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**The Connection Between CEO Characteristics and Board Meetings: An Empirical Analysis**

*Aidong Hu*

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# **The Connection between CEO Characteristics and Board Meetings: An Empirical Analysis**

Aidong Hu

## **Abstract**

I examine how firm characteristics and CEO characteristics affect the frequency of annual board meetings. The data sample covers the post Sarbanes-Oxley Act era between 2002 and 2006. Using a Tobit qualitative response model with a data set of 1,273 corporations from ExecuComp, I find evidence that seasoned CEOs with high level of stock ownership and cash compensation are less likely to hold frequent board meetings as predicted by the hypothesis of corporate governance under managerial entrenchment. The propensity to hold board meetings is significantly and positively associated with the size of the firm and is significantly and negatively associated with Return on Equity (ROE). However, the existence of executive stock options and CEO long-term incentive plan may increase the frequency of board meetings. My results extend and refine the growing literature on the relation of executive compensation, board activities and corporate governance.

## **I. Introduction**

In recent years, regulators and the congress have focused on the role of board of directors and its committees in an effort to achieve better corporate governance. According to the 2002 Sarbanes-Oxley Act, the membership of board and board committees has been explicitly formulated. The increased focus on the role of the board has led to increased activity by the board and its committees. In a recent study, Chhaochharia and Grinstein (2009) document the evidence that after the introduction of the 2002 Sarbanes-Oxley Act, firms that did not comply with the board requirements decreased CEO compensation significantly compared to the complying firms. They also find that the drop in compensation comes from the decrease in the bonus and the stock-based compensation.

In line with the recent regulatory reform, the board meeting frequency has important implications for corporate governance. Brick and Chidambaran (2007) study the association between the level of board meetings and firm value for a period around the induction of Sarbanes-Oxley Act. They show that increased board monitoring activity can increase the firm value over their sampling period.

Corporate boards are under pressure to become more active in response to increasing problems with stakeholders and government regulations nowadays. In a previous study, Vafeas (1999) finds a weak relationship between board meeting frequency and the number of directorships held by independent directors. Moreover, corporate boards meeting more frequently have lower market values. However, the association between the frequency of board meetings and characteristics of CEOs is not addressed in Vafeas (1999). In this study, I empirically examine the monitoring role of the board between 2002 and 2006 over which there has been increased political and regulator focus on board independence.

One of the main functions of corporate boards is to select and evaluate the effectiveness of CEOs. Due to costly shareholders' activism, managers can entrench themselves in many ways.

Hermalin and Weisbach (1998) show that CEO influence over corporate board increases with the CEO's tenure in the firm. Hence overlooking the relation between board meeting frequency and CEO characteristics can lead to misspecification problem. Following the introduction of Sarbanes-Oxley Act in July 2002, I explore the impact of firm and CEO characteristics on the frequency of board meetings explicitly in this research. Entrenched managers can only be disciplined or replaced at some cost to the shareholders. A growing literature examines the mechanisms through which managers entrench themselves (Stulz (1988) and Shleifer and Vishny (1989)), and also studies the implications of such entrenchment (e.g., Stulz (1990), Zwiebel (1996), and Fluck (1999)). As illustrations, Fluck (1999) shows that, in equilibrium, managers pay the minimal level of dividend payout that just forestalls "punishment" by shareholders through costly control challenges. Other things being equal, the minimal (or protection) level of payout is lower for superior and more entrenched managers, when the level of entrenchment is negatively related to the likelihood of successful control challenges.

Highly entrenched managers can undertake negative NPV projects (e.g. Zwiebel (1996) and Fluck (1999)). However, those managers are more likely to restrict themselves from non-value-maximizing behavior if executive incentive compensation sufficiently aligns managerial and shareholder interests or if there are great growth opportunities. Thus, ignoring managerial entrenchment and incentive compensation considerations in studying board activities could lead to a specification bias. I therefore extend the set of refutable predictions to include a negative relation between board meeting frequency and managerial incentives delivered through stock-based executive compensation. In addition, Raheja (2005) suggests that board structure will change with a firm's life cycle. This may be due to the amount of public information available about the firm or the fact that the verification cost of the firm's investment project decreases as the firm matures. To further explore the firm life cycle effect, I study the characteristics of firm size and past performance in my research.

I have several principal findings. As predicted by the corporate governance under managerial entrenchment hypothesis, board meeting frequency is significantly and negatively associated with the likelihood of non-value-maximizing behavior by top-management. Other things held equal, firms exhibiting greater CEO power attributes, such as higher CEO stock ownership and larger amount of compensation paid in cash salary and bonus — are significantly less likely to hold as many board meetings. Such firms also tend to be larger, have better performance records and possess more intangible assets.

Overall, a qualitative response model of the basic board meeting frequency based on the corporate governance under managerial entrenchment perspective, does remarkably well in addressing board activities in my sample of firms from 2002 through 2006. In general, my result shows a consistent but insignificant connection between board meeting frequency and a CEO's tenure and executive stock options. This result is in line with recent evidence about board monitoring activity. Specifically, the firm's growth opportunity, the tenure of a CEO and the existence of CEO stock-based compensation are correlated to a much smaller extent with the board meeting frequency. Thus, the negative relation of firm performance to board meeting frequency is not as general as suggested by the literature.

I also examine the dividend policy effects on the variations in board meeting frequencies. Existing literature suggests that there is a significant difference in terms of firm and CEO

characteristics between dividend paying firms and firms without dividend payment. With a larger sample covering the 2002-2006 periods, I find that CEO stock ownership defined as the market value of shares owned by a CEO, does significantly affect the likelihood of board meeting frequency. In addition, CEO cash compensation and exercised stock options are significant determinants of board meeting frequency for firms with existing dividend policy, but not significant determinants for firms without dividend payment – a phenomenon that has not previously been addressed in the academic literature.

My analysis extends and refines the growing literature on the relation of firm attributes to corporate board activities. I study the impact of executive compensation on the board meeting frequency directly. I find that, along with firm size and firm performance, CEO cash compensation and stock-based incentive compensation affects the board meeting frequency. I also find that CEO stock options and long-term incentive plans have different effects for firms with existing dividend policy. Thus, the negative relation of executive incentive compensation and board meeting frequency documented in the literature (Vafeas (1999)) does not hold for firms at different life cycle. Finally, I examine the relative influence of executive stock options exercised on the board meeting frequency, an important factor generally not emphasized in the literature.

The rest of the paper is organized as follows. Section 2 sets up the empirical test design and testable hypotheses. Section 3 describes the data and the sample. Section 4 presents the results of the Tobit regressions, and Section 5 concludes.

## **II. Empirical Test Design**

In the typical managerial entrenchment model, managers derive utility from controlling the firm and by undertaking new projects (empire-building). Due to costly verification or other enforcement impediments, the manager's non-value-maximizing behavior cannot be simply contracted away. Managers can be separated from control only if there is a successful proxy motion by shareholders (e.g., Fluck (1999)) or if there is hostile takeover or if the firm declares bankruptcy (e.g., Zwiebel (1996)). Managerial entrenchment is possible due to costly shareholder activism and the market for corporate control. Managers may also effectively entrench themselves by making manager specific investments (Shleifer and Vishny (1989)) and by strategically enhancing their voting rights (Stulz (1988)).

### **A. Managerial Types and Observed Board Meeting Frequency**

Consistent with the theoretical literature, my empirical test design relates number of board meetings to the notion of managerial-types. The manager's type is quantified as being proportional to the likelihood of value-maximizing behavior. More productive managers have a higher likelihood of taking value-maximizing investment decisions due to some combination of having better growth opportunities, being less entrenched, and having better incentive alignment with shareholder interests. Conversely, less productive managers are less likely to take value-maximizing investment decisions due to some combination of having inferior investment opportunities, being more entrenched, and having poor incentive alignment with shareholder interests.

I model the unobservable managerial type in a manner that facilitates econometric implementation of the entrenchment model. The unobservable managerial entrenchment is denoted by a real-valued parameter  $t^*$ . Higher  $t^*$ -values indicate more productive managers. The managerial type  $t^*$  is readily related to the decision of proposing board meetings. The theoretical models predict a negative relation between the magnitude of board activities and the strength of the managerial-type, conditional on the firm characteristics. Therefore, I estimate the following specification based on Tobit model:

$$(1) \quad Y^* = \alpha_1 + \beta_1' t^* + \varepsilon_1$$

$$(2) \quad \log(\text{meetings}) = \begin{cases} Y^* & \text{if } Y^* > 0 \\ 0 & \text{if } Y^* \leq 0 \end{cases}$$

To accommodate non-linearity, I use logarithm of number of board meetings during a year as the depended variable. I recognize Equation (1) as a univariate quantitative response model. Because of the censoring problem associated with the dependent variable, it is appropriate for us to use Tobit model to conduct the empirical analysis. The hypothesis here is that the observed  $\log(\text{meetings})$  is a non-decreasing function of  $t^*$ .

### B. Estimation of Managerial Types

I assume the manager's type is a linear function of the form:

$$(3) \quad t^* = \alpha_2 + \beta_2' X + \varepsilon_2.$$

Here  $X$  is a vector that consists of a series of observable indicators reflecting the type of the manager, and  $\varepsilon_2$  is a random error.

Combining the above three equations, I have the empirical specification of the Tobit model as:

$$(4) \quad \log(\text{meetings}) = \alpha_3 + \beta_3' X + \varepsilon_3$$

The vector  $X$  should include variables, taken to be exogenous in the short- to medium-run, that determine the strength of the managerial type. Consistent with the foregoing discussion,  $X$  includes three classes of variables that proxy for: (1) the CEO's level of entrenchment based on her power over internal governance and monitoring mechanisms, (2) the CEO's incentives for shareholder value-maximization, and (3) the characteristics of the firm. Exhibit 1 provides a precise definition of these variables and also their predicted sign with respect to board meeting frequency.

I proxy the CEO's level of internal entrenchment and incentive compensation through the following four variables derived from the corporate governance literature.

**CEO Tenure:** This variable impacts managerial type in two ways. First, organizational theorists argue that tenure is positively related to the CEO's internal power (e.g., Finkelstein and

Hambrick (1989)). Secondly, Murphy (1986, 1999) shows that CEOs nearing retirement have a shorter career horizon, relatively limited outside employment opportunity, and greater accumulated wealth tied to her equity interest in the firm. In addition, Berger et al. (1997) show that CEO tenure has significant effect on firm's debt policy. All these arguments suggest a positive association between tenure and the level of entrenchment. In my study, I calculate a CEO's tenure as the leaving date minus her inauguration date for a CEO who left her position during the sampling years. For continually serving CEOs, tenure is calculated as the difference between the end of the current reporting year and her inauguration date.

CEO cash compensation: recent evidence indicates that entrenched CEOs tend to have a large share of their compensation paid through non-contingent compensation (e.g., Core et al. (1999)). Higher amount of a CEO's cash compensation (i.e., salary and bonus) in her annual compensation indicates the level of entrenchment of a manager. In this study, I use the logarithm of CEO salary and bonus as a CEO's cash compensation.

CEO stock ownership: The CEO's personal stock ownership in the firm provides high-powered incentives. However, higher CEO stock ownership also appears to increase CEO power. For example, Dennis et al. (1997) show that top-management ownership has a significant and negative impact on CEO replacement and turnover. In this study, I take the logarithm of market value of total shares owned by a CEO in the beginning of year  $t$  as a measure of top-management stock ownership.

Executive stock options: Executive stock options have become increasingly prominent means of delivering high-powered incentives to management. I consider the value of executive stock options awarded to the CEO in the beginning of year  $t$ .

## EXHIBIT 1: DEFINITION OF VARIABLES

I define the dependent and independent variables. For the independent variables, I also indicate their theoretically predicted sign in Tobit regressions. A positive (negative) sign implies that increases in variable value increase (decrease) the likelihood of board meeting frequency, holding other things fixed. All independent variables are taken the beginning of the year.

Dependent variable		Definition
log (meetings)		Log (number of board meetings) during year $t$ . The number of board meetings is extracted from ExecuComp database.
Independent variables	Predicted Sign	Definition
CEO tenure	Negative	Log (1+CEO tenure). CEO tenure is defined as number of years a CEO stays in her position. Records are extracted from ExecuComp database.
Total Cash Compensation	Negative	Log (1+ value of salary and bonus given to a CEO in a certain year). Records are extracted from ExecuComp

		database.
CEO stock ownership	Negative	Log (1+Market value of shares owned by a CEO). The price of stock is taken from CRSP at the beginning of year $t$ ; the number of shares owned by a CEO is obtained through ExecuComp database.
Executive stock options	Positive	Log (1+value of executive stock options). Records are extracted from ExecuComp database.
Executive stock options exercised	Positive	Log (1+dollar value of stock options exercised by a CEO). Records are obtained from ExecuComp database.
Return on Equity in the preceding two years	Negative	ROE in year $t-1$ and year $t-2$ . Records are extracted from Compustat.
Market to book ratio	Negative	The market value of equity divided by the book value of equity at the beginning of year $t$ . Records are obtained from Compustat.
Value of assets	Positive	Log (1+Book value of assets). Book value of assets is taken at the beginning of year $t$ . Records are available through Compustat.
Asset Structure	Positive	Book value of intangible assets divided by the book value of total assets at the beginning of year $t$ . Records are obtained from Compustat.
Other Control Variables		Definition
Debt ratio	—	Book value of total debt divided by book value of debt + market value of equity at the beginning of year $t$ .
Firm age	—	Firm age equal to the current reporting year minus the beginning date of a firm's listing year obtained through CRSP monthly file.

Since a manager's power in a firm is related to the characteristics of the firm, I also introduce firm attributes into my study. I use the logarithm of firm asset as a measure that indicates the stage of a firm's life cycle; to evaluate the effect of a firm's growth opportunities, I consider the market-to-book ratio in the beginning of year  $t$  in my study.

Next, I use the asset structure. This variable is introduced to control for differential structure of firms with different level of intangible assets. The measure is calculated as book value of intangibles divided by the book value of asset at the beginning of year  $t$ . Moreover, firm performance measures are introduced as return on equity (ROE) in previous two years (i.e., year  $t-1$  and year  $t-2$ ).

There is a potential look-ahead bias if I use independent variables obtained from the end of the period, rather than the beginning of this period. In general, using end-of-the-period values are likely to overstate the explanatory power of the model. To control for this effect, all independent variables are taken to be the beginning-of-the-year values.

I also consider several control variables in my analysis to address the potential omitted variable problem. Firm age and size of the firm are positively correlated (e.g., Audretsch (1995)), and smaller firms are more likely to have a greater proportion of asset value in growth options. Empirically, older or more mature firms have diminishing growth opportunities and tend to have higher payout yield (e.g., Fama and French (2001)). To address the age effect, I calculated the age of a firm as the difference between the reporting year in the sample and the stock listing date of the firm. The listing date is obtained through CRSP monthly file. The second variable is debt ratio. According to the entrenchment literature (e.g., Zwiebel (1996), Fluck (1999)), highly entrenched managers use more debt to control themselves from taking non-value-maximizing behaviors voluntarily. I use the ratio of book value of debt to the sum of book value of debt and market value of equity as a proxy for a firm's debt policy.

### III. Data and Sample Selection

The data are taken from the 2007 S&P ExecuComp database. I choose 2002 as the first year in my sample since that is the year when Sarbanes-Oxley Act was officially introduced. In this study, I identify records of 1,798 top-managers from publicly traded companies that are included in various S&P indices, covering the period from 2002-2006. For each firm in the database, I take the annual board meeting frequency and compensation records for the CEO, and also obtain the firm's accounting and financial information from the S&P Compustat file. I include all firms in the ExecuComp database from 2002 through 2006, but exclude financial service (SIC code 4900 to 4999) corporations and utility (SIC code 6000 to 6999) corporations. My final sample in this study consists of 4,479 firm-year records.

### IV. Results of Multivariate Analysis

To address the non-linear relationship in the model, I use logarithm of number of board meetings in year  $t$  as dependent variable. I estimate the Tobit model given in Equation (4) above,

#### Table 1. Baseline Tobit Model on the Likelihood of Board Meeting Frequencies, 2002-2006

The dependent variable is log (number of board meetings) in year  $t$  of a firm. The records are available through *ExecuComp* database. The value of  $t$ -statistic is reported in the parenthesis. A positive (negative) coefficient sign indicates that the variable is positively (negatively) associated with the likelihood of board meetings. McFadden pseudo- $R^2$  is calculated as  $1 - L_M/L_O$ , where  $L_M$  is the log-likelihood for the estimated model, and  $L_O$  is the log-likelihood in the model with only an intercept.

Explanatory variables	Predicted sign	Coefficients of Tobit Specification
Intercept	—	1.783 (3.851)***
CEO Tenure	Negative	-0.568 (-1.071)
Total cash compensation	Negative	-0.0149 (-2.090)***
CEO stock ownership	Negative	-0.023 (-5.353)***
Executive stock options	Positive	0.172 (0.932)
Executive stock options exercised	Positive	0.003 (1.538)
Return on equity in year t-1	Negative	-0.031 (-4.340)***
Return on equity in year t-2	Negative	-0.097 (-1.47)
Value of assets	Positive	0.053 (10.578)***
Market to Book	Positive	0.024 (0.171)
Asset structure	Positive	0.157 (4.529)***
Estimated Sigma		0.388
Log Likelihood		-2106.685
Number Of Observations		4427
Pseudo R <sup>2</sup>		26.2%

Asterisks \*, \*\*, \*\*\* indicate t-statistic significance at 10%, 5%, and 1% levels, respectively.

assuming a symmetric distribution of the random disturbance  $\varepsilon_3$ . I parameterize  $F(\varepsilon_3)$  as the cumulative distribution functions of the normal distributions. Note that Equation (4) gives the likelihood of board meeting frequencies. Examining the right hand of side of this equation, I see that if the estimate for the coefficient of  $\beta_j$  for any independent variable  $X_j$  is positive (negative), then that variable is positively (negatively) related to the likelihood of holding board meetings.

#### A. Analysis of the Baseline Model

Table 1 reports the results of my basic model. I find that the likelihood of board meetings is significantly related to firm and managerial characteristics, as predicted by the empirical framework. *Ceteris paribus*, the board meeting frequency decreases significantly with the level of CEO total cash compensation (i.e., salary and bonus), and stock ownership. All of these factors are significant at the 1% level and are positively associated with the power of a CEO in

the firm. Additionally, I also find that the length of CEO tenure has a negative but insignificant impact on the likelihood of board meeting frequency. These factors are indicators of managerial entrenchment. Conversely, the frequency of board meetings is positively associated with the level of executive stock options and the value of stock options exercised.

In the same time, I find that, board meeting frequency is positively related to firm size, measured by the book value of assets, and negatively related to firm performance, measured by return on equity (ROE), in the previous two years. These effects are consistent with results reported in Vafeas (1999). Interestingly, I also find that corporate boards tend to hold more meetings when a firm has more intangible assets and when the firm's market-to-book ratio is higher though this effect is statistically insignificant.

My new study shows that board activities, measured by board meeting frequencies, have significant association with top manager's internal power and compensation plans. My basic model is highly significant from the perspective of likelihood-ratio tests: the chi-square test-statistics have p-values less than 0.001, and McFadden pseudo- $R^2$  yields 26.2%. I emphasize that the apparent success of the basic model in addressing board meeting frequencies with respect to firm and CEO characteristics should be interpreted with caution. The predictive power of the model can only be validated with robustness tests.

As a robustness check, I introduce two variables that are related to a firm's life cycle (firm age) and capital structure (debt ratio) as additional control variables into my analysis. I first introduce the two variables one by one and then use both variables simultaneously into the model. The results are shown in Table 2. Clearly, there is no significant impact from these omitted variables on my overall model, I still have the same effects that are discovered in the baseline model. My results show that, there is no relation between board activities, measured by board meeting frequency, and firm age. One possible explanation is that other firm attributes considered in the study, i.e., firm size measured by book value of assets, asset structure reported as a fraction of tangible asset, and firm performance measured by return on equity (ROE) in the previous two years, have outperformed this omitted effects. However, the debt policy shows a marginally significant impact on the likelihood of board monitoring activity. Since the use of

### **Table 2. The Effect of Other Firm Characteristics on the Likelihood of Board Meetings**

I consider two variables that are related to a firm's life cycle, capital structure and future growth opportunities. Those variables are defined in Exhibit 1. Values of those variables are calculated using beginning-of-the-year records available from Compustat. The value of t-statistic is reported in the parenthesis. McFadden pseudo- $R^2$  is calculated as  $1 - L_M/L_O$ , where  $L_M$  is the log-likelihood for the estimated model, and  $L_O$  is the log-likelihood in the model with only an intercept.

Explanatory variables	Predicted sign	Tobit Model (1)	Tobit Model (2)	Tobit Model (3)
Intercept	—	1.818 (3.679)***	1.771 (3.812)***	1.801 (3.162)***
CEO Tenure	Negative	-0.381 (-0.618)	-0.823 (-1.522)	-0.562 (-0.983)
Total cash compensation	Negative	-0.015 (-2.032)**	-0.012 (-1.673)**	-0.012 (-1.591)
CEO stock ownership	Negative	-0.023 (-5.364)***	-0.023 (-5.331)***	-0.023 (-5.452)***
Executive stock options	Positive	0.150 (0.813)	0.231 (1.242)	0.202 (1.083)
Executive stock options exercised	Positive	0.003 (1.591)	0.002 (1.240)	0.003 (1.301)
Return on equity in year t-1	Negative	-0.031 (-4.322)***	-0.030 (-4.213)***	-0.031 (-4.190)***
Return on equity in year t-2	Negative	-0.095 (-1.461)	-0.095 (-1.470)	-0.093 (-1.432)
Value of assets	Positive	0.054 (5.233)***	0.052 (4.832)***	0.051 (5.613)***
Market to Book	Positive	0.026 (0.191)	0.121 (0.877)	0.126 (0.923)
Asset structure	Positive	0.156 (4.487)***	0.146 (4.183)***	0.143 (4.121)***
Firm age	?	-0.013 (-1.033)	—	-0.017 (-1.454)
Debt ratio	?	—	0.072 (1.911)	0.073 (1.941)*
Estimated Sigma		0.347	0.352	0.387
Log Likelihood		-2067.301	-2290.17	-2106.153
Number Of Observations		4387	6293	4359
Pseudo R <sup>2</sup>		26.2%	26.7%	26.3%

Asterisks \*, \*\*, \*\*\* indicate *t*-statistic significance at 10%, 5%, and 1% levels, respectively. debt and dividend policy can be adopted as control mechanisms for managerial entrenchment, the debt effect in my model suggest a further study involves dividend policy.

**B. Effects of Dividend Policy****Table 3. The Effect of Dividend Policy on the Likelihood of Board Meetings**

I classify all observations into dividend-paying subsample vs. non-dividend subsample according to sample firms' dividend payment. A firm's dividend policy is taken as the beginning of the year dividend payment. The Tobit model estimates (cf. Table 1) are provided for the dividend-paying and non-dividend subsamples during the sampling years. The value of *t*-statistic is reported in the parenthesis. McFadden pseudo- $R^2$  is calculated as  $1 - L_M/L_O$ , where  $L_M$  is the log-likelihood for the estimated model, and  $L_O$  is the log-likelihood in the model with only an intercept.

Explanatory variables	Predicted sign	Dividend-Paying Subsample	Non-Dividend Subsample
Intercept	—	1.590 (9.872)***	1.837 (15.166)***
CEO Tenure	Negative	-0.356 (-0.592)	-1.412 (-1.301)
Total cash compensation	Negative	-0.031 (-2.201)***	-0.005 (-0.524)
CEO stock ownership	Negative	-0.019 (-5.683)***	-0.024 (-8.52)***
Executive stock options	Positive	-0.406 (-1.393)	0.291 (1.218)
Executive stock options exercised	Positive	0.005 (1.941)*	0.002 (0.633)
Return on equity in year t-1	Negative	-0.122 (-3.200)***	-0.025 (-3.292)***
Return on equity in year t-2	Negative	0.089 (0.322)	-0.077 (-1.101)
Market to Book	Positive	0.456 (1.708)*	-0.043 (-0.201)
Value of assets	Positive	0.089 (5.877)***	0.037 (5.322)***
Asset structure	Positive	0.072 (1.398)	0.223 (4.776)***
Estimated Sigma		0.353	0.403
Log Likelihood		-652.176	-1403.510
Number Of Observations		1718	2719
Pseudo $R^2$		23.6%	21.1%

Asterisks \*, \*\*, \*\*\* indicate *t*-statistic significance at 10%, 5%, and 1% levels, respectively.

The most influential variables for the board meeting frequency in Table 1 are the size of firm, measured by book value of assets, asset structure, total cash compensations, stock ownership of CEOs and recent firm performance, measured by ROE. I conjecture that these results are likely to be correlated with managerial internal powers of sample firms. Existing theory and evidence show that entrenched managers are more likely to introduce a mixture of debt and dividend payout policy in order to maximize his or her control of the firm or other unobservable benefit in the firm.

I test for the potential effects by estimating the baseline model of Table 1 separately for firms with dividend payment and firms without dividend in the sample. In my research, there are significantly more firms that do not pay ordinary cash dividend during the sampling years. The results are reported in Table 3.

In general, models for both dividend-paying firms and non-dividend firms perform at the same level as the baseline model. The most important finding here is that firm attributes and CEO compensation exhibit different impacts between dividend-paying and non-dividend firms. The value of stock options exercised can marginally increase the propensity of holding more board meetings for firms with existing dividend policy; this effect is significant at the 10% level. However, executive stock options show a negative connection with board meeting frequency, though the effect is insignificant in my study. The differential impact of executive stock options awarded among firms with different dividend policies has not been emphasized in existing literature, this effect needs further study.

It is noteworthy that in my analysis, CEOs with high cash compensation in a firm with positive dividend payment are likely to hold more meetings but this effect is insignificant for corporations without dividend payment. Moreover, different from firms without dividend payment, dividend-paying firms tend to hold more board meetings if they have higher market-to-book ratio, this effect is significant at the 10% level. This fact has generally not been explored in the literature. One possible interpretation is that market-to-book ratio can be an indicator of firm life cycle and managerial power in firms without dividend payment; corporate boards tend to stay more passively while managers have more control of the firm, but this is not the case for firms with existing dividend payment.

## **V. Summary and Conclusions**

With the introduction of Sarbanes-Oxley Act in year 2002, the environment of corporate governance has been changed drastically. The event gives us an opportunity to test the theoretical arguments regarding board monitoring role in a corporation. The theoretical and empirical literature on corporate governance and managerial entrenchment makes a number of relatively unambiguous refutable predictions regarding corporate board activities. I extend this framework to allow for the role of managerial compensation contracts. The predictions are then that (*ceteris paribus*) the likelihood of board meeting frequency is negatively related to the level of managerial entrenchment and firm performance, and positively related to firm size set and the power of performance-based managerial incentives. Since we generally face active managers in practice, we should consider the role of corporate board monitoring when managers are in control. In this case, my empirical framework under managerial entrenchment is distinct from

traditional studies about board activities. In particular, I directly incorporate the strength of internal corporate governance mechanisms and firm characteristics in my study.

Consistent with theoretical literature, my empirical test design views observed board meeting frequency to be driven by the likelihood of managers to take non-value-maximizing decisions. My results support the theoretical predictions of the management entrenchment literature. I find that factors related to managerial entrenchment levels have a significant explanatory power with respect to the propensity of holding board meetings, even controlling for the firm age, size, and the quality of investment opportunity set. My analysis extends and refines the growing literature on the relation of incentive compensation to corporate governance. Overall, my analysis confirms that executive characteristics are significant factors in determining board meeting frequency.

This study has implications for future research. Recent financial turbulences in the world cast a lot of doubts on the general practice regarding corporate executive compensations. With the introduction of Sarbanes-Oxley Act, the effectiveness and implementation of accounting and corporate governance reforms need to be monitored closely. My research can help us further understand the interaction between corporate board monitoring activities and characteristics of CEOs. Studies exploring the link between executive power and characteristics of corporate board structure need to be addressed. Such an examination can help policy makers to better restrict managerial behaviors and hence align managerial interests more closely with investors' interests.

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# **The Impact of In-Class Time on the Academic Performance in the Introductory Finance Course**

Michael H. Schellenger and Stephen P. Huffman

## **Abstract**

We evaluate the impact of in-class time on the academic performance of business students enrolled in an introductory finance course. Contrary to our expectations, we observe a significant increase in the students' academic performance when in-class time is reduced (as measured on a pre-test post-test basis). When we partitioned our sample by major, we find an increase in academic performance is significant for students majoring in finance or accounting. We also find evidence that the degree of measured change in academic performance is driven by the student's academic performance in the pre-core courses (e.g., accounting, economics, math, statistics etc.).

## **I. Introduction**

Many in academia are concerned with the assessment of academic performance and there is a plethora of research that has investigated the factors that influence performance. With respect to an introductory finance course for business majors, researchers have analyzed the relationship between academic performance and major [Sen, Joyce, Farrell, and Toutant, 1997], class attendance [Chan, Shum, and Wright, 1997], effort [Rich, 2006], GPA [Didia and Hasnat, 1998;], ACT/SAT scores [Didia and Hasnat, 1998;], prerequisites [Didia and Hasnat, 1998, Terry, 2002, Grover, Heck, and Heck, 2010], and student and faculty gender [Henebry and Diamond, 1998].

Despite the abundance of research on the factors influencing student performance, the impact of in-class hours has not been thoroughly evaluated. When presented with a unique opportunity to evaluate a significant change of in-class time, we were able to evaluate the impact of in-class time on performance, while controlling for the factors that have been found in the literature to have an influence performance.

Our expectation is that an increase of in-class time would result in a higher level of academic performance. More in-class time provides the instructor with more time for in-depth presentations and discussions of course content and problem solving exercises. Similarly, our expectation is that a reduction of in-class time would reduce the depth of the material presented and class discussions, while reducing the time available for problem solving exercises. As a result, academic performance would decrease.

Our study analyzes the performance of business students in the required introductory finance course of a program that reduced the in-class time of that course. This study contributes to the existing body of knowledge on student performance by evaluating a performance variable that has not been looked at before; in-class time. We add precision to our analysis by measuring performance using pre-and post-test methodology rather than by course grade. Contrary to our expectations, we find that students in the reduced in-class hour version of the course did not suffer a reduction in academic performance. Further, we find that accounting and finance majors achieved a significantly higher level of academic performance.

## **II. Background**

We teach at a public university with an enrollment of approximately 12,000 undergraduate and graduate students. The College of Business has approximately 1,800 undergraduate students. The Bachelor of Business Administration program is comprised of pre-core, core, and major course work. Students complete the pre-core course work as a prerequisite to being admitted to the College. The pre-core consists of course work in mathematics, statistics, economics, and accounting. After being admitted to the College, all students are required to complete the core course work and course work in their chosen major.

In fall of 2005, the College of Business began the staged implementation of approved changes to the core of the BBA program. The changes to the core were the result of a year-long study by the College's Undergraduate Curriculum Committee and part of the Committee's regular, periodic review and assessment of the BBA program. The faculty approved a reduction in the number of credits for each core course from three credits to two credits. For our program, this meant that the in-class time was reduced from 42 hours to 28 hours per core course. The reduction of credit value and class time conserved resources and allowed student credit hours to be moved from business core classes to major and elective classes.

## **III. Data and Methodology**

We design a pre-and post-testing instrument within the context of the topical coverage approved by the finance faculty and the learning objectives set forth for each topic. We used a pre/post-test methodology as opposed to course exam scores or grades because we are interested in the incremental, as opposed to the absolute, level of academic performance. Business students enter the introductory course with some basic financial information from the pre-core courses. For example, our required math courses provide elementary time value of money analysis and the required accounting provides basic financial information on financial statements and ratio analysis. In addition, some students may be repeating the course or transfer students may have taken a similar course at a previous institution. In such situations, exam scores or grades would be biased estimates of what the student learned in the course.

Topical coverage for the course consists of the first seven topical areas identified in a survey by Cooley and Heck (1996). The pre-test consists of 36 multiple choice questions from the Test Bank that accompanies the textbook used in the course, Brigham and Houston, *Fundamentals of Financial Management*. Each question is matched to a specific learning objective set forth by the finance faculty and approved by the college's Undergraduate Committee. We conducted a pilot study during the fall of 2005 using a draft of the exam instrument with one section of Essentials of Business Finance.

Similar to the studies that we cite in our results section, our sample is obtain from our classes at our university. In the spring of 2006, the 36-question pre-test was administered during the first day of class in two sections of the three-credit introductory finance course. Incentive for students to do their best on the pre-test was provided by awarding one bonus point for each correct answer on the pre-test. The 36 potential bonus points represent 9.6% of the total points in the course. During the semester, students were required to take three tests, which accounted

for 80% of their course grade. Each of the three tests included a different set of 12 questions from the 36-question pre-test given the first day of class. The same process for the same exams was followed for the three-credit course taught during the summer of 2006.

The two-credit course for introductory finance was first offered during the fall of 2006. The difference of 14 hours of class time required that changes had to be made in how class time was used. Although the topical coverage in the two-credit course was the same as in the three-credit course the depth of coverage was significantly less. The same 36-question pre-test was administered on the first day of class followed by and the same subsequent tests during the term in a same manner as in the three-credit course.

We represent the number of correct answers out of the 36 questions on the pre-test as the variable **PRETEST**. We sum the number of correct answers from each set of 12 questions included in the three exams to create the variable denoted as **POSTTEST**. Our primary performance measure is calculated by subtracting each student's value for **PRETEST** from their corresponding value for **POSTTEST**. We use the variable **DIFF** to symbolize this difference. That is, positive values for our variable **DIFF** proxy for the increase in knowledge that the student gained from the course.

For each student in both the three-and two-credit versions of the course, we obtained data on gender (**GENDER** is equal to 1 if student is female, 0 if male), age, and major. Gender is of interest because there is a perception that males do better than females in quantitative courses [Henebry and Diamond, 1998]. Age of student, **AGE**, is of interest as a proxy for maturity of the student and has been found to be of marginal significance in the prediction of performance [Didia and Hasnat, 1998]. Prior research has indicated that the major of the student, a possible proxy for student motivation, may impact student performance [Chan, et al., 1997; Sen et al., 1997; Henebry and Diamond, 1998]. Students taking a course in their major or closely related to their major may be more motivated to perform better. Therefore, our expectation is that accounting and finance majors will have higher level of academic performance than other business majors. The variable **MAJOR** has a value of 1 if major is accounting or finance and 0 if the student's major is not accounting or finance.

We also obtained the grades each student earned in the pre-core courses in macro and micro economics, statistics, math, and accounting as an indicator of student prior performance. The letter grades in the pre-core courses were converted to a weighted average numerical grade point average based on a four point scale, which we represent as the variable **PCGPA**. Finally, we included the variable **TRANSFER** to indicate if the student transferred into the University (0 = did not transfer in to University, 1 = transferred in). The transfer status of the student is included because there may be a perception that transfer students are not prepared adequately for the finance course if their prior course work in economics, statistics, and accounting was not from the current institution. Transfer students would have taken some, if not all, of the pre-core courses at another institution.

The initial sample consisted of the 223 students who were taking the course for the first time and attended the first class session: 89 in the three-credit version and 134 in the two-credit version. All of these students took the pre-test. Nine of the 89 students in the three-credit course

dropped the course prior to taking the first exam. Seven of the nine students did not attend class after the first class period and the other two students attended a number of classes, but dropped prior to the first exam. Twenty-seven of the 134 students in the two-credit course dropped the course. Of these 27 students, 14 did not attend class after the first class period, eight attended class but never took the first exam, and five dropped after taking the first exam. Eight students completed the three-credit course and 107 completed the two credit course for a final sample of 187 students. We use this sample to test our primary hypothesis, which is whether in-class time affects performance. Specifically, our null hypothesis is:

$$H_0: \mathbf{DIFF}_{3\text{-credit}} = \mathbf{DIFF}_{2\text{-credit}}$$

#### IV. Results

In Table I, we present the summary statistics on the data portioned by credit value, gender, transfer status, and major. As indicated in Panel A of Table I, we find no significant differences between the three-credit and two-credit samples for the mean values for our proxies for maturity and understanding of prerequisite material; (e.g. **AGE** and **PCGPA**). We also find that the number correct on the pre-test is not statistically different between the three-credit and two-credit samples (i.e., **PRETEST**). From the perspectives of maturity and prior performance, the samples are similar. Therefore, we conclude that the samples are from the same population and our analysis of performance during the term is justified.

Contrary to expectations, we also report in Panel A of Table I, that the difference between the post-test and pre-test, **DIFF**, is positive and significant at the 1% level. Given our finding of no significant difference in the pretest scores between the three-credit and the two-credit course, we have evidence that student performance in the two-credit course was better than in the three-credit course. Therefore, we conclude that student performance was not adversely affected by the reduction of in-class time; however, we also investigate the impact of other factors on performance.

In Panels B, C, D of Table I we present sample data and t-tests of mean differences based on student gender, transfer status, and major, respectively. From Panels B and C, we find no overall gender or transfer bias in our sample. We found that females performed significantly better than males (at the 5% level of significance) in the pre-core courses as measured by the variable **PCGPA**, but in all other respects, there are no significant differences in the sample. In Panel D of Table I, we find that the accounting and finance majors are of similar age as non-accounting and non-finance majors and performed similarly on the Pre-Test. However, we do find that the accounting/finance majors have a significantly greater **PCGPA**. Our primary finding in Panel D of Table I is that the accounting/finance majors performed significantly better (as measured by **DIFF**), which leads us to investigate whether there are differences in the performance of accounting and finance majors in the two-credit versus three-credit course.

In Panels E and Panel F of Table I, we report that in both the two- and three- credit courses, accounting/ finance majors have significantly greater understanding of the prerequisite course material and that their performance (as measured by **DIFF**) is significantly higher than that of the non-accounting/non-finance majors. Although not presented in our Tables, we find that there are no statistically significant differences between accounting/finance majors in the two-credit

versus three-credit course nor between non-accounting/non-finance major in the two-credit versus three-credit course for of the key variables (i.e., **AGE**, **PCGPA**, **PRETEST**) at the 5% level of significance. We also observe that regardless of major, academic performance (**DIFF**) was greater in the two-credit course. This difference in academic performance was significant for accounting/finance majors, but not for non-accounting/finance majors

**Table I****Test of differences in mean values of key variables:****Categorized by course credit value, gender transfer status and major**

Panel A: Mean values of key variables for 187 student sample by course credit value

Variable <sup>a</sup>	3-credit course n=80	2-credit course n=107	t-statistic for difference in mean values	p-value associated with t-statistic
AGE	22.08	21.77	0.62	0.5381
PCGPA	2.95	3.04	-1.16	0.2464
PRETEST	10.03	9.43	1.34	0.1811
DIFF	8.53	10.80	-3.19	0.0017

Panel B: Mean values of key variables for 187 student sample by course credit value by gender

Variable <sup>a</sup>	Male students n=100	Female students n=87	t-statistic for difference in mean values	p-value associated with t-statistic
AGE	22.19	21.57	1.28	0.2012
PCGPA	2.91	3.11	-2.53	0.0139
PRETEST	9.64	9.74	-0.22	0.8263
DIFF	9.71	9.98	-0.36	0.7207

Panel C: Mean values of key variables for 187 student sample by transfer status

Variable <sup>a</sup>	Non-transfer student n=163	Transfer student n=24	t-statistic for difference in mean values	p-value associated with t-statistic
AGE	21.79	22.71	-1.29	0.1985
PCGPA	3.01	2.94	0.78	0.4406
PRETEST	9.85	8.58	1.94	0.0543
DIFF	9.66	11.00	-1.21	0.2289

Panel D: Mean values of key variables for 187 student sample by major

Variable <sup>a</sup>	Non-accounting and non-finance Major n=72	Accounting and Finance Major n=115	t-statistic for difference in mean values	p-value associated with t-statistic
AGE	21.90	21.90	0.00	0.9976
PCGPA	3.25	2.85	-5.26	<0.0001
PRETEST	9.31	9.92	1.37	0.1732
DIFF	12.58	8.11	-6.48	<0.0001

VARIABLES: AGE = Age of student, PCGPA = Pre-Core Grade Point Average; PRETEST = Score on the pre-test; POSTTEST = Sum of TEST1, TEST2, and TEST3; DIFF = POSTTEST – PRETEST.

**Table I (continued)**  
**Test of differences in mean values of key variables:**  
**Categorized by course credit value, gender transfer status and major**

Panel E: Mean values of key variables for 80 students in the three-credit course sample by major

Variable	Non-accounting and non-finance Major n=26	Accounting and Finance Major n=54	t-statistic for difference in mean values	p-value associated with t-statistic
AGE	23.04	21.60	-1.63	0.1072
PCGPA	3.14	2.86	-2.57	0.0121
PRETEST	9.73	10.17	0.63	0.5297
DIFF	10.69	7.50	-3.27	0.0016

Panel F: Mean values of key variables for 107 students in the two-credit course sample by major

Variable	Non-accounting and non-finance Major n=46	Accounting and Finance Major n=61	t-statistic for difference in mean values	p-value associated with t-statistic
AGE	21.26	22.16	1.59	0.1146
PCGPA	3.29	2.85	-4.34	<0.0001
PRETEST	9.07	9.70	1.06	0.2903
DIFF	13.65	8.66	-5.23	<0.0001

VARIABLES: AGE = Age of student, PCGPA = Pre-Core Grade Point Average; PRETEST = Score on the pre-test; POSTTEST = Sum of TEST1, TEST2, and TEST3; DIFF = POSTTEST – PRETEST.

In Table II we present the results from two OLS regression models which use our performance measure, **DIFF**, as the dependent variable. Model 1 contains the four variables cited in the literature that influence academic performance (i.e., **GENDER**, **TRANSFER**, **MAJOR**, and **PCGPA**). Our results indicate that the coefficient for **MAJOR** is significant at the 1% level and with the anticipated sign; thereby, indicating that the proxy for motivation for the accounting and finance majors is significantly higher than non-accounting or non-finance majors. The proxy for prior understanding of prerequisite material, **PCGPA**, is also positive and significant at the 1% level and consistent with Borde *et al.* (1998) and Grover *et al.* (2010). That is, we find that better student performance in prerequisites classes is directly related to higher performance in our introductory finance class.

**Table II**  
**OLS Regression estimates of models with dependent variable**  
**of the difference between the post-test score and the pre-test score**  
**(p-value of coefficients in parentheses)**

VARIABLE	MODEL 1	MODEL 2
INTERCEPT	-1.426 (0.5129)	-1.932 (0.3732)
GENDER	-0.359 (0.5785)	-0.228 (0.7225)
TRANSFER	1.655 (0.0775)	1.000 (0.3033)
MAJOR	0.478 (0.0019)	0.456 0.0027
PCGPA	4.359 (<0.0001)	4.229 (<0.0001)
CREDITS		1.457 (0.0289)
R-SQUARE	0.3100	0.3280
F-VALUE	20.44 (<0.0001)	17.67 (<0.0001)

VARIABLES: DIFF = POSTTEST – PRETEST; POSTTEST = Sum of TEST1, TEST2, and TEST3 AND PRETEST = Score on the pre-test; CREDITS = credit value of course, 3 credit=0, 2 credit=1; GENDER = Gender of student, Male=0, Female=1; TRANSFER = did student transfer into program, no=0, yes=1; MAJOR = Major of student, Non-Accounting or Finance = 0, Accounting or Finance major = 1; PCGPA = Pre-Core Grade Point Average.

Similar to Didia and Hasnat, (1998) and Grover *et al.* (2010), we find that GENDER and TRANSFER are not significant in explaining performance; however, our results do differ from the findings of Sen *et al.* (1997). Contrary to Borde, Byrd, and Modani (1998) our findings indicate that transfer students are not disadvantaged with respect to the reduction of in-class time by taking pre-core classes elsewhere.

In Table II we present the results for our primary model, Model 2. In this model we include the same four independent variables from Model 1 and add the dummy variable, **CREDIT**, to distinguish between the three-credit and the two-credit course; i.e., in-class time. **CREDIT** is equal to 1 if the student is from a two-credit course and zero otherwise. For Model 2 we find that **CREDIT**, **MAJOR**, and **PCGPA**, are all significant at the 5% level. As with the results reported in Table I, we did not expect to find that the sign on the dummy variable for reduced class time to be directly related to performance. That is, we find that academic performance significantly improved in the two-credit course compared to the three-credit course even when we controlled for gender, transfer status, motivation and understanding of prerequisite material. Therefore, a reduction of in-class time did not lead to a lower degree of academic performance, but actually improved performance.

## **V. Summary**

Our analysis investigates the impact of changing the number of in-class hours on academic performance. We were presented with a unique opportunity to evaluate the impact of reducing the in-class hours by one-third (from 42 hours to 28 hours). We were able to examine the impact of this significant decline of in-class hours on academic performance while controlling for student gender, transfer status, major, and GPA in pre-core classes. Based on a sample of 187 students, simple tests of mean differences across student characteristics indicated that student performance in a two-credit, course was significantly higher than performance in a three-credit course. Although our results may be unique to our university, our OLS regressions confirmed that our primary results were not driven by gender or by transfer status. However, we did find evidence that student's prior academic performance in prerequisite courses and student's major was related to performance.

Although we found that the academic performance of non-accounting or non-finance students improved in the two-credit course relative to the three-credit course, the difference was not statistically significantly higher. We did find that accounting and finance students performed significantly better in the two-credit class than in the three-credit class, but accounting and finance students also had a greater pre-core GPA. Therefore, student motivation to perform, as proxied by major, and past performance, play an important role in academic performance. Our results confirm previous research that stressed the importance of student preparation in the prerequisite courses. Students who are more adequately prepared for the finance course are better able to adjust to changes to the traditional course delivery format. Our results also indicate that students with lower academic performance in prerequisite courses may have lower academic performance with changes to the traditional format. In-class time and the corresponding class interaction may be very important to the academic performance for these students. Business programs that alter the in-class time or format of the introductory finance class via technology may want to stress the importance of the pre-requisite courses.

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## **Board Changes in Response to Extremes in Performance**

Gerhard Barone, Kent Hickman, and Mark Shrader

### **Abstract**

This study contrasts changes in board structure in firms at the extremes of industry-adjusted performance. We find pervasive changes in board size, composition, and director pay for firms whose stock market performance ranks in the uppermost and lowest deciles of industry-adjusted returns over the period 2001-2005. Our evidence shows that these companies tended to change their board's size, added outsiders to the board, and increased director pay. Significant differences between the two groups are documented, with poor performers making more dramatic changes in all three of these governance metrics. We failed to find changes in other structural characteristics such as classified boards and shareholdings of directors.

### **Introduction**

Getting the incentives right, effective monitoring, and the review of corporate strategy are the province of corporate boards. In an era reeling from a financial crisis that arguably could have been avoided with good governance, the examination of boards and their efficacy remains an important work-in-progress. The purpose of this paper is to add to the existing knowledge of governance and changes in governance by examining changes made to the boards of directors by firms that are experiencing extremes in stock market performance. Our paper is motivated by the lack of both theoretical and empirical work in understanding the composition, and what factors bring about changes in the composition, of boards. In addition, the underlying notion that a firm's activities and results (particularly if they are undesirable) should have implications for that firm's board of directors (such as those underlying the Sarbanes Oxley Act of 2002) also suggests that governance changes, specifically through changes in the composition of the board of directors, should result from the activities and outcomes of a firm.

Our results show that while both extreme good and extreme poor performing firms make changes to their boards, the poor performing firms make significantly more changes. Specifically, poor performing firms make significantly more changes (in total) to their boards than good performing firms. When we look at the specifics of those changes, poor performing firms that add board positions add significantly more positions, as compared to good performing firms that add positions. Similarly, poor performing firms that delete board positions delete significantly more board positions, as compared to good performing firms that delete positions. In addition, while both extreme performing groups add outsiders to their boards, poor performing firms add significantly more outsiders, and while both extreme performing groups increase director pay over the time period we analyze, poor performing firms increase director pay significantly more than good performing firms. We interpret the bulk of these results as poor performing firms making changes to their overall governance structure in an attempt to change the course of the recent performance of their firms.

## Literature Review

Formal economic theory on the composition of boards (and indeed, on boards in general) is limited. The primary theoretical work with respect to understanding the composition of boards along with factors that potentially lead to changes in the composition of boards is in Hermalin and Weisbach (1998). In this paper, they develop a model that analyzes the factors that a typical board faces in the hiring and firing of management. They show theoretically, among other things, that the probability of independent directors being added to the board increases following poor performance. Ironically, this result is consistent with an earlier empirical finding of theirs, where Hermalin and Weisbach (1988) find empirically that following poor results, insider directors leave boards and outside directors are asked to join. Additional theoretical work beyond Hermalin and Weisbach (1998) in this area is limited; thus, we will continue to discuss empirical findings germane to our research question.

Additional empirical work documents changes as a result of poor performance. For example, the work of Denis and Sarin (1999) documents that significant change in board composition is likely to occur following poor performance. Boeker and Goodstein (1991) investigate a sample of 290 California hospitals to show that while hospitals change their boards in response to environmental contingencies, hospital performance, particularly poor performance, is a moderating factor in that effort. With respect to positive performance, both Hermalin and Weisbach (1988) and Denis and Sarin (1999) also show that insiders are added by CEO's of good performing corporations. In periods of good performance, these 'top' CEO's are hypothesized to have greater influence, enabling them to hand-pick new and friendly directors.

While both the theoretical and empirical literature in this area is limited, there are clearly contrasting hypotheses. First, good performers tend to add insiders, while poor performers will increase independence by adding outsiders and possibly eliminating some inside directors. In this paper, we empirically maximize the power of the experimental design by contrasting the governance-based responses of firms in the extremes of the performance distribution. Good performance is defined as being in the highest decile of stock market returns within the firm's industry, while poor performers are those firms in the bottom decile. In addition, our sample includes not only general board variables such as size and independence, but also individual director characteristics. This allows us to take a much more detailed look into the component changes that firm's make within their boards, as opposed to the overall structural changes. For example, both top-performing and poor-performing firms might not change the overall size of their boards in response to their extremes in performance, but if one group changes the composition of board (changing individual members without changing the overall size of the board) more than the other, that result can only be identified by looking at individual director characteristics, and how those characteristics changed after an extreme performance result.

## Methodology

Our sample is drawn from The Corporate Library (TCL). TCL focuses on governance information including detailed director characteristics and also contains corporate performance metrics. We sort firms in the TCL database into the 48 industry specifications identified in Fama and French (1997) and then decile rank firms, within each industry specification, by the

cumulative 4-year return, 2001-2005, reported in the database. We require at least 20 firms in each industry specification for that industry to remain in our sample. For the remaining industries, we identify top (bottom) performers as those firms in the top (bottom) return decile of each industry specification. Initially, the top and bottom performance samples each included 173 firms. In order to document changes of board characteristics, the 346 corporations' board compositions were examined in both 2005 and in 2001. The lack of availability of some firms in the TCL database in 2001 reduced the sample to 75 top-performers and 102 bottom-performers, which constituted our final dataset for analysis.

Table 1 describes the board characteristics of our sample, chronicles changes in these variables over time, while contrasting those characteristics between the high- and low-performing firms. Top performers had boards with fewer directors in both periods, although the difference between the groups lost its statistical significance in 2005 as the top-performing group added directors at a faster pace than the bottom-performers. An interesting result is that classified boards<sup>1</sup> were consistently more common among top performers than bottom performers. This statistically significant result is contrary to some governance literature that associates classified boards with managerial entrenchment and poor governance (e.g., DeAngelo and Rice, 1983). The sample also uncovers the same trend toward declassification of boards that Lee (2011) reported. Table 1 also provides evidence that 'busy' directors may not be 'effective' directors. In each period, bottom performers were monitored by directors who were more likely to be splitting their director duties across multiple firms ('busy' being defined here as serving on more than 4 boards). Finally, in conformance with the agency arguments of Jensen and Meckling (1976), bottom performing firms had more directors with virtually zero financial alignment with the shareholders whom they represented, a tendency that became more prevalent over time.

	Top Performers (n=75)	Bottom Performers (n=102)	Difference
Board Positions - 2001	8.52	9.38	0.86**
Board Positions - 2005	8.89	9.45	0.56
% of firms with Classified Boards - 2001	74.90%	58.40%	(16.5%)***
% of firms with Classified Boards - 2005	68.20%	53.40%	(14.8%)**
% of Directors on > 4 Boards - 2001	4.16%	7.09%	2.93%**
% of Directors on > 4 Boards - 2005	12.10%	17.65%	5.55%**
% of Directors with Zero Shares Owned - 2001	8.40%	13.07%	4.67%*
% of Directors with Zero Shares Owned - 2005	11.86%	17.76%	5.90%*

\*\*\*, \*\*, \* denotes significance at the 1%, 5%, and 10%, respectively.

<sup>1</sup> Classified boards are sometimes called staggered boards because the election of directors is staggered over time. Typically, in any year one-third of the directors are elected, arguably protecting board continuity but also possibly acting as a mechanism for discouraging a takeover of the company.

## Results

Table 2 provides a more detailed look at the changes in board structure over time and whether those changes differed between the performance-based groups. As noted in the analysis of Table 1, having a larger board may prove to be counter-productive. It's therefore surprising that over the five-year period average board size increased among both groups, with approximately 45% of the sample adding positions, regardless of performance. On the other hand, a stark contrast is revealed by examining which group tended to drop positions. Here, one-third of the bottom decile chose to drop positions, while only one-fifth of the top companies elected to decrease the size of their boards, a difference that is significant at the 5% level. In addition, among the firms that added positions, the poor performing firms added significantly more positions than the top performers. This result is replicated for firms deleting positions, where, for firms that eliminated director positions, the poor performing group took the more radical steps as these corporations dropped significantly more positions than did the best performers. Finally, a comparison of individual directors reveals overall director turnover, regardless of changes in the number of board positions, of about 36% among the top firms and nearly 56% for the lowest performing group, also a statistically significant difference. Apparently, directors of the under-performing group were often discouraged from running for re-election, resigned, or were somehow ousted.

	Top Performers (n=75)	Bottom Performers (n=102)	Difference
% of firms Adding Board Positions	45.30%	46.50%	1.20%
% of firms Deleting Board Positions	21.30%	33.67%	12.37%*
# of Board Positions Added (from firms adding positions)	1.52	1.95	0.43**
# of Board Positions Deleted (from firms deleting positions)	1.50	2.53	1.03***
Overall % Change in Board Members	35.50%	55.73%	20.23%***
% Change in Classified Boards	6.70%	4.95%	1.85%
% Change in Board Outsiders	10.39%	14.54%	4.15%**
% Change in Director's Pay	25.91%	58.96%	33.05%***
Change in Board Multiple Directorships	0.60	0.66	0.06*
Change in % Directors with Zero Shares Owned	3.39%	4.69%	1.30%
Change in % Directors that are Female	2.99%	2.17%	(0.82%)

\*\*\*, \*\*, \* denotes significance at the 1%, 5%, and 10%, respectively.

While both groups followed a trend toward greater outsider representation on their boards (possibly as a result of requirements of the Sarbanes-Oxley Act of 2002), poor performers were more aggressive in moving their boards toward independence, a strategy consistent with many studies of board governance efficacy (see Byrd and Hickman, 1992, or Hermalin and Weisbach, 1998). This result is contrary, however, to both Hermalin and Weisbach (1988) and Denis and Sarin (1999), given that there is no evidence that 'top CEO's' are able to stack the boards of top

performers with inside directors. As mentioned above, however, this could be the result of the time-period during which we study director changes. The Sarbanes-Oxley Act of 2002 was promulgated during our sample time period and required all members of the Audit Committee to be classified as outside members of the board. This likely skewed the percentage change in board outsiders higher (than in a normal time period) as firms replaced their inside audit committee board members with outsiders.

Other results from Table 2 indicate that directors' pay increased more dramatically for the poor performing firms, raising the question of whether management is attempting to co-opt directors or is increasing pay in order to attract better directors. In addition, director experience, as represented by directors with multiple directorships, also increased significantly more for poor-performers than for the top-performing firms. Again, both of these results could indicate an attempt by the firm to alter the composition of the firm to change the results of the recent past.

<b>Table 3</b>						
<b>Changes in Other Corporate Governance Variables, by Firm Performance</b>						
<b>from 2001 to 2005</b>						
				Top Performers (n=75)	Bottom Performers (n=102)	Difference
	% Change in Insider Ownership			20.80%	17.15%	3.65%
	% Change in Institutional Ownership			15.98%	6.03%	(22.01%)*
	% of firms Changing Auditor			32.08%	31.68%	(0.40%)

\*\*\*, \*\*, \* denotes significance at the 1%, 5%, and 10%, respectively.

In Table 3, changes in some non-board governance characteristics are documented. There is no difference in the change of insider ownership, indicating that neither group of insiders is apparently more inclined to trade given their superior knowledge of the firm. Both groups experienced net sales of their shares by their management team. Neither group was more prone to change auditors during these periods of extreme performance. One significant difference is not surprising: Institutions were net purchasers of top performers' shares and net sellers of the poor-performing corporations over the study period. This is consistent with other empirical results on changes in institutional ownership as a result of firm performance.

### Conclusion

These results paint a picture of boards being fairly actively restructured, especially those for poor-performing firms. For example, only 33% of the best firms kept their boards size constant over the period and even fewer of the poor performing group (20%) decided that the size of their board was ideal. While this data indicates that better-performing firms often ignored the adage, "if it ain't broke, don't fix it," the worst performers apparently attempted to actively respond to their poor results. The idea that governance structure is a tool in the strategic arsenal of corporations appears to be well-accepted judging by these results.

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## **A Study on Microfinance in China**

Jason Lin and Zhiqiang Wilson Zhang

### **Abstract**

This study investigates the relationship between microfinance programs' presence and farmers' welfare and the factors influencing financial demand of rural households. Empirical analysis has been conducted to investigate the detailed impacts that microfinance programs imposed on rural households based on the data collected through surveys. This study provides evidence that support the hypothesis that microfinance leads to increase in borrowers' household income.

### **I. Introduction**

Microfinance is one of those small ideas that turn out to have profound implications. The idea of microfinance has inspired microfinance movements and challenged decades of thoughts: The poor households can benefit from the access to a broader set of financial service, and institutions can profit while serving poor customers. The rationale behind microfinance is simple: "giving them a hand up, not a handout". Rather than giving donations to poor households, microfinance programs distribute micro-loans to generate personal entrepreneurial activities.

Although China's record of economic growth has been extraordinarily remarkable since 1980, the wealth gap between urban areas and rural areas is still huge. With the Gini coefficient as high as 0.45, an estimated 26% of the population in China's rural areas now live on less than \$1.25 a day (PovcalNet, 2010). Due to the historical policy (1949-1990) of priority for urban development, most financial institutions in China's rural areas were for one exclusive function: collecting savings. Hundreds of billions of RMB was absorbed from rural Chinese areas, and then were used for city development. Given the inability of most formal credit sectors to serve the rural population, microfinance programs have emerged as a potential solution for bridging the gap between the supply and demand for rural finance since the early 1990s. Microfinance programs in China now have profoundly impacted the development of rural society and have developed into seven main forms including 1) nongovernmental organizations programs, 2) the government-supported poverty alleviation programs, 3) rural credit cooperatives programs, 4) social microfinance programs led by People's Bank of China to support the layoffs in urban areas, 5) subsidized loans programs by commercial banks, 6) programs by private microloan companies started in late 2005, 7) programs by village and township banks started in late 2008.

This study is designed to investigate the relationship between microfinance programs' presence and farmers' welfare and the factors influencing financial demand of rural households. Empirical analysis has been conducted to investigate the detailed impacts that microfinance programs imposed on rural households based on the data collected through surveys. This paper is aimed to understand the microfinance puzzles in China, including:

1. To clarify the relationship between rural households' welfare and microfinance programs
2. To determine the factors that affect rural households' financial need which is reflected as the possibility of borrowing from a microfinance institution

## **II. Literature Review**

In microfinance today, the split continues between those in the poverty theory camp and those in the sustainability theory camp. The poverty camp scholars argue for subsidized credit paradigms. But the sustainability camp scholars argue for rural financial system paradigms. Imperfect market paradigms could be viewed as the extension of the rural financial system paradigm with the consideration of the imperfect market reality in developing countries.

Scholars in the poverty camp dominated the microfinance academia before the 1980s. The underlying assumption was that: poor households in rural areas don't have the ability to hold enough savings, thus making production confront with the problem of lacking capital. Due to the high risk, low return, and uncertainty of agriculture production, the commercial financial institutions may choose to stay away. Thus, the poverty camp believes that it is essential to have subsidized capital to power the production in rural areas.

Scholars in the sustainability camp hold the opposite views; the rural finance system paradigm has gradually replaced the subsidized credit paradigm since the 1980s. They argue that the microfinance programs should be free of the heavy subsidies that brought down large state banks. Institutional self-sufficiency is the priority of sustainability camp, and they target the economically active poor as their clients, rather than the extremely poor.

Even with the popularity of the rural finance system paradigm, the microfinance movement continues to be driven by hundreds of millions of dollars of subsidies worldwide. The hope for many is that microfinance programs will use the subsidies in their early start-up phases, and as scale economies and experience drive costs down, the program will eventually operate without subsidies. To do this, the sustainability camp argues that programs must mobilize capital by taking saving deposits or by issuing bonds or institutions must become profitable enough to obtain funds from commercial sources.

Imperfect market paradigm has emerged since the 1990s when supports from social and non-market factors were noticed to be essential to foster an efficient financial market. The framework of the paradigm is that the financial market in developing countries is not perfectly competitive because of information asymmetry, especially true with the financial institutions. A healthy financial market does not develop exclusively based on market mechanisms. Factors such as appropriate government intervention and borrowers institutions are indispensable.

To sum up, the knowledge about the achievements of microfinance is limited but expanding. At one end of the spectrum are studies remarking that microfinance has positive impact on rural households' financial status. At the other end of the spectrum are studies pointing out negative impacts that microfinance could impose on rural families. In the middle are works that identify beneficial impacts but argue that microfinance is not helping the poorest households in rural areas.

### **III. Empirical Analysis of Microfinance in Malinggang Village, China**

#### **III.1 Methodology and Data**

Behind all microfinance programs is the assumption that intervention (mainly loan service) will change human behaviors in ways that lead to the achievement of desired outcomes. In this section, the paper focuses on assessing the difference in the values of key variables between different groups of households. Appropriate comparison between the experimental group and the control group needs to be made because “simple comparisons appear to be driven entirely by selection biases” (Morduch, 1998).

Selection bias may occur mainly because the experimental group systematically possesses an "invisible" attribute that the control group lacks, identified as entrepreneurial drive and ability (David Hulme, 2009). This problem could be tackled by using program-accepted clients-to-be as the control group, and thus the main difference in performance between the two groups could be attributed to the impact of microfinance program.

A randomized survey of 200 households was conducted in May 2010 in Malinggang Village, Heze County, Shandong Province, China. The survey was designed to assess microfinance program outcome and to collect households' financial status and characteristics information. The study compared the group of households who received loans in past two years (experimental group) with the group of community controls who are eligible to participate in the microloan program but had not received loans in the past two years and were not seeking a loan (control group). A total of 101 valid survey samples have been collected. Income was assessed by two indicators, annual household income and per capita annual household income. The survey used questionnaire-based interviews. The questionnaire was approved by IRB at Truman State University. Data analysis was performed using SPSS 17. Income and asset values were reported in RMB which has a currency exchange rate of 6.8RMB to 1 Dollar.

The primary data for the research has been collected through the survey conducted in Malinggang Village. Five loan managers working in Malinggang RCC were also interviewed. The interview questions ranged from first-hand working experience to thoughts on risk control. Some of their thoughts are quoted in the paper. The secondary data mainly comes from the year book of China Finance, Shandong Statistical Year Book, and from a survey conducted by Tsinghua University in 2007.

Shandong Province is located on the eastern edge of the North China Plain. It is one of the most populous provinces in China. Heze County belongs to the southwest part of Shandong Province with a population of 8.86 million, 7.13 million of which live on agricultural production. In 2008, income per capita for farmers in Heze County is 4584 RMB, 5% lower than the provincial average 4824RMB (Shandong Statistical Year Book). Malinggang Village is in the southern part of Heze County with a total population of 150,000. Malinggang Rural Credit Cooperatives (RCCs) is the major microfinance institution that operates in Malinggang Village. In the 2009 fiscal year, Malinggang RCC had 67 million RMB in disbursed loans and 3980 active clients. The average outstanding loan size is 16800 RMB. Malinggang Village was selected to participate in the survey because it is a typical North China agricultural village with a

relatively lower income per capita and the RCCs branch here is relatively mature with a significant amount of clients.

### III.2. Summary of Households' Characteristics and Their Financial Behavior

According to the results of the 101 valid survey samples, Table 1 summarizes the households' characteristics as follows:

Table 1. Household Characteristics

Households' Characteristics	Mean	Std. Dev
Age of Head of Household	41.8	5.8
Years of Education	7.8	2.4
Number of Household Members	4.33	0.63
Number of Migrant Workers in Household	1.07	0.68
Number of Agricultural Workers in Household	2.07	0.91
Number of Relatives Working in Gov	0.69	0.9
Size of Farmland Owned /Mou	5.01	1.23
Size of Farmhouse/rooms	4.23	1.18
Value of Livestock/RMB	1029	1268
Value of Agricultural Equipment/RMB	2489	2615
Savings/ RMB	12840	13605
Value of Durable Assets/ RMB	6115	5766

Among 101 samples, 14.7% households have had micro-loans from formal microfinance institution in the past two years. 1.9% households have had micro-loans from Non-governmental Organizations and, 20.7% households have borrowed from friends and relatives (informal finance sector). The average loan size is 29866 RMB from MFIs, 1050 RMB from NGOs and 10502 RMB from informal finance.

Formal MFIs are the main players in this area, while non-governmental organization programs have a very limited influence. Informal finance plays an important role, but the relatively small average loan amount makes it less influential than the RCCs and VTBs. It is noticeable that 62.37% of rural households are without any loans. This ratio is partly associated with the Chinese traditional borrowing attitude that most people intuitively choose to save rather than to borrow to accumulate capital, and this attitude is evidenced by the national saving rate of 40% (China Statistical Yearbook).

As for the way rural households used the microloans, Table 2 summarizes households usage of microloans.

Table 2. Households Usage of Microloans

1-Agriculture Production Investment or Entrepreneur Activity Investment	31.58%
2-Building House or House Repair	28.95%
3-Healthcare	18.42%
4-Education	10.53%
5-other consumption	5.26%
No Response	5.26%

#### IV. Hypothesis

As mentioned in the introduction, one aim of the study, through the empirical analysis, is to assess the impact of microfinance by clarifying the relationship between rural households' welfare and microfinance program' presence. What are the factors that affect rural households' financial need? In order to do so, several hypotheses have been made and models will be built to test the following hypotheses:

- I. Micro-loans distributed by MFIs lead to increase in borrowers' household income.
- II. The amount of a microfinance loan has a positive relationship with the household income.
- III. Among all factors that influence farmers' financial need, years of education, number of relatives working in the government, and all assets-related variables may have a positive relationship with the possibility for households to get micro-loans from microfinance institutions.

The experimental group consists of households who received micro-loans from MFIs in the past two years. The control group consists of households who are eligible to participate in the microloan programs but haven't sought loans in the past two years. Microfinance institutions such as RCCs have distributed a large number of loan-certificates that grant micro credit lines to the qualified households since 2005. The control group households mainly consist of qualified clients-to-be. The differences of household income between the two groups are summarized in Table 3.

Table 3. Comparison of Income Growth

	Household Income 2009 (RMB)	Income Increase Rate %	Non Agriculture Income (RMB)
Experimental Group (15)	22846	13.92%	6733
Control Group (24)	16437	3.02%	8062

The average 2009 household income of the experimental group is 6409 RMB greater than that of the control group; however the nonagricultural income of the experimental group is 1329 RMB less than that of the control group. This interesting comparison may attribute to the different household labor structure. In experimental group, an average household has 0.8 migrant

workers working in urban area whereas the number is 1.37 for control group, thus leading to a higher non-agriculture income for control group household.

For hypothesis I, the focus is the impact of the loans, which is measured by the income increase rate. The average income increase rate of experimental group is 13.92% with a standard deviation of 0.26 and the average income increase rate of control group is 3.02% with a standard deviation of 0.06. Based on the information, a T-test with null hypothesis is conducted to determine whether the difference of the two groups is statistically significant.

Ho: There is no statistically significant difference between the average income increasing rate of the experimental group and that of the control group.

H1: The average income increasing rate of the experimental group is significantly greater than that of the control group.

The test statistic is  $2.07 > 1.67$ , there is sufficient evidence to reject the Ho hypothesis and conclude that the average income increase rate of the experimental group is significantly greater than that of the control group. Thus hypothesis H1 of this section is supported by the evidence of the micro-study.

We reached the conclusion from the comparison that the experimental group experienced a higher income increase rate than the control group, but questions were raised when we look at each individual household within the experimental group closely: why were some households experiencing a greater income increase rate than others?

For hypothesis II, multiple regressions are used to test the relationship between household income per capita and the amount of the micro-loan. Independent variables such as years of education, number of relatives working in government and consumption & productive assets values are also included in the model.

Table 4. Dependent Variable: Income Per Capita

Model	Unstandardized coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	4724.211	2042.607		2.313	.054
X1-Years of Education Householder Received	-460.057	175.253	-.252	-2.625	.034
X2-Number of relatives working in Government	291.847	262.614	.091	1.111	.303
X3-Size of Farmland (Mu)	412.669	264.246	.129	1.562	.162
X4-Value of Agriculture Equipment(RMB)	.010	.174	.010	.055	.958
X5-Value of Durable Assets	.237	.044	.799	5.431	.001
X6-The Amount of Money Borrowed from RCC or VTB	.043	.013	.377	3.401	.011
X7-Number of Migrant Workers in Household	-2904.59	847.659	-.341	-3.427	.011

Regarding the choice of different variables inputs, highly correlated variables are avoided. The model thus could be translated into an equation:

$$Y = 4724 - 460x_1 + 291x_2 + 412x_3 + .01x_4 + .24x_5 + .04x_6 - 2904x_7$$

The coefficient of the amount of money borrowed from MFIs is 0.043 with p value 0.011, which suggests that the amount borrowed from microfinance institution is statistically significant to the household income level. For every RMB borrowed from MFIs, the income per capita of the household increased by about 4 cents. The evidence found supports hypothesis II.

Interestingly enough, it is noticeable that years of education has a negative relationship with household income level, which is against intuition and the hypothesis. During the interview with loan managers of RCCs, one of the managers pointed out the tendency that the less education the head of household has, the more risk he is willing to take to carry out his entrepreneurial plan. The higher the risk is, the higher the reward probably is. It might not be generally applicable, but in the experimental group of Malinggang Village, it turns out that the households whose heads have less education generally experience a higher per capita annual income. Thus the hypothesis II is partially supported by the evidence from the micro-study.

In order to get a more comprehensive look at microfinance, hypothesis III is brought up to deal with the possibility that households with certain characteristics will end up borrowing from microfinance institutions. A discriminant analysis model is deployed to pursue the potential factors. The dependent variable used to represent this situation is a variable that has either the value 1 if the household borrowed from MFIs in the past 2 years or the value 0 if the household did not borrow.

Let years of education, number of migrant workers and all assets-related factors be explanatory variables that are used to help predict which of the two categories each of the household in the samples should be classified. The explanatory variables are assumed to be approximately normally distributed. The results are follows:

Table 5 Wilks' Lambda

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1	.784	22.370	12	.034

Wilks' lambda is used in an ANOVA (F) test of mean differences of groups in discriminant analysis. A Wilks' lambda of .784 suggests the two groups are not well separated, and a p-value of .034 signifies an important relationship between the variables.

As the classification results table shows, we correctly classified 80% of the subjects with the canonical coefficient. The number of relatives working in government, size of farmland, the amount of saving account and the value of durable assets are the factors that have a strong positive impact to the possibility of getting a loan for rural households, while the number of migrant workers working in cities and value of livestock are the factors that have a negative impact on such a possibility. Public servants usually hold a high social status in China, and having relatives working in government is often seen as an implicit guarantee to repay loans. In Malinggang Village, agricultural activity is the main source of income, so a certain size of farmland guarantees the rural households' repayment ability. Assets generate future income, and future income becomes future assets. The amount of savings and the value of durable assets reflect the rural household's ability to generate stable income. It is reasonable to assume that households with the above characteristics are more likely to get microloans than other households and thus hypothesis III is partially supported by evidence from the micro-study.

Table 6

Standardized Canonical Discriminant Function Coefficients	
Age of Householder	0.353
Years of Education Householder Received	-0.027
Number of Household Members	0.332
Number of Migrant Workers	-0.657
Number of Agriculture Workers in Household	-0.197
Number of relatives working in Government	0.265
Size of Farmland (Mu)	0.141
Value of Livestock (RMB)	-0.087
Value of Agriculture Equipment(RMB)	-0.187
Savings Account (RMB)	0.121
Size of Farmhouse (Number of Rooms)	0.04
Value of Durable Assets	0.854

It is true that the wages earned by migrant workers working in cities have contributed a lot to the overall household incomes; however this factor doesn't help much in the possibility of getting loans. An average migrant worker usually spends 10 months per year working in cities. It is difficult for loan managers to get a hold of him and collect repayment in a timely manner. Moreover, cultivation activity is often regarded as risky because of animal diseases, which is probably why the value of livestock, as an assets-related variable, imposed slightly negative influence to the possibility of getting microloans.

## V. Conclusion

From the empirical analysis of Malinggang Village, the evidence clearly shows that microfinance is a power tool to effectively increase rural household annual income especially when it is made available to the creditworthy economically-active poor. There is a statistically significant relationship between the amount borrowed from MFIs and the amount of household annual income, and thus, we are reasonably convinced that it is beneficial for most people to further promote microfinance in Chinese rural area.

However, it is sometimes forgotten that another word for credit is debt. Placing in debt on those who are too poor to use credit effectively helps neither borrowers nor lenders. As the test in the above section shows, the poorer households tend to use credit less effectively than the economically active poor household. And borrowers without opportunities to use credits may have no choice but to consume their loans, leading to humiliation and the diminishing of already low self-confidence. The poorest of the poor should not be the responsibility of the microfinance sector, but of the government agencies or donors who can provide them food, shelters, training, and other basic requirements to overcome desperate poverty.

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## Impact of EVA Adoption on Long-Term Shareholder Value: An Empirical Investigation

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### Abstract

Our study examines Economic Value Added metric's link to long term shareholder value creation. We assume that EVA adoption directs a positive change in managerial behavior that in turn affects long-term value generation. Unlike most prior research that uses only one sample, we employ two samples. The first sample is based on 57 U.S. firms that Stern Stewart & Company has posted on its website. They report that these firms have achieved superior financial performance as a consequence of the adoption of EVA for the 1994-98 periods. The second sample is based on 178 U.S. firms' proxy statements for the 1994-1999 periods in which these firms have described EVA use as a part of their performance evaluation and compensation metric. Our study's results, using both long-term abnormal holding period returns and analyst forecast based on five-year growth of earnings per share show that EVA adoption has no significant impact on a firm's long-run performance when compared to a control sample matched on industry, size and past performance. Moreover, we find no evidence that EVA adoption induces greater shortsightedness as EVA adopters do not underperform, on average, the non-EVA firms.

Since the early 1990s the business press has presented an innovative and simple to understand and to apply value metric, Economic Value Added (trade-marked as "EVA") that could tie managerial motivation and performance to building shareholders' wealth. Since then, Fortune magazine has been publishing a 1000 performance ranking of the America's "best" or "real" wealth creators using EVA as a wealth predictor (*Fortune, December, 2004*). A recent article in Fortune magazine claims that "EVA-based analysis has proven extremely valuable in analyzing individual companies" (Colvin, G., *Fortune*, Feb. 21, 2008). The EVA developers, the consulting firm of Stern Stewart & Company, have refined the traditional residual income (RI) concept into a measure that tends to minimize the generally accepted accounting principles (GAAP) based distortions in economic earnings. They argue, "earnings, earnings per share, and earnings growth are misleading measures of corporate performance" (Stewart, 1991, p. 66).<sup>2</sup> They define EVA as the difference between the firm's net operating income after taxes (NOPAT) and the cost of *both* the debt and equity capital employed by the firm to generate NOPAT (Stern Stewart, 1993). The interest in EVA or EVA-types performance measures is not limited to the firms in the United States. Quite a few firms across the Atlantic in United Kingdom and in Germany and an increasing number in New Zealand and Australia are using EVA as an internal performance evaluation and incentive compensation tool.

According to Abate et al. (2004), EVA users are identified in three areas: corporate users, investment players, and value-based consultants. Some key corporate users include Coca-Cola, Eli Lilly, Home Depot, among many others. Examples of financial institutions include GAM and Oppenheimer Capital (on the buy-side) and Credit Suisse First Boston, Deutsche Bank Securities, Goldman, Sachs & Co. (on the sell-side). These investment players employ EVA

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1. "Forget EPS, ROE, and ROI. The true measure of your company's performance is EVA." (Stern Stewart & Co., magazine advertisements). Copeland et al. (2000) use the term "Economic Profits" instead of Economic Value Added while assigning the same definition, i.e., a short-term financial indicator.

approach in training their analysts in security valuation and portfolio management. On the consulting side, the EVA (economic profit) players include Boston Consulting Group, L.E.K. Consulting, Marakon Associates, Mckinsey & Co., and Stern Stewart & Co.

Our study examines EVA's link to long term shareholder value creation. We assume that EVA adoption directs changes in managerial behavior that in turn affects long-term value generation. Prior studies have demonstrated links between EVA measures and changes in behavior of managers for firms that adopt EVA. Biddle, Bowen, and Wallace (1999) investigate whether residual income (EVA)-based compensation plans affect managers' operating, investing, and financing decisions. Their results show that asset turnover experienced a significant increase of 14 percent, asset disposition increased 100 percent, new investment decreased 21, and share repurchase increased 112 percent, for residual income-based compensation plan adopter firms as compared to the control group in the post adoption period. Sheikholeslami (2001) based his study on the Wall Street Journal' Executive Pay Survey (April 10, 1997) data for 350 largest U.S. businesses and on Stern Stewart 1000 database and finds EVA to be linked to the compensation components (base salary, cash bonus, and long-term compensation) in a positive and significant way.

Riceman et al. (2002) investigate whether managers exhibit superior performance under EVA driven bonus scheme when compared to a control group. Their results show that, of the managers who are assessed using EVA bonus plans, only the ones who understand the EVA concept outperform managers who are compensated based on traditional accounting-based bonus plans.

Fatemi et al. (2003) examine the relationship between top management compensation and the two economic rates of return measures: EVA and Market Value Added (MVA is the present value of all expected future EVA). Specifically, the authors are interested in knowing whether compensation rewards managers for past performance or it encourages them to show higher future performance. They report strong association between executive compensation and MVA but a weak one with EVA. Fatemi et al. identify the most significant finding of their study as one that suggests that EVA and MVA based compensation contracts induce top managers to act in the long-term interest of shareholders even though doing so will impact short-term value creation.

Our study differs from past work on EVA in three distinct ways. First, unlike the prior research that primarily evaluates the relationship between firms' adoption of EVA and stock market performance strictly around the adoption date, our study provides evidence of EVA impact over longer term stock market performance. Second, our study focuses on how a firm's EVA adoption impacts financial analysts' consensus of growth of earnings per share for long-term forecast horizon. Finally, unlike most prior research that uses only one sample, we employ two samples to conduct empirical analysis. As with any application of shareholder methodology, the EVA researcher seeks some assurance that the management implements EVA metric properly and not just in "name only." Therefore, we base our first sample on 57 U.S. firms that Stern Stewart & Company has posted on its website and where they report that these firms have achieved superior financial performance as a consequence of the adoption of EVA (1994-98).

The second sample is composed of 178 U.S. firms who mention EVA in their proxy statements as a part of the performance evaluation and compensation metric over the 1994-1999 periods<sup>3</sup>. Only Klieman (1999), an academic work, addresses the long-term EVA performance issue using stock market measures. Klieman identifies a sample of 71 firms that reported the adoption of EVA in their annual reports and 10-K during the 1987-1996 periods. He matches these EVA firms with a control sample based on industry (four-digit SIC code) and on size (measured in sales) a year before the year of adoption. He then uses abnormal returns and cumulative abnormal returns metric to conduct stock market performance tests. His study results show that the EVA firms significantly outperform their peers - they earn, over their peers, an industry-adjusted stock market total return of 28.8% over a four year period subsequent to EVA adoption. He concludes that long-run stock market performance of EVA adopters is significantly better than those of EVA non-adopters when compared to the peer firms. We feel that we make significant improvement to the research design employed by Klieman (1999) by not only matching EVA firms with the control firms on industry and on size but also on prior financial performance. We believe that matching firms on prior financial performance strengthens the research design.

Cordeiro and Kent, Jr. (2001) employ security analyst earnings forecasts as alternative to accounting and stock market performance measures. They test the relationship between adoption of EVA programs and analyst forecast of earnings per share. They use Stern Stewart list of 63 firms that adopted EVA and match these firms with 676 control sample firms matched by size, leverage, and by industry for the 1997 adoption year. They separately estimate three cross-sectional multiple regression models employing ordinary least squares (OLS) and using as dependent variables security analyst earnings per share forecasts of current-year, one-year-ahead and next five-year growth as measures of firm performance. Cordeiro and Kent, Jr. failed to find a link between EVA adoption and security analyst forecast of earnings per share. Our use of analysts forecast metric is different from the work of Cordeiro and Kent, Jr. in two specific ways: 1) They use security analyst forecast as a level variable, whereas, we use it as a change variable, and 2) They examine the statistical association between analysts forecast of EPS and adopters versus non-adopters of EVA sample at a point in time, whereas, we develop a measure that is a change in earnings forecasts following the adoption of EVA over a five-year forecast horizon. In our study's empirical results, we find no significant difference in long term stock price performance between EVA adopters and the control sample of firms matched on industry, size and past performance. We also find no evidence that financial analysts significantly revise their forecasts for the five-year growth of earnings per share for firms adopting EVA.

The rest of the paper is organized as follows: In the next section, we present the conceptual framework of EVA. We, next, describe sample selection and research design of the study. Following that, we report the results and finally, provide summary and conclusion of the study.

## **I. CONCEPTUAL FRAMEWORK OF EVA**

Simply put, EVA is based on the centuries old financial concept that the true or economic profit of a firm must be based on the difference between all revenues or gains and all expenses or

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<sup>3</sup> Most of the prior descriptive and empirical research examines periods that end in 1993.

losses that should include all the cost of borrowing from banks and other lenders and all the cost (opportunity cost) of “borrowing” from the owners (equity capital). Why is this issue so important? According to Drucker (1995) “until a business returns a profit that is greater than its cost of capital, it does not create wealth; it destroys it.”<sup>4</sup> Since, a firm is not required by accounting rule-makers to deduct the estimated cost of equity “borrowing” on its income statement or disclose it in any section of the annual report, investors and other users have to estimate it themselves in order to arrive at this number. More importantly, the firms in the past have not been explicitly recognizing and accounting for this cost in a significant number of their internal decision making functions such as strategic planning, motivating, and performance evaluation. Rather, a case can be made that managers tend to perceive equity capital as free.

The modern theory of corporate finance postulates that managers’ job is ‘to maximize shareholder value, in turn maximizing the value of the firm.’ The value of a firm is a function of its ability to generate future free cash flows. Based on a widely accepted discounted cash flow model (DCF), the discounted value of the expected free cash flows equals the value of the firm. Similarly, based on the EVA model, the value of the firm can also be calculated as the amount of capital invested, plus a premium equal to the present value of the value generated each year (Copeland et al. 2000). The two models and their formulations borrowed from extant finance literature (see more in Young (1999); Copeland et al. 2000) are reproduced herein:

#### DCF Model vs. EVA Model:

$$\begin{aligned} \text{FCF} &= \text{NOPAT} - \text{Change in capital} \\ \text{EVA} &= \text{NOPAT} - (\text{WACC} \times \text{Capital}) \\ \text{Enterprise value (DCF)} &= \text{PV of future FCF} \\ \text{Or,} &= \text{Beginning book capital} + \text{PV of future EVA} \end{aligned}$$

#### EVA Model, in general, is described as follows:

$$\begin{aligned} \text{EVA} &= \text{NOPAT} + \text{AcctAdj} - \text{Capital charge (based on AcctAdj. Of capital)} \\ &= \text{NOPAT} - (\text{Invested capital} \times \text{WACC}) \end{aligned}$$

EVA can also be defined as:

$$\begin{aligned} \text{EVA} &= \text{Invested capital} \times \text{Spread} \\ &= \text{Invested capital} \times (\text{ROIC} - \text{WACC}) \end{aligned}$$

Where

$$\begin{aligned} \text{NOPAT} &= \text{Net operating profits after taxes} \\ \text{AcctAdj} &= \text{Accounting adjustments} \\ \text{WACC} &= \text{Weighted average cost of capital (debt cost + equity cost)} \\ \text{ROIC} &= \text{Return on invested capital} \\ \text{Invested Capital} &= \text{adjusted book value of net capital at the beginning of the period.} \end{aligned}$$

<sup>4</sup> Earlier research, Anthony (1982, 1973), strongly advocated that in reporting to outsiders the earnings for a period, a firm should also deduct the cost of equity interest, so as it does, the cost of debt from operations. This view is not new. The nineteenth century classical economist Alfred Marshall (1890) discussed the concept of an economic or real profit that is calculated after deducting all interest cost on invested capital from net profits. In the 1920s, Alfred Sloan introduced a residual income measure in General Motors and in the 1930s Matsushita also used it (Young, 1999). David Solomon in a 1965 monograph also proposed the use of residual income as an internal measure to structure performance evaluation contracts (Biddle et al, 1999). One related stream of research linked residual income to the value of a firm [Edwards and Bell 1961; Ohlson, 1995]. In academic circles, this approach is widely known as Edwards-Bell-Ohlson (EBO) valuation model.

Both models arrive at exactly the same firm value. However, the difference in EVA model compared to the DCF model is that EVA model provides a measure of the value added (in dollars) in a single year. A firm adds value if EVA calculation provides a positive dollar number (without a corresponding decline in future EVA's). On the other hand, the company destroys value if the EVA calculation results in a negative dollar number. It is important to note that EVA measures the addition to wealth. Therefore, the timing of wealth creation in the current period could be somewhat arbitrary. This is precisely why we need to examine the creation of wealth over a longer time horizon since the wealth creation starts occurring when positive NPV projects are selected (Copeland et al. 2000). Moreover, a criticism of EVA based compensation is that it encourages shortsightedness in managers, especially on the divisional level, as it rewards higher current earnings. Future losses will not penalize managers who expect to be promoted or leave the firm.

Stern Stewart & Co. recommends making 164 accounting adjustments to GAAP-based accounting. Consultants argue for no more than ten to twelve adjustments, in fact, some recommend no more than six as more than adequate (Young, 1999). The most commonly proposed GAAP-based accounting adjustments reported in Young (1999) are:

1. Non-recurring gains and losses.
2. Research and development.
3. Deferred taxes.
4. Provisions for warranties and debts.
5. LIFO reserves.
6. Goodwill.
7. Depreciation.
8. Operating leases

Companies can improve future EVA by taking some of the following actions (Young, 1999):

- a. Decrease capital to lower the overall capital employed; this will increase ROIC only if NOPAT does not decrease more than the decrease in capital.
- b. Increase investment only if the return on new investment is greater than the WACC.
- c. Increase NOPAT without increasing capital investments.
- d. Reduce WACC cost of capital.

## II. SAMPLE SELECTION AND RESEARCH DESIGN

We use two samples to conduct the empirical analysis of our study. The first sample is based on 57 U.S. firms that Stern Stewart & Company has listed on its website and where they report that these firms have achieved superior financial performance as a consequence of the adoption of EVA for the 1994-98 periods. The second sample is based on 178 U.S. firms' proxy statements for the 1994-1999 periods<sup>5</sup> in which these firms have described EVA use as a part of their performance evaluation and compensation metric. We believe that the sample period is not an issue as the motivations on managerial behavior induced by EVA adoption should not be time specific. As a measure of performance and a basis for compensation, EVA is designed to

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<sup>5</sup> Most of the prior descriptive and empirical research examines periods that end in 1993.

produce a specific focus on value creation that may be considered universal and; therefore, should not be expected to change over time.

The initial second sample was collected from the National Automated Accounting Research Service (NAARS) data tape obtained from the American Institute of Certified Public Accountants (AICPA) and Mead Data Control using the key words "EVA" or "Economic Value Added". We extracted the text from the Proxy Statements in which either of the above key words was mentioned. There were a total of 196 firms, which specifically mentioned EVA (or Economic Value Added) in their 1994-1999 Proxy statements, indicating that EVA is likely being used for management evaluation and compensation purposes. The following process was used to arrive at the final sample: 1) Only the earliest date was retained for those firms that mentioned EVA (or Economic Value Added) in more than one year in order to avoid multiple counting error, and 2) The firms were dropped if the price or analysts forecast information was not available on the CRSP or I/B/E/S database, respectively for the sample period. The application of this screen resulted in a final sample of 178 firms (hereafter, Proxy sample) which then is used in the study.

### III. Long Term Abnormal Returns

We examine the long-term stock performance of an EVA adopting firm relative to that of a matched firm over a specified holding period. We match each EVA adopting firm with a benchmark firm matched for the adopting firm's industry affiliation, size, and prior stock price performance. In addition to the obvious reasons for using industry affiliation and firm size, we use the prior stock price performance as one of the matching criteria because DeBondt and Thaler (1985, 1987), Fama and French (1988), Cutler, Poterba and Summers (1991), Jegadeesh and Titman (1993), Chan, Jegadeesh and Lakonishok (1996) and Barber and Lyon (1997) report evidence that future returns can be predicted using past returns;<sup>6</sup> and therefore, failing to control for it may lead to incorrect measurement of the post-announcement long-term abnormal return.

We first establish a list of non-adopting firms having the same industry affiliation as the EVA adopting firm which we determine by the two-digit Standard Industry Classification code of the adopting firm as indicated in the CRSP database. We then restrict the list to those non-adopting firms having market values within 20 percent of that of the adopting firm. We measure the total market value of the equity of the firms as of one month before the EVA adoption date. From this list of non-adopting firms, we select that firm whose prior stock price performance most closely matches that of the EVA adopting firm. Prior stock price performance is measured over one year before the EVA adoption date using the CRSP database.

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<sup>6</sup> DeBondt and Thaler (1985, 1987) find that portfolios of long-term past losers outperform long-term past winners over the subsequent three to five years. Fama and French (1988) and Cutler, Poterba and Summers (1991) find a negative autocorrelation over horizons of three to five years. Jegadeesh and Titman (1993) report that (over an intermediate horizon of three to twelve months) past winners continue to outperform past losers. Chan, Jegadeesh and Lakonishok (1996) document the persistence, or momentum, of stock returns over the horizon of six months to a year. Also, using simulation for the period 1973 to 1994, Barber and Lyon (1997) show that for firms with high pre-event momentum; conventional *t*-tests are positively biased for the one-year horizon, and negatively biased for the three- and five- year horizons. For firms with low pre-event momentum, conventional *t*-tests are negatively biased for the one-year horizon, but positively biased for three-year horizon. The implication of the study of Barber and Lyon (1997) is that the post-announcement abnormal return might be caused by pre-announcement abnormal return, either explained by mean-reversion or under-reaction.

<sup>6</sup> We also performed the tests using monthly CARs and found similar results to those reported for the BHARs.

After matching the EVA adopting firms with non-adopting benchmark firms, we follow the prescription of Barber and Lyon (1997) and calculate the holding period abnormal return for a firm as:

$$BHAR_{(i,a,b)} = \prod_{t=a}^b (R_{it} + 1) - \prod_{t=a}^b (R_{mt} + 1)$$

where  $BHAR_{(i,a,b)}$  is the buy-and-hold abnormal return for EVA adopting firm  $i$  over the holding period  $a$  to  $b$ ,  $R_{it}$  is the return on stock  $i$  on day  $t$ , and  $R_{mt}$  is the return on the matched firm on day  $t$ .

We compute the buy-and-hold average abnormal returns (BHAAR) over holding periods that extend from one to five years. None of the buy-and-hold periods include the announcement day of the EVA adoption and the following trading day. If an adopting firm is de-listed before the end of a holding period, we still include its truncated return series in the analysis, and we assume that it earns the daily return of the benchmark firm during the remaining days in the holding period. We determine the statistical significance of each of the BHAARs using the parametric  $t$ -test (two-tailed) and the non-parametric Wilcoxon signed-rank test (two-tailed).<sup>7</sup> If EVA adoption motivates managers at all levels of the firm to focus on value creation, the long term stock price performance of EVA adopters should be at least comparable to that of control firms. If EVA adoption increases the shortsightedness of managers, EVA adopting firms may underperform comparable firms. If firms that adopt EVA are better at creating shareholder value than comparable firms not adopting EVA, we should observe superior performance in the stock prices of EVA firms. The cumulative effect of EVA focused decisions should become increasingly manifest over time. Therefore, we examine long-term holding period returns for EVA firms and for comparable benchmark firms that are matched with the EVA firms in terms of industry, size, and prior performance.

#### IV. Estimating Analysts' Forecast Revisions

Monthly data on earnings forecasts made by analysts are obtained from the I/B/E/S database. We measure revisions of analysts' forecasts for the five-year growth rate of earnings around announcements of EVA adoptions. Specifically, the monthly forecast revision (FR) of the five-year growth rate of earnings for firm  $i$  in month  $t$  is calculated as:

$$FR_{i,t} = (F_{i,t} - F_{i,t-1}) / F_{i,t-1}$$

where  $F_{i,t}$  is the mean of analysts' forecasts for firm  $i$  at month  $t$ ,  $F_{i,t-1}$  is the mean of analysts' forecasts for firm  $i$  at month  $t-1$  as reported by IBES. The monthly forecast revisions of the five-year forecast are normalized by the prior month's forecast. Average forecast revisions are calculated for each event month where month 0 is the EVA adoption month in event time. We determine the statistical significance of each of the average forecast revisions using the parametric  $t$ -test (two-tailed) and the non-parametric Wilcoxon signed-rank test (two-tailed). Several studies provide evidence that analysts' earnings forecasts are superior to forecasts generated by time-series models. This forecasting advantage is partly attributed to their access to

<sup>7</sup> Barber and Lyon (1997) recommend using buy-and-hold abnormal returns. We also performed the tests using monthly CARs and found similar results to those reported for the BHARs.

private firm-specific information which in turn, helps them more aptly identify and isolate the permanent from the transitory and value-irrelevant earnings shock [Copeland and Mayers (1982); Brown and Zmijewski (1987); Ramakrishnan and Thomas (1991)]. Security analysts' main sources of information among other sources include frequent direct contacts with the top management of the firms they follow on a regular basis. Thus, security analysts frequently visit operational sites, query managers about their operational and strategic decisions, and closely monitor the ongoing developments around the firm. Consequently, they gain insight about firm's future prospects and then use this and other value relevant information to revise their forecasts of firm's earnings per share (Rao and Sivakumar, 1999). In fact, evidence in Imhoff & Lobo (1984) and Puffer & Weintrop (1991) indicate that analysts' forecasts serve as a proxy for expectations held by the board of directors.

Contemporary research argues that analysts' forecasts can be employed as a measure of performance of a firm. For example, Fried and Givoly (1982) provide evidence that analysts' forecasts are better than those of time-series models when used as proxy for market expectations. Brown et al. (1985) show that share price of a firm is driven by analysts' expectations of its future earnings. They also report that analysts' long-term earnings forecasts (e.g., a five-year earnings growth forecast) are 'more valuation-relevant than their short-term earnings expectations.' Similarly, Easton and Zmijewski (1989) report a positive relationship between the earnings response coefficient and the analyst's earnings revision coefficient. On similar lines, Givoly and Lakonishok (1979), Freeman and Tse (1989), and Beneish (1991) show that forecast revisions metric can be employed to predict future abnormal returns.

## **V. RESULTS**

### **A. Long-term Holding Period Returns Test – Stern & Stewart Sample**

TABLE 1

**Holding-Period Abnormal Returns for EVA Firms Identified by Stern Stewart**

Average holding-period returns and average holding-period abnormal returns are reported for EVA firms and size/industry/performance matched benchmark firms. Holding-period abnormal return is the paired difference of the holding period returns for the EVA firm and its benchmark firm. Percent under-perform reports the percentage of EVA firms that under perform their benchmarks. *T*-statistics test the hypothesis that the average holding-period abnormal returns equals zero. The Wilcoxon Signed Rank Test is used to test the hypothesis that the percentage under-performance is equal to fifty percent.

HOLDING PERIOD	HOLDING PERIOD		PERCENT		N
	EVA FIRMS	ABNORMAL BENCHMARK	UNDER-RETURN	WILCOXON T-STAT (P-VAL)	
1 YEARS	28.614	24.509	4.105	0.51 (0.609)	56
2 YEARS	56.543	52.952	3.591	0.20 (0.840)	56
3 YEARS	65.878	117.477	-51.599	-1.13 (0.265)	56

\* Significant at the 0.05 levels.

\*\* Significant at the 0.01 levels.

Average holding period returns are reported for both sets of firms in Table 1 for holding periods of one, two and three years. Holding period abnormal returns are calculated as the pair-wise difference between the holding period return of the EVA firm and its benchmark firm. A positive average holding period abnormal return indicates that EVA firms outperform, on average, their non-EVA counterparts over the holding period. The *t*-statistics in the table indicate that the average holding period abnormal returns are not statistically different from zero in each of the three holding periods. Moreover, the results of Wilcoxon signed-rank tests for each of the holding periods show that the percentage of EVA firms under-performing their counterparts are not statistically different from 50 percent.

Table 1 reports the long-term holding period returns for the Stern & Stewart sample of 57 EVA firms and for comparable benchmark firms that are matched with the EVA firms in terms of industry, size, and prior performance. These Average holding period returns are reported for both sets of firms for holding periods of one, two and three years. Holding period abnormal returns are calculated as the pair-wise difference between the holding period return of the EVA firm and its benchmark firm. A positive average holding period abnormal return indicates that EVA firms outperform, on average, their non-EVA counterparts over the holding period.

As shown in Table 1, the t-statistics values indicate that the average holding period abnormal returns for EVA adopters and non-adopters are not statistically different from zero in each of the three holding periods. Moreover, the results of Wilcoxon signed-rank tests for each of the holding periods show that the percentage of EVA firms under-performing their counterparts are not statistically different from 50 percent. Therefore, we find no evidence that adopting of EVA results in better share price performance, as measured against comparable non-EVA adopting firms. Nor does the evidence indicate that EVA adopting firms underperform comparable non-EVA adopting firms. These results indicate that EVA firms and non-EVA firms give comparable attention to shareholder value creation.

#### **B. Analysts long-term EPS Growth Forecast – Stern & Stewart Sample**

##### **TABLE 2**

Average Forecast Revisions (AFR) for the Five Year Growth Forecast Horizon.

The forecast month is from the 3rd Thursday in one month to the 3rd Thursday in the following month relative to the event month 0. Forecast revisions for the current-year earnings are normalized by the price per share listed by the IBES the month prior to the announcement. Forecast revisions are cumulated over forecast months to calculate cumulative forecast revisions. The null hypothesis tested by the t-statistics is that the average FR equals 0.

**Event: EVA Adopters - Stern & Stewart sample****Average Forecast Revision - Five Year growth**

Forecast Month	Average Forecast Revision	T-Stat (P-Val)	Percent Pos/0/Neg	Wilcoxon T-Stat (P-Val)	N
-6	-0.00049	-0.08 (0.940)	24.5/49.1/26.4	0.10 (0.459)	53
-5	-0.00510	-0.70 (0.490)	20.4/50.0/29.6	0.84 (0.201)	54
-4	-0.00782	-1.33 (0.189)	20.0/50.9/29.1	0.53 (0.299)	55
-3	0.02804	1.49 (0.141)	30.9/52.7/16.4	1.89 (0.029)**	55
-2	0.00604	1.86 (0.068)	23.6/60.0/16.4	0.29 (0.385)	55
-1	0.00485	0.88 (0.383)	27.3/49.1/23.6	1.00 (0.159)	55
0	0.00057	0.08 (0.938)	19.6/51.8/28.6	1.12 (0.132)	56
1	-0.00111	-0.18 (0.856)	16.1/53.6/30.4	1.81 (0.035)**	56
2	-0.00075	-0.10 (0.921)	23.2/55.4/21.4	0.30 (0.381)	56
3	0.02013	1.08 (0.285)	28.6/50.0/21.4	0.80 (0.212)	56
4	-0.00012	-0.03 (0.979)	24.6/57.9/17.5	0.93 (0.175)	57
5	0.00215	0.29 (0.771)	21.1/54.4/24.6	0.12 (0.454)	57
6	-0.00291	-0.59 (0.560)	26.3/52.6/21.1	0.56 (0.288)	57

\* Significant at the 0.05 levels.

\*\* Significant at the 0.01 levels.

Table 2 shows the revision in monthly average analysts' forecasts of five-year growth in EPS for EVA adopters. These average forecast revisions are also provided for the +6 and -6 months around the event month (the month of the issuance of the Proxy Statement). The parametric t-statistic and the nonparametric (tests of proportions), p-value, is used to test whether the average forecasts revisions around the event date are positive and significantly different from zero for EVA adopting firms.

As shown in Table 2, we do not observe any significant positive revision made by analysts in their EPS forecasts of five-year time horizon. The results indicate that analysts do not perceive the adoption of EVA to be impacting the long term prospect of the firms.

### C. Long-term Holding Period Returns Test – Proxy Statement Sample

**TABLE 3**  
**Holding-Period Abnormal Returns for EVA Firms**  
**Proxy Sample**

Average holding-period returns and average holding-period abnormal returns are reported for EVA firms and size/industry/performance matched benchmark firms. Holding-period abnormal return is the paired difference of the holding period returns for the EVA firm and its benchmark firm. Percent under-performance reports the percentage of EVA firms that under perform their benchmarks. *T*-statistics test the hypothesis that the average holding-period abnormal returns equals zero. The Wilcoxon Signed Rank Test is used to test the hypothesis that the percentage under-performance is equal to fifty percent.

HOLDING PERIOD	PERCENT			PERFORM T-STAT (P-VAL)	N		
	TARGET BENCHMARK DIFFERENCE	UNDER-WILCOXON T-STAT (P-VAL)	PERFORM T-STAT (P-VAL)				
1 YEARS	31.697	25.226	6.471	0.94 (0.348)	50.6	0.72 (0.237)	178
2 YEARS	23.719	13.955	9.764	1.32 (0.190)	49.4	0.66 (0.254)	178
3 YEARS	22.499	23.257	-0.759	-0.09 (0.930)	47.8	0.55 (0.292)	178

\* Significant at the 0.05 levels.

\*\* Significant at the 0.01 levels.

Average holding period returns are reported for both sets of firms in Table 1 for holding periods of one, two and three years. Holding period abnormal returns are calculated as the pair-wise difference between the holding period return of the EVA firm and its benchmark firm. A positive average holding period abnormal return indicates that EVA firms outperform, on average, their non-EVA counterparts over the holding period. The *t*-statistics in the table indicate that the average holding period abnormal returns are not statistically different from zero in each of the three holding periods. Moreover, the results of Wilcoxon signed-rank tests for each of the holding periods show that the percentage of EVA firms under-performing their counterparts are not statistically different from 50 percent.

Table 3 reports the long-term holding period returns for firms that disclosed the use of EVA in their proxy statements (Proxy sample) and for comparable benchmark firms that are matched with the EVA firms in terms of industry, size, and prior performance. These Average holding period returns are reported for both sets of firms for holding periods of one, two and three years. As reported in Table 1, the holding period abnormal returns are calculated as the pair-wise difference between the holding period return of the EVA firm and its benchmark firm. A positive (negative) average holding period abnormal return indicates that EVA firms outperform (underperform), on average, their non-EVA counterparts over the holding period.

As shown in Table 3, the t-statistics values indicate that the average holding period abnormal returns for EVA adopters (Proxy sample) and non-adopters are not statistically different from zero in each of the three holding periods. Moreover, the results of Wilcoxon signed-rank tests for each of the holding periods show that the percentage of EVA firms underperforming their counterparts are not statistically different from 50 percent. Therefore, we find no evidence that adopting of EVA results in better share price performance, as measured against comparable non-EVA adopting firms. Moreover, we find no evidence that EVA adoption induces greater shortsightedness as EVA adopters do not underperform, on average, non-EVA firms. These results indicate that EVA firms and non-EVA firms give comparable attention to shareholder value creation.

#### **D. Analysts long-term EPS Growth Forecast – Proxy Statement Sample**

##### **TABLE 4**

Average Forecast Revisions (AFR) for the Current-year Earnings Per Share – Five year growth.

The forecast month is from the 3rd Thursday in one month to the 3rd Thursday in the following month relative to the event month 0. Forecast revisions for the current-year earnings are normalized by the price per share listed by the IBES the month prior to the announcement. Forecast revisions are cumulated over forecast months to calculate cumulative forecast revisions. The null hypothesis tested by the t-statistics is that the average CFR equals 0.

**Event: EVA Adopters - Proxy Sample****Average Forecast Revision - Five Year growth model**

Forecast Month	Average Forecast Revision		T-Stat (P-Val)	Percent Pos/0/Neg		Wilcoxon T-Stat (P-Val) N	
	Average Forecast Revision	T-Stat (P-Val)		Percent Pos/0/Neg	Wilcoxon T-Stat (P-Val) N		
-6	0.00870	1.62 (0.107)	23.8/59.4/16.8	0.25 (0.401)	143		
-5	-0.01048	-1.88 (0.062)	14.2/60.1/25.7	2.29 (0.011)	148		
-4	-0.06404	-1.84 (0.067)	21.3/60.7/18.0	0.41 (0.340)	150		
-3	-0.00108	-0.35 (0.729)	17.0/67.3/15.7	0.97 (0.167)	153		
-2	0.00602	1.67 (0.097)	25.5/58.8/15.7	1.80 (0.036)	153		
-1	0.03284	1.68 (0.094)	21.8/53.2/25.0	0.72 (0.237)	156		
0	-0.00423	-0.70 (0.484)	25.8/54.7/19.5	1.28 (0.101)	159		
1	0.00282	0.64 (0.524)	21.7/54.8/23.6	0.48 (0.316)	157		
2	-0.02153	-1.64 (0.104)	22.5/51.3/26.3	0.65 (0.258)	160		
3	0.00352	1.23 (0.219)	20.3/59.5/20.3	0.41 (0.341)	158		
4	0.00031	0.08 (0.938)	18.6/51.6/23.1	1.22 (0.112)	159		
5	-0.00527	-1.26 (0.211)	23.1/58.3/18.6	0.61 (0.270)	156		
6	0.00388	1.24 (0.217)	20.1/64.3/15.6	1.25 (0.106)	154		

\* Significant at the 0.05 levels.

\*\* Significant at the 0.01 levels.

Table 4 shows the revision in monthly average analysts' forecasts of five-year growth in EPS for EVA adopters. These average forecast revisions are also provided for the +6 and -6 months around the event month (the month of the issuance of the Proxy Statement). The parametric t-statistic and the nonparametric (tests of proportions), p-value, is used to test whether the average forecasts revisions around the event date are positive and significantly different from zero for EVA adopting firms.

As shown in Table 2, we do not observe any significant positive revision made by analysts in their EPS forecasts of five-year time horizon. The results indicate that analysts do not perceive the adoption of EVA to be impacting the long term prospect of the firms.

## VI. SUMMARY AND CONCLUSION

Our study examines EVA's link to long term shareholder value creation. We assume that EVA adoption motivates changes in managerial behavior that in turn affects long-term value creation.

Our study differs from past work on EVA in three distinct ways. First, unlike the prior research that primarily evaluates the relationship between firms' adoption of EVA and stock market performance only around the adoption date, our study provides evidence of EVA impact

over longer term stock market performance. Second, we do not have knowledge of any study that has directly examined EVA's effect on security analysts' forecasts of earnings per share (EPS) over a long-term horizon of five years. Our study focuses on how a firm's EVA adoption impacts financial analysts' consensus of growth of earnings per share for long-term forecast horizon. We believe that the cumulative effect of EVA focused decisions should increasingly manifest over time. If EVA's proponents' claims are valid then we expect to observe superior stock price performance and upward revisions of earnings per share forecasts by analysts over a longer period for EVA adopters.

Finally, unlike most prior research that uses only one sample, we employ two samples to conduct empirical analysis. The first sample is based on 57 U.S. firms that Stern Stewart & Company has posted on its website and where they claim that these firms have achieved superior financial performance as a consequence of the adoption of EVA for the 1994-98 periods. The second sample is based on 176 U.S. firms' proxy statements for the 1994-1999 periods in which these firms have described EVA use as a part of their performance evaluation and compensation metric.

Our study's empirical results, using both long-term holding period returns and analyst forecast based on five-year growth of earnings per share show that EVA adoption is not associated with superior long performance or expectations of superior performance for EVA adopting firms. The long run stock performance of EVA adopting firms is not significantly different from that of a control sample matched on industry, size and past performance. And financial analysts do not systematically revise their forecasts for the long term growth in earnings when firms adopt EVA. Thus, we did not find support for research that advocates adoption of EVA because it results in superior stock performance. However, these results should not be interpreted as indicating that EVA is not a useful tool for evaluating and rewarding performance as there is no evidence that EVA adopters underperform comparable firms. Moreover, it is also likely that firms who adopt EVA do so to benefit from market's positive perception about EVA. What our results do imply is that managers in both EVA and non-EVA firms are subject to internal monitoring and rewards and to the discipline of the external markets for corporate control and for managerial labor that induce a comparable focus in shareholder wealth creation in both sets of firms.

## **VII. Limitations and Further Research**

Our study has some limitations that we should acknowledge. First, the use of NAARS database resulted in 310 hits. It is likely that some firms were inadvertently excluded when we used the search term EVA or Economic Value added. For instance, some firms might be using the term "Controllable Earnings" or "Economic Profits" to mean the same thing. We do not feel that the inclusion of a few more firms could affect the results of our study. Second, we did not include the time period before the year 1994 and after the year 1999. We are confident that a six-year span (especially, the period that combines both slow growth and an economic boom) is sufficient to address the research questions posed in the study.

A number of sample firms stated that the recent evidence in the financial press of a positive correlation between changes in EVA and market value of common stock was what motivated them to formally adopt EVA. Since, quite a few firms have also combined the application of

EVA with other measures of performance; future research can identify the differential value of these metrics by correlating them to the stock returns. Another interesting future research avenue would be the extension of the EVA focus to multiple measures as advocated by the Balanced-Scorecard proponents. As such one would explore companies' external financial reporting mechanisms to identify future trends in financial and non-financial management measures (including EVA) that are used in building the Balanced Scorecard.

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# **An Evaluation of the Stock Price Announcement Effect of Seasoned Equity Offerings**

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## **Abstract**

The finance literature documents substantial negative stock price reaction to Seasoned Equity Offerings (SEO). Most studies on SEOs focus on the average negative reaction; however, about thirty to forty per cent of the firms actually experience positive abnormal returns at announcement. This paper tries to find firm specific factors that may explain the apparent heterogeneity in the stock price reaction to SEOs. We find that the firms with observed positive market reaction tend to have higher price run-up before the announcement, suggesting that investors may have higher expectations for the growth potential of the companies and hence the SEO may be viewed as an effort to raise the funds for the growth needs. We also find that these firms have high debt ratios, suggesting that the purpose of the SEO may be to reduce debt and optimize the capital structure, rather than taking advantage of the information asymmetry by issuing additional shares when the management believes the shares are overvalued.

## **I. Introduction**

When a public company issues additional shares to raise capital, it is said to be engaged in a Seasoned Equity Offering (SEO). Previous studies (Myers; Myers & Majluf, 1984) (Asquith & Mullins; Masulis & Korwar, 1986) report that the market reacts negatively to SEOs. These studies attribute the negative market reaction to information asymmetry. It is believed that the managers will only issue additional shares when they believe the share price is over-valued. However, these studies also report that despite the average negative reaction, about 30% of the firms that announced SEOs actually had positive announcement returns. The purpose of this paper is to determine the reason for the differential market reaction to SEOs and try to explain why the market reacts differently to a subset of the firms that announced SEOs. More specifically, we try to determine whether some firm specific factors determine the market reaction to the SEO announcements. We find that the firms with higher price run-up before the SEO announcement and the firms with higher debt levels tend to have positive market reactions. We believe that the higher price run-up before the announcement reflects investors' expectation of greater growth potential of the firms and the SEO may suggest to the investors that the firms are raising equity capital to meet the investment needs. The higher debt level may suggest that the purpose of the SEO may be to reduce debt and to optimize the capital structure, rather than taking advantage of the information asymmetry by issuing additional shares when the management believes the shares are overvalued.

It is widely accepted that managers are asymmetrically informed about the value of their shares compared to outside investors; i.e., there is asymmetric information. For example, insider trading laws that prohibit insiders from trading on non-public information would be irrelevant if insiders were not asymmetrically informed. Therefore, at any given point in time the firm's shares might be fairly valued, undervalued, or overvalued as perceived by the insiders with information that the market does not have. When investors receive new information about firm value from insiders, they revise their expectations by adjusting the stock price to reflect the new information. Managers are more like to offer SEO when they believe the firm is overvalued to

minimize dilution effects to existing shareholders (Myers & Majluf, 1984). Aware of this, investors react negatively to announcements of seasoned equity offers.

The empirical evidence suggests that announcements of SEOs are associated with negative stock price reactions, which range from 2 to 3 percent of the firm's share price (Asquith & Mullins; Masulis & Korwar, 1986). This decline is substantial in economic terms. Consider a typical firm that raises seasoned equity and has \$1 billion in market capitalization. A stock price reduction of 2 to 3 percent equates to a loss in market capitalization of \$20 to 30 million. However, despite the overall negative reaction, on average, about 30 percent of SEOs are associated with favorable market reactions. In other words, instead of losing millions in market capitalization, some firms gain value. The problem to be examined in this study is why a significant percentage of SEOs generate a positive market reaction despite what the finance theories predict and the empirical evidence of overall average negative market reactions. More specifically, we try to determine whether the differential market reactions are caused by firm specific factors. While there has been many studies on the market reactions to SEOs, most are focused on explaining the overall negative market reaction to such announcements. The study has a different focus and we believe our findings will enrich our understanding of the market reaction to SEOS and contribute to the literature.

The paper proceeds as follows: Section 2 presents a literature review. Section 3 presents data and methodology. Sections 4 and 5 are results and conclusions respectively.

## II. Literature Review

Many studies on SEOs have been conducted. Asquith and Mullins (1986) find that there is a negative stock price reaction at SEO announcements. Masulis and Korwar (1986) also document a significant stock price decline at the announcement of SEOs. On average, firms announcing SEOs experience average negative returns in the range of 2 to 3 percent. The average negative market reaction has generally been attributed to asymmetric information, market timing, growth opportunities and business cycles. Korajczyk, Lucas, and McDonald (1991) and Dierkens (1991) find that the reaction to announcements of SEOs is less negative when there was a smaller amount of asymmetric information between managers and outside investors. Lucas and McDonald (1990) argue that the market believes that the firms only issue additional equity when they believe that their shares are overvalued. Therefore, the market reacts negatively to SEO announcements. Carlson, Fisher, and Giammarino (2006) find large share price run-ups prior to SEO announcements because of potential increases in growth opportunities. Choe, Masulis, and Nanda (1993) believe SEOs during expansionary business cycles are more likely to have less negative stock price reactions because expansionary periods are often associated with more growth opportunities in general and less information asymmetry. Asquith and Mullins (1986) report that the larger the relative offer size (as a percent of total shares outstanding), the greater the negative announcement day stock price decline. Despite the large number of studies on SEOs, few studies have examined the reasons as for why about 30 percent of the firms announcing SEOs actually experience positive market reaction.

Scholes (1972) provides a theoretical justification for the negative market reaction by arguing that stocks have a downward sloping demand curve. This essentially means that an increase in the supply of shares directly corresponds to a decrease in the price at which investors

are willing to purchase the shares. Since the announcement of a seasoned equity offer indicates that the number of shares will increase, investors react negatively to the announcement in anticipation of the actual issue. Myers and Majluf (1984) and Myers (1984) both study the preferred way to raise capital. According to the pecking order that they suggest, firms needing external financing prefer debt and only issue equity as a last resort. The rationale is as follows: Managers have better information about the prospects of their company than do ordinary investors. This difference in the quality of information between managers and outside investors is commonly referred to as information asymmetry. Managers naturally want to avoid diluting the value of the stock especially when the stock price is going up. So, information asymmetry is viewed as an important reason for SEOs to be associated with negative market reaction at the announcement.

Korajczyk, Lucas, and McDonald, (1991) conduct an empirical study using quarterly data between 1978 and 1983 from NYSE, OTC, and AMEX stocks to test whether the timing of equity issue affects returns. They find that firms that make SEO announcements shortly after earnings releases experience less negative announcement reactions than those whose announcements are not right after the earning reports. Choe, Masulis, and Nanda (1993) find that firms are more likely to announce SEOs during economic expansion when the market generally generates higher returns.

D'Mello, Tawatnuntachai, and Yaman (2003) find that firms doing several SEOs are associated with less information asymmetry because these firms receive more market scrutiny and are more likely to be followed by analysts. Therefore, there may be less information asymmetry. In addition, firms that make several SEOs are generally larger and more mature. Similarly, Dierkens (1991) finds that firms with larger amounts of information asymmetry experience larger stock price declines at SEO announcements. Lucas and McDonald (1990) argued that firms try to issue equity when their shares are overvalued and therefore encounter a negative stock price reaction. In their model, the degree of overvaluation is measured by the stock price runup prior to the offer announcement. Their model predicts that greater stock runup results in more negative reactions.

Bayless and Chaplinsky (1996) examine SEOs in "hot" (high volume) and "cold" (low volume) equity issue markets. They find that, in periods of high volume, SEOs have much less negative price reactions than periods of low volume. Carlson, Fisher, and Giammarino (2006) argue that firms believed to have good growth opportunities may experience positive market reaction upon SEO announcement as the capital raised from the SEO may be used to fund the investment opportunities and therefore, increase the value of the firm.

Several recent studies have emerged that specifically study the announcement reaction to SEOs. Datta, Iskandar-Datta, and Raman (2005) study managers' compensation structure and find that SEO announcement reactions are more negative when managerial incentives are aligned with existing shareholders, because these managers are more likely to try to issue overvalued stock. Rauterkus and Song (2005) find that SEOs conducted by firms who were audited by Arthur Andersen in the early 2000s are associated with more negative announcement effects. Lee and Masulis (2009) find that poor accounting information quality leads to larger negative SEO announcement effects. Two contemporaneous working papers also study why investors react

negatively to SEOs. Kim and Purnanandam (2011) find that weak governance is the primary reason why firms react negatively to SEO announcements. Ferreira and Laux (2011) find evidence of more negative announcement reactions when the firm's board of directors is dominated by executives and other insiders as opposed to independent outside directors. Our study adds to this recent literature on SEO announcement effects. Our central question differs from these studies. Instead of examining why investors react negatively to SEOs, we investigate a number of possible reasons why investors react favorably to some SEOs.

### III. Data and Methodology

The purpose of this study is to determine whether the differential market reactions to SEO announcements are due to firm specific factors. The null and alternative hypotheses are as follows:

Null: The differential market reaction to SEO announcements is not related to firm specific factors

Alternative: The differential market reaction to SEO announcements is related to firm specific factors.

The sample of SEOs was manually collected from Investment Dealer's Digest and consists of publicly listed firms that filed an S-3 form with the Securities and Exchange Commission (SEC) to issue SEOs during 2004, 2005, and 2006. Investment Dealer's Digest is a weekly publication for investment banks and capital market participants and is available in libraries at academic institutions. The company name, number of shares filed, and filing date were all collected. The filing date listed in Investment Dealer's Digest is the date used as the announcement date of the SEO, consistent with previous studies. The original sample consisted of 942 SEO filings. Financial firms (SIC code in the 6000s) were excluded as many firms did SEO due to regulatory requirements. Also excluded were SEOs that were entirely secondary, meaning all the proceeds went to individual shareholders and not the issuing firms. Moreover, firms were excluded if they were not listed on the NYSE, AMEX or NASDAQ. These exclusions are consistent with sample criteria used in the previous studies

Stock prices and beta were collected from the website Yahoo Finance. The abnormal announcement returns were based on a three-day window centered on the filing date, which was also consistent with previous studies. The adjusted closing prices were used to account for any stock splits or dividends. If stock prices or betas were not available, Google Finance was utilized. Firms were excluded from the sample if either the stock price data or beta was not available during the event dates in Yahoo Finance or Google Finance. These screens result in a final sample of 184 firms that made an SEO announcement during 2004-2006. The number of filings per year in the final sample consists of 74 in 2004, 53 in 2005, and 57 in 2006. The majority of the exclusions were due to the issuer being a financial firm and / or the SEOs were purely of secondary nature.

The Abnormal Return (AR) was calculated by using the market model. The Cumulative Abnormal Return (CAR) was calculated by summing the three days of abnormal returns, the day before, of, and after the announcement. The calculations of AR and CAR are consistent with

previous studies. The stock price run-up (RUNUP) is defined as the abnormal return of a sample firm from one year before to two days before the filing date, adjusted for the returns of the market. Other firm specific variables were collected from the sample firms' annual financial statements, the year before the SEO filing. Quantitative data collected included the total book value of assets, number of shares outstanding, long-term debt, research and development expense, and net income. Utilizing the data collected, other variables were calculated, such as market value, market-to-book ratio, relative filing size, and profitability.

A firm's long term debt ratio is calculated by dividing long-term debt by the total assets. The total number of shares filed is represented in millions and indicative of the relative size of the offering as compared to the total number of shares outstanding. A firm's market to book ratio was calculated by taking the ratio of the market value (i.e., stock price times the number of shares outstanding) to the book value of assets. R&D is the firm's indicated research and development expense. The firm's profit is represented in millions and the profit ratio is the profit divided by book assets. The information is collected from the quarterly or annual financial statements issued by the firms in question.

The total sample consists of 184 firms. The average abnormal return for the sample is negative 1.89% and the median is negative 1.61%. The negative abnormal return is statistically significantly different from zero. Among the 184 firms, 120 (65%) had negative abnormal returns at announcement and 64 (35%) had positive abnormal returns (See Table I). The average abnormal return for the negative group is negative 4.71% and the median is negative 3.79%. The average abnormal return for the positive group is 3.42% and the median is 2.78%. Two-sample *t*-tests are conducted to determine whether the variables in the two groups are significantly different and to see the differential market reactions are related to the differences in firm specific variables.

Regression analysis is conducted in Microsoft Excel using the standard application, ordinary least squares (OLS), to test for associations between variables, while controlling for the impact of other variables. These tests are important because it is possible that, in univariate tests, there will appear to be a difference across groups along a certain dimension, but that this difference is driven by some other factor that is not being controlled for. The specific application is as follows. The dependent variable, or left hand side variable, in the OLS regression will be the abnormal stock price reaction over the three-days centered on the filing date. The independent variables, or explanatory / right hand side variables, will be the various measures that are hypothesized to influence the stock price reaction. The estimation will indicate whether there is a statistically significant association whereby the explanatory variables have an important impact on the stock price reaction. The explanatory variables will include the market model stock price runup, firm size, which is approximated by book assets or market value, the long-term debt ratio, the market-to-book ratio, the relative offer size, and the change in R&D expense. The regression coefficient for a particular explanatory variable will indicate whether that variable has a significant influence on the market model reaction, after controlling for the influence of the other variables.

The univariate tests conducted include one-sample *t*-tests, which examine whether the mean of a particular variable is significantly different from zero, two-sample *t*-tests, which test

whether the mean of a variable differs significantly across two groups, sign tests, which assess whether the median observation is different from zero, and correlation analyses. The multivariate tests are conducted using OLS estimations that test each of the hypothesized relations while controlling for the influence of each of the other hypothesized relations.

## VI. Results

Our results indicate that the market reaction to SEO announcements was significantly negative, with the average abnormal return of negative 1.89% during the three days centered on the SEO filing date. Despite this, 64 out of the 184 SEOs experienced positive market reaction with an average abnormal return of 3.42%. These results are consistent with the findings in the previous studies. This table (table I) displays market reactions for the sample of 184 seasoned equity offers during the period 2004-2006. \*\*\* indicates statistical significance at the 1% level

Variable	#obs.	Mean	T-Stat	Median	# pos.	Sign Test z-stat.
Market model reaction(abnormal return)	184	- 1.89%	- 4.85***	-1.61%	64	- 4.13***
Market model reaction(neg.only)	120	- 4.71%	-	-3.79%	-	-
Market model reaction(pos.only)	64	3.42%	-	2.78%	-	-

The average market value of equity for the whole sample is \$2,426.7 million but the positive group is \$2,949.6, which is much higher than the negative group, \$2,138.3. It is generally believed that there is more information available about the large firms than smaller firms. This may suggest that there is less information asymmetry for the positive group and hence the positive abnormal return. But the difference in the average market value of equity between the two groups is not statistically significant.

Another important finding of our study is that the positive group has significantly higher debt to asset ratio than the negative group and the whole sample. The Long term debt to asset ratio is 0.23 for the positive group as opposed to 0.18 and 0.19 for the negative group and the whole sample respectively. This suggests that the firms in the positive group may issue additional shares to reduce their debt level to improve their capital structure, instead of taking advantage of the information asymmetry. This should theoretically reduce the financial risk of the firm and if the reduced debt level improves the capital structure, it should also reduce the weighted average cost of capital and thus the totally value of the firm. The relative offer size for the negative group is 24% and it is 22% for the positive group. This is consistent with the findings of the previous studies that find the greater the offer size, the more negative the market returns.

Table II presents the data for the whole sample, the positive group, and the negative group. We find that the firms in our sample have significant stock price run up, adjusted for the market, prior to the SEOs. The average stock run up is 81.8% for the whole sample but the positive group's run up is much higher than the negative group. The difference is statistically significant, suggesting that one possible reason for the group to have positive abnormal return is that the firms were believed to have good investment opportunities and that the SEO is viewed as a way to finance the investment opportunities.

This possible explanation is supported by the differences in Market to Book ratio and the average Research and Development expenditures both before and after the filings between the positive and the negative groups. The average Market to Book ratio for the positive group is 5.14, which is higher than the negative group's 4.22. A higher market to book ratio may indicate greater growth potential. The positive group also has higher Research and Development expense both before and after the SEOs. This is also consistent with the notion that the market reacts positively to the firms with good growth potentials and views the SEOs as a way to raise capital to finance these growth opportunities. The differences in Market to Book ratio and the Research and Development expenses between the two groups are not statistically significant, though.

**Table II**

This table displays data results for all SEO's in the sample during the period 2004-2006, data for the negative reaction group, data for the positive reaction group, and p-values for statistical differences between the two groups during the same period.

\*\*\* indicates statistical significance at the 1% level \*\* indicates statistical significance at the 5% level

<u>Variable</u>	<u>All SEO's in sample w/data</u>			<u>Neg. announcement reaction group</u>			<u>Pos. announcement reaction group</u>			<u>p-value</u>
	<u># of obs.</u>	<u>mean</u>	<u>media n</u>	<u># of obs.</u>	<u>mean</u>	<u>media n</u>	<u># of obs.</u>	<u>mean</u>	<u>media n</u>	
Market model stock runup (%)	171	81.8 2426.	58	113	68.4	48.1	58	107.8 2949.	65	0.02*** *
MV of equity (\$)	166	7	479.8	107	2138.3	568.9	59	6	416.5	0.66
Book assets (\$ millions)	175	915.7	160.3	114	1002.2	191	61	754.1	147.4	0.59
Market to Book	166	4.54	3.01	107	4.22	3.09	59	5.14	2.81	0.24
R&D expense prior to filing (\$ m)	108	32.1	11.3	69	28.9	15.8	39	37.6	6.4	0.56
R&D expense after filing (\$ m)	107	52.1	13.4	68	48.5	17.2	39	58.4	10.1	0.77
Change in R&D expense (%)	106	65%	25%	67	58%	25%	39	76%	29%	0.57
Long term debt (\$ m)	172	269.3	12.2	111	315.4	13.5	61	185.4	8.6	0.37
Long term debt / assets	172	0.19	0.13	111	0.16	0.11	61	0.23	0.18	0.06***
# shares filed (m)	184	9.9	5.4	120	9.9	5.7	64	9.9	5	0.99
Shares outstanding (m)	167	55.2	34.9	107	57.8	35.9	60	50.7	32.4	0.49
Relative offer size (m)	167	0.24	0.14	107	0.26	0.14	60	0.22	0.14	0.79

**Table III Regression analysis of announcement effect**

This table displays ordinary least squares regression estimates. The dependent variable is the market model reaction and the explanatory variables are listed. The coefficient estimates are presented, with standard errors in parentheses. \*\* indicates statistical significance at the 5% level, and \* indicates statistical significance at the 10% level.

	1	2	3	4
Intercept	-0.0404** (0.0179)	-0.0437** (0.0179)	-0.0487* (0.0248)	-0.0544* (0.0291)
Market model stock runup (%)	0.0077* (0.0040)	0.0076* (0.0040)	0.0079 (0.0053)	0.0080 (0.0054)
Log Book assets	0.0010 (0.0030)	-	0.0022 (0.0048)	-
Log Market value of equity	-	0.0015 (0.0030)	-	0.0029 (0.0050)
Long-term debt / assets	0.0372* (0.0210)	0.0372* (0.0210)	0.0523* (0.0266)	0.0519** (0.0261)
Market-to-book	0.0015* (0.0009)	0.0014* (0.0009)	0.0018 (0.0011)	0.0015 (0.0013)
Relative offer size	-0.0020 (0.0051)	-0.0019 (0.0051)	-0.0020 (0.0056)	-0.0019 (0.0056)
Change in R&D expense	-	-	-0.0013 (0.0039)	-0.0010 (0.0040)
R-squared	0.06	0.06	0.10	0.10
Number of Obs.	151	151	92	92

Table III presents coefficient estimates and standard errors from ordinary least square (OLS) regression estimates conducted using Microsoft Excel. In OLS estimations, the T-statistic equals the coefficient estimate divided by its standard error. Four estimations are presented. The first two estimations excluded the change in R&D expense because including this variable reduced the sample size considerably. The first estimation used book assets to proxy for firm size, whereas the second used market capitalization to proxy for size. The third and fourth regressions are similar, but also included changes in R&D expense. From the descriptive statistics, market value and book assets contained large outliers. This becomes clear when examining the large difference between mean and median values. This is problematic because

OLS is designed to work under a normal distribution. This problem is fixed by using the natural logarithm of market value and book assets in the regression models. This approach is a standard way to address outliers in the data or skewed data.

In the first two regressions the number of observations was only 151 because 33 observations had missing values for at least one of the explanatory variables. The regressions provided similar results. Greater stock run-up, higher market-to-book ratios, and higher debt ratios were all associated with more favorable SEO reactions at the 10% level of significance. The fit of the model is reflected by the R-squared of 0.06. Although this value is low, it was consistent with the findings of numerous prior studies that regressions explaining the market reaction to SEOs had low values of R-squared (e.g., Asquith & Mullins, 1986).

In the third and fourth regressions the number of observations fell to 92 because of the large number of missing observations for R&D data. The regressions provided similar results. Higher debt ratios were associated with more favorable SEO reactions at the 5% or 10% level of significance. The lack of significance for the other variables could be due to the large number of excluded observations, reducing the amount of cross-sectional variation. Nevertheless, it is not uncommon for academic finance studies to conduct OLS regressions using samples of 100 or fewer observations.

Based on the above results, the null hypothesis is rejected. We have reason to believe that the different market reactions to SEO announcements are related to firm specific factors.

## **VII. Conclusions**

The finance literature has documented the average overall negative market reaction to SEO announcements. The negative market reaction is primarily attributed to information asymmetry. The rationale is that firms will only issue additional stocks when they are overvalued. However, this cannot explain the fact that has also been well documented in the literature and that is about 30% of firms announcing SEOs actually have positive market reaction. This is the focus of our study.

We use a sample of 184 firms that announced SEOs from 2004 to 2006. We use market model to determine the announcement abnormal returns. We find that the overall market reaction to the announcements for the total sample is negative 1.89% and it is statistically significantly different from zero. We also find that about two thirds of the firms experience negative abnormal returns with an average of negative 4.71% and one third of the firms experience positive abnormal returns with an average of 3.42%. These results are consistent with the results of the previous studies. We then dividend the sample into two groups based on the market reaction; positive and negative groups. We find that the positive group has a significantly higher price run up prior to the SEO announcements than the negative group, suggesting that these firms may be viewed by the market as having greater growth potential and the managements' purpose to issue additional shares is to raise the needed capital, instead of taking advantage of the information asymmetry. Another important finding of our study is that the firms in the positive group have significantly higher debt to asset ratios than the negative group. This may suggest that the firms in the positive group may issue additional shares to reduce the debt level and to improve the capital structure. This should theoretically reduce the financial risk of the firm and if the reduced

debt level improves the capital structure, it should also reduce the weighted average cost of capital and thus the total value of the firm. If the purpose is to improve the capital structure and not to take advantage of the information asymmetry, that alone can also explain the positive market reaction.

The firms in the positive group have higher market to book ratios than the negative group. This is consistent with the notion that the positive group may have greater growth potential. In addition, the positive group has greater research and development expenses than the negative group. This is also broadly consistent with the belief that the positive group may have greater growth potential and therefore, the reason for the SEO is to raise additional capital to fund the investment needs.

However, our results are based on a sample that was collected in the years that the stock market was booming. Whether the results will hold in bear markets is yet to be determined. That can be an issue for future research.

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## Portfolio Construction Using Key Fundamental Ratios and the DJIA Stocks

Thomas M. Krueger and Mark A. Wrolstad

### Abstract

Index funds have attracted investors over the years by promising to lower fees, turnover, taxes, and other expenses while outperforming the average actively-managed fund. Portfolio indexation has historically focused on three main methods of portfolio weighting: price-weighting, market capitalization-weighting, and occasionally equal-weighting. More recently, attention has been focused on “fundamental weighting” using financial statement items like sales, total assets, EBIT, and dividends to weight stock portfolios. This research focuses on portfolios of the 30 Dow Jones Industrial Average (DJIA) stocks that are constructed using 15 different metrics. Two of the methods of indexation are the traditional approaches of price and market capitalization and the other 13 methods of indexation are ratios based upon the DuPont equation, price relatives, and operating cash flows. After the decade studied, the portfolio with the highest terminal value for the \$1000 originally invested was the \$1198 of the Operating Cash Flow (OCF) / Current Liabilities indexed portfolio and the lowest terminal value was the \$670 for the Price/Sales indexed portfolio. The OCF / Current Liabilities, OCF / Total Debt, and OCF / Net Income-based portfolios all show significantly better performance at the 2% to 5% level when compared to the market value-weighted portfolio. None of these ratios had an abnormal level of skewness or kurtosis, which would have minimized the implications of these findings. Across the financial statements, the cash flow statement appears to provide the most fertile ground for above average rates of return to the passive, long-term investor.

### I. Literature Review

The basic approaches to portfolio creation have been used for some time. Price-weighting is used for the DJIA, market capitalization-weighting is used for the NASDAQ Composite and Russell 2000 Indexes, and equal-weighting is used for the Value Line Index. In comparing these three approaches, Krueger & Wrolstad (2010) found that an equal-weighted portfolio of DJIA stocks performed the best during the period from 1999 to 2009. The initial investment of \$1,000 in the equal-weighted portfolio grew to \$1,020 during that volatile decade while the price-weighted portfolio declined in value to \$777 and the market capitalization-weighted portfolio declined even further to \$731.

A study by Arnot, Hsu, & Moore (2005) found that fundamental indexes outperformed the market capitalization-weighted Standard & Poor's 500 (S&P 500) Index by approximately 2% annually between 1962 and 2004. Studying geometric average returns, McQuarrie (2008) found that an equal-weighted S&P 500 Index outperformed the Research Affiliates Fundamental 1000 Index (RAFI) by 13.11% versus 12.47% while the S&P 500 itself had a return of only 10.39%. The RAFI weights companies by four factors: book equity value, free cash flow, total cash dividends, and total sales.

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Since the favorable investment results of using fundamental factors to index portfolios cited above became more widely known, there has been controversy concerning the use of

income statement and balance sheet accounts to index portfolios. Hsu (2006) suggests that the return drag in capitalization-weighted portfolios is driven entirely by capitalization weighting's tendency to overweight the overvalued stocks and underweight the undervalued stocks. In an article critical of fundamental weighting, Perold (2007) suggests that fundamental indexing is really only an active security selection technique which relies upon investing in value stocks. Kaplan (2008) tries to reconcile these two perspectives by suggesting that both market capitalization and fundamental variables contain information about fair market values and that they can be combined to form portfolio weights that reflect the information contained in each.

Still another approach is to use ratios created from financial statement values to enhance stock returns and/or index portfolios. Examples of papers using financial ratios include a study by Fama & French (1995) which found that the book/market value (B/MV) ratio variable had the strongest relationship with stock returns of the variables they tested. In a subsequent investigation using S&P 500 industry-level data, Kothari et al. (1995) did not find any significant relationship between the B/MV ratio and stock returns. The study by Barbee et al. (1996) found that the annual sales per share/common stock price (S/P) ratio was the only variable that consistently had a significant role in explaining stock returns in their models. Still another example of using ratios is the work done by Mills and Yamamura (1998) where they extol the use of a variety of cash flow ratios to help people gauge a company's viability and ability to withstand cyclical downturns or price wars. Regardless of the portfolio construction method used, Bailey (1992) offers good advice in suggesting that the chosen criteria for indexing a portfolio be unambiguous, investable, measurable, and appropriate. This study considers some of the ratios mentioned above as well as the DuPont equation ratios and a variety of cash flow ratios. Our goal is to identify measures that could be employed by investors interested in optimizing portfolio performance given a predetermined set of companies in their portfolio. By limiting the sample to a specific, well-known sample of stocks, we exclude the confounding effects arising from inclusion of uncommon, unique firms and can focus our analysis on the process of portfolio construction.

## **II. Data and Methodology**

Table I presents a listing of the companies which were members of the Dow Jones Industrial Average during the decade studied. As can be seen, the DJIA membership is quite stable with over three-fourths of the thirty companies in the index for the entire ten-year sample period which runs from 1999 through 2009. Most of the membership volatility that does occur coincided with the recession in the latter part of the sample period. To deal with membership changes, sample membership is updated on an annual basis. The replacement company is assumed to be in place for the whole year in which it replaces another company that is dropped out of the index. For instance, on March 8, 2004, Kodak and International Paper were replaced by Pfizer and Verizon. Year-end 2003 financial statement values for Pfizer and Verizon are used for portfolio allocation purposes in the year 2004. As a consequence, the returns presented in this paper will vary slightly from those presented in the financial press for the DJIA. Median returns are presented because the mean portfolio returns are based upon only ten annual returns.

Total returns serve as the independent variable. Price and dividend data were obtained from finance.yahoo.com. Data used in the allocation process were primarily obtained from Morningstar.com. Missing data were obtained from the individual company financial statements. Fifteen portfolios are created in total. Two of them are weighted upon the traditional allocation models of price and market capitalization. To make the returns of the various methods more comparable, dividends have been added to the returns of the price-weighted DJIA.

<b>Table I - DJIA Membership</b>			
<b>Stock in DJIA for Entire Decade</b>			
3M Company	Coca-Cola	Intel	Microsoft
Alcoa Incorporated	DuPont	IBM	Procter & Gamble
American Express	Exxon Mobile	Johnson & Johnson	United Technologies
AT&T	General Electric	J.P. Morgan	Walmart
Boeing	Home Depot	McDonalds	Walt Disney
Caterpillar	Hewlett-Packard	Merck	
<b>Changes in DJIA Membership</b>			
On 4/8/04	Kodak & International Paper	Replaced by	Pfizer & Verizon
On 2/19/08	Altria & Honeywell	Replaced by	Bank America & Chevron
On 9/22/08	AIG	Replaced by	Kraft
On 6/8/2009	Citigroup & General Motors	Replaced by	Travelers & Cisco

In most cases, the observed value of the allocation variables is positive in all periods. For example, firms always have positive price, sales, and total assets levels. When no dividends are paid, no allocation is made to the company on the basis of that metric. In instances where an independent variable is negative (i.e., net income), it was assumed that the portfolio shorted the weighting of this DJIA member.

Portfolio return statistics were measured using Microsoft's Excel statistical package, which provides direct evidence of mean significance using z-tests and t-tests. Like return means, skewness and kurtosis measures are seldom zero. However, Excel does not present a direct measure of the significance of skewness and kurtosis estimates. One commonly used technique to test for skewness consist of determining whether the skewness values are more than two standard errors of skew. Tabachnick and Fidell (1996) report that the standard error of skew can be estimated as  $\sqrt{(6/n)}$ , which for a sample of ten years would be  $\sqrt{(6/10)}$ , or 0.775. Doubling this value results in a critical value of 1.55 for skewnewss. Tabachnick and Fidell (1996) also state that the standard error of kurtosis estimated as  $\sqrt{(24/n)}$ , which for a sample of ten years would be  $\sqrt{(24/10)}$ , or 1.549. Doubling this value results in a critical value of 3.098 for kurtosis. Bell (2010a, 2010b) provides a clear explanation of the application of skewness and kurtosis for anyone seeking additional insight to these measures. Taylor (2008) provides a specific application of skewness (p. 44) and kurtosis (p. 47) for financial time series modeling.

### III. Results

The next three tables provide an analysis of the return and risk resulting from portfolios that vary by the way in which the money invested in the thirty companies of the DJIA is allocated. Each of these tables begins with the performance of the traditional price-weighted and value-weighted portfolios. Table II compares the performance of these traditional portfolios to portfolios whose allocations are based upon the Du Pont Equation components of profit margin, total asset turnover, equity multiplier, and the return on equity. In Table II, we see that over the 2000-2009 decade, using the equity multiplier would have resulted in a mean rate of return of 4.0 percent. The highest median was registered by the price-weighted DJIA. By comparison, the capitalization-weighted Dow index, an "S&P 30" if you will, had the only negative mean and median values.

The capitalization-weighted portfolio had the lowest maximum return and the total asset turnover-weighted portfolio registered the lowest loss in 2008, which was the worst year for all indexes. By comparison, the best and worst single year was experienced by the portfolio based on the equity multiplier. Therefore, it is not surprising that the equity multiplier based portfolio has the greatest standard deviation. In fact, the equity multiplier's standard deviation is over fifty percent greater than the standard deviation of the total asset turnover-based portfolio which was the lowest. Low skewness and kurtosis values indicate that the return distributions did not significantly deviate from a normal "bell-shaped" distribution. The final row of Table II demonstrates that seemingly low variations can result in large differences in terms of ending portfolio values. The total asset turnover-indexed portfolio registered a positive gain of \$112 and the capitalization-weighted portfolio lost \$270 by December 2009. Consistent with the difference in ending monetary values, the asset turnover-weighted portfolio's geometric return is 1.07 percent and the capitalization-weighted portfolio's geometric return is -3.10 percent. This represents an annual difference of 4.17 percent.

Table II Comparative Performance of Portfolios Based on Du Pont Analysis Components						
	Common Market Index Weightings Schemes		Weightings based on Du Pont Analysis Components			
	Price	Capitalization	Profit Margin	Asset Turnover	Equity Multiplier	Return on Equity
Mean	2.5	-1.7	1.0	2.4	4.0	0.2
Median	3.5	-0.4	0.7	1.6	0.1	0.9
Maximum	28.3	18.7	24.2	24.2	42.5	23.2
Minimum	-31.9	-29.0	-30.3	-26.4	-43.5	-39.9
Std Deviation	17.9	17.0	17.1	16.8	26.7	18.5
Skewness	-0.3	-0.2	-0.2	-0.1	-0.0	1.9
Kurtosis	0.4	-1.2	-0.6	-0.6	0.4	-1.1
Terminal value of initial \$1000 investment	\$1105	\$730	\$959	\$1112	\$1073	\$855

Table III examines portfolio creation using some popular price relative ratios. For ease of reading, the first two columns found in Table II are repeated in the next two tables. As the reader may have expected after looking at the ratios considered, Table III demonstrates the disadvantage of investing in companies with a high price. At least one value in the first two rows for each price relative is negative. The lowest return was obtained by investing in a portfolio based upon the price/sales ratio which had an average loss of 2.1 percent and a median loss of 1.4 percent. Although price/book and price/dividends ratios showed a small mean gain, their median returns are both losses of over two percent. In fact, this table shows that only the price-weighted portfolio ended up with both a positive mean and median returns. Our price-weighted DJIA exceeds the Dow's performance reported in the financial press due to our inclusion of the healthy dividends paid by these thirty mature companies.

The best single annual return was registered by the price/dividends ratio, which gained 36.0 percent in 2003. Portfolios based on the price/dividends, price/earnings, and price/sales ratios all lost about thirty-two percent in 2008. Although the price/free cash flow weighted portfolio lost 26.9 percent in 2008, it was the least impacted by the market selloff. Standard deviations were found to be within a relatively narrow band, running from 17.0 percent for the capitalization-weighted portfolio to 21.4 percent for the price/dividends-weighted portfolio. At \$670, or a loss of \$330, the price/sales based portfolio would have lost the most of any portfolio in this study over the 2000-2009 periods.

Table 3 exhibits the only instance in which portfolio return has a significantly skewed and peaked distribution. The negative skewness arises from a large negative return in 2008. Firms with higher price/earnings ratios experienced a large decline in value that year.

Excluding this year, as witnessed by the high kurtosis value, the returns were closely bunched around the mean return for a portfolio based on firm price/earnings ratios.

	Common Market Index Weighting Schemes		Weightings Based on Price Relatives				
	Price	Capitalization	<u>Price</u> Book Value	<u>Price</u> Dividends	<u>Price</u> Earnings	<u>Price</u> Free Cash Flow	<u>Price</u> Sales
Mean	2.5	-1.7	0.1	0.7	-0.8	-0.3	-2.1
Median	3.5	-0.4	-2.7	-2.3	-1.4	1.7	-1.4
Maximum	28.3	18.7	27.6	36.0	22.9	22.4	27.0
Minimum	-31.9	-29.0	-30.2	-32.2	-32.4	-26.9	-32.9
Std. Deviation	17.9	17.0	18.1	21.4	18.4	18.9	19.5
Skewness	-0.3	-0.2	-0.2	0.4	-1.9	0.4	-0.4
Kurtosis	0.4	-1.2	-0.5	-0.0	4.52	0.6	-0.9
Terminal Value Of The Initial \$1000 Invested	\$1105	\$730	\$864	\$875	\$918	\$819	\$670

Portfolio indexation using operating cash flow (OCF) values divided by current liabilities, total debt, sales, and total stockholder's equity are presented in Table IV. We have chosen OCF because it is the lifeblood of a company and one of the most important barometers that investors have. Among the advantages of selecting OCF is that operating cash flow is harder to manipulate under GAAP than net income (although it can be done to a certain degree). Another reason for selecting it is simply the importance of cash to a firm and the fact that any company that does not generate cash over the long-term is on its deathbed. A company can live with negative cash flows for a limited period of time. Eventually the company will need to pay their suppliers and bankers. Many companies have gone bankrupt because they could not generate enough cash.

Unlike the price relatives, each of the operating cash flow ratios has a positive mean and median return. With a mean return of 3.3 percent, the OCF/Current Liabilities ratio-based portfolio had the second highest average return after the 4.0 percent of the to the equity multiplier-based portfolio found in Table II.

Although the price-weighted portfolio outperformed all operating cash flow-based portfolios in terms of median income and maximum income, it performed more poorly in 2008 than all of the other portfolios in Table IV. Return standard deviations again fall in a relatively narrow band, running from 16.7 percent to 18.1 percent, with none of the skewness or kurtosis measures being statistically significant. The highest terminal value in this entire study was the \$1198 observed in the OCF/Current Liabilities portfolio. It should also be pointed out that all OCF-based ratios ended up with a terminal value exceeding the initial \$1000.

Table IV Comparative Value of Operating Cash Flow Ratios						
	Common Index Schemes	Market Weighting	Weighting Based on Popular Operating Cash Flow Ratios			
	Price- weighted	Value Weighted	<u>Operating Cash Flow</u> Current Liabilities	<u>Operating Cash Flow</u> Total Debt	<u>Operating Cash Flow</u> Sales	<u>Operating Cash Flow</u> Stockholders' Equity
Mean	2.5	-1.7	3.3	1.9	2.0	2.4
Median	3.5	-0.4	0.9	0.2	0.2	1.5
Maximum	28.3	18.7	26.5	24.2	22.4	26.8
Minimum	-31.9	-29.0	-25.6	-26.8	-29.7	-28.1
Std Deviation	17.9	17.0	18.1	17.7	17.7	16.7
Skewness	-0.3	-0.2	-0.1	-0.2	-1.4	-0.6
Kurtosis	0.4	-1.2	-1.0	-0.8	2.5	1.3
Terminal Value of the Initial \$1000 Invested	\$1105	\$730	\$1198	\$1041	\$1057	\$1123

The performances of the fifteen portfolios found in Tables II to IV vary by the way in which wealth is allocated to the thirty companies in the Dow Jones Industrial Average. The key issue we want to address is whether any measure considered in this research can be used for indexing a portfolio in order to earn statistically significant, positive returns. A related concern is whether any of these approaches for indexing a portfolio can provide a higher return than the market portfolio. Given the poor performance of stock market investments during the last decade, beating the market becomes an important concern.

In order to determine whether returns were statistically different from zero, z-statistics were calculated and exhibited in the first numerical data column of Table V. Given the 2000 dot-com bust, 9/11/2001 terrorist attacks, and financial crisis of 2007-2009, it is not surprising that none of the measures provide a significant z-statistic. One less obvious implication of insignificant z statistics is that investors cannot use the financial ratios presented here in a

short-selling strategy to earn returns that are significantly greater than zero despite some seemingly large drops in terminal values.

Since market capitalization-based indexation is currently the predominant investment industry method, the other 14 portfolios are compared to it in the second numerical data column in Table V. Both the dividend-enhanced price-weighted and the profit margin-weighted portfolios performed statistically different from the market capitalization-weighted portfolio at the 0.10 level. Looking back at the mean returns reported in Table II, we can conclude that these indexation techniques slightly outperformed the capitalization method.

Table V. Analysis of Statistical Significance			
z-test - "Is the mean return statistically different from zero?"			
t-test - "Is the return distribution statistically different?"			
		<u>z-</u> <u>statistic</u>	<u>t-statistic</u>
Traditional Weighting	Price-weighted	0.328	0.062*
	Mkt. Cap.-weighted	0.624	n/a
Du Pont Analysis Measures	Profit Margin	0.429	0.061*
	Asset Turnover	0.328	0.560
	Equity Multiplier	0.317	0.201
	Return on Equity	0.484	0.485
Price Relatives	Price/ Book Value	0.495	0.193
	Price/ Dividends	0.465	0.374
	Price/Earnings	0.448	0.113
	Price/ Free Cash Flow	0.520	0.627
	Price/Sales	0.633	0.815
Operating Cash Flow Ratios	OCF/ Current Liabilities	0.282	0.017**
	OCF/ Total Debt	0.370	0.044**
	OCF / Net Income	0.358	0.018**
	OCF / Stockholders Equity	0.322	0.123

Key: \* = 0.10, \*\* = 0.05

The portfolios with greater statistical significance were some of the OCF-based models. As shown in the bottom right corner of Table V, returns using OCF/Current Liabilities and OCF/Net Income were significant at the 0.02 level. Double-checking the mean

returns found on Table IV, we can be confident that these indexation techniques outperformed the market capitalization method. Portfolio returns using the OCF/Total Debt was also significant at the 0.05 level. Given the limitations of this study--use of annual data, the most recent (volatile) decade, and only thirty companies--such high levels of statistical significance are impressive. Even if the next decade is as volatile as the last, additional data from future years will increase the degrees of freedom and may push the statistical significance level of these comparisons even higher.

#### **IV. Summary and Conclusions**

This research focuses on portfolios of the thirty DJIA stocks that are indexed using 15 different metrics. Two of the methods of indexation are the traditional approaches of price and market capitalization used in the DJIA and S&P 500, respectively. The other 13 methods of indexation are ratios based upon the DuPont equation, price relatives, and operating cash flows.

After the decade studied, the portfolio with the highest terminal value for the \$1000 originally invested was the \$1198 of the OCF/Current Liabilities portfolio and the lowest terminal value was the \$670 for the Price/Sales indexed portfolio. The best single year performance for any of the portfolios was the 42.5% return of the equity multiplier-based portfolio and the worst yearly performance was the loss of 43.5% of the same portfolio. Given its leverage-related magnification effect, it is not a surprise that the equity multiplier-based portfolio returns had the highest standard deviation of 26.7%. The OCF/Stockholders Equity had the lowest standard deviation at 16.7%.

Our limited sample size did not permit us to show that the abnormal performance of our portfolios were significantly different from zero. We were able to show statistical significance when comparing the rest of our portfolios to the market capitalization-indexed portfolio. Specifically, the OCF/Current Liabilities, OCF/Total Debt, and OCF/Net Income-based portfolios all show significantly different performance at the 2% to 5% level when compared to the market value-weighted portfolio. Across the financial statements, over this period and based on financial statement information studied here, the cash flow statement appears to provide the most fertile ground for above average rates of return to the passive, long-term investor. The average terminal value for portfolios based on cash flow statement values exceeded the income statement-based portfolio's average terminal value by \$35 and the balance sheet-based portfolio's average terminal value by \$180.

These findings have important implications for the investors. Despite the limited coverage of cash flow statement ratios in popular textbooks, cash flow statement ratios appear to provide significant investment opportunities. They can be used by investors at all levels, from the individual to the hedge fund manager, increasing the former's return and the latter's performance-based bonus. For the researcher, these findings challenge the concept of market efficiency and open up new venues for the study of abnormal returns.

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## **Transmission Of Interest Rates Volatility: A Case Study Of Upper, Middle And Lower Income Groups Countries**

Tarika Singh, Seema Mehta, and Aarti Bajaj

### **Abstract**

With the development of liberalization of capital movements, an increasing attention has been given to international transmission of volatility to different market returns. This article empirically tests the effects of the volatility in the time value of the US t bills and RBI t bills on the developed, developing, and underdeveloped market. By using daily values of twelve equity markets and the interest rates on the 10 years treasury bills from 2000 to 2010, the Gaussian and Student's-t GARCH models are tested to display the international Transmission effects of the US and Indian interest rates on the world equity markets. The empirical findings vary between the sub-economy groups. The equity markets in the upper, middle, and lower income group do not have strong interest rate effects. The markets are affected by the volatility in the US and RBI interest rates at low levels. On the other hand, impacts of the volatility in the US interest rates on the domestic money markets –i.e. bond spreads- in the emerging economies are stronger with negative direction.

### **I Introduction**

The liberalization and following reform measures have drawn the attention of foreign investors most important to a rise in portfolio investment in the developing markets like Indian capital market. Over the recent years, India has emerged as a major recipient of portfolio investment among the emerging market economies. Recent McKinsey Global Institute (MGI) research highlights the unrelenting growth and deepening of global capital markets as investors pour more money into equities, debt securities, bank deposits, and other assets around the world the soaring growth of financial markets in emerging economies and the growing ties between financial markets in developed and developing countries the shift of financial weight in Asia from Japan toward China and other fast-growing emerging markets the growing financial clout of the eurozone countries and the significance of the euro the burgeoning role of oil-rich Middle Eastern countries as suppliers of capital to the world, along with the rise of new financial hubs in the Middle East to complement the rapidly growing hubs in London and Asia. While these trends expose a shift in financial power from the United States toward other parts of the world, the absolute size and depth of the US market will give it a leading role on the international financial stage for years to come. The going up level of foreign investment is making the world more financially inter-dependent than it was even a few years ago.

Additionally, the source and route of cross-border investment flows are shifting. In 1999, the United States was the central hub of the global financial system. By 2006, it remained the largest single foreign investor and a major hub in global capital markets—but the euro-zone countries together had as many financial links with other parts of the world, including budding markets. The United Kingdom too has become a more

significant global financial hub, and Middle Eastern countries are now major investors in global financial markets, thanks to the one-off generated by rising oil prices. In 2006, for the first time since the 1970s, the oil-exporting countries joined those of East Asia as the world's largest net suppliers of capital.

As the international equity markets have veteran their most volatile growth over the past decade, budding equity markets have experienced an even more rapid growth, taking on an ever larger share of this global explosion. The Indian financial system has undergone structural transformation over the past decade. The financial sector has acquired strength, efficiency, and stability by the combined effect of competition, regulatory measures, and policy environment.

Volatility in the Treasury bill markets is influenced by a number of factors foremost among which is interest rates in determining the level of long-term volatility in the stock market. Interest rates are themselves influenced by volatility, since the fluctuations caused by ongoing and long-term volatility strongly influence the decisions of central banks. The aim of the paper is to present empirical results from different types of economies in the world on the subject under investigation. In this research, the normal and Student's-t distribution GARCH (1;1) models are chosen to test the volatility transmission. The paper continues with a literature review on the interest rates effects on the stock markets. The emphasis is given on the global interest rates effects in domestic equity indexes. In the third part, the data and methodology used in the research are introduced. The results of ADF and P-P tests with descriptive statistics are presented. The GARCH model as a test method in the stock return volatility is discussed in detail. The empirical results of the research are categorized into types of the economies. The findings of the research is discussed in terms of both theoretical and portfolio management perspectives. The concluding remarks include some methodological and empirical suggestions for the future research on the global interest rate risk in return volatility of the stock markets.

## **A. Transmission of Volatility**

The diffusion of international investments and capital movements across borders has marked the evolution of financial markets and has changed the profile of correlations among assets denominated in different currencies which are exchanged in geographically separated markets. Single market volatility reacts to innovations in other markets as a result of financial integration. Mechanisms of transmission of shocks across variables in an econometric model have received a great deal of attention in the literature. Single market volatility reacts to innovations in other markets as a result of financial integration. Mechanisms of transmission of shocks across variables in an econometric model have received a great deal of attention in the literature.

In this era of globalization and mounting integration among global financial markets, inter linkages and spillovers have been a major focus of financial debate in the last few decades. Early works in this field came up with strong evidence of inter linkage between the stock markets around the globe, a result of global economic integration.

The rationale of the study is to find out the impact of volatility in interest rate of us T-bills and RBI T-bills on stock returns of developed, under-developed, and developing nations. The reason for doing this study was to investigate the predictive power of interest rate on the stock returns. There are very few studies done on this subject especially in on the international level by using stock indices of all the nations. The results of this study provide valuable information for both financial decision makers and domestic and global fund investors who are more interested in investing in growing emerging stock market. This study contributed a lot to the literature as it examine the impact of interest rates on stock returns of developed, under-developed and developing nations. In the study, the world's equity market is divided into three main segments: developed, developing, and under-developed market. Four major representative indices of each segment are taken to find the exact effect of volatility transmission.

### **B. Literature Review on Impact of interest rates volatility on stock returns of developed nations**

The below given section gives a brief idea about the existing research work done in the area of volatility transmission among different nations. For example the study Agmon (1972), Hillard (1979); Ripley (1973) did study on the developed countries during the 60s. Glezakos, Merika and Kaligosfiris (2007) found strong influence of the US financial market, DAX and FTSE on the other markets of the sample.

Mukherjee and Leblang 2007 found that the relationship between government partisanship, interest rates and the mean and volatility of stock prices in the United States and United Kingdom. Ibrahim and Sulaiman (2001) study results indicated that there is no long-run relationship between the stock market index and any of the exchange rates

### **C. Literature Review on Impact of interest rates on stock returns of developing nations**

Several studies recently focused on the role of exchange rate fluctuations in the capital market around the Asian financial crisis. Sharma and Kennedy (1977) find strong link between Indian, US and UK markets in term of interest rates. Rao and Naik (1990) conducts a Cross-Spectral analysis and finds a weak relationship of Indian market with international markets which they attribute to the controlled Indian Economy regime throughout the 70s with liberalization measures initiated only in the late 80s.

However, in recent years there has not been much investigation into this aspect, except one by Wong, Agarwal and Du (2005); specifically it also tries to identify the interest rates volatility transmission channels for Indian stock market in recent years. Raju and Ghosh (2004) in their study amongst emerging markets except India and China, all other countries exhibited low returns (sometimes negative returns with high volatility).

Arshanapalli and Doukas (1993); Cheung and Ng (1992) confirmed the dominant role of US in the global financial scenario. Lee and Kim (1994); Jeon and Von-Furstenberg (1990) cited evidence for a significant increase in the movement of the stock

price indices after the crash. Frankel and Roubini (2003) find out the empirical results that the IFC Global index of equities declines by 17 points and Emerging Markets Bond Index (EMBI) decreases 34 % if the real G-7 interest rate increases 1 point. Dailami, Masson, and Padou (2005) also display that a 200 bps increase in US short-term interest rates decreases emerging market spreads ranging from 6 bps to 65 bps, depending on debt/GDP ratios of examined countries.

Abdalla et al. (1997) have done a study on the interaction between exchange rates and stock prices with reference to India, Korea, Pakistan and the Philippines by applying bivariate vector autoregressive models on monthly observations of stock price index and the real effective exchange rate over 1985:1 to 1994:7. The study found the unidirectional causality from exchange rate to stock prices in all the countries except the Philippines.

#### **D. Literature of Impact of interest rates on stock market returns of under developed nations**

Yau and Nieh (2006) investigated the interrelationship between new Taiwan dollar/Japanese yen exchange rate and stock prices of Taiwan and Japan for the period of January 1991 to July 2005 and find that there was no long-term linkage between the exchange rate and stock prices of Taiwan and Japan, but the linkage existed only for short durations.

Wu (2001) used the monthly distributed-lag model to examine the impact of macroeconomic variables on the Straits Times Industrial Index (STII) by categorizing the macroeconomic indicators into three groups: money supply, interest rates, and the government fiscal stance. Choi, Elyasiani and Kopecky (1992), Fama (1991), Evans (1998), Unal and Kane (1987), Ehrhardt (1991), Titman and Warga (1989), Ramsey and Lampart (1998), Elyasiani and Mansur (1998), Faff and Howard (1999), Staikouras (1998) found out the empirical fact that the interest rates with other macroeconomic variables such as GDP growth rate, exchange rates, inflation and trade balance are effective on the stock returns.

#### **E. Other Empirical Evidences**

Apart from this theoretical investigation, there is a well-documented but puzzling empirical relation between stock prices and exchange rates. Most of the empirical literature has examined dynamic interaction between stock prices and exchange rates in the context of developed countries rather than developing countries. The review of literature in this line brings out that the results of these studies are, however, mixed and inconclusive. Studies like Smith (1992) Solnik (1987), Aggarwala (1981), Franck and Young (1972), Granger, CWJ. et al. (2000), Abdalla et al. (1997) have found a significant positive relationship between stock prices and exchange rates while others such as Soenen and Hennigar (1998), Ajayi, A and Mogoue (1996), Ma and Kao (1990) have reported a significant relationship between the two variables. On the other hand, some studies such as Bartov and Bodnar (1994), Franck and Young (1972) found very weak or no relationship between stock prices and exchange rates. On the issue of

causation, most of the studies found mixed results. Representative examples are Morley (2000), Oskooe, BM and Sohrabian (1992), Ibrahim (2000), Kanas, A (2000) etc.

To examine the impact of exchange rate changes on stock markets, Franck and Young (1972) investigated the relationship between stock prices and exchange rates and found no relationship between these two financial variables. Solnik (1987) found a negative relationship between real domestic stock returns and real exchange rate movements. Taylor, MP et al. (1988) the study concluded that there has been no significant increase in the correlation of stock market returns as a result of the abolition of exchange control. Cointegration test confirmed that the UK and foreign (non-US) stock market indices were cointegrated in post 1979 period but not before that.

Ma and Kao (1990) countries found that domestic currency appreciation negatively affected the domestic stock price movements for an export dominant economy and positively affected an import dominant economy. Oskooe, BM, et al. (1992) found that there is a bi-directional causality between stock prices and the effective exchange rate of dollar at least in the short-run. The cointegration analysis reveals that there is no long-run relationship between the two variables. Jorion (1998) attempted to analyze and compare the empirical distribution of returns in the stock market and in the foreign exchange market found that exchange rates displayed significant variations, which were much more than in that of stock market.

Ong, LL and Izan HY (1999) found that US share price returns fully reflect information conveyed by movements in both Japanese yen and the French franc after four weeks. Nissim and penman (1988) has stated that changes in interest rates are positively related to subsequent earnings, but the change in earnings is typically not large enough to cover the change in the required return.

From the above literature, it can be seen that researches are available in the area of exchange rate volatility and its impact on stock returns but few researches are available in The area of interest rates volatility and its impact on stock returns. This lacuna of research prompted the present study. The present study is carried out to fulfill the

**Objective** of studying the transmission of volatility in the interest rates (treasury bills) to the index returns in the selected developed developing and under developed nations.

## **II Research Methodology**

For the study a sample of 4 developed countries, 4 developing countries and 4 under developed countries indices were chosen. Individual stock exchange of each nation during the study period acted as a sample element. Non probability judgmental sample technique was used in our study. Secondary source was used to collect the data i.e. official website of bank of Japan, Reserve bank of India, official website of Federal Reserve's for collecting U.S. Treasury bill rates, official website of Bloomberg, utv to find out the representatives of world stock exchanges. Apart from this we also used other official and reliable sites for collecting the data of different stock exchanges.

After collecting the stock index data for all the nations under study, the first thing for proceeding for volatility calculation was checking of normality and stationarity of data. Then normality of the data was checked with the help of jarque bera test. Stationarity was checked by ADF and PP test. Further GARCH model (1,1) was used to study the effects of the US T Bills rates and RBI interest rates of Treasury bills on stock market volatility in 12 equity markets indices under study. Volatility calculation was done using the following formulation:

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta \sigma_{t-1}^2$$

where  $\alpha_0$  is the mean,  $\varepsilon_{t-1}^2$  is the ARCH term and  $\sigma_{t-1}^2$  is the GARCH term.

$$y_t = x_t' r + \varepsilon_t \quad (1)..... \text{Mean equation}$$

$$\sigma_t^2 = \omega + \alpha \cdot \varepsilon_{t-1}^2 + \beta \cdot \sigma_{t-1}^2 \quad (2)..... \text{The conditional variance}$$

### III Result & Discussion

The two-variate GARCH-in-mean model is estimated for 12 countries. They are the following: Argentina, Malaysia, Mexico, America, Sri Lanka, Indonesia, India, China, Hong Kong, Australia, and London, Japan. For each country, the variables collected include 90-day US Treasury Bill rates, 90-day RBI Treasury Bill and return of various major stock indices of different countries. The financial time series are chosen from different emerging markets and advanced markets.

The equity indexes are categorized into three groups:

- a. Upper Middle Income Economies - Argentina, Malaysia, Mexico, America
- b. Lower Middle Income Economies - Sri Lanka, Indonesia, India, China
- c. High Income Economies - Hong Kong, Australia, London, Japan.

The market indices selected for each country are as follows: All Ordinaries (Australia), Shanghai Composite (China), Hang Seng (Hong Kong), BSE 30 (India), Jakarta Composite (Indonesia), KLSE Composite (Malaysia), Nikkei 225 (Japan), Merval Aires (Argentina), IPC (Mexico), S&PTX Composite index (America), All Composite Index (Sri Lanka), KISE (Malaysia). The data frequency is daily, ensuring a sufficiently high number of observations. The sample period varies depending upon data availability. For all the 12 countries, it goes from 01.04.2000 to 31.03.2010.

The daily values of the interest rates on the 10 years US Treasury Bills, 10 years RBI Treasury Bills and 12 equity indexes from 01.04.2000 to 31.03.2010 are used for the empirical tests. The logarithmic values of the first difference (return) are calculated.

### A. Descriptive Statistics and Normality Check

The descriptive statistics and Jarque-Bera test results of all financial time series (log-returns) are presented in the Table 1.

#### Normality Of Errors (Tests Jarque-Bera)

The Jarque-Bera test is a goodness-of-fit measure of departure from normality, based on the sample kurtosis and skewness. The Jarque-Bera test statistics point out the finding that the time series satisfy the normality distribution assumption. On the basis of results of Skewness, Kurtosis and Jarque-Bera test statistics, we can either accept or reject the null and alternative hypothesis.

The below given table shows that the data of all the indices return is not normally distributed. The Negative skewness implies that the distribution has a long left tail. The kurtosis of the normal distribution is 3. If the kurtosis exceeds 3, the distribution is peaked (leptokurtic) relative to the normal; if the kurtosis is less than 3, the distribution is flat (platykurtic) relative to the normal (Peters, 2001) The Value of Jarque Bera test is at 0% level of probability; a small probability value leads to the rejection of the null hypothesis of a normal distribution Therefore we reject the null hypothesis of normality. Hence reject the **H<sub>0</sub>** and conclude that the residues are not normally distributed.

**Table 1. Descriptive Statistics and Jarque-Bera Test Results**

Variable	Max.	Min.	Standard Dev.	Skewness	Kurtosis	Jarque-Bera
<b>Upper Middle Income Economies</b>						
Argentina	0.486848	-1	0.145184	-2.41784	22.50245	2018.648
Malaysia	0.135454	-1	0.10406	-7.37806	71.32628	24431.49
Mexico	0.165604	-1	0.111766	-6.18006	56.16986	14899.03
America	0.112092	-1	0.102975	-7.64509	74.01185	26382.36
<b>Lower Middle Income Economies</b>						
Sri Lanka	0.252602	-1	0.121055	-4.73998	42.00218	8055.107
Indonesia	0.201305	-1	0.119675	-5.14586	43.50168	8731.529
India	0.282551	-1	0.121739	-4.73766	40.18611	7362.941
China	0.274464	-1	0.12617	-4.19507	34.27182	5241.604
<b>High Income Economies</b>						
Hong Kong	0.170737	-1	0.112825	-5.81021	51.99069	12675.61
Australia	0.168502	-1	0.11171	-6.17425	55.40035	14491.41
London	0.086541	-1	0.100755	-8.05264	79.63173	30659.01
Japan	0.128499	-1	0.108438	-6.4278	59.06548	16543.02

## B. ADF & PP Test

The unit root for serial correlation and stationary tests are performed with Augmented Dickey-Fuller (ADF) and Phillips and Perron (P-P) unit root tests. For ADF test, Schwarz Information Criterion, for P-P test Newey-West Bandwidth is preferred.

**ADF Test** - This test is to see if an econometric model estimated has a unit root or not, i.e. if I is zero order (0) or is of order 1 I (1). It has three processes generate data model with no deterministic component, model with intercept and with intercept and trend model presents the enlarged part.

$$\Delta\mu_t = \alpha_0 + \alpha_1 t + \lambda\mu_{t-1} + \sum\beta_j\Delta\mu_{t-j} + v_t$$

**PP Test** - It is a generalization of the proceedings of the DF, but unlike this, allows for autocorrelation and heteroskedasticity in the error term, which consists of three data generating processes: model without deterministic component, model and model intercept and trend, however it is not the augmented, so this test is a nonparametric solution, i.e not follow any known distribution.

$$\Delta Y_t = \Delta\beta + \rho Y_{t-1} + \Delta v_t$$

The hypothesis is prepared to check out whether the dependent variable (returns of stock indices) is stationary or not and whether it has any unit root or not.

- **Null Hypothesis, Ho:** The dependent variable (returns of stock indices) is not stationary and it has a unit root.
- **Alternative Hypothesis, Ha:** The dependent variable (returns of stock indices) is stationary and it has no unit root.

The results presented in the Table 2 show that there do not exist any unit root problem and the series are stationary.

**Table 2. The ADF and P-P Tests Results**

Variable	ADF Test	ADF Test Results	P-P Test	P-P Test results
<b>Upper Middle Income Economies</b>				
Argentina	-7.29585	Null hypothesis is rejected	-7.39067	Null hypothesis is rejected
Malaysia	-4.9251	Null hypothesis is rejected	-4.95958	Null hypothesis is rejected
Mexico	-6.25221	Null hypothesis is rejected	-6.51376	Null hypothesis is rejected
America	-4.38922	Null hypothesis is rejected	-4.20016	Null hypothesis is rejected
<b>Lower Middle Income Economies</b>				
Sri Lanka	-5.86456	Null hypothesis is rejected	-5.82267	Null hypothesis is rejected
Indonesia	-6.02892	Null hypothesis is rejected	-6.08088	Null hypothesis is rejected
India	-6.71669	Null hypothesis is rejected	-7.02704	Null hypothesis is rejected
China	-6.78686	Null hypothesis is rejected	-7.97175	Null hypothesis is rejected
<b>High Income Economies</b>				
Hong Kong	-5.30732	Null hypothesis is rejected	-5.26092	Null hypothesis is rejected
Australia	-5.57008	Null hypothesis is rejected	-6.31537	Null hypothesis is rejected
London	-5.53448	Null hypothesis is rejected	-5.46926	Null hypothesis is rejected
Japan	-6.47386	Null hypothesis is rejected	-6.52668	Null hypothesis is rejected

Notice here that the statistic value is greater than the critical values of 1.96 so that we do reject the null at conventional test sizes.

### C. GARCH Estimation For Checking Causality In Variance

The model is a **Generalized Autoregressive Conditional Heteroskedasticity (GARCH, Bollerslev(1986))** model. Autoregressive Conditional Heteroskedasticity (ARCH) models are specifically designed to model and forecast conditional variances. The variance of the dependent variable is modeled as a function of past values of the dependent variable and independent or exogenous variables. In developing an ARCH model, you will have to provide two distinct specifications—one for the conditional mean and one for the conditional variance.

The GARCH(1, 1) Model specification (1), (2) in which the mean equation given in (1) is written as a function of exogenous variables with an error term. Since is the one-period ahead forecast variance based on past information, it is called the conditional variance. The conditional variance equation specified in (2) is a function of three terms:

\* A constant term

\* News about volatility from the previous period, measured as the lag of the squared residual from the mean equation: (the ARCH term).

\* Last period's forecast variance: (the GARCH term).

The GARCH(1,1) model is given by

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta \sigma_{t-1}^2$$

where  $\alpha_0$  is the mean,  $\varepsilon_{t-1}^2$  is the ARCH term and  $\sigma_{t-1}^2$  is the GARCH term.

$$y_t = x_t' r + \varepsilon_t \quad (1) \dots \text{Mean equation}$$

$$\sigma_t^2 = \omega + \alpha \cdot \varepsilon_{t-1}^2 + \beta \cdot \sigma_{t-1}^2 \quad (2) \dots \text{The conditional variance}$$

The GARCH(1,1) variance specification is analogous to the sample variance, but that it down-weights more distant lagged squared errors.

\* The error in the squared returns is given by substituting for the variances in the variance equation and rearranging terms we can write our model in terms of the errors.

The financial markets are sensitive to the time dependent information flows. For that reason, financial data should be parameterized with Autoregressive Conditional Heteroskedastic (ARCH) models. ARCH process models a time- varying conditional variance as a linear function of past squared residuals and of its past values. ARCH test says that the prediction error variance is not constant, but it varies from one period to another, i.e. if there is any kind of autocorrelation in the variance of prediction errors. The above model is tested by GARCH with Gaussian distribution and GARCH with Student's-t-distribution for each stock market by using E-views5. The test results of the interest rates effect show deviation between upper middle, lower middle and high income economies. Therefore, the empirical findings are discussed in three different categories as specified in the data part.

**H0: The interest rates effect show no deviation between upper middle, lower middle and high income economies**

**Ha: The interest rates effect show deviation between upper middle, lower middle and high income economies**

Table 3 given below displays the test results with (Gaussian) normal GARCH model for the US T-bills interest rate effects on the return volatility of upper middle, lower middle and high income economies. Test results show that the time value of US dollar has statistically significant negative impact on the return volatility of stock markets but its effect is relatively at low level. All equity indexes have similar empirical results both in terms of levels coefficients, R square values, and direction. America, Japan and London are an exception in those general results because the US interest rates do have statistically significant effects on it. a strong effect on US interest rates has been diluted, perhaps reflecting the effect of massive purchases of US securities by foreign central banks

**Table3: showing Test Results of GARCH with Gaussian Distribution for Returns of Stock Indices**

ECONOMIES	Coeff. (US T-Bill)	z-Statistics	RESID(-1)^2	GARCH(-1)	R2	Results
<b>UPPER MIDDLE INCOME ECONOMIES</b>						
Argentina	-0.0101	-0.0089	0.0341	0.40859	-0.0055	H0 is accepted
America	-0.0086	3.92933	2.31504	0.51938	-0.0252	H0 is not accepted
Malaysia	-0.0062	-0.1415	-0.7305	0.55903	-0.000038	H0 is accepted
Mexico	-0.0034	0.51244	-0.6324	0.05711	-0.0003	H0 is accepted
<b>LOWER MIDDLE INCOME ECONOMIES</b>						
Indonesia	-0.0064	-0.1934	-0.2579	0.53003	-0.0122	H0 is accepted
India	-0.0066	-0.1837	-0.2879	0.57147	-0.0076	H0 is accepted
China	-0.0044	2.1189	-0.2518	0.1409	-0.0342	H0 is accepted
Sri Lanka	-0.0022	0.68136	-0.2111	-0.0206	-0.0004	H0 is accepted
<b>HIGH INCOME ECONOMIES</b>						
Japan	-0.0039	-1.4713	1.52635	0.34255	-0.0005	H0 is not accepted
Hongkong	-0.0054	-0.7965	-0.5058	0.54349	-0.0013	H0 is accepted
London	-0.0017	-0.7388	4.12277	0.1514	-0.0044	H0 is not accepted
Australia	-0.0031	0.5935	3.85737	0.0165	-0.000006	H0 is accepted

Table 4 given below displays the test results with (Gaussian) normal GARCH model for the RBI T-bills interest rate effects on the return volatility of upper middle, lower middle and high income economies. All equity indexes have similar empirical results both in terms of levels coefficients, R square values, and direction.

**Table 4 showing Test Results of GARCH with Gaussian Distribution for Returns of Stock Indices**

ECONOM IES	COEFF. OF RBI-TBILL	Z-Statistics	RESID(-1)^2	GARCH(-1)	R2	Results
<b>UPPER MIDDLE INCOME ECONOMIES</b>						
Argentina	-0.0115	1.5997	0.7688	0.37231	-0.0028	H0 is not accepted
America	-0.009	1.45925	3.15071	0.33269	-0.0123	H0 is not accepted
Malaysia	-0.0044	-0.1961	-0.3136	0.5722	-0.0011	H0 is accepted
Mexico	-0.0031	0.65795	-0.6743	0.1592	-0.000085	H0 is accepted
<b>LOWER MIDDLE INCOME ECONOMIES</b>						
Indonesia	-0.0058	0.87059	1.59018	0.15842	-0.0005	H0 is not accepted
India	-0.0029	0.1889	-0.2293	0.43812	-0.0003	H0 is accepted
China	-0.0041	-0.4044	-0.3159	0.55005	-0.0035	H0 is accepted
Sri Lanka	-0.002	0.38585	-0.1964	-0.6371	-0.0034	H0 is accepted
<b>HIGH INCOME ECONOMIES</b>						
Japan	-0.00445	-1.4705	1.57394	0.29132	-0.0006	H0 is not accepted
Hongkong	-0.00204	-0.8572	-0.4471	0.50139	-0.0052	H0 is accepted
Australia	-0.00371	0.46186	3.15103	-0.0098	-0.000005	H0 is not accepted
London	-0.002736	-0.2736	3.676325	0.220790	-0.005658	H0 is not accepted

Hypothesis tests the sensitivity of returns of selected stock indices to interest rates. By the results of the table some null hypothesis are accepted. It means that the independent variable (interest rates) does not have any effect on dependent variable (returns of selected stock indices).

As the results show that the time value of interest rates and exchange rates has statistically insignificant but negative impact on the selected stock indices of different countries and its effect is relatively at low level. All stock indexes have similar empirical results both in terms of levels of coefficients, R square values and direction. Argentina, America, Japan, Indonesia, Australia and London are an exception in those general results because the RBI t-bills interest rates do have statistically significant effects on it. Spiegel (2006) opines that although QEP led to fall in long term interest rates, change in expectation of market participants along with increased risk tolerance, the magnitude of impact of QEP was uncertain and that QEP had delayed the long overdue structural reform in the Japanese economy. QE in the UK also led to improved liquidity in the government securities market.

All the selected stock indices of different countries are under a low negative impact of the changes in the interest rates (US & RBI Treasury Bills). The percentages of significance are not so high and there is no volatility effect of interest rates on the returns of selected stock indices of different countries. The results have distinctive empirical results. The financial markets in lower middle income economies are under positive impact of the changes in the US Treasury Bills. The reason for this distinctive difference might be the effects of the US monetary policies on the Asian currency/USD parity.

#### **IV Suggestions for Future Research**

The empirical findings of the research have important results. Volatility in the time value of the US bills and RBI bills have international transmission effects on the world equity markets. However, the level of illustrative power of the US interest rates varies on the types of equity markets. For example the stock markets in the Asian and the US stock markets (domestic markets) are strongly affected by the volatility in the US interest rates. The empirical findings for the stock markets in the Asian Zone might be explained by the fact that the US interest rates also affect the Asian currency/USD parity. The emerging stock markets and non-US financial markets are affected by the US interest rates at statistically significant but low levels. The direction of the effect is positive. In those economies, the stock markets are affected by the changes in the US interest rates but they might behave in accordance with other factors such as domestic interest rates or foreign exchange rates. The same is the case with RBI treasury bills rate but in this case the economies which are comparatively stronger than Indian economy have significantly lesser transmission effect. The future research might focus on the other international factors such as the parity, business cycles, and excess liquidity, affecting the equity markets. The US interest rates might have stronger effects on the money markets rather than the stock markets in emerging markets. The future research might examine the issue by using monetary variables. Even more stock indices can be included in order to cover a larger area. Time period of the study can be increased upto 20 to 25 years to know a generalized result.

## Conclusion

This study examines the transmission of volatility in interest rates on stock markets of twelve countries and also looks about the effect of interest rate on returns of stock markets. In this study, we have studied the effect of interest rates on the returns of stock market with the help of GARCH (1, 1) model. We have also tested for the presence of causality-in-mean and volatility spillovers. The extensive coverage of representative indices of high, middle and lower income economies, and the careful (simultaneous) modeling of risk sensitivity and causality-in-variance effects differentiate the present study from earlier ones, normally focusing on a single country. For applying this some assumptions are taken into consideration like normality check and stationery check. The whole data was found to be not normally distributed (by Jarque-Bera test) and the time series proven as stationery. For stationery check Augmented Dickey-Fuller (ADF) and Phillips and Perron (P-P) unit root tests were used and the result shows that the dependent variable series at 5% is stationary and therefore has no unit root.

While computing the transmission volatility in interest rates on returns of different economies we found that 2 countries from upper middle income segment (Argentina, America) has found volatility impact, 1 country from lower middle income segment (Indonesia) and 3 from high income segment (Japan, Australia and London) has shown significant impact of volatility in their returns. But the study shows no impact of transmission of volatility in interest rates risk on returns of stocks indices. In overall, the theoretical argument of negative relationship between stock price and prevailing interest rate is not rejected.

GARCH was used to check causality-in-variance running from the interest rate volatility to the stock market index volatility of the selected indices for the study. Tests of no causality in mean effect is used to check out whether there is any impact of independent variable (US T-Bills and RBI T-Bills) on dependent variable (returns of stock indices) The results have similar empirical results. All the selected stock indices of Asian countries are under a low negative impact of the changes in the interest rates (US and RBI Treasury Bills). The percentages of significance are not so high and there is no volatility effect of interest rates on the returns of selected stock indices of the world. The results of our study are in line with (DORON NISSIM, STEPHEN H. PENMAN) (2003).

There could be many reasons for this like stock and bond interest rates, consumer and business spending, inflation, terrorism and recessions. All these reasons are macroeconomic factors. Hence, the overall effect of changes in interest rates on equity value is negative, consistent with the negative correlation between changes in interest rates and stock returns.

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## **Why Do Managers Use IRR in Investment Analysis?**

Nalinaksha Bhattacharyya

### **Abstract**

Finance textbooks recommend the use of Net Present Value (NPV) as the evaluation tool for Capital Budgeting. Yet surveys of managers have consistently shown that managers prefer Internal rate of Return (IRR) to NPV. This article rigorously establishes the interpretation of IRR as the return earned on funds that remains internally invested in the project. Using this interpretation IRR can be viewed as a tool to evaluate the riskiness of the capital budgeting proposal.

### **I. Introduction**

Capital budgeting literature tells us that the criterion for accepting or rejecting a project should be based on the Net Present Value (NPV) of the project. We should accept the project if the NPV is positive and we should reject the project if the NPV is negative. This much is drilled into every student who has taken a course in introductory finance. However, when we look at surveys of managers we find that a significantly large number of managers prefer to use Internal Rate of Return (IRR) for capital budgeting over NPV.

In order to understand this phenomenon, we need to examine the economic interpretation of IRR. In this paper we provide a rigorous justification for interpreting IRR as akin to a mortgage rate. When we take out a mortgage we prepare an amortization table. The amortization table divides every mortgage installment in two parts -interest and repayment of principal. Towards the beginning of the mortgage period, a larger fraction of the mortgage payment is going towards interest payment and towards the end of the mortgage period a larger fraction of the mortgage amount is going towards the repayment of the amount borrowed. At the end of the mortgage period, with the last payment, the account is squared off and the borrower has paid off the loan.

One possible explanation for use of IRR by managers is that managers interpret IRR as something akin to a mortgage rate and this makes it easier for them to intuitively estimate the probabilities of financial embarrassment of not meeting the return expectations of security holders. IRR thus serves as a risk measure for managers. In this article we provide a rigorous justification for interpreting IRR as akin to a mortgage rate. After establishing the validity of this particular interpretation of IRR we discuss how managers plausibly use this information to estimate the probability of the project not meeting the return expectations of security holders.

The paper is organized as follows. Section II motivates the paper and establishes the scope for the paper. Section III discusses the two economic interpretations of IRR and which of these interpretations are useful for establishing a rationale for observed managerial use of IRR, while Section IV establishes the generality of the interpretation of IRR as the rate of return on funds remaining internally invested. The next section segues into the question of managerial use of IRR and posits that managers use IRR as a risk

measure. Section IV discusses the direction for future research. Section V summarizes and concludes. All proofs are given in the appendix.

## II. Motivation and Scope for the Paper.

Finance textbooks are unanimous in their recommendation of NPV as the preferred method for evaluating capital budgets.<sup>1</sup> However when we look at the choices of practicing managers we find that they often prefer IRR to NPV as the choice for analyzing capital expenditure proposals.

### A. Literature Review.

Surveys of corporate managers have consistently shown that managers often rank IRR ahead of NPV as their preferred means of evaluating projects. In a survey of 90 US firms and 65 Canadian firms by Payne et al. (1999), American managers ranked IRR as number one, ahead of NPV, which was judged the second most important technique. In the same survey, Canadian managers ranked IRR as number two and NPV as number one in importance. Jog and Srivastava (1995) however find that Canadian managers use IRR more than they use NPV. Kim and Ulferts (1996) summarize five surveys on capital budgeting practices of multinational companies. Each survey found that IRR is used more as a primary project evaluation technique than NPV. Sangster (1993) surveys capital budgeting practices in UK and reviews findings of other researchers and opines that “(t)he theorist’s recommendation that NPV be used rather than IRR was generally found not to have been adopted”(page 309) Graham and Harvey (2001) find that “74.9% of CFOs always or almost always... use net present value...; and 75.7% always or almost always use internal rate of return ...” (page 197)

The preference for IRR over NPV as a technique is ubiquitous. Block (1997) finds that small firms use IRR preferentially over NPV—a conclusion which is found to be true also for Fortune 500 companies [Burns and Walker (1997)], for subsidiaries of US multinationals [Shao and Shao (1996)] and for firms in Singapore [Kester and Chong (1998)]. The puzzle is described by Bierman (1993) as below:

“Seventy-three of the firms (99%) used IRR compared to 63 of the firms (85%) using NPV. ... Given that IRR can be improperly used (two illustrations of potentially improper use are mutually exclusive investments and multiple rates of return), the sole use of IRR without using NPV is of some concern.”(page 24)

Similar concern is expressed by Brealey et al. (2006) when they write

“...for many companies DCF means IRR, not NPV.”(page 99)

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<sup>1</sup> For recent theoretical critiques of the NPV criterion see Berkovitch and Israel (2004), Magni (2002), Bert (2005), and Magni (2009). Osborne (2010) advocates use of the ratio of NPV to the absolute value of initial investment as the decision method.

B. Scope of the Paper

In the light of the survey evidence we should try to see if there could be a plausible rational reason why managers could be more favorably inclined towards IRR over NPV. This paper aims to supply such a rational reason. We demonstrate that IRR can be rigorously interpreted as a rate of return on funds that remain internally invested in the project. We then posit that managers use IRR as an intuitive measure of risk in a world where they face a stochastic cost of capital. It is to be emphasized here that this is a theoretical paper. The empirical validity of this theory will be the subject of future research (see Section IV).

III. Interpreting Internal Rate of Return

If managers are more favorably inclined to use IRR as a technique of capital budgeting, then IRR must be carrying some kind of meaningful economic information for managers. If we try to look at the economic interpretations of IRR we come across two interpretations.

A. The More Popular Interpretation

The more popular and standard interpretation<sup>2</sup> says that *internal rate of return is the return earned on the initial investment*. This interpretation follows from the structure of the equation used to determine IRR. In particular, if  $-I_0, c_1, c_2, \dots, c_n$  are the cash flows associated with the project, the  $j$ th term of the series being the cash flow in the  $j$ th period, then IRR  $r$  is given by

	$I_0 = \frac{c_1}{(1+r)} + \frac{c_2}{(1+r)^2} + \frac{c_3}{(1+r)^3} + \dots + \frac{c_n}{(1+r)^n} \quad (1)$
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After simplification Equation (1) becomes

	$I_0 (1+r)^n = \sum_{j=1}^n c_j (1+r)^{n-j} \quad (2)$
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The left hand side of Equation (2) is the value of an investment  $I_0$  after  $n$  periods at a compounded rate of  $r$  per period. However, accepting this interpretation means that we have to accept the interpretation of the right side of Equation (2) as well. This means that the intermediate cash flows are being reinvested for the remainder of the project life, at a rate equal to IRR<sup>3</sup>. However, there is no way to guarantee that there will be opportunities

<sup>2</sup> As for example Brealey et al. (2006) write:  
 “Unfortunately, there is no wholly satisfactory way of defining the true rate of return of a long-lived asset. The best available concept is the so called **discounted cash flow (DCF) rate of return** or **internal rate of return (IRR)**.”(page 91) (emphasis in original).

<sup>3</sup> For more on the assumption of reinvestment of intermediate cash flows at the rate of IRR, see Alchian (1955), Robinson (1956), Solomon (1956), Renshaw (1957), Dudley (1972) and Levy and Sarnat (1986). A very comprehensive discussion on the reinvestment rate assumption is given in Herbst (2002).

available in future to invest intermediate cash flows at the rate of IRR. This interpretation is therefore not very useful in enhancing our understanding of the observed preference of managers for IRR.

**B. An Alternative and Less Popular Interpretation.**

This interpretation says that the internal rate of return is the "return earned on funds that remain internally invested in the project" Clark et al. (1989) (page 106). This interpretation of IRR does not involve consideration of reinvestment decisions for intermediate cash flows. To quote Bierman and Smidt (1993):

"The internal rate of return of a conventional investment has an interesting interpretation.... It represents the highest rate of interest that an investor could afford to pay, without losing money, if all the funds to finance the investment were borrowed and the loan (principal and accrued interest) was repaid by application of the cash proceeds from the investment as they were earned." (page 66)

It merits reiteration that this interpretation has the advantage of bypassing the knotty problem of reinvestment rate. This interpretation treats the internal rate of return as an amortization rate such that the cash flows would be just sufficient to amortize the initial investment over the life of the project.

**C. A Numerical Illustration**

The alternative interpretation has the attractive feature that it bypasses the thorny issue of the investment rate completely. In this section we present a numerical illustration of this interpretation.

Consider the following cash flow (amounts in \$ Millions)

<b>Year</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>Cash Flow</b>	-5000	1250	1450	1650	1918

The IRR for this cash flow is 9%. The initial investment of \$ 5000 Million can be amortized as in Table 1.

**D. Comments**

We have given a numerical illustration of the interpretation of IRR as akin to an amortization rate. However, before we can use this interpretation of IRR to explain the widespread observation of managers using IRR, we need to establish the generality of this interpretation. We need to be able to assert that the kind of decomposition shown in Table 1 will work for all possible cash flows and for all possible finite project durations - even for non simple ones where there may be changes in sign for intermediate cash flows.

In order to answer this question we need to establish the validity of the interpretation formally.<sup>4</sup> This is done in the next section.

**Table 1: Amortization of the Project Cash Flows Using IRR. (Amounts in \$ Millions Rounded)**

Row Number	Item	How Calculated	Year 1	Year 2	Year 3	Year 4
1	Cash Flow	From the Cash Flow Data	1250	1450	1650	1918
2	Outstanding Investment at the beginning of the year	For Year 1, it is the initial investment. For other years it is from Row 5 of the previous year.	5000	4200	3128	1760
3	Interest Paid	Row 2 Multiplied by IRR, in this case 9%.	450	378	282	158
4	Principal Repaid (Amortized)	Row 1 minus Row 3	800	1072	1368	1760
5	Outstanding Investment at the end of the year	Row 2 minus Row 4	4200	3128	1760	0

#### **IV. Interpreting IRR as a Rate of Return on Funds Remaining Internally Invested-A Generalized Result.**

In this section we formally and rigorously prove that IRR is the return on funds remaining internally invested and that it is both a necessary and a sufficient condition. We set out the notation in this section and state the theorems. The formal proofs are given in the Appendix. We state the theorems for the case where the initial cash flow is negative. The proofs and the theorems can be trivially extended to the cases where the initial cash flow is positive. We also assume that the cash flows are such that the IRR exists.

Let  $-I_0, c_1, c_2, \dots, c_n, I_0 > 0$  be the cash flows associated with the project, the  $j$ th term of the series being the cash flow in the  $j$ th period. It is to be noted that  $c_j, j \neq 0$  are unrestricted in sign. Each cash flow  $c_j, j \neq 0$  can be notionally divided into the following two parts:

<sup>4</sup> The following perspicacious quote from Russell (1986) may be recalled in this context.

“What I do wish to maintain - and it is here that the scientific attitude becomes imperative - is that insight, untested and unsupported, is an insufficient guarantee of truth, in spite of the fact that much of the most important truth is first suggested by its means.” (page 30)

- A part of  $c_j, j \neq 0$  goes toward providing one period return (say  $i$ ) on the amount remaining internally invested in the project at the end of the previous period.
- The balance part of  $c_j, j \neq 0$  goes toward repayment (in full or in part) of the amount remaining internally invested in the project at the end of the previous period. Note that if a particular  $c_j < 0, j \neq 0$ , then there will be negative repayment or in other words additional investment. Without loss of generality we assume that the cash flows take place at the end of each period. It is to be noted that this assumption in no way affects the validity of the formal proofs.

Let

- $i$  be the return per period on the funds remaining internally invested.
- $r$  be the discount rate, at which the cash flows are discounted to arrive at the net present value.
- $r^*$  be the internal rate of return.
- $R_j$  be the repayment of investment (either in whole or in part) in period  $j, j \geq 1$ .
- $n$  be the total number of periods in the cash flow stream, i.e.  $c_j = 0 \forall j \geq n+1$ .

The decomposition of the cash flows is shown in Table 2

**Table 2:** Decomposition of Cash Flows

Column 1	Column 2	Column 3	Column 4	Column 5
<b>Period</b>	<b>Funds Remaining Internally Invested at the Beginning of the Period</b>	<b>Return On Funds Remaining Internally Invested During the Period</b>	<b>Repayment of Investment During the Period</b>	<b>Total Cash Flow = <math>c_j</math> = Column 3 + Column 4</b>
1	$I_0$	$iI_0$	$R_1$	$c_1 = R_1 + iI_0$
2	$I_0 - R_1$	$i(I_0 - R_1)$	$R_2$	$c_2 = R_2 + i(I_0 - R_1)$
3	$I_0 - R_1 - R_2$	$i(I_0 - R_1 - R_2)$	$R_3$	$c_3 = R_3 + i(I_0 - R_1 - R_2)$
...	...	...	...	...
...	...	...	...	...
j	$I_0 - R_1 - R_2$ ..... $-R_{j-1}$	$i(I_0 - R_1 - R_2 - \dots - R_{j-1})$	$R_j$	$c_j = R_j$  $+i(I_0 - R_1 - R_2 - \dots - R_{j-1})$
...	...	...	...	...
...	...	...	...	...
n	$I_0 - R_1 - R_2$ ..... $-R_{n-1}$	$i(I_0 - R_1 - R_2 - \dots - R_{n-1})$	$R_n$	$c_n = R_n$  $+i(I_0 - R_1 - R_2 - \dots - R_{n-1})$

Since  $i$  is defined as the return on funds remaining internally invested and  $R_j$  is defined as the repayment of investment balance (in part or in full) in period  $j$ , therefore, it follows that, the total repayment of investment balances must equal the initial investment amount  $I_0$ . This means that we can write

$\sum_{j=1}^n R_j = I_0$	$(3)$
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Please note that this does not preclude any of the  $R_j$ 's from being negative. We want to establish the following results

- If  $i$  is any return on the funds remaining internally invested for the given cash flow, then  $i$  is an IRR for this given cash flow.
- If  $r^*$  is any IRR for the given cash flow, then  $r^*$  is a return on the funds remaining internally invested for this given cash flow.

We state the above results in the form of formal theorems.

**Theorem 1:** Let  $-I_0, c_1, c_2, \dots, c_n, I_0 > 0, c_n \neq 0$  and  $c_j = 0 \forall j \geq n+1$  be the cash flows associated with the project, the  $j$ th term of the series being the cash flow in the  $j$ th period. Let  $i$  be the return on funds remaining internally invested,  $i \neq -1$ , such that  $c_j = R_j + i(I_0 - R_1 - R_2 - \dots - R_{j-1})$ ,  $j = 1, 2, 3, \dots, n$ .  $R_j$ s can be generated by the recursive relationship  $R_j = c_j - i(I_0 - R_1 - R_2 - \dots - R_{j-1})$ . Since  $i$  is by definition a return on the funds remaining internally invested, therefore  $R_j$ s also satisfy the additional condition  $\sum_{j=1}^n R_j = I_0$ . Then  $i$  is an IRR for the cash flow so defined.

*Proof:* See Appendix.

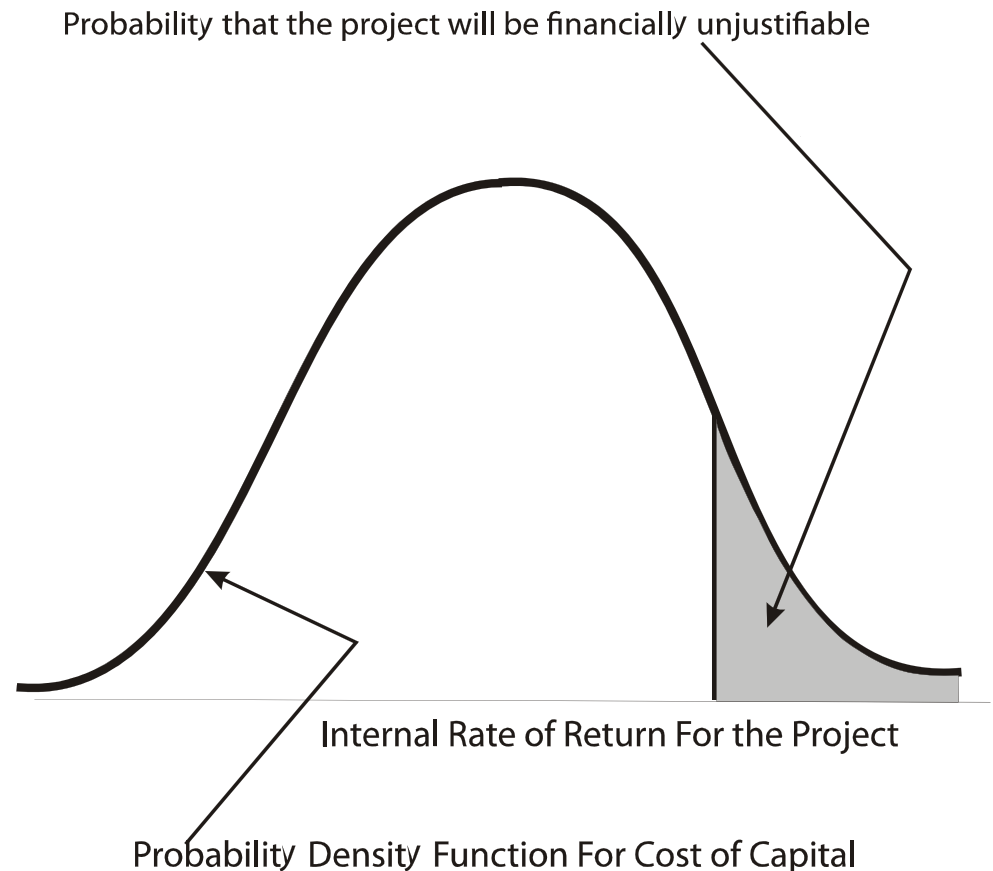
**Theorem 2:** Let  $-I_0, c_1, c_2, \dots, c_n, I_0 > 0, c_n \neq 0$  and  $c_j = 0 \forall j \geq n+1$  be the cash flows associated with the project, the  $j$ th term of the series being the cash flow in the  $j$ th period. Let the IRR  $r^*$  exist for this cash flow,  $r^* \neq -1$ . Let  $R_j$ s can be generated by the recursive relationship  $R_j = c_j - r^*(I_0 - R_1 - R_2 - \dots - R_{j-1})$ . Then  $\sum_{j=1}^n R_j = I_0$  i.e.  $r^*$  is the return on the funds remaining internally invested.

*Proof:* See Appendix.

Together these two theorems establish that IRR as the return on funds remaining internally invested is both a necessary and a sufficient condition.

### V. Why Managers Use Internal Rate of Return.

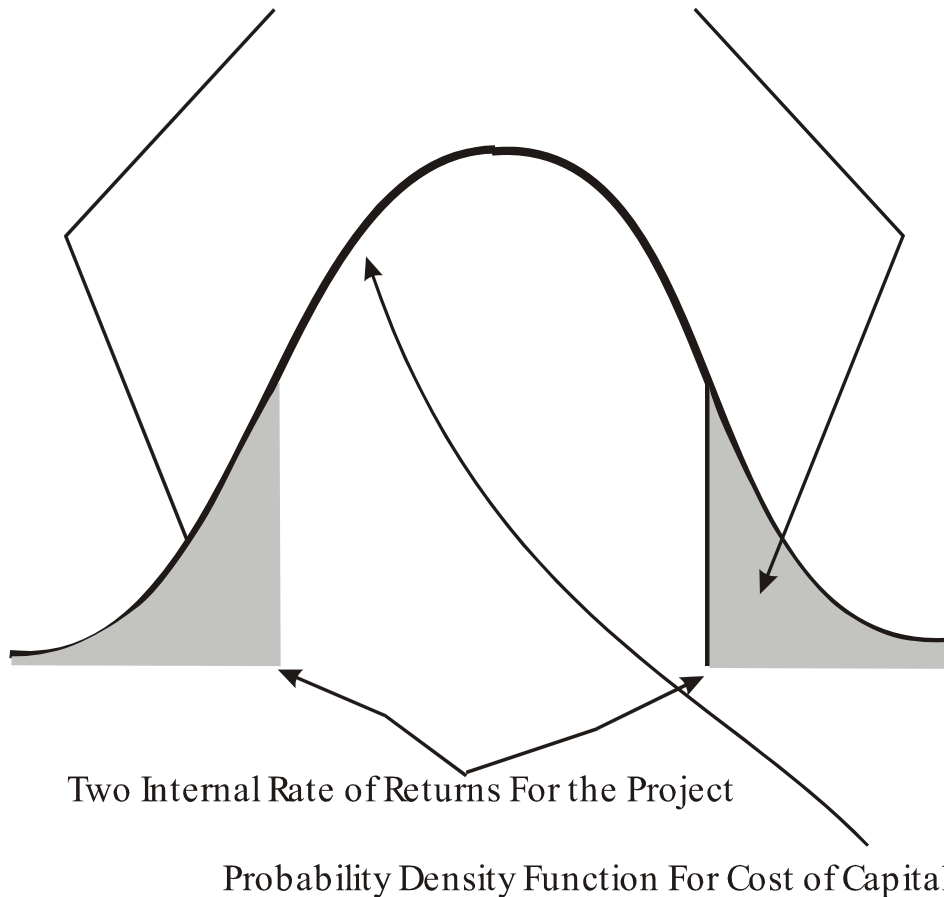
Internal rate of return is derived without any reference to the conditions in the capital market. In order to derive the IRR we just need to have the cash flows. According to the IRR criterion of Capital Budgeting Decision, in deciding upon the acceptability of the project, managers will have to compare the internal rate of return against the cost of capital. *However, the cost of capital can change randomly depending on the capital market conditions. Indeed Chatrath and Seiler (1997) find that managers face a stochastic cost of capital.* A rational manager will therefore treat cost of capital as a random variable following some probability distribution and knowing the IRR of the project can determine the tail end probability of the project being financially untenable. We should emphasize here that we are not suggesting any particular form for the probability distribution. The only thing we are assuming here is that managers know or, at the least have some intuitive idea about the probability distribution for their cost of capital.



**Figure 1:** IRR as a Risk Measure

We can illustrate this by referring to Figure 1. Figure 1 shows the probability density function for the cost of capital. We reiterate that the probability distribution sought to be depicted in Figure 1 is a general probability distribution and is not necessarily a normal distribution. For a particular project the IRR can be determined with the knowledge of the expected cash flows alone. From the probability density function we can then determine the probability of the project being financially unviable. In other words IRR conveys the risk information pertinent to the project. Note that for this rendition to be valid IRR needs to be interpreted as the return earned on funds that remain internally invested-an interpretation which has been shown to be rigorously valid.

Probability that the project will be financially unjustifiable



**Figure 2:** IRR as a Risk Measure-The Case for Double IRRs

One of the criticisms frequently advanced against the IRR method is that there could be cases when a particular set of cash flows could generate multiple IRRs.<sup>5</sup> Once

<sup>5</sup> The issue of multiple IRR started with the famous pump problem of Lorie and Savage (1955). In this problem there is a cash outflow when the company purchases a pump of higher capacity, pumps out additional oil which gives the company positive cash flows in the period of operation of the pump. In the terminal period there is a cash outflow because the company has pumped out the additional oil

managers know the probability distribution of the cost of capital, they can estimate the probability of the project causing financial embarrassment using the multiple IRRs. Figure 2 shows graphically how the probability of financial embarrassment can be estimated for a set of cash flows with two IRRs.

#### **IV. Directions for Future Research**

This paper has advanced a theoretical rationale to explain the puzzling observation that while the theories of finance recommend use of NPV in investment appraisal, in practice managers often use IRR in preference to NPV. A theory however needs to be validated by empirical tests. This will be the subject of future research.

There are two ways to test the rationale posited here. One is the survey method where we can design a questionnaire to test the hypothesis that managers use IRR as a rough measure of the riskiness of the project. The second method is to use the approaches of experimental finance. We can set up an experiment where we present subjects with choices of projects and then observe their choices. The choices will have to be so designed that once we observe the choice we can infer whether they are using IRR as a rough measure of riskiness or not. Designing such surveys and such experiments are full-fledged research projects by themselves and will be subjects of future research.

#### **V. Summary and Conclusion**

In this paper we have tried to understand why managers use IRR in preference to NPV much to the chagrin of finance academics. For example Brealey et al. (2006) lament: "... for many companies DCF means IRR, not NPV." (page 99)

We have provided a rigorous justification for the interpretation of IRR as the rate of return on funds that remain internally invested in the project. Based on this interpretation it can be argued that IRR may be used by managers as a risk assessment tool.<sup>6</sup> Future research efforts would involve understanding this aspect in more depth either through survey methodology or through experimental finance.

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and exhausted the supply and thus it no longer has the incremental cash flow. The cash flow of the pump problem is characterized by a negative cash flow in the initial period, followed by periods of positive cash flows and then followed by periods of negative cash flows. This kind of situation can also arise in mining where after extracting the minerals the company might be required to fill the mine with sand in order to prevent cave ins. A series of negative cash flows towards the end of project life might also occur when companies might be required to rectify environmental degradation. In all such cases the pattern of cash flows will be an initial negative cash flow, followed by a set of positive cash flows, followed by a set of negative cash flows. Using Descartes' Rule of signs [Herbst (2002)] we can see that in such cases there will be at best two IRRs.

<sup>6</sup> We may note here that payback period is another popular technique of capital budgeting which finds ever lesser approval among academics than IRR. Weingartner (1969) suggests that payback period may be a measure of the rate of resolution of uncertainty. Readers may find it interesting to look up Booth (1996) for some relations between payback period and IRR.

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### Appendix: Proof of Theorems

**Theorem 1:** Let  $-I_0, c_1, c_2, \dots, c_n, I_0 > 0, c_n \neq 0$  and  $c_j = 0 \forall j \geq n+1$  be the cash flows associated with the project, the  $j$ th term of the series being the cash flow in the  $j$ th period. Let  $i$  be the return on funds remaining internally invested,  $i \neq -1$ , such that  $c_j = R_j + i(I_0 - R_1 - R_2 - \dots - R_{j-1})$ ,  $j = 1, 2, 3, \dots, n$ .  $R_j$ s can be generated by the recursive relationship  $R_j = c_j - i(I_0 - R_1 - R_2 - \dots - R_{j-1})$ . Since  $i$  is by definition a return on the funds remaining internally invested, therefore  $R_j$ s also satisfy the additional condition  $\sum_{j=1}^n R_j = I_0$ . Then  $i$  is an IRR for the cash flow so defined.

*Proof:*

Case 1:  $i=0$ .

In this case  $c_j = R_j \forall n \geq j \geq 1$ .

From the given condition

$$\sum_{j=1}^n R_j = I_0$$

$$\Rightarrow -I_0 + \sum_{j=1}^n R_j = 0$$

$\therefore i = 0$  is an Internal Rate of Return (IRR).

Case 2:  $i \neq 0, i \neq -1$ .

We know from the definition of  $R_j$ s.

$$R_1 = c_1 - iI_0$$

$$R_2 = c_2 - i(I_0 - R_1)$$

$$= c_2 - i(I_0 - c_1 + iI_0)$$

$$= c_2 + ic_1 - i(1+i)I_0$$

$$R_2 = c_3 - i(I_0 - R_1 - R_2)$$

$$= c_3 - i(I_0 - c_1 + iI_0 - c_2 - ic_1 + i(1+i)I)$$

$$= c_3 + ic_2 + i(1+i)c_1 - i(1+i)^2 I_0$$

Suppose we assume that

$$R_j = c_j + ic_{j-1} + i(1+i)c_{j-2} + i(1+i)^2 c_{j-3} + \dots + i(1+i)^{j-2} c_1 - i(1+i)^{j-1} I_0$$

$$j = 1, 2, 3, \dots, k, i \neq 0, i \neq -1$$

$$\text{i.e. } R_\tau = c_\tau + i \sum_{j=1}^{\tau-1} (1+i)^\tau (1+i)^{-(j+1)} c_j - i(1+i)^{(\tau-1)} I_0 \quad \forall k \geq \tau \geq 1.$$

$$\begin{aligned} \therefore \sum_{\tau=1}^k R_\tau &= \sum_{\tau=1}^k c_\tau + i \sum_{\tau=1}^k \sum_{j=1}^{\tau-1} (1+i)^\tau (1+i)^{-(j+1)} c_j - i \sum_{\tau=1}^k (1+i)^{(\tau-1)} I_0 \\ \Rightarrow \sum_{\tau=1}^k R_\tau &= \sum_{\tau=1}^k c_\tau + i \sum_{j=1}^{k-1} \sum_{\tau=j+1}^k (1+i)^\tau (1+i)^{-(j+1)} c_j - I_0 \left[ (1+i)^k - 1 \right] \\ \Rightarrow \sum_{\tau=1}^k R_\tau &= \sum_{\tau=1}^k c_\tau + \sum_{j=1}^{k-1} \left[ (1+i)^{k-j} - 1 \right] c_j - I_0 \left[ (1+i)^k - 1 \right] \\ \Rightarrow \sum_{\tau=1}^k R_\tau &= c_k + \sum_{j=1}^{k-1} (1+i)^{k-j} c_j - I_0 \left[ (1+i)^k - 1 \right] \\ \Rightarrow R_{k+1} &= c_{k+1} + ic_k + i \sum_{j=1}^{k-1} (1+i)^{k-j} c_j - i(1+i)^k I_0 \because R_{k+1} = c_{k+1} - i \left[ I_0 - \sum_{\tau=1}^k R_\tau \right] \end{aligned}$$

\(\therefore\) By Mathematical Induction,

$$R_j = c_j + ic_{j-1} + i(1+i)c_{j-2} + i(1+i)^2 c_{j-3} + \dots + i(1+i)^{j-2} c_1 - i(1+i)^{j-1} I_0$$

$$\forall j = 1, 2, 3, \dots, n, i \neq 0, i \neq -1$$

$$\text{Now } R_j = c_j + i \sum_{\tau=1}^{j-1} (1+i)^{-\tau} (1+i)^{j-1} c_\tau - i(1+i)^{(j-1)} I_0 \quad \forall n \geq j \geq 1.$$

$$\begin{aligned} \therefore \sum_{j=1}^n R_j &= \sum_{j=1}^n c_j + i \sum_{j=1}^n \sum_{\tau=1}^{j-1} (1+i)^{-\tau} (1+i)^{j-1} c_\tau - i \sum_{j=1}^n (1+i)^{(j-1)} I_0 \\ \Rightarrow \sum_{j=1}^n R_j &= \sum_{j=1}^n c_j + i \sum_{\tau=1}^{n-1} \sum_{j=\tau+1}^n (1+i)^{-\tau} (1+i)^{j-1} c_\tau - I_0 \left[ (1+i)^n - 1 \right] \\ \Rightarrow \sum_{j=1}^n R_j &= \sum_{j=1}^n c_j + \sum_{\tau=1}^{n-1} \left[ (1+i)^{n-\tau} - 1 \right] c_\tau - I_0 \left[ (1+i)^n - 1 \right] \\ \Rightarrow \sum_{j=1}^n R_j &= c_n + \sum_{j=1}^{n-1} (1+i)^{n-j} c_j - I_0 \left[ (1+i)^n - 1 \right] \\ \Rightarrow -(1+i)^n I_0 + \sum_{j=1}^{n-1} (1+i)^{n-j} c_j + c_n &= 0 \because \sum_{j=1}^n R_j = I_0 \\ \Rightarrow -I_0 + \sum_{j=1}^n \frac{c_j}{(1+i)^j} &= 0 \end{aligned}$$

\(\therefore\)  $i$  is an IRR for the cash flow.

**Theorem 2:** Let  $-I_0, c_1, c_2, \dots, c_n, I_0 > 0, c_n \neq 0$  and  $c_j = 0 \forall j \geq n+1$  be the cash flows associated with the project, the  $j$ th term of the series being the cash flow in the  $j$ th period. Let the IRR  $r^*$  exist for this cash flow,  $r^* \neq -1$ . Let  $R_j$ s can be generated by the recursive relationship  $R_j = c_j - r^*(I_0 - R_1 - R_2 - \dots - R_{j-1})$ . Then  $\sum_{j=1}^n R_j = I_0$  i.e.  $r^*$  is the return on the funds remaining internally invested.

*Proof:*

Since  $r^*$  is the IRR for the given cash flow,

	$\therefore -I_0 + \sum_{j=1}^n \frac{c_j}{(1+r^*)^j} = 0$	(4)
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Case 1:  $r^* = 0$

From Equation (4) we get

	$\sum_{j=1}^n c_j = I_0$	(5)
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From the definition of  $R_j$  we get,

	$\sum_{j=1}^n R_j = \sum_{j=1}^n c_j$	(6)
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Equations (5) and (6) show that  $\sum_{j=1}^n R_j = I_0$ .

Case 2:  $r^* \neq 0, r^* \neq -1$ .

Put  $k = \frac{1}{1+r^*}, \therefore k \neq 0, k \neq 1$ .

From Equation (4) we get,

	$\therefore -I_0 + \sum_{j=1}^n k^j c_j = 0$	(7)
--	--	-----

Also from the definition of  $R_j$

	$c_j = R_j + r^* \left[ I_0 - \sum_{u=1}^{j-1} R_u \right] = R_j + \frac{1-k}{k} \left[ I_0 - \sum_{u=1}^{j-1} R_u \right]$	(8)
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From Equations (7) and (8), we get

$$\begin{aligned}
& -I_0 + \sum_{j=1}^n k^j \left[ R_j + \frac{1-k}{k} \left[ I_0 - \sum_{u=1}^{j-1} R_u \right] \right] = 0 \\
\Rightarrow & -I_0 + \sum_{j=1}^n k^j R_j + \frac{1-k}{k} I_0 \sum_{j=1}^n k^j - \frac{1-k}{k} \sum_{j=1}^n k^j \sum_{u=1}^{j-1} R_u = 0 \\
\Rightarrow & -I_0 + \sum_{j=1}^n k^j R_j + \frac{1-k}{k} \frac{k(k^n-1)}{k-1} I_0 - \frac{1-k}{k} \sum_{u=1}^{n-1} R_u \sum_{j=u+1}^n k^j = 0 \\
\Rightarrow & -I_0 + \sum_{j=1}^n k^j R_j - (k^n-1) I_0 + \frac{k-1}{k} \sum_{u=1}^{n-1} R_u \frac{k^{u+1} [k^{n-u} - 1]}{k-1} = 0 \\
\Rightarrow & \sum_{j=1}^n k^j R_j - k^n I_0 + \sum_{j=1}^{n-1} k^n R_j - \sum_{j=1}^{n-1} k^j R_j = 0 \\
\Rightarrow & k^n R_n - k^n I_0 + k^n \sum_{j=1}^{n-1} R_j = 0 \\
\Rightarrow & k^n \left[ \sum_{j=1}^n R_j - I_0 \right] = 0 \\
\Rightarrow & \sum_{j=1}^n R_j = I_0 \because k \neq 0.
\end{aligned}$$

## **Financial Arbitrage and Information Technology**

Monzurul Hoque and Hamid Mohammadi

### **I. Introduction and Motivation**

In his 2003 controversial article entitled "IT does not matter", Nickolas G. Carr argued that Information Technology (IT) has lost its magical power to provide competitive advantages and that corporations would be better off focusing on the risk of IT rather than looking at IT as a strategic asset that can provide opportunities.

His reasoning is similar to what took place a century ago with electricity, when utility companies became able to centralize power generation in big utilities and were able to distribute electricity over a network of electrical grid systems. At first, many electric producing/providing companies resisted the change, but lower costs, freed-up capital, more flexibility, and fewer problems made even the larger companies to change their strategies and switch. This transformation helped smaller companies, which before had to stand on the sidelines and just watch bigger companies, to buy electricity over the public electrical grid and sell it to their customers. In a similar fashion, advances in computer networking, hardware sharing, grid computing, and internet services are all making IT utilities possible, in which IT has become more accessible, affordable, and ubiquitous.

In the past, building or buying new IT systems required a large amount of investments, and only the largest and best funded companies could afford cutting-edge technology. Smaller companies did not have any choice to just wait for costs to come down, and by then, they would have been many years behind the other big companies.

Further, it is hypothesized that over time, centralizing control over the basic IT infrastructure will ultimately increase the level of security and make network grid more reliable, which in turn make the utility model much more successful.

Another important fact about computing technology is that today, due to free open-source software, utility and application services provided over the internet, and the more affordable computers of today, most customers are small to midsize organizations without a large IT budget. These organizations vary from small businesses, to schools, and to non-profit organizations, and can all have and benefit from the same state-of-the-art systems that used to be only available to large companies with astronomical IT budgets. Thus, this new trend in business-computing - that is the era of inexpensive, affordable, reliable, and ubiquitous hardware and software is leading the way into the future.

On the other hand, IT guru, Robert M. Metcalfe, views IT investment as a source of competitive advantage. He further argues that it determines the path of sustainable excellence for a corporation.

Obviously, Carr and Metcalfe are at polar opposites. Carr's beliefs are that IT and IT investments are not sources of competitive advantage, and they do not give a company an edge over its competitors. However, Metcalfe believes that IT innovation and those who adopt IT early can get a competitive advantage.

We believe that, like any heated debate, the truth may lie in the blend of both views. In this paper we will find out whether the reality supports IT as a strategic asset or infrastructural asset in the financial services industry or both. In case of both, it will indicate that there is an optimal level of investment in IT beyond which it will cease to be a strategic asset.

## **II. Review of the Literature**

In this section we review the works of leading researchers and practitioners in the area of information technology on strategic values of information technology and their views on Carr's argument of IT no longer is the source of competitive advantage.

According to George Stalk (1998) competitive advantage is a constantly moving target like the competition itself. For any company in any industry, the key is not to get stuck with a single simple notion of its source of advantage. Innovation represents the most powerful new sources of competitive advantage.

Piccoli & Ives (2005) in a survey of the IT literature surmise that the sustainability of IT-dependent competitive advantage can be obtained through efficiency improvements, differentiation, and channel domination.

Kohli and Grover (2008) observe that the information technology has now become an essential part of today's modern organizations, but still have difficulty measuring its contribution to business performance. They maintain that the innate logic of Carr's argument implies that if IT does not matter, then all IT research does not matter. A very tough notion to accept.

According to Clemons and Row (1991) as business value of IT has been difficult to measure, many have classified IT as a strategic necessity. They further observe that IT is necessary but not sufficient for sustainable competitive advantage. They believe information systems are strategic business tools, frequently essential to a firm and central to its competitive strategy.

Clemons and Kimbrough (1986) believe that because IT can improve the cost, timing, and quality of information flows and decision processes, it can radically change the transaction economics with far-reaching strategic results. Monitoring costs and, hence, uncertainty can be decreased.

Nevo and Wade (2010) emphasize that IT assets derive their business value from the impact they make on the organizational resources with which they interact. Thus, they maintain, that the intrinsic capabilities of the IT assets should not be used alone to measure their business value; the emergent capabilities arising from their synergistic relationships with organizational resources should be part of valuation metric.

According to Barua, Mani, and Mukherjee (2010) conducted a study of over 150 Fortune 1000 firms from every major industry. They illustrate that small and even marginal investments in information technology such as effective and quality data can have a large positive impact on key financial measures. They show, among others, the slight investment in IT can increase the return on Equity (ROE) of the average Fortune 1000 by 16%, the Return on Invested Capital

(ROIC) by 1.4%, resulting in net income increase of \$5.4 million, and the Return on Asset (ROA) by 0.7%, resulting in additional income of \$2.87 million.

Marcus Heidmann (2010) indicates that a core-banking-system replacement can close more than 50% of the cost gap with competitors for one bank. A core-banking-system project can yield strong returns over ten years.

In summary, many IT professional and practitioners believe that as technology becomes more affordable, reliable, and wide-spread, the potential for competitive advantage increasingly depends on how organizations make use of acquired technology and the how they adapt their organizations and business processes to make the best use of that technology.

As evidenced above, Nicholas Carr's argument that affordable and accessible IT will no longer offer strategic values to companies as scarcity—not ubiquity—makes a business resource essentially strategic, stands out in sharp contrast with others' views of IT's capability. He believes that much of the over \$1 trillion invested globally on IT every year is wasted, and it is not efficient for an organization to invest and create its own computing infrastructure, because this will lead to massively redundant investment and will result in extraordinarily low levels of asset utilization.

### III. Empirical Testing of the Arguments

We will test the arguments by looking into financial services industry. We chose to look at financial arbitrage as this involves not only strategic thinking but also quick execution to make an abnormal profit. We will test whether the companies who execute covered interest arbitrage as strategic activity, value technology as a competitive advantage or as a commodity.

#### a. Covered Interest Arbitrage

Let us start by explaining why covered interest arbitrage involves strategic applications. The Covered Interest Rate Parity (IRP) states that

$$F_0^{IRP} = S_0 \left[ \frac{1+i_s}{1+i_e} \right] \text{ where } i_s = \text{annual money market rate in US, } i_e = \text{annual money market rate in}$$

UK,  $S_0$  = Spot Price defined as price of foreign currency,  $F_0^{MKT}$  = Forward market price of foreign currency, and  $F_0^{IRP}$  = Forward IRP price of foreign currency.

The left hand side of the above equation is the forward rate for delivering one unit of foreign exchange in future. The right hand side gives the cost of delivering one unit of foreign exchange through money market. If the market is competitive then the costs of forward and money market should be equal. Companies like Wachovia looks at the above equation and looks to take advantage of disparity. If both sides are equal then the foreign exchange is fair valued. However, arbitrage opportunities present themselves if the following happen. 1) If the forward market is overvalued then one should sell or lend the foreign currency and buy or borrow the domestic currency to take advantage of mispricing. 2) On the other hand if the foreign exchange is undervalued, then one will go for the foreign exchange. The case of overvalued £ is presented.

**Scenario: Overvalued £**

$i_{\$} = 3\%$        $i_{£} = 5\%$        $S_0 = \$2.00/£$        $F_0^{MKT} = \$2.05/£$  where variables are as defined above.

Test 1: Cost of Borrowing

$(1+.03) < 2.05/2.00 * (1+.03)/1+.05$  - Borrow in US, Lend/Invest in UK

Test 2: Mispricing

$F_0^{IRP} = 2 * [1.03/1.05] = \$1.9619/£ < F_0^{Mkt} = \$2.05/£$  - £ is overvalued.

Borrow \$ and sell £.

Actions	ICF (\$)	FCF (\$)
Convert into £,		
Invest in UK	-\$1	+£0.50(1.05) $S_1$ =+£0.525 $S_1$
Sell £, Go short £0.525 @		
$F_0^{Mkt} = \$2.05/£$	0	£0.525(\$2.05/£- $S_1$ ) =\$1.0763-£0.525 $S_1$
Borrow \$1 in US	+\$1	-\$1(1+.03) =-\$1.03
	-----	-----
	0	1.0763-1.03=+.0463

There will be arbitrage where \$ is demanded and £ is sold bringing  $F_0^{Mkt} = \$2.05/£$  **down** to  $F_0^{IRP} = \$1.9619/£$ . Market corrects itself because of self-interest or invisible hand. Here sustainable greed is at work

b. *Cross Rate Arbitrage*

$S^{HM} (€£) = S^{HM} (\$/£) \div S^{HM} (\$/€)$  where

$S^{HM} (€£)$  is homemade cross rate as obtained from market data on respective country's spot rate. On the other hand the market provides a direct spot cross rate,  $S^{MKT} (€£)$ . If  $S^{MKT} (€£) \neq S^{HM} (€£)$ , then there is an unexploited profit opportunity ( $UPO_{SCR}$ ) and will be cross rate arbitrage.

**Scenario: £ is undervalued**

Citi  $S^b(\$/\pounds) = 1.9712$ ; Chase  $S^b(\pounds/\pounds) = .6783$ ; Wells  $S^a(\pounds/\pounds) = 1.3310$

With the given data, we get homemade cross rate as follows:

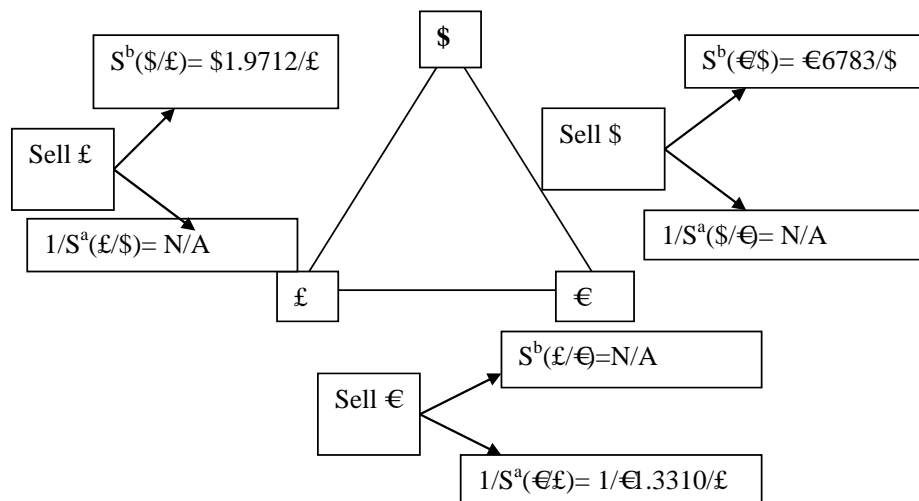
Homemade Cross Rate  $S^{HM}(\pounds/\pounds)$ :  $S^b(\pounds/\pounds) = S^b(\$/\pounds) \times S^b(\pounds/\pounds) = \text{Sell } \pounds \text{ to get } \$ \times \text{Sell } \$ \text{ to buy } \pounds - \pounds \text{ Investor.}$

Market Cross Rate  $S^{MKT}(\pounds/\pounds)$ :  $S^b(\pounds/\pounds) = S^b(\$/\pounds) \times S^b(\pounds/\pounds) = 1.9712 \times .6783 = \pounds 1.3371/\pounds.$

Since  $S^{HM}(\pounds/\pounds) - S^{MKT}(\pounds/\pounds) \neq 0$ , there is unexploited profit opportunity for Spot Cross Rate.

**The Homemade bid cross rate is higher than market ask cross rate. Hence, £ is undervalued. An arbitrageur will go for £ and a triangular arbitrage will ensue.**

**Cross Rate Arbitrage**



Riskless Profit =  $.6783 \times 1/1.3310 \times 1.9712 \times 5,000,000 = 5,022,783$  or 22,783 profit.

**Implications**

The implications of the above arbitrage process are as follows. Whenever a mispricing is detected, three sets of activities are generated – two money market activities and one forward market activity in covered interest arbitrage. The large banks carry out these activities as Spot Forward Swap accompanied by borrowing or lending activity. This trading entails strategic placement of orders. The size and reputation of players and quick access to order books are essential. Similarly, in cross rate arbitrage triangular activities are generated. As we look into the

executions of the players in reality, we will find out whether technology gets the prominence as Metcalfe contends or whether the technology is no longer a strategic asset as all competitors have the similar technology. Further, if we find out that the players emphasize co-locations as their strategy; this will mean that technology is no longer a strategic advantage. The competitors are seeking elsewhere to get strategic advantage. This will support Carr's view. In either case, we will be successfully bringing the debate to the empirical realm of financial arbitrage.

#### IV. Data, Methodology, and Empirical Findings

We test the following two hypotheses on the linkage between financial arbitrage and information technology.

**Hypothesis 1:** Covered Interest Arbitrage is affected by comparative advantage in information technology.

**Hypothesis 2:** Cross Rate Arbitrage is affected by comparative advantage in information technology.

##### a. Data

1. The data is obtained through hand collection. To test the hypotheses and investigate the relationship between UPOs and IT investments, yearly data from 1999 to 2010 for the Euro (exchange, spot, forward, interest rates), yearly data from 1989 to 2010 for the British Pound and US Dollar (exchange, spot, forward, interest rates), and yearly expenditures from 1980 to 2010 for IT investments were tabulated. The starting point of the sample period was determined by the availability of data.
2. To obtain data on interest rates on notes we have used the Federal Reserve and Federal Reserve Bank of St. Louis Federal databases. We have used data from Bank of England and European Central Bank for Exchange rates, Spot and Forward on Euros and Pounds. And to obtain data for Euros & Pounds Cross rates, Spot and Forward Rates, we have used databases from the University of British Columbia - Sauder school of Business and Institute of Chartered Accountants in England and Wales.

**Hypothesis 1:** Covered Interest Arbitrage is affected by comparative advantage in information technology. We define,

$$UPO = f - (i_s - i_f) \neq \text{where UPO is unexploited profit opportunities.}$$

We have analyzed the relationship between UPOs and technology investments and level of investment (high and low) for the following scenarios for Euro and British Pounds.

- $UPO_f(UPO_{\text{€}}) = \alpha + \beta (\text{Tech. Exp.}) + \gamma (\text{High or Low Tech. Exp}) + \varepsilon$  1
- $UPO_f(UPO_{\text{€}}) = \alpha + \beta (\text{LN Tech. Exp.}) + \gamma (\text{High or Low Tech. Exp}) + \varepsilon$  2
- $UPO_f(UPO_{\text{€}}) = \beta (\text{Tech. Exp.}) + \gamma (\text{High or Low Tech. Exp}) + \varepsilon$  3
- $UPO_f(UPO_{\text{€}}) = \beta (\text{LN Tech. Exp.}) + \gamma (\text{High or Low Tech. Exp}) + \varepsilon$  4

In equations 1 and 3, we are looking at the level of technological expenditure, and equations 2 and 4 deal with natural log of technological expenditure. We are using dummy variable regression to find out the impact of high or low levels of technological expenditure.

Initially, we used a t-test with the assumption of unequal variances to test our hypothesis. We used multiple regressions to investigate the relationship between technology expenditure, level of IT investment and UPOs. We analyzed the relationship for both absolute values of UPOs and squared values of UPOs. The analysis revealed that with respect to the Euro (see Table 1 for data summary), there was a significant difference, with P-value of  $.009 < .05$ , between the two means. We further ran regression to study the relationship between absolute value of UPOs and IT investments and level of IT investments. Our analysis showed that indeed there was a strong relationship between UPOs and investments in IT with multiple R of almost 85% for scenarios 3 and 4, but for scenarios 1 and 2, the relationship was weak with multiple R of around 35% (Table 2). Also, the regression analysis further showed that except for the scenario 3, the level (high or low) of IT expenditure was not an influential variable. The regression analysis almost showed the same results, however with smaller multiple R, when we used squared values of UPOs instead of absolute values (Table 3). We concluded that even the small sum of money spent on IT can have an impact on UPOs, as does the large amount of IT investments. Therefore, our analyses show greater support for the Metcalfe's views and full support for hypothesis 1. However, as far as the British Pound (see Table 4 for data summary) was concerned, the t-test showed that there was not a significant difference between the two means, with P-value of  $.89 > .05$ . Furthermore, the regression analyses (Tables 5 & 6) also showed that although there was a relationship between UPOs, for both absolute and squared values and the IT investments, but the relationship was not as high as the Euro's was. Overall, our analyses showed greater support for the Carr's views of IT with partial to no support for hypothesis one.

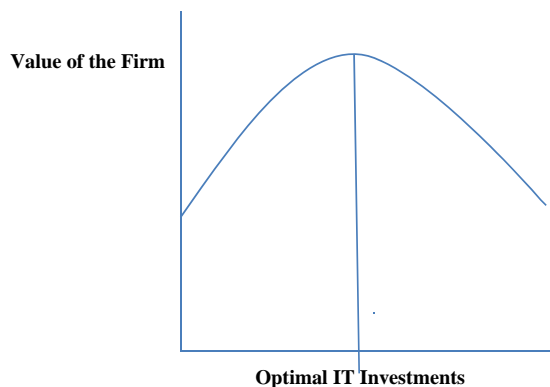
**Hypothesis 2:** Cross Rate Arbitrage is affected by comparative advantage in information technology. We define:

- $UPO_{SCR} = S^{HM} (\text{€£}) - S^{MKT} (\text{€£}) \neq 0$  if there is unexploited profit opportunity for Spot Cross Rate ( $UPO_{SCR}$ ) where  $S^{HM} (\text{€£})$  is homemade spot cross rate and  $S^{MKT} (\text{€£})$  is market spot cross rate. Similarly, we define for forward market,
- $UPO_{FCR} = F^{HM} (\text{€£}) - F^{MKT} (\text{€£}) \neq 0$  if there is unexploited profit opportunity for Forward Cross Rate ( $UPO_{FCR}$ ) where  $F^{HM} (\text{€£})$  is homemade forward cross rate and  $F^{MKT} (\text{€£})$  is market forward cross rate.

We have analyzed the relationship between UPOs and technology investments, and the level of investment (high and low) for the following scenarios for both Spot and Forward Cross Rate:

- $UPO_{SCR} (UPO_{FCR}) = \alpha + \beta (\text{Tech. Exp.}) + \gamma (\text{High or Low Tech. Exp}) + \varepsilon$  5
- $UPO_{SCR} (UPO_{FCR}) = \alpha + \beta (\text{LN Tech. Exp.}) + \gamma (\text{High or Low Tech. Exp}) + \varepsilon$  6
- $UPO_{SCR} (UPO_{FCR}) = \beta (\text{Tech. Exp.}) + \gamma (\text{High or Low Tech. Exp}) + \varepsilon$  7
- $UPO_{SCR} (UPO_{FCR}) = \beta (\text{LN Tech. Exp.}) + \gamma (\text{High or Low Tech. Exp}) + \varepsilon$  8

We used t-test for two sample with unequal variances to investigate the hypothesis two. We also used multiple regression to analyze the relationship between IT investments, high or low level of investment and UPOs for both absolute values and squared values of UPOs. The t-test analysis for the Spot Cross Rate (€£) (see Table 7 for data summary) showed that there was not a significant difference between the two means with a P-value of  $.93 > .05$ . We further ran regression to study the relationship between absolute value of  $UPO_{SCR}$ , the IT investments, and the level of IT investments. Our analysis showed that there was a relationship between  $UPO_{SCR}$  and investments in IT with multiple R of almost 83% for scenarios 7 and 8, but for scenarios 5 and 6, the multiple R of around 14% (Table 8), and the regression analysis further showed that generally, the level of IT expenditure was not an influential variable. The regression analysis almost showed the same results, however, with smaller multiple R when we used squared values of  $UPO_{SCR}$  instead of the absolute values (Table 9). We concluded that even the small investment in IT can have an impact on  $UPO_{SCR}$ . The analysis showed mixed results and therefore, we believed it leaned more towards the Metcalfe's views of IT with partial support for hypothesis one. Similarly, The t-test analysis for the Forward Cross Rate (€£) (see Table 10 for data summary) showed that there was not a significant difference between the two means with the P-value of  $.82 > .05$ . We further ran regression to study the relationship between absolute value of  $UPO_{FCR}$ , IT investments, and the level of investments. Our analysis showed that there was a relationship between  $UPO_{FCR}$  and investments in IT with multiple R of almost 75% for scenarios 7 and 8, but for scenarios 5 and 6, the multiple R of around 60% (Table 11). The regression analysis also showed that, in general, the level of IT expenditure was not an influential variable. The regression analysis almost showed the same results, however, with smaller multiple R, when we used squared values of  $UPO_{FCR}$  instead of the absolute values (Table 12). We concluded that there was a relationship between  $UPO_{FCR}$  and the IT investments, though not very strong, however, even the small investment in IT can have an impact on  $UPO_{FCR}$ . The analysis showed mixed results, but we believed it leaned more towards the Metcalfe's views of IT with partial support for hypothesis 2. Our results indicate that there is optimality of IT investments. The following graph explains it well, and the optimal level will maximize the value of the firm.



## V. Concluding Remarks

In the introduction we posited that truth may lie in the middle. That is, it is neither 'IT does not matter at all' nor it is 'IT matters all the time'. Our empirical findings indicate such a result

when we linked financial arbitrage and information technology. Our data show that IT investment matters sometime and not always. The implications of our findings suggest that there is an optimal IT investment level. At the beginning stage, the strategic benefits from IT investments far exceeds the risk of IT investments. At some point the role reverses and the risk and mis-utilization of IT investments outweigh the independent and interactive strategic benefits of IT. The challenge is to find the optimal level of IT investments. That will be our next endeavor.

**Table 1 - Euro Data Summary**

	Data 1 Forward US & EUR	Data 2 US Interest	Data 3 EUR Interest	Data 4 US EUR	Data 5 - F - (US - EUR)	Data 6 IT Exp	Data 7 NL Exp	IT
Mean	0.45	2.64	2.89	-0.23	0.69	559.15	6.32	
Standard Error	0.13	0.56	0.37	0.45	0.50	20.20	0.04	
Median	0.57	2.38	2.88	-0.62	0.97	547.88	6.31	
Mode	#N/A	1.37	#N/A	#N/A	#N/A	#N/A	#N/A	
Standard Deviation	0.45	1.95	1.27	1.56	1.74	69.99	0.12	
Sample Variance	0.20	3.79	1.63	2.43	3.04	4898.78	0.01	
Kurtosis	-1.31	-1.43	-1.08	-0.30	0.68	-1.82	-1.78	
Skewness	-0.14	0.20	-0.16	-0.21	0.42	0.03	-0.05	
IT - Information Technology NL - Natural Logarithm				F - Forward EUR - Euro				

**Table 2 - Euro Absolute value of UPO**

	R	F	$\alpha$	$\beta$	$\gamma$	P-value A	IT \$	Hi/Lo IT \$	NL IT \$
<b>UPO <math>\in</math> <math>\alpha + \beta</math> (Tech. Exp.) + <math>\gamma</math> (High or Low Tech. Exp) + <math>\varepsilon</math></b>	.35	.55	-4.38	.01	-1.10	.47	.32	.49	-
<b>UPO <math>\in</math> <math>\alpha + \beta</math> (LN Tech. Exp.) + <math>\gamma</math> (Hi or Low Tech. Exp) + <math>\varepsilon</math></b>	.33	.53	-34.52	5.77	-.96	.40	-	.39	.55
<b>UPO <math>\in</math> = <math>\beta</math> (Tech. Exp.) + <math>\gamma</math> (High or Low Tech. Exp) + <math>\varepsilon</math></b>	.85	.002*	0	.002	-.05	-	.008	.93	-
<b>UPO <math>\in</math> = <math>\beta</math> (LN Tech. Exp.) + <math>\gamma</math> (High or Low Tech. Exp) + <math>\varepsilon</math></b>	.84	.002*	0	.22	.26	-	-	.68	.01*
R - linear correlation coefficient F - Significance F $\alpha$ - Intercept, Regression Coefficient $\beta$ - Regression Coefficient * shows overall significant relationship between UPO and IT investments @5%				$\gamma$ - Regression Coefficient UPO - unexploited profit opportunity IT - Information Technology NL - Natural Logarithm					

**Table 3 - Euro Square value of UPO**

	R	F	$\alpha$	$\beta$	$\gamma$	P-value A	IT \$	Hi/Lo IT \$	NL IT \$
<b>UPO <math>\epsilon = \alpha + \beta</math> (Tech. Exp.) + <math>\gamma</math> (High or Low Tech. Exp) + <math>\epsilon</math></b>	.35	.56	-20.07	.04	-2.89	.51	.47	.72	-
<b>UPO <math>\epsilon = \alpha + \beta</math> (LN Tech. Exp.) + <math>\gamma</math> (High or Low Tech. Exp) + <math>\epsilon</math></b>	.33	.59	-135.85	22.20	-2.35	.52	-	.77	.51
<b>UPO <math>\epsilon = \beta</math> (Tech. Exp.) + <math>\gamma</math> (High or Low Tech. Exp) + <math>\epsilon</math></b>	.59	.12	0	.004	1.91	-	.35	.59	-
<b>UPO <math>\epsilon = \beta</math> (LN Tech. Exp.) + <math>\gamma</math> (High or Low Tech. Exp) + <math>\epsilon</math></b>	.58	.13	0	.32	2.46	-	-	.45	.38

R - linear correlation coefficient  
 F - Significance F  
 $\alpha$  - Intercept, Regression Coefficient  
 $\beta$  - Regression Coefficient  
 $\gamma$  - Regression Coefficient

UPO - unexploited profit opportunity  
 IT - Information Technology  
 NL - Natural Logarithm

**Table 4 - British Pound Data Summary**

	Data 1 Forward US & UK	Data 2 US Interest	Data 3 UK Interest	Data 4 US - UK	Data 5 F - (US - UK)	Data 6 IT Exp	Data 7 NL IT Exp
Mean	-0.01	5.43	7.90	-2.47	2.46	320.99	5.51
Standard Error	0.00	0.59	0.72	0.36	0.36	36.75	0.14
Median	-0.01	5.04	6.56	-2.06	2.04	267.43	5.59
Mode	#N/A	1.37	5.88	#N/A	#N/A	#N/A	#N/A
Standard Deviation	0.02	3.36	4.06	2.06	2.05	207.90	0.77
Sample Variance	0.00	11.26	16.44	4.26	4.20	43223.55	0.60
Kurtosis	0.35	0.14	-0.71	-0.52	-0.50	-1.52	-1.38
Skewness	-0.38	0.55	0.26	-0.58	0.59	0.29	-0.28

IT - Information Technology  
 NL - Natural Logarithm

**Table 5 - GBP Absolute value of UPO**

	R	F	$\alpha$	$\beta$	$\gamma$	P-value A	IT \$	Hi/Lo IT \$	NL IT \$
<b>UPO<sub>£</sub> = <math>\alpha</math> + <math>\beta</math> (Tech. Exp.) + <math>\gamma</math> (High or Low Tech. Exp) + <math>\epsilon</math></b>	.47	.027	3.79	-.003	-.53	0	.42	.75	
<b>UPO<sub>£</sub> = <math>\alpha</math> + <math>\beta</math> (LN Tech. Exp.) + <math>\gamma</math> (High or Low Tech. Exp) + <math>\epsilon</math></b>	.45	.04*	4.06	-.16	-1.55	.35		.25	.85
<b>UPO<sub>£</sub> = <math>\beta</math> (Tech. Exp.) + <math>\gamma</math> (High or Low Tech. Exp) + <math>\epsilon</math></b>	.67	.00*	0	.01	-5.58	-	.00*	.00**	-
<b>UPO<sub>£</sub> = <math>\beta</math> (LN Tech. Exp) + <math>\gamma</math> (High or Low Tech. Exp) + <math>\epsilon</math></b>	.83	.00*	0	.66	-2.60	-	-	.00**	.00*

R - linear correlation coefficient  
F - Significance F  
 $\alpha$  - Intercept, Regression Coefficient  
\* shows overall significant relationship between UPO and IT investments @5%  
\*\* shows significant relationship between UPO and IT investment level @5%

$\beta$  - Regression Coefficient  
 $\gamma$  - Regression Coefficient  
GBP - British Pound Sterling

**Table 6 - GBP Square value of UPO**

	R	F	$\alpha$	$\beta$	$\gamma$	P-value A	IT \$	Hi/Lo IT \$	NL IT \$
<b>UPO<sub>t</sub> = <math>\alpha</math> + <math>\beta</math> (Tech. Exp.) + <math>\gamma</math> (Hi or Lo Tech. exp) + <math>\epsilon</math></b>	.46	.03*	16.50	-0	-8.98	.002	.77	.41	
<b>UPO<sub>t</sub> = <math>\alpha</math> + <math>\beta</math> (LN tech. exp.) + <math>\gamma</math>(Hi Lo tech. exp)+<math>\epsilon</math></b>	.46	.03*	7.81	1.52	-13.92	.78	-	.79	.12
<b>UPO<sub>t</sub>= <math>\beta</math> (Tech. Exp.) + <math>\gamma</math> (Hi or Low Tech. Exp) + <math>\epsilon</math></b>	.57	.00*	.00	.06	-30.99	-	.00	.00**	-
<b>UPO<sub>t</sub> = <math>\beta</math> (LN Tech. exp.) + <math>\gamma</math> (Hi or Lo Tech. exp) + <math>\epsilon</math></b>	.71	.00*	.00	3.09	-15.94	-	-	.00**	.00

R - linear correlation coefficient  
 F - Significance F  
 $\alpha$  - Intercept, Regression Coefficient  
 $\beta$  - Regression Coefficient  
 $\gamma$  - Regression Coefficient  
 GBP - British Pound Sterling

\* shows overall significant relationship between UPO and IT investments @5%  
 \*\* shows significant relationship between UPO and IT investment level @5%

**Table 7 - Spot Cross Rate Data Summary**

	Data 1	Data 2	Data 3 = Data 1 / Data 2	Data 4	Data 5	Data 6	Data 7
	SCR US/GBP	SCR US/EUR	SCR EUR/GBP	SCR (HM) EUR/GBP	SCR (Mkt) EUR/GBP	UPO	IT Exp
Mean	0.61	0.88	0.70	0.71	0.00	567.63	6.34
Standard Error	0.03	0.06	0.03	0.03	0.01	20.09	0.04
Median	0.57	0.83	0.68	0.67	0.01	563.77	6.33
Mode	0.71	0.83	#N/A	0.67	#N/A	#N/A	#N/A
SD	0.09	0.18	0.10	0.09	0.03	66.63	0.12
Sample Variance	0.01	0.03	0.01	0.01	0.00	4439.01	0.01
Kurtosis	-1.64	-0.48	-0.39	-0.03	0.50	-1.84	-1.77
Skewness	0.12	0.66	0.89	1.22	-0.90	-0.10	-0.18

SCR (HM) - Spot Cross Rate – Homemade  
 SCR (Mkt) - Spot Cross Rate - Market  
 IT - Information Technology  
 NL - Natural Logarithm

**Table 8 - Spot Cross Rate Euro/GBP - Absolute value of UPO**

	R	F	$\alpha$	$\beta$	$\gamma$	P-value $\alpha$	IT \$	Hi/Lo IT \$	NL IT \$
<b>UPO<sub>SCR</sub> = <math>\alpha</math> + <math>\beta</math> (Tech. Exp.) + <math>\gamma</math> (High or Low Tech. Exp) + <math>\epsilon</math></b>	.14	.92	.03	.00	.00	.83	.99	.88	
<b>UPO<sub>SCR</sub> = <math>\alpha</math> + <math>\beta</math> (LN Tech. Exp.) + <math>\gamma</math> (High or Low Tech. Exp) + <math>\epsilon</math></b>	.14	.92	.07	-.007	.00	.93		.92	.96
<b>UPO<sub>SCR</sub> = <math>\beta</math> (Tech. Exp.) + <math>\gamma</math> (High or Low Tech. Exp) + <math>\epsilon</math></b>	.82	.00*	.00	.00	-.01	-	.006*	.41	
<b>UPO<sub>SCR</sub> = <math>\beta</math> (LN Tech. Exp.) + <math>\gamma</math> (High or Low Tech. Exp) + <math>\epsilon</math></b>	.82	.00*	.00	.004	-.005	-	-	.006**	.64

R - linear correlation coefficient  
F - Significance F  
 $\alpha$  - Intercept, Regression Coefficient  
\* shows overall significant relationship between UPO and IT investments @5%  
\*\* shows significant relationship between UPO and IT investment level @5%

$\beta$  - Regression Coefficient  
 $\gamma$  - Regression Coefficient  
GBP - British Pound Sterling

**Table 9 - Spot Cross Rate Euro/GBP - Square value of UPO**

	R	F	$\alpha$	$\beta$	$\gamma$	P-value $\alpha$	IT \$	Hi/Lo IT \$	NL IT \$
<b>UPO<sub>SCR</sub> = <math>\alpha + \beta</math> (Tech. Exp.) + <math>\gamma</math> (Hi or Low Tech Exp) + <math>\epsilon</math></b>	.22	.81	.005	.00	.00	.63	.71	.88	-
<b>UPO<sub>SCR</sub> = <math>\alpha + \beta</math> (LN Tech. Exp.) + <math>\gamma</math> (High or Low Tech. Exp) + <math>\epsilon</math></b>	.23	.81	.03	.00	.00	.68	-	.87	.69
<b>UPO<sub>SCR</sub> = <math>\beta</math> (Tech. Exp.) + <math>\gamma</math> (Hi or Lo Tech. Exp) + <math>\epsilon</math></b>	.57	.17	.00	.00	.00	-	.10	.48	-
<b>UPO<sub>SCR</sub> = <math>\beta</math> (LN Tech. Exp.) + <math>\gamma</math> (Hi or Lo Tech. Exp) + <math>\epsilon</math></b>	.58	.16	.00	.00	.00	-	-	.09	.57

R - linear correlation coefficient  
 F - Significance F  
 $\alpha$  - Intercept, Regression Coefficient  
 $\beta$  - Regression Coefficient  
 $\gamma$  - Regression Coefficient  
 GBP - British Pound Sterling

**Table 10 - Forward Cross Rate Data Summary**

	Data 1	Data 2	Data 3 = Data 1 / Data 2	Data 4	Data 5	Data 6	Data 7
	FR US & GBP	FR US & EUR	FCR EUR/GBP	(HM) FCR (Mkt) EUR/GBP	UPO	IT Exp	NL IT Exp
Mean	0.60	0.86	0.72	0.71	0.01	559.15	6.32
Standard Error	0.02	0.04	0.03	0.03	0.01	20.20	0.04
Median	0.61	0.80	0.68	0.68	0.01	547.88	6.31
Mode	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
SD	0.06	0.15	0.09	0.09	0.02	69.99	0.13
Sample Variance	0.00	0.02	0.01	0.01	0.00	4898.7	8
Kurtosis	-1.24	-1.35	0.02	0.24	1.34	-1.82	-1.78
Skewness	-0.04	0.59	1.09	1.16	-0.11	0.03	-0.06

FCR (HM) - Forward Cross Rate - Homemade  
 FCR (Mkt) - Forward Cross Rate - Market

**Table 11 - Forward Cross Rate Euro/GBP - Absolute value of UPO**

	R	F	$\alpha$	$\beta$	$\gamma$	P-value			
						A	IT \$	Hi/Lo IT \$	NL IT \$
<b>UPO</b> $_{FCR} = \alpha + \beta$ (Tech. Exp.) + $\gamma$ (High or Low Tech. Exp) + $\varepsilon$	.63	.10	.17	.00	.03	.03	.05	.17	-
<b>UPO</b> $_{FCR} = \alpha + \beta$ (LN Tech. Exp.) + $\gamma$ (High or Low Tech. Exp) + $\varepsilon$	.60	.13	1.02	-.16	.03	.07	-	.18	.07
<b>UPO</b> $_{FCR} = \beta$ (Tech. Exp.) + $\gamma$ (High or Low Tech. Exp) + $\varepsilon$	.74	.02*	.00	.00	-.01	-	.02*	.31	-
<b>UPO</b> $_{FCR} = \beta$ (LN Tech. Exp.) + $\gamma$ (High or Low Tech. Exp) + $\varepsilon$	.76	.02*	.00	.003	.00	-	-	.39	.01*

R - linear correlation coefficient  
F - Significance F  
 $\alpha$  - Intercept, Regression Coefficient  
 $\beta$  - Regression Coefficient  
 $\gamma$  - Regression Coefficient  
GBP - British Pound Sterling  
\* shows overall significant relationship between UPO and IT investments @5%

**Table 12 - Forward Cross Rate Euro/GBP - Square value of UPO**

	R	F	A	$\beta$	$\gamma$	P-value			
						A	IT \$	Hi/Lo IT \$	NL IT \$
<b>UPO</b> $_{FCR} = \alpha + \beta$ (techexp) + $\gamma$ (Hi or Lo techexp) + $\varepsilon$	.62	.12	.00	.00	.001	.03	.04	.08	
<b>UPO</b> $_{FCR} = \alpha + \beta$ (LN tech exp) + $\gamma$ (Hi or Lo techexp) + $\varepsilon$	.57	.16	.05	-.007	.001	.06		.11	.07
<b>UPO</b> $_{FCR} = \beta$ (Tech Exp) + $\gamma$ (Hi or Lotech. exp) + $\varepsilon$	.57	.18	.00	.00	.00	-	.14	.67	
<b>UPO</b> $_{FCR} = \beta$ (LN Tech. Exp.) + $\gamma$ (Hi or Lo techexp) + $\varepsilon$	.57	.14	.00	.00	.00	-		.72	.11

R - linear correlation coefficient  
F - Significance F  
 $\alpha$  - Intercept, Regression Coefficient  
 $\beta$  - Regression Coefficient  
 $\gamma$  - Regression Coefficient  
GBP - British Pound Sterling

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- [http://www.icaew.com/en/library/subject-gateways/financial markets](http://www.icaew.com/en/library/subject-gateways/financial%20markets) (*Institute of Chartered Accountants in England and Wales*)

# **Insurance Stock Returns Sensitivity to Changes in the Default Spread**

Raja Bouzouita, Mihaela Craioveanu, and Arthur J. Young

## **Abstract**

Default spreads between corporate bonds and government bonds proxy the systematic risk of default. Using insurance monthly stock returns covering a period from 2000 through 2009, this paper investigates empirically the relationship between insurance company stock returns and default spreads. We find evidence of stock return sensitivity to changes in the default spread. The results are consistent for property- liability and life-health insurance companies.

## **1. Introduction**

In addition to a market factor, insurance stock returns have been shown to be sensitive to changes in interest rates (Fraser et al., 2002, Brewer et al., 2007, Carson et al., 2008, Bouzouita and Young, 2010). Even though a number of studies looked at different aspects of the effect of changes in interest rates on stock prices in terms of measurement and techniques of estimation, little or no attention was given to the effect of default spread on insurance stock returns.

The default spread is commonly used as an indicator of credit market risk premium (Fama and French, 1989, Hahn and Lee, 2006). Default spread is defined as the difference in the yields to maturity of corporate bonds and U.S. Treasury bonds with similar maturity. The default spread is of viable interest to investors for the purpose of hedging and performance attributes and to regulators for an assessment of systematic risk. In the aftermath of the financial crisis of 2008, a sweeping financial reform took place to prevent future financial crisis and to reduce the risks and costs of systematic crises. The Dodd-Frank Act of 2010 established a Federal Insurance Office to monitor insurance companies in all aspects that could lead to an increase in systematic risk to the industry or to the entire financial system.

The contribution of this paper is to investigate the effect of changes in the default credit spread on insurance stock returns. The results of this study will contribute to the understanding of systematic risk of default in the insurance industry. Following Fama and French (1989) we use the spread between BAA corporate bonds and 20 year Treasury bonds as proxy for financial market distress. Using a data set consisting of 132 insurance companies covering the period between 2000 and 2009, we find significant sensitivity between default credit spread and insurance stock returns. Furthermore, we confirm the results for the two segments of the industry.

The remainder of the paper is organized as follows. In the next section we present a brief literature review. In Section 3 we describe the dataset and the methodology used. The results are presented in Section 4. Section 5 concludes.

## **2. Literature Review**

The literature on the effect of interest rate risk on stock returns is vast. Various studies have documented a significant relationship between equity returns and interest rates (Lloyd and

Shick, 1977, Chance and Lane, 1980, Flannery and James, 1984, Bae, 1990, Elyasiani and Mansur, 1998, 2004, Viale et al., 2009). Some studies incorporate a measure of interest rate risk in the asset valuation process (Stone, 1974, Akela and Greenbaum, 1992). The interest rate risk is measured as either the difference or the level of short term or long term rates. Other studies (Fama and French, 1989, Fama, 1990, Duffee, 2001, Reilly et al., 2007) include a measure of maturity spread defined as the difference between long-term and short term interest rates. Finally, some studies include a measure of default premium defined as the difference between a corporate bond yield and a government bond yield (Chen et al., 1986, Fama and French, 1989, Pontiff and Schall, 1998, Jagannathan and Wang, 1996, Hahn and Lee 2006, Boudoukh et al., 2008). The general finding across these studies is that most of these measures have predictive power in explaining stock returns.

The aim of the majority of these papers was to predict stock returns using interest rate changes and other variations as one of the macroeconomic factors in addition to company specific measures and not to analyze the impact of interest rates risk on stock returns per se. Furthermore, with a few exceptions, the studies that specifically analyze the impact of interest rate on equity returns are industry specific. Flannery and James (1984) find that bank, savings, and loan stock returns are sensitive to interest rates of U.S. government securities and the sensitivity varies according to maturity mismatch between assets and liabilities; Bae (1990) finds a negative interest rate sensitivity that is greater for savings and loans, insurance companies, and commercial banks using a medium-term interest index.

Studies in the insurance industry show that interest rate risk affects stock returns. Using a sample of 60 life insurance companies covering the period from January 1972 through December 2000, Brewer et al. (2007) find evidence that stock returns of life insurance companies are affected by changes in interest rates. Carson et al. (2008) includes three segments of the insurance industry: life, accident and health, and property and casualty and find significant interest rate sensitivity to changes in interest rates in the three segments of the insurance industry. The above studies used a GARCH model to study the impact of interest rate volatility on insurance stock returns. Finally, Bouzouita and Young (2010) investigated the interest rate risk for insurance companies using a balanced panel data covering the period 2000 to 2009. Their results confirm previous studies that find significant impact of changes in short term and long term interest rate changes on insurance stock returns.

### **3. Methodology**

#### **Data**

Monthly return data are obtained from the Center for Research in Security Prices (CRSP) database. The sample period is January 2000 through December 2009. Our sample only includes insurance companies with available data. We select insurance companies according to their SIC code: 6311 (Life insurance, 34 companies), 6321 (Accident & Health, 24 companies), and 6331 (Property & Casualty, 74 companies) excluding reinsurance companies. Our final sample consists of 132 companies.

We use three series of interest rates in this study: short-term default-free rates measured by U.S. Treasury bills, long-term default-free rates measured by U.S. Treasury Bonds, and long-term corporate bonds which are exposed to default risk. The long-term U.S. Treasury return is the yield on 20-year government bonds constant maturity. The short-term U.S. Treasury bill rate is the 3-month constant maturity U.S Treasury rate. The long-term corporate rate is the BAA corporate bond rate. All three rates are from FRED II database from the Federal Reserve Bank of St Louis website.

The focus of our analysis is the sensitivity of insurance stock returns to changes in the default spread. The spread between the BAA corporate bond rate and the 20 year U.S. Treasury bond rate is used as measure of the default risk premium. We also employed an alternative measure of default spread, measured as the difference between BAA and AAA corporate bonds. This alternative definition did not alter our main findings. We also include a measure for the term spread defined as the spread between the 20 year and the 3-month U.S. Treasury rates.

Finally, in order to test whether the results are sensitive to the choice of a proxy for the market index we use two measures of market returns: the CRSP value weighted total returns, which is labeled as CRSP, and the S&P 500 index, which is labeled as SP500. Both series are obtained from the CRSP database.

We use the augmented Dickey-Fuller (Dickey and Fuller, 1979) and Phillips Perron (Phillips and Perron, 1988) tests to check for stationarity for the variables of interest. We find that the short term interest rate, maturity and default spread follow an I(1) process, but their first differences follow an I(0) process. Given the panel nature of our dataset, we also employ the Maddala and Wu unit root test (Maddala and Wu, 1999). The test indicates that returns follow an I(0) process and confirms our findings for the short term interest rate, maturity, and default spread.

Summary statistics for our sample are presented in Table 1.

#### Estimation

Extending the model in Flannery and James (1984), we estimate the following model:

$$R_{i,t} = \alpha + \beta_m R_{m,t} + \beta_{RF} \Delta RF_{t+} + \beta_{MAT} \Delta MATURITY_{t+} + \beta_{DEF} \Delta DEFAULT_{t+} + \varepsilon_{i,t}$$

where  $\alpha$ ,  $\beta_m$ ,  $\beta_{RF}$ ,  $\beta_{MAT}$ , and  $\beta_{DEF}$  are the parameters to be estimated,  $R_{i,t}$  is the return of insurance company  $i$  at time  $t$  (last trading day of each month),  $R_{m,t}$  is the market index at time  $t$  (last trading day of each month),  $\Delta RF_{it}$  is the change (first difference) in the 3 month U.S. Treasury Bills,  $\Delta MATURITY_{it}$  is the change (first difference) in the term spread,  $\Delta DEFAULT_{it}$  is the change (first difference) in the default spread, and  $\varepsilon_{i,t}$  represents the random error term.

Given that stock returns and risks for the insurance companies are probably interrelated, we allow for serial correlation in the estimation procedure. The null hypothesis of no autocorrelation is rejected. We choose a first-order autoregressive specification for the error term.

#### 4. Results

Table 1 presents summary statistics for our sample. Over the time period covered, the average return of insurance stocks was slightly over one percent (1.03%) while the average return of the CRSP value weighted is 0.14 %. It seems that insurance stocks performed better than the market index measured by CRSP and even better performance compared to S&P 500 which registered a negative return over sample period. On the other hand, we notice that insurance stock returns exhibit a higher risk, measured by the standard deviation, than either market returns. The interest rate measures show that the short term interest rate declined, and both the maturity spread and the default spread increased over the time period. Table 2 reports the partial correlation among independent variables. The correlation matrix reveals no strong correlation between the variables. The two proxies for market returns, as expected, are highly correlated but these measures are not included in the same model.

Results of our analysis are shown in Table 3. We find the coefficient of our measure of default spread to be negative and significant in all models. This implies that an increase in the default spread is associated with worsening business conditions which results in a decrease in the return on insurance stocks. This result holds while controlling for the market effect, the change in short term interest rate, and the change in the maturity spread. We get similar results by using either the CRSP value weighted total returns or the S&P 500 total returns.

Table 4 reports the results by industry. The industry results are in line with the results for the entire industry presented in Table 3. The magnitude of the market beta is higher for life and health insurance companies than for property liability companies irrespective of the measure of market index used. Similar results have been reported by previous studies (Brewer et al., 2007, Carson et al., 2008) which use data covering periods that end at the beginning of our sample period. The systematic risk of the insurance stock has been stable. Life insurance companies exhibiting higher systematic risk than property liability companies may be explained by two factors that affect beta which are size and leverage. Life insurance companies tend to be larger in terms of assets and more leveraged than property and liability companies. The effect of size and leverage on market beta has been widely reported in the financial literature (Brealy and Myers, 2000).

#### 5. Conclusion

In this paper we investigate empirically the sensitivity of insurance stock returns to changes in the default spread. Although previous studies looked at the relationship between default spreads and stock returns, this relationship has not been addressed in the context of insurance companies. The relationship of insurance stock returns to changes in default spreads is uncertain because insurance firms are regulated in order to reduce the default risk for their policies. Using monthly return data over a period of 10 years, we find evidence of a negative relationship between insurance stock returns and changes in the default spread. These results are consistent within the life and health and property and liability segments of the industry.

The implication of our result is that, despite the publication of default risk ratings by A.M. Best Company and intensive state regulation, default risk is still a problem for

stockholders. Insurance companies are advised to aggressively engage in risk management practices that would mitigate the interest rate risk to shareholders. Also, the results will further our understanding of factors that affect insurance stock returns.

**Table 1 Summary Statistics**

Variable	Obs	Mean	Std. Dev.	Min	Max
Insurance Company Return	15840	0.0103	0.1277	-0.8348	2.4498
CRSP Value Weighted	15840	0.0014	0.0489	-0.1847	0.1094
S&P 500	15840	-0.0012	0.0463	-0.1694	0.0967
$\Delta$ RF	15840	-0.0453	0.2415	-0.8900	0.4500
$\Delta$ MATURITY	15840	0.0252	0.2917	-0.9300	0.8600
$\Delta$ DEFAULT	15840	0.0039	0.2215	-0.8500	1.4400

**Table 2 Partial Correlations**

Variable	CRSP	S&P 500	$\Delta$ RF	$\Delta$ MATURITY	$\Delta$ DEFAULT
CRSP	1.000				
S&P 500	0.9787	1.000			
$\Delta$ RF	0.1695	0.1508	1.0000		
$\Delta$ MATURITY	-0.1175	-0.09	-0.698	1.0000	
$\Delta$ DEFAULT	-0.3383	-0.2981	-0.3172	0.0125	1.000

**Table 3 Panel Data Results, N= 132 Companies, T= 120 Monthly Returns**

Variable	Coef.	Std. Err.	p-val
<b>Panel A: Model using CRSP Value Weighted Total Returns</b>			
Market Return	0.5810	0.0215	0.0000
$\Delta$ RF	-0.0339	0.0062	0.0000
$\Delta$ MATURITY	-0.0373	0.0050	0.0000
$\Delta$ DEFAULT	-0.0203	0.0051	0.0000
Intercept	0.0090	0.0010	0.0000
<b>Panel B: Model using S&amp;P500</b>			
Market Return	0.6240	0.0222	0.0000
$\Delta$ RF	-0.0373	0.0062	0.0000
$\Delta$ MATURITY	-0.0415	0.0049	0.0000
$\Delta$ DEFAULT	-0.0259	0.0050	0.0000
Intercept	0.0105	0.0010	0.0000

**Table 4 Results by Industry**

Variable	Life & Health Insurers			Property & Liability Insurers		
	Coef.	Std. Err.	p-val	Coef.	Std. Err.	p-val
<b>Panel A: Model using CRSP Value Weighted Total Returns</b>						
Market Return	0.7351	0.0365	0.0000	0.4607	0.0254	0.0000
$\Delta$ RF	-0.0314	0.0107	0.0030	-0.0359	0.0074	0.0000
$\Delta$ MATURITY	-0.0403	0.0084	0.0000	-0.0352	0.0059	0.0000
$\Delta$ DEFAULT	-0.0185	0.0087	0.0350	-0.0214	0.0060	0.0000
Intercept	0.0114	0.0017	0.0000	0.0070	0.0011	0.0000
<b>Panel B: Model using S&amp;P500</b>						
Market Return	0.7808	0.0378	0.0000	0.5014	0.0263	0.0000
$\Delta$ RF	-0.0359	0.0106	0.0010	-0.0386	0.0073	0.0000
$\Delta$ MATURITY	-0.0459	0.0084	0.0000	-0.0384	0.0058	0.0000
$\Delta$ DEFAULT	-0.0262	0.0086	0.0020	-0.0254	0.0059	0.0000
Intercept	0.0134	0.0017	0.0000	0.0082	0.0011	0.0000

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# **The Impact of International and Industrial Diversification Strategies on Firms' Overinvestment of Free Cash Flow**

Mussie Teclezion

## **Abstract**

We examine the quarterly data of Compustat's all active and research firms from the first quarter of 1999 to the fourth quarter of 2005. Using a dataset that includes more than 79,000 firm quarters, we look at the impact of diversification on the firms' tendency to over-invest their free cash flow. Our fixed-effects regressions show positive and significant effect of the interaction between industrial diversification and free cash flow on the degree of over-investment. That is, firms tend to over-invest their free cash flow as they become more industrially diversified.

## **I. Introduction**

The question of whether international diversification and industrial diversification strategies create or destroy value has been extensively researched in the financial economics literature. The outcome of the research in the area is conflicting; with no clear consensus on whether the two diversification strategies create or destroy value. Even in the absence of consensus on the value-creation/value-destruction frontier, some characteristics of diversified firms have been attributed to value created and others to value destroyed by diversification. Among the characteristics of diversified firms that underlie the value destruction impact of diversification are: agency cost (Denis et al., 1997), information asymmetry (Scharfstein and Stein, 2000), over-investment (Berger and Ofek, 1995; Blanchard et al., 1999), and inefficient capital markets (Lamont, 1997; Lamont and Polk, 2002). On the other hand, studies that find value creation from diversification have associated the value created with the following characteristics of diversified firms: market completion (Errunza and Senbet, 1981, 1984), internalizing the market for intangible assets (Morck and Yeung, 1991), and increased debt capacity (Lewellen's, 1971).

There is also a documented evidence that firms have the tendency to over-invest their free cash flow (Richardson, 2006) and over-investment problem has been associated with agency problems in firms (Jensen, 1986). In this paper, we tie the two strands of literature, diversification as well as over-investment of free cash flow, and directly assess the impact of diversification strategy on the over-investment of free cash flow. We pose the question of whether the two diversification strategies exasperate or mitigate the over-investment problem. Using a novel approach of measuring over-investment as well as free cash flow, as developed by Richardson (2006), we assess the impact of the two diversification strategies on the over-investment of free cash flow.

We add to the literature evidence that industrial diversification actually exasperates the over-investment of free cash flow. In addition, our findings are consistent with an already documented evidence that industrial diversification destroys value. Coupled with an existing literature that agency costs contribute to value destruction by industrial diversification, our findings lead us to believe that over-investment of free cash flow by industrially diversified firms is another manifestation of agency problems in industrially diversified firms.

## II. Literature Review and Hypotheses

In frictionless capital markets, firms could raise capital from external sources at the same cost as that of internal sources to finance their positive NPV projects. However, friction in the capital markets may make the cost of raising capital internally cheaper than the cost of raising it externally. Hence firms may be inclined to finance their projects using internal sources of funds and at the same time over-invest their free cash flow in negative NPV projects (Jensen, 1988). Richardson (2006) has found that firms have the tendency to over-invest their cash flow. Richardson (2006) defines free cash flow as cash flow beyond what is needed to finance positive NPV projects, and defined over-investment as negative NPV investment. We examine the relationship between over-investment and free cash flow in light of international and industrial diversification. We examine whether internationally and industrially diversified firms are more or less inclined to over-invest as their free cash flow increases. That is, do the two types of diversification strategies affect the relationship between over-investment and free cash flow of firms?

There are two reasons why the two diversification strategies may lead firms to mitigate over-investment of their cash flow. First, positive relationship between excess value and firms' level of internationalization has been documented for US firms (Errunza and Senbet, 1981, 1984; Morck and Yeung, 1991, 2001; Bodnar et al., 1999). Morck and Yeung (1991) find evidence that U.S. acquiring firms with information-based intangible assets experience a significantly positive stock price reaction upon announcing a foreign acquisition. That is, a firm's Tobin's Q increases as result of the firm internalizing the value of foreign markets for the firm's intangible assets. Therefore, greater investment opportunities created in different geographic areas of the world may make firms less inclined to over-invest in negative NPV projects. The growth opportunities internationally diversified firms could enjoy in several geographic markets and the number of viable positive NPV projects that come with geographic expansion could lead international diversification to mitigate the relationship between free cash flow and over-investment. Second, diversification may increase operating efficiency, and when internal capital markets within the firm operate efficiently, firms could have the opportunity to utilize their internal resources in subsidiaries that could efficiently utilize it. Lundstrum (2003) finds evidence that diversified firms' access to internal capital market is positively related to firm value when firms face low levels of information problems. Therefore, diversification may reduce the impact of free cash flow on firm's tendency to over-invest.

On the other hand, diversified firms tend to have higher information asymmetry problems, higher agency cost as well as inefficient cross-subsidization of less profitable business units. Firm diversification may be as a result of managerial self-interest; therefore, diversified firms may have the tendency to over-invest firm's free cash flow (Jensen and Merklings, 1976; Jensen, 1986). Diversification could also result in more complex business structure and higher information asymmetry that increases the cost of capital of the firm (Doukas and Pantzalis, 2003). Lamont (1997) and Shin and Stulz (1998) find evidence of cross-subsidization of poorly performing divisions of conglomerates by other divisions. Thus, when diversification is agency motivated, it may result in over-investment of free cash flow. We put forth the following two hypotheses.

**Hypothesis One:** International diversification has no effect on the relationship between free cash flow and over-investment. A positive  $\alpha_4$  in equation (1) is consistent with agency motivated international diversification strategy, while a negative  $\alpha_4$  is consistent with the presence of efficient capital market within the internationally diversified firms.

**Hypothesis Two:** Industrial diversification has no effect on the relationship between free cash flow and over-investment. A positive  $\alpha_5$  in equation (1) is consistent with agency motivated explanation of industrial diversification strategy, while a negative  $\alpha_5$  is consistent with the presence of efficient capital market within the industrially diversified firms.

### III. Data and Methodology

#### A. Data

The sample is compiled from Compustat quarterly data from Q1Y1999 to Q4Y2005. We started our sample with all active and research firms in the Compustat database. Firms with SIC codes from 6000-6999 and 4000-4999 are excluded from our sample. American Depository Receipts (ADRs) are also excluded from the sample. We use Compustat Industrial segment files (C.I.S) to find segment-related information for industrially diversified firms, and Compustat Geographic Segment files (C.G.S) to find segment information for internationally diversified firms.

SFAS No. 14 requires firms with more than 10% of their consolidated sales to report income or assets from operations outside of the U.S., to report data on unaffiliated sales, income and identifiable assets for non-domestic operations. SFAS No. 14 requires firms to report data for any activity segment making up more than 10 percent of the firm's consolidated revenues, operating income, or identifiable assets. Following Kim and Mathur (2005) we limit our sample period to the period after the adoption of Statement of Financial Accounting Standard (SFAS) No. 131, the rule that supersedes SFAS No. 14. This will avoid the effect of the SFAS 131 in our findings (Kim and Mathur, 2005). Firms with total sales of \$20 million or less are eliminated from the sample. The sample screening criteria is similar to that of Denis et al (2002). We winsorize the sample on the bottom 1% for Cash Holdings, Cash flow from operations, Depreciation and Amortization, operating income after depreciation and amortization, first-order lag of Firm Value as computed in Table I, first-order lag of stock return, and on the top 1% , for Cash Holdings, Cash flow from operations, Depreciation and Amortization, operating income after depreciation and amortization, first-order lag of Firm Value, first-order lag of stock return, research and development expense, capital expenditure, acquisition, sale of property, plant and equipment, and debt ratio. After deleting observations with missing data, our sample size for the entire sample period includes 79,755 firm quarters.

A firm is classified as internationally diversified if it reports foreign sales in the Compustat Geographic Segment file, and is classified as industrially diversified if it reports more than one segment in the Compustat Industrial Segment file. Following Kim et al. (2005) firms are classified into four groups, single-segment domestic firms (SD), single-segment geographically diversified firms (SG), multi-segment domestic firms (MD), and multi-segment geographically-diversified firms (MG).

**B. Measures of International Diversification and Industrial Diversification**

To measure the impact of international diversification, we use the percentage of foreign sales of a company from Compustat Geographic Segment files (C.G.S). To measure the degree of industrial diversification we use (1 - Herfendeil Index) coded as HR\_INDEX. HR\_INDEX is measured between 0 and 1 and is directly related with the degree of industrial diversification. We compute sales based Herfendeil Index as the sum of squared segment sales divided by the square of total firm sales. Segment related information is obtained from Compustat Industrial segment files (C.I.S).

**C. Methodology**

To test the two hypotheses we start by computing over-investment variables as in Richardson (2006). Richardson (2006) develops an accounting based definition of over-investment and free cash flow and finds positive relationship between free cash flow and the practice of over-investment. The author develops an over-investment variable that is residual from a model that estimates expected investment of a firm on positive NPV projects, and free cash flow variable as a difference between cash flow from existing assets and expected investment in new projects. Table I, prepared based on definition of variables and tables from Richardson (2006), depicts the development of the over-investment and free cash flow variables. After estimating the free cash flow and over-investment variables following Richardson(2006), we examine the impact of international diversification on the relationship between free-cash flow and over-investment. The hypothesis is tested using the following model.

$$\text{OverInvstment}_{it} = \alpha_0 + \alpha_1 \text{FCF}_{i,t} + \alpha_2 \text{Total Foreign Sales}_{i,t} + \alpha_3 \text{HR\_INDEX}_{i,t} + \alpha_4 \text{Total Foreign Sales}_{i,t} * \text{FCF}_{i,t} + \alpha_5 \text{HR\_INDEX}_{i,t} * \text{FCF}_{i,t} + \varepsilon_{i,t} \dots \dots \dots (1)$$

Where  $\text{OverInvstment}_{it}$  is an over-investment measure defined as  $I_{\text{NEW}}^e$  in Table I , and  $\text{FCF}_{i,t}$  is a free-cash-flow measure as defined Table I. The other variables are as defined in section III(B).

**IV. Univariate Tests**

**A. Over-investment of Free Cash Flow**

Figures 1 and Figure 2 show the average and median over-investment for the four diversification groups, for the sample period starting in Q3Y1999. Two lags are lost in estimating the free cash flow. The graphs show single-segment, internationally diversified firms had the highest rate of over-investment than the other groups for the most of the sample period. Multi-segment, internationally diversified firms had, on average, higher rate of over-investment than multi-segment, domestic firms for most of the sample period. Figure 2, shows the median over-investment for the sample period. The median over-investment for each of the four groups compare similarly to those of Figure 1. A cursory view of the graphs shows that single-segment, internationally diversified and single-segment, domestic firms had higher rate of over-investment for the sample period.

**Table I**  
**Over-investment and Free Cash Flow Variables**

The following relationships elaborate the how Free Cash Flow and Over-investment are estimated as proposed by Richardson(2006). We use the measures of over-investment and free cash flow, developed by Richardson (2006) and illustrated below, to asses the impact of the two diversification strategies on the relationship between over-investment and free cash flow using Equation 1.

$$I_{TOTAL\ i,t} = CAPEX_{i,t} + ACQUISITIONS_{i,t} + RD_{i,t} - SalePPE_{i,t}$$

$$I_{MAINTENANCE\ i,t} = \text{Amortization and Depreciation}_{i,t}$$

$$I_{NEW\ i,t} = I_{TOTAL\ i,t} - I_{MAINTENANCE\ i,t} \quad I_{NEW\ i,t} = I_{NEW\ i,t}^e + I_{NEW\ i,t}^*$$

The following pooled regression is used to estimate the estimated amount of quarterly investment

$$I_{NEW\ i,t} = \beta_0 + \beta_1 V/P_{i,t-1} + \beta_2 Leverage_{i,t-1} + \beta_3 Cash_{i,t-1} + \beta_4 Age_{i,t-1} + \beta_5 Size_{i,t-1} + \beta_6 StockReturns_{i,t-1} + \beta_7 I_{NEW\ i,t-1} + \sum QuarterIndicator + \sum IndustryIndicator + \varepsilon_{i,t} \quad (A)$$

V/P is a measure of growth opportunities and is calculated as  $V_{AIP}$  divided by market value of equity.

$V_{AIP}$  is calculated as follows:  $V_{AIP\ i,t} = (1 - \alpha r) BV_{i,t} + \alpha(1+r)X_{i,t} - \alpha rd_{i,t}$  where,  $\alpha = (\omega / (1+r-\omega))$

Where BV is the book value of common equity, X is operating income after depreciation, and d is quarterly dividend.  $\omega$  is the abnormal earnings persistence parameter from Ohlson(1995) estimated following Dechow et al. (1999).  $r = 12\%$ , and  $\omega = 0.51$ .

$I_{NEW}^*$  is the predicted value from the model (A), and  $I_{NEW}^e$  is the residual value from Model (A).  $I_{NEW}^*$  is interpreted as estimated investment, while  $I_{NEW}^e$  is the amount of over-investment.

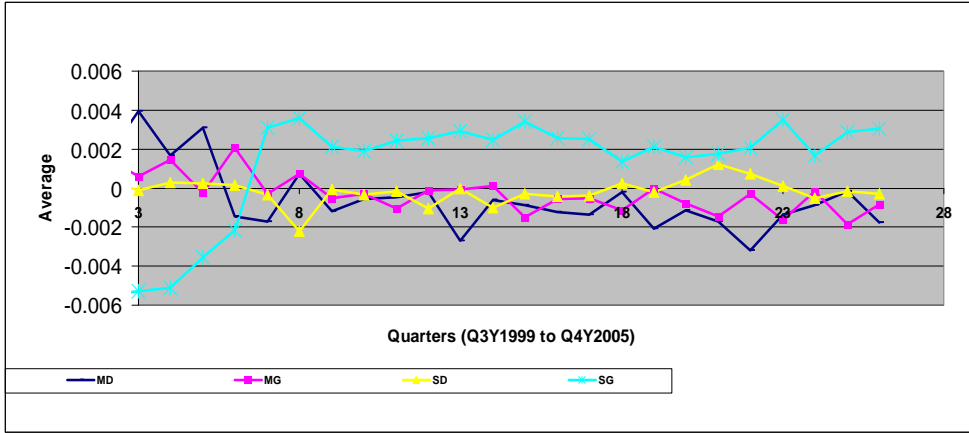
Leverage is (short-term debt + long-term debt) / total assets, Cash is (cash + short-term investments) / total assets, Age is the number of year the firm has been in CRSP, Size is the log of total firm assets in Q1Y1999 dollars, StockReturns is the stock return of firm prior to the investment year computed as the change in the market value of the firm. QuarterIndicators capture the quarterly effects, Industry Indicators capture industry effects (Fama-French, 1997 groupings)

$$CF_{AIR\ i,t} = CFO_{i,t} + RD_{i,t} - I_{MAINTENANCE\ i,t}$$

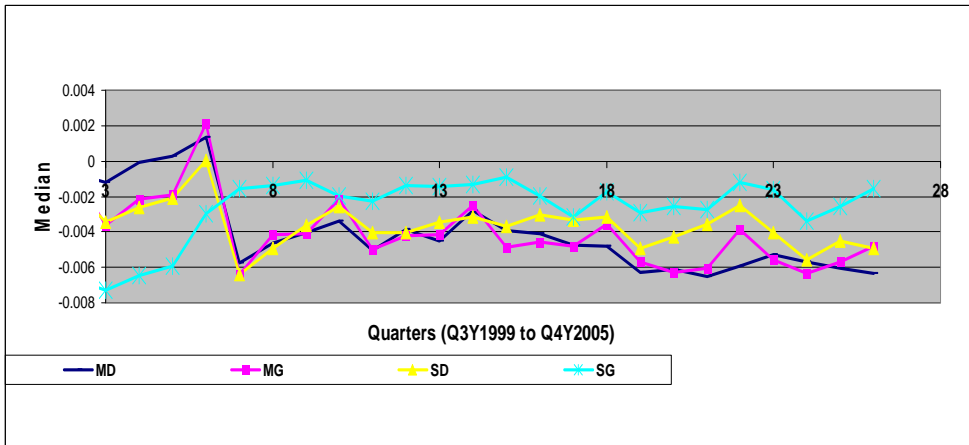
$CFO_{i,t}$  is quarterly cash flow from operations, RD is quarterly research and development, and  $I_{MAINTENANCE}$  is Amortization and Depreciation  $_t$

$$FCF_{i,t} = CF_{AIR\ i,t} - I_{NEW\ i,t}^*$$

FCF<sub>i,t</sub> is an estimate of free cash flow beyond what is needed for expected investment.



**Figure 1. Mean Over-Investment** - The trend of the mean over-investment for each diversification group from Q3Y1999 to Q4Y2005.



**Figure 2. Median Over-Investment** - The trend of the median over-investment for each diversification group from Q3Y1999 to Q4Y2005.

Table II is a descriptive statistics of the variables in equation 1 as well as diversification related variables. The sample size is 79,755 firm quarters, and diversified firm-quarters make more than 62% of the sample size. The average degree of over-investment is 0, however the standard deviation of over-investment is 2.7% of total assets per quarter with firms on the lower quartile under-investing and firms on the upper quartile over-investing. The average and the median quarterly free cash flow of firms are both positive with 0.45% and 0.5% of book value of assets, respectively.

## B. Univariate Tests of Factors that Affect Over-Investment of Free Cash Flows

Table III is a univariate test of the factors that determine the amount of over-investment. Firms are classified between two groups. Firm quarters with over-investment greater than the median are classified into one group, and firm quarters with over-investment below the median are classified into another group. T- test and Wilcoxon Z-score is conducted for the each diversification group. Firms with above average level of over-investment tend to be larger, with more free cash flow, less industrially diversified, more internationally diversified, and with higher Market-to-Book ratio. Firms with above the median level of over-investment have higher amount of free cash flow than firms below the median over-investment. The same holds for all diversification groups, with the largest difference being for single-segment and multi-segment internationally diversified firms. Thus, the univariate test of the relationship between over-investment and free cash flow is consistent with positive relationship between free cash flow and over-investment as documented in the literature.

**Table II**

### Descriptive Statistics for free cash flow and over-investment variables

The sample includes a quarterly data from active and research files of Compustat from Q3Y1999 to Q4Y2005. **OverInvestment** ( $I_{NEW}^e$ ) is residuals from a regression of New Investment on determinants of New Investment as defined in Table I. **Free Cash Flow** is Cash Flow from Operation + R&D expenditure – Depreciation Expense – fitted value of New Investment from a regression on determinants of New Investment (Richardson, 2006). **TFSALEP** is percentage of foreign sales to total firm sales and is used as a measure of international diversification. **HR\_INDEX** is (1 - Herfindahl Index), and is used as proxy for industrial diversification. **Real Size** is the log of total firm assets in Q1Y1999 dollars, **Market-To-Book** is (Book Value of Total Assets – Book Value of Equity + Market Value of Equity )/ Book value of Total Asset.  $I_{TOTAL}$  and  $I_{NEW}$  are defined in Table I.

Label	N	Mean	Lower Quartile	Median	Upper Quartile	Std Dev
<i>SD Proportion</i>	79755	0.3789	0.000	0.000	1.000	0.485
<i>SG Proportion</i>	79755	0.1794	0.000	0.000	0.000	0.384
<i>MD Proportion</i>	79755	0.1770	0.000	0.000	0.000	0.382
<i>MG Proportion</i>	79755	0.2648	0.000	0.000	1.000	0.441
<i>HR_INDEX</i>	79755	0.1960	0.000	0.000	0.444	0.258
<i>Total Foreign Sales</i>	79755	0.1699	0.000	0.000	0.293	0.259
<i>Over Investment (<math>I_{NEW}^e</math>)</i>	74914	0.0000	-0.012	-0.004	0.007	0.026
$I_{TOTAL}$	79735	0.0231	0.006	0.015	0.032	0.027
$I_{NEW}$	79735	0.0096	-0.004	0.003	0.019	0.028
<i>Real Size</i>	79755	5.7517	4.405	5.606	6.919	1.820
<i>Market-To-Book</i>	79260	1.8807	1.057	1.401	2.077	1.855
<i>Free Cash Flow</i>	74917	0.0045	-0.017	0.005	0.027	0.044

**Table III****Univariate tests of variables for firms above the median over-investment and firms below the median over-investment**

Firm quarters are classified into groups. Firm quarters above the median over-investment are classified into groups with High over-investment rate and firm quarters below the median are classified into groups with Low over-investment. The univariate test of mean between the variables of the two groups are provided in the table. The sample includes a quarterly data from active and research files of Compustat from Q3Y1999 to Q4Y2005. *OverInvestment* is residuals from a regression of New investment on determinants of new investment as defined in Table I. *Free Cash Flow* is Cash Flow from Operation + R&D expenditure – Depreciation Expense – fitted value of New Investment from a regression on determinants of New Investment (Richardson, 2006). *TFSALEP* is percentage of foreign sales to total firm sales and is used as a measure of international diversification. *HRINDEX* is (1 - Herfindahl Index), and is used as proxy for industrial diversification. *Real Size* is the log of total firm assets in Q1Y1999 dollars, *Market-To-Book* is (Book Value of Total Assets – Book Value of Equity + Market Value of Equity) / Book value of Total Asset. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

	Two-Groups	Real Size	FCF	HRINDEX	TFSALEP	Market-To-Book
<b>Total</b>	<b>High</b>	5.806	0.0097	0.1922	0.1786	1.9036
	<b>Low</b>	5.7037	-7.40E-04	0.1994	0.1622	1.8604
	T-test	7.93***	33.09***	-3.95***	8.93***	3.31***
	Z-Score	7.67***	35.76***	-4.69***	7.75***	11.38***
<b>SD</b>	<b>High</b>	5.344	0.0075			1.824
	<b>Low</b>	5.1319	-0.003			1.792
	T-test	11.35***	17.89***			1.56
	Z-Score	11.71***	19.19***			6.81***
<b>SG</b>	<b>High</b>	5.5266	0.0132		0.4269	2.43
	<b>Low</b>	5.6972	0.0016		0.4045	2.356
	T-test	-6.16***	15.59***		4.84***	1.54
	Z-Score	-6.88***	17.31***		5.65***	7.28***
<b>MD</b>	<b>High</b>	5.7734	0.0086	0.4079		1.665
	<b>Low</b>	5.5578	-0.003	0.4024		1.617
	T-test	7.06***	16.41***	1.6		2.50**
	Z-Score	7.95***	16.44***	1.12		2.80***
<b>MG</b>	<b>High</b>	6.6936	0.0113	0.4707	0.3686	1.8194
	<b>Low</b>	6.6157	0.002	0.4686	0.3531	1.788
	T-test	3.04***	17.9***	0.77	4.44***	1.64
	Z-Score	2.51**	19.81***	0.64	5.09***	3.44***

**V. Multivariate Tests**

To test the two hypothesis, we run a fixed-effects regression model as shown in Table IV. Table IV is fixed-effect regression of all firms as well as for each diversification group

separately. The fixed effect regression controls for firm effect as well as time effect and the standard errors for the coefficients are robust. We run the regression for the entire sample as well as for each diversification group. The free cash flow is significant for the entire sample, as well as for each diversification groups. Thus, we find significant and positive relationship between free cash flow and degree of over-investment in our sample, as documented in the literature.

**Table IV**  
**Fixed-Effects Regression of Over-investment of Free Cash Flow**

Dependent Variable is Quarterly *OverInvestment*. The models are fixed-effects regressions of quarterly *OverInvestment* on *Percentage of Foreign Sales*, *HR\_INDEX*, *Free Cash Flow*, and interaction variables. The sample includes a quarterly data from active and research files of Compustat from Q3Y1999 to Q4Y2005. The first regression is a fixed effects regression on the entire sample, while the other four regressions are fixed effects regressions for each diversification group. *OverInvestment* is residuals from a regression of New investment on determinants of new investment as defined in Table I. *Free Cash Flow* is Cash Flow from Operation + R&D expenditure – Depreciation Expense – fitted value of New Investment from a regression on determinants of New Investment (Richardson, 2006). *Total Foreign Sales* is percentage of foreign sales to total firm sales and is used as a measure of international diversification. *HR\_INDEX* is (1 - Herfindahl Index), and is used as proxy for industrial diversification. Robust t statistics in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

COEFFICIENT	Total	SD	SG	MD	MG
<i>Total Foreign Sales</i>	0.00471** * (3.276)		0.00990** * (2.694)		0.000416 (0.134)
<i>HR_INDEX</i>	0.00382** * (2.936)			-0.0019 (-0.504)	0.00576* * (2.099)
<i>Free Cash Flow</i>	0.0610*** (16.5)	0.0579** * (13.42)	0.0624*** (4.983)	0.0481*** (3.299)	0.0442** * (2.933)
<i>TotalForeign Sales* Free Cash Flow</i>	0.0221* (1.706)		0.0490* (1.809)		0.0187 (0.826)
<i>HR_INDEX * Free Cash Flow</i>	0.0454*** (3.287)			0.0994*** (2.621)	0.0611** (1.997)
<i>Constant</i>	-0.000788 (-1.303)	0.00156* * (2.001)	- 0.00756** * (-3.931)	0.00581** * (2.731)	-0.00312 (-1.615)
Observations	74914	27944	13647	13170	20153
Number of groups	5262	3044	1129	1077	1278
R-squared	0.014	0.014	0.029	0.026	0.013
F	19.13	9.143	5.489	7.221	5.291

*Total Foreign Sales* and *HR\_INDEX* are positive and significant for the firms in the regression, indicating that both types of diversification are associated with over-investment. However, the positive impact of *Total Foreign Sales* on the amount of over-investment only holds for single-segment diversified firms, and the positive impact of *HR\_INDEX* on the amount of over-investment holds only for the multi-segment geographic firms. Thus, there is evidence that both types of diversification strategies positively affect the amount of over-investment. We find evidence that international diversification has positive impact on the degree of over-investment for single-segment internationally diversified firms but not for multi-segment diversified firms. On the other hand, industrial diversification has positive impact on the amount of over-investment for multi-segment internationally diversified firms but not for multi-segment domestic firms. In addition, although each diversification group has a positive relationship between free cash flow and the amount of over-investment, single-segment internationally diversified firms tend to have the highest coefficient of free cash flow, which is in consistent with Figures 1 and 2, indicating single segment internationally diversified firms tend to over-invest their free cash flow more than the other groups do.

When we examine, the effect of the two diversification strategies on the relationship between free cash flow and amount of over-investment, we find the interaction of *Total Foreign Sales* with *Free Cash Flow* to be barely significant, while the interaction of *HR\_INDEX* with *Free Cash Flow* is positive and significant at less than 1% for two of the regressions and at less than 5% for the last regression. Thus, we find strong evidence that industrial diversification increases the propensity of firms to use their free cash flow to invest in negative NPV projects. This is in consistent with agency motivated explanation of industrially diversified firms being valued at discount.

## VI. Conclusion

In this paper we examine the relationship between over-investment and free cash flow in light of international and industrial diversification. We examine whether internationally and industrially diversified firms are more or less inclined to over-invest as their free cash flow increases. That is, do the two types of diversification strategies affect the relationship between over-investment and free cash flow of firms?

After looking at compustat's quarterly data from the first quarter of 1999 to the last quarter of 2005, we find that over-investment of the free cash flow is strong across all diversification groups and consistent with existing literature. However, our strongest finding is that that industrial diversification exasperates the over-investment of free cash flow. The result is in consistent with agency motivated explanation of industrially diversified firms being valued at discount.

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# **Financial Intermediation and Economic Growth: Evidence from East Africa**

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## **Abstract**

This paper investigates the relationship between financial development and economic growth in 12 East African countries (Burundi, Comoros, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Rwanda, Seychelles, Sudan, Tanzania, and Uganda) for the period 1981-2007. The dynamic panel generalized method of moments (GMM) estimation is employed to test whether financial sector development has a positive impact in economic growth of East Africa. The results show that each of 2 financial development measures (domestic credit provided to the private sector and liquid liability) has a positive impact on economic growth and is statistically significant at the 5% level. These results provide additional evidence to the literature. The findings suggest that governments in East Africa can spur long run and sustainable economic growth by developing their financial sectors. Therefore, policies aimed at improving financial development and intermediation should be promoted.

## **I. Introduction**

The success of the financial sector of a country, to a large extent, relies on financial deepening, which refers to the widening range of financial services available to all levels of society. In principle, financial deepening can stimulate economic growth by mobilizing resources and channeling them to capital accumulation and technological innovation. Countries with well-functioning banking systems and capital markets are expected to grow their economies faster. On the other hand, economic growth can also spur innovations in financial services such as derivative products, microfinance, and so on. One question arises: what is the relationship between financial sector development and economic growth?

How financial sector development affects economic growth and how economic growth influences financial sector development have interested scholars and policy makers for many years. There are at least 3 lines of research. The first line of research focuses on different aspects of the relationship at both the theoretical and empirical levels. The second line of research attempts to examine whether financial development leads to economic growth. The third line of research tries to establish the channels of transmission from financial intermediation to economic growth. Empirical results support, at varying degrees, unilateral (either direction) and bi-directional relationships.

Although research on financial development and economic growth has been done using data from many developing countries, only a few papers focus on Sub-Saharan Africa (SSA). All these studies, however, exclude most East African countries. In developing economies, low income countries in particular, the financial sector has been seen as a means to reduce poverty and ensure sustainable economic development. Therefore, studying East African countries, whose per-capital GDP is relatively low, may shed some light on economic and financial

development. This paper intends to fill the gap in research by investigating the relationship between financial development and economic growth in East Africa.

Despite many factors that have hindered growth in East Africa (EA), countries in the region have shown satisfactory economic growth. These countries have been expanding their financial sectors, including traditional lending channels and informal ones such as microfinance and microcredit services. Also, structural reforms taken in most countries of the region have encouraged the entry of foreign banks, and increased their involvements in international trade. Moreover, different policy measures have been taken to improve their financial sectors, including privatization of banks and expansion of the financial services in scope and depth. The economic and financial progress of East Africa provides an opportunity to test various theories in economic development.

The purpose of this paper is to examine how financial development affects economic growth in 12 East African countries. The results show that each of 2 financial development measures (domestic credit provided to the private sector and liquid liability) has a positive impact on economic growth and is statistically significant at the 5% level. These results provide additional evidence on the relationship between financial development and economic growth, which is consistent with the results from some of prior studies in the literature. The findings suggest that governments in East Africa can spur long run and sustainable economic growth by developing their financial sectors. Therefore, policies aimed at improving financial development and intermediation should be promoted.

The remainder of this paper is as follows. Section II provides a literature review. In Section III, data sources and major variables are discussed. In Section IV, we detail empirical model specifications and estimation techniques. Section V discusses major results and implications. We conclude in Section VI.

## **II. Literature in financial development and economic growth**

A good financial system can allocate, channel, and mobilize resources in a nation to accumulate investment capital and advance technological innovations, therefore promoting economic growth. King and Levine (1993) argue that the development of the domestic financial sector may enhance the efficiency of capital accumulation, and that financial intermediation can contribute to raising the savings rate and, hence, the investment rate. They find a strong positive relationship between financial indicators and economic growth. Also, financial development is robustly correlated with subsequent rates of growth, capital accumulation, and economic efficiency. They suggest that government interventions in the financial system (through interest ceilings, directed credit programs, and high reserve requirements) may hinder financial development by affecting the quality and quantity of investments and thus negatively affecting economic growth.

In addition to facilitate the trading, hedging, diversifying, and pooling of risk, financial systems allocate resources, monitor managers and exert corporate control, mobilize savings, and facilitate the exchange of goods and services. As a result, economic growth is achieved through capital accumulation and technological innovation. Ang (2008) suggests two channels through

which financial development influence economic growth, capital accumulation, and total can factor productivity. In the quantitative channel, economic growth depends on capital accumulation through domestic credit and foreign capital investment. Therefore, an efficient financial system is needed to mobilize savings and channel them to productive ventures. The qualitative channel proposes that an efficient financial system boosts economic growth through provision of credit facilities to facilitate human capital accumulation and development of technology-intensive industries.

One determinant of financial development is openness of an economy. Rajan and Zingales (2003) argue that incumbents' (the forces opposing financial development) opposition will be weaker when an economy is open to both trade and capital flows. Hence, the opening of both the trade and capital accounts holds the key to successful financial development. This view is supported by Gries et al. (2009) who argue that openness may induce economic growth in several ways. For example, it increases a country's level of specialization and/or it positively affects innovation and technological diffusion. Openness promotes financial development because it not only expands opportunities, but also increases competition. However, Baltagi et al. (2008) find trade and financial openness to be statistically important determinants of the variation in financial development across countries. For developing countries that are already open to trade and capital flow, opening their trade and capital accounts don't have a significant effect on financial development due to the diminishing returns to openness.

La Porta et al. (2002) examine the effects of government ownership of banks in financial development and economic growth. They suggest that the financial systems of countries with higher initial government ownership of banks grow less fast and that government ownership of banks reduces future productivity growth, but not capital accumulation. However, Andrianova et al. (2008) argue that government ownership of banks may be an effective substitute for weak institutions. Furthermore, they underline that privatizing government owned banks without strengthening institutions, which protect depositors from bank failures, is likely to result in a decline in financial development. This view challenges the conclusion of La Porta et al. (2002).

However, some studies don't support the hypothesis that financial development affects economic growth or financial development is affected by economic growth. Lucas (1988) argues financial development and economic growth are not causally related. Singh (1997) claims that financial development may not be beneficial to economic growth for several reasons. First, it may be difficult to achieve efficient investment allocation in developing countries due to the inherent volatility and randomness of the stock market pricing process. Second, in the wake of unfavorable economic shocks, the interplay between the stock and currency markets may exacerbate macroeconomic instability and reduce long-term economic growth. Third, stock market development is likely to undermine the existing group-banking systems in developing countries, which, despite their many difficulties, have not been without merit in several countries.

In a time series analysis for Kenya over the period 1966-2005, Wolderufael (2009) finds bi-directional causality between financial development and economic growth when international trade openness is included in the model. Ghirmay (2004), employing a VAR time series methodology, provides empirical evidence on the existence of a long run relationship between

financial development and economic growth in 12 out of the 13 SSA (Sub-Sahara Africa) countries. He suggests that African countries can accelerate their economic growth by improving their financial systems. Allen and Ndikumana (2000) also find similar results in the data of the Southern African.

Ndebbio (2004) investigates financial deepening and economic growth for SSA countries. His study uses two financial deepening variables-- the degree of financial intermediation measured by M2 as a ratio to GDP and the growth rate of per capita real money balances. The study finds both financial deepening indicators are positively related to economic growth, rendering a conclusion that a developed financial sector spurs overall high and sustainable growth of an economy. Odiambho (2004) examines the role of financial development on economic growth in South Africa. Using the Johansen-Juselius co-integration approach and vector error correction model, he concludes that economic growth has a positive impact on financial development, not the other way round. Odedokun (1996), in a panel of 71 countries including 21 SSA countries, finds a positive and significant effect of financial sector on economic growth when using the ratio of liquid assets to GDP. However, Atindehou et al. (2005) use causality tests to examine the relationship between finance and economic growth in the context of the West African countries members of the Economic Community of West African States (ECOWAS) and find a weak causal relationship between finance and economic development.

### **III. Data Sources and measurement of variables**

Annual data on the measures of financial development and economic growth, and all the control variables are obtained from the World Development Indicators online database (WDI)<sup>14</sup>. Additional data are obtained from International Monetary Fund (IMF) and the International Financial Statistics (IFS) CD ROM (2009 version). This research uses the panel estimation for 12 EA (East Africa) countries, namely, Burundi, Comoros, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Rwanda, Seychelles, Sudan, Tanzania, and Uganda.

Due to the underdevelopment of the capital markets in the region of EA, the financial systems in the region can be described as bank-based rather than market-based. That is, the banking systems play a dominant role in financing. Although some countries in EA have capital markets, these markets are underdeveloped and at their infant stage. Thus, we do not use any indicator for capital market development.

There is no consensus among researchers on the right measures of financial development. Each indicator has its own advantage and disadvantage. The ratio of broad measure of money stock, M2, to the level of nominal Gross Domestic Product (GDP) is the first indicator we use to measure financial intermediation. This indicator has been commonly used to proxy financial development. Ghirmay (2004) strongly advocates for the use of M2/GDP as a measure of financial deepening and thus financial development. According to him, the accumulation of

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<sup>1</sup> World Development Indicators (WDI) online provides direct access to more than 800 development indicators, with time series for 209 countries and 18 country groups from 1960 to now, where data are available, <http://data.worldbank.org/data-catalog/world-development-indicators>

lumpy real money balances is necessary before self-financed investment can take place and a high degree of monetization is positively related to growth performance. However, Abu-Bader and Abu-Qarn (2008) believe that M2/GDP is only designed to show the real size of the financial sector of a growing economy and that an increase in the M2/GDP ratio may reflect an extensive use of currency rather than the increase in bank deposits. Particularly in a developing economy, the large portion of M2 is currency held outside the banking system. Thus, excluding the currency in circulation from the broad measure of money stock can provide a more representative measure of financial intermediation (King and Levin, 1993; and Demetriades and Hussien, 1996). Therefore, the second proxy to measure financial development is the ratio of liquid liabilities in the banking system to GDP.

The third financial development indicator is total domestic credit to the private sector as a percentage of GDP. This proxy can better capture financial development as credit to the private sector is based on the financial viability of the borrowers. It represents a true situation of financial intermediaries in channeling funds to the private sector participants, and is closely related to the level and efficiency of investment and thus economic growth (De-Gregorio and Guidotti, 1995). Private Credit is probably the most important banking development indicator, not least because it proxies the extent to which new firms have opportunities to obtain bank finance. As Rajan and Zingales (2003) suggest, this indicator measures “the ease with which any entrepreneur or company with a sound project can obtain finance.” Total domestic credit to the whole economy (both private and public sector) can’t render the desired perspective considerations as credit to the public sector usually is based on political considerations rather than the financial viability of the investment projects (Law, 2008). He suggests that the supply of credit by the banks to the private sector is an important determinant of the quantity and quality of investment and hence economic growth.

However, Demetriades and Hussien (1996) argue that the ratio of bank claims on the domestic sector to nominal GDP provides more direct information on the extent of financial intermediation. They advocate for the use of this financial variable in measuring financial intermediation. We therefore use the ratio of domestic credit provided by the banking sector to GDP as the fourth financial indicator to measure financial development. Lastly, Real GDP per capita will be used as a measure for economic growth (King and Levin, 1993; Rajan & Zingales, 2003).

In the rest of this paper, “Broad money” and “Liquid liability” are used to denote broad money stock as a percentage of GDP and liquid liabilities as a percentage of GDP respectively. While domestic credit by the banking sector and domestic credit provided to the private sector both as percentages of GDP are both denoted by “Domestic credit” and “Private credit,” respectively.

#### **IV. Empirical model specifications and estimation techniques**

To examine the role of financial development in economic growth in East Africa (EA), a panel data analysis is used. Following Arellano and Bond (1991), used later by Christopoulos & Tsionas (2004) and Baltagi et al. (2008), a dynamic Generalized Method of Moments (GMM) is applied in this study. A dynamic panel estimator allows for the exploitation of time series

variations in the data, accounts for unobserved country specific effects, allows for the inclusion of lagged variables as regressors, and controls for endogeneity of all explanatory variables.

This study estimates the relationship between economic growth and financial development equation with unbalanced panel data from 12 EA countries<sup>15</sup> over the 27-year period 1981-2007.<sup>16</sup> These equations may contain country fixed effects, which are correlated with the regressors. A dynamic panel data estimator based on the GMM methodology can correct the correlated fixed effects as well as account for endogeneity of regressors (Baltagi, 2005).

The model in this study is thus estimated using the GMM estimator proposed by Arellano and Bond (1991). This estimation technique allows the economic growth indicator to partially adjust to its long run equilibrium values within a year. The consistency of the estimates is premised on the assumption of a lack of autocorrelation of the error terms. Specifically, there should be a rejection of the null hypothesis of first order serial correlations but no rejection of the second order (Baltagi, 2005). The study restricts the moment conditions to a maximum of two lags on the dependent variable to reduce the potential bias, resulting from too many moment conditions while increasing the efficiency of the estimates.

Hence, this basic dynamic panel model is estimated as follows.

$$y_{it} = \alpha_i + \beta_i FD_{it} + \gamma_i X_{it} + \varepsilon_{it} \quad (1)$$

$i = 1, \dots, N$        $t = 1, \dots, T_i$       Where:

$y_{it}$     - real GDP per capita in country  $i$  at year  $t$  - economic growth variable

$FD_{it}$  - measure of financial development

$X_{it}$     - includes conditioning set of control variables that affect economic growth

$\alpha_i$     - country specific intercept

$\varepsilon_{it}$     - error terms that capture country and time specific effects

$i$         - individual country

$t$         - time

$N$         - the number of countries;

$T_i$         - the number of observations over time for country  $i$  in the panel.

To allow for the possibility of partial adjustments, a dynamic log linear equation is specified below:

$$\ln y_{it} = \alpha_i + \beta_i \ln FD_{it} + \gamma_i \ln X_{it} + \varepsilon_{it} \quad (2)$$

Following the literature, one year lagged real GDP per capita (denoted by  $y_{it-1}$ ), trade openness (denoted by  $TO_{it}$ ), inflation (denoted by  $INF_{it}$ ), and government consumption as the percentage of GDP (denoted by  $GC_{it}$ ) are included as control variables. After including the control variables to the basic model, the new model is:

<sup>15</sup> East Africa is comprised of 14 countries. Only 12 countries are included in this study. Somalia and Democratic Republic of Congo are excluded from the sample due to lack of data.

<sup>16</sup> The panel data is unbalanced. For Eritrea it is from 1995-2007, Djibouti and Tanzania 1990-2007 each. The remaining nine countries have full data, 1981 through 2007.

$$\ln y_{it} = \alpha + \gamma \ln y_{it-1} + \beta_{1i} \ln FD_{it} + \beta_{2i} \ln TO_{it} + \beta_{3i} \ln GC_{it} + \beta_{4i} \ln INF_{it} + \varepsilon_{it} \dots \dots \dots (3)$$

## V. Empirical findings and Analysis

The summary statistics in Table 1 suggest that there is a reasonable degree of independent variation among the variables and countries in the dataset, which can justify the use of panel estimation technique. The correlation matrix is reported in Table 2. The correlations between all financial development indicators and economic growth are positive as expected, ranging from 0.1844 in Private credit to 0.4459 in Broad money. Trade openness and government consumption are positively correlated to GDP with correlation coefficients of 0.7909 and 0.2830, respectively. Inflation is negatively correlated to economic growth and trade openness. Inflation is also negatively correlated to private credit, broad money, and Liquid liability. However, the correlation between inflation and domestic credit is positive. Moreover, correlations among the four measures of financial development are positive and significant as expected from the literature.

**Table 1 Summary statistics of variables**

Annual data (1981-2007, Countries = 12, Observations = 292)

Variable	Source	Unit of measurement	Mean	Standard deviation	Minimum	Maximum
Real GDP per capita	WDI	US Dollars at constant price	878.80	1882.71	85.54	11439.79
Domestic credit	WDI	% of GDP	36.89	34.91	4.14	220.12
Private credit	WDI	% of GDP	15.63	10.50	1.62	48.38
Broad money	WDI	% of GDP	31.45	27.73	5.81	154.17
Liquid liability	WDI	% of GDP	34.57	29.37	7.29	164.97
TO	WDI	% of GDP	55.52	37.83	10.83	252.74
GC	WDI	% of GDP	17.38	10.19	4.61	69.54
INF	WDI	Annual inflation rate (% change in CPI)	15.58	27.49	-9.81	200.02

Source: authors' computation based on the data in World Bank – WDI

Note: TO, GC, and INF refer to Trade openness, Government consumption and Inflation, respectively.

In using GMM dynamic estimators, the integration and co-integration properties of the data are ignored and not important (Christopoulos and Tsionas, 2004). Thus there is no need to check for the stationarity of the series. For each indicator of financial sector development, a dynamic GMM is estimated. The estimation results are presented in Table 3.

**Table 2 Correlation matrix of variables**

	Real GDP per capita	Domestic credit	Private credit	Broad money	Liquid liability	TO	GC	INF
Real GDP per capita	1.0000							
Domestic credit	0.4192	1.0000						
Private credit	0.1844	0.4416	1.0000					
Broad money	0.4459	0.7022	0.6696	1.0000				
Liquid liability	0.4204	0.7196	0.6882	0.9919	1.0000			
TO	0.7909	0.4227	0.5102	0.6682	0.6467	1.0000		
GC	0.2830	0.4681	0.5876	0.7694	0.7600	0.6212	1.0000	
INF	-0.1413	0.1745	-0.2535	-0.1871	-0.1633	-0.2625	-0.2455	1.0000

Note: TO, GC, and INF refer to Trade openness, Government consumption and Inflation, respectively.

As it is reported in Regression 1 of Table 3, when using Domestic credit as a measure of financial development, the regression gives a coefficient of -0.0194 and is statistically significant at the 10% level. This could suggest that the large size or proportion of domestic credit goes to the government and that the economies in the sample countries are highly dominated by the public sector. It appears that higher dependence on banks with the larger portion of the loan given to the government tends to adversely affect economic growth. This result is similar to that of Xu (2000), which shows a negative coefficient of Domestic credit in 14 of the 15 SSA countries. He suggests that in some countries, it is the resource endowment that is driving their economies. When using Private credit to proxy financial development in Regression 2 of Table 3, all variables, including the conditioning variable, are statistically significant. Private credit has a positive coefficient of 0.037 and is statistically significant at the conventional level of 5%. This implies the importance of financial sector development in driving the economic growth in the region. The high demand of financial services, which follows increased private capital accumulation and investment by the private sector, gives a positive stimulus to economic growth. However, the coefficient of Private credit is relatively small. A 10% increase in Private credit results in a 0.3% increase in economic growth. As Baltagi et al. (2008) suggest that banking sector development may be particularly useful to low income countries, the result here supports that an increase in Private credit can foster economic growth in the region.

In Regression 3, Broad money is positive but statistically insignificant. It has a coefficient of 0.011 and standard error of 0.092. This suggests that Broad money has a positive, but little impact on economic growth in the region. However, the positive coefficient of broad money shows that Broad money has the potential to influence economic growth. In Regression 4, with Liquid liability as a financial development indicator, all variables are statistically significant. It appears with a positive coefficient of 0.297 and statistically significant at the conventional level of 5%. As can be seen in Regression 4, a 10% increase in Liquid liability results in a 2.97% economic growth. The result supports the hypothesis that financial sector development significantly and positively affects economic growth in developing countries, particularly in low and middle income countries.

As presented in Table 3, the lagged real GDP per capita is positive and statistically significant at the 1% level in all the regressions, but it is statistically different from unity in all cases. The high and positive coefficients in all the regressions show strong evidence of a considerable persistence in the variable and slower speed of adjustment to shocks. This implies that economic growth in a particular year is highly dependent on the size of the economic growth of the previous year. From the estimated coefficients for lagged real GDP per capita, we can see that comparatively the variable has the highest coefficient in Regression 1, implying that the dependent variable is highly persistent with the lowest speed of adjustment to shocks when Domestic credit is used to proxy financial development. In Regression 4, with Liquid liability as a proxy of financial development, the dependent variable shows relatively lower persistence and a higher rate of adjustment to shocks.

Trade openness has a robust and positive correlation with economic growth. It is positive and statistically significant at the 1% level in all regressions, except in Regression 3, which is statistically significant at the 5% level when Broad money is used as a proxy of financial sector development. The result is consistent with those of Rajan and Zingales (2003) and Baltagi et al. (2008), who suggest that developing countries, particularly the low income countries, can benefit from opening their trade and capital accounts. The result also strongly supports the hypothesis that trade openness promotes economic growth. Government consumption appears statistically significant but negative in all regressions with coefficients ranging from -0.245 to -0.057. As expected, inflation has a negative and significant impact on economic growth.

The consistency of the GMM estimator depends mainly on the assumptions that the error terms do not exhibit second order serial correlation and that the instruments are valid. To check whether or not these assumptions hold, we conducted the Sargan test for over-identification and serial correlation tests. Failure to reject the null hypothesis of these tests implies that the assumptions of the estimation hold. We also run the Wald (joint-significance) test. As presented in Table 3, from the diagnostic statistics, we see the tests do not reject the econometric specification of the model. In all of the GMM specifications, the test for first-order serial correlation rejects the null hypothesis of no first-order serial correlation but does not reject the null hypothesis of no second-order serial correlation. Thus, we conclude that the GMM estimators are valid and consistent because the Sargan test supports the validity of the instruments and from the second-order serial correlation test we cannot reject the hypothesis of the absence of second-order serial correlation. According to Baltagi et al. (2008), if the lagged dependent variable is included in the model, all estimated beta coefficients represent short run effects. The long run effect can be derived by dividing each of the betas by 1 minus the coefficient of the lagged dependent variable.

**Table 3 Financial sector development and economic growth in EA (GMM estimation)**

$$\ln y_{it} = \alpha + \gamma \ln y_{it-1} + \beta_{1i} \ln FD_{it} + \beta_{2i} \ln TO_{it} + \beta_{3i} \ln GC_{it} + \beta_{4i} \ln INF_{it} + \varepsilon_{it}$$

Dependent variable: Real GDP per capita Method: Panel Generalized Method of Moments (GMM)					
Variables		Dependent variable: Real GDP per capita			
		Regression N <sup>o</sup> .			
		(1)	(2)	(3)	(4)
Lagged Real GDP per capita		0.670*** (0.041)	0.657*** (0.046)	0.606*** (0.044)	0.569*** (0.045)
Financial development (FD) indicators	Domestic credit	-0.0194* (0.052)			
	Private credit		0.037** (0.071)		
	Broad money			0.011 (0.092)	
	Liquid liability				0.297** (0.080)
Control variables	TO	0.059*** (0.087)	0.129*** (0.092)	0.355** (0.106)	0.204*** (0.119)
	GC	-0.057 (0.089)	-0.118* (0.127)	-0.227** (0.090)	-0.245** (0.096)
	INF	-0.001*** (0.001)	-0.002*** (0.001)	-0.031*** (0.001)	-0.012*** (0.001)
Total (unbalanced) Observations		256	256	256	256
R <sup>2</sup>		0.730	0.725	0.715	0.755
Wald test of joint significance-probability		(0.00)	(0.00)	(0.00)	(0.00)
Sargan <sup>17</sup> Test (p-value)		16.78 (0.56)	19.01(0.77)	14.92(0.38)	21.51(0.62)
First order serial correlation (p-value)		-3.42(0.02)	-4.22(0.01)	-3.99(0.00)	-4.15(0.03)
Second order serial correlation (p-value)		0.49(0.32)	0.37(0.55)	0.84(0.17)	0.54(0.26)

**Notes:**

1. The regressions are estimated using dynamic panel GMM at first difference
2. The variables are defined as follows: y = Real GDP per capita, y<sub>t-1</sub>= lagged Real GDP per capita, FD = financial development indicator, TO = trade openness, GC= Government consumption, INF = Inflation
3. Figures in parentheses are standard errors

<sup>17</sup> The Sargan test is a joint test of model specification and the appropriateness of the instruments

4. \*\*\*, \*\*and \* indicate statistical significance at the 1%, 5%, and 10% levels, respectively.
5. The null hypothesis of the Sargan test is that the instruments are valid. The null hypothesis of the serial correlation test is the absence of serial correlation.

As a robustness check, some changes are made to the model and estimation techniques. The dependent variable is changed from the Real GDP per capita to the Real GDP growth rate. The new model with the Real GDP growth rate is estimated with the dynamic panel GMM (but not reported here due to the lack of space). The results are not different from the estimations made with the Real GDP per capita as the dependent variable.

## **VI. Concluding Remarks**

The empirical evidence presented in this paper is generally supportive to the hypothesis that financial development positively influences future economic growth rates. The policy implication is straight forward in that policies aimed at enhancing the development of the financial sector can help spur economic growth. One of the reasons that have been slowing African growth is the small financial systems that allocate capital inefficiently.

The findings of this study show that the financial sector is crucial for the growth of the economy. These findings might indicate that there exists a pervasive inefficiency in the credit allocation mechanism. Therefore, policies that promote financial development and intermediation should be promoted. In general, governments in East Africa should seek to develop a larger financial sector through regional integration, by expanding access to credit and financial services, enhancing savings mobilization, expanding microfinance institutions, encouraging the entry of foreign banks, promoting a competitive and viable domestic banking system with an adequate regulatory and supervisory framework, and restricting government involvement in the financial sectors.

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