AoF
Academy of Finance

# Journal of Finance Issues

**Volume 10** **Issue 1** **Summer 2012**

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**On the Risk Exposure of Asia Pacific Banking Industry**

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## Abstract

Despite its potential benefits, financial globalization also carries some risks, especially for developing countries. The recent 1997 Asian financial crisis is such episode associated with a globalized financial system. In this paper, I examine whether there is any significant impact of the 1997 Asian crisis on the risk exposures of the banking sector for a group of Asia Pacific emerging markets. Using a conditional multi-factor asset-pricing model that allows time variation in the risk premiums, I find that the risk exposure increased during the crisis, with the greatest increase occurring for the crisis countries. However, the incremental increase in the risk exposure has diminished after the crisis. The evidence provided here indicates that the 1997 Asian crisis does not appear to have a permanent effect on the riskiness international banking industries, implying that the financial globalization is still beneficial, at least in the long run. Consequently, the main challenge for policy makers is to manage the integration process as to take full advantage of the opportunities, while minimizing its risks.

## I. Introduction

For at least the past two decades, the process of financial globalization and deregulation has been rapidly advancing. The removal of many important regulatory barriers to international banking and capital mobility has tightened linkages among global financial markets. As a result, capital has flowed more freely across national borders in search of the highest risk-adjusted rates of return. However, despite the potential benefit of this burgeoning global financial system, financial globalization also carries some risks, especially for developing countries. Financial globalization appears to have facilitated the transmission of financial disturbances far more effectively than ever before and can lead to crises in countries with weak fundamentals as the economies become subject to the reaction of domestic and foreign investors. The recent 1997 Asian financial crisis is such episode associated with this new high-tech global financial system.

A number of complex factors trigged the 1997 Asian crisis, but, fundamentally, unbridled expansion and subsequent contraction of banking lending played a leading role. The potential benefits and important risks resulting from the financial globalization raise several important questions: Did the 1997 Asian crisis increase the risk exposures of the banking industry in Asia Pacific emerging countries? Are there any changes in the risk exposures *after* the crisis for Asia Pacific banking industries? To examine these questions, I rely on a multi-factor asset pricing model to investigate the impact of the 1997 Asian crisis on the time-varying market, interest rate, and foreign exchange risk exposures of nine Asia Pacific (Hong Kong, Indonesia, Japan, Korea, Malaysia, Philippines, Singapore, Taiwan, and Thailand) banking industries. The focus of banking industry in this study is important not only because theories of financial crises emphasize the role played by banks and other financial institutions, but also because they are of particular importance in real and financial sectors especially in bank-based emerging markets. The finding of this study has an

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important policy implication as to whether market liberalization and deregulation are worthwhile in particular for emerging markets. If the evidence suggests that there is an overall increase in the risk exposure during the crisis for Asian emerging banking industries, but this increase is only temporary and eventually diminishes after the crisis, then it may not be a problem as far as the market liberalization and deregulation are concerned since the net gains from the financial globalization are still positive, at least in the long run. In this situation, the main challenge for policy makers is therefore to manage the integration process as to take full advantage of the opportunities, while minimizing its risks.

The empirical results indicate that on average (in absolute terms) the banking industries in Asia Pacific countries become more exposed to all three risks during the crisis, particularly for the interest rate risk. These incremental increases in the exposures resulting from the crisis have diminished after the crisis for all the risks, causing the exposures to revert back to their pre-crisis levels.

The remainder of the paper is organized as follows. Section II motivates the theoretical multi-factor asset pricing model and the econometric methodologies used to test the model. Section III discusses the data. Section IV reports and discusses the empirical results. Concluding comments are offered in Section V.

## II. The Model and Methodology

In this paper, I consider a three-factor model where the three factors are world market, interest rate, and foreign exchange risks. In particular, I test the following model:

$$\begin{aligned} r_{i,t} &= (\lambda_{mkt,t-1} + \varepsilon_{mkt,t})(\beta_{i,mkt} + crisis\beta^{d}_{i,mkt} + post\beta^{a}_{i,mkt}) \\ &+ (\lambda_{\text{int},t-1} + \varepsilon_{\text{int},t})(\beta_{i,\text{int}} + crisis\beta^{d}_{i,\text{int}} + post\beta^{a}_{i.\text{int}}) \qquad \forall i = 1 \cdots\cdots N \qquad (1) \\ &+ (\lambda_{fx,t-1} + \varepsilon_{fx,t})(\beta_{i,fx} + crisis\beta^{d}_{i,fx} + post\beta^{a}_{i,fx}) + \varepsilon_{i,t} \end{aligned}$$

where $r_{i,t}$ is the raw returns of asset $i$ in excess of the risk-free rate, "$mkt$", "int" and "$fx$" denote world market risk, interest rate risk, and foreign exchange risk, respectively. "$crisis$" is a dummy variable for Asian crisis, which is equal to one after 07/04/1997, and zero otherwise.[1] "$post$" is a post-crisis dummy variable, which is equal to one after 12/25/1998 and zero otherwise. $\beta_{i,k}$ ($\forall k = mkt, \text{int}, fx$) is the risk exposure (or beta) with respect to factor $k$ measured over the entire sample period; $\beta^{d}_{i,k}$ ($\forall k = mkt, \text{int}, fx$) is the incremental risk exposure during the crisis, and $\beta^{a}_{i,k}$ ($\forall k = mkt, \text{int}, fx$) is the incremental risk exposure after the crisis.

The factor risk premium, $\lambda_{k,t-1}$ ($\forall k = mkt, \text{int}, fx$), specified in equation (1) are allowed to be time-varying since previous studies have shown that short- and long-horizon

[1] I assume that Asian crisis began in the first week of July 1997 and ended in the last week of December 1998.

security returns are predictable (e.g., Harvey (1991), Bekaert and Hodrick (1992), Ferson and Harvey (1991, 1993), Bekaert and Harvey (1995), among others). This predictability has been attributed to time-variation in expected returns. In light of this, the expected time-varying factor risk premium can be re-written as,

$$E[F_{k,t} \mid \Omega_{t-1}] = \lambda_{k,t-1} = \varphi_k^{'} z_{t-1} \quad \forall k \tag{2}$$

where $Z_{t-1}$ is a vector of information variables observed at the end of time $t-1$ and $\varphi$'s are time-invariant vectors of weights. Given the dynamics of factor risk premiums, I can then test whether the factor risk premiums are time varying by testing the statistical significance of the information variables in $Z_{t-1}$.

This specification in equation (1) has a number of important features. First, it permits me to examine whether the three factor risk exposures are individually significant during the entire sample period by testing the null hypothesis of $\beta_{i,k} = 0 \ \forall k$. Second, the inclusions of two dummy variables, *crisis* , and *post* , allow me to ask not only whether there is any incremental increase/decrease in each of the three factor risk exposures during the crisis by testing the statistical significance of $\beta_{i,k}^{d} = 0 \ \forall k$, but also whether these factor risk exposures have returned to their previous levels in its aftermath by comparing the size of $(\beta_{i,k} + \beta_{i,k}^{d} + \beta_{i,k}^{a})$ with that of $\beta_{i,k} \ \forall k$. If $(\beta_{i,k} + \beta_{i,k}^{d} + \beta_{i,k}^{a})$ is equal to or very close to $\beta_{i,k}$, it is an indication that the risk exposure for factor $k$ has returned to its pre-crisis level after the crisis. To estimate the model, I need to simultaneously estimate the $\beta$ and $\lambda$ coefficients. This requires a nonlinear estimation process. I estimate the model [equations (1) and (2)] as a system of equations using an iterated NSURE technique, which is asymptotically equivalent to maximum-likelihood estimation under the assumption of normality.

## III. Data and Summary Statistics

I use US dollar denominated stock returns at the weekly interval for the banking industry across 9 Asia Pacific countries– Hong Kong (*HK*), Indonesia (*ID*), Japan (*JP*), Korea (*KO*), Malaysia (*MY*), Philippines (*PH*), Singapore (*SG*), Taiwan (*TA*), and Thailand (*TH*). For the risk factors, the excess returns on Datastream world total return index (*WD*) is used to construct the world market risk, and the excess returns on JP Morgan global bond total return index (*JPMGB*) is used to reflect interest rate risk. The inclusion of the interest rate risk factor is particularly important because banks serve as a vehicle for the transmission of monetary policy (see, e.g., Hoshi et al. (1993) and Kashyap et al. (1996)) and should be sensitive to changes in interest rates. For exchange rate risk factor, I use the log-first differences of a currency index (*TWFX*). This index is a trade-weighted average of the foreign exchange values of the US dollar against the currencies of a large group of major US trading partners. It is expressed as US dollar price per unit of foreign currency, so a positive change indicates a decreasing value of the US dollar. Finally, 7-day Eurodollar deposit rate is used to compute excess returns. To model the time-varying factor risk premiums, I consider three information variables which are lagged excess dividend yield measured by the dividend yield on *WD* in excess of the 7-day Eurodollar interest rate (*DIV*), the first lag of the

respective factor return ( $F_{k,t-1}$ ), and a constant (*Constant*). The weekly data ranges from 01/03/92 to 12/31/04, which is a 679-data-point series. However, I work with rates of return and use the first difference of the information variables and finally all the information variables are used with a one-week lag, relative to the excess return series; that leaves 677 observations expanding from 01/17/92 to 12/31/04.

Table 1 presents summary statistics of the returns for banking industry indices, risk factors, and information variable. As can be seen, the weekly mean excess returns ranging from –0.249% for *ID* to 0.288% for *HK*. Of the 9 banking industries, 5 have negative mean excess returns (*ID*, *JP*, *KO*, *TA*, and *TH*). For the standard deviations, they range from 3.652% for *HK* to 9.582% for *ID*. The poor performance of Asia Pacific national banking industries is not surprising since most of them were seriously affected by the 1997 Asian crisis. For the risk factors, the mean return is 0.086%, 0.064%, and 0.012% for *WD*, *JPMGB*, and *TWFX* , respectively. Table 1 also reports Bera-Jarque test statistics. Bera-Jarque test rejects normality of excess returns for all banking industry indices and two risk factors (*WD* and *TWFX*).

## *IV. Empirical Results*

### *A. Market Risk exposures*

Table 2 reports, respectively, the point estimates and robust standard errors of the market risk exposure for the full sample period ( $\beta_{mkt}$ ), the incremental market risk exposure during the crisis ( $\beta_{mkt}^{d}$ ) and after the crisis ( $\beta_{mkt}^{a}$ ) for each of the 9 banking excess industry returns. The results indicate that the market risk exposures ( $\beta_{mkt}$ ), ranging from 2.201 for *ID* to 6.971 for *KO*, with a mean of 3.887, are all positive and significantly different from zero at the 1% level in all cases. To see if there are any incremental changes in the market risk exposures during the crisis, I turn to the point estimates and the robust standard errors of $\beta_{mkt}^{d}$. As can be seen, the market risk exposure tends to rise since $\beta_{mkt}^{d}$ is positive in seven of nine cases (*KO* and *MY* are the two exceptions). In particular, for *SG*, *HK*, *PH*, *TA*, *TH*, *JP* and *ID*, the market risk exposure increases by an amount between 0.101 and 1.904, but it is only significant for *ID* and *JP*. In all cases the total market risk exposure ( $\beta_{mkt}+\beta_{mkt}^{d}$ ) remains significant, with a mean of 4.314, which is 11.00% larger than its pre-crisis level. Overall, the 1997 Asian crisis has a positive incremental impact on the market risk exposure for most of the banking industries.

After the crisis, the market risk exposure seems to have returned to its pre-crisis level with the total market risk exposures ( $\beta_{mkt}+\beta_{mkt}^{d}+\beta_{mkt}^{a}$ ) in many cases returning remarkably closely to where they had stood before the crisis ( $\beta_{mkt}$ ) for both groups of countries. For example, the incremental market risk exposures for *ID* and *JP*, which are significantly positive during the crisis, have become significantly negative after the crisis, suggesting a reversed incremental impact after the crisis. Further, the means of the total market risk exposures before and after the crisis are very close to each other (3.860 vs. 3.887). To

summarize, the exposure to the world market risk on average rises during the crisis, then falls back to its pre-crisis level afterwards.

### *B. Interest rate exposure*

I now turn to the interest rate exposure. The point estimates and robust standard errors of the interest rate exposure for the full sample ($\beta_{\text{int}}$), the incremental interest rate exposure during the crisis ($\beta_{\text{int}}^{d}$) and after the crisis ($\beta_{\text{int}}^{a}$) for the 9 banking industries are shown in Table 3. Before the crisis, $\beta_{\text{int}}$ is significant in all cases expect *HK* and ranges from -7.689 (*ID*) to 15.201 (*TH*), with an average (absolute) value of 5.545 (7.342) and a standard deviation of 6.864. Apparently the interest rate exposures not only have wide range than the market risk exposures, but also are generally larger in magnitude than those of the market risk exposure, suggesting that the interest rate risk has a larger impact than the world market risk does on the Asia Pacific banking industries. In terms of the sign of the interest rate exposures, it is positive in seven of nine cases.

During the crisis, the interest rate exposure falls, by an amount between 0.964 and 5.879, in five cases (*HK*, *ID*, *KO*, *PH*, and *SG*), and is significantly in three cases (*HK*, *ID*, *SG*). For the other four cases (*JP*, *MT*, *TA*, and *TH*) the interest rate exposure rises, but significantly for *JP* (2.538) only. This result is not surprising since according to Kaminsky and Reinhart (2001), Japanese banks were lending heavily during the crisis to Asian emerging markets, including crisis countries – Indonesia, Malaysia, Philippines, South Korea, and Thailand. In addition, Japanese banks were most exposed to Thailand--which is the first country to experience a crisis. The overall interest rate exposure ($\beta_{\text{int}} + \beta_{\text{int}}^{d}$) remains significant in all cases except *KO*, with an average (absolute) value of 4.863 (8.437), which is 14.90% higher than its pre-crisis level in absolute terms, suggesting that, on average, there is a positive incremental impact on the interest rate exposure due to the 1997 Asian crisis. After the crisis, there is a reversed incremental impact on the interest rate exposures for all cases as can been seen from the opposite signs of $\beta_{\text{int}}^{d}$ and $\beta_{\text{int}}^{a}$. Although the coefficients of $\beta_{\text{int}}^{a}$ are only significant in three cases (*HK*, *ID*, and *SG*), the overall interest rate exposure ($\beta_{\text{int}} + \beta_{\text{int}}^{d} + \beta_{\text{int}}^{a}$) still remains significant in all cases. By comparing the absolute means of the interest rate exposure in the crisis and post-crisis periods, it can be seen that the mean has dropped by 8.14% (from 8.437 to 7.750), causing the interest rate exposure to revert back to its pre-crisis level. To summarize, the interest rate exposure on average rises during the crisis, and after the crisis, the interest rate exposure appears to reverted back to its pre-crisis level.

### *C. Foreign exchange exposure*

Considering the foreign exchange exposure, Table 4 shows that Asia Pacific banking industries are significantly exposed to the foreign exchange risk since $\beta_{fx}$ is statistically significant in all cases except *ID*. The finding of large proportion of exposures to the foreign exchange risk is consistent with several previous works on exchange rate exposure of individual firms or industry portfolios (e.g., Doidge, Griffin, and Williamson (2006)). Compared to the world market risk exposures, similar to the interest rate exposures the

foreign exchange exposures not only display a wide range of values, from -13.502 (*JP*) to 1.834 (*ID*) with a standard deviation of 5.531, but also are more economically important based on the magnitudes of the exposure. In terms of the sign of $\beta_{fx}$, it is most negative (7 out of 9), implying that the banking sectors in most of the Asian emerging markets would provide investors who invest in the foreign exchange markets with the benefits of international diversification.

During the crisis, the exposure to the foreign exchange risk rises for five of nine Asia Pacific countries (*HK*, *ID*, *KO*, *PH*, and *SG*), but falls for the other four countries (*JP*, *MY*, *TA*, and *TH*), with a positive mean of 0.542. This result suggests that the 1997 Asian crisis on average has a positive incremental effect on the foreign exchange exposure for the Asia Pacific countries. Although the incremental foreign exchange exposure is only significant in two cases (*ID* and *JP*), the total foreign exchange exposure ($\beta_{fx}+\beta_{fx}^{d}$), ranging from -16.295 (*JP*) to 7.764 (*ID*), are significant in all nine cases during the crisis compared to eight cases before the crisis. The additional significant case during the crisis is *ID*, and it is the only case with a significantly positive $\beta_{fx}^{d}$ (5.930), indicating that the 1997 Asian crisis has a strong and positive impact on the foreign exchange exposure of the Indonesian banking sector. After the crisis, the foreign exchange exposure falls in four cases (*HK*, *ID*, *KO*, and *MY*), and rises for the other five cases, with an average (absolute) value of -0.604 (1.162), suggesting, on average, a negative incremental effect on the foreign exchange exposure after the crisis. Although none of the coefficients of $\beta_{fx}^{a}$ is significant, the total foreign exchange exposure ($\beta_{fx}+\beta_{fx}^{d}+\beta_{fx}^{a}$) has become significant in all nine cases with an average value of -7.359, which is very close to its pre-crisis level (-7.297), indicating that the foreign exchange exposure on average has reverted back to its pre-crisis level. To summarize, the foreign exchange exposure of banking industries on average tends to rise during the crisis, and revert back to its pre-crisis level afterwards.

## 5. Summary and conclusions

Given the fact that most of the Asian emerging markets have liberalized their financial markets in early 1990s, and the fact that financial liberalization has potential benefits but carry some risks, in this paper I have attempted to examine whether there is any significant impact of the 1997 Asian crisis on the risk exposures of the banking industry for a group of Asia Pacific emerging countries. The finding of this study has an important policy implication as to whether market liberalization and deregulation are worthwhile in particular for emerging markets.

The empirical results indicate that on average (in absolute terms) the banking industries in Asia Pacific countries become more exposed to all three risks during the crisis, particularly for the interest rate risk. These incremental increases in the exposures resulting from the crisis have diminished after the crisis for all the risks, causing the exposures to revert back to their pre-crisis levels. The evidence found in this paper indicates that the 1997 Asian crisis does not appear to have a permanent effect on the risk exposures of international banking industries, implying that the financial globalization is still beneficial, at least in the

long run. Consequently, the main challenge for policy makers is to manage the integration process as to take full advantage of the opportunities, while minimizing its risks. This task is not easy, particularly because financial globalization influences the instruments available to policy makers. In a more integrated world, governments are left with fewer policy tools and thus international financial coordination becomes more important.

**Table 1: Summary statistics of returns of banking industries and risk factors**

The statistics are based on weekly data from 1992:01:17 to 2004:12:31 (677 observations). The 9 excess banking industry returns are calculated from Datastream national banking industry total return indices. The excess returns on Datastream world total market return index (*WD*) is used to proxy the global market risk, JP Morgan global broad bond index (*JPMGB*) is used to proxy the global interest rate risk, and the log first difference of the trade-weighted U.S. dollar price of the currencies of major industrialized countries (*TWFX*) is used to proxy the currency risk. The conditioning variable is the excess dividend yield, measured by the dividend yield on Datastream world total market return index in excess of the 7-day Eurodollar deposit rate (*DIV*). The Bera-Jarque (*B-J*) tests normality based on both skewness and excess kurtosis and is distributed $\chi^2$ with two degrees of freedom. * and ** denote statistical significance at the 5% and 1% level, respectively.

| | Mean (%) | Std (%) | Minimum (%) | Maximum (%) | *B-J* |
|---|---|---|---|---|---|
| **Asia Pacific Banking Industry** | | | | | |
| ***HK*** | 0.288 | 3.652 | -18.544 | 16.563 | 258.46** |
| ***ID*** | -0.249 | 9.582 | -68.950 | 46.498 | 2319.14** |
| ***JP*** | -0.191 | 4.523 | -15.201 | 18.931 | 66.504** |
| ***KO*** | -0.186 | 8.853 | -47.104 | 40.450 | 886.467** |
| ***MY*** | 0.165 | 5.566 | -39.741 | 53.261 | 14811** |
| ***PH*** | 0.007 | 4.109 | -31.447 | 14.642 | 1705.37** |
| ***SG*** | 0.114 | 4.097 | -34.009 | 22.029 | 4066.07** |
| ***TA*** | -0.020 | 5.135 | -21.480 | 23.640 | 241.971** |
| ***TH*** | -0.080 | 6.762 | -33.027 | 37.405 | 544.987** |
| **Risk Factors** | | | | | |
| ***TWFX*** | 0.012 | 0.894 | -2.831 | 3.781 | 13.247** |
| ***JPMGB*** | 0.064 | 0.888 | -2.685 | 2.902 | 0.179 |
| ***WD*** | 0.086 | 1.866 | -9.619 | 7.608 | 214.669** |
| **Instrument** | | | | | |
| ***Rf*** | 0.076 | 0.033 | 0.019 | 0.141 | 62.052** |
| ***DIV*** | -0.472 | 0.486 | -1.322 | 0.468 | 55.858** |

**Table 2: Market risk exposure before, during, and after the crisis**

This table reports the market risk exposures before the crisis ($\beta_{mkt}$), the incremental market risk exposure during the crisis ($\beta^{d}_{mkt}$), and after the crisis ($\beta^{a}_{mkt}$) estimated from equations (1) and (2) of the system of equations for nine Asia Pacific banking industries. In addition, the total market risk exposure during the crisis ($\beta_{mkt}+\beta^{d}_{mkt}$) and after the crisis ($\beta_{mkt}+\beta^{d}_{mkt}+\beta^{a}_{mkt}$) are also presented. The last row reports the percentage change between $\beta_{mkt}$ and ($\beta_{mkt}+\beta^{d}_{mkt}+\beta^{a}_{mkt}$). Heteroscedasticity-consistent standard errors are in parentheses. Standard deviations are given in brackets. * and ** denote statistical significance at the 5% and 1% level, respectively.

| | ***HK*** | ***ID*** | ***JP*** | ***KO*** | ***MY*** | ***PH*** | ***SG*** | ***TA*** | ***TH*** | **Mean** | **Abs (Mean)** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $\beta_{mkt}$ | 4.957 | 2.201 | 3.740 | 6.971 | 3.141 | 2.438 | 4.094 | 2.381 | 5.059 | 3.887 | 3.887 |
| **Std** | (0.162)** | (0.472)** | (0.201)** | (0.438)** | (0.276)** | (0.201)** | (0.187)** | (0.258)** | (0.325)** | [1.576] | [1.576] |
| $\beta^{d}_{mkt}$ | 0.161 | 1.904 | 0.931 | -0.657 | -0.312 | 0.312 | 0.101 | 0.559 | 0.849 | 0.427 | 0.643 |
| **Std** | (0.234) | (0.683)** | (0.292)** | (0.633) | (0.400) | (0.291) | (0.271) | (0.374) | (0.470) | [0.753] | [0.555] |
| $\beta^{a}_{mkt}$ | 0.108 | -2.171 | -0.709 | -0.006 | 0.233 | -0.351 | -0.422 | -0.483 | -0.290 | -0.455 | 0.530 |
| **Std** | (0.190) | (0.552)** | (0.236)** | (0.512) | (0.324) | (0.236) | (0.219) | (0.302) | (0.380) | [0.711] | [0.649] |
| $\beta_{mkt}+\beta^{d}_{mkt}$ | 5.118** | 4.105** | 4.671** | 6.314** | 2.829** | 2.750** | 4.195** | 2.940** | 5.908** | 4.314 | 4.314 |
| $\beta_{mkt}+\beta^{d}_{mkt}+\beta^{a}_{mkt}$ | 5.226** | 1.934** | 3.962** | 6.308** | 3.062** | 2.399** | 3.773** | 2.457** | 5.618** | 3.860 | 3.860 |
| **% change** | 0.054 | -0.121 | 0.059 | -0.095 | -0.025 | -0.016 | -0.078 | 0.032 | 0.111 | -0.0069 | -0.0069 |

**Table 3: Interest rate risk exposure before, during, and after the crisis**

This table reports the interest rate risk exposures before the crisis ($\beta_{\text{int}}$), the incremental market risk exposure during the crisis ($\beta^{d}_{\text{int}}$), and after the crisis ($\beta^{a}_{\text{int}}$) estimated from equations (1) and (2) of the system of equations for nine Asia Pacific banking industries. In addition, the total interest rate risk exposure during the crisis ($\beta_{\text{int}}+\beta^{d}_{\text{int}}$) and after the crisis ($\beta_{\text{int}}+\beta^{d}_{\text{int}}+\beta^{a}_{\text{int}}$) are also presented. The last row of each Panel reports the percentage change between $\beta_{mkt}$ and ($\beta_{mkt}+\beta^{d}_{mkt}+\beta^{a}_{mkt}$). Heteroscedasticity-consistent standard errors are in parentheses. Standard deviations are given in brackets. * and ** denote statistical significance at the 5% and 1% level, respectively.

| | *HK* | *ID* | *JP* | *KO* | *MY* | *PH* | *SG* | *TA* | *TH* | **Mean** | **Abs (Mean)** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $\beta_{\text{int}}$ | -0.394 | -7.689 | 4.074 | 3.178 | 11.023 | 11.156 | 7.526 | 5.833 | 15.201 | 5.545 | 7.341 |
| **Std** | (0.437) | (1.272)** | (0.544)** | (1.180)** | (0.746)** | (0.543)** | (0.504)** | (0.696)** | (0.876)** | [6.864] | [4.591] |
| $\beta_{\text{int}}^{d}$ | -2.119 | -5.879 | 2.538 | -0.964 | 2.486 | -1.769 | -2.621 | 1.214 | 0.978 | -0.682 | 2.285 |
| **Std** | (0.813)** | (2.369)* | (1.013)* | (2.198) | (1.389) | (1.010) | (0.939)** | (1.296) | (1.631) | [2.578] | [1.501] |
| $\beta_{\text{int}}^{a}$ | 1.772 | 5.101 | -1.283 | 0.916 | -1.833 | 0.769 | 2.761 | -0.040 | -0.599 | 0.840 | 1.675 |
| **Std** | (0.772)* | (2.248)* | (0.963) | (2.086) | (1.319) | (0.960) | (0.892)** | (1.230) | (1.550) | [2.157] | [1.514] |
| $\beta_{\text{int}} + \beta_{\text{int}}^{d}$ | -2.513** | -13.569** | 6.612** | 2.214 | 13.509** | 9.387** | 4.905** | 7.047** | 16.179** | 4.863 | 8.437 |
| $\beta_{\text{int}} + \beta_{\text{int}}^{d} + \beta_{\text{int}}^{a}$ | -0.741* | -8.467** | 5.329** | 3.130** | 11.676** | 10.156** | 7.666** | 7.007** | 15.580** | 5.704 | 7.750 |
| **% change** | 0.881 | 0.101 | 0.308 | -0.015 | 0.059 | -0.090 | 0.019 | 0.201 | 0.025 | 0.0287 | 0.0557 |

**Table 4: Foreign exchange risk exposure before, during, and after the crisis**

This table reports the foreign exchange risk exposures before the crisis ($\beta_{fx}$), the incremental market risk exposure during the crisis ($\beta_{fx}^{d}$), and after the crisis ($\beta_{fx}^{a}$) estimated from equations (1) and (2) of the system of equations for nine Asia Pacific banking industries. In addition, the total foreign exchange risk exposure during the crisis ($\beta_{fx}+\beta_{fx}^{d}$) and after the crisis ($\beta_{fx}+\beta_{fx}^{d}+\beta_{fx}^{a}$) are also presented. The last row of each Panel reports the percentage change between $\beta_{mkt}$ and ($\beta_{mkt}+\beta_{mkt}^{d}+\beta_{mkt}^{a}$). Heteroscedasticity-consistent standard errors are in parentheses. Standard deviations are given in brackets. * and ** denote statistical significance at the 5% and 1% level, respectively.

| | ***HK*** | ***ID*** | ***JP*** | ***KO*** | ***MY*** | ***PH*** | ***SG*** | ***TA*** | ***TH*** | **Mean** | **Abs (Mean)** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $\beta_{fx}$ | 0.764 | 1.834 | -13.502 | -7.779 | -11.756 | -9.184 | -8.243 | -5.152 | -12.652 | -7.297 | 7.874 |
| **Std** | (0.375)* | (1.093) | (0.467)** | (1.014)** | (0.641)** | (0.466)** | (0.433)** | (0.598)** | (0.753)** | [5.531] | [4.553] |
| $\beta_{fx}^{d}$ | 1.194 | 5.930 | -2.793 | 3.417 | -0.363 | 0.481 | 0.059 | -1.364 | -1.687 | 0.542 | 1.921 |
| **Std** | (0.657) | (1.913)** | (0.819)** | (1.776) | (1.123) | (0.816) | (0.759) | (1.047) | (1.318) | [2.704] | [1.869] |
| $\beta_{fx}^{a}$ | -1.016 | -3.773 | 1.089 | -3.075 | -0.082 | 0.245 | 0.002 | 0.014 | 1.156 | -0.604 | 1.162 |
| **Std** | (0.671) | (1.951) | (0.835) | (1.81) | (1.144) | (0.833) | (0.774) | (1.067) | (1.344) | [1.733] | [1.377] |
| $\beta_{fx}+\beta_{fx}^{d}$ | 1.957** | 7.764** | -16.295** | -4.362** | -12.118** | -8.703** | -8.184** | -6.516** | -14.339** | -6.755 | 8.915 |
| $\beta_{fx}+\beta_{fx}^{d}+\beta_{fx}^{a}$ | 0.942* | 3.991** | -15.205** | -7.436** | -12.201** | -8.457** | -8.182** | -6.501** | -13.182** | -7.359 | 8.455 |
| **% change** | 0.233 | 1.176 | 0.126 | -0.044 | 0.038 | -0.079 | -0.007 | 0.262 | 0.042 | 0.0085 | 0.0738 |

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**Sovereign Debt Markets in Euro-zone: Implications for Capital Markets Integration**

G. N. Naidu and Askar Choudhury

## Abstract

This paper examines the impact of the financial crisis of 2007-2008 on the Euro-zone markets integration by analyzing their sovereign debt markets convergence/ divergence to see if the Euro-zone stock markets are moving towards integration. As economic integration of Euro-zone proceeds under the banner of the Single Market Europe, it is vital to observe the degree of economic harmonization that exist in these member countries at different economic cycles. Thus, the purpose of this research is to explore the yield spreads on government debt across the Euro-zone nations at different time periods to observe if the spreads display any divergent trend over time.

Analysis suggests that, time period 2008-2010 is a significant predictor for the government debt volatility of these countries financial stability and thus their economy's strength. This indicates that the country's yield spread and thus government debt is time dependent. Therefore, a country's financial stability and thus their economic status (or level) would depend on the economic cycle. However, results also indicate that financial crisis has impacted some of the countries more than the others. Thus, exhibiting differences in economic stability (or strength) among the countries and therefore, this has important implications for the economic policy makers in the Euro-zone countries.

## I. Introduction and Background

It is widely accepted that European market integration is dependent on the successful common monetary policy as well as the fiscal discipline exercised by the member nations. The common monetary policy administered by the European Central Bank is expected to harmonize the short-term interest rates in the Euro-zone. However, fiscal policies of member nations administered by individual governments have not been in harmony. Growth and Stability Pact placed limits on debt loads and budget deficits as percent of GDP. Violation of these fiscal norms occurred even before the financial crisis of 2007-2008. Fiscal divergences only grew bigger and much more widespread among the Euro-zone members after the financial crisis. The present study seeks to analyze the economic convergence/ divergence of Euro-zone countries in order to discover whether or not the Euro-zone will stabilize from the fiscal point of view. In order to gain an understanding of Euro-zone's fiscal conditions, it is important for us take a short walk along the memory lane.

Maastricht treaty was expected to foster fiscal and economic convergence among the Euro-zone countries. With this expectation Euro-zone's sovereign debt markets showed remarkable convergence of interest rates (risk-free rates) at the outset. The stock markets also showed an early but feeble trend towards integration (Naidu and Choudhury, 2008 & 2010). The financial crisis of 2008 struck a devastating blow to the fiscal health of several Euro-zone countries (see Graph-1). Their sovereign debt markets began to diverge. German bond yields stayed low and steady. However, the bond yields in other Euro-zone countries began to rise.

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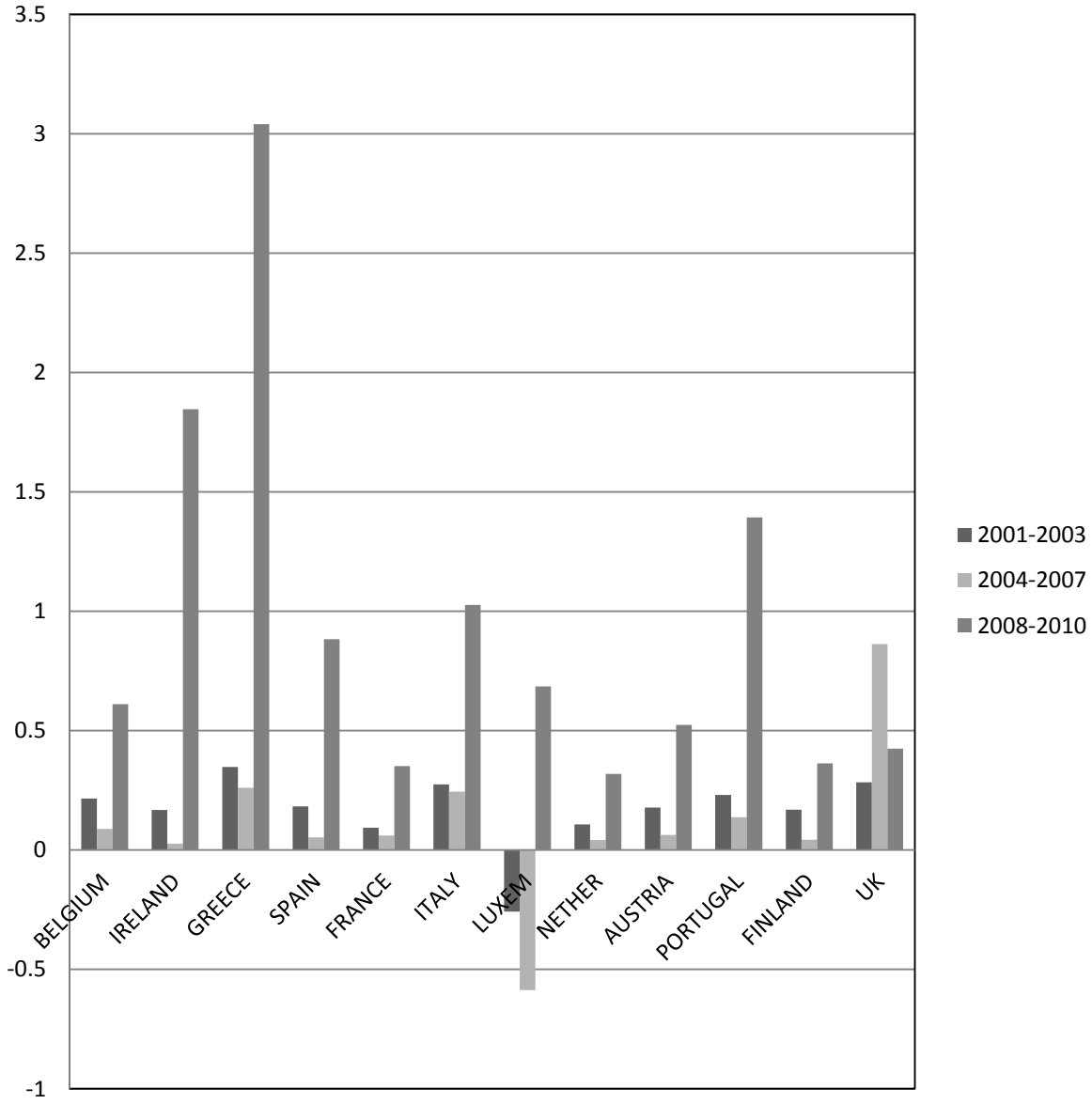
Graph-1: Graph of average yield spread by countries
(2001-2003, 2004-2007, 2008-2010)




The purpose of this research is to explore the yield spreads on government debt across all the Euro-zone nations over time period 2001 to 2010 to observe if the spreads display widening divergent trends. The main questions we aim at answering are: Which are the countries that contributed in the divergence of yield spreads? What is the magnitude of observed variability of yield spread before and after financial crisis? This paper aims to provide evidence on the significance of sovereign debt markets convergence as a necessary condition for Euro-zone capital market integration.

TABLE-1: Summary statistics of yield spreads in the Euro-zone (2001-2003)

| Variable | N | Mean | Std Dev | Minimum | Maximum |
|---|---|---|---|---|---|
| BELGIUM | 36 | 0.2158333 | 0.0992652 | 0.0800000 | 0.4100000 |
| IRELAND | 36 | 0.1677778 | 0.0832933 | 0.0200000 | 0.2800000 |
| GREECE | 36 | 0.3475000 | 0.1369958 | 0.1500000 | 0.6100000 |
| SPAIN | 36 | 0.1830556 | 0.1136616 | 0.0400000 | 0.3700000 |
| FRANCE | 36 | 0.0927778 | 0.0395410 | 0.0300000 | 0.1700000 |
| ITALY | 36 | 0.2741667 | 0.0946686 | 0.1400000 | 0.4600000 |
| LUXEM | 36 | -0.2577778 | 0.4227536 | -1.1200000 | 0.3000000 |
| NETHER | 36 | 0.1069444 | 0.0513152 | 0.0100000 | 0.1900000 |
| AUSTRIA | 36 | 0.1777778 | 0.0941158 | 0.0100000 | 0.3400000 |
| PORTUGAL | 36 | 0.2308333 | 0.1117746 | 0.0300000 | 0.4400000 |
| FINLAND | 36 | 0.1691667 | 0.0826136 | 0.0300000 | 0.2700000 |
| UK | 36 | 0.2838889 | 0.1946466 | 0.0700000 | 0.7500000 |

## II. Data and Research Methodologies

For this study, we collected yields on 10-year government bonds from European Central Bank's data source. Yield spreads are calculated using German Bund yield as the benchmark reference rate. The data was divided into three time periods (2001-2003, 2004-2007, and 2008-2010) for each country in order to facilitate the comparisons. These time periods can be thought of as different stage of economic integration, such as, initial stage (2001-2003), intermediate stage (2004-2007), and tertiary stage (2008-2010).

TABLE-2: Summary statistics of yield spreads in the Euro-zone (2004-2007)

| Variable | N | Mean | Std Dev | Minimum | Maximum |
|---|---|---|---|---|---|
| BELGIUM | 48 | 0.0887500 | 0.0455522 | 0.0300000 | 0.2000000 |
| IRELAND | 48 | 0.0268750 | 0.0577285 | -0.0500000 | 0.2400000 |
| GREECE | 48 | 0.2604167 | 0.0521029 | 0.1300000 | 0.3500000 |
| SPAIN | 48 | 0.0535417 | 0.0365239 | 0 | 0.1600000 |
| FRANCE | 48 | 0.0600000 | 0.0307357 | 0.0200000 | 0.1400000 |
| ITALY | 48 | 0.2447917 | 0.0535541 | 0.1400000 | 0.3600000 |
| LUXEM | 48 | -0.5866667 | 0.5953698 | -1.3300000 | 0.4700000 |
| NETHER | 48 | 0.0418750 | 0.0376239 | -0.0200000 | 0.1300000 |
| AUSTRIA | 48 | 0.0633333 | 0.0393205 | 0 | 0.1400000 |
| PORTUGAL | 48 | 0.1379167 | 0.0670649 | 0 | 0.2800000 |
| FINLAND | 48 | 0.0422917 | 0.0566903 | -0.0500000 | 0.1700000 |
| UK | 48 | 0.8622917 | 0.2068738 | 0.4800000 | 1.1900000 |

We hypothesize that the yield spread should be more or less similar for all Euro-zone countries and converge over time for them to have economic harmonization. Tables1-3 presents summary statistics of yield spread for Euro-zone countries at three different time periods. We observe (see, Tables 1-3) that the average yield spread is lower for the periods 2001-2003 and 2004-2007 compared to the period 2008-2010. Standard deviations of yield spread also follow the similar pattern; indicating that the yield spread is more erratic lately, specifically after the

financial crisis and thus the economic harmonization of these countries are in jeopardy. Greece is being in the worst place with an average yield spread of 3.0394 and standard deviation of yield spread of 2.8065 immediately followed by Ireland and Portugal with average yield spread of 1.8466 and 1.3922, and standard deviation of yield spread 1.3571 and 1.1454 respectively. Therefore, we analyze the distribution of yield spread for all countries to observe any deviations from the central location and also the volatility of yield spread. Graph 1 also depicts the same information of average yield spread for three different time periods. Regression analysis is employed as a statistical methodology to test the hypothesis of equality of average yield spreads for three different time periods to identify the degree of differences between the time periods. Thus, indentifying the time period at which the economic divergence of the union is exceedingly significant. Subsequent regression models included different sets of countries to identify the country effect on the yield spreads.

TABLE-3: Summary statistics of yield spreads in the Euro-zone (2008-2010)

| Variable | N | Mean | Std Dev | Minimum | Maximum |
|---|---|---|---|---|---|
| BELGIUM | 36 | 0.6105556 | 0.2451232 | 0.2200000 | 1.1100000 |
| IRELAND | 36 | 1.8466667 | 1.3570830 | 0.2200000 | 5.6900000 |
| GREECE | 36 | 3.0394444 | 2.8065087 | 0.3700000 | 9.1000000 |
| SPAIN | 36 | 0.8822222 | 0.6058011 | 0.1500000 | 2.4700000 |
| FRANCE | 36 | 0.3508333 | 0.1215701 | 0.1200000 | 0.6300000 |
| ITALY | 36 | 1.0269444 | 0.3888284 | 0.3700000 | 1.6900000 |
| LUXEM | 36 | 0.6847222 | 0.3179711 | 0.3000000 | 1.4100000 |
| NETHER | 36 | 0.3183333 | 0.1616964 | 0.1000000 | 0.6900000 |
| AUSTRIA | 36 | 0.5236111 | 0.2360527 | 0.1900000 | 1.1400000 |
| PORTUGAL | 36 | 1.3922222 | 1.1453611 | 0.2800000 | 4.3800000 |
| FINLAND | 36 | 0.3630556 | 0.1856697 | 0.1100000 | 0.8000000 |
| UK | 36 | 0.4247222 | 0.2644616 | -0.0200000 | 0.9000000 |

A multiple regression analysis was applied to assess the significance and magnitude of time-period effect on yield spread of these Euro-zone countries to observe the effect of financial crisis. In the multiple regression model for this study, independent variables were primarily indicators of three time periods to observe the convergence/divergence of the economic integration over time. In addition to the primary independent variable, time-periods; the analysis also included country indicator variables to control for country differences on the yield spread. However, subsequent regression analysis were employed that are only country specific for the last three years of time period due to the significance of this specific time period

Thus, a multiple regression model was run using SAS software (see, SAS/STAT User's Guide, 1993) on two different types of factors; namely time-periods and countries. Time-period is to measure the effect of one of the three time periods on the yield spread for these countries. This factor is designed as indicator variables ("1" or "0") to test the hypothesis of yield spread widening in recent years (time-period) as a measure for economic performance in attaining the economic harmony of the union. The specification of the regression model takes the following form:

$$Yield\_Spread = \beta_{1,1}Period_1 + \beta_{1,2}Period_2 + \beta_{1,3}Period_3 + \beta_{2,1}Country_1 + ..... + \beta_{2,11}Country_{11} + \varepsilon \quad ..... \quad (2)$$

Where:
*Yield_Spread*: Difference between German Bund yield and a country bond yield.
*Period*: Time-periods: 2001-2003, 2004-2007, 2008-2010 (indicator variable: 1 or 0),
*Country*: A specific country=1, else=0.

TABLE 4: Regression results of three different periods on yield spread.

| **Analysis of Variance** | | | | | |
|---|---|---|---|---|---|
| **Source** | **DF** | **Sum of Squares** | **Mean Square** | **F Value** | **Pr > F** |
| **Model** | 3 | 412.83998 | 137.61333 | 257.98 | <.0001 |
| **Error** | 1437 | 766.53232 | 0.53343 | | |
| **Corrected Total** | 1440 | 1179.37230 | | | |
| **R-Square** | 0.3501 | | **Adj R-Sq** | 0.3487 | |

| **Parameter Estimates** | | | | | |
|---|---|---|---|---|---|
| **Variable** | **DF** | **Parameter Estimates** | **Standard Error** | **t Value** | **Pr > \|t\|** |
| PERIOD1 | 1 | 0.16600 | 0.03514 | 4.72 | <.0001 |
| PERIOD2 | 1 | 0.10795 | 0.03043 | 3.55 | 0.0004 |
| PERIOD3 | 1 | 0.95528 | 0.03514 | 27.19 | <.0001 |

*Note: Periods (three different time periods):*
*Period1=2001-2003, Period2=2004-2007, Period3=2008-2010*

## III. DISCUSSION OF EMPIRICAL RESULTS

Monthly data for Euro-zone countries were obtained. Summary statistics of yield spread appear in Table 1 for the period 2001-2003, in Table 2 for the period 2004-2007, and in Table 3 for the period 2008-2010. As discussed above, average yield spread is highest during the period of 2008-2010 and also the variability of yield spread is highest during that period. This can also be observed through Graph 1. Greece displays the highest average yield spread and also the volatility of yield spread during 2008-2010. This leads us to examine the phenomenon of capital market integration of the union in two phases. In the first phase, we run regression analysis with all Euro-Zone countries (except for UK to avoid perfect collinearity) on the yield spread using all ten years of data. Regression result indicates the significant effect of third time-period (2008-2010) on the yield spread (see Table-4). Similar result is also observed in Table-5 even after controlling for country effects. This leads us to the second phase of regression analysis that uses the data only from the last three years (2008-2010) to observe the differences of country effects on the yield spread to avoid any confounding effect.

TABLE 5: Regression results of third period and countries on yield spread.

| **Analysis of Variance** | | | | | |
|---|---|---|---|---|---|
| **Source** | **DF** | **Sum of Squares** | **Mean Square** | **F Value** | **Pr > F** |
| **Model** | 12 | 335.08165 | 27.92347 | 62.57 | <.0001 |
| **Error** | 1427 | 636.83317 | 0.44627 | | |
| **Corrected Total** | 1439 | 971.91482 | | | |
| **R-Square** | 0.3448 | | **Adj R-Sq** | 0.3393 | |

| **Parameter Estimates** | | | | | |
|---|---|---|---|---|---|
| **Variable** | **DF** | **Parameter Estimates** | **Standard Error** | **t Value** | **Pr > \|t\|** |
| **Intercept** | 1 | 0.31076 | 0.06206 | 5.01 | <.0001 |
| **PERIOD3** | 1 | 0.82245 | 0.03842 | 21.41 | <.0001 |
| **BELGIUM** | 1 | -0.27408 | 0.08624 | -3.18 | 0.0015 |
| **IRELAND** | 1 | 0.05758 | 0.08624 | 0.67 | 0.5044 |
| **GREECE** | 1 | 0.56275 | 0.08624 | 6.53 | <.0001 |
| **SPAIN** | 1 | -0.21650 | 0.08624 | -2.51 | 0.0122 |
| **FRANCE** | 1 | -0.40042 | 0.08624 | -4.64 | <.0001 |
| **ITALY** | 1 | -0.06925 | 0.08624 | -0.80 | 0.4221 |
| **LUXEM** | 1 | -0.66408 | 0.08624 | -7.70 | <.0001 |
| **NETHER** | 1 | -0.41317 | 0.08624 | -4.79 | <.0001 |
| **AUSTRIA** | 1 | -0.32175 | 0.08624 | -3.73 | 0.0002 |
| **PORTUGAL** | 1 | -0.01542 | 0.08624 | -0.18 | 0.8582 |
| **FINLAND** | 1 | -0.38092 | 0.08624 | -4.42 | <.0001 |

The following results address research question of similarities/dissimilarities of average yield spreads between time periods for the Euro-zone countries. This is to infer whether the union will converge or diverge in the long run. Comparing the three different time periods using regression (without 'intercept' to avoid perfect collinearity), the analysis (three indicator categories for three time periods) shows a significant difference in the mean yield spread ($F=257.98$, $p < 0.0001$, see Table-4). Period 2008-2010 shows the highest levels of yield spread ($\mu=.9553$), the next highest level is period 2001-2003 ($\mu=0.1660$). The lowest average yield spread period is 2004-2007 ($\mu=.1080$). This show that the economic integration started sound at the initial stage (2001-2003), and then improved further at the intermediate stage (2004-2007); only to collapse later during 2008-2010 time periods. Moreover, results also indicate that period 2008-2010 differs significantly from the other two periods. While the results of these analyses show a significant difference in yield spread over time, further study would help to identify which time period is contributing the most for these yield spread differences and thus contributory to the economic divergence.

The multiple-regression model (with all three periods included) accounts for 35.01% variation (see, Table-4) in the yield spread ($R^2=.3501$), among these, period 2008-2010 is the strongest ($t=27.19$, $p < 0.0001$) indicator variable to account for yield spread divergence. However, to control for country specific differences on the yield spread we have run a regression

model that also include countries as a categorical variable (eleven indicator variables for twelve countries to avoid perfect collinearity). This regression model accounts for 34.48% variation (see, Table-5) in the yield spread ($R^2$=.3448) and period 2008-2010 (Period-3) is still highly significant (t=21.41, p < 0.0001) indicator variable to account for yield spread divergence. In addition, interaction between time-periods and countries indicate that yield spread of a country is dependent on economic cycle. Thus, suggesting that some of these countries are not economically strong enough to withstand different economic cycle (specifically, economic downturn) and thus economic integration of these countries may not be viable to be in the union.

TABLE 6: Regression results on yield spread after controlling for countries in third period.

| **Analysis of Variance** | | | | | |
|---|---|---|---|---|---|
| **Source** | **DF** | **Sum of Squares** | **Mean Square** | **F Value** | **Pr > F** |
| **Model** | 11 | 256.36882 | 23.30626 | 23.48 | <.0001 |
| **Error** | 420 | 416.86575 | 0.99254 | | |
| **Corrected Total** | 431 | 673.23457 | | | |
| **R-Square** | 0.3808 | | **Adj R-Sq** | 0.3646 | |

| **Parameter Estimates** | | | | | |
|---|---|---|---|---|---|
| **Variable** | **DF** | **Parameter Estimates** | **Standard Error** | **t Value** | **Pr > \|t\|** |
| **Intercept** | 1 | 0.42472 | 0.16604 | 2.56 | 0.0109 |
| **BELGIUM** | 1 | 0.18583 | 0.23482 | 0.79 | 0.4292 |
| **IRELAND** | 1 | 1.42194 | 0.23482 | 6.06 | <.0001 |
| **GREECE** | 1 | 2.61472 | 0.23482 | 11.13 | <.0001 |
| **SPAIN** | 1 | 0.45750 | 0.23482 | 1.95 | 0.0520 |
| **FRANCE** | 1 | -0.07389 | 0.23482 | -0.31 | 0.7532 |
| **ITALY** | 1 | 0.60222 | 0.23482 | 2.56 | 0.0107 |
| **LUXEM** | 1 | 0.26000 | 0.23482 | 1.11 | 0.2688 |
| **NETHER** | 1 | -0.10639 | 0.23482 | -0.45 | 0.6507 |
| **AUSTRIA** | 1 | 0.09889 | 0.23482 | 0.42 | 0.6739 |
| **PORTUGAL** | 1 | 0.96750 | 0.23482 | 4.12 | <.0001 |
| **FINLAND** | 1 | -0.06167 | 0.23482 | -0.26 | 0.7930 |

Subsequent multiple regression analysis is used to further explore the study using only the last time-period (Period-3) data to observe the differential effect of Euro-zone countries (without UK to avoid perfect collinearity) on the yield spread during this 2008-2010 time period. This multiple-regression model (with all eleven countries) accounts for 38.08% variation (see, Table-6) in the yield spread ($R^2$=0.3808), among these, only five PIIGS countries (namely Portugal, Ireland, Italy, Greece, and Spain) are highly statistically significant with positive parameter estimates indicating that these countries together contributes most to the higher yield spread and thus account for yield spread divergence. However, to avoid any confounding effect that may be due to country specific differences on the yield spread we have run another regression model that only include PIIGS countries as a categorical variable (five indicator variables for five countries). This second regression model accounts for 37.44% variation (see,

Table-7) in the yield spread ($R^2$=0.3744), among these, Greece is still the strongest (t=14.51, p < 0.0001) country to account for yield spread divergence with respect to core Euro-zone countries. These findings combined suggest that period 2008-2010 is the most significant predictor of yield spread divergence economic cycle. This indicate that European Union countries are moving further apart in recent years, specifically after the financial crisis, with respect to economic integration and thus may result in union disintegration. However, necessary fiscal policy reforms by the PIIGS countries assisted by the ECB and stronger members of Euro-zone countries may be able to reverse this economic divergence in the future and keep the union intact.

TABLE 7: Regression results of PIIGS countries on yield spread in third period.

| **Analysis of Variance** | | | | | |
|---|---|---|---|---|---|
| **Source** | **DF** | **Sum of Squares** | **Mean Square** | **F Value** | **Pr > F** |
| **Model** | 5 | 252.07050 | 50.41410 | 50.99 | <.0001 |
| **Error** | 426 | 421.16407 | 0.98865 | | |
| **Corrected Total** | 431 | 673.23457 | | | |
| **R-Square** | 0.3744 | | **Adj R-Sq** | 0.3671 | |

| **Parameter Estimates** | | | | | |
|---|---|---|---|---|---|
| **Variable** | **DF** | **Parameter Estimates** | **Standard Error** | **t Value** | **Pr > \|t\|** |
| **Intercept** | 1 | 0.46798 | 0.06264 | 7.47 | <.0001 |
| **PORTUGAL** | 1 | 0.92425 | 0.17716 | 5.22 | <.0001 |
| **IRELAND** | 1 | 1.37869 | 0.17716 | 7.78 | <.0001 |
| **ITALY** | 1 | 0.55897 | 0.17716 | 3.16 | 0.0017 |
| **GREECE** | 1 | 2.57147 | 0.17716 | 14.51 | <.0001 |
| **SPAIN** | 1 | 0.41425 | 0.17716 | 2.34 | 0.0198 |

## IV. CONCLUSION

In this study we have examined the impact of financial crisis on the economic integration of Euro-zone countries for three different time periods. Preliminary analysis through mean comparisons from summary statistics tables (Tables 1-3) provided the fact that the time-periods and country effect are significant factors on the yield spread. We also observed that the country's yield spread and thus government debt is time dependent. Thus, a country's financial stability and therefore their economic status (or level) would depend on the economic cycle. The economic cycle 2008-2010 found to be the most statistically significant predictor for the government debt volatility. Results indicate that primarily PIIGS countries (Portugal, Ireland, Italy, Greece, and Spain) were deeply impacted by this recent financial crisis. Regression analysis also provided similar conclusions of the effect of financial crisis. Regression models without controlling for country effects and also after controlling for country effect displayed the same results that financial crisis has impacted some of the countries more than the others. Thus, exhibiting difference in economic stability (or strength) among these Euro-zone countries and thus questioning the economic integration of the union.

Findings from this study have important implications for capital markets integration and the future of the Euro-zone itself. Despite the differences among individual countries, their performance on the yield spread was impacted by the recent financial crisis. Therefore, the relationship of yield spread difference with respect to economic cycle for different countries does appear significant in this research study. This predictive power of country's economic/financial cycle (time-period) dependent performance on the government debt does not depend on whether and how long they have been with the union. Rather, it may depend on the social and political environment of these countries. These findings are consistent with the hypothesis that an efficient economic development process is very much interrelated with the country's economic stability. Therefore, the results of this study indicate that the financial crisis influence on the country's economic progression is dependent on the country and may be its fiscal and other socio-economic policies. Thus, the countries with wider yield spreads may be a hindrance to the process of full market integration in the Euro-zone.

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**Reexamining Performance of Socially Responsible Firms**

Tarek Zaher

## Abstract

This study reexamines the controversy surrounding "Doing well while doing well" debate within the investment literature. We retest whether investors who are dedicated to socially responsible investing will realize additional returns or will be penalized for their investment philosophy. We control for the size bias and sector concentration bias that were identified in previous studies. Our findings indicate that there is no difference in performance between the socially responsible firms and their conventional counterparts. The Investors who chose to invest in socially responsible firms will not earn additional return nor will be penalized. The findings also suggest that there is no difference in the performance of socially responsible and conventional firms over long periods versus short periods. Our findings also indicate that the constraints that are placed on an investment decision would lower or leave unchanged the maximum utility that an investor may obtain.

## I. Introduction

Investors who base their decisions on a company's social and environmental policies have recently moved into the mainstream. According to the Social Investment Forum, Socially responsible investing now captures one out of every eight-investment dollar in the US, and accounts for more than $2 trillion in investment assets under managements. Some studies report that recent evidence on the performance of socially responsible funds runs counter to previously held wisdom that investors seeking to do good with their money have to be satisfied with lower returns. Other studies provide evidence that lend support to the notion that the performance of socially responsible firms or funds is not significantly different from the performance of the universe of conventional firms or funds in the short run, but in the long run the market tend to price social responsibility characteristics. The evidence in these studies suggests that long term performance of socially responsible firms was better than overall market. At this time it is inconclusive whether socially responsible investing would add value to its followers. Many recent studies also asserts that ethical and moral screening of firms is likely to affect the asset structure, portfolio diversification and also introduce size and other biases into the portfolio, thus negatively affecting the performance of the socially responsible portfolios.

The objective of the study is to reexamine the extent to which socially responsible investing affects the characteristics of assets that investors include in their portfolios and the performance of these portfolios. Can Investors do well on their investments while doing well? Conclusive evidence may indicate a change in the investment philosophy of some investors. In particular we retest whether investors who are dedicated to socially responsible investing will realize additional returns or will be penalized for their investment philosophy. We control for the size bias and sector concentration biases that were identified in previous studies. We match socially responsible firms with conventional firms of the same size (measured by total assets) from the same sector. We also test if there is difference in the performance over long periods versus short periods**.**

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The remainder of the paper is organized as follows: Section II presents the literature review. Section III; provide a short narrative of the data and the research methodology. Data analysis and results are presented in Section IV and in section V; we present the summary and conclusion.

## II. Literature Review

The existing literature on the socially responsible funds has mainly focused on the relative performance of fund returns. The majority of studies have compared the risk adjusted returns of socially responsible funds to conventional funds. The studies by Asmundson and Forester (2001), Cummings (2000), and Statman (2000) indicate that on a risk adjusted basis, there is no difference in performance between socially responsible and conventional funds. The same conclusion was reached by Malin (1995) Hamilton et al. (1993), Goldreyer and Diltz (1999), Bauer et al. (2005), Ferson and Schadt's (1997). On the other hand the studies by Reyes and Grieb (1998) present evidence that some socially responsible funds underperformed the market during the 1980s and outperformed the broader market in the 1990s.

The second line of studies on socially responsible investing argue that because ethical and moral screening may impose an additional set of constraints on the investors it will likely affect the characteristics of the assets they include in the portfolio, the portfolio diversification and portfolio performance. These studies include Rudd (1981), Grossman and Sharp (1986), Hall (1986) and Diltz (1995). Rudd (1981) in addition argues that socially responsible investing introduces size bias with consequent deterioration in the run performance. Chow (1999) also argues that social and environmental filters would move investors away from investment in old-line industrial manufacturers leading to a bias in socially screened portfolio towards high tech and growth investments. Grossman and Sharp (1986) also argue that any constraint placed on any decision can only lower or leave unchanged the maximum utility that can be obtained. Ahmed and Diltz (1999) find that application of social screens does not have an effect on the investment performance.

## III. Data Sources and Research Method

The main objective of the study is to reinvestigate empirically the controversy surrounding "Doing well while doing well" debate within the socially responsible investment literature. The focus of previous studies was on comparing the performance of existing socially responsible funds and conventional funds. Rudd (1981) predicts that social screening introduces size bias into a socially responsible fund and therefore impairs portfolio diversification and long run investment performance. His hypothesis is that constrained portfolios are more likely to contain small firms thus resulting in higher systematic risk. In this study we control for the size bias by comparing the performance of selected individual firms that are widely recognized as socially responsible to their peers of conventional firms.

The sample of socially responsible firms is drawn initially from ten socially responsible funds that are recognized as the most socially responsible Large Cap funds. These includes Acquinas Growth, American Trust Allegiance, Calvert Social Investment Equity, Citizens Core Growth A. Devcap Shared Return, Domini Social Equity A, Dreyfus Premier 3rd Century A,

Green Equity, MMA Praxis, Neuberger Berman S. R. A. Parnassas Fund and Walden Social Equity. These funds were given their social responsible investing classifications by the Social Investing Forum at www.socialinvest.org. The top 50 stocks holdings of these funds were identified. The firms were then sorted by sector and matching firms with similar size were identified from the conventional firms in the same sector. This also allows us to test if there is difference in the performance across different sectors. Seven sectors were identified as holding socially responsible funds; these are reported in table 1. Another shortcoming of the previous studies is that they were performed mostly over short periods of time. In this study we test if there is difference in the performance of firms over long periods versus short periods.

The monthly return and size data were collected from CRSP and COMPUSTAT tapes. The three months Treasury bill rate extracted from the Federal Reserve web site was used as a proxy for the risk free rate in the regression. The analysis was performed over the whole period of study (1998-2007) and was repeated for a shorter period, June 2002-June 2007 to examine if the performance changes over different periods.

We use two alternative measures of performance to compare the performance of socially responsible firms and their peers of conventional firms. The Jensen's alpha $\alpha_p$; and Sharp information ratio, $S_p$. The Jensen's alpha depends on beta as a measure of the risk of the portfolio. We estimate the Jensen's alpha $\alpha_p$ as**:**

$$r_{pt} = \alpha_p + \beta_p r_{mt} + \varepsilon_{pt}, \qquad (1)$$

*Where* $r_{pt}$, is the excess return ( i.e., the observed return minus the risk free rate) on the portfolio *p* in month *t,* $r_{mt}$ is the excess return on the benchmark portfolio in month *t,* $\beta_{p,}$ is portfolio *p*'s beta, and $\varepsilon_{pt}$ is the residual term during period *t.*

The second measure of investment performance is the Sharp information ratio. This statistic measures the portfolio's average return in excess of a benchmark portfolio divided by the standard deviation of the excess return. The information ratio is calculated as

. $$IR_j = (R_{,}-R_b)/\sigma_{ER} \qquad (2)$$

Where:

$IR_j$ = the information ratio for portfolio j

$R_j$ = the average return for portfolio *j* during

$R_b$ = the average return for the benchmark portfolio

$\sigma_{ER}$ = the standard deviation of the excess return

Since the excess portfolio returns are estimated with historical data using the same single factor model to estimate Jensen's alpha, the IR simplifies to

$$IR_{j} = \alpha_j/\sigma_e \qquad (3)$$

Where $\sigma_e$ *is* the standard error from the regression

To convert the information ratio that is based on a periodic returns measured T times per year to annualized information ratio we used the following formula,

Annualized IR = $(T)\alpha_j/(T\text{^}0.5)\sigma_e = (T\text{^}0.5)IR \qquad (4)$

Since we are using monthly data, we, compute the annualized information ratio by multiplying the monthly IR calculated from equation (3) by the square root of 12 as shown in equation (4). Grinold and Khan (2000) suggest that reasonable information ratio should fall between 0.50 and

1.0. Annualized Information ratio of 0.5 indicates good performance and an IR of 1.0 indicates exceptional performance.

## IV. Results

Empirical analysis was performed on eight portfolios of socially responsible firms and their eight matching peers of conventional firm's portfolios. Descriptive statistics for each of the sixteen portfolios and the performance measures are reported in tables I through table IV.

Table I reports monthly returns means, average standard and coefficient of variation for eight portfolios of socially responsible firms representing each of the seven identified sectors and the portfolio that contains all the sample of the socially responsible firms. The same descriptive statistics were calculated for the matching portfolios of conventional firms. Wilcoxon two-sample rank sum test was also computed to compare the characteristics of the two sets of portfolios. The Z scores for the difference in means of monthly return, average standard deviation and average coefficient of variation are 0.338, 0.507, and 1.589 respectively, indicating that none of the descriptive statistics of socially responsible combined portfolio is significantly different from that of matching conventional portfolio over the long period 1998-2207. We repeat the test over the shorter period 2002-2007. The Z scores for the difference in means of monthly return, average standard deviation and average coefficient of variation are 0.336, 0.007, and 0.00189 respectively. The Z scores for the descriptive statistics over the short period are also statistically not significant. These results indicate that after controlling for the size of the firm the investment characteristics of socially responsible firms are not different from the conventional firms.

Table II reports the beta estimates from the regression and the estimated measures of performance (Jensen's alpha and Sharp IR) for the portfolios of socially responsible firms and portfolios of conventional firms over the (January 1998-June 2007) period. The Jensen alpha was computed from equation (1) using NASDAQ equally weighted index from the CRSP as a benchmark. Sharp IR is calculated by dividing the estimated alpha from the regression in equation (1) by the regression standard error. This statistics is then annualized by multiplying the monthly IR by the square root of 12.

The Jensen's alpha estimates are positive and statistically significant for the conventional firms in all sectors except for the health care sector, but it is not statistically significant for the all sectors portfolio of conventional firms. The alpha estimates for the portfolios of socially responsible firms are all positive and are significant for basic materials, industrial goods, services, technology and all sectors portfolio, but not significant for the consumer goods, financials and health care sectors. The Z score for the difference in performance of 1.690 is significant at the 10% level indicating that socially responsible firms outperform their conventional peers. However, this conclusion is not supported by the results of information ratio. The Z-score of 1.352 suggests that there is no difference in the performance of the socially responsible firms and conventional firms. Both socially responsible portfolios and conventional portfolios outperformed the market but have comparable performance. The IR figures of 1.18 for the socially responsible all sector portfolio and 1.39 for conventional all sectors portfolio indicate exceptional performance for both portfolios. The IR estimates for conventional firms in the

sectors indicate good performance for all the sectors except the health care sector. The IR estimates for socially responsible firms indicate mostly good performance within the sectors too.

Table-I Descriptive Statistics of Socially Responsible Firms and Conventional Firms
Jan 1998 to Jun 2007

| | **Socially Responsible Firms** | | | **Conventional Firms** | | |
|---|---|---|---|---|---|---|
| Sector | **Mean** | **Std dev** | **CV** | **Mean** | **Std dev** | **CV** |
| Basic Materials | 0.022809 | 0.107074 | 4.694418 | 0.024984 | 0.099784 | 3.993924 |
| Consumer Goods | 0.009775 | 0.051952 | 5.314767 | 0.017086 | 0.07471 | 4.372625 |
| Financials | 0.012496 | 0.083991 | 6.721608 | 0.014995 | 0.064042 | 4.270877 |
| Health Care | 0.012292 | 0.084183 | 6.848367 | 0.01733 | 0.099944 | 5.767108 |
| Industrial Goods | 0.027439 | 0.141381 | 5.152606 | 0.019847 | 0.082231 | 4.143136 |
| Services | 0.022961 | 0.07957 | 3.465464 | 0.018682 | 0.073529 | 3.935866 |
| Technology | 0.023469 | 0.103528 | 4.411248 | 0.022472 | 0.108022 | 4.807019 |
| All Sectors | 0.018156 | 0.063472 | 3.496026 | 0.020444 | 0.067944 | 3.32335 |

Table I reports monthly returns mean, average standard deviation and average coefficient of variation of portfolios of socially responsible firms and peer conventional firms. The Z scores for the difference in means of monthly return, average standard deviation and average coefficient of variation are 0.338, 0.507, and 1.589 respectively.
* Significant at the 5% level
** Significant at the 10% level

The results of performance comparison over the long period using the IR measure in table III indicate that the performance of socially responsible firms is not significantly different from the performance of their conventional firm peers. These results weaken the results we got from the Jensen alpha comparisons. The Z-scores for the difference in betas' means is also

Statistically not significant, indicating that there is no difference in the systematic risk between the socially responsible firms and conventional peers

Table-II Performance of portfolios of Socially Responsible Firms and Conventional Firms, Jan 1998 to June 2007

| | **Socially Responsible Firms** | | | **Conventional Firms** | | |
|---|---|---|---|---|---|---|
| Sector | Beta | Jensen α | Sharp IR | Beta | Jensen α | Sharp IR |
| Basic Materials | 1.21102 | 0.015084** | 0.564192 | 0.898922 | 0.018486* | 0.698303 |
| Consumer Goods | 0.537289 | 0.0047 | 0.352514 | 0.703424 | 0.011357** | 0.578083 |
| Financials | 1.470381 | 0.00375 | 0.253684 | 0.718507 | 0.009207** | 0.577366 |
| Health Care | 0.974049 | 0.005499 | 0.265563 | 1.123013 | 0.009951 | 0.399678 |
| Industrial Goods | 1.172203 | 0.019866** | 0.522593 | 0.546928 | 0.014734* | 0.647125 |
| Services | 1.162016 | 0.015429* | 0.889025 | 1.00913 | 0.011751* | 0.703591 |
| Technology | 1.815953 | 0.013365* | 0.733657 | 1.9598 | 0.011802* | 0.663645 |
| All Sectors | 1.232949 | 0.010344* | 1.180225 | 0.401713 | 0.012204 | 1.391535 |

Table II provides a comparison of portfolio performance using the Jensen's alpha and sharp information ratio across all the sectors. Jensen alpha was computed from equation (1). The information ratio was calculated from equation (3) and equation (4). The Z scores for the performance measures, Jensen alpha and the information ratio are 1.690, ** and 1.352 respectively. The Z score for the risk measure Beta is 0.845.

* Significant at the 5% level

** Significant at the 10% level

Table-III Descriptive Statistics of Socially Responsible Firms and Conventional Firms, Jun 2002 to Jun 2007

| | **Socially Responsible Firms** | | | **Conventional Firms** | | |
|---|---|---|---|---|---|---|
| **Sector** | **Mean** | **Std dev** | **CV** | **Mean** | **Std dev** | **CV** |
| Basic Materials | 0.033016 | 0.08975 | 2.718364 | 0.040624 | 0.091426 | 2.250564 |
| Consumer Goods | 0.011749 | 0.039165 | 3.333486 | 0.029157 | 0.075041 | 2.573661 |
| Financials | 0.013871 | 0.068347 | 4.927261 | 0.011822 | 0.045849 | 3.878329 |
| Health Care | 0.014197 | 0.069337 | 4.88387 | 0.01293 | 0.087045 | 6.732233 |
| Industrial Goods | 0.040547 | 0.119173 | 2.939112 | 0.018341 | 0.058084 | 3.166896 |
| Services | 0.02261 | 0.065216 | 2.884345 | 0.017241 | 0.058564 | 3.396832 |
| Technology | 0.021761 | 0.072508 | 3.331987 | 0.022632 | 0.08386 | 3.705359 |
| All Sectors | 0.019395 | 0.048765 | 2.514343 | 0.022892 | 0.058212 | 2.542888 |

Table III reports monthly returns mean, average standard deviation and average coefficient of variation of portfolios of socially responsible firms and peer conventional firms. The Z scores for the difference in means of monthly return, average standard deviation and average coefficient of variation are 0.336, 0.007, and 0.00189 respectively.

* Significant at the 5% level

** Significant at the 10% level

The results of performance measures analysis over the shorter period 2002-2007 in table IV support the findings over the long period. The alpha estimates for the socially responsible firms are statistically significant for basic material sector and services sector and all sectors portfolio and insignificant for the remaining sectors. The alpha estimates for the conventional firms are also significant for the all sectors portfolio, the basic materials sector and consumer goods sector only and insignificant for the remaining sectors. However the results of the Wilcoxon two-sample test indicate that there is no significant difference in the alpha estimate indicated by the Z-scores of 1.1833 which suggest that there is no significant difference in the performance of socially responsible firms and conventional firms. The results of the annualized Sharp information ratio analysis provide support to the findings from the alpha measure analysis. The performance of the conventional firms and the socially responsible firms are comparable.

Table-IV Performance of portfolios of Socially Responsible Firms and Conventional Firms, Jun 2002 to June 2007

| | **Socially Responsible Firms** | | | **Conventional Firms** | | |
|---|---|---|---|---|---|---|
| Sector | Beta | Jensen α | Sharp IR | Beta | Jensen α | Sharp IR |
| Basic Materials | 1.310377 | 0.01971** | 0.865049 | 1.105996 | 0.029035* | 1.194393 |
| Consumer Goods | 0.69803 | 0.00359 | 0.39465 | 1.173881 | 0.016998* | 0.915669 |
| Financials | 1.6292 | -0.00212 | -0.17958 | 0.897614 | 0.001985 | 0.196808 |
| Health Care | 1.342007 | 0.000625 | 0.040903 | 1.300771 | -0.0003 | -0.01351 |
| Industrial Goods | 1.505127 | 0.025604 | 0.81647 | 0.008655 | 0.879674 | 0.591542 |
| Services | 1.416929 | 0.008408* | 0.646074 | 0.004078 | 1.293271 | 0.359339 |
| Technology | 1.703469 | 0.00515 | 0.398559 | 2.115416 | 0.002558 | 0.198577 |
| All Sectors | 1.335527 | 0.005877* | 1.069348 | 1.575224 | 0.007359* | 1.054193 |

Table IV provides a comparison of portfolio performance using the Jensen's alpha and sharp information ratio across all the sectors. Jensen alpha was computed from equation (1). The information ratio was calculated from equation (3) and equation (4). The Z scores for the performance measures, Jensen alpha and the information ratio are 1.8593, ** and 0.676 respectively. The Z score for the risk measure Beta is 0.6776.
* Significant at the 5% level
**Significant at the 10% level

The evidence presented in this paper has clear implications for socially responsible investors. Investment practices of socially responsible firms do not differ from those of their peers of conventional firms with similar assets size. These findings are consistent with the findings of Asmundson and Forester (2001), Cummings (2000), Statman (2000), Malin (1995) Hamilton et al. (1993), Goldreyer and Diltz (1999), Bauer et al. (2005) and Ferson and Schadt's (1997). Our findings also support the findings of Sharp (1986) who asserts that the constraints that are placed on an investment decision would lower or leave unchanged the maximum utility that an investor may obtain. Furthermore, our findings do not rule out the possibility of a size bias in some of the existing socially responsible funds as indicated by Rudd (1981).

## V. Conclusion

In this study we investigated the extent to which socially responsible investing affects the characteristics of assets that investors include in their portfolios and the performance of these portfolios. Recent studies assert that ethical and moral screening of firms is likely to affect the asset structure, portfolio diversification and also introduce size and other biases into the portfolio, thus negatively affecting the performance of the socially responsible portfolios. In our study we retest whether investors who are dedicated to socially responsible investing will realize additional returns or will be penalized for their investment philosophy. To control for the size bias and sector concentration bias that were identified in previous studies, we match socially responsible firms with conventional firms of the same size from the same sector. We also test if there is difference in the performance over long periods versus short periods.

Our findings suggest that there is no difference in performance between the socially responsible firms and their conventional counterparts with similar assets size. The findings also suggest that there is no difference in the performance of socially responsible and conventional firms over long periods versus short periods. The Investors who chose to invest in socially responsible firms will not earn excess return nor will be penalized.

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# Governance and Regulatory Determinants of Financial Markets Resilience - Cross Country Evidence

Jamshed Y. Uppal and Inayat Ullah Mangla

## Abstract

The study seeks to identify factors that made some countries more susceptible than others to the impact of the global financial crisis (GFC), and factors that made some more resilient and better able to recover from its adverse impact. Results suggest that different sets of variables best explain the experience of the stock markets in the period following the onset of GFC, than during the recovery period. Developed countries experienced a sharper decline in their stock markets and higher relative volatility following the GFC compared to the emerging markets but also experienced a flatter recovery in the level and volatility of the stock markets. The extent of stock trading and a greater reliance on the international capital inflows prior to the on-set of GFC is associated with subsequent sharper fall and higher volatility in the markets.

## I. Introduction

The global financial crisis of 2007-09 (GFC) has impacted countries across the globe, though its impact has been varied in severity as well as in duration; some economies have been affected more than others, and some have rebounded quicker than others. Stock markets in Ireland, Belgium, Croatia, and Greece, for example, dropped by over 50% following the onset of GFC, while stock indices of Indonesia, Brazil, Chile, India lost less than 5%. Likewise, the market volatility in some countries greatly increased compared to others (e.g., Iceland, USA) over the first two years of the GFC period. Figure 1 depicts varied experience of various countries as to the markets indices and relative volatility during the first two year of GFC (crash period), and the subsequent recovery period, 2009-2011. Statistics are provided in Table 1, showing the GFC's impact on different markets and the subsequent recovery.

The present study's objective is to empirically identify economic, financial and regulatory determinants which may explain the experience of a cross-section of countries as to (i) the initial impact of GFC, (ii) recovering from the external shock of the GFC. We start by hypothesizing a number of economic and financial characteristics of the economies that may influence the vulnerability of a country to external shocks, and the characteristics that may help it to recover from such shocks. These factors are suggested by previous related studies, and include variables reflecting the structure of the economy and financial markets. We also include a set of governance indicators which may help a country in absorbing the adverse impact from external shocks and recovering from it.

A particular factor in exacerbating the financial crisis is attributed to the fact that in many countries the regulatory and governance structure lagged behind the innovations and increasing complexity in the financial products. As the powerful forces of globalization and information technology revolution reshaped the financial markets, the legal and regulatory capacity failed to evolve alongside. Financial services firms on the other hand also indulged in *regulatory avoidance* to circumvent regulation. The recent episode of financial crisis seems to be similar to the interplay of market innovation and regulatory response suggested by Kane (1988). The cycle

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of *avoidance-reregulation-avoidance* is triggered by changes in the market and technological environment. Markets adapt to such changes in the form of innovation, avoidance and circumvention of regulation. The resulting conflict calls for new regulations, which are, however, followed by another round of avoidance. Kane describes it in Hegelian terms as "a delayed reaction to interacting dialectical processes." The conflicting elements play out as *thesis* and *antithesis*, and evolve into a new policy *synthesis*. However, the new synthesized policy mix generates its own contradictions in the dialectical process. This on-going process of conflict resolution is a particular source of volatility in the financial markets. Kane (1988) considers financial instability as a cost of inefficient financial regulation. Therefore, we want to focus on the quality of governance and regulatory framework which could affect the vulnerability and resilience of a country to external shocks.

The next section discusses the concepts of vulnerability, resilience and the related literature. It is followed by section III describing the data and the empirical methodology. Section IV describes the set of determinants of resilience and vulnerability included in the empirical models. Results are discussed in section V. The last section concludes the paper.

## II. Economic Vulnerability and Resilience

The concept of *economic vulnerability* was first explored by Briguglio (1995). A number of empirical studies (for example, Briguglio, 2003; Crowards, 2000; and Atkins et al., 2000) showed that small states, particularly the island states, tend to be economically more vulnerable than other countries. This tendency has been attributed to a high degree of economic openness and export concentration. These structural characteristics lead to a higher exposure to exogenous shocks, which could magnify the economic fluctuations and the risks in economic growth. Cordina (2004a and 2004b) shows that higher variability in economic growth rate can also adversely affect the economic growth itself.

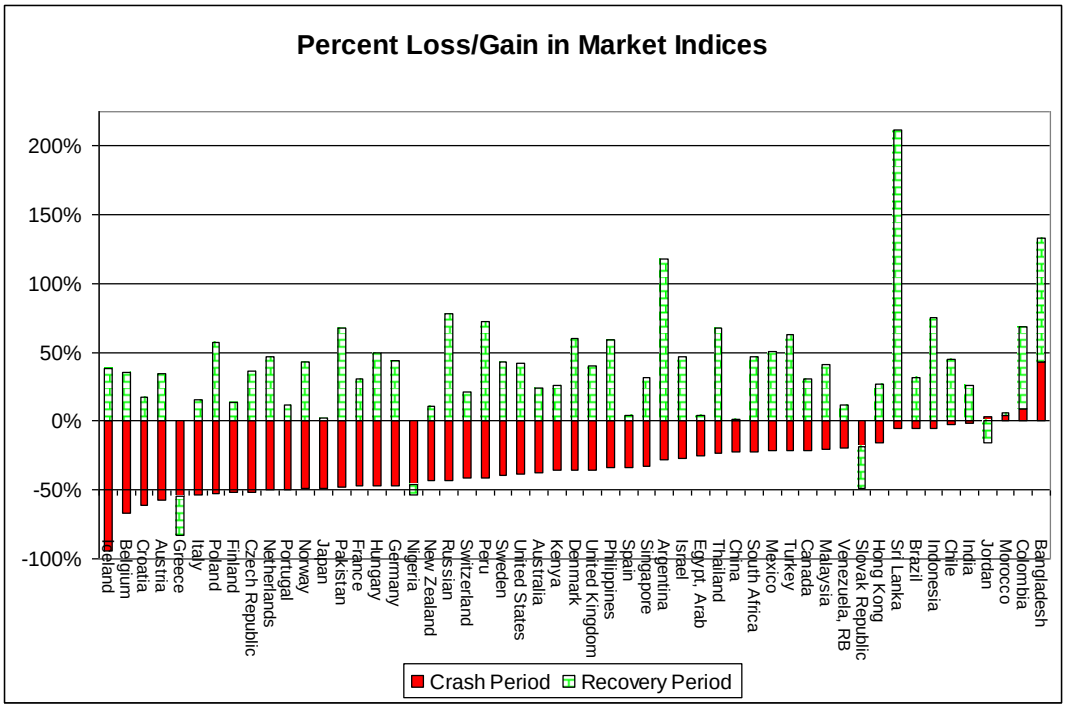
The term '*resilience*' is generally understood to mean the ability to recover quickly from the effect of an adverse incident.[1] Briguglio (2003) observed that some small states are able to generate relatively higher GDP per capita despite their higher vulnerability to external economic shocks. He termed this phenomenon as the "*Singapore Paradox*". Singapore although being highly exposed to external shocks, has yet managed to sustain relatively higher rates of economic growth and higher GDP per capita. He explains this paradox in terms of the ability of Singapore to build its *economic resilience* by structuring the economy so that it may offset the disadvantages associated with its economic vulnerability. Briguglio (2003; 2004) refers to the economic vulnerability as reflecting an economy's inherent features which are permanent or quasi-permanent. On the other hand, economic resilience is *nurtured* and associated with "man-made measures, which enable a country to withstand or bounce back from the negative effects of external shocks." As Briguglio et al. (2009) note, the term has been used in the economics literature in at least three senses relating to the ability to (a) recover quickly from a shock,

[1] Merriam-Webster defines resilience as 1) the capability of a strained body to recover its size and shape after deformation caused especially by compressive stress, 2) an ability to recover from or adjust easily to misfortune or change; origin, Latin *resilire*, to jump back, recoil.

"*shock-counteraction*"; (b) withstand the effect of a shock, "*shock-absorption*"; and (c) avoid the adverse impact of shocks, the *shock avoidance* as the obverse of economic vulnerability.

**Figure 1: Impact of the Global Financial Crisis**

**A: % Change in Market Indices**

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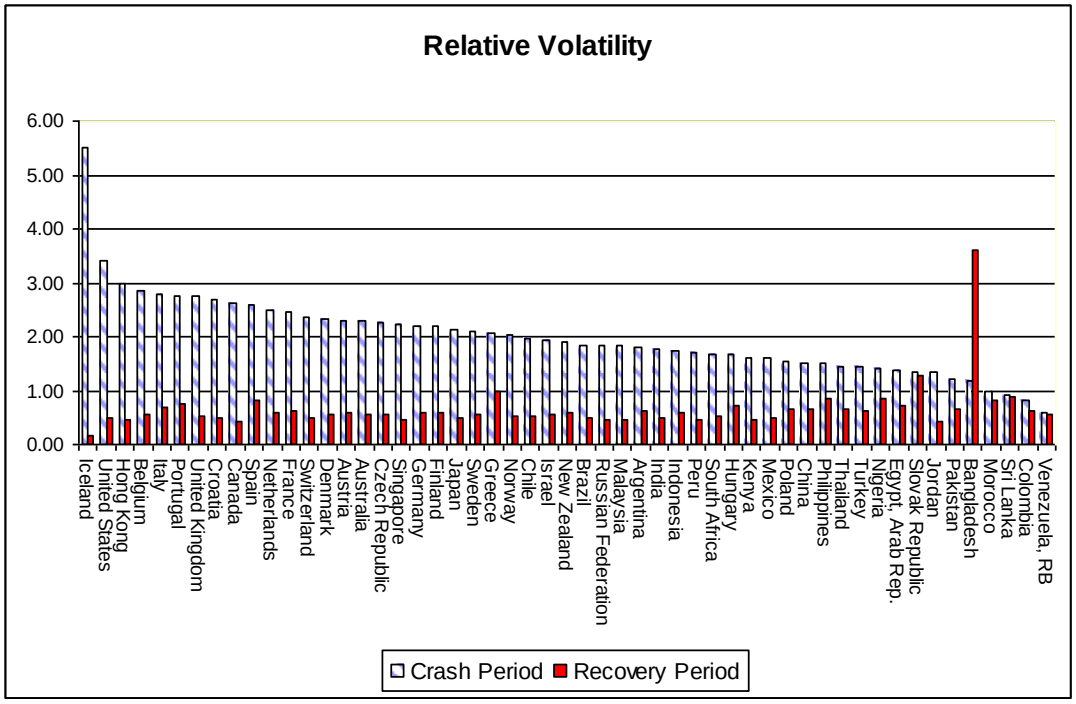
**B: Relative Change in Market Volatility**



## Table 1: Data Sample and Summary Statistics

| A: Emerging Markets | | Change in Market Index | | Relative Volatility | | B: Developed Markets | | Change in Market Index | | Relative Volatility | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Crash Period | Recovery Period | Crash Period | Recovery Period | | | Crash Period | Recovery Period | Crash Period | Recovery Period |
| 1 | Argentina | -28% | 118% | 1.81 | 0.62 | 1 | Australia | -37% | 24% | 2.29 | 0.55 |
| 2 | Bangladesh | 43% | 90% | 1.17 | 3.62 | 2 | Austria | -57% | 35% | 2.31 | 0.59 |
| 3 | Brazil | -5% | 32% | 1.85 | 0.48 | 3 | Belgium | -67% | 35% | 2.85 | 0.55 |
| 4 | Chile | -2% | 45% | 1.97 | 0.53 | 4 | Canada | -21% | 31% | 2.61 | 0.43 |
| 5 | China | -23% | 1% | 1.51 | 0.65 | 5 | Croatia | -61% | 18% | 2.68 | 0.48 |
| 6 | Colombia | 9% | 59% | 0.81 | 0.62 | 6 | Czech Republic | -52% | 36% | 2.26 | 0.55 |
| 7 | Egypt, | -25% | 4% | 1.38 | 0.72 | 7 | Denmark | -36% | 60% | 2.33 | 0.55 |
| 8 | India | -1% | 26% | 1.76 | 0.48 | 8 | Finland | -52% | 14% | 2.19 | 0.60 |
| 9 | Indonesia | -5% | 76% | 1.72 | 0.59 | 9 | France | -47% | 31% | 2.45 | 0.63 |
| 10 | Jordan | 3% | -15% | 1.33 | 0.42 | 10 | Germany | -47% | 44% | 2.20 | 0.59 |
| 11 | Kenya | -36% | 26% | 1.61 | 0.46 | 11 | Greece | -54% | -28% | 2.06 | 0.98 |
| 12 | Malaysia | -21% | 41% | 1.82 | 0.46 | 12 | Hong Kong | -16% | 27% | 2.98 | 0.46 |
| 13 | Mexico | -22% | 50% | 1.61 | 0.48 | 13 | Hungary | -47% | 50% | 1.67 | 0.73 |
| 14 | Morocco | 4% | 3% | 0.99 | 0.81 | 14 | Iceland | -94% | 39% | 5.50 | 0.17 |
| 15 | Nigeria | -46% | -7% | 1.40 | 0.85 | 15 | Israel | -28% | 46% | 1.92 | 0.57 |
| 16 | Pakistan | -48% | 68% | 1.22 | 0.64 | 16 | Italy | -54% | 15% | 2.80 | 0.70 |
| 17 | Peru | -42% | 73% | 1.71 | 0.47 | 17 | Japan | -49% | 3% | 2.12 | 0.49 |
| 18 | Philippines | -33% | 59% | 1.51 | 0.84 | 18 | Netherlands | -50% | 47% | 2.48 | 0.60 |
| 19 | Russian Fed | -43% | 78% | 1.84 | 0.47 | 19 | New Zealand | -43% | 11% | 1.91 | 0.60 |
| 20 | South Africa | -22% | 46% | 1.68 | 0.52 | 20 | Norway | -49% | 43% | 2.02 | 0.51 |
| 21 | Sri Lanka | -5% | 212% | 0.92 | 0.88 | 21 | Poland | -53% | 57% | 1.53 | 0.66 |
| 22 | Thailand | -23% | 68% | 1.45 | 0.66 | 22 | Portugal | -50% | 12% | 2.76 | 0.75 |
| 23 | Turkey | -22% | 63% | 1.44 | 0.62 | 23 | Singapore | -33% | 31% | 2.22 | 0.46 |
| 24 | Venezuela, RB | -19% | 12% | 0.59 | 0.54 | 24 | Slovak Republic | -19% | -30% | 1.33 | 1.29 |
| | | | | | | 25 | Spain | -33% | 4% | 2.59 | 0.82 |
| | | | | | | 26 | Sweden | -40% | 43% | 2.10 | 0.54 |
| | | | | | | 27 | Switzerland | -42% | 21% | 2.36 | 0.50 |
| | | | | | | 28 | United Kingdom | -36% | 41% | 2.75 | 0.53 |
| | | | | | | 29 | United States | -39% | 43% | 3.42 | 0.49 |
| *Average:* | | -17.2% | 51.2% | 1.46 | 0.73 | *Average:* | | -45.0% | 27.7% | 2.44 | 0.60 |
| *Std Deviation* | | 20.9% | 47.9% | 0.36 | 0.63 | *Std Deviation* | | 15.5% | 21.8% | 0.74 | 0.19 |
| *Minimum* | | -48.0% | -15.5% | 0.59 | 0.42 | *Minimum* | | -94.0% | -30.2% | 1.33 | 0.17 |
| *Maximum* | | 42.9% | 211.8% | 1.97 | 3.62 | *Maximum* | | -15.6% | 60.4% | 5.50 | 1.29 |

***Full Sample Summary Statistics***

| | | | | |
|---|---|---|---|---|
| *Average:* | -32.4% | 38.3% | 2.00 | 0.66 |
| *Std Deviation* | 22.7% | 37.6% | 0.77 | 0.45 |
| *Minimum* | -94.0% | -30.2% | 0.59 | 0.17 |
| *Maximum* | 42.9% | 211.8% | 5.50 | 3.62 |

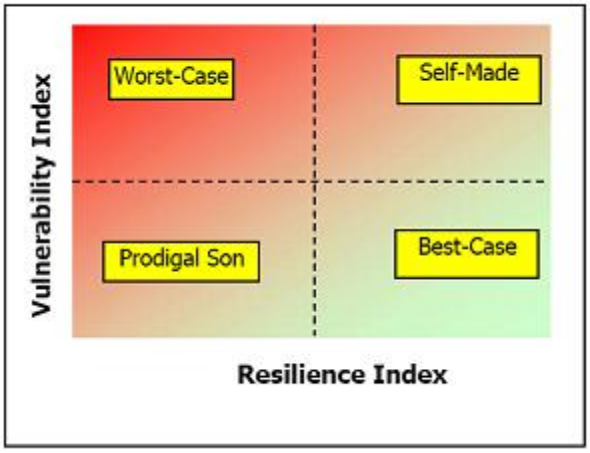
*Source: Authors' calculations based on market data from the Data Stream International.*

In his conceptual framework, Briguglio (2004) identifies four possible cases into which countries may be classified according to their vulnerability and resilience characteristics. He terms these as "*best-case*", "*worst-case*", "*self-made*", and "*prodigal son*".

- "Self-made" countries have a high degree of inherent economic vulnerability, but have adopted offsetting policies to build their economic resilience, thereby reducing the overall exposure to external shocks.
- Countries termed as "prodigal son" are characterized by a relatively low degree of inherent economic vulnerability, but have adopted policies that increase their exposure to exogenous shocks.
- The "best-case" scenario countries are not inherently highly vulnerable and adopt resilience-building policies as well.
- The "worst-case" is of the countries that are not only highly vulnerable and but also adopt policies that exacerbate the negative effects of their vulnerability

.

**Figure 2**




These four cases are illustrated in Figure 2, where the inherent economic vulnerability and nurtured resilience are measured on the vertical and horizontal axes, respectively. Briguglio et al. (2009) go on further to construct vulnerability and resilience indices for eighty seven countries, which we use in this study. The composition of these indices is explained in the next section.

## III. Data and Methodology

Considering the time-line of the progression of the GFC, we mark the onset of the down turn in the stock markets as the first of July, 2007, and the beginning of the recovery as of July 1, 2009, when the recession was officially declared to have ended in the USA. We go back about two years to establish a base case. Therefore, our study spans a time period from July 1, 2005 to

March 4, 2011, subdivided into the following three sub-periods:

July 1, 2005 to June 30, 2007 – the *Base Period*, 520 trading days.

July 1, 2007 to June 30, 2009 – the *Crash Period*, 521 trading days.

July 1, 2009 to March 4, 2011 – the *Recovery Period*, 437 trading days.

The impact of the GFC is the dependent variable measured in its two dimensions. The first is the impact on the level of stock prices, measured as a percentage drop in the market indices from the beginning of the crash period to its end. And likewise, we measure the gain in the markets indices over the recovery period. The second dimension is the relative market volatility during one period relative to its observed level in the previous period. Thus relative volatility in the crash period is the ratio $\boldsymbol{\sigma_{i,\text{ crash period}}}$ / $\boldsymbol{\sigma_{i,\text{ base period}}}$, and $\boldsymbol{\sigma_{i,\text{ recovery period}}}$ / $\boldsymbol{\sigma_{i,\text{ crash period}}}$

for the recovery period where $\sigma_i$ is the raw standard deviation of the first log differences of the ith stock market index. Market data was obtained from the DataStream International.

A list of the countries included in the sample in placed as Table 1, along with the observed changes in the market indices and relative volatility over the crash and recovery periods. Summary statistics are also placed at the bottom of the list. There are 24 emerging and 29 developed markets in the sample. The developed markets experienced an average decline of 45% compared to a 32% decline for the emerging markets over the crash period. Similarly, the developed markets' volatility was 2.44 times in the crash period relative to the base period, while the corresponding relative volatility of the emerging markets was 1.46 times. However, over the recovery period, the emerging markets' gains were higher (51%) compared to the developing markets' gains (28%).

Percent losses/gains and the relative volatility of individual market's returns over the crash and recovery periods are then further used in the cross-country regression on various measures of economic, financial market characteristics and governance indicators. We start with a broad set of theoretically feasible determinants (fifteen variables) and employ step-wise linear regression to narrow down to the most parsimonious models. Forward/backward selection criteria were used with a cut-off statistical significance level of 20%.

## IV. Feasible Set of Determinants

### *A. Economic Vulnerability and Resilience Indices*

As mentioned before Briguglio, Cordina, Farrugia, and Vella (2009), henceforth called the BCFV, developed the concept of economic vulnerability and resilience and constructed indices to represent the two constructs.

1. The BCFV *economic vulnerability index* is "based on the premise that a country's proneness to exogenous shocks stems from a number of inherent economic features, including high degrees of economic openness, export concentration and dependence on strategic imports." Economic openness is measured as the ratio of international trade to the GDP. Export concentration is measured by the UNCTAD index on merchandise trade. Dependence on strategic imports is measured as the ratio of the imports of energy, food or industrial supplies to GDP.

2. BCFV *economic resilience index* is based on the following variables:

- Macroeconomic stability constructed on the basis of three variables namely: (i) the fiscal deficit to GDP ratio, (ii) the sum of the unemployment and inflation rates, and (iii) the external debt to GDP ratio.
- Microeconomic market efficiency based on the indicators reflecting (i) the size of government, and (ii) the freedom to trade internationally.
- Good governance as indicated by the Economic Freedom of the World Index has a component which reflects legal structure and security of property rights. The Index is based on the following indicators: (i) judicial independence, (ii) impartiality of courts, (iii) the protection

of intellectual property rights, (iv) military interference in the rule of law; and (v) political system and the integrity of the legal system.

- Social development index utilizes the education and health indicators used to construct the Human Development Index of the UNDP.

### *B. Economic and Financial Market Indicators*

We include the following indicators characterizing the economy and financial markets as theoretically feasible determinants of the vulnerability and resilience of the stock markets to the global financial crisis. These indicators, except for the last one, were extracted from the World Bank's online databank of World Development Indicators (WDI) and Global Development Finance (GDF).[1]

1. Financing via international capital markets (gross inflows, % of GDP), "INT-FINANCING". Accessing capital through international capital markets may render a country vulnerable to sudden stoppage of capital inflows. But it could also be a factor in reviving the capital markets through inbound international capital flows.

2. Market capitalization of listed companies (% of GDP), "MARKET-CAP." Market capitalization reflects not only the size of the markets, but also the maturity and depth of the markets. It may also indicate the extent to which complex financial products are available.

3. Stocks traded, total value (% of GDP), "STOCK-TRADING." The relative volume of stocks traded would indicate the role of the stock market in the economy.

4. Stocks traded, turnover ratio (%), "TURN-OVER." The ratio of total volume to the market capitalization indicates an active and liquid market, and a capacity to absorb adverse shocks. However, excessive turnover might also indicate a speculative market.

5. GDP (constant 2000 US$). A larger economy is likely to have greater capacity to absorb shocks in one sector of the economy. We use the natural log of the GDP as an explanatory variable, LnGDP.

6. Natural log of GDP per capita (constant 2000 US$) is used as "LnPerCAPITA. It would indicate the degree of economic development, and also be a proxy for concomitant developed institutional capacity for making and executing appropriate policies for absorbing and taking offsetting measures.

7. Systematic Risk (BetaWRLD). Each market's systematic risk factor is measured over the base period with respect to the Morgan Stanley Capital International World Index using the single factor model: $R_{i,t} = \alpha_i + \beta_i R_{W,t} + \varepsilon_{i,t}$ , where $R_i$ and $R_w$ are respectively the first log differences of market index for country i and MSCI-World index, using daily observations. The

[1] http://databank.worldbank.org/ddp/home.do

$\beta_i$ should indicate the sensitivity of the country i's stock market to the overall world index representing a global market place.

### *C. Governance Indicators*

In order to capture the governance environment in different countries we use aggregate governance indicators for the year 2007 developed at the World Bank. A detailed discussion can be found in Kaufmann, Kraay, and Mastruzzi (2004). The six indicators are as follows:
1. *Voice and Accountability*, the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and free media.

2. *Political Stability and Absence of Violence*, the perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including political violence and terrorism.

3. *Government Effectiveness*, the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.

4. *Regulatory Quality*, the ability of the government to formulate and implement sound policies and regulations which permit and promote private sector development.

5. *Rule of Law*, the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, the police, and the courts, as well as the likelihood of crime and violence.

6. *Control of Corruption*, the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.

We hypothesize that the increase in the cross-country market volatility in the wake of the GFC is negatively related to the effectiveness of regulation and the quality of governance environment. Effective governance mechanism and financial regulations in a country are likely to lessen the initial impact of the GFC. Effective governance environment should also help in managing an effective response in terms of monetary and fiscal policies, leading to a quicker economic recovery and subsiding of the market volatility.

## V. Results and Discussion

The results of the empirical estimation are reported in Table 2; Panels A and B report results for the crash period and the recovery period respectively. Each panel is sub-divided into two sections for the two regression models; in section (i) decline/increase in the market indices is the dependent variable, in section (ii) relative increase/decline in the volatility is the dependent variables. Discussion of the results follows.

### *A. Crash Period Results (Table 2 - Panel A)*

In section (i) the dependent variable is the percent change in the markets indices over the period, the step-wise regression results in the selection of five explanatory variables, TURNOVER, CONTROL-OF-CORRUPTION, POLITICAL-STABILILTY, LnGDP and LnPerCAPITA. All of these are significant at 5% or better level, except for POLITICAL-STABILILTY with a *p-value* of 8.8%. Its coefficient also has an unexpected negative sign, implying that countries with higher scores on this indicator suffered relatively greater decline in their markets. The negative sign could be driven by the indicator's positive correlation with the level of development. This observation is supported by the significant and negative coefficient of the LnPerCapita variable. It reflects the fact that the Global Financial Crisis of 2007-09 originated in the sub-prime real estate sector in the US and had an immediate impact on the most developed economies. As to the size of the economy, however, the positive sign of the LnGDP indicates that for smaller economies the negative economic impact has been larger than for the developed economies. Positive coefficient of the CONTROL-OF-CORRUPTION indicator is as expected since better governance should be associated with a lower decline in the stock markets. The coefficient on the TURNOVER variable is negative, meaning that markets with higher turnovers experienced a greater drop in their markets indices. The market turnover could be reflecting an element of speculation preceding the GFC, which was followed by a bubble burst triggered by the down-turn in the sub-prime real estate market.

In the second section of Panel A, results are presented for the regression model when the dependent variable is the relative market volatility. The selected model consists of four independent variables, RESILIENCE, STOCK TRADED, CONTROL-OF-CORRUPTION and ACCOUNTABILTY. The coefficient of CONTROL-OF-CORRUPTION has the expected sign, but is not significant at the conventional levels. However, ACCOUNTABILTY and the RESILIENCE indices are significant but of unexpected positive signs, implying that countries scoring higher on these indicators experienced a relatively higher levels of volatility. The positive sign on the STOCK TRADED indicates that more active, and probably speculative markets, also experienced relatively higher levels of volatility following the financial shocks.

### *B. The Recovery Period Results (Table 2 – Panel B)*

Section (i) of Panel B of Table 2 reports results for the model where percent change in the markets over the recovery period is the dependent variable. Five variables are included in the final set, RESILIENCE, VULNERABILITY, POLITICAL-STABILITY, BETA-WRLD, and LnGDP, which are all statistically significant at 5% or better level. RESILIENCE and BETAWRLD are of the expected sign, indicating that countries scoring high on these indicators experienced a sharper recovery in their stock markets. The VULNERABILITY index has a negative sign as expected. However, POLITICAL-STABILITY has an unexpected negative sign. LnGDP's negative sign indicates that markets in larger economies gained relatively less than the markets in the smaller economies.

**TABLE 2: RESULTS OF STEPWISE REGRESSIONS**

**PENAL A: CRASH PERIOD**

| ***Section (i)*** | **DEPENDENT VARIABLE: % CHANGE IN INDICES** | | |
|---|---|---|---|
| Regression F(5,47) | 7.3698 | Adj. R Squared | 0.3798 |
| Significance Level of F | 0.0000 | Durbin-Watson | 1.8716 |
| Variable | Coefficient | T-Statistics | Significance |
| 1. Constant | -0.8242 | -1.5631 | 0.1247 |
| 2. TURNOVER | -0.1673 | -3.0550 | 0.0037 |
| 3. CONTROL_OF_CORRUPTION | 0.1356 | 2.3442 | 0.0233 |
| 4. POLITICAL_STABILITY | -0.0905 | -1.7410 | 0.0882 |
| 5. LNGDP | 0.0640 | 2.7777 | 0.0078 |
| 6. LNPCAPITA | -0.1261 | -2.6542 | 0.0108 |

| ***Section (ii)*** | **DEPENDENT VARIABLE: RELATIVE VOLATILITY** | | |
|---|---|---|---|
| Regression F(4,48) | 14.4266 | Adj. R Squared | 0.5081 |
| Significance Level of F | 0.0000 | Durbin-Watson | 1.9390 |
| Variable | Coefficient | T-Statistics | Significance |
| 1. Constant | 0.8263 | 2.6511 | 0.0108 |
| 2. RESILIENCE | 1.7892 | 2.3810 | 0.0213 |
| 3. STOCKS TRADED | 0.3498 | 2.6253 | 0.0116 |
| 4. CONTROL_OF_CORRUPTION | -0.2573 | -1.3149 | 0.1948 |
| 5. VOICE_AND_ACCOUNTABILITY | | 0.3526 | 2.4350 |
| 0.0187 | | | |

**PANEL B: RECOVERY PERIOD**

| ***Section (i)*** | **DEPENDENT VARIABLE % CHANGE IN INDICES** | | |
|---|---|---|---|
| Regression F(5,47) | 4.8382 | Adj. R Squared | 0.2696 |
| Significance Level of F | 0.0012 | Durbin-Watson | 2.3158 |
| Variable | Coefficient | T-Statistics | Significance |
| 1. Constant | 3.6132 | 2.9988 | 0.0043 |
| 2. RESILIENCE | 1.1932 | 2.9124 | 0.0055 |
| 3. VULNERABILITY | -0.7913 | -2.5997 | 0.0124 |
| 4. POLITICAL_STABILITY | -0.3485 | -3.9675 | 0.0002 |
| 5. BETAWRLD | 0.2560 | 2.1730 | 0.0349 |
| 6. LNGDP | -0.1437 | -3.0246 | 0.0040 |

| ***Section (ii)*** | **DEPENDENT VARIABLE RELATIVE VOLATILITY** | | |
|---|---|---|---|
| Regression F(2,50) | 6.1512 | Adj. R Squared | 0.1654 |
| Significance Level of F | 0.0041 | Durbin-Watson | 1.9036 |
| Variable | Coefficient | T-Statistics | Significance |
| 1. Constant | 2.1593 | 4.9795 | 0.0000 |
| 2. INT-FINANACING | -6.5621 | -2.1683 | 0.0349 |
| 3. LNPCAPITA | -0.1597 | -3.4568 | 0.0011 |

In Panel B, section (ii) reports results for regressions where the dependent variable is the relative market volatility. Two variables are selected by the step-wise procedure, INT-FINACING and LnPerCAPITA, both with negative coefficients. The international financing variable captures the extent to which countries were financing via international capital markets (as a % of GDP). It reflects the ability of the countries to attract international capital and, hence, it is expected to lead to calmer markets with lower volatility. The LnPerCAPITA's negative coefficient implies that more developed economies experienced relatively greater decreases in the market volatility.

**EXHIBIT 1: SUMMARY OF SIGNIFICANCE AND SIGNS OF COEFFICIENTS**

| # | Determinant | Crash Period | | | | Recovery Period | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | %Δ Index | | Relative Volatility | | %Δ Index | | Relative Volatility | |
| | | Signifi-cance | Coeff Sign | Signifi-cance | Coeff Sign | Signifi-cance | Coeff Sign | Signifi-cance | Coeff Sign |
| 1 | Vulnerability Index | | | | | ** | - | | |
| 2 | Resilience Index | | | ** | + ? | *** | + | | |
| 3 | International Financing | | | | | | | ** | - |
| 4 | Market capitalization | | | | | | | | |
| 5 | Stocks Traded | | | ** | + | | | | |
| 6 | Turnover Ratio | *** | - | | | | | | |
| 7 | ln(GDP) | *** | + | | | *** | - | | |
| 8 | ln(per capita GDP) | ** | - | | | | | *** | - |
| 9 | BetaWRLD | | | | | ** | + | | |
| 10 | Accountability | | | ** | + ? | | | | |
| 11 | Political Stability | * | - ? | | | *** | - ? | | |
| 12 | Govt. Effectiveness | | | | | | | | |
| 13 | Regulatory quality | | | | | | | | |
| 14 | Rule of law | | | | | | | | |
| 15 | Control of corruption | ** | + | ~ | - | | | | |

Exhibit 1 provides a summary of the statistical significance and signs of the feasible determinants tested in this empirical exercise. It shows that the vulnerability index is significant in explaining change in volatility in the recovery period. The resilience index is significant but of unexpected sign in explaining change in volatility in the crash period. However, it is significant and of the expected sign in the market recovery. The indicators of market characteristics, economy size and economic development do a better job in both periods. Among the governance indicators "Political Stability" and "Accountability" yield unexpected signs; the "Control of Corruption" variable, however, is significant and of the expected sign.

The country differences in the level of development proxied by the per capita income seem to be explaining the variations in the impact on stock market indexes and the volatility in the crash period as well as in the market gains and subsiding of volatility in the recovery period. The shifting signs of the different governance indicators and the Resilience index point out to the problem of multi-collinearity in the explanatory variables, since the governance indexes are

highly correlated within the group and with the LnPerCapita variable. The Resilience index is also highly correlated with the lnPerCapita.

It is evident from the step-wise regression procedure that four different sets of determinants are needed to explain the drop in the market indices and increase in volatility in the crash period and gains in the indices and decline in volatility in the recovery period. It seems logical that one set of circumstances determined the impact of the GFC, and a different set influenced the economic recovery from the shock.

In order to see if one set of explanatory variables can explain the GFC impact in both the crash and the recovery period we employ all the variables identified by the step-wise regression procedure in a series of OLS models as follows. First, we replace the LnPerCapita variable with a dummy variable which takes a value of zero for the emerging markets and of one for the developed markets. Second, in order to reduce the number of explanatory variables and to mitigate the multi-collinearity problem we extract the first principal component (GOVERNANCE-PC) from the six governance indicators; it explains 90% of the variance proportion. Third, we start with a basic model with six independent variables, and then expand the model by including GOVERNANCE-PC, RESILIENCE AND VULNAERABILITY variables, thus forming four models as shown Exhibit 2. We run the four comparative models for both the crash period and the recovery period for the two dependent variables: %change in the market index and relative volatility. The results are presented in Tables 3 and 4.

**EXHIBIT 2: COMPARATIVE MODELS**

| *Independent Variable* | *Model 1* | *Model 2* | *Model 3* | *Model 4* |
|---|---|---|---|---|
| TURNOVER | ✓ | ✓ | ✓ | ✓ |
| LNGDP | ✓ | ✓ | ✓ | ✓ |
| DEVELOPED MKT (Dummy) | ✓ | ✓ | ✓ | ✓ |
| STOCKS TRADED | ✓ | ✓ | ✓ | ✓ |
| BETAWRLD | ✓ | ✓ | ✓ | ✓ |
| INT-FINANACING | ✓ | ✓ | ✓ | ✓ |
| GOVERNANCE-PC | | ✓ | | ✓ |
| RESILIENCE | | | ✓ | ✓ |
| VULNERABILITY | | | ✓ | ✓ |

In Table 3 results for the crash period regressions for the four models are presented. In Panel A the dependent variable is the percent change in the market indices. Out of the four models, model #1, the most parsimonious, should be selected on the basis of the Akaike Information Criteria and the Bayes-Schwartz Criteria. Inclusion of Governance variable or the Resilience and Vulnerability indexes in the extended models does not improve the explanatory power; coefficients on these variables are insignificant as well. The most important factors appear to be the dummy variable for the developed markets, and the "Stocks Traded" variable. Panel B of Table 3 shows the results when the dependent variable is the relative volatility over the crash period. Here too the most parsimonious model #1 appears to be the best explanatory set of variables, which does not include Governance, Resilience or Vulnerability indices.

In Table 4 we present results for the recovery period; panel A and B show results for the four models when the dependent variable is the change in the indices and the relative volatility. Notably none of the model is statistically significant as a whole as indicated by the F-statistics. There is some indication that the larger and developed economies, as indicated by the negative signs of the coefficients of LnGDP and the dummy for developed market in Model 3, experienced weaker recoveries in their market indices. However, as far the relative volatility in the recovery period is concerned none of the variable seems to have much explanatory power

.

## VI. Conclusions

The study aimed at empirically identifying economic, financial and regulatory determinants which may explain the experience of different countries as to the initial impact of the GFC, and their recovery in terms of changes in market indices and market volatility.
Results of the step-wise regressions used to identify the determinant suggests that a different set of variables best explains the experience of different markets in each of the four cases: (i) decline in the market indices in the crash period (ii) increase in the market volatility in the crash period (iii) gain in the market indices in the recovery period and (iv) subsiding of volatility in the recovery period. This finding reflects the fact that the global financial crisis arose due to unique combination of institutional and economic factors and also impacted the economies across the globe through distinct channels and linkages. In the recovery period countries adopted various different measures to deal with the adverse impact of the GFC.

The results suggest that the developed countries (as indicated by the per capital income or a dummy variable) experienced a sharper decline in their stock markets and higher relative volatility following the onset of the GFC compared to the emerging markets. The developed markets also experienced a flatter recovery in the stock markets. It seems that the emerging markets fared better on the down-side as well as the up-side over the course of the GFC. There is also some evidence that the extent of stock trading prior to the on-set of GFC is associated with sharper fall in the markets. The extent of reliance on the international capital inflows seems to also lead to steeper drops in the market indices resulting from the GFC.

In examining comparative models with and without the resilience, vulnerability indices constructed by Briguglio at el (BCFV, 2009) and the governance indicators developed at the World Bank, it appears that these do not provide additional explanatory power beyond the level of economic development and the degree of speculation prior to the crash. The results of the study underscore the need to develop reliable predictors of the financial vulnerability and resilience to external shocks. The need for such indicators cannot be overemphasized in the age of a globally integrated financial and economic systems for assessing and managing systemic risk to financial systems arising through external shocks.

**TABLE 3: RESULTS OF OLS - CRASH PERIOD**

**PANEL A: DEPENDENT VARIABLE: PERCENT CHANGE IN INDICES**

| **Independent** | *Model 1 1* | | | | *Model 2 2* | | | | *Model 3* | | | | *Model 4* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Variable** | **Coef.** | **t-Stat.** | | **Prob.** | **Coef.** | **t-Stat.** | | **Prob.** | **Coef.** | **t-Stat.** | | **Prob.** | **Coef.** | **t-Stat.** | | **Prob.** |
| Constant | -0.9711 | -1.7452 | * | 0.0876 | -0.9850 | -1.7712 | * | 0.0833 | -0.7738 | -1.0873 | | 0.2828 | -1.0153 | -1.4012 | | 0.1683 |
| TURNOVER | -0.1282 | -2.1601 | ** | 0.0360 | -0.1177 | -1.9555 | * | 0.0568 | -0.1291 | -1.9523 | * | 0.0573 | -0.1462 | -2.1974 | ** | 0.0334 |
| LNGDP | 0.0365 | 1.6028 | | 0.1158 | 0.0401 | 1.7418 | * | 0.0884 | 0.0297 | 1.0744 | | 0.2885 | 0.0480 | 1.5836 | | 0.1206 |
| DEVELOPED MKT | -0.3611 | -4.9202 | *** | 0.0000 | -0.4565 | -3.8946 | *** | 0.0003 | -0.3623 | -3.6163 | *** | 0.0008 | -0.4559 | -3.8177 | *** | 0.0004 |
| STOCKS TRADED | 0.0492 | 1.0893 | | 0.2817 | 0.0260 | 0.5161 | | 0.6083 | 0.0529 | 0.9931 | | 0.3261 | 0.0405 | 0.7569 | | 0.4533 |
| BETAWRLD | -0.0033 | -0.0515 | | 0.9592 | -0.0225 | -0.3350 | | 0.7392 | -0.0110 | -0.1624 | | 0.8717 | -0.0399 | -0.5675 | | 0.5734 |
| INT-FINANACING | -3.0341 | -1.8599 | * | 0.0693 | -3.2844 | -1.9938 | * | 0.0523 | -3.0222 | -1.8002 | * | 0.0787 | -3.2112 | -1.9274 | * | 0.0605 |
| GOVERNANCE-PC | | | | | 0.0253 | 1.0430 | | 0.3025 | | | | | 0.0511 | 1.4047 | | 0.1673 |
| RESILIENCE | | | | | | | | | 0.0152 | 0.0741 | | 0.9413 | -0.2972 | -0.9878 | | 0.3288 |
| VULNERABILITY | | | | | | | | | -0.0768 | -0.4609 | | 0.6472 | -0.0088 | -0.0515 | | 0.9592 |
| *Regression Statistics* | | | | | | | | | | | | | | | | |
| Adjusted R-squared | 0.4071 | | | | 0.4083 | max | | | 0.3832 | | | | 0.3965 | | | |
| Durbin-Watson | 2.3787 | | | | 2.2993 | | | | 2.3973 | | | | 2.2784 | | | |
| Akaike Info Criterion | -0.5257 | min | | | -0.5118 | | | | -0.4550 | | | | -0.4622 | | | |
| Schwarz criterion | -0.2655 | min | | | -0.2144 | | | | -0.1205 | | | | -0.0904 | | | |
| F-statistic | 6.9519 | max | *** | 0.0000 | 6.1256 | | *** | 0.0000 | 5.0379 | | *** | 0.0002 | 4.7964 | | *** | 0.0002 |

**PANEL B: DEPENDENT VARIABLE: RELATIVE VOLATILITY**

| **Independent** | *Model 1 1* | | | | *Model 2 2* | | | | *Model 3* | | | | *Model 4* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Variable** | **Coef.** | **t-Stat.** | | **Prob.** | **Coef.** | **t-Stat.** | | **Prob.** | **Coef.** | **t-Stat.** | | **Prob.** | **Coef.** | **t-Stat.** | | **Prob.** |
| Constant | 1.9480 | 1.0765 | | 0.2873 | 1.9056 | 1.0523 | | 0.2983 | 2.7720 | 1.2296 | | 0.2254 | 2.9383 | 1.2529 | | 0.2170 |
| TURNOVER | -0.0960 | -0.4972 | | 0.6214 | -0.0636 | -0.3247 | | 0.7469 | 0.0293 | 0.1400 | | 0.8893 | 0.0411 | 0.1908 | | 0.8496 |
| LNGDP | -0.0287 | -0.3872 | | 0.7004 | -0.0177 | -0.2366 | | 0.8140 | -0.0690 | -0.7866 | | 0.4357 | -0.0815 | -0.8313 | | 0.4104 |
| DEVELOPED MKT | 0.9317 | 3.9036 | *** | 0.0003 | 0.6398 | 1.6764 | | 0.1006 | 0.6056 | 1.9080 | * | 0.0629 | 0.6700 | 1.7335 | * | 0.0902 |
| STOCKS TRADED | 0.4093 | 2.7855 | *** | 0.0077 | 0.3382 | 2.0629 | ** | 0.0449 | 0.2986 | 1.7685 | * | 0.0839 | 0.3071 | 1.7754 | * | 0.0829 |
| BETAWRLD | -0.0311 | -0.1482 | | 0.8828 | -0.0898 | -0.4107 | | 0.6832 | -0.0685 | -0.3176 | | 0.7523 | -0.0486 | -0.2134 | | 0.8320 |
| INT-FINANACING | 6.3175 | 1.1909 | | 0.2398 | 5.5516 | 1.0349 | | 0.3062 | 5.2856 | 0.9938 | | 0.3258 | 5.4156 | 1.0044 | | 0.3208 |
| GOVERNANCE-PC | | | | | 0.0773 | 0.9800 | | 0.3323 | | | | | -0.0352 | -0.2986 | | 0.7667 |
| RESILIENCE | | | | | | | | | 1.0309 | 1.5884 | | 0.1193 | 1.2458 | 1.2795 | | 0.2076 |
| VULNERABILITY | | | | | | | | | -0.2711 | -0.5137 | | 0.6100 | -0.3179 | -0.5719 | | 0.5704 |
| *Regression Statistics* | | | | | | | | | | | | | | | | |
| Adjusted R-squared | 0.4514 | | | | 0.4510 | | | | 0.4583 | max | | | 0.4469 | | | |
| Durbin-Watson | 2.0663 | | | | 1.9832 | | | | 1.9283 | | | | 1.9364 | | | |
| Akaike Info Criterion | 1.8328 | min | | | 1.8494 | | | | 1.8511 | | | | 1.8868 | | | |
| Schwarz criterion | 2.0930 | min | | | 2.1468 | | | | 2.1857 | | | | 2.2586 | | | |
| F-statistic | 8.1323 | max | *** | 0.0000 | 7.1018 | | *** | 0.0000 | 6.5001 | | *** | 0.0000 | 5.6681 | | *** | 0.0000 |

## TABLE 4: RESULTS OF OLS - RECOVERY PERIOD

**PANEL A: DEPENDENT VARIABLE: PERCENT CHANGE IN INDICES**

| **Independent** | *Model 1* | | | *Model 2* | | | *Model 3* | | | *Model 4* | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Variable** | **Coef.** | **t-Stat.** | **Prob.** | **Coef.** | **t-Stat.** | **Prob.** | **Coef.** | **t-Stat.** | **Prob.** | **Coef.** | **t-Stat.** | **Prob.** |
| Constant | 1.6369 | 1.4102 | 0.1652 | 1.6237 | 1.3866 | 0.1724 | 2.9973 | 2.1056 ** | 0.0410 | 3.3988 | 2.3285 ** | 0.0247 |
| TURNOVER | 0.0652 | 0.5268 | 0.6009 | 0.0753 | 0.5940 | 0.5555 | 0.1317 | 0.9958 | 0.3248 | 0.1601 | 1.1947 | 0.2387 |
| LNGDP | -0.0500 | -1.0518 | 0.2984 | -0.0466 | -0.9612 | 0.3416 | -0.1033 | -1.8657 * | 0.0688 | -0.1337 | -2.1891 ** | 0.0341 |
| DEVELOPED MKT | -0.2506 | -1.6366 | 0.1085 | -0.3411 | -1.3818 | 0.1738 | -0.4394 | -2.1928 ** | 0.0337 | -0.2838 | -1.1799 | 0.2445 |
| STOCKS TRADED | -0.0530 | -0.5618 | 0.5770 | -0.0750 | -0.7076 | 0.4829 | -0.0984 | -0.9230 | 0.3610 | -0.0777 | -0.7213 | 0.4747 |
| BETAWRLD | 0.2268 | 1.6828 * | 0.0992 | 0.2086 | 1.4761 | 0.1469 | 0.1707 | 1.2544 | 0.2163 | 0.2187 | 1.5430 | 0.1302 |
| INT-FINANACING | -0.2563 | -0.0753 | 0.9403 | -0.4938 | -0.1424 | 0.8874 | -0.7828 | -0.2331 | 0.8167 | -0.4688 | -0.1397 | 0.8895 |
| GOVERNANCE-PC | | | | 0.0240 | 0.4700 | 0.6406 | | | | -0.0850 | -1.1591 | 0.2528 |
| RESILIENCE | | | | | | | 0.6489 | 1.5835 | 0.1205 | 1.1681 | 1.9275 * | 0.0605 |
| VULNERABILITY | | | | | | | -0.5014 | -1.5046 | 0.1396 | -0.6143 | -1.7758 * | 0.0828 |
| *Regression Statistics* | | | | | | | | | | | | |
| Adjusted R-squared | 0.0553 | | | 0.0390 | | | 0.0962 | | | 0.1032 | max | |
| Durbin-Watson | 2.3614 | | | 2.3547 | | | 2.4110 | | | 2.4201 | | |
| Akaike info criterion | 0.9447 | | | 0.9776 | | | 0.9314 | min | | 0.9384 | | |
| Schwarz criterion | 1.2050 | Min | | 1.2750 | | | 1.2660 | | | 1.3102 | | |
| F-statistic | 1.5072 | | 0.1971 | 1.3016 | | 0.2716 | 1.6922 | max | 0.1273 | 1.6652 | | 0.1275 |

**PANEL B: DEPENDENT VARIABLE: RELATIVE VOLATILITY**

| **Independent** | *Model 1* | | | *Model 2* | | | *Model 3* | | | Model 4 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Variable** | **Coef.** | **t-Stat.** | **Prob.** | **Coef.** | **t-Stat.** | **Prob.** | **Coef.** | **t-Stat.** | **Prob.** | **Coef.** | **t-Stat.** | **Prob.** |
| Constant | 0.3299 | 0.2352 | 0.8151 | 0.3760 | 0.2708 | 0.7878 | 0.7173 | 0.4120 | 0.6823 | 0.9163 | 0.5067 | 0.6150 |
| TURNOVER | 0.0278 | 0.1858 | 0.8535 | -0.0075 | -0.0497 | 0.9606 | -0.0806 | -0.4980 | 0.6210 | -0.0665 | -0.4004 | 0.6908 |
| LNGDP | 0.0264 | 0.4609 | 0.6470 | 0.0145 | 0.2529 | 0.8015 | 0.0232 | 0.3428 | 0.7334 | 0.0082 | 0.1082 | 0.9144 |
| DEVELOPED MKT | -0.1252 | -0.6768 | 0.5019 | 0.1928 | 0.6586 | 0.5135 | 0.1379 | 0.5627 | 0.5765 | 0.2150 | 0.7215 | 0.4745 |
| STOCKS TRADED | -0.1594 | -1.4002 | 0.1681 | -0.0820 | -0.6520 | 0.5177 | -0.0478 | -0.3669 | 0.7155 | -0.0376 | -0.2816 | 0.7796 |
| BETAWRLD | -0.1815 | -1.1149 | 0.2707 | -0.1177 | -0.7021 | 0.4862 | -0.1925 | -1.1564 | 0.2538 | -0.1687 | -0.9605 | 0.3422 |
| INT-FINANACING | -4.2746 | -1.0399 | 0.3038 | -3.4401 | -0.8364 | 0.4074 | -3.3573 | -0.8174 | 0.4181 | -3.2017 | -0.7700 | 0.4455 |
| GOVERNANCE-PC | | | | -0.0842 | -1.3924 | 0.1706 | | | | -0.0421 | -0.4636 | 0.6453 |
| RESILIENCE | | | | | | | -0.7700 | -1.5363 | 0.1316 | -0.5127 | -0.6828 | 0.4984 |
| VULNERABILITY | | | | | | | -0.1916 | -0.4701 | 0.6406 | -0.2475 | -0.5776 | 0.5666 |
| *Regression Statistics* | | | | | | | | | | | | |
| Adjusted R-squared | 0.0276 | | | 0.0470 | max | | 0.0464 | | | 0.0291 | | |
| Durbin-Watson | 1.9952 | | | 1.9821 | | | 1.9530 | | | 1.9519 | | |
| Akaike info criterion | 1.3227 | | | 1.3183 | min | | 1.3342 | | | 1.3670 | | |
| Schwarz criterion | 1.5830 | Min | | 1.6157 | | | 1.6688 | | | 1.7387 | | |
| F-statistic | 1.2460 | | 0.3010 | 1.3667 | max | 0.2427 | 1.3163 | | 0.2607 | 1.1730 | | 0.3361 |

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**The Transmission of Shocks to LIBOR Risk Spreads and Nominal Risk-Free Rates**

Albert E. DePrince, Jr. and Pamela D. Morris

## Abstract

In this study, effects of shocks to international money market conditions, as measured by the three-month London Interbank Offer Rates (LIBOR) for five financially integrated economies (United States, the euro zone countries, Great Britain, Japan, and Canada) are examined. The sample period runs from January 4, 1999, through December 31, 2010. A five-equation vector autoregressive (VAR) model is developed using daily risk spreads between each country's LIBOR and its nominal risk-free rate. Also, effects of the risk spreads on the respective nominal risk-free rates are identified in a separate VAR system. Based on the risk-spread VAR, effects of exogenous shocks are examined. Single-country impulse tests show that the feed-through effects on the other countries are surprisingly limited for these integrated countries. Only when a shock is applied concurrently to all five risk spreads can effects on the magnitude noted in 2008 and 2009 be replicated, suggesting that all LIBOR rates were affected by a contemporaneous shock. Finally, a proportion of the shock to the risk-spread feed has an inverse effect on each country's nominal risk-free rate, reflecting the effect of the flow of funds from risky assets to safe assets in a time of increased risk and vice versa.

## I. Introduction

The spread between the London Interbank Offer Rate (LIBOR) and the Treasury bill rate of a corresponding maturity is considered an international measure of risk and liquidity. This can be calculated for any country, and this study uses five such spreads. Since these incorporate both risk and liquidity risk in the interbank market for respective currencies, it is always positive. This measure is closely related to the LIBOR risk spread which is the difference between the 3-month Eurodollar futures contract and the three-month Treasury bill contract.

The LIBOR risk spread is reported in Figure 1 on a monthly average basis for the 1971–2010 period. Each of the periods in which the spread widened can be traced to specific events. For example, the period from 1979 through 1988 can be traced to the evolution of the risk in dollar-based loans to "Less Developed Countries (LDC)." For example, the widening spread from roughly 1979 through 1983 represented the market recognition of the riskiness of LDC lending. The narrowing spread from 1984 through 1987 represented the systematic elimination of this risk through charge-offs and loan sales. The latest episode (2008–2009) can be attributed to the sub-prime mortgage crisis in general, the failure of Lehman Brothers, and the ensuing liquidity crisis in banking.

If each of these episodes is considered a shock, the obvious question is the degree to which a shock that boosts dollar-based LIBOR and originates in the United States is transmitted to countries with which the U.S. is financially integrated. To address this question, this paper assesses the linkage in the risk spreads between the London Interbank Offer Rate (LIBOR) and nominal risk-free rate (both at the three-month maturity) for five financially integrated countries. These linkages are then used to assess the international transmission of shocks. The paper also

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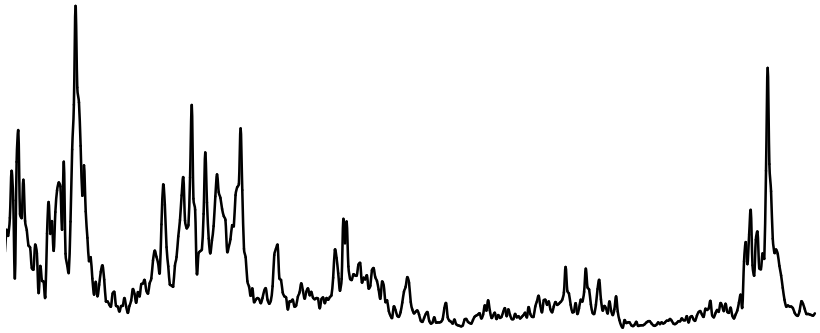
assesses the extent to which shifts in risk spreads affect nominal risk-free rates. That is, as shifts in risk spreads affect the appetite for risky assets, funds flow from risky assets to risk-free assets and vice versa. Thus, events that have a traumatic effect on risk spreads should also have an opposite effect on nominal risk-free rates.

**Figure 1: Spread between 3-month LIBOR and 3-month Treasury Bills (Coupon Basis)**



The paper begins with the literature review, followed by a discussion of the data and data manipulation methodology. The estimation methodology is explained, and the results are discussed and compared with DePrince and Morris (2009). The paper ends with a note on the significance of the findings.

## II. Literature Review

In many studies that examine shocks, it is the transmission of a monetary shock that is studied. The monetary shock is expressed as either a one-time change in money growth or in the federal-funds rate. Ehrmann and Fratzscher (2009) examine the transmission of monetary policy shocks to 50 worldwide equity markets looking at both advanced and emerging market economies. They use a precisely identified structural shock known to have substantial effects on financial models as well as international macroeconomic effects. They addressed the strength of transmission of U.S. monetary policy shocks to global equity markets. In their findings many differences in transmission strengths were observed. They further examine the macroeconomic policy differences and degree of financial integration to identify the underpinnings of these transmission strength differences across countries.

Mumtaz and Surico (2009) extend the work of Bernanke, Bovin, and Eliasz (2005) to the open economy as they examine the extent to which limited information sets plays in small-scale VARs. They focus on the growing importance of the inclusion of relevant information when the analysis moves from a closed economy to an open economy and attribute the puzzles found in the literature to the selection of information used in the analysis. They mention the Global VAR approach used by Dees, di Mauro, Smith, and Pesaran (2007) as an interesting alternative to use when examining the impact of shocks that originate in specific countries.

In this study, a multi-variable vector autoregressive (VAR) model is used to capture interdependencies among the risk spreads. This is a well-used technique, and many studies have

used this econometric technique to address the effects of monetary policy and exchange rates including Sims (1992), Eichenbaum and Evans (1995), Grilli and Roubini (1995), Cushman and Zha (1997), Clarida and Gertler (1997), and Kim and Roubini (2000). Of these studies, Sims (1992) addresses the price puzzle by identifying monetary policy shocks with interest rate shocks in order to obtain positive (negative) output and money supply responses that are consistent with expansionary (contractionary) policy implementation. Eichenbaum and Evans (1995) examine the impact of an innovation (shock) on U.S. interest rates and the relative impact on exchange-rate movements in the other G-7 countries, while Sims (1992) and Grilli and Roubini (1995) examine the interest-rate innovations in the G-7 countries in order to assess exchange rate movements relative to the U.S. dollar.

The frequency used in the VAR studies varies based on the focus of the study. Since financial data is available on a daily basis, this study is based on high-frequency data, applying innovations or shocks to the daily risk spreads associated with the currencies under examination. Typically, however, it is more common for VAR studies to be based on data with lower frequencies due to data availability or the underlying assumptions of informational delays (Kim and Roubini 2000). For example, the use of quarterly data by Sims and Zha (1995) is important in the identification of the structural VAR in their analysis, whereas the structural VAR identifications of Kim and Roubini (2000) and Kim (2005) following the same general assumptions of Sims and Zha (1995) are based on the use of monthly data, leading them to alter the model's underlying assumptions.

In this analysis, the endogenous variables in the VAR are treated symmetrically. This treatment allows for the endogenous variables to be explained by their lags and the lags of the other endogenous variables. Sims (1980) advocates this econometric technique to avoid the "incredible identification restrictions" associated with structural VARs while still obtaining resultant economic relationships. Using high-frequency interest-rate data, daily Libor rates, in the implementation of this econometric technique is done to avoid the "pervasive orthagonalization problem" caused by co-movement of rates (Cocharane and Piazzesi 2002).

A study of the transmission of monetary shocks is not the intention of this study. In this model, a shock external to the system is the event, so the error term in each of the endogenous variables is the vehicle through which the shock is introduced.

Thus, the research question is whether (1) a shock that originates in the U.S. moves around the globe as represented in the risk spread VAR model, and a shock in the U.S. accounts for the global rise in LIBOR risk premiums in 2008–2009, or (2) all countries experienced a simultaneous exogenous shock that led to a global rise in the risk/liquidity premiums incorporated into the LIBOR rates.

## III. The Model and Estimation Methodology

Based on the introductory comments, the underlying research hypothesis is that events (shocks) in one country are transmitted to other countries that are financially integrated. Here it is assumed that the shock would affect the risk spread (*Risk Spread*), or premium above the

nominal risk-free rate, and it may have an indirect effect on the nominal risk-free rate (*Nominal RF Rate*) in each of the countries.

LIBOR risk spreads are subject to the default, liquidity, and other risks of financial institutions (Jagannathan, Kaplin, and Sun 2003). Using this approach, the model of the LIBOR risk spread may be represented by

$$Risk\ Spread = F\left(CR_t\ LR_t, OC, v_t\right) \tag{1}$$

where $CR$ = Credit risk,
$LR$ = Liquidity risk,
$OR$ = Other risks, and
$v$ = Error term

In order to test the research hypothesis, it is assumed that each of the explanatory terms responds to shock with persistence. Therefore, the entire risk-spread structure can be approximated by a Vector Autogressive Model (VAR). Additionally, there is a separate VAR model for each country within the financially integrated environment. Thus, the VAR has *n* equations, one for each of the *n* countries in the study. Each of the endogenous variable risk spreads (*Risk Spread)* will have 1 through *m* lags in each equation. The system is denoted by:

$$\Delta\left(Risk\ Spread_{j,t}\right) = \beta_{0,j} + \sum_{j=1}^{n}\sum_{k=1}^{m}\beta_{k,j}\Delta\left(Risk\ Spread_{j,t-k}\right) + \mu_{j,t} \tag{2}$$

Where

$$Risk\ Spread_{j,t} = LIBOR_{j,t} - Nominal\ RF\ Rate_{j,t}$$

and $j$ = 1, …, $n$ and represents the $n$ countries, and
$k$ = 1, …, $m$ and represents the $m$ lags on each of the $n$ countries within the system.

During the test phase, the estimation results for each country's *Risk Spread* can be shocked by pinging its stochastic innovation term by a given amount—say, for example, one percentage point—and the VAR system will show the feed through to the other currencies.

Next, the nominal risk-free rate depends in turn upon relative supply and demand for funds. Since this is typically measured by a short-term Treasury rate, the demand for funds by that sector depends upon the need for funds at that maturity as well as a random term. Thus, the demand for funds depends upon the nominal risk-free rate (the real risk-free rate plus expected inflation), relative conditions in competing sectors, and the usual random element. Relative conditions in other sectors reflect relative credit and liquidity considerations, relative information costs, and relative uncertainty. The system can be solved for the nominal risk-free rate as a function of the need for funds, relative conditions in other sectors, and a random term. On the assumption that this reduced-form equation can be approximated by a VAR, the nominal risk-free rate of each country may be expressed as

$$\Delta\left(Noninal\ Risk\ Free\ Rate_{j,t}\right) = \beta_{0,j} + \sum_{j=1}^{n}\sum_{k=1}^{m}\beta_{k,j}\Delta\left(Noninal\ Risk\ Free\ Rate_{j,t-k}\right) + \sum_{j=1}^{n}\delta_j\, Relative\ Conditions_{j,t} + \mu_{j,t} \quad (3)$$

where $j = 1, \ldots, n$ and represents the $n$ countries,
$k = 1, \ldots, m$ and represents the $m$ lags on each of the $n$ countries within the

Relative conditions are approximated, in turn, by the change in the LIBOR risk spread or

$$Relative\ Conditions_{j,t} = \Delta\left(Risk\ Spread_{j,t}\right) \quad (4)$$

Thus, shifts in the risk spread have an indirect effect upon the nominal risk-free rate. This is the expected outcome in a world of two assets in which one becomes relatively riskier (and vice versa). If short-term lending is perceived to rise in risk, relative to the risk-free sector, the resulting movement of funds from the riskier sector to the safer sector leads to a rise in the lending rate in the riskier sector and a fall in the rate in the risk-free sector.

## IV. The Data

LIBOR data and data on the nominal risk-free rates (approximated by the three-month Treasury or government rate for each country) were obtained from the Bloomberg database. The focus is on the post-euro period, which extends from January 4, 1999, through December 31, 2010. Industrialized (financially integrated) countries used in the study include the United States, the United Kingdom, the euro-zone countries, Canada, and Japan.[1] Daily observations are used in this study, organized into five-day weeks. Observations for holidays were set equal to the observation on the day preceding the holiday.

## V. Estimation Results

### a. Screening Results

The first step was to assess the stationarity of the day-to-day changes in the risk spread and the nominal risk-free rate at the three-month maturity. Using the Augmented Dickey-Fuller method, the null hypothesis (the presence of a unit root implying a non-stationary series) was rejected with near certainty for the first difference of the risk spreads and the nominal risk-free rates. Thus, the first difference of the risk spreads and the nominal risk-free rates can properly be used in the estimation phase.

Next, the appropriate number of lags was addressed. Lag-length test results varied, depending on the specific test. Since results were ambiguous, it was decided that a week (five

[1] Data for Swiss and Australian LIBOR are available, but data for their Treasury yields are not available through Bloomberg. Hence, the study is limited to the five countries for which both data sets are available.

business days) would be an appropriate lag structure. While arbitrary, a business week does have a certain intuitive appeal.

### b. Model Results

Table I reports estimation results using Equation 2 for the five-variable VAR system for the daily changes in the LIBOR risk spreads. Table II reports results for the nominal risk-free rate (Equation 3). Both are at the three-month maturity. To help the reader visualize the results, the lags on the "own" rate in each of the five estimated equations are boxed in both models.

Readers can see that the adjusted $R^2$ is low for each of the LIBOR risk spread equations (Table I, Equation 2). In a sense, this should not be surprising, since changes in interest rates are often viewed as following a random-walk process. Nonetheless, the test of the null hypothesis (i.e., that the independent variables have no influence on the dependent variables) is rejected with near certainty using the F-test for each of the five countries. From reviewing results for each equation, it is evident that the most significant variables are the own rate, though the significant lags vary among countries. The cross-country coefficients vary in importance; however, several are significant at the 95-percent level in each country. These lags determine, in turn, the extent to which a shock in one country propagates across the other four countries. Finally, the diagnostic evaluation of the lags is favorable. The inverted AR roots of the polynomials associated with the five functions reported in Table I all lie within the unit circle. This implies that impulse simulation will be damped in all cases—a highly desirable outcome.

Table II reports results for Equation 3 which explains the daily changes in the nominal risk-free rate at the three-month maturity for all five currencies. In addition to lags on the daily changes in the five risk-free rates, it includes the LIBOR risk spread for each of the five countries as exogenous variables. Results for endogenous variables are roughly similar to results for five LIBOR risk spreads in Table I for Equation 2. Most of the statistically important lags are those of the own rate. As in Equation 2, cross-country lags have scattered importance, but several are significant at least at the five-percent level.

Turning to the exogenous variables in Equation 3, the risk spreads are designed to capture effects of asset flows between riskier and safer assets as the financial environment evolves. Signs, as expected, are negative, implying that an increase in risk (an increase in the LIBOR risk spread) is reflected in a movement of funds from the risky asset to the safe asset. This increases the supply of funds for the safe asset and reduces the supply of funds for the risky asset. These results confirm that, other things being equal, as the risk spread rises, the yield on safe assets falls, and vice versa. Coefficients on the own risk spread ranges from a high of 92 percent in the euro zone to a low of 43 percent in the U.K.

## VI. Shock Test Phase: The Risk Spreads

### a. Introduction

In this phase, a 100-basis-point shock is applied to the day-to-day change in each LIBOR spread. The change occurs in Period 1, and subsequent effects on the own LIBOR spread and the

cross LIBOR spreads begin in Period 2. The shocks are applied to each spread separately, the day-to-day effects on each on the five LIBOR spreads are reported over a 15-day period, and the

**Table I: Estimation Results for Equation 2**
Daily Changes in LIBOR Risk Spreads (LIBOR less nominal risk-free rates)

| | US | EU | JPY | UK | CAN |
|---|---|---|---|---|---|
| US(-1) | 0.046 | 0.002 | -0.003 | 0.006 | 0.175 |
| | (2.388) | (0.123) | (-0.608) | (0.233) | (12.151) |
| US(-2) | 0.048 | 0.012 | 0.007 | 0.079 | 0.029 |
| | (2.481) | (0.762) | (1.626) | (2.832) | (2.005) |
| US(-3) | -0.021 | 0.020 | 0.015 | 0.050 | 0.051 |
| | (-1.108) | (1.316) | (3.384) | (1.809) | (3.521) |
| US(-4) | -0.120 | -0.024 | 0.014 | 0.015 | -0.015 |
| | (-6.307) | (-1.583) | (3.278) | (0.547) | (-1.041) |
| US(-5) | -0.028 | 0.009 | -0.001 | 0.031 | 0.032 |
| | (-1.446) | (0.592) | (-0.318) | (1.139) | (2.250) |
| EU(-1) | 0.120 | -0.071 | 0.016 | 0.088 | 0.004 |
| | (4.821) | (-3.637) | (2.899) | (2.449) | (0.231) |
| EU(-2) | 0.121 | -0.176 | 0.010 | -0.544 | 0.021 |
| | (4.907) | (-9.074) | (1.801) | (-15.333) | (1.153) |
| EU(-3) | 0.103 | -0.126 | 0.009 | 0.144 | 0.045 |
| | (4.057) | (-6.275) | (1.502) | (3.927) | (2.347) |
| EU(-4) | 0.111 | -0.149 | 0.005 | -0.016 | 0.069 |
| | (4.377) | (-7.414) | (0.888) | (-0.444) | (3.583) |
| EU(-5) | 0.038 | 0.027 | -0.004 | 0.353 | 0.004 |
| | (1.499) | (1.339) | (-0.639) | (9.638) | (0.199) |
| JP(-1) | -0.187 | -0.025 | -0.207 | -0.259 | 0.044 |
| | (-2.34) | (-0.401) | (-11.496) | (-2.243) | (0.733) |
| JP(-2) | 0.012 | 0.041 | -0.004 | 0.012 | 0.054 |
| | (0.147) | (0.639) | (-0.213) | (0.105) | (0.894) |
| JP(-3) | -0.014 | 0.060 | -0.078 | -0.134 | 0.041 |
| | (-0.172) | (0.957) | (-4.320) | (-1.164) | (0.678) |
| JP(-4) | -0.230 | -0.137 | -0.145 | 0.077 | 0.091 |
| | (-2.875) | (-2.179) | (-8.091) | (0.670) | (1.514) |
| JP(-5) | -0.017 | 0.130 | -0.040 | 0.206 | 0.183 |
| | (-0.216) | (2.079) | (-2.254) | (1.807) | (3.075) |
| UK(-1) | 0.038 | 0.010 | -0.018 | 0.003 | 0.062 |
| | (2.824) | (0.967) | (-5.918) | (0.169) | (6.213) |
| UK(-2) | 0.059 | 0.081 | -0.008 | 0.083 | -0.056 |
| | (4.403) | (7.659) | (-2.520) | (4.319) | (-5.525) |
| UK(-3) | 0.023 | 0.067 | -0.003 | 0.014 | -0.018 |
| | (1.710) | (6.338) | (-1.139) | (0.711) | (-1.748) |
| UK(-4) | -0.053 | 0.002 | -0.005 | 0.030 | -0.015 |
| | (-3.993) | (0.152) | (-1.811) | (1.563) | (-1.499) |
| UK(-5) | -0.044 | 0.003 | 0.008 | -0.068 | -0.138 |
| | (-3.338) | (0.298) | (2.575) | (-3.548) | (-13.857) |

| | | | | | |
|---|---|---|---|---|---|
| CD(-1) | -0.113 | 0.193 | 0.012 | 0.198 | -0.121 |
| | (-4.587) | (9.933) | (2.213) | (5.595) | (-6.559) |
| CD(-2) | -0.092 | 0.055 | 0.009 | 0.084 | -0.053 |
| | (-3.669) | (2.770) | (1.516) | (2.313) | (-2.786) |
| CD(-3) | 0.008 | 0.134 | 0.004 | 0.265 | 0.004 |
| | (0.302) | (6.761) | (0.645) | (7.327) | (0.215) |
| CD(-4) | 0.172 | 0.061 | 0.003 | 0.083 | 0.050 |
| | (6.841) | (3.072) | (0.497) | (2.296) | (2.637) |
| CD(-5) | 0.110 | -0.038 | -0.001 | -0.118 | 0.084 |
| | (4.450) | (-1.944) | (-0.106) | (-3.316) | (4.541) |
| C | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | (-0.194) | (0.267) | (-0.414) | (-0.009) | (-0.001) |
| Summary Statistics | | | | | |
| Adj. R-squared | 0.091 | 0.123 | 0.081 | 0.157 | 0.162 |
| F-statistic | 13.507 | 18.464 | 11.978 | 24.324 | 25.071 |

**Table II: Estimation Results for Equation 3**
Daily Changes in nominal risk free-rate

| | US | EU | JPY | UK | CD |
|---|---|---|---|---|---|
| US(-1) | 0.124 | 0.028 | -0.002 | -0.013 | 0.049 |
| | (13.953) | (4.718) | (-0.705) | (-1.141) | (6.424) |
| US(-2) | -0.006 | 0.002 | -0.002 | -0.007 | -0.008 |
| | (-0.627) | (0.350) | (-0.884) | (-0.581) | (-1.095) |
| US(-3) | 0.015 | 0.014 | 0.001 | 0.008 | 0.021 |
| | (1.644) | (2.302) | (0.383) | (0.735) | (2.804) |
| US(-4) | 0.006 | -0.008 | 0.005 | 0.012 | -0.017 |
| | (0.721) | (-1.261) | (1.903) | (1.066) | (-2.205) |
| US(-5) | 0.029 | 0.007 | 0.007 | -0.025 | 0.021 |
| | (3.273) | (1.127) | (2.522) | (-2.215) | (2.755) |
| EU(-1) | 0.010 | 0.032 | 0.004 | 0.012 | 0.022 |
| | (0.878) | (4.248) | (1.286) | (0.860) | (2.375) |
| EU(-2) | -0.029 | 0.005 | 0.001 | -0.043 | 0.003 |
| | (-2.571) | (0.606) | (0.235) | (-2.893) | (0.286) |
| EU(-3) | -0.035 | -0.021 | 0.004 | -0.016 | -0.037 |
| | (-3.118) | (-2.742) | (1.196) | (-1.114) | (-3.873) |
| EU(-4) | 0.012 | 0.021 | -0.005 | -0.007 | 0.016 |
| | (1.051) | (2.695) | (-1.389) | (-0.471) | (1.704) |
| EU(-5) | -0.045 | 0.009 | -0.004 | 0.002 | -0.040 |
| | (-3.963) | (1.176) | (-1.077) | (0.117) | (-4.115) |
| JP(-1) | 0.158 | 0.047 | 0.196 | 0.361 | 0.037 |
| | (3.548) | (1.555) | (14.448) | (6.254) | (0.985) |
| JP(-2) | 0.068 | 0.046 | 0.089 | -0.027 | 0.048 |
| | (1.601) | (1.585) | (6.821) | (-0.479) | (1.327) |
| JP(-3) | 0.160 | 0.023 | -0.009 | 0.333 | 0.064 |

| | | | | | |
|---|---|---|---|---|---|
| | (3.733) | (0.791) | (-0.671) | (5.952) | (1.754) |
| JP(-4) | 0.096 | -0.004 | 0.001 | 0.101 | 0.054 |
| | (2.248) | (-0.149) | (0.039) | (1.819) | (1.493) |
| JP(-5) | 0.150 | 0.061 | -0.015 | 0.156 | 0.042 |
| | (3.524) | (2.107) | (-1.172) | (2.824) | (1.166) |
| UK(-1) | -0.044 | -0.013 | -0.011 | 0.091 | -0.012 |
| | (-4.554) | (-1.921) | (-3.652) | (7.144) | (-1.420) |
| UK(-2) | -0.018 | 0.012 | 0.009 | 0.063 | 0.029 |
| | (-1.797) | (1.733) | (3.066) | (4.864) | (3.481) |
| UK(-3) | -0.009 | 0.015 | 0.002 | 0.004 | -0.006 |
| | (-0.912) | (2.258) | (0.544) | (0.348) | (-0.684) |
| UK(-4) | -0.011 | -0.002 | 0.004 | -0.037 | -0.035 |
| | (-1.190) | (-0.345) | (1.256) | (-2.959) | (-4.217) |
| UK(-5) | -0.005 | 0.011 | 0.009 | -0.128 | -0.092 |
| | (-0.497) | (1.66) | (3.129) | (-10.121) | (-11.036) |
| CD(-1) | 0.007 | 0.020 | 0.005 | 0.139 | 0.106 |
| | (0.556) | (2.530) | (1.490) | (8.991) | (10.490) |
| CD(-2) | 0.048 | -0.011 | 0.002 | -0.019 | -0.016 |
| | (4.026) | (-1.328) | (0.573) | (-1.197) | (-1.581) |
| CD(-3) | 0.074 | -0.002 | -0.003 | 0.017 | 0.059 |
| | (6.173) | (-0.206) | (-0.867) | (1.072) | (5.789) |
| CD(-4) | 0.005 | 0.025 | -0.005 | -0.015 | 0.016 |
| | (0.425) | (3.114) | (-1.398) | (-0.946) | (1.556) |
| CD(-5) | -0.055 | 0.000 | -0.004 | 0.089 | 0.002 |
| | (-4.652) | (0.015) | (-1.163) | (5.820) | (0.236) |
| C | -0.001 | -0.001 | 0.000 | -0.001 | -0.001 |
| | (-2.851) | (-1.644) | (-0.275) | (-2.281) | (-2.747) |

**Table II: Estimation Results for Equation 3 (continued)**

Daily Changes in nominal risk free rate

| Exogenous Variable Risk Spreads | | | | | |
|---|---|---|---|---|---|
| | US | EU | JPY | UK | CD |
| US | -0.842 | 0.041 | 0.011 | 0.039 | 0.009 |
| | (-102.203) | (7.385) | (4.320) | (3.608) | (1.305) |
| EU | 0.058 | -0.921 | 0.001 | -0.135 | 0.038 |
| | (5.487) | (-127.795) | (0.433) | (-9.804) | (4.252) |
| JPY | 0.170 | 0.200 | -0.546 | 0.084 | 0.170 |
| | (4.96) | (8.606) | (-52.101) | (1.893) | (5.818) |
| UK | 0.022 | 0.006 | -0.001 | -0.432 | -0.023 |
| | (3.869) | (1.398) | (-0.538) | (-57.182) | (-4.703) |
| CD | 0.113 | 0.049 | 0.008 | -0.081 | -0.735 |
| | (10.503) | (6.744) | (2.514) | (-5.798) | (-80.369) |
| Summary Statistics | | | | | |
| Adj. R-squared | 0.798 | 0.877 | 0.496 | 0.667 | 0.758 |
| F-statistic | 412.325 | 741.235 | 103.512 | 209.142 | 327.221 |

cumulative effect of each shock on each of the LIBOR spreads over the 15-day period are reported at the bottom each column. The 15-day horizon is admittedly arbitrary; however, a quick examination of Tables III-VII shows that effects dissipate over this period. Table VIII reports results for a simultaneous 100-basis-point shock to the daily changes in all five LIBOR spreads.

### b. Shock to Dollar LIBOR Spread

While day-to-day effects differ among the five LIBOR risk spreads in Table I, the 100-basis-point shock to the day-to-day change in the dollar LIBOR risk spread leads to a cumulative effect of nearly 1.0 percentage points to the U.S. LIBOR rate spread as the shock moves through the systems of lag effects. It is interesting that the cumulative effects to the other four currencies are muted. The largest feed-through effect is felt on the U.K. risk spread (32 basis points [bp]),

**Table III: Effect of 100 BP Shock to U.S. LIBOR Spread**

| Period | D(US) | D(EU) | D(JPY) | D(UK) | D(CAN) |
|---|---|---|---|---|---|
| 1 | 1 | 0 | 0 | 0 | 0 |
| 2 | 0.0458 | 0.0019 | -0.0026 | 0.0064 | 0.1753 |
| 3 | 0.0314 | 0.0455 | 0.0096 | 0.1150 | 0.0163 |
| 4 | -0.0272 | 0.0312 | 0.0133 | 0.0735 | 0.0541 |
| 5 | -0.1106 | 0.0121 | 0.0127 | 0.0635 | -0.0229 |
| 6 | 0.0049 | 0.0225 | -0.0037 | 0.0439 | 0.0240 |
| 7 | 0.0240 | -0.0011 | -0.0033 | -0.0015 | 0.0130 |
| 8 | 0.0146 | 0.0018 | -0.0040 | 0.0026 | -0.0129 |
| 9 | 0.0152 | 0 | -0.0024 | 0.0138 | 0.0021 |
| 10 | 0.0057 | 0.0025 | 0.0015 | 0.0099 | -0.0052 |
| 11 | 0.0040 | -0.0013 | 0.0012 | 0.0022 | -0.0022 |
| 12 | -0.0003 | -0.0003 | 0.0008 | -0.0023 | 0.0019 |
| 13 | -0.0033 | 0.0009 | 0.0005 | 0.0026 | -0.0022 |
| 14 | -0.0033 | -0.0015 | -0.0002 | -0.0022 | -0.0018 |
| 15 | -0.0024 | 0.0002 | -0.0002 | 0.0005 | -0.0020 |
| 15-Day Cumulative | 0.9984 | 0.1142 | 0.0232 | 0.3279 | 0.2376 |

| **Table IV: Effect of 100 BP Shock to Euro LIBOR Spread** | | | | | |
|---|---|---|---|---|---|
| Period | D(US) | D(EUR) | D(JPY) | D(UK) | D(CAN) |
| 1 | 0 | 1 | 0 | 0 | 0 |
| 2 | 0.1197 | -0.0713 | 0.0162 | 0.0877 | 0.0043 |
| 3 | 0.1176 | -0.1698 | 0.0037 | -0.5530 | 0.0477 |
| 4 | 0.0636 | -0.0883 | 0.0146 | 0.1929 | 0.0226 |
| 5 | 0.0458 | -0.1285 | 0.0007 | 0.0333 | 0.1197 |
| 6 | -0.0481 | 0.0924 | -0.0063 | 0.4303 | -0.0101 |
| 7 | -0.0073 | 0.0831 | -0.0031 | 0.0601 | -0.0009 |
| 8 | 0.0277 | 0.0520 | -0.0086 | -0.0078 | 0.0528 |
| 9 | 0.0240 | 0.0363 | 0.0039 | -0.0367 | -0.0346 |
| 10 | 0.0181 | -0.0425 | 0.0008 | -0.0653 | 0.0139 |
| 11 | -0.0043 | -0.0145 | 0.0064 | 0.0008 | -0.0514 |
| 12 | 0.0099 | -0.0188 | 0.0009 | 0.0310 | 0.0081 |
| 13 | -0.0012 | -0.0037 | -0.0014 | 0.0086 | 0.0118 |
| 14 | -0.0066 | 0.0138 | -0.0012 | 0.0211 | -0.0019 |
| 15 | -0.0091 | 0.0033 | -0.0017 | -0.0101 | 0.0061 |
| 15-Day Cumulative | 0.3497 | 0.7433 | 0.0248 | 0.1930 | 0.1881 |

| **Table V: Effect of 100 BP Shock to Japanese LIBOR Spread** | | | | | |
|---|---|---|---|---|---|
| Period | D(US) | D(EUR) | D(JPY) | D(UK) | D(CAN) |
| 1 | 0 | 0 | 1 | 0 | 0 |
| 2 | -0.1872 | -0.0253 | -0.2069 | -0.2587 | 0.0441 |
| 3 | 0.0243 | 0.0533 | 0.0441 | 0.0702 | -0.0092 |
| 4 | -0.0447 | 0.0299 | -0.0859 | -0.1638 | 0.0476 |
| 5 | -0.2118 | -0.1567 | -0.1095 | 0.1120 | 0.0500 |
| 6 | 0.0543 | 0.1733 | 0.0070 | 0.1785 | 0.1354 |
| 7 | -0.0016 | -0.0133 | 0.0041 | 0.1048 | -0.0193 |
| 8 | 0.0599 | 0.0325 | 0.0142 | -0.0569 | -0.0285 |
| 9 | 0.0853 | 0.0447 | 0.0124 | 0.0685 | 0.0073 |
| 10 | 0.0431 | -0.0470 | 0.0029 | -0.1062 | 0.0015 |
| 11 | 0.0059 | -0.0056 | 0.0001 | 0.0201 | -0.0059 |
| 12 | -0.0207 | -0.0066 | 0.0004 | 0.0194 | 0.0016 |
| 13 | -0.0200 | -0.0024 | -0.0022 | 0.0259 | 0.0111 |
| 14 | -0.0105 | 0.0156 | 0 | 0.0185 | -0.0111 |
| 15 | 0.0012 | 0.0011 | -0.0018 | -0.0068 | 0.0118 |
| 15-Day Cumulative | -0.2225 | 0.0936 | 0.6790 | 0.0254 | 0.2363 |

| **Table VI: Effect of 100 BP Shock to U.K. LIBOR Spread** | | | | | |
|---|---|---|---|---|---|
| Period | D(US) | D(EUR) | D(JPY) | D(UK) | D(CAN) |
| 1 | 0 | 0 | 0 | 1 | 0 |
| 2 | 0.0376 | 0.0102 | -0.0177 | 0.0032 | 0.0622 |
| 3 | 0.0583 | 0.0928 | -0.0032 | 0.1014 | -0.0572 |
| 4 | 0.0449 | 0.0525 | -0.0030 | 0.0148 | 0.0029 |
| 5 | -0.0175 | -0.0051 | -0.0019 | 0.0162 | -0.0037 |
| 6 | -0.0136 | -0.0123 | 0.0131 | -0.0847 | -0.1318 |
| 7 | 0.0070 | -0.0506 | -0.0003 | -0.0264 | 0.0153 |
| 8 | -0.0109 | -0.0077 | 0.0007 | 0.0183 | -0.0069 |
| 9 | -0.0120 | -0.0116 | -0.0024 | 0.0025 | -0.0013 |
| 10 | -0.0285 | 0.0016 | -0.0021 | -0.0155 | -0.0127 |
| 11 | -0.0152 | 0.0146 | -0.0009 | 0.0206 | -0.0065 |
| 12 | -0.0002 | -0.0048 | -0.0007 | -0.0254 | 0.0027 |
| 13 | 0.0003 | -0.0021 | 0.0004 | -0.0158 | -0.0085 |
| 14 | 0.0024 | -0.0052 | 0.0002 | -0.0084 | -0.0007 |
| 15 | -0.0006 | -0.0041 | 0 | -0.0004 | 0.0018 |
| 15-Day Cumulative | 0.0519 | 0.0682 | -0.0178 | 1.0005 | -0.1442 |

| **Table VII: Effect of 100 BP Shock to Canada LIBOR Spread** | | | | | |
|---|---|---|---|---|---|
| Period | D(US) | D(EUR) | D(JPY) | D(UK) | D(CAN) |
| 1 | 0 | 0 | 0 | 0 | 1 |
| 2 | -0.1126 | 0.1925 | 0.0122 | 0.1980 | -0.1212 |
| 3 | -0.0554 | 0.0193 | 0.0045 | 0.0734 | -0.0440 |
| 4 | 0.0551 | 0.0994 | -0.0001 | 0.1498 | 0.0014 |
| 5 | 0.2253 | 0.0266 | -0.0016 | 0.0714 | 0.0657 |
| 6 | 0.1475 | -0.0695 | -0.0058 | -0.1568 | 0.1193 |
| 7 | -0.0105 | 0.0391 | 0.0057 | 0.1194 | -0.0336 |
| 8 | -0.0192 | 0.0008 | 0.0041 | 0.0858 | 0.0158 |
| 9 | -0.0192 | 0.0201 | 0.0040 | 0.0520 | -0.0143 |
| 10 | 0.0173 | 0.0175 | 0.0009 | 0.0133 | -0.0013 |
| 11 | 0.0174 | -0.0084 | -0.0040 | -0.0283 | 0.0349 |
| 12 | -0.0047 | 0.0084 | 0.0004 | 0.0128 | -0.0220 |
| 13 | -0.0028 | -0.0085 | -0.0001 | -0.0012 | -0.0058 |
| 14 | -0.0024 | 0.0001 | 0.0007 | 0.0073 | -0.0058 |
| 15 | 0.0059 | 0.0010 | 0.0004 | 0.0061 | 0.0005 |
| 15-Day Cumulative | 0.2417 | 0.3385 | 0.0212 | 0.6032 | 0.9896 |

| Table VIII: Effect of 100 BP Shock to All LIBOR Spreads | | | | | |
|---|---|---|---|---|---|
| Period | D(US) | D(EUR) | D(JPY) | D(UK) | D(CAN) |
| 1 | 1 | 1 | 1 | 1 | 1 |
| 2 | -0.0967 | 0.1079 | -0.1988 | 0.0367 | 0.1648 |
| 3 | 0.1762 | 0.0411 | 0.0587 | -0.1930 | -0.0463 |
| 4 | 0.0917 | 0.1246 | -0.0610 | 0.2672 | 0.1286 |
| 5 | -0.0688 | -0.2516 | -0.0997 | 0.2964 | 0.2088 |
| 6 | 0.1449 | 0.2063 | 0.0044 | 0.4111 | 0.1368 |
| 7 | 0.0116 | 0.0572 | 0.0031 | 0.2565 | -0.0255 |
| 8 | 0.0721 | 0.0794 | 0.0064 | 0.0421 | 0.0203 |
| 9 | 0.0934 | 0.0896 | 0.0155 | 0.1001 | -0.0408 |
| 10 | 0.0556 | -0.0679 | 0.0041 | -0.1638 | -0.0037 |
| 11 | 0.0077 | -0.0152 | 0.0028 | 0.0155 | -0.0311 |
| 12 | -0.0160 | -0.0220 | 0.0018 | 0.0355 | -0.0077 |
| 13 | -0.0270 | -0.0158 | -0.0029 | 0.0201 | 0.0063 |
| 14 | -0.0203 | 0.0228 | -0.0005 | 0.0362 | -0.0213 |
| 15 | -0.0050 | 0.0015 | -0.0033 | -0.0106 | 0.0181 |
| 15-Day Cumulative | 1.4192 | 1.3578 | 0.7304 | 2.1498 | 1.5074 |

followed by the Canada spread (24 bp) and the euro-zone spread (11 bp). Effects on the Japanese risk spread are minimal, consistent with the findings of U.S. monetary policy shocks (Ehrmann & Fratzscher 2009).

In looking at events in the second half of 2008 and the first half of 2009, these results suggest that a shock to the U.S. alone has a limited effect as effects move through time and across countries. In other words, the global turmoil may not be explained solely by effects of the U.S. LIBOR spread. Rather, it is more likely that exogenous shocks hit all economies roughly simultaneously. This stands in contrast to the popular notion that the problem began in the U.S. and was transmitted outward from the U.S. to other countries. Results for single-country shocks discussed below tend to support this conclusion.

### c. Shock to Euro-Zone LIBOR Risk Spreads

Results of a one-time shock to the euro-zone risk spread are reported in Table IV. As with Japan (see next section), there is a slight offset to the 100 bp shock over the 15-day test period, with cumulative effects of only 74 bp on the euro-zone LIBOR. Feed-through effects to the other currencies vary, with the U.S. at 35 bp and the U.K. and Canada at 19 bp.

### d. Shock to Japanese LIBOR Spread

Results of a one-time shock to the Japanese LIBOR risk spread are reported in Table V and show a cumulative effect of 68 bp. In other words, effects of the shock are partly reversed over the subsequent three weeks. Again, there are muted feed-through effects to other currencies. The Canadian risk spread experienced a cumulative rise of 24 bp. Thus, while the Japanese seem to successfully isolate themselves from shocks originating in Canada (see subsequent sections for

results of the Canadian shock), the same cannot be said for the ability of Canada to isolate itself from shocks originating in Japan. In contrast, the 100 bp shock to the Japanese risk spread leads to a cumulative decline of 22 bp in the U.S. risk spread. While seemingly a surprising outcome, it suggests that problems in Japan lead to a flight to quality from Japan to the U.S., putting a downward pressure on U.S. risk spreads. On balance, results for Japan are not surprising, since short-term rates were basically flatlined over the sample period.

### e. Shock to U.K. LIBOR Risk Spread

Results of a one-time shock to the U.K. LIBOR risk spread are reported in Table VI. Results are similar to the shock to the U.S. LIBOR risk spread. The cumulative effect on the U.K. risk spread is roughly one percentage point, with very muted effects on the U.S. and euro-zone spreads of roughly 5 to 6 bp each. Effects are minimal on the Japanese risk spread (-2 pb) and surprisingly negative on Canada (-14 bp).

### f. Shock to Canadian LIBOR Risk Spread

Results of a one-time shock to the Canadian LIBOR risk spread are reported in Table VII. The cumulative effect on the Canadian risk spread is in the vicinity of one percentage point. Some feed-through effects are observed on the U.S. and the euro-zone risk spreads (24 and 34 bp, respectively), but there is a sizeable effect on the U.K. risk spread (60 bp), and effects on the Japanese risk spread are minimal.

### g. On Balance

Of the five LIBOR risk spreads, the dollar, the U.K. and the Canadian spreads are around one percentage point, while the Japanese and the euro-zone spreads respond with a cumulative effect of roughly 70 to 75 pb. In terms of feed-through effects, the largest was the effect of a Canadian shock on the U.K. (60 pb). A number of modest bilateral effects were noted in the preceding paragraphs, but Japan stands out as the only country that has successfully isolated itself from shocks originating in the other four countries. The U.S., in turn, shows an inverse relationship between a shock in Japan and resulting cross-country effects in the U.S.

## VII. Simultaneous Global Shocks

The muted feed-through effect of shocks in any single currency to other currencies is an interesting finding and suggests that the magnitude of the current turmoil must have been the result of a simultaneous shock to the daily changes in all five LIBOR risk spreads. To assess this possibility, a 100 bp shock was simultaneously applied to all five risk spreads. Results are reported in Table VIII. Cumulative effects are smallest for Japan at 73 bp, which is consistent with its isolation from single-country shocks noted above. The weak cumulative-impulse response of the Japanese risk spread may seem surprising, but it probably reflects the low rates and the lack of effect of global markets in the Japanese LIBOR over the same period. The cumulative effect is largest for the U.K. (215 bp), which is probably attributable to feed-through effects from Canadian and U.S. shock. Cumulative effects for the U.S., Canada, and the euro

zone are all in the 135-150 bp range. On balance, these results support the view that the shock was global in nature, affecting all countries simultaneously.

## VIII. Shocks to Risk Spreads and the Implication for the Nominal Risk-Free Rate

Equation 2 is based on the separation of the LIBOR risk spread from the nominal LIBOR. Equation 2 in isolation presumes that shocks to the risk spread affect LIBOR but not the nominal risk-free rate. At the same time, a strong negative correlation was found between the LIBOR risk spreads and the nominal risk-free rates. This negative influence is captured in Equation 3 (Table II), which shows significant negative effects of daily changes in LIBOR risk spreads on daily changes in the respective nominal risk-free rates.

While a significant effect on the nominal risk-free rates from shifts in risk premiums were identified in Equation 3, effects of shock on the nominal risk-free rates were not assessed. The main purpose of this paper was to assess the effect of shocks on risk spreads. Nonetheless, Equation 3 shows that shocks to the LIBOR risk spreads have a feed-through effect on the nominal risk-free rates. Feed-through effects range from a high of .92 for the euro zone (92 percent of the change in the risk spread feeds through to a decline in the nominal risk-free rate) to a low of a 43-percent fall in the nominal risk-free rate for the U.K.

These negative coefficients are consistent with the view that flights to safety (or movement from LIBOR to a risk-free-rate asset) leads to an increase in the supply of funds in the risk-free market and a reduction of the supply of funds to the risky market. As a result, the nominal risk-free rates would fall in response to increased risk and fall in response to reduced risk in the LIBOR market. Thus, while it would be interesting, an extension of the simulations to include the nominal risk-free rates would not have extended the results in a meaningful manner. However, it is evident that the cumulative effect on each of the LIBOR risk spreads would inversely impact the nominal risk-free rates by the proportion equal to the coefficient on the own-rate LIBOR risk spread in each of the functions in Table II (Equation 3), a pattern reflective of the shift in the supply of funds from a risky market to a risk-free market.

## IX. Summary

The main purpose of this study was accomplished. A VAR model of risk spreads can be developed to assess the international transmission of financial shocks. This model led to two findings. First, there is a muted feed-through effect of a shock to any single-risk spread to the risk spread of other countries. Second, global turmoil, such as that experienced in the second half of 2008 and the first half of 2009, was probably the result of exogenous shocks through the world and not a problem in the U.S. that was transmitted to the rest of the world. Thus, markets responded globally to consecutive shocks around the globe that then went through a multiplier effect as effects accumulated across time and across countries. This does raise the question of the origin of massive contemporaneous shocks around the globe. Nonetheless, it does show that the U.S. was not a singular source of the jump in LIBOR rates in the second half of 2008. Finally, the full model confirmed the inverse impact on the risk-free rates as risk spreads widen (or narrow). This inverse effect is due to the movement of funds from (to) short-term risky assets to (from) the risk-free assets when risk inherent in the risky assets rises (falls).

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**Native American Banks: Overview and Recent Performance**

William Lepley and Robert A. Nagy

**Abstract**

While minority-owned commercial banks have received some attention in the finance literature, little attention has been directed at a particular sub-category: *Native American* commercial banks. Our paper attempts to fill that void. After covering some background information on Native American banks, we contrast this category's financial performance with peer group institutions—focusing on the period 2005-10. Profitability, as measured by return on assets (ROA), has been a problem for Native American banks. Looking behind ROA, the Native American category has done reasonably well in maintaining net interest margin, while encountering difficulties in controlling overhead expenses and loan losses.

## I. Introduction

For a number of years, U.S. commercial bank regulators have encouraged participation of minorities in the commercial banking business. For example, in 2002, the FDIC established a national coordinator for a "minority depository institutions program"—describing the coordinator as one who "will regularly contact the various minority depository institution trade associations to seek feedback on the FDIC's efforts under this program, discuss possible training initiatives, and explore options for preserving and promoting minority ownership of depository institutions" (FDIC, 2002). Formally, minority institutions are those identified by the FDIC as being "operated by a minority board serving an African American, Hispanic, Asian or Pacific Islander, or multi-racial community or majority owned by such minorities."

Another regulator program for the minority bank segment came about in 2008, with the Federal Reserve's launch of its "Partnership for Progress." A Federal Reserve press release described this as "an innovative outreach and technical assistance program for minority-owned and de novo institutions…." (Board of Governors, 2008). The Partnership for Progress website turns out to be a useful source for performance data on minority commercial banks, and in what follows, is used extensively. Data are organized according to minority category: African American, Asian, Hispanic, Native American, and multi-racial.

While minority-owned commercial banks have received some attention in the finance literature, we find very little attention directed to the sub-category of *Native American* commercial banks. Our paper attempts to fill that void. Our goal is to highlight performance characteristics of the Native American banks—especially noting how their performance stacks up relative to peer institutions. But first, in the next two sections, we review some related literature on minority banks, and provide some background on Native American banks.

## II. Previous literature on minority banks

A representative article in the minority commercial bank literature was authored by Douglas A. Price, and appeared in the 1990 Federal Reserve Bank of Cleveland *Economic Commentary*. Price compared minority and nonminority institutions, using some basic financial performance measures (Price, 1990). He reported that minority banks tended to be less

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profitable than their nonminority peer institutions, with the disparity being especially pronounced among smaller banks. But Price was not able to offer data on different *sub-categories* of minority banks. As an aside, the Price article can provide a nice source of reference citations for the earlier literature on minority banks—especially in the 1970s and 1980s. We will not attempt to review that literature here; much of it focused on African American banks.

A few years later, in 1996, a Federal Reserve Bank of Chicago article examined minority and women-owned banks, specifically looking at the managerial efficiency of such institutions, compared to their non-minority bank peers. Iftekhar Hasan and William C. Hunter, using data just for the year 1992, found that "the average minority- or women-owned bank was significantly more inefficient than the average nonminority bank" (Hasan and Hunter, 1996, page 27). But, out of a total of 95 minority banks in 1992, just five were Native American banks.

Literature aimed specifically at Native American commercial banks is very slim. One fairly recent example was published by the Federal Reserve Bank of Boston (Swan, 2008). Jon Swan provides a case study of a Colorado-based institution, Native American Bank, NA. The bank was started in 2001, resulting from a purchase of an existing tribal bank. One interesting aspect is the bank's ownership makeup: multiple tribes, from across the United States, came together as investors. According to Swan, the bank appears to have a national focus in its lending endeavors as well.

## III. Background on Native American banks

As of June 30, 2010, the Partnership for Progress website reports a total of 21 Native American commercial banks. This compares with 185 banks in the entire *minority* category. Table I lists the Native American institutions, arrayed by average total assets in 2010. The largest, Lumbee Guarantee Bank in North Carolina, has average total assets of about $271 million. Clearly, most Native American banks are small, and would be categorized as "community banks." In terms of chartering, six are *national* banks, having been chartered by the Office of the Comptroller of the Currency. The remaining banks are state-chartered, with most having the FDIC as primary Federal regulator—and as such, they are *not* members of the Federal Reserve System. Not surprisingly, the Native American banks tend to be found in the vicinity of tribal populations. Eleven of the 21 banks are located in Oklahoma.

A review of the websites of the Native American Banks shows a wide variety in how such banks present themselves to the public. Sometimes, a bank's connection with Native Americans is prominently displayed, but not always. Lumbee Guarantee Bank presents a detailed history of its origins at its website, including the following passage:

*Lumbee Bank was incorporated under the laws of North Carolina on September 29, 1971, and commenced operations as a North Carolina state-chartered bank on December 20, 1971. This day, what appeared to be an impossible dream became a reality, and history was made because Lumbee Bank was the first Indian owned bank in the United States.*

Along the same lines, the website of the Bank of Cherokee County, in Oklahoma, notes the following:

| **Table I** | | | | | |
|---|---|---|---|---|---|
| **Bank** | **City or town** | **State** | **2010 Avg Tot Assets (000)** | **2010 ROA (%)** | **Primary Federal Regulator** |
| Lumbee Guarantee Bank | Pembroke | NC | 271,251 | 0.52 | FDIC |
| Canyon National Bank | Palm Springs | CA | 236,048 | -4.24 | OCC |
| First National Bk. and Trust | Shawnee | OK | 200,195 | 0.35 | OCC |
| Borrego Springs Bank, N.A. | La Mesa | CA | 137,583 | 1.47 | OCC |
| Farmers & Merchants Bank | Crescent | OK | 127,173 | 0.72 | FDIC |
| Woodlands National Bank | Hinckley | MN | 125,899 | 0.39 | OCC |
| Bay Bank | Green Bay | WI | 121,700 | 0.36 | FDIC |
| American Bk. of Baxter Springs | Baxter Springs | KS | 117,067 | -4.06 | Fed. Res. |
| Bank of Cherokee County | Hulbert | OK | 99,452 | 0.78 | Fed. Res. |
| Bank of Commerce | Stilwell | OK | 94,624 | 1.56 | FDIC |
| Oklahoma State Bank | Vinita | OK | 91,300 | 1.09 | FDIC |
| Native American Bank, N.A. | Denver | CO | 89,660 | 1.46 | OCC |
| Bank2 | Oklahoma City | OK | 89,644 | 1.14 | Fed. Res. |
| Peoples Bank of Seneca | Seneca | MO | 86,796 | 1.28 | FDIC |
| F & M Bank, N.A. | Yukon | OK | 81,653 | 0.32 | OCC |
| Fort Gibson State Bank | Fort Gibson | OK | 63,879 | 0.82 | FDIC |
| Peoples Bank | Westville | OK | 53,990 | 1.87 | FDIC |
| First State Bank of Porter | Porter | OK | 34,936 | 2.22 | FDIC |
| AllNations Bank | Calumet | OK | 27,749 | 0.5 | Fed. Res. |
| Eagle Bank | Polson | MT | 24,018 | 0.27 | FDIC |
| Turtle Mountain State Bank | Belcourt | ND | 17,018 | -0.81 | FDIC |

*The bank was founded in 1907, the year Indian Territory and Oklahoma Territory united as the State of Oklahoma, by a group of prominent members of the Cherokee tribe. In 1996 the ownership of the bank changed only for the fourth time in its history when another group of prominent members of the Cherokee tribe headed by Gary D. Chapman acquired the bank.*

In stark contrast, the website of Bay Bank, in Green Bay, Wisconsin, displays absolutely nothing about its tribal ownership.

In passing, we acknowledge a disputed issue of exactly *when* the *first* Native American bank appeared on the scene. The quotations above—from Lumbee Bank and Bank of Cherokee County—seem to be at odds with each other, at least on the surface. Adding even more to the mystery, an article published by the Federal Reserve Bank of Boston in 2008 makes reference to "the first tribal bank, founded in 1987"—that being identified as "Blackfeet National Bank of Browning, Montana" (Swan, 2008, page 22).

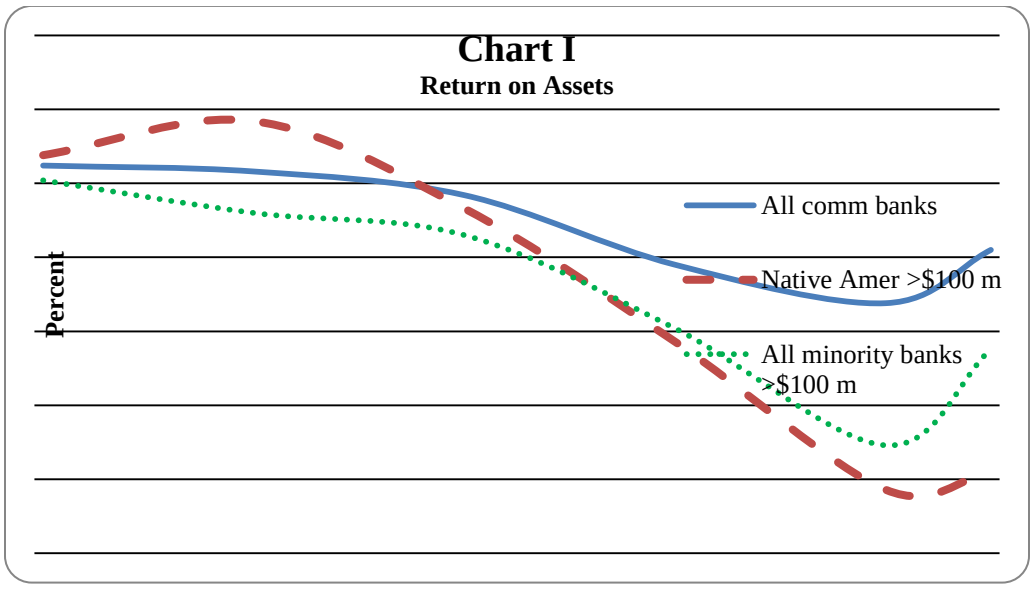
## IV. Financial performance of Native American banks

In what follows, we rely on the Partnership for Progress website for minority bank data. For general bank comparative statistics, we employ data from the Federal Financial Institutions Examination Council (FFIEC). The Partnership for Progress presents quarterly data, and reports the data for *two* size categories: (1) banks under $100 million in total assets, and (2) banks of at least $100 million in assets. In what follows, we present just the "over-$100 million" bank data—since statistics in the small-bank Native American group appear to be dramatically influenced by some newly-chartered banks. Our performance data are based on the *fourth-quarter* results for years 2005 through 2009, and the *second-quarter* results for 2010 (the fourth quarter 2010 data were not yet available.)

We have divided our performance coverage into four areas: (a) profitability, (b) loan quality, (c) liquidity, and (d) bank capital. And we compare Native American results with *two* peer groups: (1) minority banks having at least $100 million in assets, and (2) all U.S. commercial banks. At year-end 2005, there were 117 banks in the minority category, with eight identified as Native American. By June, 2010, the minority group had grown to 128, with nine identified as Native American. By comparison, the total number of insured commercial banks fell from 7,471 at year-end 2005 to 6,636 in June, 2010.

### a) Profitability

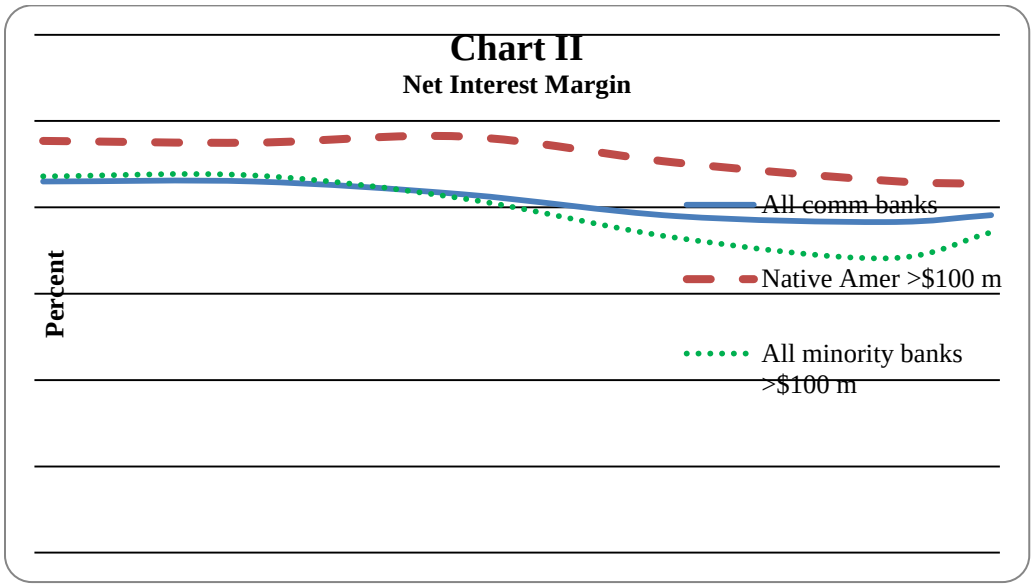
In Chart I, we see that minority bank return on assets (ROA) suffered dramatically as the 2007-09 recession became apparent. And Native American banks were particularly challenged.



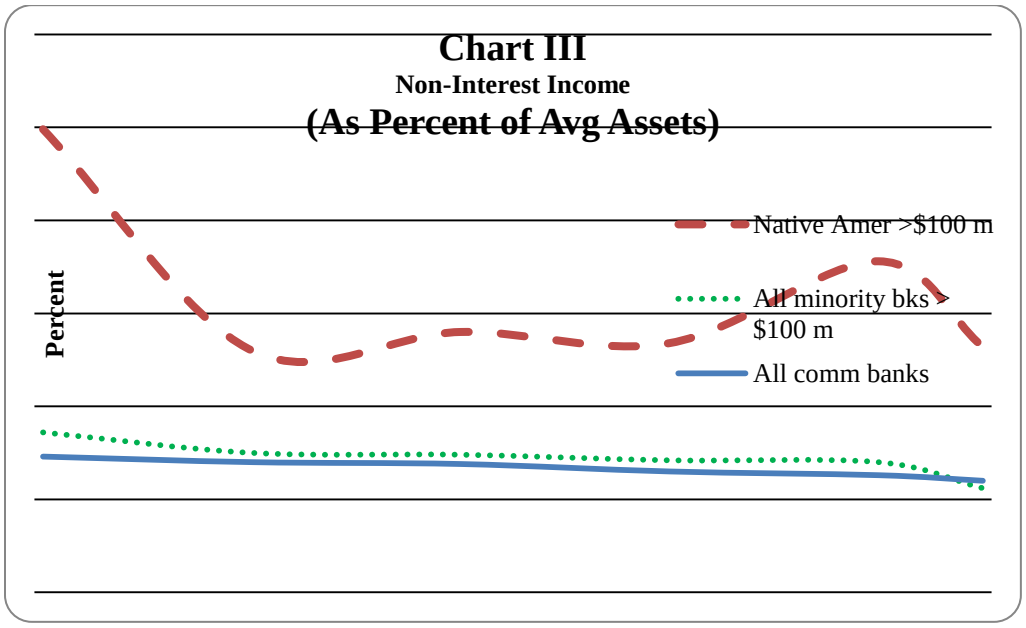

To dig a bit deeper, the next set of charts addresses important *sources* of bank profitability—in essence, the *drivers* behind Chart I.

Although Native American banks had their problems with ROA, they displayed comparatively *good* results on net interest margin (NIM), which is plotted in Chart II. NIM is

simply interest income less interest expense, divided by earning assets. As such, it is sensitive to the bank's pricing—on both the asset and liability sides of the balance sheet.

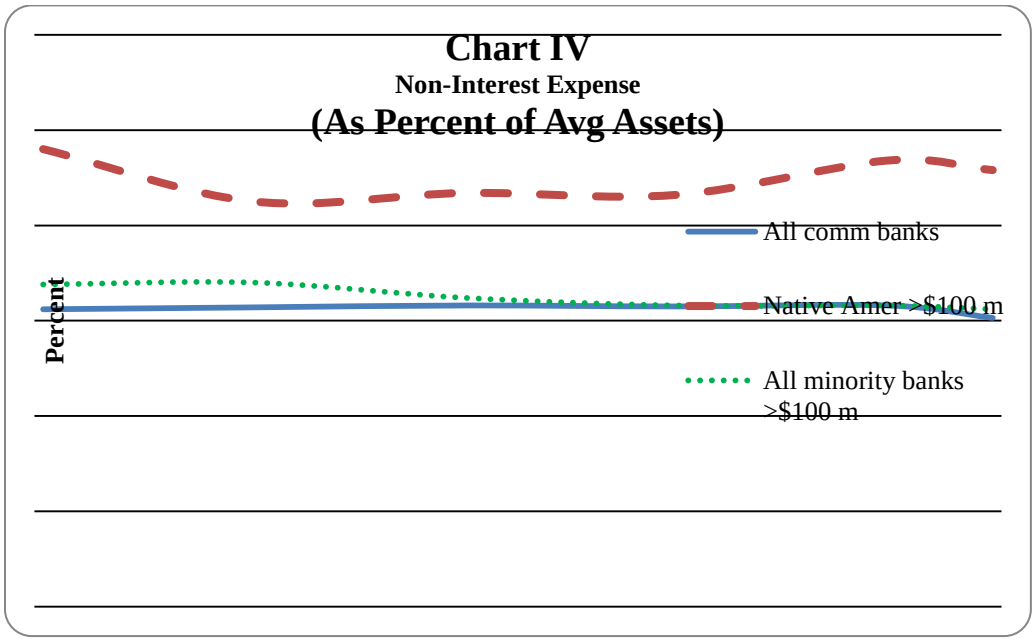



Two additional measures get at remaining major parts of the income statement. First, Chart III presents non-interest income (as a percent of average assets). This part of the income statement will reflect the bank's success in generating fee income. And the Native American banks show relatively good performance here.



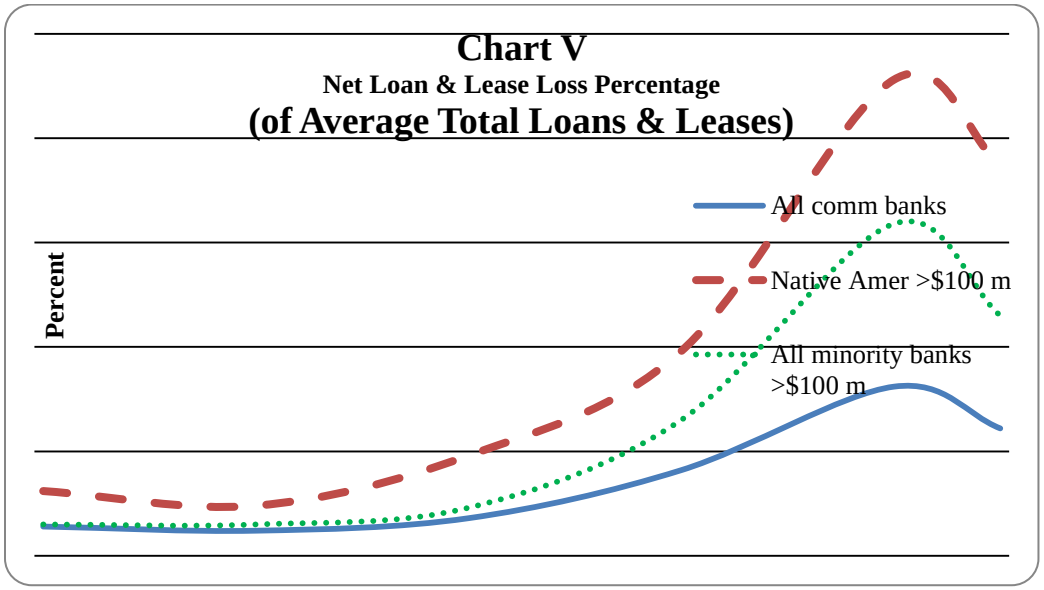

Obviously, Charts II and III tell some "good news" for the Native American category—and seem at odds with the poor ROA results displayed in Chart I. The answer to the apparent contradiction appears in "non-interest expense"—essentially, *overhead*. This is where personnel and

occupancy expenses are captured. Clearly, as displayed in Chart IV, the Native American banks have *not* fared well on this metric.




**b) Loan quality**

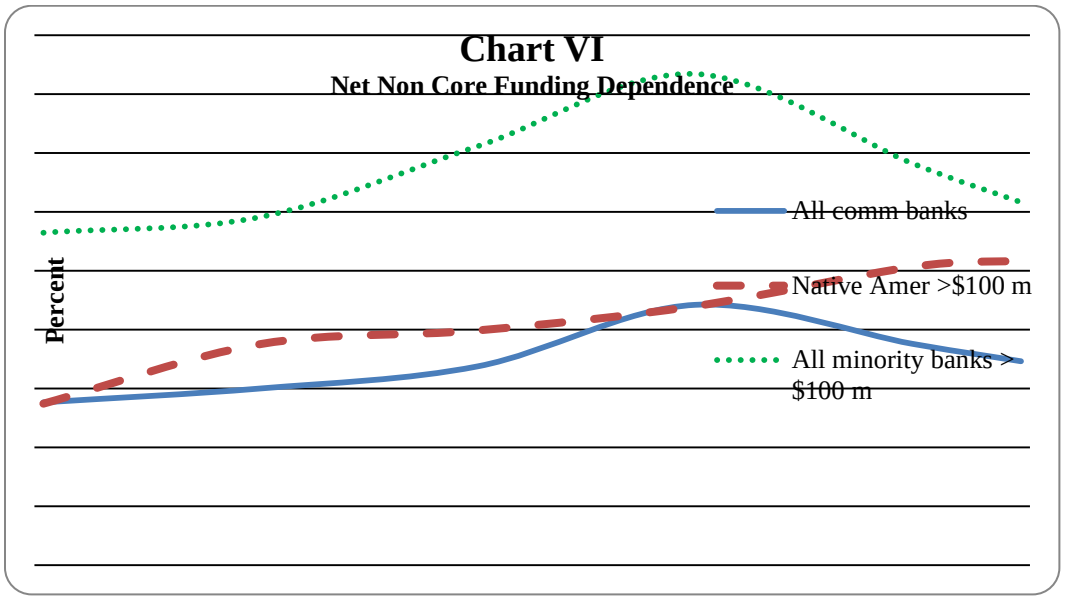
In banking, it's one thing to book a "nice fat margin." But it's quite another to build a *quality* loan portfolio. To capture loan quality, we've chosen to look at loan losses. Formally, Chart V presents the "net loan and lease loss percentage." It appears that problems in the loan portfolio—particularly as the economy fell into recession—were especially pronounced for Native American banks.



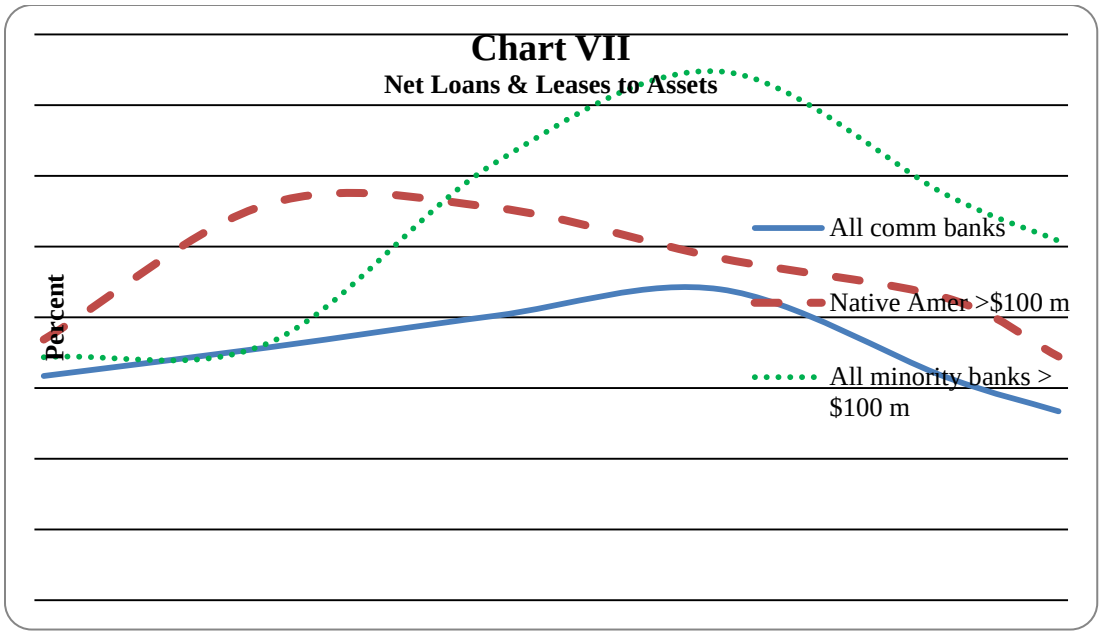
## c) Liquidity

Liquidity risk in banking can be rooted in different parts of the balance sheet. One source of liquidity risk is associated with a bank's reliance on *non-core* deposits. Non-core funding is basically large-denomination, *money market* funding. It comes from suppliers who are highly sensitive to interest rate movements. Non-core funding tends to be more expensive than core deposit funding—but also, it tends to have a *less predictable* cost, and hence, present *more* liquidity risk. In Chart VI, we show "non-core funding dependence" for our different bank categories.

The Native American category was somewhat more heavily dependent on non-core funding than all commercial banks. But Native American non-core deposit usage did suggest a *lower* risk profile, when compared to *all* minority banks. In addition, it's also interesting to note that the Native American banks were *increasing* their usage of non-core funding, at a time when our peer bank categories were reducing their use of such funding.




A second indicator of bank liquidity relates to the bank's *asset* structure. How much of a bank's total assets is tied up in items having limited liquidity? One traditional measure of this is the "loan to assets" ratio, captured here in Chart VII.

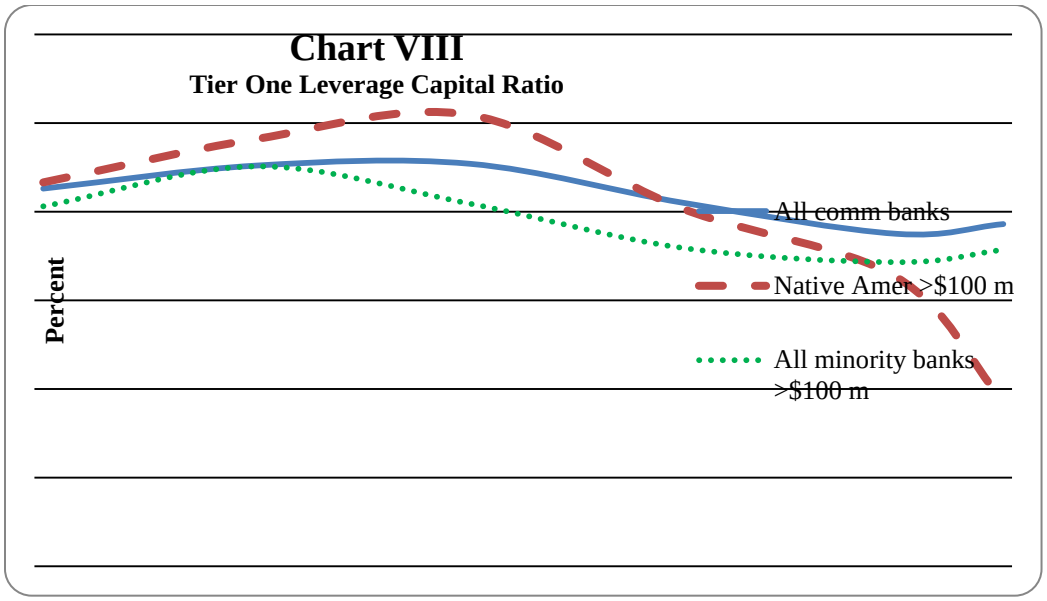



All of our peer categories were showing declines in this measure by 2009. The ratio for Native American banks started to decline even earlier. But also note that, in 2005 and 2006—the Native American banks had *relatively heavier* holdings of loans.

**d) Bank capital**

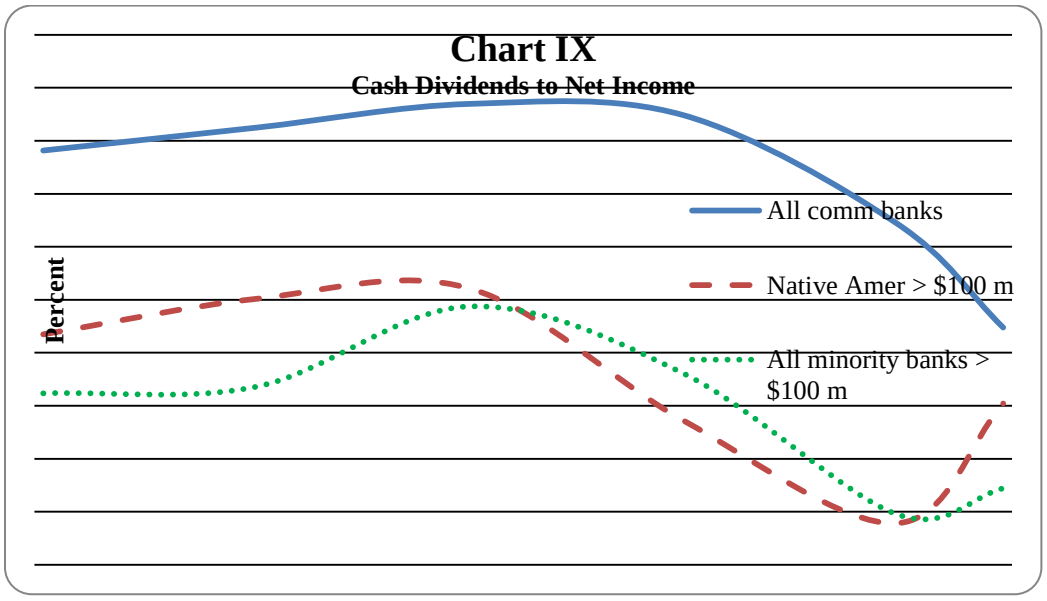
Finally, we turn to bank capital. Capitalization has been a major concern to bank regulators in recent years—particularly for large banks, which have often been treated as "too big to fail" candidates.

Chart VIII presents the "Tier I leverage" ratio—in essence, the capital-to-assets ratio. And for the banking industry as a whole, we observe a fall-off during the recession. But once again—as in the case of both ROA and loan losses—the Native American category has shown a *more dramatic* decline.




Another capital-related issue is how the contributors of bank *equity* capital have been *paid* over recent years. Chart IX presents readings for "cash dividends to net income," or the dividend payout ratio. Both Native American banks and the larger, minority bank cohort have paid out smaller fractions of net income, compared to all U.S. banks. And clearly, the recession has had an impact—in the logical direction—on dividend payout ratios.

Perhaps one puzzling shred of information is the slight *increase* in payout ratios of minority (and Native American) banks as of mid-2010. You might say that minority institutions wasted little time in responding to a *slightly* improved profitablity picture in 2010 (as noted by the ROA movement, displayed back in Chart I).



## V. Conclusion

We have presented an overview of Native American commercial banks. Our overview included performance comparisons for the years 2005 through mid-2010. We showed performance results for those Native American banks having at least $100 million in total assets, and compared the results with: (1) all minority banks having at least $100 million in total assets, and (2) all U.S. commercial banks.

Native American banks have been particularly challenged in the recent recessionary period. Profitability, as measured by ROA, has shown a more dramatic movement during the 2005-10 period. Looking *behind* the ROA figures, Native American banks have done reasonably well in maintaining *net interest margin*, but have had a difficult time keeping overhead expenses under control. And loan losses have been a significant problem. Measures of liquidity risk did not appear especially notable for the Native American banks, on the whole. But it was interesting that the Native American banks were increasing their *non-core* deposit usage in very recent years—when our two peer groups were showing a decline in such usage. Finally, Native American bank profitability problems have no doubt contributed to a declining Tier I leverage ratio.

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# Investors' Ripple Effects in the Restructured Financial Environment

Cheng-Huei Chiao, Robert Kao, and Chiou-Fa Lin

## Abstract

After the burst of high-tech bubble in year 2000, many companies have been financially restructured so that they can be in a better position to deal with their debt burdens. They restructured to maintain some growth in earnings despite a decline in sales by booking the realized gains on some appreciated investments, reducing deferred revenue, revising its deferred tax asset allowance, and emphasizing on strong cash flow from operations. In this paper, we analyze the variations of key financial composite ratios to verify the structural change and investigate investors' reactions to PE ratios in previous periods. We apply the Polynomial Distributed Lag Model to explore the existence of these investors' financial ripple effects. These effects reflect investors' behavior with under-reactions, over-reactions, or excessive optimism to this new financial information. The findings prove that there are different investor's proclivities spreading across those financial ratios on both high-tech and non-high-tech companies.

## I. Introduction

Typically, the PE ratio implies the capital structure and often is used for financial valuation of a company. In other words, the PE ratio represents the period of time of today's earnings that investors are willing to pay for the stock. Investors are willing to pay more for each unit of net income when the ratio is high. The PE ratio also can be interpreted as "number of time of earnings to pay back purchase price" without considering the time value of money. Hence, the PE ratio becomes an indicator for investors regarding how many shares they would purchase for that particular company at the current time. Investors view PE ratios as whether the price is appropriately valued for a company.

When using PE ratio as a measurement for financial returns, it may mislead the investors in their investing decisions in several occasions (Easterling, 2006). For example, if investors use PE ratio to evaluate a growing company, they are based on either the past quarters of earnings or a forecast of future earnings. The projected earnings are always blushing in the future, but the future may or may not work out as predicted. Another instance, the banking sector essentially trades at a discount to the market. Thus, the average PE ratio for the diversified banking industry can make it look much less like a searing deal. According to the equity analysts from the StarMine (Thomson Reuters), nearly 60% of companies report earnings below what analysts expected a year earlier for the forecasts of Wall Street. Additionally, if investors use PE ratios to evaluate companies for cyclical businesses, such as autos, steel, paper, or mining, they generally would face peak and valley fluctuations with economic cycles. When such stock prices soar, their PE ratios sometimes shrink because their earnings rise at an even a faster rate and their profits usually decline considerably.

In this study, we apply the Polynomial Distributed Lag Model to explore the existence of these investors' financial ripple effects. These effects reflect investors' behavior with under-reactions, over-reactions, or excessive optimism to this new financial information. The findings

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prove that there are different investor's proclivities spreading across those financial ratios on both high-tech and non-high-tech companies.

## II. Literature Review

Penman's (2002) indicated that the high PE ratios of the 1990s are now seen as more to do with the quality of prices rather than the quality of earnings after the high-tech bubble. Following by Penman and Zhang's study (2004), they continued to track the PE ratios to analyze sustainability or persistence of earnings. They applied the PE ratio for the amount paid for a dollar of current earnings. They specified and estimated a model that employed financial statement information to indicate the probability of sustainable earnings. Furthermore, they stated that stock returns can be predicted when the market's PE ratios are different from that indicated by their models. Anderson and Brooks (2005) exploited a regression model with weights' factors according to companies' power in predicting returns. Their decomposed PE ratio is able to double the gap in annual returns between the value and glamour deciles, and thus constitutes a useful tool for value fund managers and hedge funds. Soliman (2008) expended a common form of financial statement analysis by using profit margin and asset turnover ratios to measure accounting information. He suggested the component of the DuPont Analysis as an incremental and viable form of information to disclose the operating characteristics of a firm.

Another recent research by Chiao, et al. study (2010), they applied the Chow test to prove that the financial environment has been restructured after the high-tech bubble. In the new financial environment, the profit is more sensitive to the investors, and decisions of investors have become more reasonable and sensitive aftermath. The non-high-tech companies have shown more impact on profitability after the bubble. The profitability, sales, and long-term equity have higher volatility and risk after the year 2000. The results also showed high-tech companies have reduced more cost than the non-high-tech companies due to the proportion of net income among high-tech companies have grown more than their assets and equities. The high-tech companies have a higher efficiency level than non-high-tech companies after the effect of the high-tech bubble. On the whole, the non-high-tech companies had a lower declining rate or they were more mature than the high-tech companies.

Their regression results indicated that many companies have structured the way they can deal with the debt much better after the bubble. Investors have paid more attention to this issue after the event. However, the high-tech companies have not had significant influence either before or after the bubble. Investors also have paid more attention to the debt-ratios after the bubble. The large high-tech and non-high-tech companies had higher price to earning ratio rankings because of their awareness and reputation even after the bubble. The earnings have reduced more than the prices in both large high-tech and large non-high tech companies' aftermath. Generally, aftermath companies have changed most of their focus from revenue-oriented measures to profitability assessment, asset utilization, and debt burden.

We have further investigated the certain deep-seated cognitive responses in investors' earning perspectives in this new financial environment. Three such reactions have been proposed in the different literatures, including "underreaction", "overreaction", and "excessive optimism" phenomenon. Papers published by Lys and Sohn (1990), Abarbanell (1991), Abarbanell and

Bernard (1992), Ali, Klein and Rosenfield (1992), and Elliot, Philbrick, and Wiedman (1995) suggested that investors had the propensity of systematical under-reaction to new financial information. Moreover, DeBondt and Thaler (1990) suggested that investors overreacted systematically to the new financial information. Additionally, Easterwood and Nutt (1999) indicated that investors were inclined to underreact to the bad earnings news and overreact to good earnings news. They called this kind of responsiveness a "systematic optimism." Abarbanell and Lehavy (2003) indicated that the same observations comprising asymmetries in forecast error distributions that drive evidence of optimism and pessimism, have an important impact on inferences concerning analyst over/underreaction to information in prior abnormal returns and prior earnings changes.

## III. Data Structure

Two major sources of financial data for all firms are obtained in the intersection of the Center for Research in Security Prices (CRSP) files and the merged of COMPUSTAT quarterly files of income-statement and balance-sheet data, which is also maintained by CRSP. All 52,895 companies' price data are extracted from the CRSP, and corporate financial ratios data are mined from the COMPUSTAT.

We created the comparative study of financial ratios' changes during the high-tech stock market bubble and its aftermath as in the study of Chiao, et al. (2010). The data for the period of 1993-2007 are separated into two seven-year segments. The first covers 1993-1999, while the second 2001-2007. In this analysis, we repeat the steps in the main procedure that they have developed for the financial ratios and firms.

Stocks listed in NYSE, AMEX, and NASDAQ that have the required CRSP-COMPUSTST data then are allocated to three size portfolios based on the NYSE deciles breakpoints, divided at the 3rd and the 7th deciles breakpoint. A vast majority of the firms are in the industries closely related to Internet, telecommunication, computer, or biomedical products. The proportion of firms in the so-called "high-tech" sector comprises 27% of all firms in our sample for the period 1/1998 – 3/2000. The high-tech companies before and after the high-tech bubble include 9.480 companies, or 17.92 percent of the total. The non-high-tech companies before and after the high-tech bubble include 43,415 companies, or 82.08 percent of the total.

The composite index of the ranked profitability, assets utilization, liquidity, and debt utilization ratios are used for the companies in each industry; each company also is grouped as a high-tech or non-high-tech company. For comparison purposes between industries, we rank each financial ratio instead of using the direct ratio of each company, allowing the different nature and characteristics of each industry to be neutralized and cross-examined in the analysis. First, we create nine equivalent partitions, then group and rank each company in each industry, assigning each company a rank from one through nine. Second, we group those financial ratios into four categories: profitability, assets utilization, liquidity, and debt utilization.

As shown in Table 1, the profitability composite ranked ratios (profitrank) are composed of gross profit margin ratio, return on assets ratio, and return on equity ratio. The assets utilization composite ranked ratios (assetrank) are composed of receivables turnover ratio,

inventory turnover ratio, fixed assets turnover ratio, and total assets turnover ratio. The liquidity composite ranked ratios (liquisrank) are composed of current ratio, current assets, quick ratio, and net working capital to total assets ratio. The debt utilization composite ranked ratios (debtrank) are composed of long-term debt to equity ratio and total debt to total assets ratio. The price to earnings ranked ratio is generated from stock price divided by earnings per share.
Table 2 Panel A and B provides a comparison of means and slopes for all companies before and after the high-tech bubble burst. In Table 2 Panel A, we observe that the significant decline of return on equity indicated that the high-tech companies reduced their product unit cost and profits. They have reduced their proportion of sales to outweigh the reduced product unit cost. Among the mean ratios of assets utilization, it again shows the decrease of sales, receivables, and inventory among the high-tech companies after the bubble.

Among the mean ratios of liquidity, it shows that the short-term liabilities and current assets have declined; however, the long-term liabilities have increased in the aftermath. When observing debt utilization ratio means, the long-term debts of those high-tech companies have increased some, but the short-term debts have declined slightly after the year 2000. The price-to-earnings ratios have increased from 19.5788 to 21.9535 after the bubble. It has shown that the short-term earnings per share have declined some in the new environment. Other ratios have shown the larger volatility and higher risk because of their higher standard deviations after the bubble. Also, the ROE, IT, and PE ratios all show the wider minimum and maximum values range after the bubble. They are confirmed that the profitability, sales, and short-term earning have become more volatile and higher risk after the bubble.

In Table 2 Panel B, we observe that after the bubble, there are significantly higher of ROE mean ratios. It indicates that the non-high-tech companies have less profit than the high-tech companies; however, the non-high-tech companies have higher liability than the high-tech companies, i.e. CR and QR mean ratios are lower in the non-high-tech companies. Also, the insignificant sales changes prove that the non-high-tech short-term liability has been declining after the bubble. In general, the non-high-tech companies have more impact on profitability after the bubble.

Among the mean ratios of assets utilization, it indicates a small increase of receivables after the high-tech bubble. As for the liquidity ratios, it indicates that the short-term current liabilities and assets have declined after the bubble. When we observe debt utilization ratios, it shows that the increase of long-term debt and short-term debt have increased modestly after the bubble, respectively. The significant increase of MB has shown a small increase in price and equity after the bubble. The higher standard deviations of other ratios have shown that the profitability, sales, and long-term equity have higher volatility and risk after the year 2000.

## IV. The Model and the Estimation Procedure

Anderson and Brooks (2006) stated that multiple years of earnings are a better predictor of returns than the traditional one-year PE ratio, and an eight-year average is twice as effective. They examined several plausible weighting rules for the past years of earnings, using the subset of companies with a full eight years of positive normalized earnings, and showed that the

individual earnings figures from five, six, seven or eight years ago, divided by the current share price, are better predictors of returns than the traditional PE ratios.

In Soliman's (2008) study, he found that the DuPont Analysis was a useful tool of financial statement analysis and applied a linear regression to analyze the DuPont decomposition of a firm's return on net operating assets that had been derived from a theoretical and parsimonious framework of valuation and relates to the operational aspects of the firm. We further adopt the nonlinear regression method for analyzing these grouped financial composite indices from the study of Chiao, et al. (2010). The squared terms represent the accelerated effects of impacts from the composite indices. They are used to test the financial structure change before and after the high-tech bubble occurred in the year 2000.

We adopt the similar method (Chao, et al. 2010) by creating nine equivalent partitions, then group and rank each company in each industry, assigning each company a rank from one through nine. Second, we group those financial ratios into four categories: profitability, assets utilization, liquidity, and debt utilization. The procedure for ranking composite index for four indices is presented as below.

$$\sum_{i=1}^{n} [Rank(Ratio_{it})]/n, \quad t = 1, 2, 3\ldots \qquad (1)$$

where $Rank(Ratio_{it})$ represents the ranking of the financial ratios $i$ at year $t$.
Then, the nonlinear regression method has been applied in terms of price earning and market to book value ratios for both high-tech and non-high-tech companies. We further adopt the nonlinear regression method for analyzing these grouped financial composite indices from Chiao et al.'s study (2010). The squared terms represent the accelerated effects of impacts from the composite indices. They are used to test the financial structure change before and after the high-tech bubble occurred in the year 2000. The models are presented below.

$$Y_i = \alpha_i + \sum_{j=1}^{4} \beta_j \times Ratios\,rank_j + \sum_{j=1}^{4} \gamma_j \times (Ratios\,rank_j)^2, \quad i = 1 \text{ and } 2 \qquad (2)$$

where $Y_i$ represents the market to book value ratios and price to earning ratios for all companies, high-tech, and non-high-tech companies. $Ratiosrank_j$ represents the composite indices of profitability ratios, the composite indices of assets utilization ratios, the composite indices of liquidity ratios, and the composite indices of debt utilization ratios. $\alpha_i$ , $\beta_j$ , and $\gamma_j$ represent the coefficients with the corresponding ratios for all companies, high-tech, and non-high-tech companies.

Furthermore, we apply the Polynomial Distributed Lag (PDL) model for the investor's cognitive proclivity analysis. The past quarterly financial ratios may have an influence on the present year's PE ratios. The PDL model is an ideal method used for assessing these ratios' impacts. The lag weights in the PDL model can be specified by a continuous function. Evaluating a polynomial function at the appropriate discrete points in time, in turn, can approximate their relationships. Both total $R^2$ and Akaike information criterion will be used to determine the lagged numbers for the composite financial ratios.

The PDL model for quarterly PE ratios ($Y_{PE}$) was estimated by the time series of composite financial ratios as regressors with distribution lags and other covariates, which are also regressors without lag distributions. It assumes that the effect of an input variable *X* on an output *Y* is distributed over time. If the value of *X* at time *t* changed, *Y* will experience some immediate effect at time *t*, and it also will experience a delayed effect at times *t-1*, *t-2*, and so on up to time *t-p* for some limit *p*. In this two-regressor model with a distributed lag effect for one regressor is written as below.

$$Y_{PE} = \theta + \sum_{j=1}^{4}\sum_{k=0}^{p}\delta_k x_{j,t-k} + \sum_{j=1}^{4}\varphi_j x_j^2 + u_{PE} \quad (3)$$

where $x_{j,t-k}$ are the composite financial ratio regressors with a distributed lag effects and $x_j^2$ are covariates of the squared-term of other financial ratios, $u_{PE}$ is an error term. Symbols of $\theta$, $\delta_k$, and $\varphi_j$ represent the coefficients with the corresponding ratios for all companies, the high-tech, or the non-high-tech companies.

The distribution of the lagged effects is expressed by Almon lag polynomials. The coefficients of the lagged values of the regressor are assumed to lie on a polynomial curve. That is,

$$\delta_k = \theta_0^* + \sum_{j=1}^{d}\delta_j^* k^j \quad (4)$$

where $d(\leq p)$ is the degree of the polynomial. The preceding equation can be transformed into orthogonal polynomials:

$$\delta_k = \theta_0 + \sum_{j=1}^{d}\delta_j f_j(k) \quad (5)$$

where $f_j(k)$ is a polynomial of degree *j* in the lag length *k*, and $\delta_j$ are coefficients estimated from the composite financial ratios.

The PDL model also can test for autocorrelated residuals and perform autocorrelated error correction by using the autoregressive error model. The PDL model computes generalized Durbin-Watson statistics to test for autocorrelated residuals. For models with lagged dependent variables, the procedure can produce Durbin h and Durbin t statistics.

This PDLs model is an ideal method for the financial ratios' ripple effect study. The past financial ratios surely can influence the later year's PE ratio and its effect most likely had polynomial relationships. We then use both total $R^2$ and Akaike information criterion to decide the lags' number. We found that a third-degree of polynomial and a four-period lag model would fit to this investor's reaction analysis.

Similarly, each coefficient in the non-linear PDL model would then represent an important effect on the magnitude of each financial ratio in the category. Each coefficient can be used for the comparison between and across the industries. The composite index ratios also can prevent the multi-collinearity problem between industry groups in the regression procedure. These coefficients can generate the meaningful outcome to reflect the ratio variances before and after the bubble.

## V. Empirical Results

The PDL model is applied for testing the existence of investors' ripple reactions. The past financial ratios can influence the current PE ratios in the responses of under-reactions, over-reactions, or excessive optimism. In Table 3, the coefficients of the profitability in different lag periods have changed from negative coefficient to positive sign in each lag period. It is a typical underreaction phenomenon. Investors generally underreact with earnings news, which drive the stock price out of their regular range and then self-correct in the next quarter. Statistically, all the coefficients of the lagged variables are significant and confirmed the existence of investor reactions in the profitability ratios. We observed that the coefficients of profitability ratios are more significant before the high-tech bubble burst than the aftermath. As the gap becomes wider, it indicates that investors show less concern about the profit impact after the bubble. This phenomenon is especially more significant in the high-tech companies than the non-high-tech companies.

When examining the asset utilization ratios, the coefficients of the high-tech companies all have positive signs comparing to the coefficients' signs change in the non-high-tech companies. It reveals that investors have different asset management perspectives between the high-tech and the non-high-tech companies. The high-tech company investors demonstrated excessive optimism reactions, while the non-high-tech company investors possess under-reaction perspectives. After the high-tech bubble, investors who invested in the high-tech stocks were paying more attention to the asset management performance. Hence, the coefficients in Model 4 are more statistically significant than in Model 3 for the last three quarters.

From the liquidity ratios' results, the coefficients of the high-tech companies all have positive signs when comparing to the negative signs for the non-high-tech companies before the high-tech bubble except the second quarter. The investors expressed different liquidity perspectives between the high-tech and the non-high-tech stocks before the high-tech bubble. High-tech investors possessed excessive optimism effect while the non-high-tech companies had a tendency of excessive passivism. Before the high-tech bubble, investors who invested in high-tech stocks were concentrating more on the liquidity ratios. This can be explained by the coefficients in Model 3 that exhibit significantly positive signs while Models 5 showed most of the coefficients in negative signs. It implies that investors have corrected their excessive proclivities after the high-tech bubble.

When observing the debt ratios, most of the coefficients have negative signs. We discover that investors demonstrate excessive passivism effects on the debt ratios to the PE ratios. The results show that investors not only have high negative effect to PE ratios but also last for some time in the market. After the high-tech bubble, investors were focusing more on the debt ratios that were explained by the greater and more significant coefficients' results. In addition, the non-high-tech company investors had more significant weights than the high-tech company investors in the previous three quarters. The study shows that investors exert their proclivities of excessive passivism in the restructured financial environment, especially in the non-tech company stocks.

From Figure 1, profitability chart indicates that all four models are negative interchanged reactions. While Models 4 and 6 (after the bubble) show slightly less of such effect. It explains that investors are less concern about the profitability information after the bubble. As for the assets utilization chart, Models 3 and 4 (the high-tech companies) exhibit the under-reaction signals. This effect has shown even strong outcomes in Model 4. On the other hand, Model 5 and 6 exhibit negative interchanged reactions. In liquidity chart, Model 3 (the high-tech companies before the bubble) has shown the under-reaction phenomenon. However, Model 4 (the high-tech companies after the bubble) shows a positive interchanged-reaction and Models 5 and 6 (non-high-tech companies) express negative interchanged-reactions. In the last Chart of debt utilization, all four models are showing over-reaction phenomenon, However, Models 3 and 4 (the high-tech companies) have shown slightly less of such effect. This outcome explains that investors have shown less concern about the debt utilization rate for the high-tech companies.

## VI. Summary and Conclusion

In the 2000s, firms maintained some growth in earnings despite a decline in sales by booking the realized gains on some appreciated investments, reducing deferred revenue, revising its deferred tax asset allowance, and pointing to "robust" cash flow from operations. Many companies have been financially restructured, so that they can be in a better position to deal with their debt burdens after the high-tech bubble. Investors may respond systematically with under-reactions, over-reactions, or excessive optimism to this new financial information.

In this paper, we first generated the composite index of the profitability, assets utilization, liquidity, debt utilization, price to earnings, and market to book value by ranking and consolidating from a company level. We then analyzed the variations of these key financial composite ratios to verify the investors who are facing a new financial environment. We further applied Polynomial Distributed Lag Model to explore the existing of financial ratios' ripple effects. The effects displayed the previous periods of financial ratios may influence the current PE ratios by investors' responses.

The results showed that the insignificant sales changes proved that the non-high-tech short-term liability has been declining after the period of the bubble. In general, the non-high-tech companies have more impact on profitability after the bubble. The profitability, sales, and long-term equity have higher volatility and risk after the year 2000. We observed that the non-high-tech companies are more conservative than the high-tech companies.

The high-tech companies have reduced more cost than the non-high-tech companies. This phenomenon indicated that the proportion of net income among high-tech companies has grown more than their assets and equities. The trend has shown a strong recovery after the bubble. The high-tech companies have a higher efficiency level than the non-high-tech companies after the effect of the high-tech bubble. In general, the non-high-tech companies had a lower declining rate or they were more mature than the high-tech companies.

The regression results indicated that the non-high-tech companies have turned around faster than the high-tech companies after the bubble. Investors have used the profitability ratios on the non-high-tech companies' investment more frequently than before the bubble. Many

companies have structured the way they can deal with the debt much better after the bubble. Investors have paid more attention to this issue after the event. However, the high-tech companies have not had significant influence either before or after the bubble. Investors also have paid more attention to the debt-ratios after the bubble. The large high-tech and non-high-tech companies had higher price-to-earnings ratios' rankings because of their awareness and reputation even after the bubble. The earnings have reduced more than the prices in both large high-tech and large non-high tech companies' aftermath. Generally speaking, aftermath companies have changed most of their focus from revenue-oriented measures to more profitability assessment, asset utilization, and debt burden.

We applied the Polynomial Distributed Lag Model to explore the existence of financial ratios' ripple effects. The effects displayed in the previous periods of financial ratios may influence the current PE ratios by investors' responses. The findings proved that there were different ripple effects spreading across those financial ratios. The results of the profitability ratios indicated that the under-reaction ripple effects existed among the high-tech investors. From examining the asset utilization ratios, we concluded that the high-tech investors demonstrated excessive optimism ripple effects while non-high-tech investors expressed the under-reaction propensities. From the liquidity ratios' results, we found that the high-tech company investors possessed the tendency of excessive optimism while the non-high-tech company investors were inclined to have perspectives of excessive passivism. Lastly, the debt ratios revealed that the non-high-tech investors exerted their proclivities of excessive passivism in the restructured financial environment.

**Table 1. Definitions of Financial Ratios**

Each financial ratio has been ranked instead of using the direct ratio of each company. It allows the different nature and characteristics of each industry to be neutralized and cross-examined in the analysis. Nine equivalent partitions have been created first, then group and rank each company in each industry. Each company has been assigned a rank from one through nine. Lastly, we group those financial ratios into four categories: profitability, assets utilization, liquidity, and debt utilization. We then have analyzed and interoperated each set of ratios by our proposed methodologies and models. Listed below are the individual ratios within each set, with their definitions.

1) Profitability Ratios:
Gross Profit Margin Ratio (PM): Gross Profit / Sales
Return on Assets Ratio (ROA): Net Income / Assets
Return on Equity Ratio (ROE): Net Income / Stockholder's Equity

2) Assets Utilization Ratios:
Receivables Turnover Ratio (RT): Sales / Receivables
Inventory Turnover Ratio (IT): Sales / Inventory
Fixed Assets Turnover Ratio (FAT): Sales / Property, Plant and Equipment
Total Assets Turnover Ratio (TATO): Sales / Assets

3) Liquidity Ratios:
Current Ratio (CR): Current Assets / Current Liabilities
Quick Ratio (QR): (Current Assets – Inventory) / Current Liabilities
Net Working Capital to Total Assets Ratio (NWTA): (Current Assets – Current Liabilities) / Assets

4) Debt Utilization Ratios:
Long-term Debt to Equity Ratio (LTDE): Long-term Debt / Stockholder's Equity
Total Debt to Total Assets Ratio (TDTA): (Assets – Stockholder's Equity) / Assets

5) Price Ratios:
Price to Earnings Ratio (PE): Stock Price / Earning Per Share
Market to Book Value Ratio (MB): (Market price × Common Shares Outstanding) / Stockholder's equity

**Table 2. Descriptive Statistics**

This table displays the descriptive statistics of the most important financial ratios in our database. PM is Gross Profit Margin Ratio, ROA is Return on Assets Ratio, ROE is Return on Equity Ratio, RT is Receivables Turnover Ratio, IT is Inventory Turnover Ratio, FAT is Fixed Assets Turnover Ratio, TATO is Total Assets Turnover Ratio, CR is Current Ratio, QR is Quick Ratio, NWTA is Net Working Capital to Total Assets Ratio, LTDE is Long-term Debt to Equity ratio, TDTA is Total Debt to Total Assets Ratio, PE is Price to Earnings Ratio, and MB is Market to Book Value Ratio.

T-statistics are calculated by using a pooled difference of means test, F-statistics are for a Chow test
* Significant at the 10 percent level (two-tailed)
** Significant at the 5 percent level (two-tailed)
*** Significant at the 1 percent level (two-tailed)

Panel A: High-Tech Firms

| | Pre-HTB (1993-1999) | | | | Post-HTB (2001-2007) | | | | | | Slope | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ratios | Mean | Std. Dev. | Min. | Max. | Mean | Std. Dev. | Min. | Max. | Diff. in mean (Post - Pre) | t-stat | Pre-HTB | Post-HTB | Diff. in slope (Post - Pre) | F-stat |
| PM | 0.484 | 0.013 | 0.467 | 0.506 | 0.525 | 0.013 | 0.499 | 0.539 | 0.041 | 5.77*** | 0.006 | 0.003 | -0.003 | 0.79 |
| ROA | 0.088 | 0.002 | 0.084 | 0.090 | 0.080 | 0.004 | 0.075 | 0.087 | -0.008 | -4.71*** | 0.000 | 0.001 | 0.001 | 7.08** |
| ROE | 0.149 | 0.004 | 0.143 | 0.153 | 0.140 | 0.010 | 0.129 | 0.159 | -0.009 | -2.36*** | 0.001 | 0.003 | 0.002 | 5.89** |
| RT | 5.546 | 0.096 | 5.406 | 5.661 | 6.291 | 0.092 | 6.195 | 6.437 | 0.745 | 14.88*** | -0.034 | -0.004 | 0.029 | 39.04*** |
| IT | 14.345 | 0.844 | 13.311 | 15.663 | 16.281 | 1.255 | 13.830 | 17.852 | 1.936 | 3.39*** | 0.365 | 0.140 | -0.225 | 0.38 |
| FAT | 4.347 | 0.097 | 4.185 | 4.466 | 3.964 | 0.168 | 3.754 | 4.242 | -0.383 | -5.21*** | -0.012 | 0.071 | 0.083 | 22.51*** |
| TATO | 1.063 | 0.044 | 0.986 | 1.111 | 0.864 | 0.031 | 0.830 | 0.910 | -0.199 | -9.83*** | -0.019 | -0.013 | 0.007 | 9.06*** |
| CR | 3.351 | 0.109 | 3.234 | 3.500 | 3.406 | 0.111 | 3.336 | 3.649 | 0.055 | 0.93 | -0.002 | -0.030 | -0.029 | 1.45 |
| QR | 2.737 | 0.114 | 2.557 | 2.877 | 2.921 | 0.072 | 2.823 | 3.049 | 0.184 | 3.61*** | 0.026 | -0.012 | -0.038 | 1.83 |
| NWTA | 0.415 | 0.016 | 0.395 | 0.434 | 0.378 | 0.014 | 0.366 | 0.407 | -0.037 | -4.76*** | -0.003 | -0.005 | -0.002 | 0.3 |
| LTDE | 0.164 | 0.012 | 0.146 | 0.177 | 0.176 | 0.006 | 0.166 | 0.184 | 0.012 | 2.18** | 0.003 | 0.000 | -0.003 | 0.63 |
| TDTA | 0.359 | 0.010 | 0.340 | 0.371 | 0.352 | 0.008 | 0.340 | 0.364 | -0.007 | -1.26 | 0.000 | 0.003 | 0.003 | 2.15 |
| PE | 19.579 | 2.135 | 16.445 | 23.401 | 21.954 | 3.354 | 16.697 | 25.723 | 2.375 | 1.58 | 0.605 | 0.364 | -0.242 | 0.15 |
| MB | 3.610 | 0.439 | 3.090 | 4.449 | 3.322 | 0.309 | 2.702 | 3.676 | -0.288 | -1.42 | 0.161 | 0.015 | -0.145 | 4.94** |

**Table 2. Descriptive Statistics (continued)**

Panel B: Non-High-tech firms

| | Pre-HTB (1993-1999) | | | | Post-HTB (2001-2007) | | | | Diff. in mean (Post - Pre) | | Slope | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ratios | Mean | Std. Dev. | Min. | Max. | Mean | Std. Dev. | Min. | Max. | | t-stat | Pre-HTB | Post-HTB | Diff. in slope (Post - Pre) | F-stat |
| PM | 0.375 | 0.006 | 0.369 | 0.385 | 0.413 | 0.018 | 0.390 | 0.435 | 0.038 | 5.25*** | 0.000 | -0.002 | -0.002 | 3.35* |
| ROA | 0.054 | 0.001 | 0.052 | 0.056 | 0.054 | 0.005 | 0.048 | 0.061 | 0.000 | 0.00 | 0.000 | 0.002 | 0.003 | 17.77*** |
| ROE | 0.141 | 0.003 | 0.139 | 0.147 | 0.143 | 0.008 | 0.132 | 0.153 | 0.002 | 0.59 | 0.001 | 0.004 | 0.003 | 14.25*** |
| RT | 5.554 | 0.081 | 5.436 | 5.663 | 5.511 | 0.097 | 5.384 | 5.625 | -0.043 | -0.91 | 0.003 | 0.029 | 0.026 | 2.00 |
| IT | 18.590 | 1.411 | 16.061 | 20.593 | 20.693 | 0.398 | 20.150 | 21.360 | 2.103 | 3.80*** | 0.596 | 0.119 | -0.476 | 6.95** |
| FAT | 3.681 | 0.024 | 3.638 | 3.707 | 3.589 | 0.144 | 3.413 | 3.737 | -0.091 | -1.66 | -0.004 | 0.061 | 0.065 | 28.67*** |
| TATO | 0.843 | 0.018 | 0.804 | 0.855 | 0.761 | 0.012 | 0.742 | 0.774 | -0.082 | -10.07*** | -0.006 | -0.001 | 0.007 | 8.83*** |
| CR | 2.372 | 0.082 | 2.217 | 2.455 | 2.315 | 0.075 | 2.197 | 2.398 | -0.057 | -1.37 | -0.027 | 0.034 | 0.060 | 12.19*** |
| QR | 1.684 | 0.076 | 1.556 | 1.771 | 1.723 | 0.102 | 1.563 | 1.831 | 0.039 | 0.8 | -0.022 | 0.046 | 0.068 | 14.29*** |
| NWTA | 0.172 | 0.011 | 0.149 | 0.181 | 0.150 | 0.011 | 0.137 | 0.160 | -0.022 | -3.84*** | -0.004 | 0.005 | 0.008 | 16.91*** |
| LTDE | 0.389 | 0.033 | 0.354 | 0.446 | 0.419 | 0.023 | 0.394 | 0.446 | 0.030 | 1.96* | 0.014 | -0.010 | -0.024 | 25.67*** |
| TDTA | 0.539 | 0.010 | 0.530 | 0.558 | 0.541 | 0.010 | 0.529 | 0.553 | 0.002 | 0.34 | 0.003 | -0.004 | -0.007 | 9.38*** |
| PE | 14.215 | 1.730 | 12.106 | 17.307 | 16.038 | 1.580 | 13.702 | 17.754 | 1.822 | 2.06** | 0.019 | 0.349 | 0.330 | 0.27 |
| MB | 2.330 | 0.112 | 2.195 | 2.498 | 2.427 | 0.267 | 1.984 | 2.667 | 0.097 | 1.19 | 0.008 | 0.086 | 0.078 | 1.31 |

**Table 3. Polynomial Distributed Lag Model Before and After the High-Tech Bubble**

1. All models include the independent variables of ranks and 4 lag variables of ranks in profits, assets, liquidities, and debts for all sample companies, high-tech companies, and non-high-tech companies. The composite indexes have been utilized for each category.
2. Models 1 and 2 represent the entire sample companies before and after high-tech bubble, respectively, for all 52,895 companies. Models 3 and 4 represent the high-tech companies only before and after high-tech bubble, respectively, for 9.480 companies or 17.92 percent of the total. Models 5 and 6 represent the non-high-tech companies before and after high-tech bubble for 43,415 companies or 82.08 percent of the total.
3. T-statistics are calculated by using a pooled difference of means test.

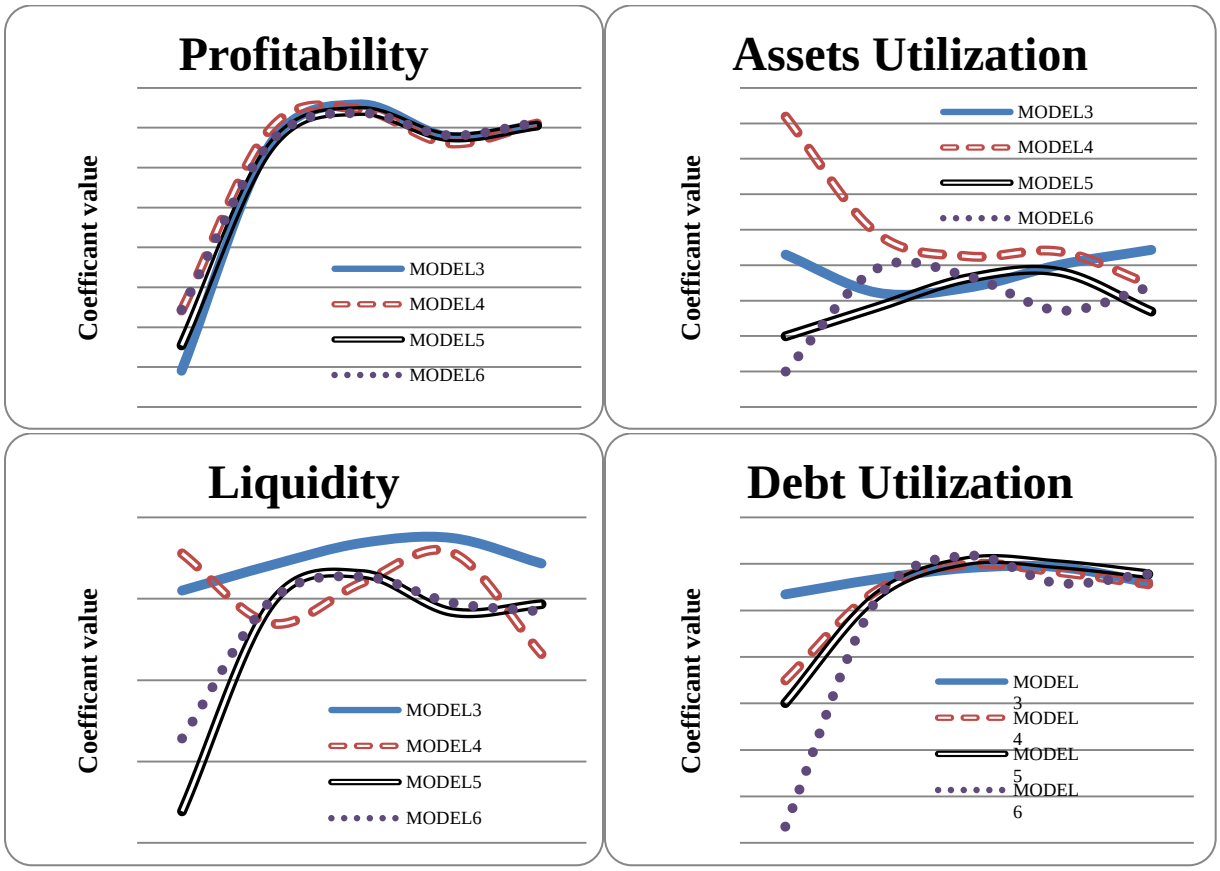
* Significant at the 10 percent level (two-tailed)
** Significant at the 5 percent level (two-tailed)
*** Significant at the 1 percent level (two-tailed)

| PDL model for PE ratio | | | | | | |
|---|---|---|---|---|---|---|
| | MODEL | MODEL | MODEL | MODEL | MODEL | MODEL |
| Intercept | 7.839*** | 8.037*** | 6.968*** | 7.281*** | 8.453*** | 8.191*** |
| | (122.14) | (65.66) | (31.21) | (29.37) | (70.69) | (57.30) |
| Profitrank_$b_0$ | - | - | - | - | - | - |
| | (-83.36) | (-51.85) | (-42.18) | (-27.39) | (-62.66) | (-43.62) |
| Profitrank_$b_1$ | - | - | - | -0.005 | - | - |
| | (-5.97) | (-11.99) | (-10.98) | (-0.63) | (-21.52) | (-13.58) |
| Profitrank_$b_2$ | 0.131*** | 0.080*** | 0.117*** | 0.094*** | 0.084*** | 0.074*** |
| | (25.82) | (20.90) | (18.73) | (13.15) | (21.55) | (16.27) |
| Profitrank_$b_3$ | - | - | - | - | - | - |
| | (-6.58) | (-11.18) | (-5.94) | (-9.12) | (-10.35) | (-7.14) |
| Profitrank_$b_4$ | 0.203*** | 0.021*** | 0.014 | 0.021** | 0.011** | 0.026*** |
| | (26.22) | (4.18) | (1.66) | (2.26) | (2.22) | (4.46) |
| Assetrank_$b_0$ | -0.011 | -0.011 | 0.026 | 0.104** | -0.020 | -0.040 |
| | (-0.50) | (-0.48) | (0.66) | (2.27) | (-0.93) | (-1.54) |
| Assetrank_$b_1$ | -0.001 | 0.025*** | 0.004 | 0.038*** | -0.004 | 0.018*** |
| | (-0.11) | (4.56) | (0.46) | (3.30) | (-0.69) | (2.87) |
| Assetrank_$b_2$ | 0.005 | 0.018*** | 0.007 | 0.025*** | 0.013*** | 0.014*** |
| | (0.78) | (3.75) | (0.89) | (2.59) | (2.77) | (2.54) |
| Assetrank_$b_3$ | -0.005 | 0.001 | 0.020** | 0.028*** | 0.016*** | -0.006 |
| | (-0.46) | (0.26) | (2.07) | (2.41) | (3.04) | (-0.90) |
| Assetrank_$b_4$ | - | 0.012** | 0.029*** | 0.009 | -0.006 | 0.008 |
| | (-4.43) | (1.97) | (2.67) | (0.70) | (-1.06) | (1.13) |

**Table 3. Polynomial Distributed Lag Model Before and After the High-Tech Bubble (continued)**

| PDL model for PE ratio | | | | | | |
|---|---|---|---|---|---|---|
| | MODEL | MODEL | MODEL | MODEL | MODEL | MODEL |
| Liquisrank_$b_0$ | - | - | 0.005 | 0.028 | - | - |
| | (-5.74) | (-4.25) | (0.21) | (1.06) | (-9.47) | (-5.21) |
| Liquisrank_$b_1$ | -0.008 | -0.002 | 0.021*** | -0.015* | -0.003 | -0.001 |
| | (-1.03) | (-0.44) | (2.56) | (-1.81) | (-0.64) | (-0.14) |
| Liquisrank_$b_2$ | 0.006 | 0.014*** | 0.034*** | 0.010 | 0.015*** | 0.014*** |
| | (1.32) | (3.79) | (5.23) | (1.41) | (4.45) | (3.22) |
| Liquisrank_$b_3$ | -0.003 | 0.004 | 0.037*** | 0.028*** | -0.008** | -0.002 |
| | (-0.43) | (0.84) | (4.60) | (3.35) | (-2.00) | (-0.49) |
| Liquisrank_$b_4$ | -0.004 | - | 0.022** | - | -0.003 | -0.008 |
| | (-0.57) | (-3.40) | (2.38) | (-3.61) | (-0.75) | (-1.47) |
| Debtrank_$b_0$ | - | - | -0.033 | - | - | - |
| | (-4.18) | (-16.66) | (-1.15) | (-3.72) | (-10.25) | (-16.11) |
| Debtrank_$b_1$ | -0.003 | - | -0.016* | - | - | - |
| | (-0.34) | (-8.15) | (-1.87) | (-3.18) | (-8.65) | (-7.99) |
| Debtrank_$b_2$ | 0.010* | 0.008 | -0.004 | -0.001 | 0.003 | 0.009** |
| | (1.95) | (2.18) | (-0.63) | (-0.09) | (0.87) | (2.06) |
| Debtrank_$b_3$ | -0.003 | - | -0.003 | -0.009 | 0.000 | - |
| | (-0.37) | (-4.76) | (-0.39) | (-0.94) | (-0.09) | (-4.18) |
| Debtrank_$b_4$ | - | - | -0.020** | -0.022** | - | -0.011** |
| | (-2.44) | (-3.10) | (-2.04) | (-2.17) | (-2.47) | (-2.02) |
| Profitrank$^2$ | 0.101*** | 0.050*** | 0.090*** | 0.039*** | 0.078*** | 0.054*** |
| | (52.80) | (23.55) | (25.80) | (9.68) | (37.05) | (21.46) |
| Assetrank$^2$ | - | - | - | - | - | - |
| | (-5.66) | (-7.74) | (-4.69) | (-7.36) | (-8.03) | (-4.83) |
| Liquisrank$^2$ | 0.009*** | 0.007*** | 0.011*** | 0.006* | 0.010*** | 0.007*** |
| | (5.88) | (4.02) | (4.05) | (1.80) | (5.95) | (3.35) |
| Debtrank$^2$ | - | 0.013*** | - | -0.001 | 0.004** | 0.016*** |
| | (-3.91) | (7.28) | (-3.54) | (-0.19) | (2.18) | (7.88) |
| Total $R^2$ | 19.4% | 19.2% | 21.8% | 27.0% | 16.5% | 16.7% |

**Figure 1. Investor's Ripple Effects Before and After the High-Tech Bubble - Polynomial Distributed Lag Model Results**




Notes:
1. All models include the independent variables of ranks and 4 lag variables of ranks in profits, assets, liquidities, and debts for all sample companies, high-tech companies, and non-high-tech companies. The composite indexes have been utilized for each category.
2. Models 3 and 4 represent the high-tech companies only before and after high-tech bubble, respectively, for 9.480 companies or 17.92 percent of the total. Models 5 and 6 represent the non-high-tech companies before and after high-tech bubble for 43,415 companies or 82.08 percent of the total.

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**Using Two Sets of Multiple Moving Averages of Price to Time Positions in a Portfolio of Exchange Traded Funds**

Timothy Peterson

## Abstract

This paper attempts to determine if the use of two sets of multiple moving averages of price can be employed to generate above market portfolio rates of return in a portfolio of exchange traded funds. A set of short term moving averages of price and a set of long term moving averages of price and the relationship within each set are used to determine the timing of entry and exit points for establishing positions in the exchange traded funds (ETFs). Returns using the moving average convergence divergence (MACD) indicator and a combination of the short term MACD and long term MACD to determine entry and exit points are compared to a buy and hold strategy of the S&P 500 Index. The portfolio returns over a five year time period (1/1/2006 – 12/31/2010) are calculated and compared to their S&P 500 benchmark. A comparison is then performed between a portfolio of seven exchange traded funds using the combined S-T MACD indicator and the L-T MACD indicator for entry and exit points to a buy and hold equally weighted and rebalanced portfolio comprised of the same exchange traded funds. The asset classes represented in the portfolio include domestic equities, developed foreign equities, emerging market foreign equities, domestic bonds, precious metals, and real estate. The use of two MACD indicators used in sequence with different parameters to represent expanding and contracting bands of multiple moving averages to determine entry and exit points was found to increase the return of a portfolio of exchange traded funds for the selected holding period over a buy and hold strategy.

## I. Introduction

Technical analysis attempts to forecast future prices by observing patterns on price charts. Many traders and investors use technical analysis to time their entry and exit points both in time and in price points based upon their interpretation of repeating patterns. Technical analysis may work because of the self-fulfilling nature of its prophecy. Many traders and investors see the same patterns and act upon those patterns in similar ways and hence the observed patterns become self-fulfilling.

May indicators have been developed over the years and used in technical analysis to predict future price movements. An indicator is an algorithm resulting in values graphed on a price chart. The moving average indicator and the moving average convergence divergence (MACD) indicator are common indicators used in technical analysis.

The moving average of price is the average price calculated over a certain number of time periods. In this study the time periods are days. Each new day's price results in the calculation of a new moving average. The successive moving averages over time can be graphed on a price chart as the moving average indicator. Selecting various time periods over which to calculate the moving average can result in multiple moving average indicators which can be shown on a price chart.

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There are two conventional approaches using multiple moving averages to indicate entry and exit price points when opening or closing positions. The first approach employs the use of two moving average indicators of differing time periods. This is referred as the moving average crossover strategy. The entry price point is indicated when the moving average computed using fewer time periods crosses from below the moving average computed using more time periods. The exit price point is indicated when the moving average computed using fewer time periods crosses from above the moving average computed using more time periods. The second approach is a modification of the first approach and uses the moving average convergence divergence (MACD) indicator. The MACD indicator is the difference between two moving averages of price. The MACD indicator acts as an oscillator line fluctuating within limits above and below a zero value line. The entry point is determined where the MACD indicator crosses from below a moving average of the MACD indicator itself. The exit point is determined where the MACD indicator crosses from above a moving average of the MACD indicator itself. A variation of the MACD indicator is the MACD histogram that plots the difference between the MACD indicator and a moving average of the MACD indicator. The entry point is determined when the histogram crosses the zero line from below. The exit point is determined when the histogram crosses from above the zero line. Both of these approaches are essentially the same in that they both look at the coming together (convergence) or spreading apart (divergence) of two moving average indicators of price.

This paper is unique in that it examines the results of using the convergence and divergence of two moving average indicators in sequence rather than in isolation. The sequence of that convergence and divergence or vice versa is founded upon the classification of two sets of moving averages representing the actions and sentiment of two distinct participants in the equities market. This paper essentially tests the results of two moving average crossover strategies in sequence, a 3 and 15 day moving average crossover strategy followed in sequence by a 30 and 60 day moving average crossover strategy. The results from testing the combined sequence of the S-T MACD (Short Term Moving Average Convergence Divergence) indicator followed by the L-T MACD (Long Term Moving Average Convergence Divergence) indicator are the same as testing the sequence of 3 and 15 day moving average crossovers followed by the 30 and 60 moving average crossovers.

## II.Literature Review

Whether technical analysis trading rules can generate above market returns has been a controversial issue. Malkiel (2011) states that technical analysis cannot be relied upon to generate above market returns and is essentially a useless and fruitless endeavor. Various studies have suggested that technical indicators alone cannot be used to predict future prices. Neftci (1991), Hudson (1996) and Mills (1997) suggested that technical trading rules cannot be profitably employed. Hudson and Mills found that a modification of the moving average, the variable length moving average, was profitable in the FT 30 Index. Some studies have supported technical analysis trading rules. Treynor and Ferguson (1985) and Brock (1992) suggested that trading rules can be used profitably. Brock found that a moving average crossover strategy from 1910 to 2000 performed better than a buy and hold strategy except for the period from 1980 to 2000 where the market followed a major uptrend. Most of these earlier studies examined simple trading rules such as the moving average and MACD Indicators. Parisi and Vasquez (2000)

found buy signals were more profitable than sell signals in the Chilean stock market. Hameed and Ting (2000) found evidence of predictability in the Malaysian stock market. Gunasekarage and Power (2001) found that technical trading rules are useful to predict equity prices in the stock markets of Bombay, Colombo, Dhaka, and Karachi. Ito (2009) found profitable trading rules for equities in the Mexican, Indonesian and Taiwan stock markets. Sehgal (2007) found that technical trading rules do not outperform a buy and hold strategy on a net return basis for individual stocks in India although technical indicators performed better during market upturns compared to market downturns. There appears to be greater probability of success using technical analysis trading rules in less developed financial markets than in more developed markets. This pattern would be in harmony with the efficient markets hypothesis.

Some have tested the MACD Indicator with mixed results. Brock, Lakonishok and LeBaron (1992) tested several moving averages and their crossing and found them beneficial in forecasting stock prices. Their benchmark was holding cash. Seykota (1991) tested the MACD Indicator from 1989 to 1991 on the S&P 500 Index and found no above average returns. Chong, Li, and Yu (2008) tested the MACD Indicator against some of the major stock indexes in the United States, the United Kingdom, Germany, Japan, and Hong Kong and found that the MACD Indicator generated above market returns in the German and Hong Kong stock markets. The MACD indicator crossing the 0 line which this paper tests produced higher returns than the MACD indicator crossing its signal line. The results after 2000 were inferior to the results before 2000. Sullivan, Timmermann and White (1999) found above market performance of moving average crossovers for the Dow Jones Industrial Average. Chong and Ng (2008) tested the MACD Indicator on the London Stock Exchange FT 30 Index and determined that they generated above market returns. Chong, Cheng, and Wong (2010) found that the MACD Indicator trading rules beat a buy and hold strategy in the BRIC countries (Brazil, Russia, India, China). Again the trading rules were more successful in stock markets with a short history (Russia) but work less successfully in markets with a long history (Brazil).

## III. Construction and Use of Indicators

The GMMA indicator is comprised of two sets of six moving averages of price each. The short term set is comprised of moving averages of 3, 5, 8, 10, 12, and 15 days and a long term set comprised of moving averages of 30, 35, 40, 45, 50, and 60 days. These are the time periods recommended by Guppy (www.guppytraders.com) and the ones used in this paper. The GMMA indicator is the visual representation on price charts of these two sets of moving averages of price. According to Guppy the short term set of moving averages represents traders and the long term set of moving averages represents investors. According to Guppy the GMMA indicator is a clue to the behavior of traders and investors as two distinct groups that can be used to understand the character and strength of the price trend.

According to Guppy the GMMA indicator shows changes in trend by visualizing the sentiment of investors (long term set of moving averages) and traders (short term set of moving averages). It is the composite picture of these averages that provides the view of the trend. The GMMA indicator is interpreted by observing the relationship between these two sets of moving averages and the relationship within each set of moving averages. The relationships within and

between the sets of moving averages reveal agreement and disagreement between traders and investors.

This paper uses multiple moving averages to determine entry and exit points but in a different way. In this paper I have constructed two indicators that represent the relationships within each set of moving averages and the relationship between the two sets of moving averages. The first indicator (S-T MACD) calculates the sum of the differences between all of the individual moving averages in the short term set and graphs them. It is analogous to the moving average convergence divergence (MACD) indicator. The S-T MACD reveals the degree of separation between the individual moving averages (3, 5, 8, 10, 12, and 15) in the short term set of moving averages. The MACD indicator plots the difference between two moving averages of price. I used the MACD indicator with the moving average settings of 3 and 15 days to represent the sum of the differences between the moving averages in the short term set of moving averages and graphs them. The second indicator (L-T MACD) calculates the sum of the differences between all of the individual moving averages in the long term set of moving averages and graphs them. It also is analogous to the moving average convergence divergence (MACD) indicator. The L-T MACD reveals the degree of separation between the individual moving averages (30, 35, 40, 45, 50, and 60) in the long term set of moving averages. I used the MACD indicator settings of 30 and 60 days to represent the sum of the differences between the moving averages in the set. Each of the indicators is an oscillator – a graph of the results of a computation where the results behave in a wavelike pattern where the wave fluctuates between an upper and lower value around the zero value line.

A higher relative value of the S-T MACD and the L-T MACD reveals more separation of the moving averages and a lower value represents less separation of the moving averages. Contraction of the band of moving averages indicates convergence and agreement on the price. Expansion of the band of moving averages indicates divergence and disagreement on the price. A value of zero of the S-T MACD and the L-T MACD indicates no separation of the moving averages within the band and agreement on price. Movement of the S-T MACD and the L-T MACD towards a value of zero represents convergence of the moving averages. Movement of the S-T MACD and the L-T MACD away from zero represents divergence of the moving averages. Agreement on price indicates an actionable point – an entry or exit point.

The GMMA concept is based on the composite picture of these two sets of multiple moving averages that provide a view of the trend. The expansion and contraction of the band of moving averages gives clues to the current stage of the trend of price. When the two sets of moving averages are consistently separated it shows trend consistency. The GMMA indicator and its related indicators (L-T MACD and S-T MACD) were used to determine if a systematic and mechanical method could be developed to trade the trend.

This paper tests the use of a sequence of MACD indicators to arrive at entry and exit points on a price chart. The S-T MACD indicator crosses the 0 line prior to the L-T MACD crossing the 0 line because it uses shorter term moving average periods in the calculation of the MACD indicator. Traders are more concerned with shorter term price movements and the S-T MACD indicator reacts more quickly than the L-T MACD indicator to changes in trend as revealed by the moving average. Traders come to agreement on price quicker than investors who

use longer term moving averages to reveal changes in trend. Traders lead investors in their buy and sell decisions. This paper then differs from other studies using the MACD indicator in that this paper uses a sequence of MACD indicators crossing the 0 line instead of a singular MACD indicator line crossing the 0 line or its signal line. The signal line is a moving average of the MACD indicator values.

Others have tested the MACD indicator with mixed results. Seykota (1994) tested the MACD indicator from 1989 to 1991 on the S&P 500 Index. His results found no above average returns. Chong, Li, and Yu (2008) tested the MACD indicator against some of the major stock indexes in the United States, the United Kingdom, Germany, Japan, and Hong Kong. In the German and United Kingdom stock markets the MACD indicator did provide above market returns. The MACD indicator crossing the 0 line which this paper tests produced higher returns than the MACD indicator crossing its signal line. The results post 2000 were inferior to the results pre 2000.

## IV. Backtesting of Indicator Conditions

Backtests were performed for a set of exchange traded funds representing various asset classes. Backtesting involves using backtesting software to generate entry and exit rules against historical prices to determine the success of a trading strategy. The back test period was from 01/01/2006 thru 12/31/2010. Exchange traded funds included in the backtest set were screened using the ETF screener at Fidelity.com and met all of the following criteria. A total of 161 exchange traded funds met all of the following criteria.

- Inception date prior to 01/01/2006
- Sponsor was from one of the following families: PowerShares, iShares, Proshares, Rydex, or Vanguard. These fund families sponsor the most numerous exchange traded funds.
- Financial asset classes: domestic small cap equities, domestic large cap equities, foreign developed equities, foreign emerging markets, fixed income, real estate, precious metals
- Leveraged and inverse funds were excluded

Source: www.fidelity.com

### 1) Backtest of S-T MACD Indicator on 161 Exchange Traded Funds.

The first backtest was run on the S-T MACD indicator. The sequence of an entry point and an exit point constituted a trade.
Enter position: the following condition must be met
S-T MACD moving up crossing 0 (short term moving averages diverging)
Exit position: the following condition must be met
S-T MACD moving down crossing 0 (short term moving averages converging)

TABLE I BACKTEST RESULTS OF S-T MACD INDICATOR – 161 ETF

| | Winning Trades | Losing Trades | Total Trades |
|---|---|---|---|
| Number of Trades | 3,137 | 6,042 | 9,221 |
| Average Return per Trade | 4.8 | (2.3) | .1 |
| Average Days in Trade | 26 | 6 | 13 |
| Winning Percentage | | | 34 |
| Average Gain/Loss Ratio | | | 2.1 |

The wealth index after the five year test period was 76.23 meaning the portfolio value at the end of the five year period was 76.23 percent of the beginning of period portfolio value. The wealth index indicates the compounded value of the portfolio thru time. The wealth index for the same period for a buy and hold strategy was 112.61. The buy and hold strategy assumed purchasing equal dollar amounts of the exchange traded funds and holding them for the five year duration.

**2) Backtest of L-T MACD indicator on 161 Exchange Traded Funds.**

The second backtest was run on the L-T MACD indicator. The sequence of an entry point and an exit point constituted a trade.
Enter position: the following condition must be met
L-T MACD moving up crossing 0 (long term moving averages diverging)
Exit position: the following condition must be met
L-T MACD moving down crossing 0 (long term moving averages converging)

TABLE II BACKTEST RESULTS OF L-T MACD INDICATOR – 161 ETFs

| | Winning Trades | Losing Trades | Total Trades |
|---|---|---|---|
| Number of Trades | 548 | 605 | 1,154 |
| Average Return per Trade | 17.4 | (5.0) | 5.7 |
| Average Days in Trade | 161 | 34 | 94 |
| Winning Percentage | | | 47 |
| Average Gain/Loss Ratio | | | 3.5 |

The wealth index after the five year test period was 103.09 meaning the portfolio value at the end of the five year period was 103.09 percent of the beginning of period portfolio value. The wealth index for the same period for a buy and hold strategy was 112.61.

**3) Backtest of MACD HISTOGRAM Indicator on 161 Exchange Traded Funds.**

The third backtest was run using the conventional MACD HISTOGRAM indicator using the standard parameters of 12, 26, and 9 day moving averages. The MACD HISTOGRAM indicator calculates the difference between the 12 - 26 day moving averages and a 9 day moving average of that difference and plots the difference as a histogram.
Enter position: the following condition must be met
MACD HISTOGRAM indicator moving up crossing 0

Exit position: the following condition must be met
MACD HISTOGRAM indicator moving down crossing 0

TABLE III BACKTEST OF RESULTS OF MACD HISTOGRAM INDICATOR – 161 ETFs

| | Winning Trades | Losing Trades | Total Trades |
|---|---|---|---|
| Number of Trades | 3,319 | 5,047 | 8,407 |
| Average Return per Trade | 4.34 | (2.70) | .09 |
| Average Days in Trade | 20 | 8 | 12 |
| Winning Percentage | | | 39 |
| Average Gain/Loss Ratio | | | 1.6 |

The wealth index after the five year test period was 97.22 meaning the portfolio value at the end of the five year period was 97.22 percent of the beginning of period portfolio value. The wealth index for the same period for a buy and hold strategy was 112.61.

**4) Backtest of combined S-T MACD Indicator and L-T MACD Indicator on 161 Exchange Traded Funds.**

Enter position: the following combined condition must be met
S-T MACD indicator moving up crossing 0 and then L-T MACD moving up crossing 0 (short term and long term moving averages diverging)
Exit position: the following combined condition must be met
S-T MACD indicator moving down crossing 0 and then L-T MACD moving down crossing 0 (short term and long term moving averages converging)
The crossing of the L-T MACD indicator and 0 occurred the next trading day after the crossing of the S-T MACD indicator and the 0 line

TABLE IV BACKTEST RESULTS OF COMBINED S-T AND L-T MACD INDICATOR – 161 ETFs

| | Winning Trades | Losing Trades | Total Trades |
|---|---|---|---|
| Number of Trades | 420 | 528 | 949 |
| Average Return per Trade | 15.10 | (5.17) | 3.81 |
| Average Days in Trade | 153 | 38 | 89 |
| Winning Percentage | | | 44 |
| Average Gain/Loss Ratio | | | 2.9 |

The wealth index after the five year test period was 121.86 meaning the portfolio value at the end of the five year period was 121.86 percent of the beginning of period portfolio value. The wealth index for the same period for a buy and hold strategy was 112.61.

**5) Backtest of combined S-T MACD Indicator and L-T MACD Indicator on Portfolio of Exchange Traded Funds (7 ETFs).**

The following table lists the exchange traded funds in the simulated portfolio

DESCRIPTION OF EXCHANGE TRADED FUNDS IN SIMULATED PORTFOLIO

| ETF Symbol | Description | Asset Class | Inception Date |
|---|---|---|---|
| IWM | iShares Russell 2000 Index Fund ETF | Domestic Equities Small Cap | May 2000 |
| LQD | iShares Trust Government $Investment Top Corporate Bond | Domestic Fixed Income | July 2002 |
| EEM | iShares MSCI Emerging Markets Index | Foreign Emerging Markets | April 2003 |
| IVV | iShares S&P 500 Index | Domestic Equities Large Cap | May 2000 |
| GLD | SPDR Gold Trust | Precious Metals | November 2004 |
| EFA | iShares MSCI EAFE Index Fund | Foreign Developed Markets | August 2001 |
| VNQ | Vanguard REIT ETF | US Real Estate | September 2004 |

Enter position: the following combined condition must be met
S-T MACD indicator moving up crossing 0 and then L-T MACD moving up crossing 0 (short term and long term moving averages converging)
Exit position: the following combined condition must be met
S-T MACD indicator moving down crossing 0 and then L-T MACD moving down crossing 0 (short term and long term moving averages converging)
The crossing of the L-T MACD indicator and 0 occurred the next trading day after the crossing of the S-T MACD indicator and the 0 line.
TABLE V BACKTEST RESULTS OF COMBINED S-T MACD INDICATOR AND L-T MACD INDICATOR – 7 ETFs

| | Winning Trades | Losing Trades | Total Trades |
|---|---|---|---|
| Number of Trades | 20 | 25 | 45 |
| Average Return per Trade | 17.36 | (4.52) | 5.20 |
| Average Days in Trade | 171 | 31 | 93 |
| Winning Percentage | | | 44 |
| Average Gain/Loss Ratio | | | 3.8 |

The wealth index after the five year test period was 134.24 meaning the portfolio value at the end of the five year period was 134.24 percent of the beginning of period portfolio value. The wealth index for the same period for a buy and hold strategy was 112.61.

The benchmark buy and hold portfolio for the S-T MACD (161 ETFs), L-T MACD (161 ETFs), MACD HISTOGRAM (161 ETFs), S-T L-T combination (161 ETFs), and S-T L-T combination (7 ETFs) was a $100,000 investment in the S&P 500 Index at 01/03/2006. The benchmark portfolio of the S&P 500 Index had a value of $112,610 at 12/31/2010. The wealth index was calculated by dividing $112,610 by $100,000 resulting in a wealth index of 112.61.

Fidelity, Schwab, and Ameritrade now allow commission free trading in selected exchange traded funds. There are no exchange traded funds for certain asset classes like commodities or precious metals that can be traded without commissions thru these online brokerages. Some online brokerages like Trade Station and Interactive Brokers do charge commissions of two dollars per transaction on stocks. Fidelity, Schwab, and Ameritrade charge eight dollars for each equity transaction.

The wealth index for Table IV and Table V was calculated using a commission cost of eight dollars per transaction. Tables IV and V were revised because only the trading results in these tables were profitable before commissions were considered.

TABLE VI SUMMARY OF SIMULATED PORTFOLIOS

| | | Portfolio Value at 12/31/2010 | Use of MACD Indicator – Wealth Index | Buy and Hold S&P 500 Index Wealth Index |
|---|---|---|---|---|
| TABLE I | S-T MACD (161 ETFs) | $76,230 | 76.23 | 112.61 |
| TABLE II | L-T MACD (161 ETFs) | $103,090 | 103.09 | 112.61 |
| TABLE III | MACD HISTOGRAM (161 ETFs) | $97,220 | 97.22 | 112.61 |
| TABLE IV | S-T L-T MACD combination (161 ETFs)<br>After commissions (1,898 commissions) | $121,860<br>$106,676 | 121.86<br>106.67 | 112.61 |
| TABLE V | S-T L-T MACD combination (7 ETFs)<br>After commissions (90 commissions) | $134,240<br>$133,520 | 134.24<br>133.52 | 112.61 |

## IV. Conclusion

The S-T MACD indicator, L-T MACD indicator, and the MACD HISTOGRAM indicator resulted in a lower wealth indexes than a respective buy and hold strategy. The combined S-T MACD L-T MACD indicators resulted in a higher wealth index than a buy and hold strategy in a portfolio of exchange traded funds.

This study did not indicate that the MACD indicator by itself can be used to generate above market returns. The use of a combination of two MACD indicators with different parameters used in sequence to generate entry and exit signals can be used to produce returns greater than a buy and hold strategy in a small portfolio of diverse asset classes over a buy and hold portfolio of those same asset classes.

The superior performance of the portfolio of 7 exchange traded funds over the portfolio of 161 funds was probably due to the more diversified nature of the portfolio. Most of the funds in the portfolio of 161 funds were equity funds. The 7 fund portfolio was composed of funds from diverse asset classes.

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# The Volatility Transmission of Gold around the World

Ingyu Chiou

## Abstract

This paper studies how one gold market affects another gold market in a different time zone, using the daily data from the Hong Kong, London, and New York markets over the period 2000-2005. When using the variable of intraday returns in regressions, we find that the Hong Kong market does not affect the London market, which has no impact on the New York market, which, in turn, does not affect the Hong Kong market. This finding is consistent with the theory of market efficiency because the intraday performance of one gold market cannot predict the intraday performance of another gold market that trades subsequently. However, when using the variable of intraday return volatility in regressions, we find that the Hong Kong market positively affects the London market, that the London market positively affects the New York market, and that the New York market positively affects the Hong Kong market. This new evidence contributes to the existing literature in financial market integration by suggesting that there are high degrees of volatility linkages between the Hong Kong, London, and New York gold markets.

## I. Introduction

Academics, practitioners, and regulators have long been interested in the degree to which national financial markets are interrelated. Studies of this topic typically focus on the examinations of portfolio diversification, the co-movements of equity prices, or the lead-lag relationships among national stock market indexes. Earlier research on the synchronization among equity prices across different countries [e.g., Grubel 1968; Levy and Sarnat 1970; Agmon 1972; Ripley 1973; Hilliard 1979; and others] explores the benefits of international diversification in reducing portfolio risk. Using weekly or monthly return data, most studies find that return correlations across countries are low or statistically insignificant.

Research in the 1980s on market interdependence examines the linkages of international equity markets using higher-frequency data. Jaffe and Westerfield (1985), using daily closing prices for five countries, find that return correlations between the U.S. and four other national markets are generally positive and significant for each day of the week. Schollhammer and Sand (1985) study the co-movements of stock market indices of major European countries and the U.S. Contrary to the findings of previous research, a significant degree of interdependence is found between the stock prices of Germany, the UK, the Netherlands, and Switzerland. In addition, a change in the US stock price index normally leads to a same-direction change of all the European markets except Italy. Eun and Shim (1989) use the vector autoregression (VAR) methodology to investigate cross-country price transmissions of nine national stock markets and detect a high degree of linkage among these national stock markets. They also find that the U.S. market is the most important information producer, often affecting other national stock markets unilaterally.

More recently, Becker, Finnerty, and Gupta (1990), using the opening price to the closing price returns of the Japanese and U.S. stock markets, find that the U.S. market Granger-causes the Japanese market, while the Japanese market has only a small impact on

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the U.S. market. Campbell and Hamao (1992) find evidence of common movements in expected excess stock returns between the Japanese and U.S. financial markets, suggesting a high degree of integration between the long-term capital markets of these two countries. In addition, Chiou (2011) finds strong evidence that Tokyo, London and New York stock markets are significantly interdependent in terms of equity return volatility.

Overall, previous research on the interactions and integration of financial markets shows that the degree of interdependence among national stock markets increases over time, as suggested by Koch and Koch (1991). They examine the relationships between daily closing index prices of eight national stock markets for the years 1972, 1980, and 1987. This evidence is consistent with the increased trade and capital flows across country borders in the past 50 years.

Based upon theoretical foundations and empirical findings of prior research on international market linkages, this paper extends the existing literature by examining how national gold markets interact. We study how the gold prices in different time zones (Hong Kong, London, and New York) affect one another. Gold is one of the most invested commodities and is traded in a lot of national financial markets. Therefore, it is suitable to use gold to investigate price transmission around the world. Some interesting questions arise. First, do the gold prices in the three major markets behave similarly in return and return volatility? Second, what are the causality relationships in the gold prices between these three markets?

The present paper is different from most of previous studies in three important ways. First, while we investigate the linkages between national gold markets, most previous papers research the topic using national equity markets. Second, unlike many previous studies that use close-to-close return data (i.e., 2 days' closing prices are used), we use open-to-close return data (i.e., same-day opening and closing prices are used) in three major gold markets (Hong Kong, London, and New York). Close-to-close returns tend contain noises over a 24-hour period that may distort the true performance of a financial market in a trading day. In contrast, open-to-close returns make direct tests of market efficiency easier. Finally, we focus on how a change in return volatility in one gold market affects the change in return volatility in another gold market. Prior research normally studies how a change in the index return in one stock market affects the change in the index return in another stock market. The focus on return volatility is interesting and important because return volatility is one key variable determining the price of an option contract.

We find no evidence that three gold markets are significantly interdependent, using the variable of the intraday return. This result is not consistent with those of prior papers that examine market integration, using the close-to-close returns of national equity markets. When using the variable of the intraday return volatility, we find that the Hong Kong market positively affects the London market, that the London market positively affects the New York market, and that the New York market positively affects the Hong Kong market. This new evidence contributes to the existing literature by suggesting that there are high degrees of volatility linkages between the Hong Kong, London, and New York gold markets.

The remainder of this paper is organized as follows. Section II briefly discusses the selection of three gold markets. In Section III, we describe the data and methodology. Section IV presents and discusses empirical results. We summarize and conclude in Section V.

## II. Selection of Three Gold Markets

Gold is traded around the clock and in many countries. With so many forms, gold trading ranges from the spot contract to the abstractions of futures contracts and to the solid tangibility of bracelets and rings.

The spot contract of gold is normally traded in an over the counter (OTC) market. This means an exchange does not match buyers and sellers, who, instead, come together on their own terms. The spot price of gold is the prevailing rate for a direct transfer of gold for cash. In normal situations, the spot price of a gold contract is lower than the futures price of a comparable contract because of the additional cost associated with storing the gold until delivery and the effect of speculation.

To examine the volatility transmission of gold prices across Asia, Europe, and North America, we selected Hong Kong, London (UK), and New York (the U.S.) as the representative markets for each of three continents. Because these three markets are in different time zones, they can be used for studying international linkages of financial markets. Also, we chose these three markets (Hong Kong, London, and New York) because they are consistently among the most active in the world in terms of market size, breadth, depth, liquidity, and foreign participation.

## III. Data and Methodology

We obtained the daily opening and closing prices of spot gold contracts for the Hong Kong, London, and New York markets from a Wall Street firm over the period March 2000-July 2005 (65 months). All of these prices are expressed in local currency units.

Because holidays in Hong Kong, the UK, and the U.S. differ, we first aligned the opening and closing prices by the calendar date for these three markets. To examine the pricing transmission of the spot gold contract, we then calculated the intraday return (= (close - open)/open) for each day and for each of the three markets. We deleted the dates in which at least one market did not trade.

Table 1 shows the summary statistics of intraday (open-to-close) returns over the 65-month period for each of three markets. During the sample period, the New York market has the highest average return (0.016%) while the London market has the lowest average return (-0.038%). Interestingly, the New York market also has the highest standard deviation (0.0225%), followed by London and Hong Kong. When we compare the return distributions, we find that the return distribution of the Hong Kong market is more left-skewed (the largest negative skewness) and more peaked (the largest kurtosis) than those of London and New York.

**Table 1**

Summary statistics of the intraday returns of spot gold contracts in Hong Kong, London, and New York over the period March 2000-July 2005
Spot contracts (in local currency units)

| | Hong Kong | London | New York |
|---|---|---|---|
| Sample size | 1265 | 1265 | 1265 |
| Mean (%) | -0.0038 | -0.0384 | 0.0161 |
| Standard Dev (%) | 0.0225 | 0.0139 | 0.0224 |
| Max (%) | 2.726 | 5.224 | 3.674 |
| Min (%) | -4.054 | -3.901 | -4.728 |
| Skewness | -3.395 | 0.777 | -0.028 |
| Kurtosis | 45.028 | 14.871 | 2.261 |

Because our focus is on how the gold price transmits continually from one gold market to another, the simple regression model, as used in Becker, Finnerty, and Gupta (1990), is appropriate for capturing the pricing transmission. Specifically, we use simple regression models to examine the causal relationships between Hong Kong, London, and New York, using the daily open-to-close intraday returns and return volatility.

## IV. Empirical Findings and Interpretations

On a typical business day, the chronological trading sequence is as follows: (1) Hong Kong opens; (2) Hong Kong closes; (3) London opens; (4) New York opens (a few hours before London's close); (5) London closes; and (6) New York closes. There is a trading-hour overlap between London and New York. To investigate the causal relationship between two gold markets, all regression models in this paper are in the sequence of Hong Kong, London, and New York.

Table 2 presents the regression results using intraday returns in regression models. Panel A shows that only 0.011% of the variability of the London intraday return can be explained by the variability of the Hong Kong intraday return, with an insignificant coefficient of the independent variable. Panel B shows that only 0.06% of the variability of the New York intraday return can be explained by the variability of the London intraday return, with an insignificant coefficient of the independent variable. Similarly, Panel C shows that only 0.016% of the variability of the Hong Kong intraday return can be explained by the variability of the New York intraday return, with an insignificant coefficient of the independent variable. It is surprising that in terms of the intraday return, there are no significant relationships in each of three pairs of gold markets. However, these results indicate market efficiency in that one market's intraday performance cannot predict another market's intraday performance.

**Table 2**

The results of causality tests using the intraday return in egression models
Regression variable = intraday return of spot gold prices = (close- open)/open
Time period = March 2000 to July 2005
* Significant at the 5% level; ** Significant at the 1% level
HK = Hong Kong; LN = London; NY = New York
**Panel A**: # of observations = 1,265
LN = -0.0383 + 0.0152(HK)
$R^2$ = 0.01%; t-value of the X variable coefficient = 0.377
**Panel B**: # of observations = 1,265
NY = 0.018 + 0.0394(LN)
$R^2$ = 0.059%; t-value of the X variable coefficient = 0.865
**Panel C**: # of observations = 1,264
HK = -0.0037 + -0.0054(NY)
$R^2$ = 0.016%; t-value of the X variable coefficient = -0.447

Table 3 exhibits the regression results using the volatility of intraday returns in regression models. Panel A shows that about 8.38% of the variability of the London intraday return volatility can be explained by the variability of the Hong Kong intraday return volatility, with the slope coefficient significant at the 1% level. Panel B shows that about 18.85% of the variability of the New York intraday return volatility can be explained by the variability of the London intraday return volatility, with the slope coefficient significant at the 1% level. Similarly, Panel C shows that only 11.85% of the variability of the Hong Kong intraday return volatility can be explained by the variability of the New York intraday return volatility, with the slope coefficient significant at the 1% level. These results are interesting in that in terms of the intraday return volatility, the Hong Kong market affects the London market positively and significantly, the London market affects the New York market positively and significantly, and the New York market affects the Hong Kong market positively and significantly.

**Table 3**
The results of causality tests using the volatility of intraday returns in regression models
Regression variable = volatility of intraday returns
Time period = March 2000 to July 2005
* Significant at the 5% level; ** Significant at the 1% level
HK = Hong Kong; LN = London; NY = New York
**Panel A**: # of observations = 1,235
LN = 6.08 + 0.275(HK)
$R^2$ = 8.39%; t-value of the X variable coefficient = 10.62**
**Panel B**: # of observations = 1,235
NY = 7.74 + 0.61(LN)
$R^2$ = 18.85%; t-value of the X variable coefficient = 16.93**
**Panel C**: # of observations = 1,234
HK = 1.62 + 0.257(NY)
$R^2$ = 11.85%; t-value of the X variable coefficient = 12.87**

The findings of this paper have at least four important implications. First, the finding that the intraday return of one gold market cannot predict the intraday return of another gold market trading subsequently is consistent with the theory of market efficiency. It implies that formulating a profitable trading strategy to explore the inefficiencies between two gold markets may be challenging. Second, portfolio theory shows that when the correlation between two assets is lower, all else being equal, the portfolio risk is reduced. If national gold markets are weakly correlated (in terms of intraday returns), then international diversification of gold investments can reduce the portfolio risk. Third, because our key variable in regressions is return volatility that is one key element in option pricing, the strong interactions of gold markets may imply the integration of gold option markets if they exist. Finally, national regulators and policy makers should be concerned about the volatility linkages between financial markets. They need to have a good understanding of world financial markets, watch these markets closely, and be prepared to handle adverse situations such as financial crises.

## VI. Summary and Conclusions

This paper studies the lead-lag relationships between three major gold markets over the period 2000-2005, using the intraday return variable and return-volatility variable, which are different from earlier papers. In terms of the intraday return variable, we find no evidence that three markets are significantly interdependent. This result is not consistent with those of prior papers that examine market integration, using the close-to-close returns of national equity markets. When using the variable of the intraday return volatility, we find that the Hong Kong market positively affects the London market, that the London market positively affects the New York market, and that the New York market positively affects the Hong Kong market.

The findings of this paper have important implications for trading strategies, portfolio management, option markets, and policy making. First, because the intraday return of one gold market cannot predict the intraday return of another gold market that trades subsequently, exploring the inefficiencies between two gold markets to profit may be challenging. Second, when national gold markets are weakly correlated (in terms of intraday returns), international diversification of gold investments can reduce the portfolio risk. Third, one key element in option pricing is return volatility, which is our key variable in regressions. The strong interactions of gold markets, in terms of return volatility, may imply the integration of gold option markets if they exist. Finally, national regulators and policy makers should be concerned about the volatility linkages between financial markets. They need to have a good understanding of how world financial markets interact, watch these markets closely, and be prepared to handle adverse situations such as financial crises.

Overall, this paper extends the existing literature in market integration by using intraday returns and return volatility to test how one gold market affects another gold market. Our new evidence suggests that there are high degrees of volatility linkages between the Hong Kong, London, and New York markets.

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# How Effective Are Foreign Currency Futures Markets As Hedging Vehicles?

Jeong W. Lee

## Abstract

In this paper, we investigate minimum risk hedges and hedging effectiveness measures for five currencies: Euro, Japanese yen, British pound, Swiss franc, and Canadian dollar. Analysis indicates the relative desirability of positions in futures contracts to minimize the risk of spot currency exposure. Among five currencies studied, Japanese yen proves the least hedging effectiveness across the time periods. Results also show hedging effectiveness increases with the investment horizon.

## I. Introduction

Even with the economic sluggishness since the "Great Recession", the daily trading volume of all foreign currencies has steadily increased to reach more than 4 trillion dollars. Undoubtedly, many speculators and hedgers utilize currency futures as alternatives to the forward exchange markets. While many studies report empirical evidence on the relationships between forward and spot foreign exchange markets, surprisingly there are not many works done on the use of foreign currency futures markets to test theories of exchange rate determination or as a practical means of hedging exchange rate movement.

The traditional method of determining the number of futures in a hedge is simply to measure the position in the underlying asset and to take an equal but opposite position in futures contracts. Now this method can be called a naïve approach. The first alternative to this approach was suggested by Ederington (1979) who defined a measure for the effectiveness of a hedge. Another one was proposed by Johnson and Walther (1984), who applied the "α-t" model of Fishburn (1977), and Howard and D'Antonio (1984, 1987). Some applied this idea to hedge a global portfolio. Thomas (1988) argued that international equity portfolios benefit from currency hedging. Perold and Shulman (1988) claimed that even after accounting for transaction costs due to hedging, currency hedging appeared to be the dominant strategy for a global fund manager. Using a hedge ratio of unity, they avoided the complexities of perfect hedge and total loss of control of the volatility. Cantaluppi (1994) found that currency hedging was beneficial but needed the integration of hedging and investment decisions. Glen and Jorion (1993) delved into the portfolio containing bonds for the search of improvement of the performance.

This study is designed to analyze hedging effectiveness and to determine the size of the minimum risk futures position for hedging each of five broadly traded currencies: Euro, Japanese yen, Swill franc, British pound, and Canadian dollar. This study is limited in scope to empirical analysis of single currency hedges. The strategy of minimizing currency risk with cocktails of spot currencies has been analyzed extensively in the literature. While theoretically holding a multiple currency portfolio of spot and futures positions may be desirable, practically managing such a portfolio requires centralized currency management facilities and experts. It also assumes stability or continued forecasting of cross-currency correlation relationships.

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A hedging usually carried out by buying (selling) a futures contract to initiate a hedge and closing out the position when the spot market transaction occurs by selling (buying) the contract in the futures market rather than taking delivery. Risk is reduced to the extent that the gain (loss) in the futures position offsets the loss (gain) on the spot position. Three types of analysis are conducted in this study. First, the minimum risk hedge ratio and associated hedging effectiveness are determined for each security assuming one week investment horizons. Summary statistics are presented for each currency. Second, since length of investment (hedging) horizons and time to delivery may affect the minimum risk hedge rates and hedging effectiveness, one, two and four week hedges are examined with contracts separated into three month periods representing time to delivery (ranging from closest to delivery (0-3 months) to that with 9-12 months remaining to delivery). The variation in the minimum risk hedge ratios and hedging effectiveness of contracts with different periods left to delivery over alternative investment horizons are analyzed. Third, while forward and future currency markets both provide similar hedging opportunities for contracts with equal time to delivery and investment horizons, differences in market characteristics may result in segmentations between markets. A currency by currency comparison of forward and futures markets in terms of hedging effectiveness is examined.

Analysis indicates the desirability of various size positions in futures contracts per unit of spot currency to obtain minimum risk hedges. Results also show edging effectiveness increases with the hedger's holding period and is sensitive to a contract's time to delivery. The next section contains a brief summary of pervious empirical results on foreign currency forward and futures markets and of the theoretical basis for the hedge ratios and the hedging effectiveness measures used in this study. A more detailed description of the data set is presented in Section III along with an analysis of the results. In the final section, conclusions are presented and areas of future work explored.

## II. Measurement of Hedging Effectiveness

Using the basic assumptions and principles of portfolio theory, it can be shown that the optimal hedge ratio (HR*), and hedging effectiveness of a market or contract(s) is related to the covariance between the spot and futures prices changes and the variances of futures price changes. In this case, the hedge ratio implies the weight of futures position in the portfolio or proportion of the given spot positions (long or short) that is hedged. A positive (negative) HR* indicates a purchase (sale) of futures and is the solution of the following equation:

$$\text{Min} \quad \text{Var}(C_{Ht}) = \text{Var}(C_{st}) + X^2_f \, \text{Var}(C_{ft}) + 2X_j \text{Cov}(C_{st}, C_{ft}) \qquad (1)$$

Subject to:

$$C^0_{Ht} = E(C_{st}) + X_f E(C_{ft}) \qquad (2)$$

Where

$C_{st}$, $C_{ft}$ = the price change during period t of the spot and futures contracts,

$C^0_{Ht}$ = the target changes in value during period of a portfolio invested in a fixed level of spot currency and a future contract in proportion $X_f$,

$X_f$= the proportion of the portfolio held in future contracts; $X^*_f$ equals the optimal hedge ratio (HR*) with $X_f < 0$ representing a short position and $X_f > 0$ a long position.

Above equation is similar to the two asset portfolio variance model. But in this case the spot $X_f$ is fixed at 1.0 and does not appear explicitly in the expression. Also risk and return are defined in terms of changes in value rather than return since the cost of setting up the position is effectively zero. Since the object of most hedging is to receive the maximum amount of price change risk reduction, the problem can be reduced to that of determining the minimum risk hedge ratio $HR^*_m$ or simply the value of $X_f$ at which the unconstrained objective function (1) reaches a minimum. The object of analysis is to measure hedging effectiveness for these risk minimizing hedges represented by a futures position in the proportion of HR*m. This minimum risk hedge ratio can be found by setting the partial derivative of the portfolio variance with respect to $X_f$ equal to 0 and solving for $X^*_f$.

$$\frac{\partial \text{Var}(C_{Ht})}{\partial X_f} = 2 X_f \text{Var}(C_f) + 2 \text{Cov}(C_s, C_f) = 0 \quad (3)$$

$$X^*_f = - \frac{\text{Cov}(C_s, C_f)}{\text{Var}(C_f)} = HR^*_m$$

The value of $X^*_f$ is equivalent to the negative of the slope coefficient of a regression of spot price changes on futures price changes and is easily determined given a data set of such price changes. The measure of hedging effectiveness $E^*_f$ for the minimum risk hedge is defined as the reduction in variance as a proportion of total variance that results from maintaining a hedged ($X_f \neq 0$) rather than unhedged position ($X_f = 0$). $E^*_f$ reduces to the coefficient of determination for the regression of spot on futures' price changes:

$$E^*_f = - \frac{\text{Cov}(C_s) - \text{Var}(C_H)}{\text{Var}(C_f)} = 1 - \frac{\text{Var}(C_H)}{\text{Var}(C_s)} \quad (4)$$

$$E^*_f = - \frac{\text{Cov}(C_s, C_f)^2}{\text{Var}(C_s)\text{Var}(C_f)} = R^2$$

As the correlation between the spot and futures price increases, the effectiveness of futures contract for reducing the risk of a particular spot position increases. The unity $R^2$ implies we have achieved the perfect hedge.

## III. Data Set and Results

Five major currencies, i.e., Euro, Japanese Yen, British Pound, Swiss Franc, and Canadian dollars were utilized in this study. Currency futures contracts call for delivery in March, June, September, and December. Therefore all 20 contracts were investigated. Futures price data were collected from the Wall Street Journal, and Investor's Business Daily using weekly Friday's closing prices of contract during the period March 2005 to December 2009 traded in the International Monetary Market of CME (Chicago Mercantile Exchange) Group. Closing prices of spot currencies on each Friday were collected from the Treasury Department.

Tables 1, 2, and 3 contain the results for each currency's futures contract of estimating minimum risk hedge ratio (HR*) and hedging effectiveness measures ($E^*_f$). Results support the hedging usefulness of the various futures currency markets. All hedge ratios exhibit significantly different from 1.0 at a significance level of 5 percent using a two-tailed *t*-test. Nonetheless, the hedge ratios were significantly less than one, meaning that a naïve one-for-one futures to spot hedge is not interpreted as the average proportional reduction in spot price change variance that could have been realized by hedging with the minimum risk hedge ratio ($HR^*_f$ ) over the period. For four currencies, Euro, Canadian Dollar, British Pound, Swiss Franc, their $E^*_f$ levels are all over 80 percent for four weeks duration. The Japanese yen proves relatively the most difficult to

hedge based on an average $E^*_f$ over all data set. For hedges of duration of one, two, and four weeks, $E^*_f$ values of Japanese yen are 23 percent, 30 percent, and 77 percent.

**Table 1**
**Futures Hedging Effectiveness Result (2005-2009)**
**Hedging duration: one week**

| | Euro | | Japanese Yen | | Canadian Dollar | | British Pound | | Swiss Franc | |
|---|---|---|---|---|---|---|---|---|---|---|
| Months included | EF* | HR* | EF* | HR* | EF* | HR* | EF* | HR* | EF* | HR* |
| All | .542 | .569 | .231 | .339 | .329 | .430 | .452 | .712 | .521 | .602 |
| 0-3 | .683 | .725 | .228 | .329 | .319 | .523 | .429 | .639 | .492 | .583 |
| 3-6 | .739 | .812 | .195 | .249 | .298 | .329 | .626 | .721 | .735 | .941 |
| 6-9 | .357 | .294 | .297 | .328 | .420 | .698 | .392 | .711 | .453 | .620 |
| 9-12 | .713 | .822 | .193 | .535 | .221 | .523 | .814 | .902 | .557 | .681 |

**Table 2**
**Futures Hedging Effectiveness Result (2005-2009)**
**Hedging duration: two weeks**

| | Euro | | Japanese Yen | | Canadian Dollar | | British Pound | | Swiss Franc | |
|---|---|---|---|---|---|---|---|---|---|---|
| Months included | EF* | HR* | EF* | HR* | EF* | HR* | EF* | HR* | EF* | HR* |
| All | .818 | .884 | .304 | .435 | .829 | .803 | .821 | .834 | .762 | .817 |
| 0- 3 | .592 | .810 | .285 | .329 | .793 | .813 | .910 | .932 | .809 | .829 |
| 3-6 | .839 | .792 | .520 | .609 | .931 | .892 | .731 | .871 | .933 | .987 |
| 6-9 | .935 | .988 | .621 | .554 | .791 | .710 | .712 | .611 | .569 | .702 |
| 9-12 | .883 | .902 | .543 | .402 | .998 | .973 | .546 | .597 | .915 | .913 |

**Table 3**
**Futures Hedging Effectiveness Result (2005-2009)**
**Hedging duration: four weeks**

| | Euro | | Japanese Yen | | Canadian Dollar | | British Pound | | Swiss Franc | |
|---|---|---|---|---|---|---|---|---|---|---|
| Months included | EF* | HR* | EF* | HR* | EF* | HR* | EF* | HR* | EF* | HR* |
| All | .887 | .933 | .772 | .797 | .982 | .998 | .989 | .997 | .938 | 1.102 |
| 0-3 | .819 | .921 | .820 | .923 | .938 | .945 | .987 | .921 | .910 | .893 |
| 3-6 | .839 | .920 | .728 | .767 | .938 | .912 | .901 | .932 | .992 | 1.032 |
| 6-9 | .993 | .924 | .520 | .709 | .824 | .792 | .938 | .798 | .932 | .915 |
| 9-12 | .932 | .948 | .992 | .763 | .983 | 1.229 | .992 | .984 | .992 | 1.182 |

The results also indicate that hedging effectiveness increases with the length of the investment horizon. For all currencies, and delivery periods, hedges of four weeks duration are twice effective as one week hedge positions. Overall all of five currencies show consistent high levels of hedging effectiveness. Japanese yen shows the least hedging effectiveness across the time periods. Even though findings reveal that hedging effectiveness increases with the length of the holding period, generally speaking, the contract closest to delivery tends to provide the most liquidity. Thus easy to hedge does not mean the best to hedge. Results also indicate the effect of time to delivery across the sample contracts.

## IV. Conclusions

In this study, new set of analysis is done to the hedging potential of foreign currency futures. Brief hedging effectiveness measures and optimal hedge ratios are presented for a sample of weekly price observations on 20 futures contracts for five currencies. Most cases the futures markets are shown to have consistently high hedging effectiveness. Hedging performance is weakest when a hedge of short duration (one week) was required and increased when one moved to longer hedging horizons. The results show all five foreign futures for one week hedge duration and Japanese yen futures for all hedge durations are somewhat inferior as hedging tools although they provide significant reduction in risk exposure when compared to a completely unhedged position. Euro maintains the least variation of hedging effectiveness throughout lengths of duration among currencies studied. Even though hedging with the short duration is the least effective, hedgers should bear in mind that the short duration increases its usefulness because the nearby contract most likely is more liquid than longer-term contracts. But the study does not indicate the nearby contract as the best hedging instrument. Results show in many cases the contracts with nine to twelve months to delivery provide the best chance of risk reduction.

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# The Effects of Human Capital on Attracting Foreign Direct Investment

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## Abstract

The main purpose of this study is to use cross sectional analysis to examine the effects of three alternative proxies for human capital on attracting FDI inflows and FDI stocks for 114 different countries. The results of this study is consistent with the market-seeking motive of FDI and supports the notion that countries with higher levels of human capital, as measured by school life expectancy or the gross enrollment at schools have been able to attract significant foreign capital into their economies.

## I. Introduction

Countries around the world are striving to raise the standards of living for their citizens by inviting Multinational Enterprises (MNEs) to establish subsidiaries in their countries or form joint ventures with exiting companies. Such policies are expected to bring new technology and management skills to the host country, create employment, increase productivity, contribute to faster economic growth and even improve balance of payments. In order to increase the likelihood of attracting suitable Foreign Direct Investment (FDI), host countries must have a talented and educated workforce, commonly referred to as the human capital.

Empirical studies have used time series and cross sectional analyses to test the effects of human capital on attracting FDI. However, the results of the available literature are mixed. Several studies such as Noorbakhsh et al. (2001) and Mumit (2008) have shown that the higher level of human capital has played an important role in attracting FDI into the host nations. Many of these studies have also found the positive impact of FDI on economic growth of the host countries. However, studies by other researchers such as Tanna and Topailboul (2005) and Quazi (2007: a,b) have shown the lack of convincing evidence to support the positive role of human capital on FDI inflows or economic growth of the host nations.

One of the major reasons for different results by researchers on this topic is the challenge of accurately measuring the level of human capital for empirical tests. There are obvious challenges associated with distilling the cumulative knowledge of a population into a single factor. As such, it is important to consider multiple measures of human capital to obtain a broad perspective of how human skills draw foreign enterprises to countries. Given the lack of consistent link between a specific measure of human capital and FDI in existing literature, the main purpose of this study is to examine the effects of human capital on attracting FDI inflows and FDI stocks for 114 different countries by utilizing three alternative proxies to measure human capital for each nation under study in 2007. The results would allow other researchers to determine the differences between and the effectiveness of different measurements of human capital in their future research. In addition to examining the role of different measures of human capital on FDI, this paper tests the role of market size in attracting FDI into the countries under study.

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The paper is organized as follows: Section II is a review of related literature; Section III explains the methodology and the data set, followed by Section IV that contains the study's empirical results. Finally, Section V provides the conclusions of the study.

## II. Review of Literature

The Organization for Economic Cooperation and Development published a study by Koji Myamoto that provided an aggregate view of worldwide trends toward the importance of human capital and development. Myamoto (2003) summarizes the literature on the subject by referring to the relationship as a virtuous circle. The study examines the current state of education and educational policy around the world. During the 1990's, there was a dramatic surge in basic, or primary, education throughout the world. Myamoto notes that while the most skilled workers are important to a country's development, the overall quality of the workforce is important as well. The study states that throughout the literature, basic education is a necessary component, although not a driver, of FDI Inflows. The key contributor that differentiates a workforce is higher-level of education. This assertion suggests that any quantitative analysis of human capital should be geared towards the examination of secondary or tertiary education as opposed to primary education.

One of the difficulties facing researchers is to agree on a universal standard for how to quantify human capital. Facing this challenge, some authors compiled their own measure of human capital in lieu of available data. Barro and Lee (2000) compiled a human capital data set that has been used in many studies. The work was originally published in 1993 and contained information on various measurements of human capital in 142 countries from 1960 to 1985. This original data set was subsequently updated to include information up to the year 2000. The variables they quantified in this study were population, the percentage that had no formal schooling, the percentage that had finished primary, secondary, and tertiary education, and school life expectancy.

School life expectancy is the average total amount of years spent in school in a given population. This variable has had significance in much of the literature written on this subject and has served as a measure of human capital in many studies, including Borenzstein et al. (1998), Nunnemkamp et al. (2002), and Barro and Lee (2000). The robustness of the variable stems from its quantification of many factors that are intrinsic to the measurement of knowledge in a society. It incorporates total years of schooling in the population, serving an absolute measurement of knowledge, but as an average it also captures the availability of education throughout a society.

Another measure of human capital, included in Barro and Lee's (2000) study, is enrollment rate. Enrollment rate serves as both a measurement of level of education as well as an important measurement of educational infrastructure. In addition to quantifying present coverage, these rates also provide a forward-looking measure of how the country is investing in its human capital stock. Those who are enrolled today become the leaders of the future. Barro and Lee note that school enrollment is likely to be a highly consistent variable in cross-sectional studies.
One of the preeminent studies on how human capital interacts with FDI and growth is the study conducted by Borenzstein et al. (1998). This study tests the effect of FDI on growth, human

capital on growth, and included measurements to capture the relationship between FDI's growth enhancing effects and the human capital stock. The authors assert that the most important growth-influencing element of FDI is technology transfer. They claim that the import of new technologies allows countries to essentially leapfrog stages of development. The study also attempts to quantify the effect of FDI on crowding out of the domestic investment.

A paper by Sailesh Tanna and Kitja Topaiboul (2005) studies the effects of human capital on economic growth. The study centers on Thailand and utilizes quarterly data from 1970-2004. They cite FDI, human capital, domestic investment, and trade as drivers of GDP growth. Much like the study conducted by Borenzstein et. al. (1998), the authors attempt to discover how human capital interacts with FDI to enhance economic growth. They presume that an economy must have a certain threshold of human capital to absorb the positive effects of FDI, such as technology transfer, job creation and the transference of management skills, etc. Their measure of human capital is School Life Expectancy. They use average years of male secondary education as the measure of human capital.

A study by Muhammed Tariq Majeed and Eatzaz Ahmad (2008) uses the illiteracy rate and health expenditures as measures of human capital and tests to see if these factors were significant determinants of FDI. In addition to these variables, they use wages, GDP, military expenditures, taxes, development assistance, remittances, urban population as a percentage of total population, and various measures of infrastructure including paved roads and vehicles per 1000 people. Their study focuses on 25 developing countries from 1970 to 2004. They find that health expenditures had a significant and positive effect on FDI inflows while illiteracy rate had a negative effect on FDI inflows.

To gain a broad perspective on the consensus of the factors that affect FDI, Chakrabarti (2003) provides an expert compilation of theories in his meta-study of the determinants of FDI. These studies have used various methodologies and have drawn different conclusions about the interaction and correlation between FDI and other economic variables.

Chakrabarti attempts to find those factors that have been regarded as significant by many studies. To test for this robustness, he utilizes extreme bound analysis to determine which variables are strongly and weakly correlate with FDI across the literature. He found that market size is highly correlated with FDI across all studies. Available literature shows that market size creates the necessary economies of scale required by foreign companies to invest in a country. This variable has been a key driver in terms of the amount of FDI inflows. However, the effects of other variables to attract FDI have been more ambiguous. The main elements of the study include openness, wages, trade barriers tax, exchange rate, trade balance, GDP growth, and tariffs. He points out that among other studies, these variables are not consistent in sign of their coefficients. He notices that openness and growth rate are more often positive than not and that trade barriers are equally positive and negative in the studies. He also observes that trade deficit, tax, wages, and exchange rate are more often negative than not.

## III. Methodology and Data

This study examines the role of different measures of human capital on FDI by using a cross-sectional analysis for 2007 for the countries under study. The value of a cross-sectional analysis is that it provides a global view of how a country's supply of human capital influences capital inflows. This study includes data for 114 countries for which we were able to find consistent data to conduct our analysis[1]. These countries have diverse economic characteristics e.g. different rates of economic growth, population size, GDP per capita, region, etc. The year 2007 was selected due to the abundance of data available during this time frame for the countries under study. Additionally, this year marks the time period before the beginning of the global financial crisis that affected major economic variables.

Given the limitation of available literature in using a common measure of human capital, this study uses three proxies for this variable in examining its effects on attracting FDI into various countries. The dependent variables are FDI Inflows and the Stock of FDI so that we could capture not only the short-term effects of human capital, through the effect on FDI Inflows, but also the long-term effects of human capital, through the effects on FDI stock.

The equations utilized for this study are as follows:

Equation (1): $FDI_{inflows} = \propto + \beta_1 H_u + \beta_2 G_r + \beta_3 O + \beta_4 E_x + \beta_5 S + \beta_6 T + \mu$

Equation (2): $FDI_{stock} = \propto + \beta_1 H_u + \beta_3 O + \beta_5 S + \beta_6 T + \mu$

Where $H_u$ stands for human capital, $G_r$ stands for growth of GDP in the period, $O$ stands for openness, $E_x$ stands for the exchange rate, $S$ stands for overall GDP as a proxy for the size of the market, $T$ stands for trade balance, and μ is the error term with zero expectations.

The dependent variables are measured as total yearly FDI Inflows and total cumulative FDI Stock respectively. These dependent variables were selected to examine the effects of human capital on current inflows annually, that is, how human capital is driving capital flows; and the effects of human capital on the accumulation of foreign capital stock in a country, that is, how human capital has driven capital flows in the past. These measurements are common dependent variables in other studies on FDI. Equation (2) excludes growth rate and exchange rate as these two variables are more short-term in nature and could vary quite considerably from year-to-year.

For the independent variables, the growth of real GDP is measured as a percentage of the previous year's GDP, openness is measured by a country's imports plus its exports divided by overall GDP, the exchange rate is the value of the local currency relative to the U.S. Dollar, GDP is measured as total annual real GDP, and the trade balance is measured as a country's exports minus its imports. The selection of independent variables to test FDI are consistent with the variables in other studies, as noted in Chakrabarti's (2003) summary of FDI research findings.

[1] The list of the 114 countries included in this study is available from the authors by request.

In both equations, multiple variables are used to quantify human capital. The three variables selected to represent human capital are primary to secondary school life expectancy, gross enrollment rate and literacy rate. These variables each capture a different aspect of human capital. School life Expectancy provides a measure of the total level of schooling within the country, gross enrollment rate provides a measure of educational infrastructure within a country and literacy rate provides a measure of quality of education. These variables were not used in the same equation because of their relation to one another. For example, a high level of school life expectancy implies a high level of literacy and a high level of gross enrollment implies a high level of school life expectancy. While the measurements are different, using them in the same equation represents a multicollinearity problem.

The measurements of human capital were obtained from UNESCO's statistical database. Information on GDP, exchange rate, and FDI were obtained from the World Bank's statistical database. Openness and trade balance were calculated using data obtained from the International Financial Statistics database.

## IV. Empirical Results

### A. FDI Inflows Tests

The study first examines the results of several variables on FDI inflows in Panel 1 in Table I. All of the independent variables are the same except we use three different measures as proxies for human capital. The results are summarized below:

#### 1. School life expectancy as the measure of human capital

The empirical results for using the school life expectancy as a proxy for human capital are shown in Table I, Panel1, below. According to the results of the study, the human capital and the market size are the only two significant variables in attracting FDI inflows into these countries. The coefficient of determination ($R^2$) is 68% and the F-value is highly significant.

#### 2. Gross enrollment as the measure of human capital

The results of using gross enrollment as the proxy for human capital are reported in Panel 2 in Table I. The coefficient of human capital is significant at 5% and the market size is the second significant variable in attracting FDI inflows. Both of these variables have the correct sign. $R^2$ is at around 68% and the F-statistic is highly significant.

#### 3. Literacy rate as the measure of human capital

Panel 3 in Table I reports the results of using literacy rate as a proxy for human capital. As the results indicate, when the literacy rate is used as the measure of human capital, it does not have a significant effect on FDI inflows. However, the size of the market has played a significant role in attracting FDI into countries under study.

**TABLE I**

**Impact of Different Measures of Human Capital on FDI Inflows**

| | **PANEL 1: School Life Expectancy** | **PANEL 2: Enrollment Rate** | **PANEL 3: Literacy Rate** |
|---|---|---|---|
| $\propto_0$ | - 1.7292 * | - 1.3050 | - 0.6025 |
| $\beta_1$ | 2.4071 ** | 2.1635 ** | 1.4216 |
| $\beta_2$ | - 0.3324 | - 0.6021 | - 0.9658 |
| $\beta_3$ | 1.1066 | 0.9495 | 0.4940 |
| $\beta_4$ | - 0.5229 | - 0.4008 | - 0.5384 |
| $\beta_5$ | 10.402 *** | 10.1843 *** | 10.0365 *** |
| $\beta_6$ | - 0.656 | - 0.5874 | - 0.5283 |
| $R^2$ | 0.6860 | 0.6828 | 0.6751 |
| $F$ | 38.9648 *** | 38.4043 *** | 37.0650 *** |

Numbers in the table are t-values.
* = 10% level of significance
** = 5% level of significance
***= 1% level of significance

The overall results coincided with the available literature on the subject. In the first two tests, human capital was a significant and positive driver of FDI Inflows. In our third test, literacy rate was not a significant determinant of FDI Inflows. This result is consistent with Myamoto's (2003) study that primary education is a necessary component but not necessarily a driver for FDI.

As manufacturing becomes more complex, companies require workers with skills above the primary level. School Life Expectancy, in conjunction with a country's Gross Enrollment Rate, provide a deeper, more holistic view of the capabilities of a country's workforce as compared to literacy rate which can be viewed as a porxy for primary education. These results seem to suggest that secondary and tertiary educations are the key drivers of FDI Inflows in the period and are similar to previous studies. Additionally, the findings of this paper are consistent with available literature in identifying the "market-seeking" motive of FDI, shown by the size of the country, as an important factor in attracting FDI into many countries.

### B. FDI Stock Tests

The second part of the empirical tests focuses on the stock of FDI as the dependent variable. As outlined earlier, Equation (2) is tested to examine the effects of several variables on accumulated FDI.

#### 1. School life expectancy as the measure of human capital

As Panel 1 in Table II shows, the coefficients of human capital and market size were the only two significant coefficients in the model. The F-value is highly significant and $R^2$ is over 76%.

2. **Gross enrollment as the measure of human capital**

Panel 2 in Table II shows that human capital as measured by gross enrollment and market size are the significant independent variables and both exhibit the correct signs. The coefficient of determination is at 85% and the F-statistics is highly significant.

3. **Literacy rate as the measure of human capital**

Finally, the study uses literacy rate to test the effects of human capital on stock of FDI. The results, as reported in Panel 3 in Table II, indicate that both the human capital and market size have significant and positive effects on accumulated FDI for countries under study.

**TABLE II**

**Impact of Different Measures of Human Capital on FDI Stock**

| | **PANEL 1: School Life Expectancy** | **PANEL 2: Enrollment Rate** | **PANEL 3: Literacy Rate** |
|---|---|---|---|
| $\propto_0$ | - 3.1650 *** | - 2.6849 *** | - 1.5537 |
| $\boldsymbol{\beta_1}$ | 3.7372 *** | 3.4143 *** | 2.1551** |
| $\boldsymbol{B_3}$ | 0.8676 | 0.6648 | 0.1205 |
| $\boldsymbol{B_5}$ | - 1.529312.1557 *** | 11.8305 *** | 11.6291 *** |
| $\boldsymbol{B_6}$ | - 1.529312 | - 1.4558 | - 1.3645 |
| $\boldsymbol{R^2}$ | 0.7618 | 0.7573 | 0.7423 |
| $\boldsymbol{F}$ | 87.1827 | 85.0339 | 78.5076 |

Numbers in the table are t-values.
* = 10% level of significance
** = 5% level of significance
***= 1% level of significance

The overall results of this part of the study show that even though the Literacy Rate is not a significant factor in driving FDI Inflows, it is a significant factor in explaining the overall FDI Stock in a country. This finding implies that past FDI Inflows were driven by a broadly educated populace equipped with the basic skills necessary to effectively assimilate to the processes and procedures of foreign businesses.

The results for School Life Expectancy and Enrollment Rate in their respective tests are stronger relative to the significance of Literacy Rate. However, the intercept is also significant in the School Life Expectancy and Enrollment Rate tests. This information indicates a more nuanced view of how human capital affects FDI stocks. Literacy rate shows how basic knowledge has permeated an economy. This dispersion of knowledge in a society helps ease the competition for talent among companies, sustaining business already located in the country while attracting new businesses. School Life Expectancy shares this characteristic and adds that countries must also have highly skilled workers. The significance of Enrollment Rate underscores the fact that countries must continually invest in their future human capital. These results are consistent with the evidence in the literature as summarized by Chakrabarti (2003). Additionally, the coefficients of the market size, as measured by the GDP of each country, were highly significant in all cases. This finding is consistent with the results of earlier studies to identify the size of the country as a "market-seeking" motive for FDI inflows and FDI stocks.

## V. Concluding Remarks and Recommendations for Further Study

Many researchers argue that an educated workforce is instrumental in attracting foreign investments into a country. However, it is fairly challenging to accurately measure the level of human capital and agree on a common definition for it. Therefore, one of the difficulties facing researchers is to agree on a common standard to quantify human capital.

The main purpose of this study is to apply cross sectional analysis to test the impact of different measures of human capital, namely school life expectancy, gross enrollment and the literacy rate, on attracting FDI to over 100 different countries by using data for 2007. The results show that human capital as defined in this study is a significant determinant of FDI in five out of the six tests. These findings are consistent with most of the empirical literature about the significant role of human capital in attracting FDI. Therefore, this study underscores the importance of investing in human capital as a matter of economic policy by countries that are interested in hosting foreign direct investment into their economies.

This study could be extended in different directions in the future. For example, the data set includes small developing countries and larger, developed countries. While this diversity is essential in capturing worldwide trends, it also creates distortion when it comes to trade balances and growth rates. The United States, for instance, has a relatively modest growth rate and runs an enormous trade deficit, but these factors have relatively little to do with the United States' ability to attract Foreign Direct Investment.

Furthermore, quantifying wage rates could be fairly important for this type of study to gain a greater view of how labor productivity and knowledge interact with the cost of production, wages. This type of analysis reflects the classic economic theory about the interaction between wages and productivity. A future study could also divide the countries into two samples of large and small nations to examine whether the role of human capital in attracting FDI is the same in small and larger economies. Finally, another extension of this paper is to replicate this study for countries with different stages of development.

One of the limitations of the study is the effect of two external shocks in 2007 that may have distorted the findings of this paper. The year 2007 produced two non-normal conditions that significantly altered the world economy. The first was the significant rise in oil prices and the second was the beginning of the global financial crisis. Those countries that have abundant oil supplies are able to export the commodity at high prices, which would aid their trade balance. At the same time, the ability of these economies to absorb and attract investment flows is limited by the size of their economy and the quality of their work force. On the opposite end of this equation, oil importers' trade balances are squeezed while their ability to absorb and attract inflows is largely unrelated to their oil imports. The symptoms of the recent financial crisis started showing some signs in 2007. The uncertainty associated with these signs may have begun to constrain investors' appetite for risk in this period. The higher growth rates experienced by developing economies may not have been enough to offset the risks investors perceived. On the contrary, companies may have been unwilling to engage in costly expansion in less proven economies at the beginning of the global economic crisis in 2007. It will be interesting for other researchers to test these tendencies in future research.

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# Equity Method of Forecasting

David Schalow and Christine Schalow

## Abstract

Projecting financial performance into the future is an important task for any business venture, and this is particularly true for new startups that have no track record. This paper examines the common pedagogy of "Percent of Sales Method" forecasting and suggests a new approach using initial equity rather than sales as the starting point for startups without a great deal of historical data. Using an unknown estimate like sales to forecast the remaining unknown values of the balance sheet and income statement is fraught with difficulties. Using a known value such as initial equity might allow the entrepreneur or other financial professionals to develop *proforma* statements which will be more realistic and perhaps more believable to outside stakeholders.

## I. Introduction

Projecting future performance is always a difficult undertaking. We all know that the past is not equal to the present; but knowing the past can obviously be helpful in forecasting the future. Forecasting difficulty is even more pronounced for small businesses, because of the dearth of information that they have available. Often they do not have the Accounting or Management Information Systems that larger entities would have available. McCarthy, Davis, Golicic, and Mentzer (2006) suggest that with the increasing availability of more and more sophisticated forecasting technologies you would assume that the reliability of sales forecasts would be improving, but this does not seem to be supported.

The percent of sales method of forecasting provides an excellent starting point for understanding how *proforma* financial statements can be developed from a limited amount of financial information. The method also highlights the importance of a good sales forecast, and encourages the user to learn key financial ratios, and establishes a basic understanding of key accounting relationships on the balance sheet and income statement.

Specifically, this paper will be limited to trying to project a *proforma* balance sheet and income statement one year out into the future. This is the typical task confronted by an entrepreneur, and is commonly used when introducing this topic in the typical accounting or finance course taught at most universities. The principal idea being proposed can be utilized more broadly, but this paper will address only the most difficult forecasting situation: A brand new business with no track record. Forecasting the financial needs of a new venture is particularly critical and extremely difficult[Stancill, 1986].

The difficulty in forecasting financial statements is not due to any particular controversy over the methodology. A quick look inside the standard textbooks used at universities to teach accounting or financial management leads to almost no choice in methodology: only some variant of the Percent of Sales Method. A brief survey of a few financial management textbooks all suggested the use of the Percent of Sales Method as a tool to forecast future financial statement values.

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- The entire Brigham series of Financial Management textbooks published by Southwestern Cengage
- Principles of Managerial Finance (Gitman) Prentice-Hall
- Fundamentals of Financial Management (Van Horne, et al) Prentice-Hall
- Introduction to Corporate Finance (Megginson & Smart) Southwestern Cengage
- Contemporary Financial Management (Moyer, McGuigan, Kretlow) Southwestern Cengage

This level of agreement is quite surprising given the question that all college professors dread when delivering the standard Percent of Sales Method lecture: "Professor, what happens if the sales forecast is wrong?" This is a surprisingly insightful question. Indeed, what do you do if the sales forecast is wrong? If the sales forecast is wrong, all of the forecasted asset and liability accounts will also be wrong. Remember the old adage, garbage in, garbage out.

## II. Start with the Sales Forecast

A brief review of the basic Percent of Sales Method of Forecasting follows. Everything starts with a good sales forecast. An accurate sales forecast is important for every aspect of planning, organizing, implementation, and controlling. Numerous techniques can be used to arrive at a sales forecast.[Pride and Ferrell, 2008] A few examples are:

- Executive Judgment
- Customer Forecasting Surveys
- Sales Force Forecasting
- Expert Forecasting (Delphi Technique)
- Time Series Analysis
- Regression Analysis
- Market Tests

This is just a partial listing. Entire university courses and countless company resources are devoted each year to forecasting sales. There are so many variables involved that even with all the available techniques; the accuracy of the sales forecast is always a question. For an established company, with a solid track record the above methods can lead to some reasonably accurate forecasts, but for a new business startup with limited historical data, the above methods may come up short. The uncertainty about the sales forecast is the key aspect that might lead to questioning the reliability of the Percent of Sales Method as a tool to forecast future financial performance.

## III. Traditional Method of Forecasting *Proformas*

Ratio analysis is an accepted approach to trying to provide meaningful information to a financial analyst.[Nissim and Penman, 2001] Once the sales number has been determined, it is assumed that many items on the income and balance sheets increase in direct proportion to sales. Past percentages can be calculated for a particular company, or if no past data is available, industry norms may be used as a substitute. The other items that are not directly related to sales are

estimated based on the firm's relative use of debt, equity, or other historical accounting relationships.

The following is a typical scenario described in textbook problems. Dave wants to start a business and needs a *proforma* Balance Sheet and Income Statement in order to present to potential investors or lenders. Dave estimates Sales his first year to be $1 Million. (No mention of how this was estimated.) In addition, Dave has found the following industry ratios highlighted in Table 1 from sources like Dun & Bradstreet, Risk Management Association (RMA) etc. With a sales estimate and the following step by step procedure, the basic financial statements can be estimated.

**Table 1 (Industry Ratios)**

| | |
|---|---|
| **Debt/Equity =1.5** | **Debt/Assets = 60%** |
| **Sales/Assets = 4** | **Current Assets/Current Liabilities** = **2.5** |
| **Sales/Inventory = 10** | **Gross Income/Sales** = 20% |
| **Net Income/Sales = 3%** | **Net Income/Equity** = 30% |
| **Fixed Assets/Assets 40%** | **Sales/Accounts Receivables** = 33.3 |

- Step 1: Use the known variable of sales to find Total Assets ie. 1,000/Assets = 4 (000's) Result: Total Assets must be 250
- Step 2: If Assets are 250, then Assets plus Equity must be 250
- Step 3: Find another ratio that includes one of your known variables. (In this case you now know the assets so you can also find the fixed assets by taking the percentage of fixed assets (40percent) and multiplying by the assets of 250 to arrive at 100.
- Step 4: If Fixed Assets are 100 and Total Assets are 250, then Current Assets must be 150.
- Step 5: If Current Assets are 150 and the CA/CL ratio is 2.5, then Current Liabilities must be 60. (150/CL = 2.5)
- Step 6: Use the D/A ratio to solve for the Total Debt. (D/250 =0 .60) The result is 150. If Total Debt equals 150 and Current Liabilities equal 60, then Long Term Debt must equal 90.
- Step 7: If Total Debt is equal to 150, Equity must be equal to 100 by default because Total Debt plus Equity must be equal to 250.
- Step 8: Now use the Sales/Inventory and Sales/Accounts Receivables to find the corresponding numbers using the same technique. ie. (1,000/10 = 100 for Inventory and 1000/33.3 = 30 for Accounts Receivables.
- Step 9: Finally, Cash must be equal to 20 because the Cash + Inventory + Accounts Receivable must equal 150.

The completed *proforma* balance sheet is shown in Table 2.

**Table 2**
**(Results of the Pro-Forma Balance Sheet)**

| | | | |
|---|---|---|---|
| **Cash** | 20 | **Current Liabilities** | 60 |
| **Accts Receivable** | 30 | **Long Term Liabilities** | 90 |
| **Inventory** | 100 | **Total Liabilities** | 150 |
| **Current Assets** | 150 | | |
| | | **Total Equity** | 100 |
| **Fixed Assets** | 100 | | |
| **Total Assets** | 250 | **Total Liabilities + Equity** | 250 |
| **Initial Sales Forecast** | 1000 | | |

This is a typical example of the use of the Percent of Sales Method to forecast a balance sheet for a new business startup as found in most finance textbooks. The ratios could be different, but the basic process is the same. Find any ratio that contains a known number and algebraically solve for the unknown variable and plug it into the balance sheet. Keep doing this until you run out of ratios. Then the student must use some element of the accounting equation to determine another unknown. For example, if you know that Total Assets are 250 and Total Liabilities are 150, Equity must be 100 because the Accounting Equation is Total Assets = Total Liabilities + Total Equity. Repeat the entire process until all the unknowns are solved.

The same process can be used to plug in the gaps for a *proforma* income statement. However, a better technique for the income statement is to use a set of industry norms using the common size income statement approach to generate more detail. This basically treats the Sales Estimate as 100 percent and then gives percentages as norms for the various income statement categories.

## IV. Alternative Equity Method

The only problem is that if the sales forecast is wrong, the entire *proforma* financial statements are wrong because they are primarily driven by fixed percentages of the incorrect sales number. Using an alternative approach, the basic procedure to create *proforma* financial statements is fundamentally the same but with a slight perceptual shift. Instead of starting with a volatile unknown variable like sales, start with a variable which is already known such as equity. The first question the new business start up will be asked, is how much equity they and their partners are going to be putting into the business. It seems logical that if you start with a known quantity as the basis of your forecast, the resulting *proformas* would be more realistic.

In the earlier example from Table 1, the only major change would be that you don't know the sales number; therefore you start with the known value of the equity of $100,000 or whatever the owners can contribute. If that were the case, you would look for any ratio that had equity in it; plug in the value of the equity and solve for the unknown variable, etc, etc. In this case,

Debt/Equity (100) = 1.5; therefore Debt must be 150 (100 X 1.5). If Debt and Equity are 150 and 100 respectively, Total Assets must be 250. If Total Assets are 250 and the Total Asset Turnover (Sales/Total Assets) is 4, then Sales must be 1,000. (Sales/250 = 4)

Alternatively, the starting point could have been, Net Income/Equity =0 .30. Net Income must be 30. (NI/100 = 0.30) If Net Income is 30 and the Net Profit Margin (NI/S = 0.03), then Sales must be 1000. (30/Sales = 0.03) The analyst would then continue in the same manner as the Percent of Sales Method to fill in the remaining gaps in the Balance Sheet and Income Statement.

The Equity Method is no panacea; there are still no guarantees. The sales forecast may still be wrong. But, at least there would be a reasonable belief that it could be realized, because you know that other firms in that particular industry with that much equity have achieved similar sales and asset levels. Deriving the Sales figure by starting with a known variable like equity, may give a more realistic figure of what might be obtainable. It might be unreasonable for a new firm to hit these targets, but at least it is a starting point.

The Equity Method might also be a good first step to develop a sales forecast. Using this realistic and obtainable number as the starting point, the entrepreneur can then apply all of the other more traditional sales forecasting techniques. The entrepreneur might then work backwards and develop a marketing plan that might be able to achieve the projected sales level. To attain a particular level of sales, the plan must be supported by the appropriate level of assets devoted to the sales budget.[Kotler and Keller, 2008] A quality sales forecast is an important step in developing the appropriate marketing mix that can lead to the attainment of the target sales level. [Lackman, 2007]

A lender or investor looking at a *proforma* derived by the Equity Method is more likely to see the projection as realistic because they are going to compare it to the industry norms. When they look at the Current Ratio to measure liquidity, CA/CL should be equal to 2.5. What they will find is 150/60 or 2.5. This same result will occur right down the line. The Equity Method also addresses the tendency for an enthusiastic entrepreneur to put forward an overly optimistic sales forecast. The level of sales being projected is actually being achieved by other firms in the industry with that much equity committed to the firm. A *proforma* projected by the Equity Method can now become a much more reliable planning device for the new entrepreneur because they now know what their competition is really doing. How much cash do they need to support the projected sales? How much credit should they grant? How about inventory levels? Although simplistic, it can still be valuable for management to be engaged in talking through these issues.

The Equity Method also lends itself to developing Optimistic/Pessimistic/Most Likely projections. Many sources of the industry norms break down the ratios by quartile and the entrepreneur could redo the forecast using the upper or lower quartile numbers depending on how much detail they are looking to include in their business planning models. [RMA, 2010] This is particularly relevant because it is unlikely that a new startup is going to realistically be operating at the industry averages. The lower quartile numbers for the relevant ratios might be

most likely for a new startup with the average or upper quartile numbers being used as targets for the future.

The only way that the Percent of Sales Method will perform as well as the Equity Method in developing an accurate *proforma* is if the sales forecast is accurate. An accurate sales forecast will trump all other methods. If we could accurately project sales, the other aspects of planning become trivial. Similar to the Wall-Street wisdom of,"Buy stocks at a low price and when they go up in price, sell. If they don't go up, don't buy!" Hindsight is 20/20.

Another useful application of the Equity Method is in the classroom for training, the professor assigns a project asking the student to do a financial forecast in addition to the standard ratio analysis assignment. With the normal percent of sales method, these are difficult to grade because no two students will have the same forecast because of the various assumptions that go into forecasting. With all the students using the same equity value from the latest financial statement, the final *proforma* should be the same from each student, making objective comparisons between students easier.

## VI. Conclusion

The percent of sales method will clearly lead to incorrect *proformas* if the sales forecast is incorrect. The premise of this paper is that it is more appropriate to use equity rather than sales as a starting point for developing *proformas* because equity is easier to predict, compared to the sales figure and therefore the resulting forecast might be closer to reality. The basic pedogogy of the percent of sales method is maintained, but the tenuous nature of the sales forecast is mitigated. Traditional sales forecasting methods are viable for existing businesses with a track record, but they are limited in usefulness for the new firm with limited or no past historical data and this is where the Equity Method may prove to be useful.

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# Corporate Governance and Performance of Banking Sector in Pakistan

Ramiz ur Rehman and Inayat Ullah Mangla

## Abstract

This paper investigates the impact of corporate governance variables on the financial performance of banking sector in Pakistan. For this purpose, the data of financial performance and corporate governance variables of thirty banks are used for the period of 2001-2009.The panel regression analysis is applied to determine this effect, firstly for the whole banking sector, and secondly for different types of banks. These types are categorized on the basis of their ownership and banking practices. The results show that there is a significant impact of corporate governance variables on the performance of overall banking sector in Pakistan. But there is no significant impact of corporate governance practices on the performance of foreign banks

## Introduction

Corporate Governance refers to the way an organization is directed, administrated or controlled. It includes the set of rules and regulations that affect the manager's decision and contribute to the way company is perceived by the current and potential stakeholders. The corporate governance structure specifies the distribution of rights and responsibilities among different participants in the corporation such as; boards, managers, shareholders and other stakeholders and spells out the rules and procedures and also decision making assistance on corporate affairs. By doing this, it also provides the structure through which the company's objectives are set and the means of obtaining those objectives and monitoring performance. Corporate governance may be the ways of bringing the interests of investors and managers into line and ensuring that firms are run for the benefit of investors.

Given the state of the economy of Pakistan in 2010, troubled as it is; ideally it would be more desirable to look at the governance issues at macro level for Pakistan. As a famous economist, Dr Shahid Javaid Burki- a long observer of Pakistan's economy has recently stated "Pakistan can generate a greater bounce in its economy than India by creating better governance. It has occurred before in the country's difficult economic history and could happen again." (Improved Governance: Dawn, 12th, October 2010).

However, as a starting point , in this paper we look at closely the governance issues for the financial sector , a sector which has played a significant role till recent years in economic activity of Pakistan.

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(Rehman et al ;2010) have looked at the issue of corporate governance in Chemical and Pharmaceutical sectors of Pakistan and found that there is a significant impact of corporate governance on the shareholder's returns in pharmaceutical sector of Pakistan. Corporate governance has become an issue of global significance. The improvement of corporate governance practices is widely recognized as one of the essential elements in strengthening the foundation for the long-term economic performance of countries and corporations. In Pakistan, the first Code of Corporate Governance for Pakistan was finalized and issued by SECP in March 2002. Then it was subsequently incorporated in all the listed companies of three stock exchanges in Pakistan. In 2004, SECP took the first step to establish the Pakistan Institute of Corporate Governance in public private partnership.

**Literature Review**

According to" A Survey of Corporate Governance Practices in Pakistan, 2007", conducted by: International Finance Corporation and SECP, 92% respondents prepare annual "statement of Ethics and Business Policy", 48% had "vision and Mission Statement", and none of the respondents have Code of Corporate Governance. On the other hand, it was also found that 50% of the corporations in Pakistan did not include non-executive directors in their board of directors, 54% have not introduced transaction administration procedure, 53% have not implement a formal remuneration system, and 55% did not have corporate governance improvement plan. Whereas, 31% respondents did not identify the barriers to improve the corporate governance, 69% identified the barriers, 42% had non availability of qualified staff to implement and 21% did have the claim that corporate governance produces sensitive information that cannot be shared with the competitors.

According to (Maria Mahar and Thomas Anderson ;2008) there are some weaknesses, strengths and economic implications associated with corporate governance systems. It is widely believed that good corporate governance is an important factor in improving the value of a firm in both developing and developed financial markets. However, the relationship between corporate governance and the value of a firm differs in emerging and mature financial markets due to disparate corporate governance structures in these markets resulting from dissimilar social, economic and regulatory conditions in these countries. There is a need to understand the differences which affect the value of a firm for academic investigations, financial and management practices and public regulation of corporations and markets. The variables used by (Kashif Rashid; 2008) price to book value ratio, market capitalization, gearing ratio, return on total assets, shareholder's concentration (agency cost), CEO duality, board size, and judicial and regulatory authority efficiency.

(Burki and Ahmad; 2007) explored the changes of corporate governance in Pakistan's banking sector and its impact on their efficiencies. They introduced dummy variables as a proxy of corporate governance changes in the banking sector of Pakistan. The result suggested that there was an impact of corporate governance changes on the banking efficiencies. (Driffield et al.,; 2007) examined a positive impact of higher ownership concentration on the firm value and its capital structure. When ownership concentration is low then the change of capital structure is depend upon the strict managerial approach. (Friend and Lang; 1998) found that ownership

concentration play an important role in the firm performance. The strong control of owners can control and direct the managers in achieving the organization goals.

(Baysinger et al; 1985) explored that there is a positive correlation between independent directors and the accounting performance of the firm. (Hambrick et al; 2000) also agreed with these results. (Agrawal et al ;1996) found a negative correlation between independent board of directors and the performance of the firm. On the other hand, studies by (Klein; 1998), 9Bhagat et al; 1997), and (Hermalin et al; 1991) contradicted the abovementioned results and found no significant relationship between independent directors and the accounting performance of the firm. Similarly, (Jeffrey et al; 1990) determined no relationship between the outside directors and the firm performance.

## Methodology

This study will explore the practices of corporate governance in major financial Institutions in Pakistan and measure its impact on their performance. Further, it will also compare the performance of conventional interest based banks and Islamic banks based on profit and loss sharing (PLS) system from the perspective of corporate governance. Pakistan has adopted an unusual three-tier Shari'a-compliance structure to ensure "deep and extensive" supervision of Shari'a compliance. The structure consists of the following components; (1) internal Shari'a advisers for Islamic banks, (2) a national Shari'a-complaince inspection unit, and (3) a national Shari'a advisory board established by the State Bank of Pakistan, the central bank (Akhtar 2006).

The secondary data of corporate governance and banking performance variables of thirty banks will be used for the analysis purpose over the period of 2001-2009. The chosen study period experienced huge structural changes in the banking sector of Pakistan. Many foreign banks are acquired by the private banks. Small banks are merged with large banks. Due to this reason, this study included only those banks which are performing their operations consistently over the period of last one decade. The selected thirty banks include all types of banks such as private, public, foreign and Islamic. But the number of private banks is more than public, foreign due the liberalization reforms of the banking sectors.

Three financial performance variables are used in this study of the selected banks i.e., return on Equity (ROE), return on Asset (ROA) and Earning per share (EPS). The data of the above mentioned variables are collected from the annual financial reports of the respective banks. The corporate governance variables such as ownership concentration (OC), board size (BS), independent Audit Committee (IAC) and tier shari's compliance structure (TSC) in case of Islamic banks is used. These variables are chosen on the basis of previous literature. The ownership concentration is defined as the majority of the shares are held by a small group of investors. For this ownership concentration value is determined by the following assumption:

Ownership Concentration = % of shares held by top five shareholder

Board size (BS) is consisted on number of total directors in the banks. It includes both executive and non-execute members of the bank. Independent Audit Committee (IAC) is defined

as the number of non-executive audit committee in the audit team of the bank. Tier Shari'a Compliance (TSC) is used as a dummy variable in this study. As it is a main component of Islamic banks and not present in conventional banks.

The data of above mentioned variables are combined in three of the following econometric models. The following models are multiple linear regression models in which financial performance variables are independent whereas corporate governance variables are dependent. The significance of these models is test with ANOVA first for whole banking sectors and then for different types of banks such as private, public, foreign and Islamic banks.

Model-I $\quad \mathrm{ROE} = \alpha_1 + \beta_1 \mathrm{BS} + \gamma_1 \mathrm{OC} + \delta_1 \mathrm{IAC} + \rho_1 \mathrm{TSC} + \epsilon$

Model-II $\quad \mathrm{ROA} = \alpha_2 + \beta_2 \mathrm{BS} + \gamma_2 \mathrm{OC} + \delta_2 \mathrm{IAC} + \rho_2 \mathrm{TSC} + \epsilon$

Model-III $\quad \mathrm{EPS} = \alpha_3 + \beta_3 \mathrm{BS} + \gamma_3 \mathrm{OC} + \delta_3 \mathrm{IAC} + \rho_3 \mathrm{TSC} + \epsilon$

Assumptions:

In the above mentioned models the coefficients of board size are $\beta_1$, $\beta_2$ and $\beta_3 > 0$, whereas $\gamma_1$, $\gamma_2$ and $\gamma_3 > 0$ are the coefficients of ownership concentration. The independent audit committee coefficients are $\delta_1$, $\delta_2$ and $\delta_3 > 0$. The coefficients of tier shari'a compliance are $\rho_1$, $\rho_2$ and $\rho_3 > 0$.

**Result and Analysis**

The impact of corporate governance practices on the performance of banking sector in Pakistan is measured in different perspectives. Firstly, overall banking sector performance and corporate governance practices are tested through three different multiple regression models over the period of 2001-2009.

The results show that all three models are highly significant at 1, 5 and 10% level of significance for all banks. The coefficients of determination of the said models are 0.28, 0.20 and 0.33 respectively. It indicates that the performance of the banking sector in Pakistan is influenced by the corporate governance practices.

Four independent variables of corporate governance are used in the abovementioned models, in which Board Size (BS) of the banks is highly significant at 1, 5 and 10% level of significance in all three models. It has a positive impact on the performance of all banks as per our assumption. Other two variables, Independent Audit Committee (IAC) and Ownership Concentration (OC) are not significant in all three models. But the coefficients of ownership concentration are affecting negatively on the performance of the banks. It is suggested that if holding of shares are concentrated in small group of investors then it hurts the accounting returns of the banks.

On the other hand, Tier Shari'a Compliance (TSC) is significant in model-I at 10% level of significant and in model-III at 5 and 10% level of significance. In both models, the impact of

TSC is negative on the banking performance. It means that the involvement of shari'a compliance in the governance structure of the banks creates hurdle in getting higher accounting returns. (see table-I)

Secondly, the impact of corporate governance is observed on the performance of different types of banks such as Private, Public and Foreign banks. The selection of banks for comparison purpose is critical at this point though only those private, public and foreign banks are selected which are consistently operating over the sample period. All those banks are ignored which merged or acquired during this period. Another comparison is made on the basis of banking operations i.e., Islamic and non-Islamic (conventional) banking practices. For this, the whole banking sector is divided into two categories, Islamic and conventional banks and then make a comparison between them i.e., which category performance is more influenced by the corporate governance variables.

The comparison results show that model-I is highly significant at 1, 5 and 10% level of significance for all types of banks except foreign banks. It is also highly significant for Islamic and Conventional banks. This shows that the return on equity for private, public, Islamic or conventional banks is influenced by the corporate governance variables.

As far as, the significance of individual corporate governance variables in model-I is concerned, the results show that the Board Size (BS) is highly significant at level 1, 5 and 10% level of significance for public, private, Islamic and conventional banks. Whereas Independent Audit Committee (IAC) is significant only for Islamic banks and Tier Shari's Compliance (TSC) is significant for private, public, Islamic and conventional banks.

The impact of board size is positive on return on equity for all types of banks except the Islamic banks. On the other hand, there is a mixed trend of the impact of IAC on return on equity for different types of banks. Such as there is a negative effect of IAC on Islamic, conventional and private banks, but a positive effect on public and foreign banks. The reason of this mixed trend is the nature of banking in different segments. The conventional and Islamic banks are affected negatively by the Independent Audit Committee because in conventional banks lack of transparency creates problem in the audit but in case of Islamic banks, a limited scope of operations can lower their returns. Whereas, there is a positive impact of TSC on the performance of Islamic banks but negative on all other banks. (see table-II)

The model-II is also highly significant at 1, 5 and 10% level of significance for conventional and public banks and significant at 5 and 10% level of significance for private banks. The impact of Board Size (BS) is positive and highly significant on conventional and private banks. Whereas, Independent Audit Committee (IAC) has negative and significant impact on conventional banks at 10% and on private banks at 5 and 10% level of significance. As most of the private banks are controlled by the private investors which hardly involve any of the non-executive audit members in the team due to their interests and it causes a lack of transparency in the operation. That is the reason when an independent audit committee member conducts the audit of a bank; he/she may become a hurdle in achieving their interest (see table-II) Model-III is significant at 1, 5, and 10% level of significance for all types of banks except the foreign banks. There is a positive and significant impact of Board Size (BS) on conventional,

public and private banks whereas a negative and significant impact on Islamic banks. The Independent Audit Committee has a negative and significant impact on all types of banks except foreign banks. In case of Tier Shari'a Compliance (TSC), it has a negative and significant impact on the performance of conventional, private and public banks but a positive and significant impact on Islamic banks. (see table-II)

**Conclusion:**

This paper is an initial effort to determine the impact of corporate governance practices on the performance of Pakistani banking industry. The impact is observed in different perspectives. First, this study investigates the impact of different corporate governance variables on the accounting performance such as return on equity (ROE), return on assets (ROA) and earnings per share (EPS) for all banks. Secondly, the impact is measured on different segments of the banking sector on basis of their ownership such as private, public and foreign and on the basis of their banking practices such as Islamic and conventional.

The results of this study are evident that there is an impact of corporate governance practices on the financial performance i.e., return on equity, return on assets and earnings per share for all banks. The most significant corporate governance variable in this respect is board size. The board size has a positive relationship with all bank's financial performance. It indicates that the size of a board does matter to increase the accounting return of the banks. Though it has no technical and direct relationship with the returns but a larger board can take the better decisions for the banks to enhance their earnings.

The comparative analysis of different types of banks show that the financial performance of all types of banks is influenced by the corporate governance practices except the foreign banks. The performance of foreign banks is least affected by either of the corporate governance variables. The reason of not affecting foreign banks financial performance by the local corporate governance variables is the central control of these banks. These banks are governed by the central executed body which may be located in their parent country. There is less influence of the local governance structure on the performance of foreign banks because they are directed by the central executive committee of the bank.

It is also concluded that the different corporate governance variables have different impact on the financial performance of different types of banks. Such as board size and tier **sharia's** compliance have a positive and negative impact on all types of banks respectively except for Islamic banks. The positive impact of board size in conventional banks financial performance indicates that a larger board can protect the interest of stockholders in better way. On the other hand, tier **shari'a** compliance has a negative impact on conventional banks because of its operational limitations. But in case of Islamic banks, board size has a negative positive impact on their performance because Islamic banks have limited banking operations, whereas, a positive impact of tier shari'a compliance on Islamic banks clearly indicated that it best suits to Islamic environment.

As this is a first effort to determine out the impact of corporate governance variables on the accounting performance of banking sector in Pakistan, it can be further studied by increasing

or replacing the different corporate governance variables and increasing the sample period of the study.

**Table-I- Multiple Regression Analysis Results for All Banks in Pakistan**

| | R Square | Co-efficient (P-value) | SE |
|---|---|---|---|
| **ROE and Corporate Governance Variables - Model-I** | | | |
| Overall Model-I | 0.28 | 0.00*** | 0.07 |
| BS | | 0.01 (0.000***) | 0.00 |
| IAC | | 0.02 (.40) | 0.02 |
| OC | | -.01 (0.53) | 0.01 |
| TSC | | -0.04 (0.05*) | 0.01 |
| **ROA and Corporate Governance Variables - Model-II** | | | |
| Overall Model-II | 0.2 | 0.00*** | 0.01 |
| BS | | 0.01 (0.00***) | 0.00 |
| IAC | | 0.01 (.98) | 0.02 |
| OC | | -.01 (0.11) | 0.00 |
| TSC | | 0.01 (0.75) | 0.00 |

**EPS and Corporate Governance Variables - Model-III**

| | | | |
|---|---|---|---|
| Overall Model-III | 0.33 | 0.00*** | 0.05 |
| BS | | 0.97<br>(0.00***) | 0.16 |
| IAC | | -2.56<br>(.0.06*) | 0.14 |
| OC | | -.1.29<br>(0.67) | 0.93 |
| TSC | | -3.02<br>(0.03**) | 0.01 |

**Note:**

*** Significant at 1, 5, 10% level of significance

**Significant at 5, 10% level of significance

*Significant at 10% level of significance

**Table-II Impact of Corporate Governance on Different Types of Bank**

| | R Square | (P-value) | SE | BS | IAC | OC | TSC |
|---|---|---|---|---|---|---|---|
| **ROE and Corporate Governance Variables - Model-I** | | | | | | | |
| Islamic | 0.60 | 0.00*** | 0.04 | -0.03 (0.00***) | -0.06 (0.00***) | 0.12 (0.23) | 0.02 (0.02**) |
| Conventional | 0.19 | 0.00*** | 0.08 | 0.01 (0.00***) | -0.16 (0.31) | 0.014 (0.56) | -0.01 (0.04**) |
| Public | 0.56 | 0.00*** | 0.01 | 0.02 (0.00***) | 0.02 (0.23) | 0.02 (0.43) | -0.01 (0.07*) |
| Private | 0.22 | 0.00*** | 0.01 | 0.01 (0.00***) | -0.01 (0.42) | -0.022 (0.46) | -0.00 (0.03**) |
| Foreign | 0.47 | 0.56 | 0.02 | 0.00 (0.33) | 0.00 (0.95) | 0.02 (0.65) | -0.01 (0.16) |
| **ROA and Corporate Governance Variables - Model-II** | | | | | | | |
| Islamic | 0.23 | 0.84 | 0.01 | 0.01 (0.62) | -0.02 (0.67) | 0.11 (0.13) | 0.01 (0.53) |
| Conventional | 0.21 | 0.00*** | 0.01 | 0.1 (0.00***) | -0.01 (0.07*) | 0.00 (0.81) | 0.01 (0.12) |
| Public | 0.29 | 0.00*** | 0.01 | 0.12 (0.01**) | -0.02 (0.58) | 0.00 (0.40) | 0.00 (0.16) |
| Private | 0.26 | 0.02** | 0.01 | 0.3 (0.00***) | -0.04 (0.03**) | 0.00 (0.80) | 0.00 (0.18) |
| Foreign | 0.30 | 0.63 | 0.01 | 0.01 (0.43) | 0.00 (0.41) | 0.03 (0.33) | -0.01 (0.13) |
| **EPS and Corporate Governance Variables - Model-III** | | | | | | | |
| Islamic | 0.53 | 0.00*** | 0.04 | -1.97 (0.00***) | -5.7 (0.00***) | 0.13 (0.33) | 0.02 (0.03**) |
| Conventional | 0.29 | 0.00*** | 0.05 | 0.94 (0.00***) | -1.97 (0.03**) | -2.37 (0.08*) | -0.01 (0.01**) |
| Public | 0.52 | 0.00*** | 0.06 | 1.08 (0.01**) | -7.72 (0.00***) | 1.2 (0.41) | -0.02 (0.00***) |
| Private | 0.28 | 0.00*** | 0.05 | 0.51 (0.00***) | -3.94 (0.00***) | 4.62 (0.01**) | -2.23 (0.09*) |
| Foreign | 0.45 | 0.33 | 0.03 | 0.01 (0.33) | 0.00 (0.95) | 0.02 (0.65) | -0.03 (0.15) |

**Note:** *** Significant at 1, 5, 10% level of significance

**Significant at 5, 10% level of significance

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