,j}$ and $c < \upsilon_{i,j}$, then accept block j, and $N = N + 1$; otherwise redraw another block j.

Step 5: Take block *j* as block *i*, and go to step 4. Repeat until investment horizon is equal to *Nb*.

In this paper, we set the block length as 6 months,[2] and generate a total of 5,000 holding period returns for different investment horizons. With the sample, we can calculate the performance for each investment horizon. To compare our result to other works, we use the Sharpe ratio to evaluate portfolio performance, which is a ratio of the expected excess return to the expected standard deviation. Based on the studies of downside risk, see, e.g., Ang, Chen, and Xing (2006) and Sortino and Meer (1991), we also consider the downside risk version of the Sharpe ratio. The downside risk version of Sharpe ratio is defined as the ratio of a portfolio's expected excess return to the square root of semi-variance, i.e., semi-standard deviation. We also use the risk-free rate as a benchmark to compute shortfall risk for each portfolio.

DATA

We rank all firms in the Taiwan Stock Exchange (TSE) and Taiwan Over-The-Counter Exchange (OTC) by their market capitalization (size) and book-to-market ratio (book/market) respectively at the end of June in each year. We classify all the stocks into five size and five book/market portfolios. We then hold these portfolios for one year and compute their value weighted continuous monthly returns. We examine the data span from July 1981 to December 2006, including 1227 firms. We compute the value weighted monthly return of all the stocks in the TSE and OTC as the proxy of the market portfolio. The risk-free rate is taken from the one-month deposit rate of the First Commercial Bank. We also group and compute the sample average return for all of the equity funds, balanced funds, and bond funds. The sample periods are from January 1992 to December 2006, which consists of 260, 93, and 108 funds for equity, balanced, and bond-funds, respectively. All the data come from Taiwan Economic Journal.

Table 1 presents some summary statistics on the stock and fund portfolios. Panel A shows the average returns, standard deviations, Sharpe ratios, number of firms, and average market values for the five size-sorted portfolios, market portfolios, and the risk-free rate. Before risk adjustment, the size effect

Table 1: Summary Statistics on the Stock and Mutual Fund Portfolios

Panel A: Size Portfolios

	Size					Market Portfolio	Risk-free Rate
	Smallest	**2**	**3**	**4**	**Largest**		
Average	4.613	3.299	2.985	2.392	2.782	3.005	0.398
Standard Deviation	13.521	11.940	11.372	10.269	9.593	9.383	0.194
Sharpe Ratio	0.312	0.243	0.227	0.194	0.249	0.278	N/A
Number of firms	11-246	11-246	11-245	11-245	11-245	55-1227	N/A
Average Market value	1076	2510	4517	8626	50009	N/A	N/A

Panel B: Book-to-Market Ratio Portfolios

	Book-to-Market Ratio					Market Portfolio	Risk-free Rate
	Smallest	**2**	**3**	**4**	**Largest**		
Average	3.568	2.284	2.489	2.398	2.889	3.005	0.398
Standard Deviation	14.213	10.779	10.203	9.537	10.659	9.383	0.194
Sharpe Ratio	0.223	0.175	0.205	0.210	0.234	0.278	N/A
Number of firms	11-246	11-246	11-245	11-245	11-245	55-1227	N/A
Average book/market	0.822	1.634	2.105	2.810	7.267	N/A	N/A

Panel C: Mutual Fund Portfolios

	Equity-type	**Balanced-type**	**Bond-type**	**Market Portfolio**	**Risk-free Rate**
Average	0.795	0.730	0.371	2.000	0.315
Standard Deviation	6.863	4.570	0.716	7.983	1.829
Sharpe Ratio	0.070	0.091	0.078	0.211	N/A
Number of funds	15-260	4-93	2-108	N/A	N/A

We classify all the stocks into five size and five book/market portfolios by ranking all firms in the Taiwan Stock Exchange and Taiwan Over-The-Counter Exchange by their market capitalization and book-to-market ratio respectively at the end of each June. The data span from July 1981 to December 2006. We also group and compute the sample average return for all of the equity funds, balanced funds, and bond funds. The sample period is from January 1992 to December 2006. The average returns and standard deviations are represented as percentages. The numbers of stocks and funds are reported from smallest number to largest number, and average market values are represented in millions of NT. dollars. The symbol of N/A denotes not available.

still holds. The average return of the smallest size portfolio reaches 4.61%, while the average return of the fourth sized portfolio is only 2.39%, and is the lowest average return. The average returns of the market and risk-free asset are 3.01% and 0.4%, respectively. The highest average return also has the highest volatility. The standard deviation of the smallest size portfolio is more than the other size-sorted and market portfolios. The standard deviation of the market portfolio is lower than those of the five size-sorted portfolios. The Sharpe ratio shows the existence of size effect after risk adjustment, where the smallest portfolio has the largest value of 0.312. From 1981 to 2006, there are 11 to 246 firms contained in each size portfolio, with an average market size of 1076 million (in NT dollar) for the smallest to 50,009 million for the largest portfolio.

Panel B displays the same statistics for the book/market portfolios. The largest book/market portfolio doesn't reward the highest return. On the contrary, the smallest book/market portfolio produces the highest average return, 3.57%. The fourth book/market portfolio reported the lowest return. A high return is also accompanied by a high volatility. The smallest book/market portfolio has a standard deviation of 14.21%, which is the highest among the other book/market portfolios. Except the smallest book/market portfolio, the other four portfolios show the book/market effect, that the largest portfolio has the largest Sharpe ratio. Some statistics for fund portfolios are shown in Panel C. The average return and standard deviation of equity-fund are larger than those of balanced- and bond-fund portfolios. Moreover, all of the fund returns are lower than those of the market portfolio. The estimates of the Sharpe ratio tell us that all of the funds did not outperform the market.

EMPIRICAL RESULTS

A:Size-Sorted Portfolios

Shortfall risk (SFR) is the probability of the examined portfolio's return falls below a threshold value, which is represented by the risk-free rate in this paper. Table 2 displays point estimates of the SFR for the five size-sorted portfolios with different investment horizons. All of the estimates decline as the investment horizons lengthen, which are same as in other studies, e.g., Strong and Taylor (2001). The estimated SFR of the smallest size portfolio decrease faster than the other size-sorted portfolios and market portfolio, and reaches zero for holding periods up to 10 years. The estimated SFR of the largest size portfolio is the lowest among the other four size portfolios, while the SFR of market portfolio lies in the middle of the five size portfolios.

Table 2: Shortfall Risks for Five Size-Sorted Portfolios

Investment Horizon (Years)	Size					Market Portfolio
	Smallest	2	3	4	Largest	
1	0.158	0.285	0.282	0.308	0.253	0.258
2	0.075	0.175	0.180	0.221	0.157	0.184
3	0.035	0.131	0.137	0.179	0.112	0.131
4	0.026	0.102	0.110	0.147	0.087	0.117
5	0.011	0.068	0.076	0.111	0.063	0.090
6	0.005	0.049	0.056	0.091	0.044	0.068
7	0.004	0.036	0.047	0.073	0.033	0.050
8	0.001	0.030	0.033	0.057	0.024	0.047
9	0.001	0.025	0.032	0.054	0.022	0.033
10	0	0.018	0.025	0.045	0.016	0.025
15	0	0.004	0.007	0.018	0.004	0.012
20	0	0.001	0.002	0.006	0.001	0.004

We use the risk-free rate as a benchmark and calculate all of the shortfall risk estimates by Markovian moving block bootstrap, where we set the block length to be 6 months, and generate a total of 5,000 holding period returns for each investment horizon.

The Sharpe ratios of the five size-sorted portfolios and the market portfolio, which are reported in Panel A of Table 3, rise firstly and then fall as the investment horizon lengthens, just as the work of Best, Hodges, and Yoder (2007). However, the pattern of decrease is not monotonous with the holding period. The results imply that, although the holding return increases with the investment horizon, the magnitude of the volatility increases much more. When the investment horizon is one year, the Sharpe ratio of the smallest size portfolio is the largest among the five size-sorted portfolios and the market portfolio. This is in accord with the size effect. However, when investment horizon increases, the Sharpe ratios of the smallest portfolios decrease faster than those of the other size-sorted portfolios. The result is also similar to the work of Hodges, Taylor, and Yoder (1997). We can see that when we lengthen the investment horizon, the larger a portfolio is, the more performance it has. The result suggests that when we want to invest in the long run, it would be better to allocate more money to larger size firms. Nevertheless, the results of comparing the Sharpe ratio between risky portfolios with diversified portfolio are mixed.

We also use downside risk, which is represented by the square root of semi-variance, to calculate the Sharpe ratio. Panel B of Table 3 lists the results. All of the estimates are higher than those of Panel A as expected, because semi-variance is lower than the traditional variance. The pattern of the calculated Sharpe ratio is different from that of Panel A. The estimates reach the highest values with three- to eight-year investment horizons respectively, and then decline as the investment horizon increases. When the investment horizon reaches 4 years, the Sharpe ratio of the largest size portfolio dominates the other size portfolios. Again, the size effect disappears when the investors take investment horizon into account. Moreover, the performance of largest size portfolio is superior to that of market portfolio for all the holding

periods. However, the smallest and middle portfolios outperform the market portfolio as investment horizons are within two and three years, but are dominated by the market portfolio when investment horizons are more than two and three years, respectively. The results imply that time diversification only exists in some portfolios, but not in all portfolios.

Table 3: Sharpe Ratios for Five Size-Sorted Portfolios

Panel A: Sharpe Ratios Calculated by Standard Deviation						
Investment Horizon (Years)	**Size**					**Market Portfolio**
	Smallest	**2**	**3**	**4**	**Largest**	
1	0.6457	0.5662	0.4958	0.4613	0.5283	0.5685
2	0.6483	0.6337	0.5925	0.5754	0.6242	0.6213
3	0.5563	0.5778	0.6054	0.6287	0.6461	0.6860
4	0.4376	0.4180	0.4474	0.5177	0.5873	0.5958
5	0.3747	0.4325	0.3508	0.3918	0.4463	0.4107
6	0.3537	0.3602	0.3928	0.4598	0.5272	0.5147
7	0.3497	0.3157	0.2563	0.3333	0.4249	0.4376
8	0.3072	0.3528	0.3800	0.4380	0.4394	0.2907
9	0.2437	0.3091	0.3300	0.3679	0.4550	0.4206
10	0.2485	0.3119	0.3525	0.3865	0.4499	0.3292
15	0.0892	0.1348	0.1897	0.2701	0.2731	0.2423
20	0.0932	0.1284	0.1582	0.1906	0.1793	0.1754
Panel B: Sharpe Ratios Calculated by Semi-Standard Deviation						
Investment Horizon (Years)	**Size**					**Market Portfolio**
	Smallest	**2**	**3**	**4**	**Largest**	
1	1.4806	1.2512	1.2148	1.1110	1.2568	1.1848
2	1.6599	1.4957	1.4721	1.3788	1.5307	1.4685
3	1.6792	1.5760	1.5718	1.5012	1.6374	1.6226
4	1.6398	1.5709	1.5876	1.5538	1.6867	1.6404
5	1.5782	1.5628	1.5769	1.5793	1.6980	1.6578
6	1.5306	1.5319	1.5812	1.6066	1.7107	1.6649
7	1.4945	1.5030	1.5576	1.6066	1.7035	1.6399
8	1.4380	1.4773	1.5469	1.6077	1.6925	1.6161
9	1.3795	1.4256	1.4967	1.5685	1.6585	1.6128
10	1.3547	1.4092	1.4828	1.5513	1.6374	1.5711
15	1.2222	1.2719	1.3354	1.4406	1.4716	1.4091
20	1.1711	1.2037	1.2744	1.3763	1.4078	1.3444

We calculate all of the estimates of the Sharpe ratio by Markovian moving block bootstrap, where we set the block length to be 6 months, and generate a total of 5,000 holding period return for each investment horizon.

B: Book-to-Market Ratio Portfolios

The estimated SFR of five book/market portfolios, which are shown in Table 4, are similar to those of size-sorted portfolios. All of the estimates decrease as the investment horizon lengthens. The smallest book/market portfolio has the smallest SFR, while the second book/market portfolio reports the largest SFR. The SFR of market portfolio is not lower than those of book/market portfolios.

Table 4: Shortfall Risks for Five Book/Market Portfolios

Investment Horizon (Years)	Book-to-Market Ratio					Market Portfolio
	Smallest	2	3	4	Largest	
1	0.2802	0.3262	0.3036	0.3010	0.3128	0.2576
2	0.1998	0.2606	0.2238	0.2306	0.2554	0.1840
3	0.1334	0.2138	0.1736	0.1868	0.2178	0.1308
4	0.1156	0.1914	0.1564	0.1706	0.2078	0.1172
5	0.0856	0.1730	0.1316	0.1442	0.1774	0.0902
6	0.0646	0.1534	0.1108	0.1158	0.1482	0.0678
7	0.0550	0.1398	0.0960	0.0958	0.1310	0.0502
8	0.0460	0.1208	0.0830	0.0912	0.1164	0.0474
9	0.0356	0.1014	0.0642	0.0698	0.0952	0.0334
10	0.0276	0.0932	0.0562	0.0654	0.0902	0.0246
15	0.0114	0.0578	0.0294	0.0334	0.0534	0.0124
20	0.0028	0.0308	0.0132	0.0138	0.0272	0.0038

We use risk-free rate as benchmark and calculate all of the shortfall risk's estimates by Markovian moving block bootstrap, where we set the block length to be 6 months, and generate a total of 5,000 holding period return for each investment horizon.

Panel A of Table 5 displays the Sharpe ratios of five book/market portfolios and market portfolios with different investment horizons. The Sharpe ratios rise firstly and reach the largest value with investment horizons up to two or three years, and then decline. The decline is not monotonous as the investment horizon lengthens. This pattern is also similar to the results of size portfolios. Therefore, no matter how we construct the portfolios, the Sharpe ratios first rise and then fall as investment horizon lengthens, a finding consistent with Lin and Chou (2003). The Sharpe ratio of the second book/market portfolio outperforms that of market portfolio at investment horizon up to two-year. Moreover, third and fourth portfolios outperform market portfolio for all of the examined holding periods.

The Sharpe ratios calculated by semi-standard deviation are displayed in Panel B. The results are different from those of Panel A. All of the estimates reach the largest value in five- to nine-year investment horizon, and then decline with non-monotonously as the investment horizon lengthens. The second, third, and fourth book/market portfolios also outperform market portfolio as the examined investment horizons are over eight, seven, and seven years, respectively. As a result, investors may benefit from holding some specific risky portfolios, but not all risky portfolios, instead of diversified portfolio in the long-run investment horizon.

C: Mutual Fund Portfolios

Table 6 summarizes the results of estimating shortfall risk for the three mutual fund portfolios. The estimates also decline as the investment horizon lengthens. When the investment horizon increases to 20 years, the shortfall risk of equity-fund portfolio still remains 35%, while the estimate of market portfolio has dropped to 2.3%. The bond-fund portfolio has the smallest shortfall risk among the three fund portfolios. On the contrary, the equity-fund portfolio has the largest estimate. The results confirm the fact that equity's risk is larger than the bonds. However, the shortfall risk of market portfolio is lower than the bonds, indicating that market portfolio is much more efficient than the bonds.

Panel A of Table 7 shows the Sharpe ratios for the three fund portfolios based on traditional standard deviation. The estimates of equity-fund and balanced-fund firstly rise and reach the highest value in the investment horizon of 10 and 15 years respectively, and then fall with longer investment horizon. However, the Sharpe ratios of bond-fund increase as the investment horizon lengthens. The balanced-fund has the largest Sharpe ratios within 15-year investment horizons. When the investment horizons are over 15 years, bond-fund outperforms the other two fund portfolios. All of the Sharpe ratios of the three fund portfolios are lower than the estimates of market portfolio within 10-year investment horizons. However, when the investment horizons are over 10 years, the performance of

Table 5: Sharpe Ratios for Five Book/Market Portfolios

Panel A: Sharpe Ratios Calculated by Standard Deviation

Investment Horizon (Years)	Book-to-Market ratio					Market Portfolio
	Smallest	2	3	4	Largest	
1	0.5853	0.5307	0.5770	0.6000	0.4152	0.5685
2	0.6823	0.6729	0.6988	0.7294	0.4195	0.6213
3	0.7251	0.7143	0.7385	0.7841	0.4468	0.6860
4	0.5789	0.6892	0.7329	0.7523	0.3438	0.5958
5	0.6033	0.6907	0.6719	0.7416	0.2178	0.4107
6	0.5275	0.6877	0.6456	0.7423	0.2861	0.5147
7	0.5526	0.6243	0.5730	0.6651	0.2520	0.4376
8	0.4984	0.6519	0.5940	0.6528	0.0960	0.2907
9	0.4594	0.6175	0.6139	0.6733	0.2068	0.4206
10	0.3590	0.5489	0.4881	0.5926	0.1710	0.3292
15	0.3049	0.4095	0.3592	0.4385	0.1156	0.2423
20	0.1161	0.1202	0.2062	0.3523	0.1141	0.1754

Panel B: Sharpe Ratios Calculated by Semi-Standard Deviation

Investment Horizon (Years)	Book-to-Market ratio					Market Portfolio
	Smallest	2	3	4	Largest	
1	1.1780	0.8830	1.0082	0.9789	1.0429	1.1848
2	1.4546	1.1933	1.3127	1.2987	1.2728	1.4685
3	1.6197	1.3873	1.5057	1.4852	1.3911	1.6226
4	1.6229	1.4613	1.5701	1.5507	1.4173	1.6404
5	1.6623	1.5451	1.6226	1.6148	1.4356	1.6578
6	1.6536	1.5782	1.6592	1.6648	1.4433	1.6649
7	1.6169	1.6106	1.6673	1.6782	1.4215	1.6399
8	1.6113	1.6254	1.6666	1.6847	1.3852	1.6161
9	1.5566	1.6224	1.6638	1.6917	1.4066	1.6128
10	1.5325	1.6086	1.6193	1.6597	1.3820	1.5711
15	1.4002	1.5334	1.5288	1.5623	1.2437	1.4091
20	1.2806	1.4280	1.4306	1.4806	1.2242	1.3444

We calculate all of the estimates of the Sharpe ratio by Markovian moving block bootstrap, where we set the block length to be 6 months, and generate a total of 5,000 holding period return for each investment horizon.

Table 6: Shortfall Risk for Three Fund Portfolios

Investment Horizon (Years)	Equity-fund	Balanced-fund	Bond-fund	Market Portfolio
1	0.453	0.450	0.289	0.302
2	0.439	0.416	0.305	0.241
3	0.433	0.399	0.323	0.210
4	0.424	0.383	0.326	0.179
5	0.421	0.360	0.315	0.146
6	0.412	0.363	0.315	0.135
7	0.402	0.338	0.292	0.115
8	0.410	0.330	0.296	0.100
9	0.400	0.327	0.278	0.089
10	0.385	0.305	0.286	0.083
15	0.367	0.271	0.235	0.039
20	0.349	0.246	0.202	0.023

We use risk-free rate as benchmark and calculate all of the shortfall risk's estimates by Markovian moving block bootstrap, where we set the block length to be 6 months, and generate a total of 5,000 holding period return for each investment horizon.

Table 7: Sharpe Ratios for Three Fund Portfolios

Panel A: Sharpe Ratios Calculated by Standard Deviation

Investment Horizon (Years)	Equity-fund	Balanced-fund	Bond-fund	Market Portfolio
1	0.2177	0.2558	0.2011	0.5733
2	0.3063	0.3548	0.2702	0.7017
3	0.3375	0.3818	0.2874	0.7285
4	0.3867	0.4431	0.3275	0.7737
5	0.4037	0.4757	0.3724	0.7464
6	0.4132	0.4872	0.3857	0.7638
7	0.4312	0.5159	0.4359	0.7464
8	0.4349	0.5282	0.4448	0.6969
9	0.4024	0.5203	0.4774	0.5734
10	0.4618	0.5795	0.4830	0.6727
15	0.4495	0.6043	0.5937	0.5082
20	0.3488	0.5283	0.6923	0.3546

Panel B: Sharpe Ratios Calculated by Semi-Standard Deviation

Investment Horizon (Years)	Equity-fund	Balanced-fund	Bond-fund	Market Portfolio
1	0.3372	0.4191	0.3408	0.9457
2	0.5082	0.5924	0.4507	1.2494
3	0.5933	0.6615	0.4691	1.3911
4	0.7072	0.7829	0.5255	1.5164
5	0.7969	0.8773	0.5922	1.6046
6	0.8134	0.8983	0.6149	1.6336
7	0.9036	0.9894	0.6888	1.6662
8	0.9423	1.0338	0.7054	1.6801
9	0.9812	1.0709	0.7565	1.6583
10	1.0356	1.1308	0.7538	1.6766
15	1.1567	1.2837	0.9335	1.6060
20	1.2244	1.3647	1.0854	1.4944

We calculate all of the estimates of the Sharpe ratio by Markovian moving block bootstrap, where we set the block length to be 6 months, and generate a total of 5,000 holding period return for each investment horizon.

balanced- and bond-fund outperform the performance of market portfolio, implying that the time diversification hold in these two funds, but not in equity fund.

By comparison, Sharpe ratios calculated by semi-standard deviation, which are shown in Panel B, differ from those obtained by ordinary standard deviation. The Sharpe ratios of the three examined mutual funds increase monotonously as the investment horizon lengthens. The Sharpe ratio of market portfolio increases firstly, and decreases as the investment horizon is equal to eight years. Moreover, the market portfolio outperforms all of the three examined mutual funds. The results indicate that holding a mutual fund longer may produce higher Sharpe ratio, but it is better for an investor to hold a diversified portfolio in the long-run.

CONCLUSION

In order to analyze whether investors should hold more risky assets or just diversified portfolio in the long run, we compare the effect of the investment horizon on the Sharpe ratios of risky and diversified portfolios in the Taiwan securities markets. We examine five size-sorted and five book/market-sorted portfolios to risky assets, and market portfolio to a diversified portfolio. We also compare the Sharpe

ratios of three-type mutual funds to market portfolio. We employ Markovian moving block bootstrap procedure of Graflund (2001) to keep the serial dependence of returns within each generated block.

Our results show that all the shortfall risks decline with longer holding period. Second, the Sharpe ratios of all size-sorted portfolios rise firstly and then fall as investment horizon lengthens. However, the performance of the small-size portfolio only outperforms those of market and large-size portfolio in the short-run investment horizon. In other words, the size effect in Taiwan only holds in the short run, but not in the long run. Third, the Sharpe ratios of book/market-sorted portfolios show that the third and fourth book/market portfolios outperform the market portfolio consistently. Therefore, some risky portfolios can outperform a diversified portfolio in the long run.

Fourth, the Sharpe ratios of equity-fund and balanced-fund portfolio also rise firstly and then fall, but the performance of bond-funds rise consistently. Moreover, when investment horizons are more than 15 years, the equity-fund and balanced-fund are inferior to the bond-fund. Nevertheless, the performance of the market portfolio outperforms those of the fund portfolios until investment horizon is 10-years, indicating that the volatility of the market portfolio is much larger than those of fund portfolios as the investment horizon extends over 10-years. Finally, although the performance of all examined fund portfolios increase as investment horizon lengthens, the market portfolio outperforms all of the examined fund portfolios when we use a downside risk measure, the semi-variance.

ENDNOTES

[1] See, for example, the work of Thorley (1995).
[2] We also consider the case of 12-month block length, whose results are similar to those of 6-month block. To save space, we leave the results upon the request

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BIOGRAPHY

Yin-Ching Jan got Ph.D. degree from National Taiwan University of Science and Technology, and is a professor in Department of Distribution Management at National Chin-Yi University of Technology.

Su-Ling Chiu is a doctoral candidate in accounting at the National Cheng Kung University, and is a lecturer in Department of Distribution Management at National Chin-Yi University of Technology.

EFFECT OF DIVIDEND ANNOUNCEMENT ON SHAREHOLDERS' VALUE: EVIDENCE FROM SAUDI ARABIAN STOCK EXCHANGE

Md Hamid Uddin, University of Sharjah
Diaeldin Osman, Tougaloo College

ABSTRACT

Literature suggests that dividend has no impact on shareholders value in the absence of taxes and market imperfections. Hence, companies invest excess funds in positive net present value projects instead of paying out as dividends. Literature also suggests that market valuation of stocks depends on the expected future dividends. If company pays out all earnings, funds for future investment will decrease and dividend may not increase in the future. Moreover, when dividend is taxable, paying more cash would increase the shareholders tax liability. Despite, companies often pay cash dividends to the shareholders possibly to signal any information about the future earnings prospects. Our empirical results based on 178 announcements of dividends between 2001 and 2005 in Saudi Arabia, a non-tax economy, showed that investors lost 2.20 percent of market value after the dividend announcement, although the lost value is recovered from the cash dividend received, and they earned 7 percent of net cash return after recovering the loss of market value. Sub-sample analyses showed that announcement of dividend increase may not signal any good information, while the announcements of dividend decrease and dividend initiation (first-time dividend) may contain information, although the information signal of the dividend initiation is somewhat weaker.

JEL: G14, G15, and G35

INTRODUCTION

The goal of corporate entities is to maximize the value of shareholders' investment in the firm. Managers pursue this goal through their investment and financing decisions. Investment decisions involve with selection of positive net present value projects while financing decisions involve with selection of a capital structure that would minimize the cost of capital of firm. Apart from the investment and financing decisions, managers need to decide on regular basis whether to payout the earning to shareholders, reducing the agency problem (Jensen and Meckling, 1976). However, the question remains whether paying out of earnings would essentially create value for the shareholders or not. A dividend payment provides cash flow to the shareholders but reduces firm's recourses for investment. This dilemma is a myth in the finance literature, but it was suggested that dividend policy has no impact on shareholders' value in an ideal economy without taxes although in reality the announcement of dividend payments showed significant market reactions in different countries.

A negative market reaction resulting in value decline is argued to be the effect of taxes, while a positive market reaction resulting in value increase is considered to be the effect of information signaled by the dividend announcement. It is understandable that if dividend income is taxable then investors would not prefer to increase their taxes liability by receiving cash return from their corporations. Given the investors' tax clientele, public corporations may like to payout surplus cash to their investors in order to signal that corporation has availed all the available investment opportunities, indicating better operating performance in the future. The existing evidence (presented in the next section) shows both positive and negative effects of dividend announcement on the shareholders' value in different markets. In this paper, we suggest that tax-induced dividend effect on share value should not exist in a non-tax economy like

Saudi Arabia (more discussion later). However, dividend may be important to the investors in Saudi Arabia due to its informational effect.

An empirical study, with a sample of 178 dividend announcements by 28 Saudi Arabian companies over a period from 2001 to 2005, showed that Cumulative Abnormal Return (CAR) increased before the announcement of dividends but the value increase did not sustain in the ex-announcement/ex-dividend periods. Investors lost about 2.20 percent of market value over a period of 61days starting from the day -30 to the day +30 relative to the announcement of dividend. However, the lost value is recovered from the cash dividend yield and investors earned about 7 percent of net cash returns after making up the capital lost in the market. Since Saudi Arabia is a non-tax country, the loss of market value in the ex-announcement/ex-dividend period cannot be considered as the reflection of tax effect. On the other hand the net cash gain from the dividend income, though cannot be directly attributed to the information hypothesis, but at least suggests that companies had adequate free cash to payout given the investment projects in hand.

The sub-sample analyses however showed that 69 dividend increasing stocks depict a market value loss of 1.68 percent over the ex-announcement/ex-dividend periods, hence it was concluded that announcement of dividend increase do not signal positive information about the future earnings and cash flows. Nonetheless, it is likely the dividend increasing companies had at least adequate free cash flows to pay dividends, and investors earned about 10 percent of net cash returns. On the other hand the 29 dividend decreasing stocks depict that the investors' incur about 4.19 of value loss after dividend announcements but the dividend income has marginally recovered the lost market value, leaving no significant return from the dividend payments. Hence, it was suggested that dividend decrease might have signaled the possible weak operating performance in the future. The 12 companies who initiated the dividends showed that investors gained only 1.77 percent of market value after the announcements of dividends and ex-dividend day price corrections, although investors earned about 13.74 percent of total returns including the cash divided received. Hence, it was suggested dividend initiating stocks may carry some positive information though the information signal is somewhat weak.

The rest of this paper is organized as follows: in the next section the literature review is presented. In the subsequent four sections, we respectively describe the Saudi Arabian stock market, research methodology, samples characteristics and empirical findings. Finally the conclusion is given in the last section.

LITERATURE REVIEW

A great deal of theoretical and empirical research on dividend effects has been done over the last several decades. Theoretically, cash dividend means giving reward to the shareholders that is something they already own in the company; hence this will be offset by the decline in stock value (Porterfield, 1959 and 1965). In an ideal world (without taxes and restrictions) therefore dividend payments would have no impact on the shareholders' value (Miller and Modigliani, 1961). It was further showed that the irrelevancy of dividend policy holds even after dropping the assumption of ideal economy. In a real world, however a change in the dividend policy is often followed by change in the market value of stocks. The economic argument for investor' preference to dividend income was offered by Graham-Dodd (1951). Subsequently, Walter (1956) and Gordon (1959 and 1962) forwarded the dividend relevancy idea, which has been formalized into a theory, postulating that current stock price would reflect the present value of all expected dividend payments in the future. Most recently researchers proceed a step further to consider the dividend payout as another asset pricing variable (Boudoukh et. al., 2007).

Other researchers made efforts to further understand the dividend controversy. Among them, Brennan (1970 and 1973), Litzenberger and Ramaswamy (1979 and 1980) showed that it is not optimal for the

investors to receive dividends if their marginal tax rate is greater than zero, and investors' after-tax expected rate of return (discount rate) depends on the dividend yield and systematic risk. In this regard, Black and Scholes (1974) argued however that tax effect is not uniform for all investors, because different investors are subject to different tax rates depending on the level of their wealth and income. This leads to an idea that at least dividend might have some effect on the share prices that is induced by taxes, and investors, subject to their personal tax rates, may prefer to have less cash dividend if it is taxable (Pye, 1972). Hence, stock prices tend to decline after announcement of dividend increase. Recently Dhaliwal et al (2005) found that dividend yield has impact on the cost of equity of firms, hence share value may be affected. In this paper we, however, suggest that tax-induced dividend effect on share value should not exist in a non-tax economy like Saudi Arabia where investors' cash income are not taxable.

Although literatures tend to suggest that dividend per-se does not have any effect on shareholders' value, the empirical studies showed mixed evidence, using the data from the US, Japan and Singapore markets. A number of studies found that stock price has a significant positive relationship with the dividend payment [Gordon (1959), Ogden (1994), Stevens and Jose (1989), Kato and Loewenstein (1995), Ariff and Finn (1986), and Lee (1995)], while others found a negative relationship [Loughlin (1989) and Easton and Sinclair (1989)]. A negative relationship between dividend announcement and stock returns is expected due to tax effect, but researchers tended to relate the positive relationship between the stock returns and dividend announcement with the information effect of dividend. The dividend information hypothesis postulates that cash dividend carries information regarding the future cash flows of firm that is to be reflected in the market price of stock after announcement of dividend, particularly when dividend increases [Bhattacharya (1979) Bar-Yosef and Huffman (1986) and Yoon and Starks (1995)].

Finally, it is largely accepted that dividend per-se has no impact on the shareholders' value in an ideal economy; although in a real world, dividend announcement is important to the shareholders because of its tax and information effects. The present evidence on dividend effects available in the literature is from the markets where the corporate and investors' income are subject to income taxes. No evidence is yet known from a country where the corporate and investors' income are tax-free. We have such a unique economy that is Saudi Arabia, which largely remains out of the academic knowledge. The new evidence from this market would enhance the body of knowledge on the dividend effects on shareholders' value.

The Saudi Stock Market

Establishment of the first public company in Saudi Arabia goes back to the third decade of the 20th century, but the first stock trading started much later after substantial increase in the number of public companies. In the year 1984, a Royal decree was promulgated for stock trading through local banks under the supervision of The Saudi Arabian Monetary Agency (SAMA). In the year 1990, the first electronic integrated system, known as ESIS, was introduced for settlements and clearing, and launching of new TADAWUL system in October 2001 with its cutting-edge technology added new dimensions to trading system.

Since then the Saudi Arabian stock market has grown leaps and bound along with the growth of national economy, and now become by far the largest market in the Middle East with a total market capitalization of US$435 billion and 70 listed companies as of April 2005. It represents about 47 percent of the total capitalization of the Arab stock markets and about 53 percent of the Gulf Cooperation Council (GCC) stocks markets. According to the World Federation of Stock Exchanges, the Saudi equity market ranks 16th out of the 50 largest equity markets in the world in terms of capitalization and 12th in terms of the amount of value traded. The growth in the equity market has been very much boosted by the government's ongoing privatization program as well as by a sharp increase in the number of companies looking to the market for capital.

Although the Saudi Arabian stock market is the major market in the Middle East and Gulf region, no significant empirical work on this market is found in the academic literature. This market draws our special interest because the individuals and corporations in Saudi Arabia need not to pay income taxes. However, they pay 'zakat' (a religious compulsory charity collected by the government) at a fixed rate based on the total surplus cash and inventory of tradable goods remaining in hand at least for one year. The details on zakat calculation can be found in http://www.zakat.gov.sa.

The tax effect of dividend payments is well known and documented in the literature. Let us now try to understand the zakat effect of dividend. We have to consider a few points to understand the zakat effects of dividend. For example, zakat is not a charge against the current gross profit (like income tax); rather it is calculated based on the net current assets value or the liquid wealth held for a minimum of period of one year. The previous year's balance sheet is taken as the basis of zakat payable for the current year. Hence the amount of zakat is known at the start of current financial year, so this is considered as a fixed cost. The corporations and individuals are separately charged zakat at a same rate of 2.5 percent based on their current wealth fulfilling one year maturity. Therefore, due to zakat, the investors neither immediately benefit nor lose any amount from extra dividend income. The zakat at individual level is charged at a flat rate of 2.5 percent irrespective of the level of investors' wealth, so there should not have a zakat-clientele effect of dividend (similar to tax-clientele effect of dividend).

Since the amount of zakat payable is not a claim on the current income like taxes, the shareholders' value cannot be increased by savings zakat. If corporations invest more in the fixed assets in order to reduce zakat payable, the shareholders are not benefited because increases in the market value of shares will in turn increase the zakat payable at personal level. Most importantly, the zakat is a compulsory charity by the God's order to the mankind hence no God believing investor would try to benefit from saving the charity that is made compulsory. In conclusion, although Saudi Arabian companies and investors pay zakat, the shareholders' wealth should not be affected by mere changing the corporate dividend policy, given that other factors are not changed. Therefore, this market provides us an opportunity to examine the effect of dividend announcements in non-tax economy. We believe that evidence from this market would enrich the body of academic knowledge on corporate dividend.

METHODOLOGY

We apply event study methodology to examine the impact of dividend announcement on shareholders' value, and use two measures of returns: (i) daily market-adjusted abnormal return (MAAR) and (ii) daily cumulative abnormal return (CAR). MAAR indicates the relative daily percentage price change in the dividend paying stocks compared to the change in average market price. We use TADAWUL all-share price index (TASI) as the proxy for average market price in

$$\mathrm{MAAR_{it}} = \mathrm{R_{it}} - \mathrm{R_{mt}} \qquad (1)$$

Saudi Arabia. MAAR is calculated as follows:

Where:

$MAAR_{it}$ is the market adjusted abnormal return for security i over time t

R_{it} is the time t return on security i, calculated as $(P_{it} - P_{it-1})/P_{it-1}$. Where, P_{it} is the market closing price of stock i on day t. P_{it-1} is the market closing price of stock i on day t-1.

R_{mt} is the time t return on the TADAWUL all-share index (TSI) calculated as $(I_t - I_{t-1})/I_{t-1}$. Where, I_{it} is the market index on day t. I_{t-1} is the market index on day t-1.

The market adjusted abnormal return (MAAR) shows the change in individual stock's value due to the dividend announcement. As the percentage change in market index (average market price) is deducted, the remainder gives us the unsystematic portion of the value change, which is specific to that particular stock resulting from its dividend announcement. MAAR is calculated over a period starting from day –30 to day +30 relative to the dividend announcement day (0-day). It should be noted that risk adjusted abnormal return using Fama and French (1993) variables may be more acceptable but due to non availability of required data we are not able to calculate the expected returns based on the Fama and French (1993) model. Nonetheless, the market-adjusted abnormal return would at least help us to know the behavior of dividend paying stocks compared to the movements in the average market prices.

The second measure used is cumulative abnormal returns (CAR), which measures the investors' total return over a period starting from well before the announcement of dividend to well after the dividend announcement day. Some researchers however argued that cumulative abnormal return (CAR) may be upward bias and suggested to use buy-and-hold return (BHR) approach. We will check the differences of results using two measurements. If the difference is not significant, then we will accept the CAR as the valid measure for this study. This is because we consider that CAR may better capture the information leakage before and after the dividend announcement and price movements around the period. We use a 61-day window period staring from -30-day to +30-day relative to the dividend announcement day (0-day). CAR is computed as follows:

$$CAR_t = \sum_{t=1}^{t=j} MAAR_t \qquad (2)$$

Where, CAR_t is cumulative abnormal return, $MAAR_t$ as defined above, j denotes the day -30 through day +30.

Finally, we will use parametric test to determine the statistical significance of market adjusted average abnormal return of dividend paying stocks over the window period (day -30 to day +30 relative to dividend announcement). The t-statistics for $MAAR_t$ were calculated cross-sectionally by using the standard deviation of abnormal returns. For CAR_t, we apply t-test suggested by Brown and Warner (1980) to test the statistical significance of the cumulative abnormal returns.

Sample Descriptions

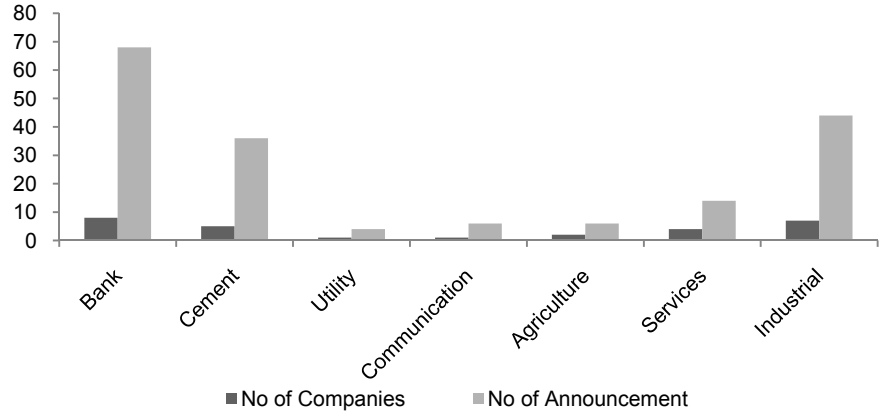
The sample includes a total of 28 companies listed on the Saudi Arabian stock market who made 178 announcements of dividends between January 2001 and December 2005. The relevant data are collected from the company announcements files available at the Saudi stock market in Riyadh. We consider the period of sample as the growth period after formation of Saudi stock market, as market has expanded with maximum number of new listings and dividend announcements from the old companies along with rapid expansion of Saudi economy due to significant increase in the oil prices. Announcements of dividends before 2001 were far less frequent, while after a long period of growth between 2001 and 2005, the market experienced major price corrections in early 2006. A breakdown of the sample companies, announcements, and average dividends according to industrial sectors is given below in Table 1, Figure 1 and Figure 2.

Table 1: Distribution of Companies Announcing Dividend during 2001-2005

Sector	Number of Companies	Number of Announcements	Average Dividend (%)	Maximum Dividend (%)	Minimum Dividend (%)
Bank	8	68	10.35	35.00	3.00
Cement	5	36	13.42	22.00	3.00
Utility	1	4	3.63	4.00	3.50
Communication	1	6	12.20	14.00	7.00
Agriculture	2	6	3.31	10.00	2.50
Services	4	14	2.00	11.39	22.00
Industrial	7	44	3.00	6.59	17.00
Total	28	178	9.26 (SD=5.29)		

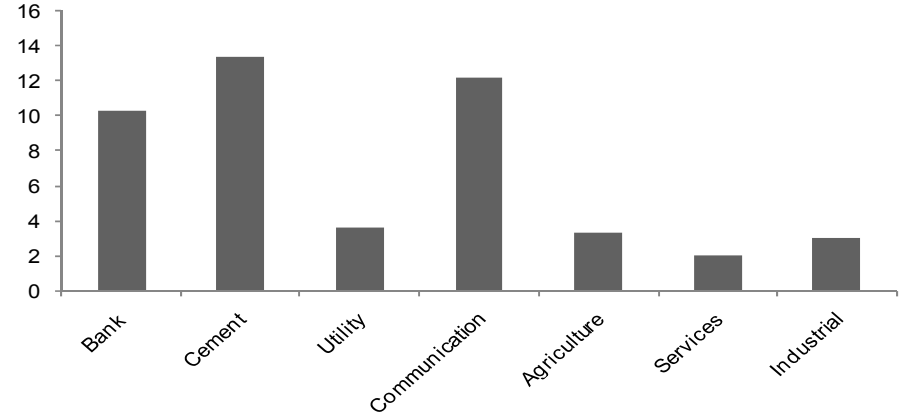
Table shows the distribution of 28 companies listed on Saudi Arabian Stock Exchange making a total of 178 announcements of dividend payments during 2001-2005. The sample covers about 38 percent of the total market in terms of companies listed, and 93 percent in terms of

Figure 1: Number of Companies and Announcements of Dividends in each Sector



This figure shows a comparison between the number of companies and total number of dividend announcements made by the companies under different sectors in Saudi Arabian stock market over the sample period from 2001-2005.

Figure 2: Average Dividend % in Different Sectors



This figure shows the extent of average of cash dividend (%) paid by the companies under different sectors of Saudi Arabian stock market over the sample period from 2001-2005.

The table and figures above show that the highest average dividend of 13.42 percent was paid in the cement sector, followed by 12.20 percent in the communication sector and 10.35 percent in the banking sector. The single highest dividend of 35 percent was announced in the banking sector, while the lowest dividend of 2 percent in the service sector. The average dividend was 9.25 percent with a standard deviation of 5.29 percent. As for the announcements of dividends, a total of 68 announcements were made by the eight banks followed by 44 announcements by the seven manufacturing companies from the industrial sector. The five cement companies made a total of 36 announcements, while the remaining 30 announcements came from the services, utility, communications, and agricultural sectors.

Overall, the sample set covers about 38 percent of the total market in terms of the number of companies, and 93 percent in terms of the number of announcements. As for the companies not included in the sample set are mostly the new companies listed in the recent years, and majority of them did not declare dividends till the samples were collected. All in all, it seems that the empirical findings based on the samples selected may reasonably reflect the effects of dividends on shareholders value in Saudi stock market.

EMPIRICAL FINDINGS AND ANALYSES

Market Adjusted Abnormal Returns

Findings reported in Table 2 shows that average market adjusted abnormal return (MAAR) on the day of dividend announcement was only 0.05 percent, which was not statistically significant. This could be due to the fact that the information of dividend payment often leaks out to the market a few days before the announcement made by the company. Hence, the announcement of dividend normally carries no surprise to the market. Therefore, evidence shows that MAARs on the five trading days immediately before the announcement of dividend were much higher than that on the day of announcement, suggesting that market tends to react earlier than the actual announcement of dividend.

Table also shows that period before the day -5 of dividend announcement, MAAR randomly varied from 0.25 percent to -0.02 percent, though none of them are found to be statistically significant. Therefore, evidence tends to confirm that market reacts a few days before the announcement of dividend is made. During the immediate post-announcement period (from day +1 to +5), the market price significantly falls and posts negative return on all the trading days. The downward pressure on the market price indeed continue even after the day +5 though there were some occasional positive returns during the period from the day +6 to day +15. Overall, MAAR results suggest that the effect of dividend announcement is not very significant in Saudi stock market. Shareholders gain nearly one percent of value over the five days period before announcement of dividend but lose the gained value over the next five days period following the announcement.

If we look at the average MAARs over a wider window (-day 30 to +day30), as it appears in Figure 3, a pattern of MAAR behavior is lightly noticeable that majority of MAARs over the 30 days prior to the announcement of dividends are positive, while the majority of those over the 30 days after the announcement are negative. However, the parametric t-test reveals that none of daily MAAR over window period is statically significant except those on day+5,+4, +3 -2, -3,and -5. The sub-sample tests for the different industries also depict the similar results, suggesting that dividend announcements in Saudi Arabia may not have strong effect on the shareholders' value. We investigate into this matter by analyzing the cumulative abnormal returns below.

Table 2: Average Market-Adjusted Abnormal Return (MAAR)

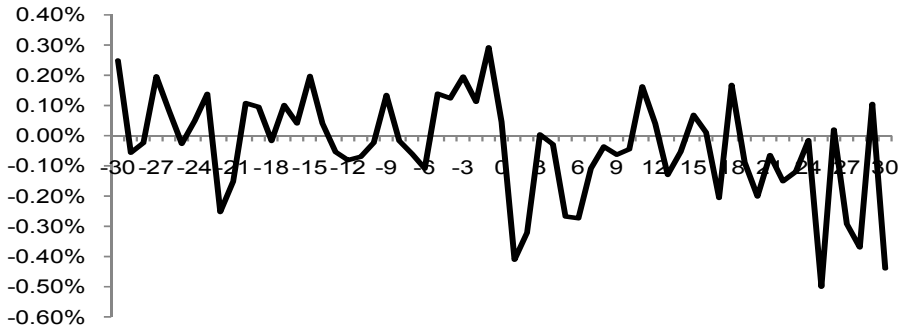
Day relative to dividend announcement	Average MAAR (%)
-15	0.20
-14	0.04
-13	-0.05
-12	-0.08
-11	-0.07
-10	-0.02
-9	0.13
-8	-0.02
-7	-0.06
-6	-0.11
-5	0.14
-4	0.12
-3	0.20
-2	0.11
-1	0.29
0	**0.05**
1	-0.41
2	-0.32
3	0.00
4	-0.03
5	-0.27
6	-0.27
7	-0.11
8	-0.04
9	-0.06
10	-0.05
11	0.16
12	0.04
13	-0.13
14	-0.05
15	0.07

Days around the announcement of dividends

Average MAAR around the announcement of dividends

This table reports the average market-adjusted abnormal return (MAAR) for dividend paying stocks around the time of 178 dividend announcements over a window period from day-15 to day +15 relative to dividend announcement The MAAR is calculated as event relative day return less the market return calculated based on TADAWUL all share price index (TSI) of Saudi stock market. The MAAR for longer window period from day -30 to +30 can be found the Figure 3.

Figure 3: Average Market-Adjusted Abnormal Returns (MAAR)



This figure depicts the changes in average market adjusted abnormal returns (%) over a window period starting from day -30 to day +30 relative to 178 dividend announcements. The MAAR is calculated as event relative day return less the market return calculated based on TADAWUL all share price index (TSI) of Saudi Arabian stock market.

Cumulative Abnormal Returns

Results in Table 3 and Figure 4 show that investors do not gain value from dividend announcement. Evidence depicts that CAR had risen from 0.25 percent on day -30 to a level of 1.4 percent on the day of

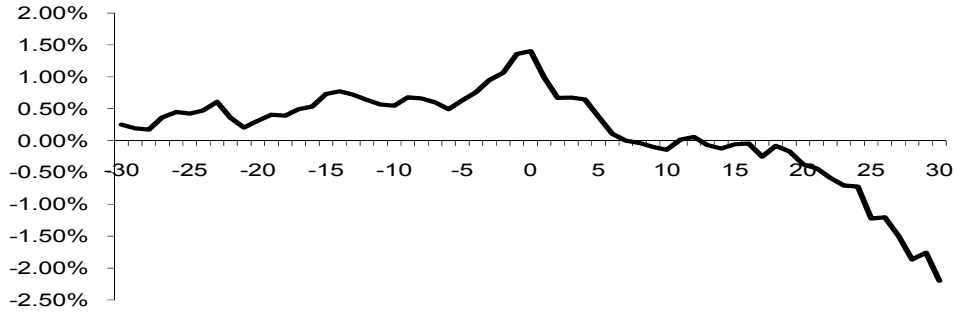
dividend announcement. But the gained market value was lost over the next 30 days after dividend announcement, as CAR dropped to –2.20 percent on the day 30. The results tend to suggest that investors may have overreacted to the dividend announcement; and apparently gain no value in the market from the dividend announcements as measured over a period of 61 days covering the pre and post dividend announcement dates.

Table 3: Cumulative Abnormal Returns (CAR) of Dividend Paying Stocks

Event Days	CAR
-30	0.25
-25	0.42*
-20	0.31
-15	0.73*
-14	0.77
-13	0.72
-12	0.64
-11	0.57**
-10	0.54
-9	0.68
-8	0.66
-7	0.60
-6	0.49
-5	0.63
-4	0.75**
-3	0.95*
-2	1.06*
-1	1.35**
0	1.40*
1	0.99*
2	0.67*
3	0.67*
4	0.65*
5	0.38
6	0.10*
7	0.00***
8	-0.04
9	-0.10
10	-0.15
11	0.01
12	0.06
13	-0.07
14	-0.13
15	-0.06*
20	-0.37
25	-1.22**
30	-2.20**
Average Cash Dividend (From Table 1)	9.26%***
Investors' Net Gain over 61 days	7.01%***

This table reports the cumulative abnormal return (CAR) for dividend paying stocks in Saudi Arabian stock market around the time of 178 dividend announcements over a window period from day-30 to day +30 relative to dividend announcement. CAR is calculated as $CAR_j = \sum_{t=1}^{t=j} MAAR_t$ Where, CARt is cumulative abnormal return, MAARt as defined earlier, j denotes the day -30 through day +30. Asterisks ***, **, and * indicate the level of significance respectively at 1 percent, 5 percent and 10 percent level.

Figure 4: Cumulative Abnormal Returns (CAR)



This figure depicts the changes in cumulative abnormal returns (%) over a window period starting from day -30 to day +30 relative to 178 dividend announcements in Saudi Arabian Stock market. CAR is calculated as $CAR_t = \sum_{t=1}^{t=j} MAAR_t$ *Where,* CAR_t *is cumulative abnormal return,*$MAAR_t$ *as defined earlier, j denotes the day -30 through day +30.*

Findings show that investors lost more market value in the post-announcement period than the value gained in the pre-announcement period, but the amount of lost value seemed recovered from the cash dividend received. The average cash dividend was about 9.26 percent (from Table1) while the loss in market value was about 2.25 percent over the period starting from the day-30 to day +30 relative to the announcement of dividend. Hence investors earned an average net cash return of about 7 percent from the dividend received. Apparently, the ex-announcement/ex-dividend market value loss is consistent with the tax-effect argument, but Saudi Arabia is a tax-free country hence we rule out the loss of market value is due to tax effect. Rather, it could be a reflection of price correction following market overreactions to the announcements of dividend in a less efficient market. It is also difficult for us to fully attribute the net return from cash dividend received to the information hypothesis. If the dividend announcements give signal any positive information about the future earnings and cash flows then the average price should not have dropped significantly within a week after the announcement (CAR by the day+7 is 0.00 percent). It rather seems that market could have overreacted to the dividend anticipation, and prices are corrected over a week after the actual announcement of divided. The CAR did not change much during the period from day +8 to day +22, but it dropped to -2.20 percent over the following 8 days, reflecting the ex-dividend effect. Samples show that the listed companies who declared dividend during the period of study have transferred the declared dividend to the investors' bank accounts within 23 working days after the announcement date.

In Saudi Arabia, the market authority ranks the listed companies based on their dividend payments, taking into consideration that the good companies with adequate free cash flow can pay dividend. Hence, companies may like to retain their good standing by paying dividends. According to M&M theory dividend per se should not have any impact on the shareholders' value in the absence of taxes, but the companies may like to pay dividend due to its information effect. Hence, in Saudi Arabia, a tax free economy, if companies pay dividend that should be for signaling information to the investors, but when the regulatory authority puts a kind of indirect pressure on the companies to pay dividends, investors may become confused about the purpose of dividend announcement. Therefore, we made an attempt to further investigate the dividend information effect by splitting the samples into three groups: announcements of dividend increase, dividend decrease, and dividend initiation (first-time dividend).

Sub-sample Analyses

The results presented in Table 4 depicts that there are a total of 69 announcements reveal divided increase from the last year's level, 29 announcements reveal decrease in dividend, and 12 companies initiate their

first dividend since their market listing. The day +30 CAR for the dividend increasing stocks was -1.68 percent, while it was -4.19 percent for the dividend decreasing stocks and 1.77 percent for the dividend initiating (first-time dividend) stocks. The day +30 CARs for three sub-samples as above are statistically significant.

Table 4: Sub-sample Analysis of Cumulative Abnormal Returns (CAR) for Dividend Increase, Dividend Decrease, and Dividend Initiation

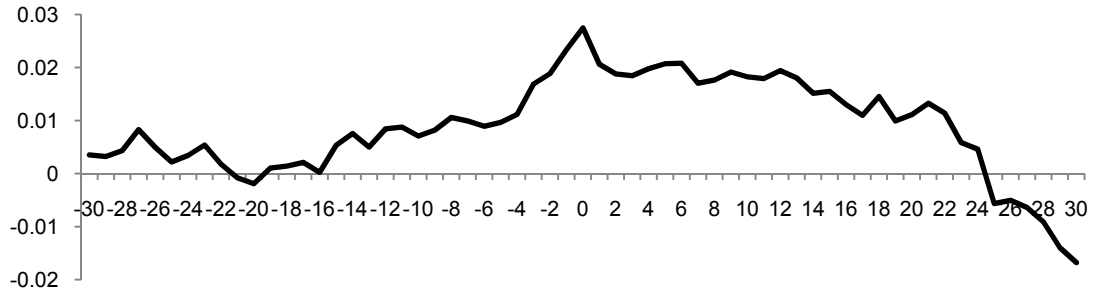
Event Days	Dividend Increase (N=69)	Dividend Decrease (N=39)	Dividend Initiating (N=12)
-30	0.35	0.71**	0.08
-25	0.22*	0.14	0.67
-20	-0.19	0.57***	1.67
-15	0.53*	0.11	2.38*
-14	0.76*	0.32*	2.32
-13	0.50	0.36	3.27
-12	0.85	0.03	2.57***
-11	0.88**	-0.27	2.71**
-10	0.71	-0.16***	2.02**
-9	0.82	-0.67	2.73*
-8	1.06*	-0.97*	3.29
-7	0.99	-0.74	3.23*
-6	0.89**	-1.79***	2.96*
-5	0.97	-1.32**	4.16***
-4	1.11*	-1.25**	3.30**
-3	1.69**	-1.08	4.06***
-2	1.89***	-0.81	4.08***
-1	2.34**	-0.22	3.81**
0	2.75**	-0.76	3.51*
1	2.06**	-1.42**	2.35**
2	1.88*	-2.67***	2.00
3	1.85**	-2.51***	1.90*
4	1.98**	-2.29***	2.40**
5	2.07***	-3.26**	1.76
6	2.08***	-3.50*	2.01*
7	1.71	-3.33***	1.80
8	1.76*	-3.82*	1.46
9	1.91*	-3.81***	1.97**
10	1.83*	-3.72*	2.10*
11	1.79	-3.20**	2.56*
12	1.94*	-3.67	2.78
13	1.81	-3.63	2.69***
14	1.51	-3.21***	3.12*
15	1.55	-2.97**	2.99
20	1.11**	-3.83*	3.42*
25	-0.56***	-3.09***	2.40
30	-1.68**	-4.19***	1.77
Average Dividend	11.68**	5.09***	11.95***
Investors' Net Gain	10.00***	0.90*	13.72**

*This table reports the cumulative abnormal return (CAR) for three sub-samples over a window period from day-30 to day +30 relative to the dividend announcement day. In 69 announcements, corporations increased the current dividends from the level of last dividend. In 39 announcements, corporations decreased the current dividend from the level of last dividend, while 12 companies initiated dividend payment for the first time during 2001-2005. The samples of dividend increase and decrease are sorted based on the criteria that the current dividend is at least 20 percent different from the last dividend (either 20 percent higher or lower than the last year's dividend). Asterisks ***, **, and * indicate the level of significance respectively at 1 percent, 5 percent and 10 percent level.*

The average dividends were 11.68 percent, 5.09 percent and 11.95 percent respectively for dividend increasing, dividend decreasing, and dividend initiating stocks. After taking into the consideration of both the cash dividend return and capital gain (CAR) investors earned about 10 percent return from the dividend increasing stocks, less than one percent return from the dividend decreasing stocks, and 13.72 percent from the dividend initiating stocks. The results show that investors on average gain significantly higher return only from the stocks that declared dividend increase and also from those initiated dividends

after their listing on the stock exchange. In order to ascertain the possible information effects of dividend we can examine the behavior of CARs for the three sub-samples presented in Figures 5 through 7

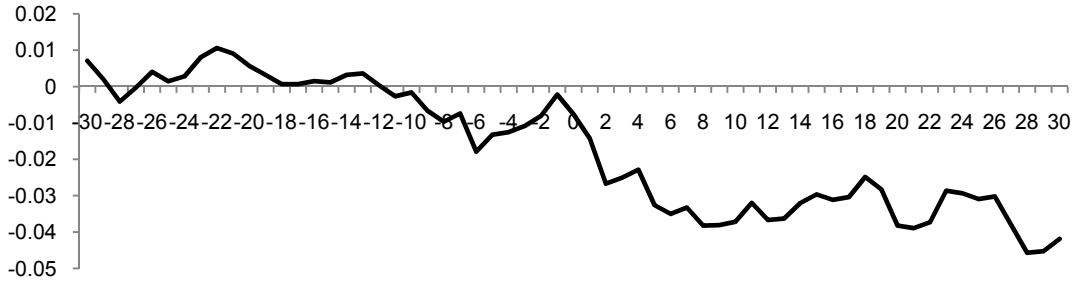
Figure 5: Cumulative Abnormal Returns (CAR) of Dividend Increasing Stocks



This figure shows the changes in cumulative abnormal return (CAR) over a window period from day -30 to day +30 relative to dividend announcement for stocks announcing dividend increase (N=69) in Saudi Arabian stock market during the period 2001-2005.

Figure 5 shows that CAR of the 69 dividend increasing stocks started to increase from the day -21 and reached to its peak on the day 0 (announcement date) when the CAR stood at 2.75 percent. Afterwards, the CAR falls slowly till the day +21 followed by a sharp drop after the ex-dividend day and the CAR become negative (-1.68%) by the day +30. Hence it is apparently difficult for us to attribute CAR of the dividend increasing stocks as the reflection of any positive information about future growth in earning. Rather the evidence depicts some kind of abnormal returns due to possible market overreaction and profit booking by the active short-term traders. However, since the investors earn about 10 returns from cash dividend after adjusting the CAR loss, we can possibly assume that companies are at least able to generate adequate free cash to payout.

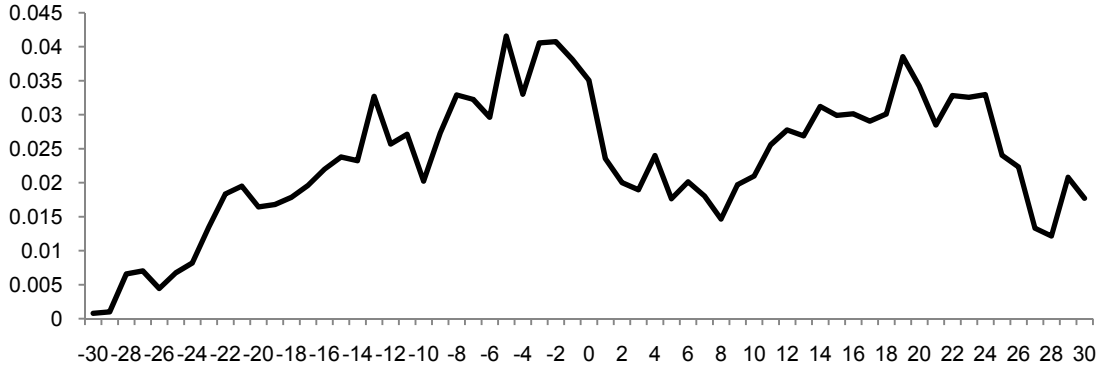
Figure 6: Cumulative Abnormal Returns (CAR) of Dividend Decreasing Stocks



This figure shows the changes in cumulative abnormal return (CAR) over a window period from day -30 to day +30 relative to dividend announcement for stocks announcing dividend decrease (N=29) in Saudi Arabian stock market during the period 2001-2005.

Figure 6 shows that CAR of 29 dividend decreasing stocks started to fall from the day -11. A sharp drop of CAR is detected immediately after the day of dividend announcement (day 0) and another significant decline in CAR occurred after the day +21 (approximate ex-dividend time). Finally investors lost about 4.19 percent of market value by the day +30. The general behavior of CAR for these dividend decreasing companies may signal about the possible decline in future earnings, as we see that prices not corrected upward sometimes after the dividend announcement. Nonetheless, investors marginally recovered the lost value from the cash divided received.

Figure 7: Cumulative Abnormal Returns (CAR) of Dividend Initiating Stocks



This figure shows the changes in cumulative abnormal return (CAR) over a window period from day -30 to day +30 relative to dividend announcement for stocks announcing of dividend initiation (first time dividend announcement after listing on exchange) (N=12) in Saudi Arabia during the period 2001-2005.

Figure 7 shows that the average CAR of 12 dividend initiating stock started to increase from the day +29 and increased steadily until the actual announcement of dividend initiation. The CAR reached to its peak at 4.08 percent level on the day -2 and temporarily dropped to 1.46 percent over the next eight days and again reached to 3.42 percent level on the day +20 (prior to the ex-dividend day) before it finally settled at 1.77 percent level by the day +30. The general behavior of the average CAR of 12 dividend initiating stocks tends to indicate that market takes the announcement of dividend initiation as positive news though investors seemed not fully clear about the information hence abnormal fluctuations of returns observed during the post-announcement period.

CONCLUSIONS

It was suggested that dividend payments have no impact on the shareholders' value in the absence of taxes and other market imperfections. A dividend payment provides cash flow to the shareholders but it reduces firm's recourses for investment. Hence, firms should not pay dividend if they have any positive net present value project in hand. On the other hand, the valuation of stock depends on the expected future dividends. If company pays out all the earnings to shareholders, funds for future investment will decrease and dividend may not increase in the future. Therefore, dividend payout should not be desirable provided that companies can better invest their funds. Moreover, cash dividend is not desirable if investors need to pay taxes on their dividend income. Given the valid reasons for not paying dividends, an announcement of dividend payments may carry some information for the market and stock prices may be adjusted accordingly.

We have investigated the dividend effects on the shareholders' value in Saudi Arabia, a country where the business corporations and investors need not to pay income taxes to the government. If the famous M&M theory of dividend irrelevancy works in reality then the Saudi Arabia, being a tax-free economy, may be considered as a suitable market for examining the dividend effects, the evidence from a non-tax economy will enrich the existing body of knowledge on corporate dividend. Based on a sample of 178 announcement of dividend during January 2001 and December 2005, we found that investors do not gain value in Saudi Arabian market from the announcement of dividend. Over the period starting from 30 days prior to the dividend announcement to 30 days after the announcement, investors lost about 2.20 percent of stock value. Although the loss in market value was fully recovered from the dividend income received, and earned about 7 percent of net cash return. We made efforts to screen the samples into three sub-groups: dividend increase, dividend decrease, and dividend initiation (first-time dividend).

The results show that investors lost about 1.68 percent of market value in the 69 dividend increasing stocks hence we cannot conclude that dividend increase do provide any positive signal about the future growth of cash flow. Nonetheless, we could suggest that these companies are able to generate adequate free cash to payout. Investors in the 29 dividend decreasing stocks lost about 4.19 percent of market value over the test period and did not earn any significant cash returns from dividends after adjusting the value lost in the market, hence we concluded that dividend decrease gives a signal of low future cash flow. On the other hand, investors earned about 1.77 of market value from the 12 dividend initiating stocks and earned a total of about 13.72 percent of returns including the cash dividend. However, we observe an abnormal fluctuation of value during the post-announcement period; hence we concluded that although investors take the dividend initiation as a signal of positive information, yet they are not fully clear about the nature of information.

Finally, the evidence from Saudi market tends to be consistent with the M&M theory of dividend irrelevancy and its information effect; although the information effect is somewhat weaker in this market. While the evidence of dividend effects from a non-tax economy supposed to carry academic significance, the regulators, corporate policy makers, and the investors also can benefit in a way that dividends in this market may not properly signal the future cash flow of the company.

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AUTHORS' BIOGRAPHY

Md Hamid Uddin, PhD, is working as Associate Professor of Finance at University of Sharjah, United Arab Emirates (iba_hu@yahoo.com or mduddin@sharjah.ac.ae). Diaeldin Osman is working as Assistant Professor of Accounting at Tougaloo College, Mississippi, USA (dosman@tougaloo.edu).

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THE RELEASE TIMING OF ANNUAL REPORTS AND BOARD CHARACTERISTICS

Chen-Hui Wu, I-Shou University
Chin-Shun Wu, National Sun Yat-sen University
Victor W. Liu, National Sun Yat-sen University

ABSTRACT

This paper posits that the release timing of an annual report has no systematic relation with earnings news in Taiwan. Since the board of directors has the ultimate responsibility for the implementation of corporate governance, we argue that board characteristics are important determinants for the timeliness of a firm's annual report. The empirical results show no behavioral evidence of good news early and bad news late. Although the magnitude of board size has no significant impact, a board with ultimate owners and a board with independent directors have a positive influence on the reporting lag. Other firm characteristics and technological changes are also found to be related with the reporting lag.

JEL: G34, M41

INTRODUCTION

The need for an audited annual report arises from the potential conflicts of interest among managers and suppliers of finance, often referred to as agency problems. The existence of controlling shareholders in the firm can ameliorate managerial agency problems, but they may pursue interests different from the minority shareholders by creating another type of agency problem. Recent studies indicate that widely dispersed corporate ownership is not common, even in developed countries (Faccio and Lang, 2002; Shleifer and Vishny, 1997). Taiwanese companies, like businesses in other East Asian countries, have a high ownership concentration through pyramidal groups and cross-holdings (Claessens et al., 2000; Yeh et al., 2001; Yeh and Woidtke, 2005).

Corporate governance mechanisms are viewed as a means to ameliorate various classes of agency problems. Among those mechanisms, the monitoring role of the board of directors is an important component in corporate governance, and its effectiveness is determined by its size, composition, and independence (John and Senbet, 1998).

Previous studies indicate that managers have incentives to influence investors' perceptions through timing the release of accounting reports, suggesting the behavior of good news earlier and bad news late (e.g., Chamber and Penman, 1984; Givoly and Palmon, 1982; Haw et al., 2000). Because the corporate environment has changed, the board of directors has the ultimate responsibility for the implementation of corporate governance (Jensen and Fuller, 2003). Thus, we argue that different board characteristics have their own impacts on the financial reporting process.

This paper contributes to both the literature on the timeliness of mandatory disclosure and the literature on corporate boards. First, we find no systematic association between earnings news and reporting timing. Stated differently, there is no behavioral evidence of good news early and bad news late during our sample period studied.

Second, we examine the relation between the board-size effect and the reporting lag, as prior research covers that a large board can make communication, coordination, and decision-making more cumbersome than a small board (Jensen, 1993; Yermack, 1996). However, we find no evidence of the board-size effect

with Taiwanese listed companies, with the only exception occurring in a company whose ultimate owners in the board are below 20%.

Third, a board with ultimate owners has a positive and significant influence on the reporting lag. The inclusion of independent directors into the board has a positive impact only for firms with a small board and a board with ultimate owners above 50%.

Fourth, we incorporate information technological changes and firm characteristics as control variables. Among them, we find that technological changes have accelerated the release timing of annual reports. In addition, our results indicate that institutional investors have more influences in reducing the reporting lag than individual investors.

Finally, policy-makers are likely to be interested in the findings of this paper. The reason for this is that providing a more timely accounting report to the market is one feature of corporate governance practices that would lead to the improvement of market efficiency.

The remainder of this paper is organized as follows. Section 2 presents the research background and hypothesis development. Section 3 describes the sample and data source. Section 4 provides descriptive statistics and the results of our empirical analysis. Section 5 concludes and suggests directions for future research.

BACKGROUND AND HYPOTHESIS DEVELOPMENT

Audited financial reporting is one of the mechanisms that help to control the conflict of interests among firm managers, shareholders, and bondholders (Chow, 1982). In the majority of cases, minority shareholders and bondholders are less likely to take an active monitoring role, for they have to rely on the firm's financial reporting process and external auditing. Since the content of financial reports may violate the implicit contract with stakeholders, managers have incentives to influence their perceptions through managing accounting disclosures. Earnings management issues have been extensively discussed in the accounting literature (for a review, see Healy and Wahlen, 1999; Schipper, 1989). However, less attention focuses on the timeliness of accounting reports.

Prior studies document that managers have incentives to time earnings announcements, suggesting the behavior of good news early and bad news late (e.g., Chambers and Penman, 1984; Givoly and Palmon, 1982). This phenomenon can be explained by the *stakeholder theory* and the *internal reporting hypothesis* (Bowen et al., 1992; Haw et al., 2000). The stakeholder theory posits that, in the absence of an opportunity to hide bad news due to mandatory disclosure requirements, managers have incentives to delay its release and let delayed bad news be impounded gradually into share prices (Watts and Zimmerman, 1990). The internal reporting hypothesis suggests that, if managers' compensations are related to earnings performance, they may delay bad news until it is verified, justified, and/or restated (Lurie and Pastena, 1975).

Recent empirical evidence, however, shows that the relation between news and timing does not appear to be strictly monotonic (Begley and Fischer, 1998). Basu (1997) examines the effects of the conservatism principle on reported financial statements and finds that earnings is more timely in reporting publicly available 'bad news' about future cash flows than 'good news'. Indeed, there is a weak association between good news and early announcement (Bagnoli et al., 2002). The authors match their findings with the increased litigation faced by management and auditors during the 1980s in the United States.

According to La Porta et al. (1998), Taiwanese legal rules covering protection of corporate shareholders and creditors pertain to the German-civil-law family, and they are classified in the middle, in terms of

investor legal protection. However, Taiwan is characterized as having high ownership concentration, predominated by family control and pyramidal groups as in other emerging markets (La Porta et al., 1999; Yeh et al., 2001; Yeh and Woidtke, 2005). The potential benefit of high ownership concentration is that controlling shareholders have the power and the incentives to discipline managers and ameliorate the managerial agency problem. On the other side, it creates a new agency problem between controlling shareholders and minority shareholders, since both their interests are not always perfectly aligned. For example, controlling shareholders can expropriate minority shareholders via entrenchment, a transfer of assets, or exploitation from a business relationship with affiliated companies through transfer pricing (Volpin, 2002; Shleifer and Vishny, 1997).

Therefore, corporate governance becomes an important factor in financial market development and firm value, particularly in emerging markets (La Porta et al., 1997, 1998, 2000). The Organization for Economic Cooperation and Development (OECD) has developed five corporate governance principles as reference guidelines. The implementation of these principles is stipulated by Taiwan's Company Law and Securities and Exchange Law. Among them, the fourth principle requires that the corporate governance framework should ensure the timely and accurate disclosure of all material matters regarding the corporation. Under the Securities and Exchange Law, listed companies must publish their annual reports within four months after the end of the fiscal year. The Securities and Futures Commission has proposed shortening the period of four months to allow earlier disclosure to the public.

The Sarbanes-Oxley Act and other new regulations in the United States emphasize on more timely and transparent financial disclosures and greater accountability for financial reporting undertaken by the board of directors (Jensen and Fuller, 2003). The Securities and Exchange Commission in the United States ruled recently to shorten the statutory due date from 90 to 60 days for 10-K filing (Griffin, 2003). In a legal environment different from the United States, we argue that the association between earnings news and the release timing of financial reports is also weak. Because of the change in the corporate governance context, this paper posits that board characteristics are important determinants for the timeliness of annual reports, thus leading to Hypothesis H1.

H1: Ceteris paribus, there is no association between earnings news and the release timing of annual reports.

In previous research, there is limited attention in examining different board characteristics that may affect a listed Taiwanese company in choosing the release date of its annual report. This paper attempts to fill this gap and control for possible firm-specific and technological factors. We employ *reporting lag* as a measure of the timeliness effect, which is defined as the number of days between fiscal year-end and the annual report filing date.

Board Characteristics

The board of directors has the ultimate responsibility for the implementation of corporate governance in a company. For a more timely annual report filing, there must exist more efficient monitoring, communication, and coordination within the board. As more directors are added to the board, the benefit may be overwhelmed by poor communication and decision-making (Jensen, 1993). Empirical evidence shows an inverse association between board size and firm value (Yermack, 1996; Eisenberg et al., 1998). Thus, based on the board-size effect, there is ineffectiveness in communication and coordination as board size increases, and a company may take longer time in releasing its annual report, leading to hypothesis H2.

H2: Ceteris paribus, board size is positively related to the reporting lag.

One possible explanation for firms with small boards attaining higher profitability in relation to their industry peers is due to the composition of the board. (Eisenberg et al., 1998). When a large board size is expanded due to the pressure to add family members or relatives to the board, such additions might not optimize the firm's value. In this situation, the board tends to show little dissent among members, but lessens the monitoring to management. La Porta et al. (1999) define a corporate having a controlling shareholder (ultimate owner) if this shareholder's direct and indirect voting rights in the firm exceed 20%. Since the boards that are dominated by ultimate owners' interests are not perfectly aligned with outside investors, they have no incentive to release annual reports earlier and are more likely to retain the reports until the statutory due date, which leads to hypothesis H3.

H3: Ceteris paribus, the percentage of ultimate owners on the board is positively related to the reporting lag.

Another feature that affects the composition of the board is the inclusion of independent directors. The primary responsibility of independent directors is to oversee the company's internal control system, the acquisition and disposal of assets, and lending or endorsement events. The board should consider the opinions of the independent directors and record them in the minutes of board meetings. The implementation of the independent directors' mechanism began from February 2002 in Taiwan. In the first stage, the Taiwan Stock Exchange requested that every IPO firm should include two independent directors on the board. Lately, it recommends to all listed companies to have independent directors in the second stage.

The function of an independent director in Taiwan is slightly different to the audit committee in the United States, in which members of an audit committee meet regularly with outside auditors and internal financial managers to review the firm's financial reporting process (Klein, 2002). This indicates lengthy communication and decision-making in the firm as well as on the board. Thus, these arguments lead to hypothesis H4.

H4: Ceteris paribus, the percentage of independent directors on the board is positively related to the reporting lag.

Control Variables

The timeliness of annual reports also depends upon information technology change, the demand pressure from a diverse investor base, a firm's growth opportunities, and the extent of audit procedures. We incorporate controls for their potential impacts on the reporting lag described as below.

The availability of a company's audited annual report over the Internet provides condensed and accelerated information to the market, and theoretically most investors can view the reports online which simultaneously reduces the cost of obtaining financial information (Asthana and Balsam, 2001). However, the cost is not homogeneous during the implementation of MOPS (Market Observation Post System) in Taiwan. There are many transitions in the MOPS - for example, in the pre-stage of the MOPS, investors interested in a listed firm's financial reports had to go to a nearby brokerage office for retrieval. The MOPS then offered free access over the Internet beginning in July 1999. Other financial information for retrieval, such as important events and operations overview, were added into the MOPS in August 2002. In addition, regulators have promoted more timely annual reports in recent years. Thus, we predict that the releases of annual reports for the post-2002 fiscal years are negatively related to the reporting lag. This control variable is a proxy for technological changes by assigning a value 1 if the fiscal year belongs to 2002-2004, and 0 otherwise.

Due to individual investors having no private information, they are eager to receive timely annual reports and be sure that their interests are well protected. Sengupta (2004) argues that the demand for timely disclosure should be greater when investors are trading more frequently, or for firms that have a greater number of shareholders outstanding. This suggests that trading volume is negatively related to the reporting lag. We measure the trading volume as the total number of shares traded over the fiscal year divided by total shares outstanding at fiscal year-end. Institutional investors have the potential to influence management's activities directly through their ownership and indirectly by trading their shares (Gillan and Starks, 2003). Empirical evidence provides supporting evidence that institutions are better at monitoring and in gathering information (e.g., Carleton et al., 1998; Gillan and Starks, 2000; Hartzell and Starks, 2003). Since institutions invest on the behalf of others, they also demand timely annual reports. Thus, we predict that institutional ownership is negatively related to the reporting lag.

In a broader definition, Shleifer and Vishny (1997) define corporate governance as "the ways in which the suppliers of finance to corporations assure themselves of getting a return on their investment." Aside from investors, debtholders are also suppliers of finance. However, there are two contrasting views in the literature on the relationship between the debt level and the reporting lag. On the one hand, because managers' interests are unlikely to be perfectly aligned with debtholders, they have incentives to invest sub-optimally (Jensen and Meckling, 1976). Debtholders thereby need timely financial reports to assess the compliance of the clauses in debt contracts. On the other hand, the probability of being under financial distress is associated with an increased level of debt, which leads to more time in verification as found in empirical studies of other countries (e.g., Carslaw and Kaplan, 1991; Ismail and Chandler, 2003; Owusu-Ansah, 2000). Thus, we predict that the debt level is positively related to the reporting lag. We measure the debt level as the debt to total assets ratio at the end of the fiscal year.

We argue that the predicted sign for the debt level contrary to institutional ownership can also be explained by the difference in terms of legal protection. Unlike shareholders, debtholders obtain certain rights, such as the ability to repossess some of the firm's assets (collateral) or the opportunity to throw the firm into bankruptcy. In contrast, shareholders may never get anything back if the firm is liquidated (Shleifer and Vishny, 1997). Thus, the timeliness of annual reports may not be a primary concern for debtholders.

Firms with a longer history have more information circulating in the market. Zhang (2006) uses firm age as a proxy variable for information uncertainty and suggests that more transparent disclosure might reduce information uncertainty and speed the absorption of new information into the stock prices. He argues that older firms are more likely to be in more mature industries, and thereby firm age also captures the underlying volatility at the industry level. As a result, older firms have less information uncertainty, and the pressure upon them to release timely reports is lower than for young firms. Hence, this leads to the prediction that firm age is positively related to the reporting lag. We measure firm age as the number of years since the firm is listed on the Taiwan Stock Exchange.

Previous studies indicate that the reporting lag is inversely associated with firm size. Because large firms have experienced accounting staffs, sophisticated accounting information systems, and a well-established internal control, they tend to be followed by a large number of analysts who demand timely financial information in order to confirm or revise their expectations (Owusu-Ansah, 2000; Sengupta, 2004). Thus, we predict that firm size is negatively related to the reporting lag. We measure firm size as the natural log of the market value of common equity at the close of two days prior to the annual report filing date. Based on the good news early and bad news late hypothesis, managers are likely to manipulate the release timing of annual reports according to the direction of earnings news as discussed in the previous section. However, this paper hypothesizes in H1 that there is no association between earnings news and the reporting lag. Thus, we do not predict the direction of this relationship. We measure earnings news as the net income change in percentage terms, defined as net income in year t minus net income in year t-1, and

divided by the absolute value of net income in year t-1. Haw et al. (2000) use the net income change as a proxy for earnings news, because no earnings forecasts are publicly available in the country studied.

Firms with high growth opportunities generally lead to greater variability in sales or earnings growth, in which auditors and managers are likely to spend more time verifying any abrupt growth news. Thus, we predict that growth opportunities are positively related to the reporting lag. The proxy variable for growth opportunities is the adjusted sales growth, defined as the firm's sales growth minus the industrial median sales growth. La Porta et al. (2002) suggest that the use of sales rather than earnings growth avoids dealing with the volatility and manipulability of earnings. In addition, the consideration of industrial median sales growth helps control different stages of maturity and growth industries.

Audited annual reports are a joint product of the firm and auditors. Therefore, the timeliness of annual reports also depends upon the quality of the work performed by auditors. It is shown that auditor size is a proxy for audit quality - the bigger the auditor is as measured by the number of current clients, the less incentive the auditor has to behave opportunistically, and the higher the perceived quality will be of the audit (DeAngelo, 1981). Hence, to control for the audit quality, we use a dummy variable that has a value of 1 if the annual report is audited by one of the Big 4 auditors, and 0 otherwise. Prior to the mergers of accounting firms, the Big 4 auditors were referred to as the Big 5. For convenience, we refer only to the Big 4 throughout the paper. Table 1 summarizes the description of the variables used in this analysis.

Table 1: Definition of Variables Used in the Analysis

Variable	Description
Reporting lag	Number of days between fiscal year-end and the annual report filing date.
Unexpected reporting lag (URL)	Reporting lag in year t-1 minus the reporting lag in year t. A positive URL indicates that the annual report is filed earlier than the previous year. A negative URL indicates that it is filed later than the previous year.
Board size	Number of directors on the board at the end of the fiscal year. Source: TEJ Controlling Shareholding and Ownership Structure Database #5.
Ultimate owners	Percentage of ultimate owners on the board at the end of the fiscal year. Source: TEJ Controlling Shareholding and Ownership Structure Database #47.
Independent directors	Percentage of independent directors on the board at the end of the fiscal year. Source: TEJ Controlling Shareholding and Ownership Structure Database #42 and #5.
Technological changes	Dummy variable that has a value of 1 if the fiscal year of the annual report belongs to 2002-2004, and 0 otherwise.
Volume	Total number of shares traded over the fiscal year divided by total shares outstanding at fiscal year-end.
Institutional ownership	Percentage of common shares held by institutions. Source: TEJ Controlling Shareholding and Ownership Structure Database #64.
Debt to assets ratio	Debt to total assets ratio at the end of the fiscal year.
Firm age	Number of years since the firm listed on the Taiwan Stock Exchange
Firm size	Natural log of the market value of common equity at the close of two days prior to the annual report filing date.
Net income change	Net income in year t minus net income in year t-1, and divided by the absolute value of net income in year t-1.
Adjusted sales growth	Firm's sales growth minus the industrial median sales growth.
Big 4 auditors	Dummy variable that has a value of 1 if the annual report is audited by a Big 4 accounting firm, and 0 otherwise. Prior to the mergers of accounting firms, the Big 4 were referred to as the Big 5. For convenience, we refer only to the Big 4 throughout the paper.
Unexpected earnings	Actual earnings per share minus the last forecast earnings per share made by analysts.

Sample and Data Sources

We collect listed companies' electronic filing dates from the MOPS for the releases of annual reports from 1998-2004, since 1998 is the first fiscal year for which annual reports appear in the MOPS. The sample includes non-financial companies listed on the Taiwan Stock Exchange. Data on firm and board characteristics as well as earnings forecasts are obtained from the Taiwan Economics Journal (TEJ) database. We exclude reporting lags above 180 days due to possible outliers and/or data entry errors. There are few companies that adopt a non-calendar fiscal year, and they are deleted from the sample. Due to filing dates in the fiscal year of 1998 are used to calculate the unexpected reporting lag, the sample period studied covers fiscal years from 1999 to 2004. This results in a final sample of 2,976 firm-year observations.

RESULTS

Descriptive Statistics

The statutory filing due date for annual reports is at the end of April for those companies that adopt a calendar fiscal year. Hence, the reporting lag is between 120 to 121 days (because of a leap day). There is no technical violation in case April 30 or May 1 is a holiday, such that the reporting lag may appear to be above 120 days. As Table 2 shows, the reporting lag varies among industries from the lowest mean of 109.27 days for tourism to the highest mean of 120.66 days for the automobile industry, and a mean of 116.49 days for all companies. Interestingly, the median values of the filing date cluster around April 28 and April 29, and the third quartile is around April 30.

Table 2: Descriptive Statistics of Reporting Lag (Filing Date)

Industry	N	Mean	First quartile	Median	Third quartile
Cement	50	119.58	118 (4/28)	120 (4/30)	121 (4/30)
Foods	119	116.73	115 (4/25)	119 (4/29)	120 (4/30)
Plastics	104	116.74	115 (4/25)	118 (4/28)	120 (4/30)
Textiles	297	117.71	115 (4/25)	119 (4/29)	120 (4/30)
Electronic and Machinery	169	116.63	115 (4/25)	119 (4/29)	120 (4/30)
Appliance and Cable	87	119.32	117 (4/27)	119 (4/29)	121 (4/30)
Chemicals and Biotech	164	115.77	113 (4/23)	118 (4/28)	120 (4/30)
Glass and Ceramics	40	119.78	118 (4/28)	120 (4/30)	122.5 (5/02)
Paper and Pulp	44	116.25	114 (4/24)	118 (4/28)	120 (4/30)
Steel and Iron	157	113.87	113 (4/23)	118 (4/28)	120 (4/30)
Rubber	56	117.38	113 (4/23)	118 (4/28)	121 (4/30)
Automobile	32	120.66	120 (4/30)	120 (4/30)	121.5 (5/01)
Electronics	1,060	116.11	116 (4/26)	119 (4/29)	120 (4/30)
Construction	167	116.10	113 (4/23)	119 (4/29)	120 (4/30)
Transportation	95	117.38	116 (4/26)	119 (4/29)	120 (4/30)
Tourism	34	109.27	102 (4/12)	114.5 (4/26)	117 (4/27)
Wholesale and Retail	68	118.06	118 (4/28)	119.5 (4/29)	120 (4/30)
Others	233	116.12	115 (4/25)	119 (4/29)	120 (4/30)
All companies	2,976	116.49	115 (4/25)	119 (4/29)	120 (4/30)

This table reports the summary statistics of the reporting lag and the annual reports' filing date (in parenthesis) for fiscal years 1999-2004. The reporting lag is defined as the number of days between fiscal year-end and the annual report filing date.

Table 3 presents summary statistics for variables of interest. Although the optimal board size is debatable in the existing literature, the median (mean) board size in our sample is 7 (7.362) directors, which is smaller than Jensen's (1993) median (mean) board size of 12 (12.25) directors taken from a sample of American companies for 1984-1991. The mean (median) of percentage of ultimate owners on the board is about 65.7% (64.3%), which is consistent with the argument that Taiwanese listed companies are predominated by a high ownership concentration. Because the inclusion of independent directors is at its initiative stage, the mean is only 4.1%.

The correlations of key variables and board characteristics are of particular interest. The board size is negatively correlated with the percentage of ultimate owners on the board. As the board size expands, unless controlling shareholders introduce family members into the board, the controlling power is otherwise diluted. There is an inverse correlation between the percentage of independent directors and ultimate owners on the board as well. Because those firm characteristics, such as firm age and firm size are highly correlated with board characteristics, we incorporate these variables to control for their possible influences on the timeliness of annual report analysis.

Table 3: Descriptive Statistics on Firm and Board Characteristics

				Correlation with	
Characteristics	**Mean**	**Median**	**Std. dev.**	**(J)**	**(K)**
(A) Firm age (years)	9.713	7.000	9.531	0.307***	0.226***
(B) Firm size	8.465	8.316	1.401	0.231***	0.090***
(C) Volume	2.437	1.736	2.278	-0.118***	0.009
(D) Debt to assets ratio	0.406	0.404	0.160	0.044**	0.063***
(E) Net income change	-2.072	0.108	57.606	0.017	-0.033*
(F) Adjusted sales growth	0.054	-0.008	0.835	-0.005	-0.039**
(G) Institutional ownership	0.356	0.332	0.216	0.148***	0.026
(H) Independent directors	0.041	0.000	0.103	-0.063***	-0.262***
(I) Big 4 auditors	0.815	1.000	0.388	-0.021	-0.025
(J) Board size	7.362	7.000	3.261	1.000	-0.084***
(K) Ultimate owners on the board	0.657	0.643	0.219	-0.084***	1.000

*This table reports summary statistics of key variables, and Pearson correlation coefficients with (J) Board size and (K) Ultimate owners on the board as shown in the last column. The symbols *, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively.*

Earnings News and Reporting Lag

Our hypothesis H1 predicts that there is no association between earnings news and the reporting lag. Panel A of Table 4 displays the unexpected reporting lag (URL) sorted into decile portfolios based on net income change as a proxy for unexpected earnings news. URL is defined as the reporting lag in year t-1 minus the reporting lag in year t. A positive URL indicates that the annual report is filed earlier than the previous year, and a negative URL indicates that it is filed later than the previous year. Portfolio 1 contains the most negative net income change labeled as "bad news". In contrast, Portfolio 10 contains the most positive and largest net income change labeled as "good news". Based on the good news early and bad news late hypothesis, bad news portfolios must have negative URLs and good news portfolios must have positive URLs. In Portolios 1 and 3 (representatives of bad news) and Portfolios 9 and 10 (representatives of good news), their URLs have the proper sign, but are statistically insignificant except for Portfolio 9. Additionally, we test if the URL of Portfolio 10 is significantly different from Portfolio 1. Both parametric and non-parametric tests indicate an insignificant difference between them.

In panel B of Table 4, we use analysts' forecast error as the proxy for unexpected earnings news, which is defined as the actual EPS minus the last forecast EPS made by analysts. Although there are a few companies whose earnings are not followed by analysts or they are shown as missing data in the database,

we still find no systematic relation between earnings news and the reporting lag as predicted in H1. This result is robust by using the average forecast EPS during the year instead of the last forecast EPS (not reported).

Table 4: Portfolios of Unexpected Reporting Lag Formed on Earnings News

	(A) Net income change		(B) Unexpected earnings	
Portfolio	**URL (n=2668)**	**t-statistics**	**URL (n=2553)**	**t-statistics**
P1 (bad news)	-0.485	(-0.71)	0.486	(0.52)
P2	0.959	(1.26)	-0.996	(-1.09)
P3	-0.603	(-0.79)	0.902	(1.13)
P4	0.479	(0.58)	0.742	(0.85)
P5	0.337	(0.39)	0.199	(0.27)
P6	-0.719	(-0.93)	0.984	(1.39)
P7	0.491	(0.66)	1.318	(1.62)
P8	0.682	(0.80)	0.020	(0.02)
P9	1.708**	(2.03)	0.344	(0.43)
P10 (good news)	1.147	(1.47)	0.115	(0.12)
P10-P1	1.632	(1.57)	-0.371	(-0.28)
P10-P1 Wilcoxon z-score (Wilcoxon p-value)	1.078 (0.28)		-1.181 (0.24)	

*This table reports the mean URL (unexpected reporting lag), which is defined as the reporting lag in year t-1 minus the reporting lag in year t. A positive URL indicates that the annual report is filed earlier than the previous year. A negative URL indicates that it is filed later than the previous year. The URLs are sorted into decile portfolios based on (A) net income change and (B) unexpected earnings (actual EPS minus the last forecast EPS). The t-tests for individual portfolios test the null hypothesis that the portfolio mean URL is not significantly different from zero. P10-P1 tests the null hypothesis that the URL of P10 is not significantly different from P1. The symbol ** represents significance at the 5% level based on a two-tailed test.*

Board Characteristics and Reporting Lag

Table 5 presents the three model specifications. In Model (1) we include the board size variable in the regression after controlling for the effects of firm and other characteristics, and the coefficient for board size is significantly negative ($p<0.1$). This result seems to contradict the board-size effect as predicted in H2. However, the intercept in Model (1) is 117.139 days higher than the intercepts in Models (2) and (3) at 115.136 days and 115.347 days, respectively. The intercept of the regression can be explained as the average days of the reporting lag when explanatory variables are zero. Thus, with a member added to the board, the reporting lag is reduced by an average period of 0.09 days.

In Model (2) of Table 5 we replace the percentage of ultimate owners into the regression analysis, and the coefficient is significantly positive at 3.333 days ($p<0.01$), which is consistent with our prediction in H3. The same result appears in Model (3), in which the ultimate owners variable countervails the impact of the board size, but remains statistically significant with a coefficient of 3.194 days ($p<0.01$), and the board size variable turns insignificant. Although the inclusion of independent directors increases the reporting lag as predicted in H4, it is not significant in the three models.

In respect of controlling firm characteristics, the presence of institutional ownership reduces the reporting lag to about 2.9 days ($p<0.01$), technological changes decreases the reporting lag to about 1.6 days ($p<0.01$), and volume shows only a decrease of 0.2 days ($p<0.05$ and $p<0.1$) as shown in Table 5. If volume is a measure for the magnitude of individual investors that a company has, then we see that institutional ownership has higher monitoring power than individual investors regarding the timeliness of accounting reports. The results are as predicted and robust across the three models in Table 5.

A firm's reporting lag by contrast increases with the debt level, which shows a significant coefficient of 5.12 days ($p<0.01$), while firm age presents a positive coefficient of 0.081 days ($p<0.01$) in Model (3). The results are as predicted and robust with Models (1) and (2).

The remaining control variables have the predicted sign, but do not reach statistical significance. For example, the variable for the Big 4 auditors has no significant impact on the reporting lag, since the audit quality is quite homogeneous as about 81.5% of companies are audited by the Big 4 in our sample. It is worth noting that the coefficient of net income change is small and insignificant, which provides little support to the good news early and bad news late hypothesis. Overall, the three models are significant (F values<0.0001) although the adjusted R^2 values are low, ranging from 2.31% to 2.68%.

Table 5: Determinants of the Reporting Lag with Controls for Firm Characteristics

Independent variables	Predicted sign	Dependent variable: reporting lag		
		Model 1	Model 2	Model 3
Intercept		117.139***	115.136***	115.347***
		(75.38)	(73.69)	(71.72)
Board size	+	-0.090*		-0.047
		(-1.89)		(-0.94)
Ultimate owners	+		3.333***	3.194***
			(3.91)	(3.58)
Independent directors	+	0.602	2.139	2.076
		(0.26)	(0.90)	(0.87)
Technological changes	-	-1.656***	-1.607***	-1.624***
		(-4.29)	(-4.20)	(-4.22)
Volume	-	-0.229**	-0.206*	-0.214*
		(-2.02)	(-1.85)	(-1.90)
Institutional ownership	-	-2.889***	-2.915***	-2.886***
		(-3.08)	(-3.10)	(-3.08)
Debt to asset ratio	+	5.384***	5.074***	5.120***
		(4.53)	(4.28)	(4.30)
Firm age	+	0.097***	0.077***	0.081***
		(4.72)	(3.94)	(3.92)
Firm size	-	-0.069	-0.154	-0.131
		(-0.43)	(-0.97)	(-0.82)
Net income change	?	0.001	0.001	0.001
		(0.51)	(0.72)	(0.72)
Adjusted sales growth	+	0.171	0.221	0.214
		(0.38)	(0.50)	(0.48)
Big 4 auditors	+	0.138	0.159	0.149
		(0.28)	(0.33)	(0.31)
Number of observations		2976	2976	2976
Adjusted R^2 (%)		2.31	2.68	2.67
F-value.		7.39***	8.45***	7.79***

*This table reports the mean reporting lag regressed on the independent variables: board size (number of directors on the board); ultimate owners (percentage on the board); independent directors (percentage on the board); technological changes (1 = fiscal year belongs to 2002-2004, 0 = otherwise); volume (total number of shares traded divided by total shares outstanding); institutional ownership (in percentage); debt to assets ratio (at the end of fiscal year); firm age (number of years since the firm listed); firm size (natural log of the market value of common equity); net income change (change in percentage); adjusted sales growth (sales growth adjusted by the industrial median sales growth); Big 4 auditors (1 = Big 4, 0 = otherwise). The maximum VIF among variables is 1.37888, which means that there is no severe multicollinearity problem. The White's (1980) heteroscedasticity-corrected standard errors are in parentheses. The symbols *, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively.*

Additional Analysis

In this subsection, we further classify the sample observations according to: (1) the median of the board size, and (2) under different ownership structures. The purpose is to examine whether different partitions of observations have different release timings of annual reports.

In Table 6 we divide the sample into large board (size>=7) and small board (size<7) sizes based on the median value reported in Table 3. The intercept of a large board size (118.427 days) is higher than that of a small board size (108.93 days). Although it is higher, the presence of institutional ownership significantly reduces the reporting lag by 3.246 days ($p<0.05$). The coefficients of ultimate owners are significantly positive in both the large and small board sizes. However, independent directors on a small board size have positive impacts on the reporting lag (5.495 days, $p<0.1$), but not for large board sizes. The coefficients on volume still show a small negative influence on the reporting lag, and finally the coefficients on the debt to asset ratio have the predicted sign with 4.071 days ($p<0.05$) for large board size and 5.829 days ($p<0.01$) for small board size. Overall, the regressions are significant (F values <0.0001) with adjusted R^2 values of 3.78% and 2.09% for large and small board sizes, respectively.

Table 6: Determinants of the Reporting Lag under Different Board Sizes

Independent variables	**Predicted sign**	**Dependent variable: reporting lag**	
		Board size >= 7	**Board size < 7**
Intercept		118.427***	108.930***
		(55.42)	(38.00)
Board size	+	0.032	0.223
		(0.37)	(0.61)
Ultimate owners	+	3.137**	3.320**
		(2.43)	(2.48)
Independent directors	+	-2.440	5.495*
		(-0.78)	(1.84)
Technological changes	-	-1.256**	-1.882***
		(-2.27)	(-3.06)
Volume	-	-0.211*	-0.244*
		(-1.79)	(-1.83)
Institutional ownership	-	-3.246**	-1.440
		(-2.55)	(-0.91)
Debt to asset ratio	+	4.071**	5.829***
		(2.38)	(3.30)
Firm age	+	0.111***	0.033
		(3.96)	(0.79)
Firm size	-	-0.566***	0.460*
		(-2.81)	(1.91)
Net income change	?	0.000	0.002
		(0.01)	(0.40)
Adjusted sales growth	+	0.707	0.156
		(0.84)	(0.46)
Big 4 auditors	+	0.026	0.478
		(0.04)	(0.63)
Number of observations		1715	1261
Adjusted R^2 (%)		3.78	2.09
F-value.		6.61***	3.24***

*This table reports the mean reporting lag regressed on the independent variables: board size (number of directors on the board); ultimate owners (percentage on the board); independent directors (percentage on the board); technological changes (1 = fiscal year belongs to 2002-2004, 0 = otherwise); volume (total number of shares traded divided by total shares outstanding); institutional ownership (in percentage); debt to assets ratio (at the end of fiscal year); firm age (number of years since the firm listed); firm size (natural log of the market value of common equity); net income change (change in percentage); adjusted sales growth (sales growth adjusted by the industrial median sales growth); Big 4 auditors (1 = Big 4, 0 = otherwise). The maximum VIF among variables is 1.42969, which means that there is no severe multicollinearity problem. The symbols *, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively.*

Table 7 presents different partitions of the sample based on the critical levels of 20% and 50%. We choose the critical 20% and 50% levels, because generally speaking, less than 20% of ultimate owners on the board have little influence on the board. Ultimate owners between 20% and 50% have significant

influences, and finally, ultimate owners above 50% on the board have decisive influences.

Table 7: Determinants of the Reporting Lag under Different Ownership Structures

Independent variables	Predicted sign	Dependent variable: reporting lag		
		Ultimate owners <20%	Ultimate owners >=20% and <50%	Ultimate owners >=50%
Intercept		125.859***	115.430***	114.044***
		(12.44)	(17.02)	(64.63)
Board size	+	1.089***	-0.094	-0.105*
		(4.52)	(0.71)	(-1.83)
Ultimate owners	+	-11.642	15.373*	4.159***
		(-0.28)	(1.75)	(3.32)
Independent directors	+	-0.752	-3.972	4.896*
		(-0.02)	(-0.84)	(1.79)
Technological changes	-	-0.833	0.599	-1.966***
		(-0.34)	(0.47)	(-4.85)
Volume	-	0.866	-0.075	-0.236*
		(0.97)	(-0.30)	(-1.86)
Institutional ownership	-	-15.206	0.007	-3.222***
		(-1.54)	(0.00)	(-3.18)
Debt to asset ratio	+	-8.317	7.560**	4.654***
		(-0.70)	(2.08)	(3.64)
Firm age	+	-0.019	0.206**	0.088***
		(-0.15)	(2.40)	(4.06)
Firm size	-	-1.641	-1.008*	0.003
		(-1.24)	(-1.79)	(0.02)
Net income change	?	-0.198	-0.047	0.001
		(-1.55)	(-1.28)	(1.11)
Adjusted sales growth	+	-9.526***	-0.116	0.438
		(-4.70)	(-0.38)	(0.74)
Big 4 auditors	+	3.659	-0.831	0.360
		(1.32)	(-0.74)	(0.66)
Number of observations		47	467	2462
Adjusted R^2 (%)		57.69	3.48	3.00
F-value.		6.23***	2.40***	7.33***

*This table reports the mean reporting lag regressed on the independent variables: board size (number of directors on the board); ultimate owners (percentage on the board); independent directors (percentage on the board); technological changes (1 = fiscal year belongs to 2002-2004, 0 = otherwise); volume (total number of shares traded divided by total shares outstanding); institutional ownership (in percentage); debt to assets ratio (at the end of fiscal year); firm age (number of years since the firm listed); firm size (natural log of the market value of common equity); net income change (change in percentage); adjusted sales growth (sales growth adjusted by the industrial median sales growth); Big 4 auditors (1 = Big 4, 0 = otherwise). The maximum VIF among variables is 4.82841, which means that there is no severe multicollinearity problem. The White's (1980) heteroscedasticity-corrected standard errors are in parentheses for ultimate owners >=20% and <50%, and ultimate owners >=50%. The symbols *, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively.*

After controlling for firm characteristics, we find that the board-size effect only appears in the group of ultimate owners below 20%, which has the highest intercept among the three groups (125.859 days). Despite the number of observations being small, the adjusted R^2 reaches 57.69%. In the case of ultimate owners on the board being between 20% and 50%, the intercept is 115.43 days, and the coefficient on the ultimate owners variable has a significantly positive impact on the reporting lag, which is 15.373 days ($p<0.1$). Finally, the intercept for ultimate owners above 50% is 114.044 days, and the coefficients on the ultimate owners and independent directors variables are significantly positive as predicted. This result can be explained that for a company with the ultimate owners above 50%, the magnitude of board size does not appear to have communication and coordination problems as discussed in the past literature. Since the interests of ultimate owners are not always aligned with outside investors, the former have no incentive to release an earlier annual report. Contrary to the monitoring role of independent directors, they take a longer time in verifying material accounting events, such that the coefficient is positively related to the

reporting lag.

CONCLUSIONS

This paper provides a different picture of the determinants of the release timing of annual reports in Taiwan. We show that the behavior of good news early and bad news late does not exist during our sample study period. We address several board and firm characteristics that are key features in determining the reporting lag of a company.

First, after controlling for firm-specific characteristics, we find that there is no impairment of communication and coordination with the magnitude of the board size, as it has no positive association with the reporting lag. The only exception occurs when less than 20% of ultimate owners are on the board.

Second, the presence of ultimate owners in the board has a positive and significant impact on the reporting lag. One possible explanation taken from the agency theory is that controlling shareholders' interests are not always aligned with outside investors, and the former have no incentive to release a more timely annual report.

Third, the inclusion of independent directors on the board also increases the reporting lag, but this result may be due to their monitoring role as they must spend more time in verifying a company's material accounting events.

Fourth, audited annual reports are the most cost-effective way for minority shareholders to collect information and monitor management. This paper shows that institutional shareholders have more influence on timely financial reporting than individual investors. In addition, information technological changes that lower the cost of obtaining annual reports and the promoting attitude by regulators both help to reduce the reporting lag.

The worldwide corporate environment has changed through the promotion of corporate governance in protecting suppliers of finance. Although we cannot find all the determinants of the release timing of annual reports in this paper, a firm's board characteristics and several firm-specific attributes have important relationships to the implementation of corporate governance. There is a substantial strain of literature discussing the corporate governance system of other countries, particularly the United States, Germany, and Japan, but our understanding of corporate governance in Taiwan remains limited. It would certainly be promising to see more future studies on the role of institutional investors, as well as on changes in the technological and regulatory environment for better corporate governance.

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BIOGRAPHY

Chen-Hui Wu is assistant professor of finance at I-Shou University. Her main research interests are behavioral finance, corporate governance, corporate finance and financial accounting.

Chin-Shun Wu is professor of finance at National Sun Yat-sen University. His main research interests are financial management, corporate governance, securities market structure and corporate finance.

Victor W. Liu is an adjunct professor of finance at National Sun Yat-sen University. His main research interests are financial management, management of financial institutions and managerial economics.

MARKET VALUATION RESPONSES TO GOODWILL ANNOUNCEMENTS: AN EARLY DIRECT TEST OF FASB 142

Halil Kiymaz, Rollins College
Roberto Marchesini, University of Houston-Clear Lake
Robert F. Hodgin, University of Houston-Clear Lake

ABSTRACT

This study provides evidence from an early direct test of the Financial Accounting Standards Board (FASB) 142 policy statement regarding investor market reaction to corporate goodwill impairment announcements. Under new rules, the amortization of goodwill is replaced with a two-step procedure to determine if goodwill is impaired. We draw a sample of 188 firms announcing impairment tests during the period of 2001-2003 to investigate market reactions. The findings for overall sample indicate that firms with impairment test announcements experience statistically significant negative abnormal returns. The findings further show that the abnormal returns are negative for NYSE and AMEX+NASDAQ listed stocks. When we analyze the industry affiliation of firms and abnormal returns based on the primary SIC of firms, we find varying market reactions to goodwill announcements among industries. The findings are consistent with an information efficiency view of the market and one other related study of similar design, conducted before the effective date of FASB 142.

JEL: G14, M41

INTRODUCTION

With the June 2001 release of the Financial Accounting Standards Board (FASB) Statement 142, the accounting profession changed its criteria for goodwill reporting in corporate consolidations. The statement aims to recast how to account for goodwill, and in so doing, improve both the assessment and reporting of goodwill's economic value in the merged enterprise. The statement's language shifts goodwill accounting from a fixed amortization of no more than 40 years, to an asset whose life span and value to the reporting unit must be tested annually. The profession expects that the new reporting criteria will more clearly reveal the combined enterprise's goodwill value to both analysts and investors.

The 1980's merger and acquisition wave and the growing importance of goodwill as a percentage of post-merger assets re-focused the accounting profession's attention on goodwill's value and measurement. Beginning in 1970, Accounting Principles Board (APB) Opinion 16 had provided for two different post-merger goodwill reporting means: the pooling-of-interests method or the purchase method. By permitting alternative goodwill accounting methods, earnings reports for merged operations could differ based on accounting technique alone. The work of making equivalent financial statement comparisons between companies was left to analysts and investors.

Relief from this reporting dualism appeared in FASB Statement 141. Effective for all business combinations after June 30, 2001, that language mandated all post-merger goodwill reporting use the purchase method. The move to a single goodwill accounting method reduced reporting inconsistencies, but left untouched the rather artificial treatment of goodwill as an intangible asset with a predetermined fixed life span.

The integrated view of goodwill's contribution embraced by FASB 142 aims to achieve two objectives:

1) acknowledge goodwill's economic value in a business combination and 2) design a reporting method that improves the transparency of goodwill's contribution. The statement mandates an annual test of goodwill impairment in two steps at the reporting unit level. If the unit's fair value is greater than its carrying amount including goodwill, then goodwill is not impaired and no change in goodwill reporting is required. If the unit's fair value is less than its carrying amount including goodwill, then the company must recognize that difference on the balance sheet and income statement. Academic debate on goodwill accounting centers on how analysts and investors weigh goodwill in their decision to hold or acquire post-merger company stock.

Applying an event methodology, we conduct an early direct test of that expectation. We use abnormal stock returns on 188 companies that either passed or failed the new annual two-step goodwill impairment test after December 15, 2001, the statement's effective date.

LITERATURE REVIEW

Prior to the mid-1990s the research literature on post-acquisition goodwill treatment relied on indirect tests of market information efficiency to see whether analysts and investors peered through a firm's particular accounting treatment to reveal earnings net of goodwill. Conventional wisdom suggested that accounting method alone should not materially affect a post-acquisition firm's market value (Davis 1990 and 1996, McCarthy 1995). Empirical tests conducted before December 2001 to assess the claim of market transparency supported the notion that analysts, at least, and perhaps market investors saw through the accounting fog of goodwill effects on earnings to reveal the basis for firm value.

More recent indirect studies used alternate measures to test market information efficiency regarding goodwill accounting. Moehrle's study (2001) echoed another aspect of conventional thinking by showing statistically that cash flow explains company returns as well as traditional accounting earnings methods, net of extraordinary items. Henning's (2000) investigation optimistically showed that investors appear to distinguish between "core" goodwill that accompanies a merger and "residual" goodwill that investors appear to quickly discount.

Academic debate about goodwill accounting's affect on transparency for analysts and investors continued as the FASB considered alternate means of post-acquisition disclosure. Recent studies have applied direct methodologies to help clarify earlier mixed goodwill reporting findings. Herz (2001) abandoned traditional firm valuation models and stated that the most direct approach on which to base goodwill impairment testing is the firm's current stock price. Hopkins (2000) empirically showed that goodwill accounting method and the number of years since the merger did affect analysts' estimates. Hopkins and his co-authors worried that eliminating the pooling method, thus increasing goodwill expense and lowering net earnings, would depress the affected firms' stock prices.

Norris (2000) finds that reporting goodwill changes negatively affects market value after the quarterly earnings announcement. Their findings hinted that investors looked more at earnings than at cash flow. Jennings' (2001) cross-section investigation further suggests that earnings before goodwill amortization is more useful as a summary indicator of share value. Hirschey (2002) bluntly concludes that if goodwill is impaired, the market will recognize it. The movement in the empirical literature from the relatively benign posture that goodwill accounting has little, if any, effect on investor actions and market value seems to be yielding toward an information-based view that goodwill, and especially unrealized expectations regarding goodwill, matters.

Hirschey and Richardson (2003) review the accounting profession's logical migration on goodwill accounting from APB 16, FASB 141 and FASB 142 to presage future goodwill announcement events and market reaction. They draw their data from 80 goodwill write-off announcements across 32 industries

occurring from 1992-1996. They applied three separate assessment measures to abnormal returns over "long windows" of 255 days encompassing event dates. Their results indicate the market does react negatively to write-off announcements and that the negative reaction continues for some time after the announcement. However, theirs is a pre-FASB 142 effective date investigation.

The next section describes our direct market valuation test of FASB 142 for a sample of 188 firms across ten industries post-December 15, 2001, separated into two subsets. One subset of firms in the working hypothesis amortized goodwill but passed the impairment test. The other subset of firms in the working hypothesis includes firms that failed the impairment test and wrote off goodwill, in whole or in part, to report lower than expected earnings. The results section shows statistically significant market reaction for certain event windows around the firms' goodwill announcement date. We interpret the results as information-based market responses to expectation changes from goodwill announcements.

DATA AND METHODOLOGY

We applied two screening criteria to an initial sample of 209 firms reported in Lexis-Nexis making goodwill announcements post-June 30, 2001. First, firms in the final sample should be traded on the New York Stock Exchange (NYSE), American Stock Exchange-National Association of Securities Dealers Automated Quotations (AMEX-NASDAQ), to ensure that stock returns of firms can be

Table 1: Sample Selection

Panel A: Sample Frequency by Industry Classification

Characteristic	All firms	Impairment passed	Impairment failed
Lexis-Nexis reports	209	106	103
Less: No data on CRSP	13	6	7
Less: Missing data	8	5	3
Net Sample	188	95	93

The panel above shows sample selection frequency by industry classification.

Panel B: Frequency of Sample Firms by Industry Classification

Industry classification	N	%
SIC20-21 Food	11	5.8
SIC26-27 Paper Products/Publishing	10	5.3
SIC28 Chemicals	12	6.5
SIC31-35 Manufacturing	20	10.6
SIC36-38 Electronics/Equipments	36	19.2
SIC48-49 Communications/Utilities	28	14.9
SIC50-58 Retail/Trade	15	7.90
SIC60-63 Financials	10	5.3
SIC73-79 Services	35	18.7
SIC80-87	11	5.8
Total	188	100 %

The panel above shows sample selection frequency by industry classification.

retrieved from the *Center for Research in Security Prices* (CRSP) daily return database. Second, firms with missing data on the CRSP database were eliminated. The net sample consisted of 188 firms making goodwill announcements during the period October 22, 2001 to November 27, 2002, shown in panels A and B of Table 1.

Data in Panel B of Table 1 report the frequency of sample firms by industry classification. Of the total 188 goodwill-related announcements, 36 (19.2%) are in Standard Industrial Classification (SIC) 36-38, 35 (18.7%) are in SIC 70-79, 28 (14.9%) are in SIC 48-49, and 20 (10.6%) are in SIC 31-35. Nearly 45 percent of the firms fell into SIC 31-35 manufacturing, 36-38 electronics, electrical equipment and SIC 48-49 communications and utilities.

The event study methodology measures the abnormal returns--actual company stock return less the regression estimated average market return--for goodwill announcements by the acquiring firms. The single-market model used in the parameter estimation appears as (1) below:

$$R_{i,t} = \alpha_i + \beta_{i,D} \cdot R_{D,t} + \varepsilon_{i,t} \quad (1)$$

Where:

$R_{i,t}$	=	the rate of return on security i on day t,
α_i	=	the intercept term,
$\beta_{i,D}$	=	the slope of the regression line of the firm i's returns against the returns on the market value weighted CRSP Index,
$R_{D,t}$	=	the rate of return on the market value weighted CRSP Index,
$\varepsilon_{i,t}$	=	the residuals.

An abnormal return for common stock of firm i on day t is defined as:

$$AR_{i,t} = R_{i,t} - \hat{R}_{i,t} \quad (2)$$

where,

$$\hat{R}_{i,t} = \hat{\alpha}_i + \hat{\beta}_{i,D} \cdot R_{D,t} \quad (3)$$

and αi, and βi,D, are estimated market model parameters obtained by using the pre-estimation period: t = - 316 days to t = - 61 days. We used 255 days to estimate model parameters for the event window to analyze abnormal returns.

We derive cumulative abnormal returns of firm i (CAR_i) by accumulating $AR_{i,t}$'s over a k-trading period running from day d_1 to day d_2:

$$CAR_i = \sum_{t=d_1}^{d_2} AR_{i,t} \quad (4)$$

Average daily abnormal returns (AARs) is obtained by dividing (4) by N:

$$AAR_t = \left(\frac{1}{N}\right) \cdot \sum_{i=1}^{N} AR_{i,t} \quad (5)$$

Finally, the Cumulative Average Abnormal Returns (CARs) for a sample of N firms across a k-day event window we calculated as follows:

$$CAR = \left(\frac{1}{N}\right) \sum_{t=d_1}^{d_2} \sum_{i=1}^{N} AR_{i,t} \quad (6)$$

The expected values of abnormal returns and average abnormal returns are zero in the absence of abnormal performance. The test for significance follows Brown and Warner (1985). We divided the net total sample along FASB 142 criteria to reveal that 95 firms passed and 93 firms failed the two-step goodwill impairment test criteria.

Table 2: Abnormal Returns Surrounding Goodwill Announcements

Panel A: Average Daily Abnormal Returns (AARs)

			Firms: N=188	
Days	**AARs (%)**	**t-value**	**Positive: Negative**	**Generalized Sign Test**
-10	-0.02	-2.57***	83:105	-1.22
-9	-0.56	-1.34	83:105	-1.22
-8	-0.21	-0.8	91:97	-0.05
-7	-0.06	-0.45	96:92	0.68
-6	-0.2	-1.2	91:97	-0.05
-5	0.41	-0.16	81:107	-1.51
-4	0.09	-0.65	80:108	-1.65
-3	-0.26	-1.45	92:96	0.1
-2	-0.2	-1.22	93:95	0.24
-1	0.04	-0.33	99:89	1.12
0	-0.51	-1.93*	81:107	-1.51
1	-0.67	-0.96	88:100	-0.49
2	-0.71	-1.73*	91:97	-0.05
3	-0.33	-0.45	100:88	1.27
4	-0.28	-0.9	94:94	0.39
5	-0.04	0.42	103:85	1.7
6	0.19	-0.72	93:95	0.24
7	0.34	0.46	95:93	0.54
8	0.27	-0.02	93:95	0.24
9	-0.43	-0.76	84:104	-1.07
10	0.57	0.48	91:95	0.09

The panel above shows average daily abnormal returns (AARs).

Panel B: Cumulative Abnormal Returns (CARs)

			Firms: N=188	
Windows	**CARs (%)**	**t-value**	**Positive: Negative**	**Generalized Sign Test**
(-1, 0)	-0.47	-1.6	84:104	-1.07
(-1, 1)	-1.13	-1.86*	84:104	-1.07
(-5, 5)	-2.46	-2.83***	89:99	-0.34
(-10, 10)	-2.57	-3.56***	80:108	-1.65

*The panel above shows cumulative abnormal returns (CARs). ***, **, and * note significance at the 1%, 5% and 10% levels, respectively. This table presents the abnormal return to firms surrounding the announcement of goodwill write-offs. The null hypothesis is that the average abnormal returns are not statistically different from zero.*

EMPIRICAL RESULTS

The wealth gains of goodwill announcements are calculated by using a market model. The results for the aggregate sample are reported in Table 2. The behavior of the daily abnormal returns to firms with goodwill impairment tests during the 21-day period surrounding the announcement based on a market model is reported in Panel A of Table 2. The average abnormal returns (AARs) are 0.04% and -0.51% on the days -1 and 0 and only results for day 0 are statistically significant at 10%. Furthermore, on the announcement day a majority of firms experience negative abnormal returns (107 out of 188 firms). The cumulative abnormal returns (CARs) may provide a better picture of stock market reactions and hence we report results for various event windows shown in Panel B of Table 2. For the (-1,0) and (-1,+1) windows,

the CARs are -0.47% and -1.13% respectively, but only the CARs on the latter window are weakly significant. When we analyze longer event windows, the findings are strongly negative. For example, the CARs for the window (-10, +10) is -2.57% and are statistically significant at the 1% level.

We, then, divide the sample based on the impairment test results. Data in Panel A of Table 3 below show AARs for each firm subset—those passing and those failing the FASB 142 goodwill impairment test.

Table 3: Abnormal Returns Based on Impairment Test

Panel A: Average Daily Abnormal Returns and t-test Values

	Impairment passed: N=95		Impairment failed: n=93	
Days	**AARs (%)**	**t-value**	**AAR (%)**	**t-value**
-10	0.42	-1.05	-0.47	-2.59***
-9	-0.49	-0.69	-0.63	-1.21
-8	-0.12	-0.35	-0.30	-0.78
-7	0.14	0.19	-0.27	-0.45
-6	-0.66	-1.50	0.27	-0.19
-5	1.01	0.53	-0.21	-0.77
-4	-0.15	-0.44	0.33	-0.48
-3	-0.03	-0.48	-0.50	-1.58
-2	-0.06	-0.44	-0.35	-1.29
-1	0.16	-0.06	-0.08	-0.41
0	-0.50	-0.81	-0.52	-1.94*
+1	-1.38	-2.03**	0.06	0.69
+2	-1.27	-2.07**	-0.13	-0.37
+3	-0.93	-0.60	0.29	-0.04
+4	-0.15	-0.70	-0.41	-0.58
+5	-0.03	0.40	-0.04	0.19
+6	0.87	1.49	-0.50	-2.53**
+7	0.55	0.64	0.12	0.00
+8	1.25	1.07	-0.73	-1.11
+9	-1.33	-1.88*	0.50	0.82
+10	1.24	1.44	-0.09	-0.75

*The above panel shows average daily abnormal returns and t-test values. ***, ** and * note significance at the 1%, 5% and 10% levels.*

Panel A: Cumulative Abnormal Returns and t-test Values

	Impairment passed: N=95		Impairment failed: n=93	
Windows	**CARs (%)**	**t-value**	**CARs (%)**	**t-value**
(-1, 0)	-0.33	-0.61	-0.60	-1.66
(-1, 1)	-1.72	-1.67	-0.54	-0.96
(-5, 5)	-3.33	-2.02**	-1.57	-1.98*
(-10, 10)	-1.48	-1.69*	-3.69	-3.35***

*The above panel shows cumulative abnormal returns and t-test values. ***, **, and * note significance at the 1%, 5% and 10% levels. The table shows the abnormal return to firms surrounding the goodwill announcement date. The sample is divided in two sets based on the impairment test results. The null hypothesis is that average abnormal returns are not statistically different from zero.*

Both subsets experienced negative stock market reaction on the announcement day, and some firms that either passed the impairment test or failed the impairment test show statistically significant returns. For the subset of firms passing the impairment test, significant results appeared for Days +1 and +2, post-goodwill announcement event date. Absent firm-specific information, we interpret the results to mean

investors reacted positively to the news. For the subset of firms failing the impairment test, significant AARs are reported for Day –10 and Day +6. Weakly significant AARs for the event date also appear for these firms. We interpret these findings to mean investors either anticipated negative goodwill news early and/or reacted to the negative goodwill news once they received the information.

Data in the Panel B of Table 2 report Cumulative Abnormal Returns (CARs) for each firm subset—those passing and those failing the FASB 142 goodwill test. The CARs measure captures more of the market reaction and serves as a more inclusive measure of investor reaction. For the 95 firms passing the impairment test no CAR window set of returns is significant above 10 percent, a statistically weak criterion. We interpret this finding to suggest that investors' expectations were confirmed. Since annual goodwill write-downs were not altered, the reporting unit passed the impairment test inducing little or no market reaction based on that information.

Table 4: The Impact of Exchange Traded and Industry Affiliation on Abnormal Returns

Panel A: Abnormal Returns by Exchange Traded Industry

	NYSE: n=86		AMEX+NASDAQ: n=102	
Days	**AARs (%)**	**t-value**	**AAR (%)**	**t-value**
-10	-1.13	-4.06***	0.91	0.24
-1	-0.58	-1.62	0.57	1.04
0	-0.05	-0.02	-0.89	-2.61**
+1	-0.44	0.15	-0.86	-1.44
+10	0.21	0.17	0.89	0.50
Windows	**CARs (%)**	**t-value**	**CARs (%)**	**t-value**
(-1, 0)	-0.64	-1.16	-0.32	-1.11
(-1, 1)	-1.08	-0.86	-1.18	-1.74*
(-5, 5)	-2.39	-1.98*	-2.51	-2.02**
(-10, 10)	-3.76	-3.15***	-1.57	-1.94*

*The above panel shows abnormal returns by exchange traded industry. ***, **, and * note significance at the 1%, 5% and 10% levels respectively.*

Panel B: Abnormal Returns by Industry Affiliation

Windows	**(-1, 0)**		**(-1, 1)**		**(-5, 5)**		**(-10, 10)**	
	CAR (%)	**t-value**	**CAR (%)**	**t-value**	**CAR (%)**	**t-value**	**CAR (%)**	**t-value**
SIC 20-21	2.19	-0.71	2.35	-0.61	4.47	-1.23	4.55	-0.77
SIC 25-27	-1.26	-1.13	-2.79	-1.94*	-5.43	1.99*	-7.86	-2.08**
SIC 28	2.79	3.59***	2.79	3.60***	-5.27	-0.28	-11.12	-1.24
SIC 31-35	-1.17	-1.30	-4.50	-2.54**	-6.97	-2.79**	-8.76	-2.07**
SIC 36-38	0.32	-0.42	-0.60	-0.77	-3.85	2.32**	-7.71	-3.79***
SIC 48-49	-3.74	-2.89**	-6.15	-3.20***	-10.44	-2.77**	-3.55	-1.64
SIC 50-59	-0.93	-0.32	0.30	1.23	7.98	2.84**	9.41	2.11**
SIC 60-63	0.20	-0.19	-0.36	-0.53	-6.14	-2.12*	-10.44	-2.49**
SIC 70-79	-1.64	-1.94*	-1.11	-1.49	1.58	-0.40	2.68	-0.22
SIC 80-87	4.84	-1.12	6.99	-1.43	5.74	-0.48	9.11	-0.36

*The above panel shows abnormal returns by industry affiliation. ***, **, and * note significance at the 1%, 5% and 10% levels respectively.*

In contrast, firms failing the goodwill impairment test, show highly significant and negative CARs for the +/- 10 day event window. Investors apparently respond to announcements revealing goodwill write-off due to the FASB 142 test. In general, results from our direct test provide evidence that announced changes in goodwill write-offs do inform investors, some of whom react by selling company stock, likely in the face of unexpected goodwill impairment. For companies passing the FASB 142 goodwill test, the lack of new

information flowing to investors prompts no or muted market response. We emphasize that the CARs data results for each firm group, those passing as well as those failing the FASB 142 criteria, are logically consistent with a market information efficiency view.

In Table 4, we report stock reaction of firms based on both the exchange in which stock is traded and industry affiliation of firms. Panel A of Table 4 reports the variation in stock price reaction based on the exchange listing. The majority of firms (102 out of 188) are traded in AMEX+NASDAQ. Since firms traded on NYSE are larger, we also attempt to see whether the stock price reaction would differ with respect to sizes of firms. On the announcement date, the AARs for AMEX+NASDAQ listed group is -0.89% and statistically significant at 1% level. The CARs, on the other hand, are negative and statistically significant for both groups of firms. In Panel B of Table 4, we analyze the industry affiliation of firms and abnormal returns based on the primary SIC of firms. The reaction seems to vary among industries. While some industries show positive reactions, others show negative reactions. For example, during the event window (-1,0), the abnormal returns are positive and statistically significant in SIC 28 (2.79%) and SIC80-87 (4.84%), while they are negative in most of the SIC groups. The SIC 48-49 experience the highest negative returns of -3.74%, followed by -1.64% by SIC70-79 group.

Our results mirror those reported by Hirschey and Richardson (2003) who applied a similar methodology to their 1992-1996 cross-section of prior merged firms. Our sample of 188 draws from 25 of the 32 industries used in the Hirschey sample of 80 firms. They report statistically significant CARs on event day announcements for companies reporting negative goodwill write-offs where our findings reflect a slightly larger window to reveal significantly negative CARs for firms with goodwill write-off announcements. Further, they report weakly significant event day results for write-offs from companies reporting positive earnings while we report no significant event day CARs. Differences between these sets of findings could be due to the market's general mood and the speed of investor response, given the goodwill information; optimistic during Hirschey's 1992-1996 data collection period and pessimistic during our 2001-2002 data collection period.

SUMMARY AND CONCLUSION

Our investigation is an early direct test of the FASB 142 effect on market response to post-merger goodwill announcements. Applying a standard event methodology, we derived daily and cumulative abnormal returns for 188 firms making goodwill announcements between October 22, 2001 and November 27, 2002. We divided the firms into those that passed versus failed the two-part FASB 142 goodwill impairment test and derived both daily and cumulative abnormal return measures for each subset. Cumulative abnormal return results show that investors react strongly to negative goodwill announcements over a –10 to +10 day window around the event date. For firms passing the impairment test, cumulative abnormal return results are only weakly significant for the same –10/+10 day window. The findings further show that the abnormal returns are negative for NYSE and AMEX+NASDAQ listed stocks. When we analyze the industry affiliation of firms and abnormal returns based on the primary SIC of firms, we find that the market reactions to goodwill announcements vary among industries. While some industries show positive reactions, others show negative reactions.

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The IBFR
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