AoF
Academy of Finance

# Journal of Finance Issues

**Volume 17** **Issue 1** **Spring 2018**

# Table of Contents

**Giving Options to Everyone: Are There Financial Implications to the Firm?**

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## Abstract

Using simulated returns series and empirically observed stock returns, we show that broad-based option grants can generally lead to direct financial benefits for the company. Cash resources can be preserved internally by substituting options for a portion of payment in cash. However, the substitution of options for $1000 cash pay will result in only $10-$30 dollars of savings to the firm. This raises the question of whether savings of this magnitude can be universally considered as economically significant. We find that the sorting mechanisms in option grants and the financial-constraints explanation cannot be easily separated and both hypotheses should be studied jointly. The financing-constraints explanation for option grants can simply be a positive supplement to the sorting processes in compensating structures used by the firms.

## I. Introduction

Substantial chain of literature focuses on identifying the original motivating factors behind option grants. Many of the recent studies search for firm-specific characteristics and theoretical explanations that can explain what makes some companies grant options to all of their employees. Hall, Murphy (2003) suggest that accounting rules play a central role in the decision to use broad option grants in compensation practices. Shifting a portion of pay into options allows firms to reduce their reported compensation expenses and thus increase reported earnings. However, Murphy (1999) shows that stock options represented a large fraction of the total compensation of the top managers and, therefore, managers and directors should understand significant wealth transfers from the owners to employees. Oyer, Schaefer (2005) support the Hall, Murphy (2003) proposition, suggesting that managers understand these costs but are not motivated to act in the shareholders' best interests. In a later study, Oyer, Schaefer (2006) address managerial awareness of the high stock-option costs to shareholders. They argue that if broad option grants result in large costs to shareholders, then institutional shareholders will utilize their control rights to discourage such compensation practices, or corporate raiders will threaten the current managers with takeovers.

Employee sorting and retention are two further thoroughly studied explanations of firm-wide option grants. Lazear (1999) is one of the earlier studies on sorting models in option-based compensation literature. The author agrees that improved performance is the outcome of a heightened employee effort, but he extends the argument, stating that a greater sensitivity of employees' pay to performance attracts higher-quality workers. Oyer (2004) and Oyer, Schaefer (2005) follow this insight with an examination of the role of option grants in employee retention. If a firm's valuation is tied to its employees' outside employment options, then non-cash

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compensation schemes will help retain employees who might otherwise pursue opportunities outside the firm. Since option grants typically have a vesting period of a few years, leaving the company earlier will result in higher costs to the employees. Oyer, Schaefer (2005) slightly redefine earlier conclusions on the sorting and retention functions of firm-wide option grants. They question the incentivizing role of option-based compensation and support earlier findings that sorting and retention are the only factors. However, since non-executive employees have little effect on a firm's valuation, even a slight level of risk aversion would discourage these employees from accepting option-based compensation. This makes the sorting explanation of option grants counterintuitive. Oyer, Schaefer (2005) conclude that the firm can benefit by using stock options as a sorting mechanism to attract only the optimistic employees. However, Hochberg, Lindsey (2010) disagree that sorting and retention are the primary factors behind option grants. If performance-based incentives attract higher-quality employees, then a greater effort by these workers should lead to improved industry-adjusted performance for both small and large firms. Results of their study do not support this hypothesis, suggesting that sorting is not a factor behind broad option grants.

Core, Guay (2001) is one of the first studies that closely addresses the financing-constraints hypothesis by examining grants of broad-based stock option in public companies. Their study suggests that firms use non-executive stock options as incentives and as the source of internal financing. Firms use more non-executive options as a cash substitute in their compensation structures when they have lower cash flows and difficulties in obtaining external financing. Kedia, Mozumdar (2002) follow the work of Core, Guay (2001) and reach similar conclusions in their study on the factors affecting option grants to non-executive employees. The authors report a significant relationship between option grants and losses carried forward and conclude that financing constraints can be an important motivating factor behind firm-wide option grants. Holland, Elder (2006) take a different approach by considering the direct economic benefits to the companies resulting from broad-based option grants. They support the financing hypothesis regarding option-based compensation, and introduce an algorithm to determine the optimal option grant level under a given distribution of stock returns and the utility function of the representative non-executive employee.

Options literature does not universally support a positive relationship between financial constraints and option grants. Ittner et al. (2003) do not consider the financing-constraints hypothesis as a separate research question, but they find that cash flows and levels of option grants are positively related in "new economy" firms. Oyer, Schaefer (2005) do not reject the financing-constraints hypothesis, but they argue that the financing-constraints explanation can be supported only when employees are the cheapest source of financing and if employees are optimistic about firm's prospects. They conclude that the difficulty of separating the sorting and financing-constraints hypotheses is the likely explanation of inconsistencies in the outstanding empirical literature. Bergman, Jenter (2007) report that non-executive option grants are positively related to high cash levels and not related to leverage or interest payments. They continue the sorting argument of Oyer, Schaefer (2005) and conclude that option grants are related to the cash

constraints proxies at firms with a high level of employee optimism. However, cash-constrained firms do not grant options when their employees are not likely to be optimistic.

## II. Methodology

### *A. Broad-based Option Grants: Utility-based Approach with Simulated Returns*

In issuing options to employees as a partial substitute for cash-only compensation, firms can benefit financially by preserving cash resources, if such substitution is cheaper than obtaining external financing. Lee et al. (1996) show that flotation costs were historically at the 7.1% average for SEOs with a possible range of 3-17%, depending on the size of the issue. As marginal costs of option grants remain below flotation costs, financially constrained firms may be motivated to utilize options in their compensation practices. They further suggest that undiversified employees placed less value on increasing option grants, due to the larger firm-specific risk exposure of their overall wealth. Hall, Murphy (2003) continue this argument, showing that undiversified, risk-averse employees place large discounts on option grants and value additional stock options less than their risk-neutral market value. This creates a tension between two forces: the firm with financial constraints is motivated to grant more options but it also has to increase the number of options granted to preserve employees' utility, as workers place higher discounts on the additional options due to increasing risks.

The methodology used in this study is a modified approach from the Holland, Elder (2006) study of stock option grants to non-executive employees. Holland-Elder is a utility-based model in which utility is based on the wealth allocation of a representative non-executive employee. As the first step, the "all-cash" compensation utility level of a typical employee is determined. The employee's wealth is allocated across three assets: company stock, investment in a market portfolio, and investment of the remaining portion in the risk-free asset. The power utility function of a typical employee has the following form (definitions of the model variables are provided in Table I):

$$\mathrm{U}(\mathrm{S_T}, \mathrm{I_T}) = \int_{S_T} \int_{I_T} \frac{[n_s S_T + \frac{\pi(\overline{C}) W(\overline{C}) I_T}{I_O} + (1-\pi(\overline{C})) W(\overline{C}) e^{rt}]^{1-\alpha}}{1-\alpha} dI_T dS_T \quad (1)$$

where $W(\overline{C}) = \overline{W} - n_s S_o + \overline{C}$ (2)

**Table I. List of Variables for Equation 1-6**

| | |
|---|---|
| C | amount of cash compensation (when cash is used in combination with options) |
| $\overline{C}$ | amount of cash pay (cash-only compensation) |
| $n_o$ | number of options granted |
| $V(S_t)$ | pay-off value of an option at the end of period T, this is defined as MAX[($S_t$ - X), 0] |
| $S_t$ | spot price of stock at time T |
| X | exercise price of the option |
| $n_s$ | number of stocks in possession by the employee |
| $S_o$ | original market price of the stock |
| F | floatation costs (costs of issuing additional equity) |
| α | risk aversion factor |
| $\overline{W} - n_s S_o + C$ | amount of free wealth (including cash salary) available for allocation between market portfolio and risk-free asset investment |
| $\overline{W}$ | outside wealth of the employee |

Since options can be substituted for a portion of the cash compensation, a new utility function can be defined in the form shown in Equation 3 below. New utility is based on wealth allocation into four assets: the firm's stock, options, market portfolio and a risk-free asset. To preserve the employee's utility, the use of options as partial replacement for cash payment should result in the same utility level from the new compensation structure, which is formally represented by a necessary constraint in Equation 5. This way, the employee remains equally satisfied with his or her compensation when a portion of the cash pay is replaced with a certain number of stock options:

$$U(n_o, S_T, I_T) = \int_{S_T} \int_{I_T} \frac{[n_o V(S_T) + n_s S_T + \frac{\pi(C) W(C) I_T}{I_O} + (1 - \pi(C)) W(C) e^{rt}]^{1-\alpha}}{1-\alpha} dI_T dS_T \quad (3)$$

where $W(C) = \overline{W} - n_s S_o + C$ (4)

with the following constraint:

$$U(S_t, I_t) = U(n_o, S_t, I_t) \quad (5)$$

Equation 5 is also a necessary participation constraint in maximizing the net benefit function of the company, presented in the following form:

$$\frac{(\overline{C} - C)}{1 - F} - n_o \int_{S_T} [e^{-rt} V(S_T)] dS_T \quad (6)$$

The first term in Equation 6 represents the savings the company can achieve due to a lower requirement for external financing (since a portion of employees' cash compensation is replaced with options and the cash retained internally does not need to be raised on the external capital markets). The second term represents the company's costs in issuing options. Since employees place a discount on options as more options replace cash compensation, options are not granted at their fair market value.

The firm aims to choose a combination of C, amount of cash compensation, and $n_o$, number of options, for maximization of the benefit function in Equation 6 under participation constraint given in Equation 5. The utility level of an average employee in Equations 1 and 2 is determined with the power utility function in the following form:

$$U(\cdot) = \frac{(\cdot)^{1-\alpha}}{1-\alpha} \tag{7}$$

This is a utility function of a risk-averse employee with a level of relative risk aversion shown by the alpha coefficient, where higher alpha represents a higher level of risk aversion. Choice of the power function is consistent with the prior studies on compensation (Hall, Murphy (2003), Holland, Elder (2006)). The power utility function is the only class of the utility functions with a constant relative risk aversion. In economic models, this has an implication that decision-making is unaffected by scale. Prior literature suggests this is an important model property to describe decision making process of non-diversified, risk averse executives (Hall, Murphy (2002)). Arguably, constant risk aversion is even more applicable to compensation decision making of non-executive workers, who are non-diversified and typically have lower levels of compensation and wealth than executives.

Below is the summary of the model parameters used in the scenarios with normally distributed returns: a) the option value is determined with the Black, Scholes (1973) pricing formula, assuming a 10-year life for an option granted at the money with the underlying returns' standard deviation levels of 0.2, 0.3 or 0.4; b) twelve series of the stock and market returns are simulated using probabilities under bivariate lognormal distribution with the following parameters: stock standard deviations of 0.2, 0.3 and 0.4; index standard deviations of 0.2 and 0.3; correlation levels of 0.33 and 0.67, a risk-free rate of 6% and the market risk premium of 6.5%; c) the spot stock price, spot index value and exercise price of an option are each set at $30; d) all-cash salary is set at $50,000; e) risk aversion (alpha) equals 2; f) outside wealth is set at $200,000 and there is no restriction for the firm's stock holding. It is possible that a typical employee does not have any company stock.

The main research objective is to determine whether option grants to non-executive employees can result in direct financial benefits to a firm and whether it can be done without

deterioration of the compensation quality. Below is the algorithm of the actual steps of testing the models in Equations 1, 3 and 6:

1. Two series of the firm and market returns are simulated using the assumptions outlined above.
2. Returns are used in calculation of the beginning employee's utility, defined by Equation 1. This is a utility level based on outside wealth and all-cash compensation only. All of the resources available are optimally allocated across company stock, the market portfolio and the risk-free asset.
3. The new utility level, Equation 3, is recalculated on a new combination of assets: stock options and three assets as in Part 1 above. The proportions of company stock, market portfolio and risk-free asset differ from those in Part 1, since a portion of the cash-only pay is replaced with options. The new utility level has to be equal to the beginning employee's utility to preserve the quality of the overall compensation.
4. Equation 6 is solved simultaneously with Equation 5 for the optimal number of options, which is a quantity of options permitting maximum financial benefits for the company and preserving the quality of pay from the employee's perspective.

Following prior literature, the base model is tested on normally distributed returns. Alternatively, non-normal distributions for describing returns are also used as robustness tests. For instance, Smith (1981) proposes using logistic distribution for returns, while Gray, French (1990) consider series of the modified exponential distributions to describe returns. However, both studies suggest that non-normality is more pronounced for the higher frequencies of observed returns, while for monthly and annual returns, deviations from normality are less significant.

### *B. Broad-based Option Grants: Utility-based Approach with Actual Returns*

The same utility-based approach is utilized to study firm-wide option grants and possible financing benefits to the company. Application of the actual returns has at least two important advantages: it is unnecessary to make any distributional assumptions regarding the firm-level and market returns; it is possible to study sub-samples of firms sorted by levels of financial constraint (for instance, by size or company age) and compare results across such firm groups. Empirical returns are also used to estimate volatilities and annualized returns for option pricing and calculation of compensation utility levels. The methodological steps in determining optimal option grants remain the same as in the previous section. Firstly, the employee's compensation utility level is determined for cash-only pay. Secondly, the company has to grant a number of options to satisfy simultaneously the following two requirements: the new compensation utility has to be equal to the utility level before restructuring of the compensation package, and the preservation of capital has to be greater than the cost of the option grants. Since actual returns are used in this part of the study, the following conditions are added to the methodology:

1. 5-year rolling returns volatilities for stocks, annual market returns are estimated and used in pricing stock options;
2. stock options are granted at the money and all options are priced with the Black, Scholes (1973) model;
3. end-of- year prices are used to determine the resulting moneyness of the options.

Use of empirically observed returns is arguably a major improvement over a simulated data approach. Remaining shortcoming of the utility-based methodology is an assumption on the homogeneity of the non-executive employees' preferences, levels of wealth and compensation and risk aversion. This study presents a methodology and gives an example of its practical application for a firm to measure any financial implications of the firm-wide option grants. The model can be easily calibrated for a specific needs of a particular firm to reflect more accurately any measurable relevant parameters.

## III. Data

Lognormal bivariate returns series are simulated under various distributional parameter assumptions: three levels of stock returns volatility, two levels of market returns volatility and two levels of correlation between stock and market returns. This gives twelve possible combinations of parameters for different returns scenarios. Parameter combinations for the log-normal returns are summarized in Table II. Each scenario is tested on 10,000 simulated individual returns observations. Two additional tests are performed on the utility model using simulated returns that follow logistic and modified exponential distributions. Empirically observed returns for the individual firms' stocks and for the market were collected from the CRSP database and used in the utility models and benefits function – Equations 1, 3 and 6. Monthly data for the individual stocks, S&P 500 Index and Treasury bill rates are used over the period from 1992 to 2011.

The final sample includes annualized twelve trailing month returns series for the individual stocks and for the S&P 500 Index; annualized T-bill rates were collected directly from the CRSP database. Options are valued with the Black, Scholes (1973) pricing model using historical 5-year rolling returns volatilities for stocks and annualized T-bill rates as a risk-free rate of return. Options have a 10-year life, they are granted at the money with the exercise price is set equal to the stock market price on the date of the option grant. The ending value of the option is determined in one year's time as the positive difference between the new stock price and the strike price, or otherwise zero.

**Table II. Scenarios Assumptions for the Bivariate Lognormal Returns Series**

| Scenario | Market Returns St. Dev. | Stock Returns St. Dev. | Stock-Market Correlation |
|---|---|---|---|
| 1 | 0.2 | 0.2 | 0.67 |
| 2 | 0.3 | 0.2 | 0.67 |
| 3 | 0.2 | 0.3 | 0.67 |
| 4 | 0.3 | 0.3 | 0.67 |
| 5 | 0.2 | 0.4 | 0.67 |
| 6 | 0.3 | 0.4 | 0.67 |
| 7 | 0.2 | 0.2 | 0.33 |
| 8 | 0.3 | 0.2 | 0.33 |
| 9 | 0.2 | 0.3 | 0.33 |
| 10 | 0.3 | 0.3 | 0.33 |
| 11 | 0.2 | 0.4 | 0.33 |
| 12 | 0.3 | 0.4 | 0.33 |

## IV. Results

### *A. Utility-Based Approach: Simulated Returns*

The power utility function, describing the compensation utility of a representative non-executive employee, is a special case and represents the only class of the utility functions with a constant relative risk aversion. In economic models, this has an implication that decision-making is unaffected by scale. Given this model property, all the tests in this section are performed for the same level of risk aversion (measured by alpha set equal to two) and a standard substitution of options for $1000 of cash pay across all scenarios.

Table III presents a summary for all the parameter combinations in these twelve returns scenarios using lognormal returns series. Table IV summarizes results for these twelve combinations of the stock and market return volatilities and correlation levels. Series of returns are generated with the following assumptions: individual stock returns standard deviation of 20%, 30% and 40%; market returns standard deviation of 20% and 30%; and correlation levels of 0.33 and 0.67. In the scenarios where returns are normally distributed, benefits to the firm are not materially different for the different levels of returns volatilities and correlations between individual stock and market returns. Direct financial benefits are in the $37-$39 range per each $1000 dollars of cash pay for which stock options are substituted. This one thousand dollars represents cash preserved internally, and the company does not have to raise this amount on the external capital markets. Interestingly, the number of options granted and their market-value equivalent differ substantially across all twelve scenarios. This is a result of the volatilities and correlation parameters: depending on the input assumptions, options are priced differently and their resulting moneyness differs across all scenarios. Calculation of the option discount that

employees place on option grants is beyond the scope of this study, while the net financial benefit to the company resulting from the option grants is the variable of interest.

**Table III. Option Grants and Financial Benefits to the Firm Under Various Distributional Assumptions for Normally Distributed Returns Series**

| Scenario | Benefits to Firm | Number of Options | Cash Substitution | Options Value |
|---|---|---|---|---|
| 1 | 38.44 | 1470 | 1000 | 9,897.00 |
| 2 | 38.79 | 577.4 | 1000 | 7,815.40 |
| 3 | 37.23 | 1526.5 | 1000 | 10,722.90 |
| 4 | 38.15 | 1081.3 | 1000 | 14,678.90 |
| 5 | 37.74 | 895.3 | 1000 | 12,687.60 |
| 6 | 38.17 | 394.7 | 1000 | 5,592.70 |
| 7 | 37.44 | 516.8 | 1000 | 6,995.50 |
| 8 | 37.31 | 433.6 | 1000 | 5,869.60 |
| 9 | 37.62 | 593.4 | 1000 | 8,056.00 |
| 10 | 38.07 | 465.4 | 1000 | 6,318.10 |
| 11 | 38.42 | 539.3 | 1000 | 7,641.90 |
| 12 | 38.81 | 612.9 | 1000 | 8,686.00 |

Financial savings of raising capital represent just under 4% of the cash retained internally due to the compensation restructuring. This approximates the lower bound of flotation costs firms are facing on the external capital markets according to Lee et al. (1996), who report that firms typically pay 3-17% of the amounts raised externally, depending on the source of capital, the amounts being raised, and firm-specific risk factors. It is known that normal distribution occasionally fails to describe the distribution of observed stock returns. Nonetheless, financial theory rests heavily on normality assumptions and many of the fundamental models critically rely on the normality assumption. At the same time, it is also known that significant departures from normality are increasing for the higher frequencies of the observed returns: daily and intra-day returns are more likely to be non-normally distributed than monthly or annual returns (see Peiro (1994)). This study is based on the annual and annualized stock and market returns, and distributional deviations from normality are, probably, not a major methodological concern. Nonetheless, additional examination of the utility-based models is done on the series that are not normally distributed.

Smith (1981) proposes logistic distribution for returns with the following density function:

$$f(x) = \frac{\exp(\frac{x-\mu}{\alpha})}{\alpha(1+\exp(\frac{x-\mu}{\alpha}))^2} \tag{8}$$

where μ is the expectation and α is the scale parameter with the following relation to the standard deviation: $\alpha = (3)^{0.5}\sigma/\pi$. This distribution is similar to the normal, but it has bigger tails.

Gray, French (1990) consider modified exponential power distributions with the density function of the following form:

$$f(x) = \frac{\exp(-\frac{1}{2}(\frac{|x-\mu|}{\phi})^{\frac{2}{1+\beta}}}{2^{\frac{3+\beta}{2}}\phi\Gamma(\frac{3+\beta}{2})} \quad (9)$$

where μ is the expectation of x and ϕ is the positive scale parameter. β is the kurtosis measure that shows a degree of "non-normality" of the distribution. When beta is zero, Equation 9 is reduced to the density function of the normal distribution; beta of one gives rise to double exponential distribution; and as beta tends to -1, Equation 9 converges to the uniform distribution.

Additional series of stock and market returns are generated under logistic, exponential and normal distributions for the three comparable returns scenarios. The characteristics of the resulting samples are reported in Table IV. A choice of the distributional parameters is made in such a way as to obtain three samples with somewhat similar characteristics – that is, with similar average returns, volatilities and correlations between market and individual stock returns. Utility functions in Equations 1 and 3 are re-run simultaneously with the benefit function in Equation 6 based on these additional returns series.

**Table IV. Summary Statistics for the Returns Samples Under Three Various Distributions.**

| | Logistic | Exponential | Normal |
|---|---|---|---|
| Stock Returns | 15.87% | 16.01% | 16.39% |
| Market Returns | 11.19% | 10.38% | 10.69% |
| Risk-free Rate | 6% | 6% | 6% |
| Stock Returns Volatility | 0.1518 | 0.1497 | 0.1499 |
| Market Returns Volatility | 0.2052 | 0.2056 | 0.2085 |
| Stock-Market Correlation | 0.1779 | 0.195 | 0.2105 |
| N | 10,000 | 10,000 | 10,000 |

Results for the financial benefits are presented in Table V. Benefits to the firm are almost identical when returns are following logistic or normal distributions: benefits are $38.47 and $39.51 respectively per each $1000 of the cash pay replaced with options. When returns are exponentially distributed, the resulting benefits are slightly higher at $42.58 per each thousand dollars of the cash-pay substitution.

**Table V. Option grants and resulting benefits to the firm under alternative distributional assumptions for the returns series.**

| | Logistic | Exponential | Normal |
|---|---|---|---|
| Benefits to Firm | 38.47 | 42.58 | 39.51 |
| Cash Substitution | 1,000 | 1,000 | 1,000 |
| Options Value | 8,483.30 | 6,630.90 | 7,865.00 |
| Number of Options | 624.9 | 488.5 | 579.4 |

As can be seen from the results of this study, distributional assumptions for the returns of lower frequencies do not materially affect results. Under all returns scenarios in this study, benefits to the firm resulting from shifting all-cash pay into cash-plus-stock options are around 1.5-4% per each $1000 of the cash pay substituted with options. The main conclusion can be formulated as follows: firms may gain direct financial benefits from option grants to non-executive employees, while the utility level of the compensation to employees is fully preserved. However, it is unclear whether benefits can be universally considered as an economically significant factor by decision makers at all firms.

*B. Utility-Based Approach: Empirical Returns*

The main difference between using real and simulated returns is the necessity to value options individually for each company. Valuation is done with the Black, Scholes (1973) option pricing model, using five-year historical volatilities. This is reducing sample size substantially, as only firms with at least five years of price history on the CRSP database are included in the sample. It is assumed that options are granted at the money for ten years and that the T-bill rate on the grant date is used as the risk-free rate of return.

In Table VI, results over entire sample period are reported. Only benefits to the firm per $1000 cash substitution are reported in the table. The number and value of options granted are not shown, as the scale of the underlying stock prices and option values are different across the companies included in the test sample. Using twelve trailing months' annualized returns for the individual securities and for the market, we find that on average the substitution of options for $1000 of cash pay results in almost $27 of savings to the company. As the next logical step we examine sub-samples of firms, which can be potentially the most and least financially constrained and, respectively, more or less likely to utilize various forms of self-financing, including stock options. Based on the prior literature (see Hadlock, Pierce (2010)), size and age are robust exogenous characteristics of the firm that can proxy for a level of financial constraint that the firm is experiencing. They show younger and smaller firms to be relatively more financially constrained. Following the findings of Hadlock, Pierce (2010), we sort the test sample into deciles based on size, age and size-age combinations. Table VI reports the results on size sorting into deciles for the top and bottom firm groups (the largest and the smallest firms in the sample). The age and size-age combination results are qualitatively similar to the size-based sorting results and are not reported.

**Table VI. Hypothetical Option Grants Using CRSP Returns: 1992-2011 Sample, 1st and 10th Size Deciles.**

| | Entire Sample | Large Firms | Small Firms |
|---|---|---|---|
| Benefits to Firm | 26.91 | 26.7 | 27.35 |
| Cash Substitution | 1,000 | 1,000 | 1,000 |
| N | 336,512 | 33,645 | 33,644 |

Based on the size, age and size-age sorting benefits of substituting options for cash, pay remains approximately $27 per each thousand dollars of pay substitution, which approximately represents the bottom range of the average flotation costs firms are facing on the external capital markets. The differences between average benefits for entire sample and small, large firm sub-samples are statistically insignificant at the conventional significance levels. As the characteristics of the stock market are not stationary – volatilities and expected returns change over time – it is important to consider possible deviations in the underlying distribution of returns and test possible implications for the financial results of the option grants from the firms' perspective. For this purpose, the base study sample is divided into one-year sub-samples of returns and the benefits function is re-evaluated. Results are reported in Table VII: five years of twenty annual model re-evaluations are selected into the table.

**Table VII. Hypothetical Option Grants Using CRSP Returns for Selected Sub-Periods**

| | Year 1992 | Year 1995 | Year 1999 | Year 2003 | Year 2007 |
|---|---|---|---|---|---|
| Benefits to Firm | 20.77 | 14.03 | 31.48 | 20.18 | 36.19 |
| Cash Substitution | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 |
| N | 11,297 | 15,945 | 16,320 | 24,607 | 28,060 |

It appears that direct financial benefits to companies resulting from substituting options for cash pay are not static over time. Benefits vary in the range of $12-$40 per thousand dollars of the cash substitution. Some of the differences are statistically significant: for example, average benefits reported for 1995 are statistically different from average benefits for 1998. From the practical standpoint, however, it may be debated whether this difference is economically significant: the savings represent around 1-4% of the cash retained internally, and these savings might not be equally economically significant for all firms. Moreover, large-scale option grants are possible only if employees are optimistic about the company's future prospects and are therefore willing to accept more options instead of cash as a part of the compensation package.

## V. Conclusions

We investigate whether financing motives may be among the factors in option grants to non-executive employees. Utility models of a representative employee are used jointly with the benefits function of a company to formally answer the question of whether firms can have direct financial benefits from restructuring cash-only into cash-plus-options compensation model.

Analysis shows that companies may be saving around 1-4% of the amounts of capital being raised internally in the form of substitution of stock options for cash payment. At the same time, the quality of pay for the representative non-executive employee can be fully preserved. It is further determined that distributional assumptions of the underlying stock returns do not have a material impact on the resulting benefits to the company.

The magnitude of the reported benefits raises two important concerns. Firstly, it is debatable whether benefits can be universally considered as economically significant, as under various returns scenarios a firm's direct savings are only $15-$40 per one thousand dollars of the cash-pay substitution. If a company does not have a large number of employees, how much scope is needed to bring the firm's total benefits to an economically meaningful level by substituting options for cash payment? Secondly, as prior compensation literature suggests, employees have to be optimistic about a firm's prospects to be willing to accept non-cash forms of pay, and financially successful firms might self-select into option granting. In general, results of this study show that broad-based option grants can lead to direct financial benefits to a company; however, it is unlikely that the financing motive is one of the primary factors in firm-wide option granting practices.

Employees are likely to have varying beliefs about the firm's prospects, varying levels of pay and accumulated wealth and to have varying preferences and risk aversion levels. Similarly, companies may have varying financial needs and flexibility in option granting, varying number of employees, they may be at various life-cycle stages and operate in different industries. All these factors may result in firms having different optimal levels of cash pay substitution with options. This leaves ample opportunities for future research: studying effect of various utility functions on sub-group of workers within the same firm, calibrating risk aversion levels and option valuation parameters to match actual personnel composition, firm-specific characteristics and market conditions.

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# Have U.S. and ASEAN Equity Markets Become More Integrated?

Jodonnis Rodriguez

## Abstract

In this paper, we find that U.S. and ASEAN equity return correlations increased post-Great Recession and that innovations in U.S. and other foreign equity markets explain a larger proportion of ASEAN return volatility after the Great Recession. The United States is increasingly cointegrated with each ASEAN member country and equity returns in the U.S. affect equity returns in ASEAN equity markets but not vice versa. Using an EGARCH-M and DCC-GARCH approach, we find that lagged U.S. weekly returns affect subsequent weekly returns in ASEAN equity markets and we find a positive equity risk premium with asymmetric volatility response to innovations in ASEAN equity markets. Our study concludes that increasing integration may be due to the increase in economic trade pacts and capital market integration initiatives between the U.S. and ASEAN member states.

## I. Introduction

The study of equity market integration across the world has increased as a result of the October 1987 collapse of equity markets across the world. There was little to no relationship between the international stock markets prior to the October 1987 and Asian stock market crash of 1997 (Cheng 1997, Sheng and Tu 2000). After the precipitous 1987 decline in global equity markets, the authors concluded that increasing globalization contributed to closer interrelations between equity markets across the world. As a result, investors' perceptions of the importance of foreign financial news became more prevalent which led to an increase in the correlation of equity returns and return volatility across markets (Hamao, Masulis, Ng 1991). Since then, major stock market crashes such as those in the U.S. from 2000-2001 and 2007-2009 have had an impact on equity market correlations across the world. Correlations are vital to many tasks in financial management such as portfolio hedging and forecasting. In addition, portfolio asset allocation relies on correlation and volatility estimates to develop efficient portfolios. Thus, it is vital to study why the relationship between equity markets change over time across regions in the world because investment portfolios require periodic adjustments that depend of market expectations. In particular, this paper seeks to study the equity return and volatility behavior, cointegration, and correlation structure between the United States and member-states of the Association of Southeast Asian Nations (ASEAN) between 2001 and 2017 and the possible factors contributing to the increasing integration between the two regions. ASEAN consists of ten developing economies in Southeast Asia with a combined GDP of $2.4 trillion. A focus of this paper is the economic and

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financial integration between the United States and ASEAN over time given the enhancements to the trade agreements and capital market integration initiatives within the region.

The study reveals several important features of ASEAN equity markets and provides significant implications for international portfolio investors with exposure to ASEAN equity markets. First, ASEAN equity returns are non-normal; however, the evidence suggests equity returns are random and weak-form efficient in the majority of ASEAN equity markets. Furthermore, the results suggest that most ASEAN equity market returns are affected by lagged U.S. equity returns per the DCC-GARCH and Johansen cointegration analysis. Results from Granger causality tests indicate that U.S. equity returns influence the equity returns in ASEAN countries. Conversely, ASEAN equity returns have no major impact on U.S. equity returns indicating that major financial news and information from the U.S. has more impact on ASEAN equity market returns than financial and economic information coming from ASEAN nations.

Granger causality tests indicate that U.S. equity returns influence the equity returns in ASEAN countries. Conversely, ASEAN equity returns have no major impact on U.S. equity returns indicating that major financial news and information from the U.S. has more impact on ASEAN equity market returns than financial and economic information coming from ASEAN nations. In addition, this paper studies the equity market relationships between the U.S. and ASEAN[2] member-states before and after the Great Recession to determine if the financial crisis had an impact on the correlation between the equity markets of the two regions. The findings indicate that correlations between the United States and ASEAN and among ASEAN countries increased after the Great Recession and persisted at the increased levels for years after the financial crisis. Similarly, the paper finds that innovations, or volatility shocks, in foreign country equity returns explain more of ASEAN countries' equity returns after the Great Recession as compared to before. For example, foreign country innovations explained 20.76% of Indonesia's returns before the Great Recession and foreign country innovations explain 52.27% of Indonesia's returns after the Great Recession suggesting that Indonesia's equity markets have become more integrated within the region and with the United States. The evidence provides a similar pattern for each ASEAN country in the sample. These results suggest that financial and economic news had more impact on equity market returns and volatility well after the financial crisis as compared to before the financial crisis providing some evidence of closer ties between the two regions' equity markets. Overall, the results suggest that there is increasing economic and financial integration between the U.S. an ASEAN countries and among ASEAN countries and, despite the higher levels of correlation between the two regions' equity markets, there are still plenty diversification benefits available for portfolio investors.

This paper is organized as follows. Section II provides an overview of the literature. Section III describes the sample data and provides descriptive statistics. Section IV discusses the

[2] The Association of Southeast Asian Nations (ASEAN) consists of 10 member states: Malaysia, Philippines, Thailand, Singapore, Indonesia, Cambodia, Vietnam, Laos, Brunei, and Myanmar. Daily equity index data is not available for Brunei and Myanmar. Brunei's stock exchange is scheduled to open in late 2017 and Myanmar's Yangon Stock Exchange was founded in 2015 with 4 listed companies

methodology for our analyses. Section V describes the results and contributing factors to our findings. Section VI concludes the paper.

## II. Prior Literature and Contribution

Much of the extant literature focuses on the interdependence between Asian-Pacific and major global capital markets to provide meaningful knowledge on Asian-Pacific financial markets and to provide portfolio investors information on potential investment opportunities for diversification benefits. For example, Chowdhury (1994) examines the interrelationship among the equity markets in four newly industrialized economies in Asia. The author finds that there is a significant relationship between the stock markets of Hong Kong, Singapore, Japan, and the United States. However, the author finds that equity markets with severe restrictions on cross-country investing such as South Korea and Taiwan are not affected by innovations in foreign equity markets. Elyasiani, Perera, and Puri (1998) study the interdependence between Sri Lanka and its trading partners using a vector auto regression (VAR) approach. The authors find no significant relationship between the Sri Lankan equity market and the equity markets of the U.S. and the other Asian markets. Liu, Pan, and Shieh (1998) find that the degree of interdependence between stock markets increased after the 1987 stock market crash, that U.S. equity markets influence the Pacific-Basin equity markets, and that Japan and Singapore both have a persistent impact on other Asian markets.

Arshanapalli, Doukas, and Lang (1995) further study the relationship of Asian stock markets and provide evidence of a common stochastic trend between the U.S. and Asian stock market movements after the October 1987 crash. The authors find that the cointegrating structure that ties these stock markets together has increased since October 1987. The authors provide evidence that Asian equity markets are less integrated with Japan's equity market as compared to the U.S. equity market. Hassan and Naka (1996) examine the dynamic linkages among the U.S., Japan, U.K., and German stock market indices using daily data from 1984 to 1991. The authors examine the long-run and short-run relationships among these four stock market indices. The authors find that the U.S. stock market leads the other equity markets in the short- and long-run using a vector error correction model (VECM) and conclude that portfolio investors may be limited in their ability to diversify their long-term holdings.

Click and Plummer (2005) consider stock market integration after the Asian financial crisis between the original five member states of ASEAN; Indonesia, Malaysia, Philippines, Singapore, and Thailand. The results suggest that the ASEAN-5 equity markets are cointegrated and are not completely segmented by national borders. Choudhry, Lu, and Peng (2007) study the change in the long-run relationships between the stock prices of eight Far East countries before, during, and after the Asian financial crisis of 1997-1998. The authors provide evidence that U.S. equity market influences increase before, during, and after the crisis. Chancharat and Valadkhani (2007) investigate the cointegration and causality between equity prices in Thailand and its major trading partners using monthly data between 1987 and 2005. The authors find potential long-run

diversification benefits and find bidirectional causality between the equity returns of Thailand and Malaysia, Singapore, and Taiwan.

Majid and Kassim (2009) examine the impact of the 2007 U.S. financial crisis on the equity markets of Indonesia and Malaysia and find a stronger relationship between the equity markets during the crisis which makes it more difficult for international portfolio investors to diversity their holdings and manage their portfolio's risk. Khan (2011) studies the cointegration of the U.S. equity markets and twenty-two developed and developing countries using daily equity market data. The author finds that China, Malaysia and Austria are highly favorable diversification opportunities as they are not cointegrated with the US and are unresponsive to the global equity index. Ali, Butt, and Rehman (2011) examine the co-movement of Pakistan's equity markets with the equity markets of India, China, Indonesia, Singapore, Taiwan, Malaysia, Japan, the U.S., and the U.K. by using monthly stock prices from July 1998 to June 2008. The authors provide no evidence of a relationship between Pakistan's equity market and the markets of the U.K, the U.S., Taiwan, Malaysia and Singapore and concludes that portfolio investors may reduce portfolio risk by investing in the equity markets of these countries.

Palamalai, Kalaivani, and Devakumar (2013) examine stock market integration among major stock markets of emerging Asia-Pacific economies and find evidence of short-run diversification benefits from significant equity market fluctuations. Bala and Takimoto (2017) investigate stock return volatility spillovers in emerging and developed markets and the impacts of the global financial crisis on stock market volatility interactions. The authors find evidence that correlations increase during the financial crisis for emerging and developed markets but the correlations are higher among developed markets. Kuper and Kuper (2016) employ a multivariate DCC-GARCH to study the relationship between foreign exchange and equity markets in six East Asian countries and find evidence of time-varying correlations between the countries, including stronger correlations during the Asian financial crisis and the U.S. financial crisis. Bekaert and Harvey (2017) analyze various dimensions of capital market integration between emerging and developed markets. The authors find increased correlations which they attribute to increased economic liberalization policies, especially during the 1990s, in emerging markets. The authors point out similar findings as those found in this paper such as non-normality and higher variance in equity market returns. In addition, the authors discuss that importance of financial and economic openness to capital market integration, especially openness in current account factors.

One focus of this paper is the weekly equity return behavior of ASEAN member states and the cointegration between the U.S. and ASEAN equity markets before and after the Great Recession, especially given observed correlation increases and volatility spillovers during the Great Recession [Chakrabarti (2011)]. This paper contributes to the extant literature by including the developing equity markets of Cambodia and Laos in the study of ASEAN markets. This is beneficial because it provides updated insight into the correlations between the equity markets of Cambodia, Laos, other ASEAN member states and the United States, provides insight into whether or not the markets are more closely integrated, and explains how much of those countries' returns are explained by news and volatility spillovers from the U.S. equity markets. Additionally, this

study carefully considers the time-varying correlation and volatility between the equity markets using a DCC-GARCH framework to model ASEAN equity return behavior. Moreover, this paper contributes to the literature by providing evidence that weekly equity market correlations increased and persisted after the Great Recession and that U.S. and ASEAN equity markets have become more integrated with each other over time which may be due to the expansion of economic and financial agreements between ASEAN countries and with the United States. This study further provides evidence that despite higher correlations post-financial crisis, the ASEAN equity markets provide diversification benefits for U.S. international investors.

## III. Data

This study uses U.S. dollar-adjusted daily equity index data available from Bloomberg L.P. for the years 2001-2017. Thus, the indices are adjusted for foreign exchange fluctuations relative to the U.S. dollar. Country-specific equity indices and data availability time ranges for each index is provided in Appendix A. The equity indices are available from the United States and eight of the ten ASEAN member countries including: Malaysia, Philippines, Thailand, Singapore, Indonesia, Cambodia, Vietnam, and Laos. Equity index data is available for 6 ASEAN countries from January 2001 through 2017 (Singapore, Malaysia, Indonesia, Philippines, Thailand, and Vietnam). Equity index data is available for Laos and Cambodia from 2011 and 2012, respectively. Thus, Laos and Cambodia are excluded from pre- and post-Great recession analysis or analyses that require a longer time frame. Weekly logarithmic returns using daily closing prices are computed per Eq. 1 to minimize the effect of equity market closures due to holidays or non-trading weekdays. In addition, Tiwari, Dar, Bhanja, and Shah (2013) study Asian stock market integration and find that higher frequency time horizons, such as weekly, provide international investors with more diversification benefits than lower frequency time horizons such as monthly or quarterly.

$$\ln(1 + r_{i,t}) = \ln\left(\frac{p_{i,t}}{p_{i,t-1}}\right) = \ln(p_{i,t}) - \ln(p_{i,t-1}) = \Delta \log P_{i,t} \tag{1}$$

Table I provides summary statistics of the weekly stock returns from 2001-2017 of the eight ASEAN member countries in our sample. All countries' equity returns are stationary, and thus, do not vary over time, and exhibit significant deviations from normally distributed returns with varying degrees of kurtosis and skewness which is consistent with the prior literature on emerging market return behavior [Bekaert and Harvey (2017)].

**Table I. Descriptive Statistics, Weekly Returns 2001-2017**

| | Singapore | Thailand | Malaysia | Philippines | Indonesia | Cambodia | Vietnam | Laos |
|---|---|---|---|---|---|---|---|---|

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| N | 898 | 841 | 896 | 891 | 884 | 224 | 840 | 314 |
| Mean | -3.3E-4 | 1.6E-3 | 5.1E-4 | 8.0E-4 | 2.0E-3 | -4.0E-4 | 1.1E-3 | 3.7E-4 |
| SD | 0.0251 | 0.0294 | 0.0186 | 0.0275 | 0.0291 | 0.0339 | 0.0359 | 0.0305 |
| Skew | -0.6605 | -1.1202 | -0.6449 | -0.5033 | -0.5420 | -0.9021 | -0.1237 | 2.9940 |
| Kurt | 5.4794 | 10.9938 | 4.7169 | 5.6372 | 2.4761 | 6.6337 | 3.5633 | 20.9910 |
| JB | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 |
| BG | 0.3024 | <0.0001 | 0.0472 | 0.0165 | 0.0803 | 0.8788 | <0.0001 | 0.001 |
| ADF | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 |
| PP | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 |

This table includes the descriptive statistics of logarithmic weekly stock returns. *JB* is the p-value that corresponds to the Jarque-Bera normality test. *BG* is the p-value that corresponds to the Breusch-Godfrey serial correlation test. *ADF* is the p-value of the Augmented Dickey-Fuller test for stationarity. *PP* is the p-value of the Phillips-Perron test for stationarity.

Table II presents the weekly stock return correlations between all countries in the entire sample period. In general, U.S. equity markets returns do not appear to be highly correlated with the ASEAN member countries, except Singapore with a correlation of approximately 0.52. In fact, U.S. equity markets typically have a positive correlation of less than 0.40 with ASEAN equity markets and is negatively correlated with the equity markets of Cambodia and Laos. Thus, based on the unconditional weekly return correlations, the equity markets between the two regions appear to offer some diversification benefits to international investors.

Appendix B provides 52-week rolling correlations between the U.S. and six ASEAN member countries from 2001-2017, given data availability. Thus, the graphs begin 52 weeks into the data set in 2002 and each week provides an additional data point. The graphs in Appendix B indicate a varying degree of correlation over time between the U.S. and each ASEAN country and there appears to be a structural shift around the time of the Great Recession. The graphs indicate an increase in weekly return correlations during the Great Recession which persist until the end of the sample period. In Appendix B, graph A, the weekly return correlation between the U.S. and the Philippines is largely below 0.30 prior to 2008 (week 364) but the correlation remains above the 0.30 for several years after 2008. A similar result is shown in graph B (Singapore) and graph D (Malaysia). The results are more mixed in graphs C (Thailand), E (Indonesia), and F (Vietnam). For example, Thailand appears to exhibit higher, persistent correlations with the U.S. around 2009 (week 416) whereas correlations between the U.S. and Indonesia and Vietnam increased around 2006 to above 0.30 from negative correlations prior to 2006. Thus, the graphs highlight the variation in the correlation between the U.S. and various ASEAN countries over time and indicate at least some shift in the correlation structure at the start of the Great Recession

**Table II. Weekly Return Correlations, 2001-2017.**

| | USA | Thailand | Malaysia | Philippines | Singapore | Indonesia | Cambodia | Vietnam | Laos |
|---|---|---|---|---|---|---|---|---|---|
| USA | 1 | 0.3990 | 0.2870 | 0.3540 | 0.5230 | 0.2960 | -0.0470 | 0.2130 | -0.0620 |
| Thailand | | 1 | 0.4280 | 0.4530 | 0.4930 | 0.4420 | -0.0770 | 0.1700 | -0.0640 |
| Malaysia | | | 1 | 0.3850 | 0.4920 | 0.4430 | 0.0290 | 0.1390 | 0.0260 |
| Philippines | | | | 1 | 0.4480 | 0.4590 | -0.0270 | 0.1780 | 0.0410 |
| Singapore | | | | | 1 | 0.4850 | -0.0240 | 0.2140 | 0.0410 |
| Indonesia | | | | | | 1 | -0.0360 | 0.1680 | 0.0620 |
| Cambodia | | | | | | | 1 | -0.0160 | 0.0910 |
| Vietnam | | | | | | | | 1 | 0.0670 |
| Laos | | | | | | | | | 1 |

This table provides the weekly stock return correlations between each country-pair for all available observations.

## IV. Methodology

For the analysis in this paper, several models are used to account for various return and volatility characteristics. The return-generating process of each ASEAN country is examined for weak-form efficiency using a random walk and whether the returns are independent and identically distributed using the Brock, Dechert, Scheinkman (BDS) (1987) test for nonlinearities and the Engle-LM test for GARCH effects. The random walk model is given by

$$\Delta \log P_{i,t} = \mu + \varepsilon_{i,t} \tag{2}$$

where $P_{i,t}$ is the price of the equity index at time $t$ and $\Delta log\ P_{i,t}$ is the logarithmic (log) difference in the equity index level between time $t$ and time $t-1$. The log difference between the equity index levels is I(0), or stationary, and the estimated coefficient $\mu$ should be statistically insignificant from zero if returns exhibit random walk behavior. We test for stationarity using the augmented Dicker-Fuller (ADF) (1981) test and the Phillips-Perron (PP) (1988) test.

Prior literature has found evidence of volatility clustering, leverage effect, and deviations from the normal distribution in equity market return time series which linear models cannot account for effectively. Additionally, a return-generating process should consider the autocorrelation present in financial data. As a result, the return-generating process of ASEAN countries is expanded from the random walk model by using an exponential GARCH-in-Mean

(EGARCH-M) model which combines the ARCH-M model of Engle, Lilien, and Robins (1989) and the EGARCH model of Nelson (1991) to account for autocorrelation in the return-generating process, test for time-varying risk premiums, volatility clustering, and asymmetric shocks to volatility. The EGARCH-M models the return-generating process as

$$\Delta logP_{i,t} = \mu + \varphi_1 \Delta logP_{i,t-i} + \delta\sqrt{h_{i,t}} + \varepsilon_{i,t} \quad (3)$$

where the parameter $\varphi_1$ is included to account for autocorrelation in the return-generating process or mean equation. The mean equation also models the equity index returns as a function of its conditional variance which allows us to study whether investors are compensated for the additional risk they take. The parameter $\delta$ is often interpreted as a risk premium. Thus, a positive and significant $\delta$ means that returns are positively related to the equity market risk premium. The volatility process for the mean equation also considers asymmetric shocks to volatility and clustering. The asymmetric EGARCH model of Nelson (1991) is able to capture such effects to volatility. The volatility process is

$$\ln(h_{i,t}) = \omega + \sum_{i=1}^{1} \alpha_i \, g(Z_{t-i}) + \sum_{j=1}^{1} \beta_j \ln(h_{i,t-j}) \quad (4)$$

$$g(Z_t) = \Theta Z_t + \{|Z_t| - E[Z_t]\}$$

where the conditional variance $h_{i,t}$ depends on the size and sign of the normalized innovations as parameterized using $\Theta$. As an example, if $\Theta$ is equal to zero then large shocks to returns increase the conditional variance if $|Z_t| - E[Z_t] > 0$ and vice versa. If $\Theta < 0$, then negative innovations in returns cause the innovation to the conditional variance to be positive. Thus, the model is better able to account for the fact that negative returns tend to increase volatility more than positive returns.

Moreover, this paper provides an analysis of cointegration between ASEAN member countries and the United States over the sample time period to determine if equity markets have become more closely integrated over time. Johansen cointegration (1991) and Granger causality (1969) tests are implemented between the United States and each individual ASEAN country using a vector autoregressive (VAR) model with 1 lag for the country pairs. The VAR(1) model is

$$\Delta logP_{t,1} = \alpha_1 + \varphi_{1,1} \Delta logP_{t-i,1} + \varphi_{1,2} \Delta logP_{t-i,2} + \varepsilon_{t,1} \quad (5)$$

$$\Delta logP_{t,2} = \alpha_2 + \varphi_{2,1}\Delta logP_{t-i,1} + \varphi_{2,2}\Delta logP_{t-i,2} + \varepsilon_{t,2}$$

where the log returns of country 1 and country 2 is a function of the prior log returns of country 1 and country 2. The VAR(1) model provides a variance decomposition of the equity market returns between each country-pair.

In addition, this paper examines the correlation in equity markets between the United States and ASEAN countries before and after the Great Recession given the appearance of a structural shift from Appendix B. The National Bureau of Economic Research (NBER) reports the Great Recession began in December 2007 and ended in June 2009.[3] Thus, equity weekly return correlations are computed from January 2001 through November 2007 and from July 2009 through January 2017 to compare pre- and post-recession equity return correlations. A panel VAR model is used to analyze the proportion of weekly return changes caused by shocks within the country, shocks from other markets within the region, and shocks from the United States. Thus, the tests will be able to shed light on the proportion of a country's stock return movements due to innovations from other countries for pre- and post-recession time periods to determine if equity markets became more closely linked after the Great Recession. Since the results of the variance decomposition model are sensitive to ordering, the countries are ordered by equity market capitalization because large indices tend to be more influential that indices with less market capitalization.

A salient feature of equity returns is that correlations and volatility are generally time-varying processes due to various factors. The previous return-generating model considered time-varying volatilities and accounted for properties such as volatility clustering and asymmetric responses to innovations. In order to simultaneously account for time-varying volatility and correlation, a dynamic conditional correlation GARCH (DCC-GARCH) model is implemented for the equity return, volatility, and correlation structure. The model is helping given the volatility in correlation estimates over time per Appendix B and the increase in correlation around 2007. The weekly equity return, variance, and correlation processes are

$$r_{i,t} = \alpha_0 + \alpha_1 r_{i,t-1} + \alpha_2 r_{t-1}^{U.S.} + \varepsilon_t \tag{6}$$

$$h_{i,t} = \beta_0 + \beta_1 \varepsilon_{i,t}^2 + \beta_2 h_{i,t-1}^2$$

[3] Dates for U.S. business cycle expansions and contractions are available on the NBER's website. http://www.nber.org/cycles.html

$$Q_t = \bar{Q}(1 - a - b) + av_{t-1}v'_{t-1} + bQ_{t-1}$$

where this model is run in a bivariate setting between the United States and each ASEAN country. The matrix *Q* produces a more accurate weekly stock return correlation between the United States and each ASEAN country as compared to static measures which do not account for the time-varying characteristics of correlation processes.

## V. Results

Table III reports the results from the random walk model and runs test. The mean is insignificant for every country except Indonesia and Cambodia indicating some evidence for weak-form efficiency in weekly stock returns. The results suggest that equity indices in ASEAN countries do not depend on past information and are driven by future performance expectations. Additionally, the runs test of weekly stock returns confirms evidence that the return-generating process is random for each ASEAN country except Vietnam. The results are positive for potential investors in ASEAN equity markets because it suggests that fundamental analysis provides greater value and insight than technical analysis to determine investment opportunities. Table III provides the parameter estimates of the random walk model for each ASEAN member state. *Runs Test* provides the p-value of the Wald-Wolfowitz runs test. *JB* is the p-value that corresponds to the Jarque-Bera normality test. *BG* is the p-value that corresponds to the Breusch-Godfrey serial correlation test. Note: a, b, and c denote significance at the 1%, 5%, and 10% level, respectively

**Table III. Random Walk Model**

| | Singapore | Thailand | Malaysia | Philippine | Indonesia | Cambodia | Vietnam | Laos |
|---|---|---|---|---|---|---|---|---|
| μ | -0.000336 | 0.001558 | 0.000509 | 0.000800 | 0.00201[b] | -0.00397[c] | 0.001107 | 0.000368 |
| Runs Test | 0.3478 | 0.8319 | 0.2758 | 0.5931 | 0.4770 | 0.1140 | <0.0001 | 0.8909 |
| JB | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 |
| BG(4) | 0.3024 | <0.0001 | 0.0472 | 0.0165 | 0.0803 | 0.8788 | <0.0001 | 0.001 |

Although the random walk seems to perform sufficiently well for most countries in our sample period, the results in Table IV indicate that the random walk model may fail to capture the nonlinearities present in the data due to evidence of autocorrelation presented in Table 1. In addition, Table IV reports significant nonlinear and GARCH effects for every lag up to lag 5 indicating a GARCH model may be better suited to model the return-generating process of

ASEAN countries and account for the serial correlation in the time series. Thus, a more parsimonious model is needed to capture the nature and structure of equity returns and volatility for the ASEAN equity indices.

**Table IV. Nonlinearity Tests**

| | Singa-pore | Thailand | Malaysia | Philippine | Indonesia | Cambodia | Vietnam | Laos |
|---|---|---|---|---|---|---|---|---|
| LM | | | | | | | | |
| 1 | <0.0001 | 0.0620 | 0.0177 | 0.1307 | <0.0001 | <0.0001 | <0.0001 | <0.0001 |
| 2 | <0.0001 | 0.1623 | 0.0045 | 0.0377 | <0.0001 | <0.0001 | <0.0001 | <0.0001 |
| 3 | <0.0001 | 0.2206 | 0.0012 | 0.0381 | <0.0001 | <0.0001 | <0.0001 | <0.0001 |
| 4 | <0.0001 | 0.0015 | 0.0006 | 0.0588 | <0.0001 | <0.0001 | <0.0001 | <0.0001 |
| 5 | <0.0001 | <0.0001 | 0.0013 | 0.1047 | <0.0001 | <0.0001 | <0.0001 | <0.0001 |
| BDS | | | | | | | | |
| 2 | <0.0001 | <0.0001 | <0.0001 | 0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 |
| 3 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 |
| 4 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | 0.0012 | <0.0001 | <0.0001 |
| 5 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | 0.0003 | <0.0001 | <0.0001 |

This table provides the p-values of both the Engle-LM test (LM) for GARCH effects and the Brock-Dechert-Scheinkman test to detect nonlinear serial dependence in a time series up to lag 5.

Table V reports the results of the EGARCH-M model which attempts to capture the GARCH effect present in the weekly stock return data and other effects present in return time series such as asymmetric responses to volatility as a result of return innovations. Singapore, Thailand, Malaysia, Philippines, and Indonesia have a negative and significant theta parameter which indicates that volatility responds asymmetrically to negative innovations in returns. Thus, in the latter countries, negative shocks to weekly stock returns cause return volatility to increase more than positive shocks to weekly stock returns. For example, a financial report below market expectations tends to increase return volatility more than results above market expectations. On the other hand, Cambodia and Vietnam have insignificant theta parameters signifying that the response to volatility depends on the size of the innovations. Interestingly, Laos has a positive and significant theta parameter less than one which suggests that positive return shocks increases volatility more than negative return shocks. The model also allows us to examine the risk premium hypothesis to determine if investors are appropriately compensated for the risk in equity returns. The results suggest that every ASEAN country has a positive risk premium except Indonesia, Cambodia, and Laos. However, it is the possible the results for the latter two countries may be

driven by index composition, lack of market volume, and/or age of the index. In general, investors in countries with positive risk premiums are rewarded for the risk in their equity positions which suggests that at least the largest ASEAN equity markets appropriately compensate investors for a given risk level. Additionally, the results indicate that the previous week's return is negatively related to the current week's return for all countries except Indonesia. The parameter for the previous week's return is negative and significant for Singapore, Malaysia, Vietnam, and Laos. This suggests that weekly returns tend to fluctuate between positive and negative performance which is consistent with the evidence of randomness in ASEAN equity markets provided in Table III. Additionally, the model indicates that previous shocks to the conditional variance process, as indicated by the beta parameter, seem to persist for some time after innovations for all ASEAN countries. That is to say, volatility tends to remain high for some time as a result of a previous shock to volatility. Thus, taken altogether, negative innovations in the equity markets of Singapore, Thailand, Malaysia, Philippines, and Indonesia tend to increase volatility to a higher level and remains elevated for some time.

**Table V. EGARCH-M Model**

| | Singapore | Thailand | Malaysia | Philippines | Indonesia | Cambodia | Vietnam | Laos |
|---|---|---|---|---|---|---|---|---|
| $\mu$ | -0.0082[a] | -0.0060 | -0.0053 | 0.0002 | 0.0056 | -0.0022 | -0.0126[c] | 0.0086 |
| $\varphi_1$ | -0.1057[a] | -0.0054 | -0.0813[b] | -0.0295 | 0.0414 | -0.0263 | -0.2150[a] | -0.2885[a] |
| $\omega$ | -0.8588[a] | -1.6635[a] | -1.2400[a] | -1.8221[a] | -1.6230[a] | -4.0045[a] | -1.9534[a] | -3.9256[a] |
| $\alpha_1$ | 0.1024[a] | 0.2221[a] | 0.1428[a] | 0.2419[a] | 0.2165[a] | 0.5625[a] | 0.2735[a] | 0.5213[a] |
| $\beta_1$ | 0.8876[a] | 0.7679[a] | 0.8472[a] | 0.7481[a] | 0.7735[a] | 0.4275[a] | 0.7165[a] | 0.4687[a] |
| $\Theta$ | -1.5047[a] | -0.4294[a] | -0.7219[a] | -0.5099[a] | -0.6494[a] | 0.1657 | -0.0951 | 0.4289[a] |
| $\delta$ | 0.3899[a] | 0.2772 | 0.3539 | 0.0309 | -0.1292 | -0.0400 | 0.4358[c] | -0.4108 |
| AIC | -4259.39 | -3589.06 | -4677.75 | -3888.05 | -3758.60 | -829.41 | -3282.24 | -1406.43 |
| SBC | -4225.83 | -3556.00 | -4644.22 | -3854.58 | -3725.25 | -806.18 | -3249.35 | -1380.34 |
| LL | 2136.70 | 1801.53 | 2345.88 | 1951.03 | 1886.30 | 421.70 | 1648.12 | 710.21 |

This table provides the parameter estimates of the EGARCH-M model for the return and variance processes of each ASEAN member state. *AIC* and *SBC* refer to the Akaike and Schwartz criterion, respectively. *LL* is the log-likelihood of each model.
Note: a, b, and c denote significance at the 1%, 5%, and 10% level, respectively.

A feature of the VAR(1) model is that it allows the study of causality and cointegration between two time series. This study examines whether there is a long-run link between the U.S. and ASEAN equity market returns and whether the equity markets influence each other. Table VI provides the results of the Johansen cointegration and Granger causality tests. The Johansen

cointegration test examines the null hypothesis that two sets of time series are not cointegrated. The results provide strong statistical evidence of a strong relationship between equity markets in the United States and equity markets in ASEAN countries. Thus, although the individual characteristics of each equity index may change over time, there is evidence to suggest that the long-run relationship between the U.S. and the ASEAN equity markets remains significant. Moreover, the Granger causality analysis provides evidence that the previous week's return in the United States has a significant effect on the current week's returns for each ASEAN country except Cambodia.

**Table VI. Johansen Cointegration & Granger Causality Tests**

| | Singapore | Thailand | Malaysia | Philippines | Indonesia | Cambodia | Vietnam | Laos |
|---|---|---|---|---|---|---|---|---|
| **Johansen Cointegration** | | | | | | | | |
| | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 |
| **Granger Causality** | | | | | | | | |
| Does Not Influence U.S. | 0.5433 | 0.5727 | 0.3336 | 0.0251 | 0.0882 | 0.9875 | 0.3946 | 0.2210 |
| U.S. Does Not Influence | <0.0001 | <0.0001 | <0.0001 | 0.0024 | <0.0001 | 0.8226 | 0.0432 | 0.0930 |

This suggests that the macroeconomic and financial factors from the United States have a strong impact on the expectations of the ASEAN equity markets. Similarly, the results suggest that the previous week's returns in the Philippines and Indonesia have a weak effect on the current week's returns in the United States indicating bidirectional causality. This result could be driven by the economic and financial relationship between the countries that may adversely impact certain sectors or industries in the United States.

Table VII reports the variance decomposition of all sample countries over the entire sample period to explain how much of the variance in one country's equity returns is explained by equity market innovations of the other countries. The innovations in U.S. equity returns explain a significant portion of return volatility in all ASEAN countries except Vietnam, Cambodia, and Laos. For example, U.S. innovations can account for 10.22% of the variance in equity returns in the Philippines and 18.08% in Singapore but accounts for less than 1% of the variance in Laos and Cambodia. In fact, equity markets in Cambodia and Laos have the smallest market capitalization and are among the youngest equity markets in ASEAN, which may help explain why innovations in foreign countries do not explain much of the volatility in their stock returns. Relatively more

experienced and developed markets may be more integrated with other regional and global markets.

Tables VIII and IX report the findings for correlations and variance decomposition between sample countries before and after the Great Recession. Comparisons of panels (a) and (b) in Table VIII indicate that correlations increased between the United States and each ASEAN country after the Great Recession. For example, the correlation between the U.S. and Thailand before December 2007 is 0.2110 and it increased to 0.5020 after the Great Recession.

**Table VII. Variance Decomposition of All Member States**

| | USA | Singapore | Thailand | Malaysia | Indonesia | Philip-pines | Vietnam | Laos | Cambodia |
|---|---|---|---|---|---|---|---|---|---|
| USA | 1 | 18.08% | 15.01% | 12.55% | 11.28% | 10.22% | 5.04% | 0.95% | 0.11% |
| Singapore | | 81.92% | 18.75% | 16.93% | 24.85% | 12.34% | 9.54% | 0.21% | 0.13% |
| Thailand | | | 66.24% | 4.34% | 13.64% | 2.93% | 1.65% | 0.66% | 0.17% |
| Malaysia | | | | 66.17% | 9.19% | 3.51% | 1.93% | 0.01% | 1.11% |
| Indonesia | | | | | 41.05% | 3.25% | 6.24% | 2.16% | 0.45% |
| Philippines | | | | | | 67.75% | 0.11% | 1.35% | 5.69% |
| Vietnam | | | | | | | 75.49% | 1.98% | 0.96% |
| Laos | | | | | | | | 92.69% | 0.49% |
| Cambodia | | | | | | | | | 90.90% |
| *All Foreign* | 0.0% | 18.08% | 33.76% | 33.83% | 58.95% | 32.25% | 24.51% | 7.31% | 9.10% |

This table provides the variance decomposition for all member states. The variance decomposition explains how much of a country's weekly stock return variance is explained by innovations from other countries in our sample. *All Foreign* is the total percentage of a country's weekly stock return variance explained by the innovations of all other countries in the sample.

**Table VIII(a). Correlation Matrix Pre-U.S. Financial Crisis**

| | USA | Thailand | Malaysia | Philippines | Singapore | Indonesia | Vietnam |
|---|---|---|---|---|---|---|---|
| USA | 1 | 0.2110 | 0.2520 | 0.2050 | 0.4550 | 0.1640 | 0.1090 |
| Thailand | | 1.0000 | 0.3790 | 0.3880 | 0.4180 | 0.3240 | -0.0470 |
| Malaysia | | | 1.0000 | 0.3380 | 0.4950 | 0.3930 | 0.0310 |

| | | | | | |
|---|---|---|---|---|---|
| Philippines | 1.0000 | 0.3640 | 0.4170 | 0.0130 | |
| Singapore | | 1.0000 | 0.3600 | 0.0740 | |
| Indonesia | | | 1.0000 | 0.0480 | |
| Vietnam | | | | 1.0000 | |

**Table VIII(b). Correlation Matrix Post-U.S. Financial Crisis**

| | USA | Thailand | Malaysia | Philippines | Singapore | Indonesia | Vietnam |
|---|---|---|---|---|---|---|---|
| USA | 1 | 0.5020 | 0.4000 | 0.3720 | 0.5620 | 0.4080 | 0.1930 |
| Thailand | | 1.0000 | 0.5200 | 0.4670 | 0.5880 | 0.5880 | 0.2620 |
| Malaysia | | | 1.0000 | 0.4890 | 0.5760 | 0.6140 | 0.2770 |
| Philippines | | | | 1.0000 | 0.4710 | 0.5020 | 0.1550 |
| Singapore | | | | | 1.0000 | 0.5860 | 0.2820 |
| Indonesia | | | | | | 1.0000 | 0.1970 |
| Vietnam | | | | | | | 1.0000 |

This pattern is consistent between the United States and each ASEAN country in the sample and is consistent with the graphs of Appendix B. Additionally, weekly return correlations among ASEAN countries all increased. For example, the correlation between Thailand and Vietnam shifted from -0.0470 to 0.2620 when comparing the pre- and post-Great Recession periods. The correlation among ASEAN country-pairs all increased after the U.S. financial crisis.

Moreover, panels (a) and (b) in Table IX indicate that innovations in foreign countries' equity returns explain more of the return volatility in ASEAN countries after the Great Recession. For example, the percentage of equity return variance explained by all innovations in foreign countries increased from 17.10% to 39.49% and from 20.76% to 52.27% for Thailand and Indonesia, respectively. These results are consistent for all ASEAN countries in our study.

**Table IX(a). Variance Decomposition Pre-U.S. Financial Crisis**

| | USA | Singapore | Thailand | Malaysia | Indonesia | Philippines | Vietnam |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| USA | 100.00% | 22.04% | 4.27% | 6.58% | 3.35% | 4.61% | 1.30% |
| Singapore | | 77.96% | 12.83% | 17.65% | 8.28% | 9.46% | 0.05% |
| Thailand | | | 82.90% | 3.92% | 4.73% | 7.46% | 0.90% |
| Malaysia | | | | 71.85% | 4.40% | 0.85% | 0.01% |
| Indonesia | | | | | 79.24% | 5.63% | 0.03% |
| Philippines | | | | | | 71.99% | 0.33% |
| Vietnam | | | | | | | 97.38% |
| *All Foreign* | 0.00% | 22.04% | 17.10% | 28.15% | 20.76% | 28.01% | 2.62% |

After the Great Recession period, U.S. return innovations explained a greater amount of ASEAN's equity volatility. For example, U.S. innovations accounted for 22.04% and 4.27% of Singapore's and Thailand's equity volatility before the Great Recession whereas those figures increased to 33.66% and 24.46%, respectively, after the financial crisis.

**Table IX(b). Variance Decomposition Post-U.S. Financial Crisis**

| | USA | Singapore | Thailand | Malaysia | Indonesia | Philippines | Vietnam |
|---|---|---|---|---|---|---|---|
| USA | 100.00% | 33.66% | 24.46% | 17.46% | 19.73% | 14.73% | 2.96% |
| Singapore | | 66.34% | 15.03% | 15.29% | 16.58% | 9.96% | 3.21% |
| Thailand | | | 60.52% | 4.43% | 9.68% | 3.52% | 1.95% |
| Malaysia | | | | 62.82% | 6.29% | 4.42% | 1.26% |
| Indonesia | | | | | 47.73% | 3.08% | 0.15% |
| Philippines | | | | | | 64.29% | 0.10% |
| Vietnam | | | | | | | 90.38% |
| *All Foreign* | 0.00% | 33.66% | 39.49% | 37.18% | 52.27% | 35.71% | 9.62% |

Table X provides the results of the DCC-GARCH model which takes into account time-varying volatility and correlation processes. The evidence suggests that lagged weekly U.S. returns have a positive and significant impact on the subsequent weekly returns for all countries except Singapore. This suggests that positive (negative) U.S. returns in the previous week have a positive (negative) effect on the subsequent week's equity returns in most ASEAN countries. Thus, good

U.S. economic and financial data is likely to have a positive effect on ASEAN equity returns. Additionally, the lagged weekly return within each country seems to weakly impact subsequent returns, or not statistically impact returns, expect for Vietnam. This result suggests that previous positive (negative) returns within Vietnam help to explain future return performance. The latter is consistent with the variance decomposition findings that Vietnam's equity volatility is largely explained [90.38% per Table IX(b)] by innovations within the country. The correlation estimates between the U.S. and each ASEAN country indicate that there are still substantial diversification benefits with correlation measures ranging from about 0.19 in Vietnam to 0.51 in Singapore. The dynamic correlations are largely below 0.40 and well below the documented equity return correlations between the U.S. and other developed markets.

**Table X. DCC-GARCH Model**

| | $\alpha_0$ | $\alpha_1$ | $\alpha_2$ | $\beta_0$ | $\beta_1$ | $\beta_2$ | a | b | ρ |
|---|---|---|---|---|---|---|---|---|---|
| Singapore | 0.0060 | -0.0342 | 0.1944 | 0.0004 | 0.1878 | 0.0314 | 0.0000 | 0.0900 | 0.5121 |
| Thailand | 0.0025[a] | -0.0927[b] | 0.1801[a] | 0.0004 | 0.1114[a] | 0.8410[a] | 0.0752[a] | 0.1085 | 0.3660 |
| Philippines | 0.0030[a] | -0.0362 | 0.0782[c] | 0.0001 | 0.1195[a] | 0.9097[a] | 0.0526 | 0.0491 | 0.3314 |
| Malaysia | 0.0012 | 0.0403 | 0.0591[b] | 0.0002 | 0.1927[a] | 0.1214 | 0.0000 | 0.1035 | 0.2970 |
| Indonesia | 0.0040[a] | -0.0747[c] | 0.1297[a] | 0.0001 | 0.1485[a] | 0.7292[a] | 0.0308 | 0.1578 | 0.2889 |
| Vietnam | -0.0005 | 0.1801[a] | 0.1255[a] | 0.0009 | 0.1823 | 0.0073 | 0.0000 | 0.0998 | 0.1857 |

Note: a, b, and c denote significance at the 1%, 5%, and 10% level, respectively.

The pre- and post-crisis cointegration and correlation results may be driven by at least two factors. First, there is empirical evidence to suggest that correlation increases were caused by the Great Recession. Chakrabarti (2011) reports that the effects of volatility spillover were greatest during the Great Recession for eight Asia-Pacific equity markets suggesting that increases in the correlation between stock markets was due to the equity market selloff across global markets. Narayan, Srianantha kumar, and Islam (2014) study the causes of stock market integration in select emerging Asian nations. The authors find higher correlations during the 2007-2009 financial crisis which is consistent with correlation increases presented in Appendix B. Furthermore, the authors also conclude that the increase in correlation is also a function of underlying economic and financial trends such as globalization and financial liberalization. This is consistent with the idea that the United States and ASEAN countries have become more closely integrated over time due to economic and financial liberalization. The Association of Southeast Asian Nations (ASEAN) is the United States' fourth largest trading partner. The partnership between the regions has undergone several advancements. In 2006, the U.S. and ASEAN agreed on the ASEAN-U.S. Trade and Investment Framework Agreement (TIFA) which has led to a significant increase in U.S. exports to the region. Furthermore, in 2012, the U.S. and ASEAN created the Expanded Economic

Engagement (E3) framework under TIFA which focuses on the cooperation on trade and standardization of trade practices.[4] These enhancements to U.S. and ASEAN trade relationships may be partly responsible for the increased integration between equity markets. Our analysis indicates that equity return correlations and cointegration both increased after the Great Recession ended in 2009 and persisted well beyond that time period.

Moreover, not only have ASEAN countries become more integrated with the United States, they have also become more integrated with each other. In addition to closer economic integration as a result of the TIFA and E3 enhancements, ASEAN governments have sought increases to capital market integration within the region. In 2011, seven ASEAN stock exchanges signed an initiative called the ASEAN Exchanges which seeks to promote the growth of ASEAN capital markets by streamlining capital market access and creating financial products that focus on regional countries' needs. In 2014, a further advancement in the initiative developed the ASEAN Trading Link which allows investors within the region to route orders from their domestic stock exchange to other participating ASEAN exchanges for execution.[5] Thus, the results provide evidence that economic and trade initiatives between the United States and ASEAN, as well as capital market integration initiatives within ASEAN, may be contributing factors to the increasing equity market integration after 2009 with the United States and within the ASEAN region, especially given that most of the initiatives have been fully implemented after the U.S. financial crisis.

## VI. Conclusion

The return behavior of equity markets and correlations between stock markets is important for investors in order to maintain well-diversified portfolios and an acceptable level of risk. This paper studies the equity markets of ASEAN member countries and their relationship with U.S. equity markets given the strengthening trade and economic ties between the two regions. The empirical results suggest that U.S. equity markets impact the majority of ASEAN equity markets and explain a larger portion of ASEAN equity return volatility after the Great Recession as

[4] Information on TIFA and E3 is provided by the Office of the U.S. Trade Representative and Center for Strategic and International Studies.

https://www.csis.org/analysis/e3-initiative-united-states-and-asean-take-step-right-direction

https://ustr.gov/countries-regions/southeast-asia-pacific/association-southeast-asian-nations-asean

[5] Information on ASEAN Exchanges and ASEAN Trading Link is provided by FTSE Russell.

http://www.ftserussell.com/files/research/frontier-developed-ftse-asean-index-series

compared to before the crisis. Additionally, the study provides evidence of strong cointegration between the United States and all ASEAN member countries during the sample period. Although some of the results may be attributed to the effect of the U.S. financial crisis on global equity markets, there is evidence to suggest that the increasing economic and financial ties between the U.S. and ASEAN may be a result of further developments in trade and financial liberalization initiatives between the United States and ASEAN as well as to initiatives within the region to better integrate capital markets with each other and the rest of the world. The closer ties and increase in economic and financial integration benefit investors due to portfolio diversification opportunities, especially given that most U.S.-ASEAN pairwise correlations remain below 0.40. Further research may expand the study by examining if political risk or political ties, corruption, and/or the strength of legal institutions have an effect on economic and financial integration efforts between countries.

## Appendix A.

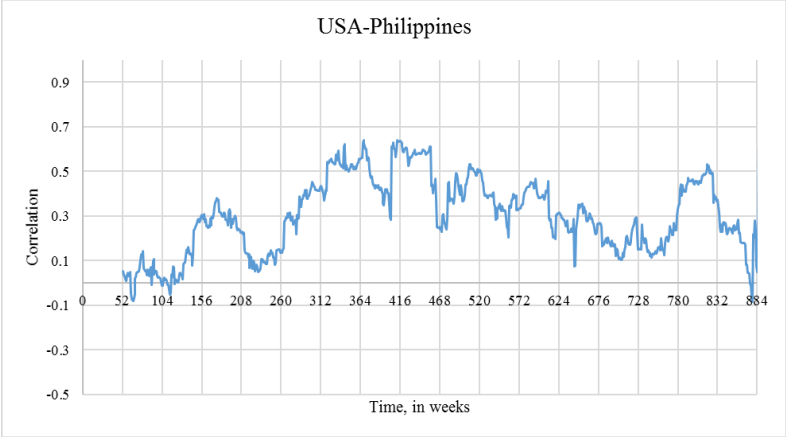
This table provides the name of the equity index used for each country in our sample and the available of the daily closing prices data.

| Country | Equity Index | Data Availability |
|---|---|---|
| United States | S&P 500 | 1/3/2001 - 2/7/2017 |
| Singapore | FTSE Straights Times Singapore (STI) | 1/3/2001 - 2/7/2017 |
| Malaysia | FTSE Bursa Malaysia KLCIi | 1/3/2001 - 2/7/2017 |
| Indonesia | IDX Composite | 1/3/2001 - 2/7/2017 |
| Philippines | PSEi Composite | 1/3/2001 - 2/7/2017 |
| Thailand | SET Index | 1/3/2001 - 2/7/2017 |
| Vietnam | VN Index | 1/3/2001 - 2/7/2017 |
| Cambodia | CSX Index | 4/18/2012 - 2/7/2017 |
| Laos | LSX Composite Index | 1/11/2011 - 2/7/2017 |

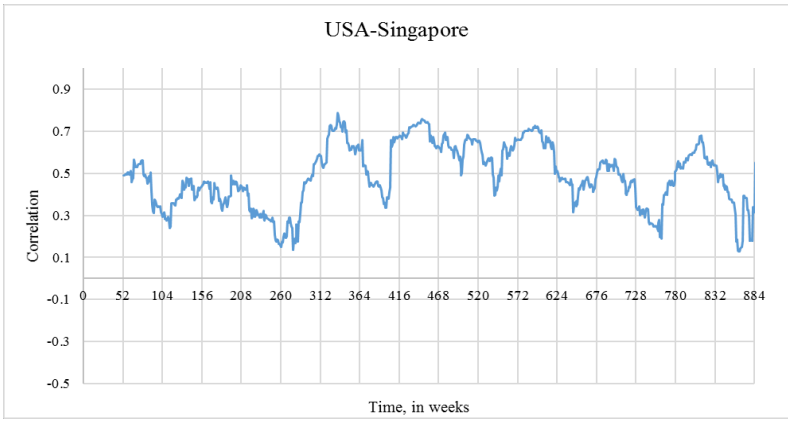
## Appendix B. Rolling 52-Week Correlations

Graphs (A)-(F) show the rolling 52-week correlations between ASEAN member states and the United States.

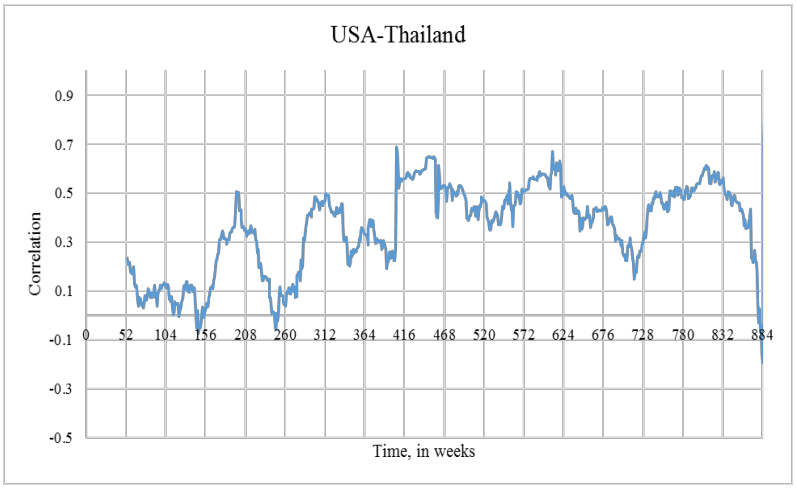
**(A)**


USA-Philippines
Correlation
0.9
0.7
0.5
0.3
0.1
-0.1
-0.3
-0.5
0 52 104 156 208 260 312 364 416 468 520 572 624 676 728 780 832 884
Time, in weeks

**(B)**

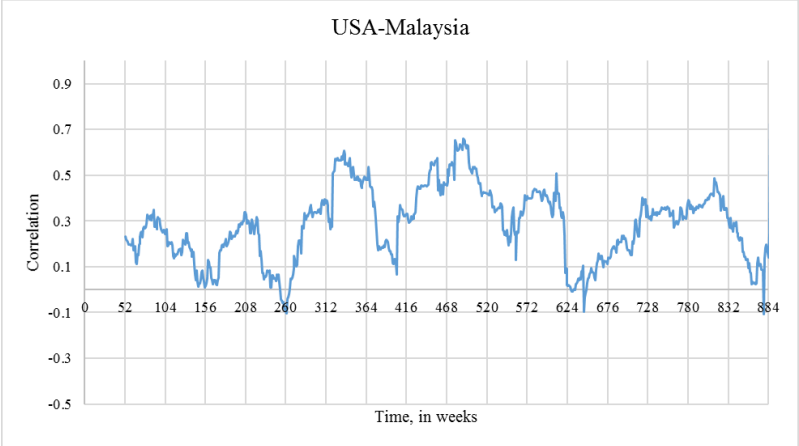

USA-Singapore
Correlation
0.9
0.7
0.5
0.3
0.1
-0.1
-0.3
-0.5
0 52 104 156 208 260 312 364 416 468 520 572 624 676 728 780 832 884
Time, in weeks

**(C)**

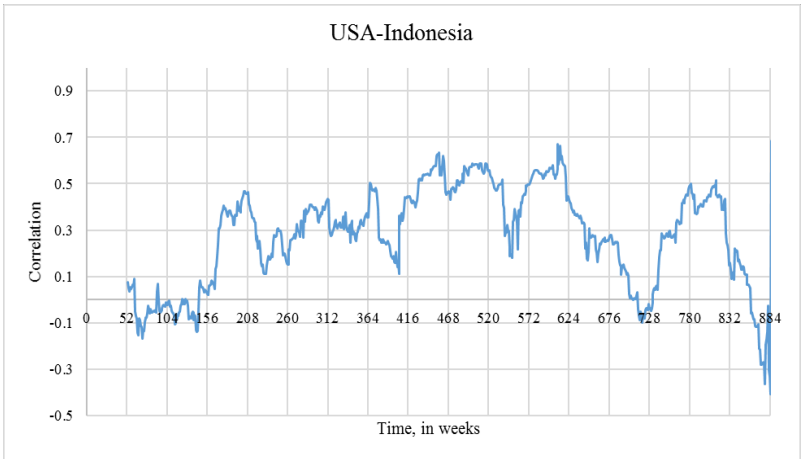

USA-Thailand
Correlation
0.9
0.7
0.5
0.3
0.1
-0.1
-0.3
-0.5
0 52 104 156 208 260 312 364 416 468 520 572 624 676 728 780 832 884
Time, in weeks

## Appendix B. Continued.

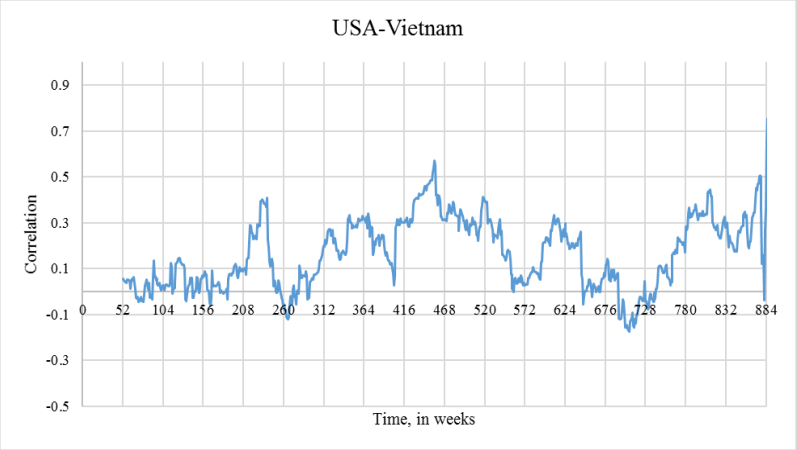
**(D)**




**(E)**



**(F)**


USA-Vietnam
Correlation
0.9
0.7
0.5
0.3
0.1
-0.1
-0.3
-0.5
0
52
104
156
208
260
312
364
416
468
520
572
624
676
728
780
832
884
Time, in weeks

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# Systemic Risk in the Insurance Industry and Its Impact on the Economy

Raja Bouzouita, Mihaela Craioveanu, Arthur J. Young

## Abstract

Systemic risk, defined as the risk that a failure of a large financial institution could lead to counterparty failures and could trigger adverse effects for the real economy, has been a priority for both academicians and policy-makers. The literature focuses on the measures and definition of systemic risk and on its impact on the financial sector with little or no attention given to the relationship between systemic risk and the real economy. In this paper, we investigate the link between the systemic risk in the insurance sector and the macro economy during the 2008 financial crisis. In particular, we test the predictive power of insurance companies' systemic risk of macroeconomic downturns using various measures of systemic risk constructed from daily returns for 169 insurance companies between 1988 and 2011. Our findings show that insurance systemic risk forecasts macroeconomic downturns three months into the future.

## I. Introduction

An important sector of the U.S. financial system is the insurance industry. According to the Bureau of Economic Analysis, in 2014, insurance companies held $5.2 trillion of assets under management, employed around 2.5 million people in different capacities, and contributed about $450 billion to the U.S. gross domestic product representing 2.6% of total GDP. In 2015, insurance companies' total claims were $15.2 billion for property and casualty companies and $617 billion for life and health insurers. Therefore, insurance companies contribute to economic growth, both as financial intermediaries and as providers of risk transfer and loss payments. They foster national savings and allow the efficient management of risks facing individuals and businesses.

The 2008 financial crisis exposed important vulnerabilities in the financial sector. In the aftermath of the Great Recession, tremendous effort has been devoted to better understand the risks posed by financial institutions and their impact on the financial system. Policymakers passed the Dodd –Frank 2010 Act to prevent future financial crisis, establish a mechanism to orderly liquidate troubled financial institutions, and monitor systemic risk of banks and nonbank entities including insurance companies. During the financial crisis, few insurance companies were under the spotlight notably AIG one of the largest insurance companies. AIG had a sizable credit default swaps portfolio around $450 billion (Sundaram and Das 2016). As the real estate prices collapsed, AIG suffered catastrophic losses on its mortgage-backed securities. The U.S. government provided AIG with an $85 billion loan to prevent the company from failing and causing further distress to the economy.

Even though the insurance sector is not directly involved in lending, insurance companies are interconnected to the wider financial sector. They play the financial intermediation role as they invest premiums collected in financial assets such as equity, debt securities, and real estate. Insurance companies are one of the major institutional investors in debt securities. In fact, about sixty percent of the assets of insurance companies are invested in government and corporate bonds.

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Therefore, any disruption in corporate financing will lead businesses to cancel or delay capital investments and would result in reduction in production and loss of job creation. On another level, insurance companies, mainly property and casualty, provide insurance protections on vehicles and real estate. This protection is a prerequisite to financing approval, without it, individuals and businesses may not be able to secure the needed loans that would spur economic growth. Another specialty insurance segment, bond insurers, provides financial guaranty insurance that facilitates credit for financial institutions and municipalities. These local and state governments spend the borrowed money on capital improvement projects, and help local economies.

Given the contribution of the insurance industry to the U.S. economy and its interconnectedness to the wider financial markets, we explore the impact of the insurance systemic risk on the macro economy. Using daily return data for a sample of insurance companies, we construct two measures of systemic risk: the expected shortfall as defined by Artzner et al (2005) and financial volatility calculated as the within-month standard of the daily returns. We check for the predictive power of our systemic risk measures by forecasting out of sample following a methodology similar to Allen et al (2012). To measure economic activity, we use the Chicago Fed National Activity Index (CFNAI). We explore an alternative measure of economic activity: growth in industrial production (IP) to check the robustness of the results. We find that both measures of systemic risk forecast future macroeconomic activity declines up to the three months in advance.

The rest of the paper is organized as follows: Section 2 explores the literature review. Section 3 describes the dataset used in the empirical application. Section 4 discusses the estimation procedure. Section 5 summarizes the findings and presents concluding remarks.

## II. Literature Review

Going back to the Great Depression of 1933, the economic crisis was attributed to failures in the financial system (Bernanke 1989). In the aftermath of the financial crisis of 2008, the literature focused on the measures and definition of systemic risk and its impact on the financial sector with little or no attention given to the relationship between systemic risk and the real economy initially. Since, a few studies have looked at the impact of systemic risk on the macro-economy. Most notably Allen, Bali, and Tang (2012) use an aggregate measure of systemic risk, CATFIN, an average of three variations of VaR, for financial firms using return data from January 1973-2009. Their aggregate measure of systemic risk was able to predict economic downturn up to six months in advance. The authors report that their results were robust to alternative measures of economic activities such as monthly growth in GDP, industrial production, and unemployment rate. Their work does not test for the systemic risk impact on the macro economy by industry in the financial sector.

Giglio, Kelly and Pruitt (2016) investigate the predictive power of systemic risk measures in forecasting macroeconomic downturns using European and U.S. data. Several measures of systemic risk have been proposed in the academic literature since the financial crisis of 2008. The purpose of these measures is to assess the contribution of each financial institution to the overall risk of a financial system. Giglio et al (2016) use a quantile regression model to estimate the predictive power of the different measures of systemic risk. The authors calculate nineteen different measures of systemic risk for financial institutions and measure macroeconomic shocks by the innovations in the industrial production index and CFNAI. The analysis shows that only a few systemic risk measures, financial volatility, CoVaR, MES, CATFIN proposed by Allen, Bali,

and Tang (2012), have predictive power of macroeconomic downturns with financial volatility yielding the strongest results. The study fails to discern the results by industry within the wider financial sector.

The previous studies examine the impact of systemic risk of the entire financial system on the macro economy. Our contribution is to investigate the effect of insurance systemic risk on the broader economy and whether the insurance systemic risk measured with expected shortfall (ES) and financial volatility has any predictive power of economic downturns. Our findings will be useful to regulators and policymakers to tailor their efforts to individual industries instead of subjecting all financial institutions to the same set of regulations without regard to their uniqueness and specificities. The results will further enrich the debate over whether the insurance industry should remain state regulated or be subject to oversight by a federal regulatory entity.

## III. Data

We use daily returns for insurance companies with SIC codes of 6331, 6311, and 6321 in order to estimate systemic risk. Our sample includes 169 insurance companies. The data was collected from the CRSP database. The sample period starts in January 1988 and ends in December 2011.

The literature on systemic risk examined a wide range of topics from measurement issues, determinants, and to out of sample predictive power. There is a wide range of systemic risk measures used in the literature. After the 2008 financial crisis a lot of systemic risk measures have been proposed and analyzed. Some of the common measures of systemic risk typically used in the literature are conditional (CoVaR), change in conditional VaR (ΔCoVaR), and marginal expected shortfall (MES) among many others. Giglio et al (2016) report that there is a strong correlation between these popular systemic risk measures; for example, the correlation between MES and CoVaR is 0.93 for their sample of financial institutions. Even though there is no consensus concerning the best measure of systemic risk, the Basel Committee starting 2016 recommends the use of the Expected Shortfall (ES).

For the purpose of this study, we estimate the systemic risk calculating the financial volatility and the Expected Shortfall (ES) methodology. The Expected Shortfall was first introduced by Artzner et al (1999) in order to overcome some of the drawbacks associated with using VaR as a risk measure. The financial volatility measure is calculated as the within –month standard deviation of daily equity returns of individual insurance companies.

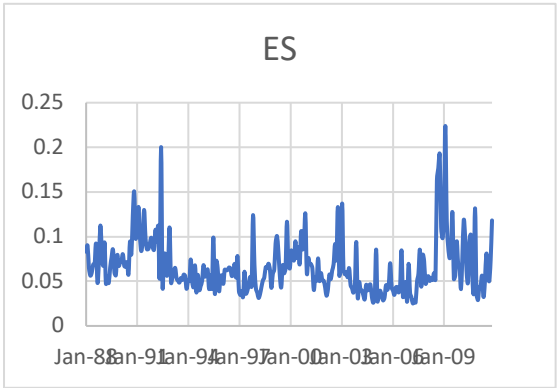
Following Artzner et al (1999) the ES measure is defined as the conditional expectation of the market loss conditional on the loss less than the α quantity that is the VaR as defined in equation (1). Therefore, we look at loss beyond the VaR level. We use a nonparametric kernel estimation of the tail expectations along the lines of Scaillet (2005) using the average of extreme returns beyond 5% VaR. Alternatively, using a 1% VaR we find qualitatively and quantitatively similar results.

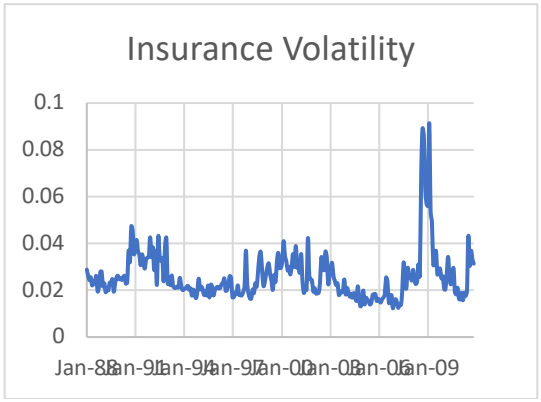
$$ES_{\alpha}(R) = E[R|\, R \leq VaR_{\propto}(R)] \qquad (1)$$

Where, ES is the expected shortfall, R represents the extreme return, and α is the probability.

Figure (1) plots the monthly ES and the financial volatility measure for our sample from January 1988 to December 2011. We notice an increase in the level of systemic risk as measured by the ES in 1992-1993, 2002-2003 and in periods of recession especially during the 2008-09 financial crisis. The estimated shortfall (ES) peaked during the period 1992-1993 where the insurance industry experienced turmoil on two fronts: the property liability companies suffered catastrophic losses due to Hurricane Andrew (1992) and life insurance companies experienced a contagion problem from the downfall of some large life insurers that invested heavily in junk bonds (Fenn & Cole 1994). These peak levels in the estimated shortfall are close to the levels reached during the financial crisis. Our second measure of systemic risk - financial volatility as measured by the monthly standard deviation of daily excess returns follows a similar pattern as the estimated shortfall. The highest level of volatility recorded occurs during the great recession.

**Figure I Time Series of Systemic Risk Measures**




Panel (a) Insurance Estimated Shortfall

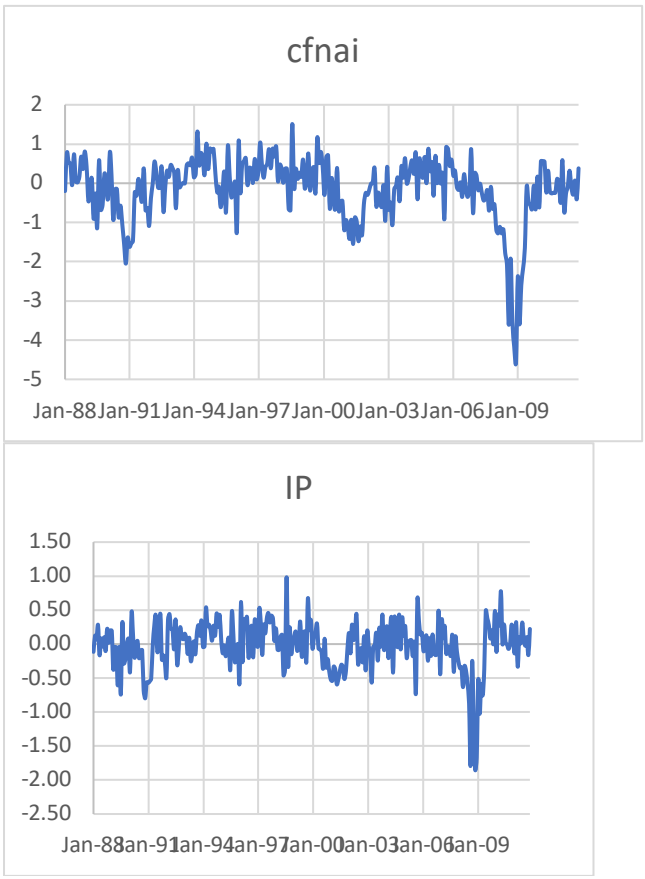
Panel (b) Insurance Financial Volatility

## IV. Model and Estimation

The recent financial crisis renewed the interest in the systemic risk of financial institutions. The role of insurance companies during the financial crisis is not well understood. On one hand, insurance companies may have proven to be resilient to economic downturns given the composition of their investment portfolio, investment grade bonds, and became a moderating factor during bad economic times. The products sold by insurance companies are prefunded and there were no disruptions in the supply of insurance during the crisis. Alternatively, they may have exacerbated the situation by failing to honor their obligations as they do not accurately predict their losses or invest in high-risk assets. Against these two competing hypotheses, we test whether insurance companies' systemic risk had any adverse impact on economic activity.

In the first step, we estimate the systemic risk (ES) as defined in equation (1). Then we apply our model in equation (2**)** to determine the impact of the insurance systemic risk on the economy. We measure economic activity through the Chicago Fed National Activity Index (CFNAI) which is a weighted average of 85 monthly economic indicators. By design, the CFNAI is constructed to have a mean value of zero and a standard deviation of one. Therefore, since economic activity tends to gravitate toward a trend, an index above zero means economic growth above the trend. Our second measure of economic activity is industrial production (IP) growth downloaded from the Federal Reserve of St Louis site.

**Figure II Time Series of Economic Indicators**




Panel (a) CFNAI Panel (b) Industrial Production Growth

Figure II shows a time series plot of CFNAI in panel (a), our proxy of economic activity. A positive index represents growth above a trend and a negative index is growth below trend. Clearly, the largest dip in economic activity occurred in 2008-2009 over the period covered by our sample. Usually the economic impact is preceded by the financial crisis. The industrial production growth follows the same pattern as the broader CFNAI index. The other peaks and troughs correspond to business cycles turning points in 1991 and 2001 as identified by the National Bureau of Economic Research.

Using this data set, we estimate the following regression:

$$Y_{t+n} = \propto + \beta SR_t + \sum_{i=1}^{12} \gamma_i Y_{t-i+1} + \varepsilon_{t+n} \quad (2)$$

Where,

$Y_t$: the monthly Chicago Fed National Activity Index (CFNAI) and the Industrial Production growth (IP)

$SR_t$: monthly systemic risk; measured by estimated short fall and financial volatility

In our estimation, we allow up to 12 lags for our dependent variable in the specification model. The choice of the number of lags was determined by using AIC and SIC model selection criteria. We use Newey-West standard errors rather than the ones obtained from standard regression, as they are robust to the autocorrelation and heteroscedasticity. We do not try to identify the factors

that forecast economic downturns our goal is simply to test the impact of insurance systemic risk on the wider economy. More precisely, we set out to test to what extent insurance systemic risk can predict macro-economic downturns.

Table I presents the results of the estimation of equation (2) using the estimated shortfall (ES) as measure of systemic risk and the two measures of economic activity: CFNAI and IP (industrial production growth).

**Table I**
**Predictive Power of Estimated Shortfall**

$$Y_{t+n} = \propto + \beta SR_t + \sum_{i=1}^{12} \gamma_i Y_{t-i+1} + \varepsilon_{t+n}$$

| | CFNAI | | | IP | | |
|---|---|---|---|---|---|---|
| N | β | t-stat | Adj.$R^2$ | β | t-stat | Adj.$R^2$ |
| 1 | -3.6899 | -2.47*** | 0.6247 | -0.0523 | -4.92 | 0.7920 |
| 2 | -3.3619 | -2.05** | 0.6032 | -0.0473 | -3.64 | 0.7991 |
| 3 | -2.8016 | -1.49 | 0.4913 | -0.0540 | -3.56 | 0.8053 |
| 4 | -1.6452 | -0.75 | 0.3713 | -0.0328 | -1.35 | 0.7946 |
| 5 | -1.6655 | -0.62 | 0.2859 | -0.0180 | -0.80 | 0.7938 |
| 6 | -1.6036 | -0.57 | 0.2295 | 0.0094 | 0.40 | 0.7918 |

The table reports the six-month ahead, the corresponding parameter estimate of (ES) t-statistics based on Newey West (1987) standard errors and the adjusted $R^2$
*10% significant, **5% significant, *** 1% significant

Table I shows that the coefficient estimates of the ES, our measure of systemic risk, are negative and significant at 5% or better up to three months in advance. From one to two months the coefficients of the CFNAI are negative as expected. The magnitude of the beta coefficients varies from -3.69 to -2.80, compared to Allen et al (2012) who find smaller beta coefficients and a longer forecasting period; their predictive window extends into six months. The adjusted $R^2$ values range from 62% to 23%. The alternative economic indicator, growth in industrial production, yields stronger results with a predictive window up to three months and a much stronger goodness of fit, adjusted R squared up to 80%.

Table II presents the results of the estimation of equation (2) using the financial volatility as measure of systemic risk and the two measures of economic activity: CFNAI and IP.

**Table II**

**Predictive Power of Financial Volatility**

$$Y_{t+n} = \propto + \beta SR_t + \sum_{i=1}^{12} \gamma_i Y_{t-i+1} + \varepsilon_{t+n}$$

| | CFNAI | | | IP | | |
|---|---|---|---|---|---|---|
| N | β | t-stat | Adj.$R^2$ | β | t-stat | Adj.$R^2$ |
| 1 | -19.1881 | -3.96*** | 0.635 | -0.3579 | -4.92*** | 0.8035 |
| 2 | -18.0776 | -2.56** | 0.613 | -0.3166 | -3.64*** | 0.8079 |
| 3 | -16.5352 | -2.15* | 0.5006 | -0.2598 | -3.56*** | 0.8086 |
| 4 | -9.6831 | -1.14 | 0.3745 | -0.1763 | -1.89* | 0.7966 |
| 5 | -10.9897 | -1.16 | 0.2903 | -0.1663 | -1.81* | 0.7965 |
| 6 | -5.9952 | -0.64 | 0.2292 | 0.0943 | -0.99 | 0.7928 |

The table reports the six-month ahead, the corresponding parameter estimate of financial volatility

t-statistics based on Newey West (1987) standard errors and the adjusted $R^2$

*10% significant, **5% significant, *** 1% significant

In order to check the robustness of our results, Table II shows the results with financial volatility, the within-month standard deviation of daily equity returns, as an alternative proxy for systemic risk. The results are stronger than with the estimated shortfall. The forecasting period extends to up to five months using industrial production growth as a measure of economic indicator and better goodness of fit as indicated by the adjusted R squared that ranges from 80% to 50%. Not surprisingly, the adjusted R squared declines at the longer forecasting horizon. The decline in goodness of fit is more pronounced using CFNAI as economic indicator.

The coefficients on the IP measure are smaller than those on CFNAI. This finding can be attributed to the fact that industrial production represents a small share of the economy and has been declining (20 % in 2016 according to the Federal Reserve Board). Moreover, the CFNAI is a much broader index than the IP meaure. Our results echo the findings of Giglio, Kelley and Pruitt (2016) who, among 19 different measures of systemic risk, find that financial volatility had the strongest predictive power to forecast macroeconomic shocks.

In summary, our measures of systemic risk of the insurance industry provides a predictive power to forecast a macroeconomic downturn up to three months. We believe that our results are important given that we only consider the insurance sector while Allen, Bali, and Yang (2012) include in their analysis the entire financial sector. This contradicts a long held belief by insurance advocates that insurance companies do not contribute to systemic risk but rather the industry, especially in times of economic hardships, is a source of security and stability and acts more as a moderating factor.

## V. Conclusion

The financial crisis of 2008 put the spotlight on banks and their role in causing the great recession. The past recession highlighted the financial sector's role in the economy, specifically that a financial crisis can result in economic downturns. Academicians and policymakers wanted to understand bank risks to prevent future crises and in case of recurrence of financial crisis to limit their impact. The insurance sector represents a large segment of the financial sector. It plays an important role in the economy, providing individuals and businesses protection against potentially catastrophic consequences. Yet the financial crisis of 2008 revealed that at least some insurance entities like AIG contributed to the severity of the crisis.

Using a sample of insurance companies, we find that insurance systemic risk forecasts macroeconomic downturns three months into the future. Knowing to what extent insurance systemic risk affects the macro economy gives the appropriate regulatory authorities the ability to make proper policies to reduce economy's exposure to systemic risk. Whether the existing insurance regulatory system has the tools to deal of systemic risk is debatable. Currently, insurance companies are subject to the 1944 McCarran-Ferguson Act that gives the right to the states to regulate the insurance industry. State regulators, long focused on solvency and consumer complaints may not have the policy tools to manage systemic risk. As a result, The Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 established the Financial Stability Oversight Council (FSOC).

The FSOC's task is to identify systemically important bank and non-bank financial institutions (SIFI) whose potential collapse could lead to a systematic failure of the financial system. Among those institutions, the largest insurance companies such as MetLife, AIG, and Prudential were identified as SIFI. After a drawn out litigation battle, the FSOC removed MetLife and Prudential's systemic risk label. The FSOC's prerogative is to monitor only large financial institutions with at least $50 billion assets. The focus of oversight should not be limited to the largest insurers but also smaller insurance companies' failures may contribute to the instability of the financial system. Effective and efficient regulation requires monitoring insurance products that are highly correlated with the economy such as financial guarantees. Second, insurance state guaranty funds, which may encourage moral hazard, maybe redesigned similarly to the FDIC that requires prefunding and risk based premiums while monitoring excessive risk taking behavior by member institutions. Next, reinsurance arrangements should be subject to more scrutiny to avoid shadow insurance, a practice by some insurers to sell liabilities to unrated and unregulated reinsurance companies. Insurance companies rely on shadow insurance to reduce risk based capital requirements ultimately increasing risk. Therefore, measures at the state level in conjunction with the FSOC and the newly created Federal Insurance Office would modernize insurance regulation.

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# ESG Ratings and the Performance of Socially Responsible Mutual Funds: A Panel Study

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## Abstract

This study uses the Fama-French 5-factor model to examine the risk-adjusted performances of Socially Responsible Mutual Funds (SRMF) relative to the market over a 12-year (2005–2016) period. The timeframe of this study overlaps the periods leading up to, during, and immediately past the Great Recession. This study also examines whether the Environmental, Social, and Governance (ESG) ratings assigned to the SRMF signal fund performance over time. The results indicate that although the SRMF underperformed in the market during the 2005–2016 period, there was no difference in the SRMF performance with respect to the market during the Great Recession period. Furthermore, our results indicate that the SRMF with higher ESG ratings outperformed the SRMF with lower ESG ratings during the Great Recession period. Implications of this study's findings for investment analysts, portfolio managers, and financial planners are included.

## I. Introduction

According to USSIF (2016), investment in US-domiciled socially responsible mutual funds (SRMF) has grown substantially over the previous two decades. The number of SRMF available in the market has increased by 33% over the past two years. This rapid growth in the number of funds available has been accompanied by an increase in the amount of assets under management, which reached $8.72 trillion in 2016. SRI funds provide investors with the opportunity to participate in the market while investing in portfolios comprising corporations that value those socially responsible causes that are important to the investors (Haigh & Hazelton, 2004). The SRMF are expected to outperform conventional funds because they comprise corporations that demonstrate corporate social responsibility (CSR) and transparency in their operations (Renneboog et al., 2008). The principal idea behind this hypothesized increased performance is that the portfolios of these funds include responsibly managed and administratively transparent corporations that make sustainable and safe products. As a result, the responsible practices followed by the corporations included within the SRMF portfolios are expected to have lower risks and liabilities arising from class-action lawsuits or other related penalties that can negatively affect the companies' corporate earnings (Guerard, 1997). Nofsinger and Varma (2012), after controlling for the 4-factor Carhart model, found that although SRMFs trailed the conventional funds during

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the non-crisis periods, SRMFs outperformed other conventional funds during periods of market crisis.

According to Rathner (2013), US-domiciled SRMF have performed better than the non-US SRMF. Although some studies have compared the performance of SRMF to the market, very few studies have compared the funds' performances within the SRMF universe (Margolis & Walsh, 2003; Orlitzky et al., 2003; Tosun, 2017). Further, no study was found to be available in the extant literature that has examined the performance of SRMF based on their ESG ratings before, during, and after the Great Recession. This study therefore adds to the body of literature by comparing the performances of SRMF based on the assigned Environmental, Social, and Governance (ESG) ratings in addition to examining the SRMF performances relative to the market leading up to, during, and after the Great Recession. This study examines whether SMRF ESG ratings translate into higher risk-adjusted returns after controlling for other fund related characteristics.

## II. Literature Review

In one of the seminal papers on SRMF, Hamilton, Jo, and Statman (1993) examined three different hypotheses when comparing the performances of socially responsible portfolios to the portfolios of conventional funds: 1) The socially responsible mandates are not associated with market risk and should not affect portfolio returns when compared with the conventional funds; 2) The expected returns of socially responsible funds should be lower than the expected returns of conventional funds because socially responsible corporations are already priced in the market; 3) The returns of socially responsible funds should be higher than the returns for conventional funds if the investors in general underestimate the probability of negative consequences for socially irresponsible corporation performance. The authors found no significant differences between the performance of SRMF and conventional funds. Hamilton, Jo, and Statman's (1993) paper was among the first to find that investors are not penalized for investing in socially responsible companies. In the UK, Mallin, Saadouni, and Briston (1995) compared the portfolio performance of 'ethical' corporations against the portfolios of non-ethical corporations and the benchmark index. They found that 'ethical' portfolios do not outperform the market. Similarly, Cortez, Silva, and Areal (2009) found that SRMF performances in the European markets are not significantly different than the performances of conventional funds; moreover, the returns of conventional indices have a higher explanatory power than the socially responsible indices when predicting SRMF performance. Similarly, no statistical difference in the performances of SRMF and conventional funds were found in the context of the Australian and Canadian markets (Bauer et al., 2005, 2007).

Tosun (2016) found that adding corporations with higher scores in CSR to the SRMF portfolio does not improve portfolio performance, and funds with greater sensitivity to the corporate socially responsible stocks underperformed in the market. On the contrary, the studies by Margolis and Walsh (2003) and Orlitzky et al. (2003) showed that greater portfolio allocation to stocks of corporations that showed greater CSR were associated with better financial performance. Other studies that have compared the performance of SRI indices with conventional market indices after removing the companies with low social records have found that the performances of social indices are similar to the performances of broad market indices (Grossman & Sharpe, 1986; Sauer, 1997; Statman, 2006).

To summarize the findings from previous studies, the researchers found no significant difference between the performance of SRMF and the conventional funds, and the SRMF and conventional funds generally underperform the benchmark indices on a risk-adjusted basis (Bauer et al., 2005, 2007; Cortez, Silva, & Areal, 2009; Hamilton, Jo, & Statman, 1993; Mallin, Saadouni, & Briston, 1995). Other studies have suggested that CSR may be associated with financial performance (Margolis & Walsh, 2003; Orlitzky et al., 2003; Tosun, 2016), and one study has found that SRMF portfolios outperform the conventional portfolios during periods of market crisis (Nofsinger & Varma, 2012). However, there are no previous studies that have examined whether the extent of fund allocation into the socially responsible stocks as evidenced by the ESG ratings of the fund portfolios differentiates fund performance. This study examines whether ESG ratings of SRMF are a factor in fund performance during periods of economic crisis and non-crisis. Based on the findings of previous studies, we hypothesize the following:

H1: The market index outperforms the SRMF on a risk-adjusted basis after controlling for Fama-French factors.
H2: SRMF with higher ESG ratings outperform SRMF with lower ESG ratings through the overall period of this study.
H3: ESG ratings of SRMF are associated with performance during periods of crisis (Great Recession) and non-crisis (periods prior to and after the Great Recession).

## III. Methods

### A. Data

We used data from the Morningstar® database for the analyses in this study. The study periods used were for the 2005–2016 period. Additional panel data analyses were performed on the sub-panel periods (T1, T2, T3) of 48 months each, with 144 months total. The first sub-panel was for the 2005–2008 period, followed by 2009–2012, and then for the 2013–2016 period. We chose funds that are US-domiciled for this study. Similar to the methodology suggested in previous studies (Grossman & Sharpe, 1986; Sauer, 1997; Statman, 2006), SRMFs with low social performance ratings were excluded, and only SRMFs in the top half of the SRI category in the Morningstar® database were examined. Specifically, to focus on the long-term consequences of allocating into SRMF for individual investors, this study focuses narrowly on the surviving funds over the 2005–2016 period. The Morningstar® database includes the ESG ratings for funds that incorporate environmental, social, and governance factors. Environmental issues include climate change and carbon emissions, air and water pollution, energy efficiency, water scarcity, waste management, and deforestation. Social issues include product safety, data protection/privacy, gender and diversity, employee engagement, supply chain management, and labor standards. Governance issues include board composition, audit committee structure, executive compensation, lobbying, political contributions, and bribery and corruption.

### B. Analyses

The analyses for this study are conducted in two phases. To test H1, the first phase compares the performances of SRMF against the market index during the overall 2005–2016 period, followed by the 2005–2008, 2009–2012, and 2013–2016 sub-periods after controlling for the five Fama-French factors. To test H2 and H3, the second phase of this study examines whether ESG ratings are associated with SRMF performances after controlling for various fund-related characteristics during the overall 2005–2016 period, followed by 2005–2008, 2009–2012, and 2013–2016 sub-periods. The empirical models used in our analyses are as follows:

*Regression Equation I:* The first dependent variable is the SRI fund returns over the periods (Ri-Rf). The independent variables are the Fama-French five factors:

$$[R_{it} - R_{Ft}] = \alpha_i + \beta_{MRPi}[MRP_t] + \beta_{SMBi}[SMB_t] + \beta_{HMLi}[HML_t] + \beta_{RMWi}[RMW_t] + \beta_{CMAi}[CMA_t] + \varepsilon_i$$

An ordinary least squares (OLS) regression with fixed effects were estimated for the panel data used in this study.

*Regression Equation II:* The second dependent variable was the rolling average of the Sharpe ratios. The independent variables included in these models are ESG score level, manager tenure, expense ratio, fund size, and fund age.

$$SHARPE_i = \alpha_i + \beta_{mid_{esg}} Mid_{ESG_i} + \beta_{low_{esg}} Low_{ESG_i} + \beta_{tenure} TENURE_i + \beta_{exp} EXP_i + \beta_{size} SIZE_i + \beta_{age} AGE_i + \varepsilon_i$$

The ESG categories in this model are not time varying; therefore, pooled panel estimation with OLS regressions were computed for this part of the study. The dependent variable for regression equation 1 is risk premium (Ri-Rf). The dependent variable for regression equation 2 is Sharpe ratio (Rp-Rf/σ).

C. Variables

The independent variables included in the first phase of this analysis comprise the Fama-French 5-factor model (Fama & French, 2016). The market risk premium (Rm-Rf) is the additional return of the market over the risk-free rate and is based on the Capital Asset Pricing Model (CAPM) (Sharpe, 1964). SMB is the difference in the mean returns of the nine small cap portfolios and nine large cap portfolios as computed by Fama and French (1996), while HML is the difference in the mean returns of the two value portfolios and the two growth portfolios as computed by Fama and French (2010). RMW is the difference in the mean returns between the two robust operating profitability portfolios and two weak operating profitability portfolios constructed by Fama and French (Nichol & Dowling, 2014). Finally, CMA is the difference in the mean returns of two aggressive investment portfolios and two conservative investment portfolios (Nichol & Dowling, 2014).

The independent variables of interest in the second phase of this study were based on the ESG® ratings of the variables. This study divides the funds into tertiles, where funds in top 33% of the assigned ESG scores are categorized as High ESG, followed by funds in the middle 33% of ESG scores as Mid ESG, and funds in the lowest 33% of ESG scores as Low ESG. Binary variables are created to represent each tertile as a variable in the empirical model. Other control variables in regression equation 2 included tenure of the fund manager, expense ratio, and size of the mutual fund. These variables were included because of the association of these variables with fund performance in previous literature (Ruf et al., 2019; Das et al., 2018; Jain & Wu, 2000).

## VI. Results

A. Descriptive Statistics

The descriptive statistics for this study are shown in Table I. When examining within the SRMF tertiles, the results indicate that SRMF in the lowest ESG tertile had significantly higher risk-adjusted returns across all periods except 2005–2008. During the 2005–2008 period, which included the Great Recession, SRMF on the middle and lowest tertiles of ESG scores had lower risk-adjusted (Sharpe) returns than the SRMF in the highest tertiles of ESG scores. The highest ESG-rated SRMF outperformed other SRMF counterparts during periods of market uncertainty.

**Table I: Descriptive Statistics**

| Variables | Panel 2005-2016 | | Panel 2005-2008 | | Panel 2009-2012 | | Panel 2013-2016 | |
|---|---|---|---|---|---|---|---|---|
| ESG_category | Monthly Return | Sharpe Ratio | Monthly Return | Sharpe Ratio | Monthly Return | Sharpe Ratio | Monthly Return | Sharpe Ratio |
| Low | 0.65 | 0.71 | -0.39 | 0.3 | 1.33 | 0.63 | 0.99 | 1.18 |
| Med | 0.56 | 0.76 | -0.37 | 0.4 | 1.12 | 0.6 | 0.94 | 1.26 |
| High | 0.51 | 0.65 | -0.32 | 0.56 | 1.11 | 0.43 | 0.75 | 0.96 |
| Chi-Squared | **p<0.01 | ***p<0.001 | ***p<0.001 | ***p<0.001 | ***p<0.001 | **p<0.034 | ***p<0.001 | ***p<0.001 |

B. Performance of SRMF When Controlling for the Fama-French 5-Factor Model

The results from the panel regressions are presented in Table II. This model uses the Fama-French 5-factor model and indicates that during the overall period 2005–2016 (Panel A), market risk premium (MRP) and RMW were positively associated with SRMF performance. Conversely, the alpha, SMB, HML, and CMA factors were significant and negatively associated with SRMF performance. During the period leading up to and through the Great Recession (2005–2008) as shown in Panel B, MRP was positively associated with SRMF performance; whereas, SMB, HML, and CMA were negatively associated with SRMF performance.

**Table II: SRMF Performance with Fama French 5 Factor Model**

| Variables | Panel A | | Panel B | | Panel C | | Panel D | |
|---|---|---|---|---|---|---|---|---|
| | 2005-2016 (n=73) | | 2005-2008 (n=73) | | 2009-2012 (n=73) | | 2013-2016 (n=73) | |
| | Coef. | SE | Coef. | SE | Coef. | SE | Coef. | SE |
| Alpha | -0.13*** | 0.01 | -0.02 | 0.03 | -0.08*** | 0.02 | -0.22*** | 0.02 |
| MRP | 0.99*** | 0.00 | 0.98*** | 0.01 | 0.95*** | 0.01 | 0.95*** | 0.01 |
| SMB | -0.03*** | 0.00 | -0.04*** | 0.01 | -0.02** | 0.01 | -0.04*** | 0.01 |
| HML | -0.02*** | 0.00 | -0.04*** | 0.01 | -0.02** | 0.01 | -0.02 | 0.01 |
| RMW | 0.04** | 0.01 | 0.01 | 0.02 | 0.02 | 0.01 | 0.07*** | 0.01 |
| CMA | -0.13*** | 0.01 | -0.15*** | 0.02 | -0.12*** | 0.02 | -0.14*** | 0.02 |

**p<0.05; **p<0.01; ***p<0.001*

In the period just following the Great Recession (2009–2012) as shown in Panel C, the results indicate that MRP was positively associated, but alpha, SMB, HML, and CMA were negatively associated with SRMF performance. Similarly, in the period following this (2013–2016), as shown in Panel D, MRP and RMW were positively associated with fund performance; whereas, alpha, SMB, and CMA were negatively associated with SRMF returns.

C. Determinants of Risk-Adjusted SRMF Performance When Controlling for ESG Ratings

The second part of our analysis focuses on examining the determinants of risk-adjusted SRMF performance when controlling for the ESG ratings. The results from Table III indicate that during the overall period of this study 2005–2016 (Panel A), medium and lower ESG-rated SRMF had higher risk-adjusted returns when compared with the higher ESG-rated SRMF. Management tenure, fund size, and age were also positively associated with fund performance.

The results in Panel B are estimated over the period leading up to and through the Great Recession (2005–2008). During this period, both medium and low ESG-rated SRMF were negatively associated with risk-adjusted fund performance when compared with the reference group of high ESG-rated SRMF. Additionally, management tenure and fund size were positively associated with fund performance.

**Table III: Determinants of Risk-Adjusted SRMF Performance by ESG Ratings**

| Variables | Panel A | | Panel B | | Panel C | | Panel D | |
|---|---|---|---|---|---|---|---|---|
| | 2005-2016 (n=73) | | 2005-2008 (n=73) | | 2009-2012 (n=73) | | 2013-2016 (n=73) | |
| | Coef. | SE | Coef. | SE | Coef. | SE | Coef. | SE |
| *ESG Scores (Ref: ESG_High)* | | | | | | | | |
| ESG_Med | 0.07*** | 0.02 | -0.22*** | 0.07 | 0.14*** | 0.05 | 0.28*** | 0.07 |
| ESG_Low | 0.06*** | 0.02 | -0.23*** | 0.07 | 0.19*** | 0.05 | 0.22*** | 0.07 |
| Tenure | 0.01*** | 0 | 0.01** | 0.07 | 0.01 | 0.02 | 0.01* | 0 |
| Expense Ratio | -0.01 | 0.01 | 0.01 | 0.01 | -0.05* | 0.03 | 0.04 | 0.04 |
| Fund Size | 0.02*** | 0 | 0.02*** | 0 | 0.02** | 0.01 | 0.02** | 0.01 |
| Age | 0.01*** | 0 | 0.01 | 0.01 | 0.02** | 0.01 | 0.04** | 0 |
| Intercept | 0.51 | 0.33 | -0.28 | 0.25 | 0.19 | 0.15 | 0.24 | 0.28 |

*$p<0.05$; **$p<0.01$; ***$p<0.001$

The results in Panel C are estimated over the period immediately following the Great Recession (2009–2012). The results indicate that both medium and low ESG-rated SRMF were positively associated with risk-adjusted SRMF returns when compared with the reference group of high ESG-rated funds. Expense ratios were negatively associated with fund performance. In addition to these factors, fund size and age were also positively associated with fund performance.

The results in Panel D are estimated over the 2013–2016 period. The results indicate that medium and low ESG-rated SRMF were positively associated with risk-adjusted performance when compared with the reference group of high ESG-rated SRMF. Management tenure, fund size, and age were also positively associated with risk-adjusted fund performance.

## V. Discussions and Conclusion

The findings from this study informs the literature on SRMF performance leading to and through the period of Great Recession and through the subsequent recovery and economic expansion periods following the Great Recession. The results of this study are consistent with our hypothesis that given the efficiency of the financial markets, SRMF underperformed in the market over the period of study. However, it should be noted that many investors who participate in SRMF have a sustainable or socially responsible motive, and outperforming the market is usually not the

most important criteria for these investors. The results also indicate that although the SRMF had negative alpha relative to the market during the overall study period (2005–2016), the positive association of MRP and RMW with SRMF returns indicates that the SRMF did well when the overall market premium went up and when the robust stocks outperformed the weak stocks. Consistent with this, the SRMF returns were negatively associated with SMB and HML factors. More research is needed to understand SRMF fund behavior when controlling for SMB and HML factors. The negative association between SMB and SRMF returns could be because the SRMF portfolios were biased towards bigger company stocks. The negative association between SRMF returns and HML indicates that the SRMF portfolios comprise low book-to-market (growth) rather than high book-to-market (value) stocks.

The results from this study find mixed evidence in support of H2 but support H3. Contrary to H2, that the higher ESG-rated SRMF outperform lower- and medium-rated SRMF, the results comparing risk-adjusted returns by ESG rating categories indicates that the medium- and lower-rated SRMF outperformed the higher-rated SRMF during all periods except during the period that overlapped with the Great Recession. Therefore, the results from this study indicate that the medium and lower ESG-rated SRMF were less resilient than the higher ESG-rated SRMF during the period of economic crisis. SRMF with longer management tenure, age, and larger fund size were positively associated with risk-adjusted performance during the period of this study.

The analyses in this study were estimated over a critical period for the market that included the period leading up to and through the Great Recession and then through the period of subsequent recovery. The results indicate that the SRMF performance was not significantly different from the market during the period of economic crisis, although the SRMF underperformed in the market during the overall period of this study. However, the period of existence of SRMF and the period covered in this study are relatively short given over 100 years of data now available for our financial markets. Future studies need to be done to examine whether SRMF performance remains consistent over longer periods of time and whether the ESG ratings remain a predictor of SRMF performance over longer periods of time.

One limitation of this study was the availability of past data for a limited number of funds. However, the SRMF universe has been growing rapidly (Yan et al., 2018) and future studies will have access to SRMF performance data over a longer period of time. Another limitation of this study was that it focused primarily on US-based SRMF. In future, it will be interesting to examine whether factors associated with SRMF performance found in this study are also similarly associated with SRMF performance in international markets.

The association between ESG ratings and SRMF performance informs financial planners and wealth managers who are responsible for managing their clients' portfolios given their clients' risk tolerance (Grable & Chatterjee, 2014). The findings from this study informs practitioners that SRMF, even after controlling for various risk related factors, do not underperform the market during periods of market uncertainty. When examining the performances of SRMF based on the assigned ESG ratings, the results from this study suggest that medium and lower ESG-rated funds underperformed the higher ESG-rated funds during the period of economic crisis, although these funds outperformed the higher ESG-rated funds during other periods. Financial advisors and wealth managers may need to consider this fact that the higher ESG-rated SRMF are more resilient during periods of market crisis when allocating the assets of risk averse clients into SRMF.

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