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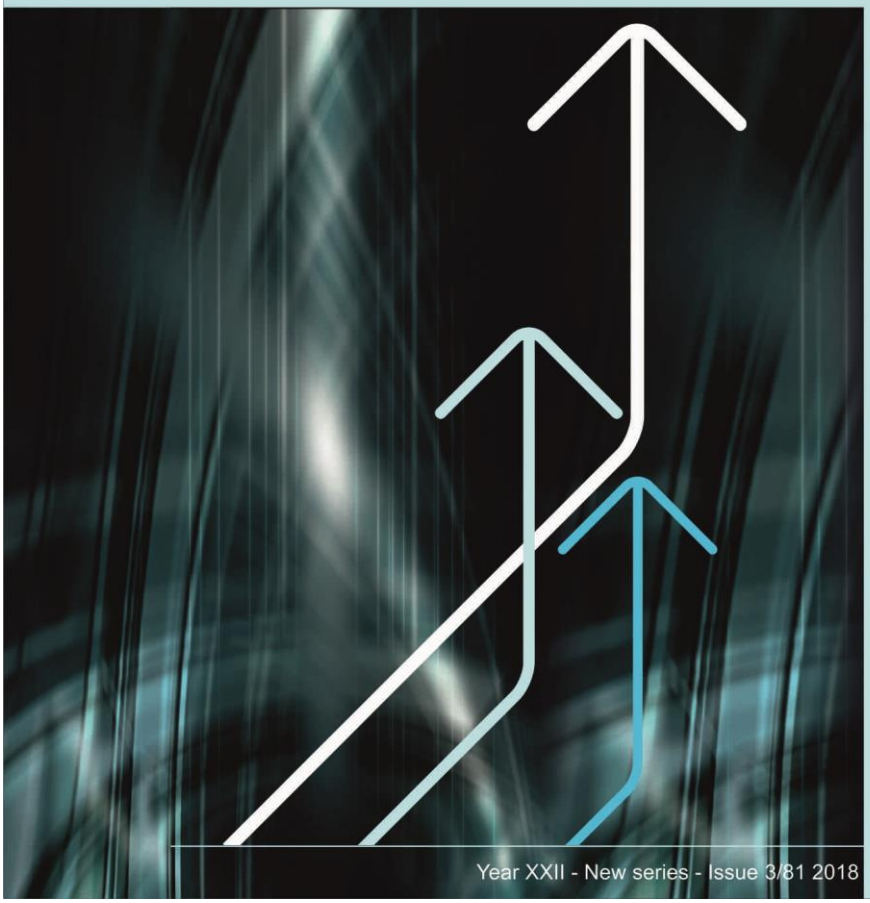

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“VICTOR SLĂVESCU” CENTRE FOR FINANCIAL
AND MONETARY RESEARCH

FINANCIAL STUDIES

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DOES CORPORATE SOCIAL RESPONSIBILITY LEAD TO SUPERIOR PERFORMANCE?

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Abstract

In view of the inconsistent empirical findings in the literature and the limitations of least squares regressions, this paper employs a quantile regression method to investigate the impact that engagement in corporate social responsibility (CSR) activities has on corporate performance in China. An important finding of this work is that a significant, negative relationship across all quantiles exists between engagement in CSR activities and corporate performance in China when using return on assets (ROA), return on equity (ROE), and earnings per share (EPS) as performance measures. However, a significant, negative relationship between engagement in CSR activities and corporate performance only exists at low quantiles when using gross profit to net sales (GP) as a performance measure.

Keywords: Corporate Performance, Quantile Regression

JEL Classification: C50, G30

1. Introduction

With the globalization of economy, corporate social responsibility (CSR) is no longer an issue that is discussed only in western developed nations. Global corporations search business opportunities in emerging markets, especially developing countries such as China. China has become the most watched economy in the world for these years no matter of the direction of political strategies

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or the trend of economic development. China has enjoyed rapid economic growth over the last thirty years. However, China's economic development has often been accompanied by reports of poor business practices. The growing number of business scandals, such as overworked and underpaid employees, worker suicides, faulty consumer products, toxic emissions and water pollution profoundly affected Chinese economic growth and sustainable development for business. These wrongdoings show that many Chinese corporate just blindly pursue high profits and do not have enough experience in governing business. These phenomena highlight the urgent need to promote CSR in China.

In the mid and late 1990s, China approved a set of laws that resulted in significant influences on CSR in China, such as Environmental Protection Law (1994), Consumer Protection Law (1994) and Labor Law (1995). These laws acted as guidelines of CSR for businesses in terms of labor, environment responsibilities, and so on. In recent years, Chinese authorities have introduced several CSR initiatives, while stock market regulators have issued guidelines for CSR reporting requirements on a subset of Chinese firms. The Company Law of the People's Republic of China (effective 2006), Article 5, requires companies to comply with social morality, business morality, and meet their social responsibilities. In 2006 the Shanghai Stock Exchange and Shenzhen Stock Exchange issued guidelines for CSR disclosure, which in 2008 were made mandatory for a subset of listed firms.

All of Chinese government departments, industries and enterprises have considered that developing CSR is an important means to build a harmonious society, implement an empirical approach to development and carry out sustainable development. Accordingly, they employed a series of positive measures to foster the advancement of CSR movement. Chinese President Hu Jintao noted at an APEC meeting, held in November 2009, that "Enterprises should become aware of global responsibility, voluntarily include social responsibility in their business strategy, optimize business model and seek harmony between economic and social benefits." Against such backdrop, China's CSR movement has rapidly developed. As of June 2009, over 400 Chinese enterprises have published CSR reports, and many have set up CSR departments to advance their practices in this area. In addition, some leading enterprises are actively exploring the inclusion of CSR practices in

their business strategies and day-to-day management, in an effort to build comprehensive CSR management systems.

CSR is when enterprises work to consider the welfare of stakeholders beyond investors, including employees, customers, suppliers, government bodies, local communities, and the environment. This issue has attracted more attention over the last decade, as organizations have realized the strategic importance of such activities, with as many as 90% of the Fortune 500 companies now having explicit CSR initiatives (Kotler & Lee 2004; Lichtenstein, Drumwright, & Bridgette 2004). However, the nature of the relationship between the socially responsible practices of a corporation and its financial performance has long been debated, and remains unresolved (Margolis & Walsh, 2003; Foote et al., 2010). The literature has yielded a mixed set of results, including positive (e.g. Inoue and Lee, 2011; Wang, 2011; Huang and Lien, 2012), negative (e.g. Aupperle et al., 1985; McGuire et al., 1988; Brammer et al., 2006), neutral (e.g. McWilliams & Siegel, 2001; Makni et al., 2009; Soana, 2011), or even complex (e.g. Barnett and Salomon, 2002) relationships, and hence there remains no agreement as to whether or not high levels of CSR activity lead to improved corporate financial performance (McWilliams & Siegel, 2000; Margolis & Walsh, 2003; Inoue & Lee, 2011).

In view of the inconsistent empirical findings in the literature and the limitations of least squares regressions, this study considers that a restudy of the CSR–performance relation is thus needed, and adopts a quantile regression method, to fill this gap. This study can analyze whether and how CSR affects corporate performance with different levels of corporate performance by using quantile regression. This study hopes to provide different point of view to the literature with regard to the impact of CSR on corporate performance based on its empirical results.

In this study, the performance measures, namely return on assets (ROA), return on equity (ROE), gross profit to net sales (GP) and earnings per share (EPS), exhibit skewed distributions, so the assumption of normal distribution error terms in ordinary least squares (OLS) is not guaranteed, and may lead to misleading results. Quantile regression can resolve these problems and also offer a more flexible and complete characterization when there is an interest in the impact of CSR at both higher and lower levels of corporate performance. In addition, some studies have determined that the

relationship between corporate performance and CSR is not linear (e.g., McWilliams & Siegel, 2001; Barnett & Salomon, 2002), and therefore we suspect that the sensitivity of a company's performance to CSR activities will vary with the level of performance. For these reasons, we adopt a quantile regression method to analyze whether and how CSR activities affect different levels of corporate performance.

The main contributions of this paper are twofold. First, this work applies quantile regression to analyze the separate responses of different quantiles of the performance distribution to the CSR, using our panel data for Chinese samples. Quantile regression enables us to observe the whole distribution of the variables, rather than only focus on a single measure of the central tendency of the distribution, so it is suitable to examine potential differences in parameters between firms at different segments of the distribution of performance variables. Specific to the concerns of this study, the quantile regression method is appropriate to examine the impact of CSR on corporate performance for both more and less successful firms. Different from previous works, this study investigates the impact of corporate social responsibility activities on corporate performance from the perspective of different levels of performance, and thus adopts a quantile regression approach. Second, few studies in the current literature explore the CSR–performance relationship in China. The present paper employs Chinese data and obtains significantly negative relationship between CSR and corporate performance which may result from specific China's socialist market economy, contrasted on previous studies on western countries with inconsistent conclusions(Huang and Lien 2012; Soana, 2011; Brammer et al., 2006). Based on the particular finding, we also address the related implications for Chinese entrepreneurs and officials.

2. Corporate Social Responsibility and Corporate Performance

What is the relationship between CSR and corporate performance? Can business implementing CSR gain positive outcomes such as reputation enhancement, performance improvement and consumer identification, or is CSR vain, heading to expense increase and loss of competitiveness? The issue has been

studied extensively in academic field for decades and it has also been scrutinized by business.

Shen and Chang (2009) noted that there are two prominent but conflicting theoretical views regarding the financial impacts of CSR, the social impact hypothesis (Cornell and Shapiro 1987) and shift of focus hypothesis (Becchetti, Ciciretti and Hasan, 2007). The stakeholder theory claims that for obtaining long-term success, managers need to satisfy requirements of all stakeholders while carrying out strategic management. Cornell and Shapiro (1987) stated that when top managers execute financial policies, their objective is to reach the requirements of stakeholders and therefore increase corporate value; that is, if corporate can fully complete its obligations towards stakeholders, it will establish positive social image and maintain cooperation with stakeholders in the same time. Therefore, the social impact hypothesis states that there exists a positive relationship between social and financial performances. Wang (2011) argued that a socially responsible firm may be welcome by investors due to better corporate image, thus having a positive impact on stock performance. Huang and Lien (2012) suggest that CSR is positively correlated with corporate image and organizational performance. Additionally, levels of corporate image are positively associated with organizational performance levels.

In contrast, Becchetti, Ciciretti and Hasan (2007) proposed the shift of focus hypothesis that found business conducting social activities, such as having a good relationship with employee and community, paying attention to environmental protection and improving corporate governance, not only to pursue stockholder interest maximization but also to pursue the interests of a broader set of stakeholders. However, these ways will result in cost expense increasing. Friedman (1970) claimed that business involving in social responsibility activities will lead to several problems, like as resource-using inefficiency and limiting product development, so as to decrease its competitiveness. Hence, the shift of focus hypothesis states that if the corporate focus on social performance, it will result in worse financial performance. Mahapatra (1984) also indicated that external investors like rational economic investors instead of ethical investors reflected the firms' expenses of pollution prevention to stock return. This meant that the expenses of pollution prevention had a negative impact on stock return. In other word, when corporation

invests largely in improving corporate social responsibility, it may damage the benefit of stockholders.

3. Data and Variables

For the empirical analysis, this study employs a sample of the top 300 Chinese firms over the period 2009–2011. This is an unbalanced panel dataset that comes from the Taiwan Economic Journal (TEJ) database. Any firms in the TEJ data set without complete information are also deleted from the sample before further analysis. The final sample consists of 254 effective observations.

The external evaluation of a firm's CSR engagement is an important element of promoting CSR practices in business. In addition, firms also need a system to evaluate the performance of their CSR efforts. Therefore, the CSR Research Center of Chinese Academy of Social Sciences has built a comprehensive evaluation system covering the latest developments in CSR practices and CSR information disclosure levels. By collecting the CSR information disclosed voluntarily by the top 300 Chinese firms through public media, like CSR reports, financial reports and official websites, and studying the latest CSR management practices and information disclosure levels of these firms, the CSR Research Center has produced the China Top 300 Firms CSR Indices each year since 2009. The CSR score is constructed by assessing a firm's CSR-related practices along four dimensions: economic, social and environmental performance, and responsibility management. The specific indicators examined in each dimension are adapted from a set of widely accepted international CSR standards, including ISO26000[1] and the Global 500 companies' CSR reporting metrics. This paper employs the variable "CSR_score" to measure CSR.

Following Shen and Chang (2009), this study uses return on assets (ROA), return on equity (ROE), gross profit to net sales (GP) and earnings per share (EPS) as the corporate performance variables.

Several variables are also likely to influence corporate performance. Based on earlier studies on the subject (Agrawal & Knoeber, 1996; Florackis et al., 2009; Li et al., 2009), this study also

[1] *ISO26000 is a set of social responsibility standards developed by the International Standardization Organization, and was first adopted in July 2010.*

controls for firm size, financial leverage, growth rate of sales, and growth rate of assets differences across firms by including the variables *size*, which is the natural logarithm of total assets, *leverage*, which is the ratio of total debt to total assets, *salegrow*, which is the annual growth rate of sales, and *assetgrow*, which is the annual growth rate of the assets in the model. The definitions of all the variables are presented in Table 1.

The following equation is the basic model of the empirical study:

$$performance_i = \beta_0 + \beta_1 CSR\_score_i + \beta_2 size_i + \beta_3 leverage_i + \beta_4 salegrow_i + \beta_5 assetgrow_i + \varepsilon_i \quad (1)$$

4. The Econometric Model

First proposed by Koenker and Bassett (1978), quantile regression is an extension of the classical least squares estimation of the conditional mean to a collection of models for different conditional quantile functions. The least squares regression only enables researchers to approximate the conditional mean and median located at the center of the distribution, and this can only result in an incomplete picture of a conditional distribution (Mosteller & Tukey, 1977). However, quantile regression enables the estimation of conditional quantile functions, where each function characterizes the behavior of a specific point in the conditional distribution, and thus it fully represents the distribution. Quantile regression is applied when an estimate of the various quantiles in a population is needed, and also has several other important features. First, the quantile regression estimator minimizes the weighted sum of absolute residuals rather than the sum of squared residuals, and thus the estimated coefficient vector is not sensitive to outliers. Second, a quantile regression model uses a linear programming representation and simplifies examination. Third, this form of analysis is specifically useful when the conditional distribution does not have a standard shape, such as a fat-tailed, truncated, or asymmetric distribution. The quantile regression approach can thus obtain a much more complete view of the effects of explanatory variables on the dependent variable. The basic quantile regression model specifies the conditional quantile as a linear function of explanatory variables, and is given by:

$$y_i = x_i'\beta_\theta + u_{\theta i} \text{ , } 0<\theta<1 \quad (2)$$

$$Quant_\theta(y_i|x_i) = x_i\beta_\theta \quad (3)$$

where *y* is the dependent variable; *x* is a matrix of explanatory variables; *u* is the error term whose conditional quantile distribution equals zero, and $Quant_\theta(y_i|x_i)$ denotes the θth quantile of *y* conditional on *x*. The distribution of the error term *u* is left unspecified. An individual coefficient $\beta_{\theta j}$ associated with the j_{th} independent variable in the vector x_i, called x_{ij} , could be explained as 'how y_i in its θ_{th} conditional quantile reacts to a (ceteris paribus) marginal change in x_{ij} '.The quantile regression method thus allows us to testify the effects of the covariates at different locations in the conditional distribution of the dependent variable.

The θth regression quantile estimate $\hat{\beta}_\theta$, is the solution to the following minimization problem:

$$\min_\beta \sum_{y_i \geq x_i'\beta} \theta|y_i - x_i'\beta| + \sum_{y_i < x_i'\beta} (1-\theta)|y_i - x_i'\beta| \quad (4)$$

which is solved via linear programming. The median regression, which is a special case of the quantile regression, is obtained by setting $\theta = 0.5$. We can use variations of θ to obtain other quantiles of the conditional distribution. To convey a sense of the relationship of selected explanatory variables across the conditional corporate performance distribution, the results for the 20th, 30th, 40th, 60th, 70th, and 80th quantiles are reported. We use the bootstrap method illustrated in Buchinsky (1995) to get estimates of the standard errors for the coefficients in quantile regression. Quantile regression is also of particular importance, as it is a consistent and robust estimation method, especially when the error term is heteroscedastic and non-normally distributed.

Additionally, it is also worth mentioning that quantile regression can help with regard to the following issue. For each quantile, all sample observations are used in the process of a quantile-fitting regression. This approach is different from the

conventional piecewise regressions that segment the dependent variable (unconditional distribution) and then run an OLS on the subsets. Moreover, piecewise regressions are not an appropriate alternative to quantile regressions, due to severe sample selection problems (Koenker & Hallock, 2001), and they are also based on least-squares, and can be sensitive to the Gaussian assumption or to the presence of outliers. For a more detailed discussion on the model specifications with quantile regression, refer to Koenker (2005).

5. Empirical Results

Table 2 provides the descriptive statistics for the variables used in the analysis. The skewness results for ROA, ROE, GP, and EPS are 0.128, 2.762, 0.322, and 1.329, respectively. Moreover, the regression residuals in all cases significantly depart from normal distribution as the results of the Shapiro–Wilk and Shapiro–Francia test indicates that we can reject the null hypothesis that the data are normally distributed at a 1% level (Tables 3-6). All four performance measures in this study thus have a skewed distribution, and the assumption of normal distribution of the error terms in OLS is not guaranteed. These findings suggest that the use of least squares may produce misleading results. As noted earlier, quantile regression can solve these problems and also provide a more flexible and complete characterization when there is a focus on the impact of CSR on corporate performance at both higher and lower levels of corporate performance.

This study conducts the empirical investigation by estimating Eq. (1) at six quantiles, namely the 20th, 30th, 40th, 60th, 70th and 80th quantiles, using the same list of explanatory variables for each of these. Doing so allows us to examine the impact of explanatory variables at different points of the corporate performance distribution. For comparison purposes, we also provide the OLS estimates, which are reported in the last column of Tables 3 to 6. In addition, this study also reports the statistical comparison of quantile regression coefficients (coefficient test of inter-quantile) in Tables 3 to 6.

Starting from Table 3 and focusing on the CSR_score, the OLS estimates indicate that there is a significant, negative correlation between the CSR_score and corporate performance levels, and the quantile regression shows the same results across all quantiles of corporate performance. This suggests that the sensitivity of a

company's performance to its engagement in CSR activities does not vary with the quantile location of the firm's performance. On the other hand, although the coefficients of the CSR_score seem to vary with the quantile location, the inter-quantile coefficient test indicates that the coefficient differences between each quantile are statistically insignificant. There is thus no significant difference in the extent of the negative impact of engagement in CSR activities between higher and lower levels of corporate performance. Similar results are obtained in Tables 4. The negative correlation that is found between the CSR_score and corporate performance levels may be because firm's insiders have an incentive to increase CSR expenditure to a level that is higher than that which maximizes firm value if they gain utility from a high CSR rating of their companies. For example, a favorable CSR rating can enhance the reputations of managers, since they will be seen as individuals who respect their employees, communities, and the environment (Barnea & Rubin, 2010).

When using EPS as a performance measure (Table 5), similar results are obtained. Although the coefficient in the 60th quantile becomes insignificant, its sign is still negative and the second panel of Table 5 indicates that the coefficient differences in terms of the 60th versus other quantiles are statistically insignificant. However, when further exploring the different coefficients of the CSR_score variable across different quantiles, the coefficient is substantially lower at higher quantiles. The inter-quantile coefficient test indicates that the coefficient of the 80th quantile is statistically significantly smaller than the coefficients of the 20th and 30th quantiles. This may be because firms with better performance have a greater ability to afford CSR-related activities, and thus have higher CSR expenditures, which may then lead to worse performance.

In the case of GP, the quantile regression shows a significant, negative relationship between the CSR_score and corporate performance at only the 20th, 30th, and 40th quantiles. Although coefficients in the 60th, 70th, and 80th quantiles become insignificant, their signs are still negative. However, the second panel of Table 6 indicates that the coefficient differences in terms of the upper versus lower quantiles are statistically significant. This may because less profitable firms cannot afford to spend much on CSR, but still do so in order to comply with government regulations, thus using resources that could otherwise be spent on developing new products and services, and further reducing corporate performance. However,

profitable firms have more resources available to spend on CSR, and thus their performance does not fall significantly when complying with government regulations. This is why the coefficients in the 60th, 70th, and 80th quantiles become insignificant when using GP as a performance measure, and it should be noted that GP measures the relationship between sales revenue and cost of goods sold, and does not consider operating expenses.

In addition, the OLS estimates are inconsistent with the quantile regression estimates in Table 6. The sometimes different results from the OLS vis-a-vis the quantile regression indicate that estimating only the conditional mean of the response variable can be inappropriate when the data fail to meet the assumptions needed to perform an OLS regression analysis.

In summary, although some of the estimated results for the quantile coefficients are insignificantly negative, it can still be concluded that engaging in CSR activities does not improve firm performance in China. Moreover, the results of the inter-quantile coefficient test suggest that the significant, negative correlation could hold for all quantiles (Table 5). The estimated coefficients of the CSR_score are thus significantly negative across all quantiles when using ROA, ROE, and EPS as performance measures. In the case of GP, the estimated coefficients of the CSR_score are significantly negative at low quantiles. These results support the shift of focus hypothesis (Becchetti, Ciciretti & Hasan, 2007), which conjectures that there is a negative relation between CSR and financial performance.

High levels of CSR result in additional costs that put a firm at an economic disadvantage compared to other, less socially responsible firms (Bragdon & Marlin, 1985; Vance, 1975). On the other hand, socially responsible activities may also bring economic benefits (Moussavi & Evans, 1986). Nevertheless, this study finds that adopting CSR leads to smaller financial returns than the related costs in China, and so a significant, negative relationship exists between engagement in CSR activities and corporate performance. This finding is in line with Brammer et al. (2006).

There are still many state-owned enterprises (SOEs) in China, which are legally owned by the state and administered by central, provincial, or local governments. In addition, according to Chen, Firth, Gao, and Rui (2006), about 30% of all shares in Chinese firms are owned by central or local governments, and another 30% by legal

entities which are usually ultimately controlled by these. About 70% of the Chinese samples in this study are SOEs, which often pursue social and political objectives that may conflict with purely economic ones (Rawski, 1994; Qi et al., 2000; Lin & Zhu, 2001; Chen et al., 2006; Huang & Boateng, 2013), and this may be why negative relationship exists between engagement in CSR activities and corporate performance in China.

6. Conclusions

This paper investigates the impact that engagement in CSR activities has on corporate performance in China. In view of the inconsistent empirical findings in the literature and the limitations of least squares regressions, we adopt a quantile regression method to fill this gap in the literature and provide a different perspective to that in the current literature with regard to the relationship between CSR and corporate performance. The conditional quantile regression estimator extends the classical least squares estimation of the conditional mean to a collection of models running for different quantile functions. Accordingly, it permits the effect of a regressor to differ at different points of the conditional dependent-variable distribution, allowing us to examine the relations between the engagement in CSR activities and corporate performance for better and worse performing firms. According to the empirical results, the sensitivity of a company's performance to its engagement in CSR activities vary with the quantile location of the firm's performance level when using GP as a performance measure, although this does not occur when using other performance measures. However, these findings could not be obtained with conditional mean-focused regressions. The sometimes different results from the OLS vis-a-vis the quantile regression indicate that estimating only the conditional mean of the response variable can be inappropriate when the data fail to meet the assumptions needed to perform an OLS regression analysis.

Moreover, the results of the quantile regression can provide a more complete understanding of the impact of engagement in CSR activities on corporate performance, thus overcoming the weaknesses of earlier studies. The inconsistent findings on this issue in other works might be due to the inappropriate use of conditional mean-focused regressions.

An important finding of this work is that a significant, negative relationship across all quantiles exists between engagement in CSR activities and corporate performance in China when using ROA, ROE, and EPS as performance measures. However, a significant, negative relationship between engagement in CSR activities and corporate performance only exists at low quantiles when using GP as a performance measure. This may be because the measures of ROA, ROE, and EPS consider the operating expenses due to engagement in CSR activities, while the measure of GP does not.

To sum up, this study argues that in China adopting CSR leads to smaller financial returns than the related costs, and so a significant, negative relationship exists between engagement in CSR activities and corporate performance, supporting the shift of focus hypothesis. The reason may be that there are many SOEs in China, and these often pursue social and political objectives that hinder economic performance (Rawski, 1994; Qi et al., 2000; Lin & Zhu, 2001; Chen et al., 2006; Huang & Boateng, 2013). Although the results for China suggest that firms should not engage in CSR activities, we think that this would be short-sighted. With its accession to the WTO, China has become more integrated into the global economy, and so its companies should consider how to use the concept of CSR in order to derive new competitive advantages, as this would benefit investors and other stakeholders. Therefore, this study suggests that the firms in China should avoid lowering competitive advantage due to additional costs resulted from high levels of CSR. In addition, managers need to consider economic, social, and political objectives simultaneously. Only paying attention to specific or some aspect is not a way to manage permanently. Managers should encourage innovation and think strategically how to create business opportunities from engaging in CSR activities so as to increase shareholders' interests.

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APPENDIX

Table 1

Definitions of variables

Variable	Definition
Dependent variable	
ROA (%)	Return on assets=the ratio of net income to total asset.
ROE (%)	Return on equity=the ratio of net income to total equity.
GP (%)	Gross profit to net sales=the ratio of gross profit to net sales.
EPS	Earnings per share= net income divided by the number of shares outstanding.
Independent variable	
CSR_score	CSR Development Index, measured as the sum of scores in four social rating categories: responsibility management, economic, social and environmental responsibilities.
size	The natural logarithm of total assets.
leverage	Ratio of total debt to total assets.
salegrow (%)	Annual growth rate of sales.
assetgrow (%)	Annual growth rate of assets.

Table 2

Summary statistics of main variables

	Obs	Mean	Median	Standard deviation	Skewness	Kurtosis
ROA	254	3.621	3.191	4.087	0.128	5.635
ROE	254	10.356	10.019	14.600	2.762	36.578
GP	254	16.050	14.2	10.637	0.322	4.524
EPS	254	0.434	0.32	0.511	1.329	6.534
CSR_score	254	36.998	37.75	21.925	0.138	1.825
size	254	17.291	17.207	1.852	-0.078	2.234
leverage	254	0.617	0.655	0.189	-0.836	3.185
salegrow	254	76.605	23.27	662.720	12.988	170.438
assetgrow	254	25.482	15.81	65.845	10.237	121.415

Table 3

Regression results with ROA as the performance measure

	Quantile regressions						OLS
	20th Quant	**30th Quant**	**40th Quant**	**60th Quant**	**70th Quant**	**80th Quant**	
CSR_score	-0.018 (0.052)*	-0.028 (0.001)***	-0.025 (0.019)**	-0.036 (0.034)**	-0.028 (0.05)**	-0.030 (0.048)**	-0.027 (0.053)*
assetgrow	0.017 (0.121)	0.004 (0.389)	0.012 (0.218)	0.020 (0.155)	0.018 (0.191)	0.009 (0.382)	0.023 (0.054)*
salegrow	-0.0013 (0.211)	-0.0002 (0.683)	-0.0009 (0.313)	-0.0018 (0.168)	-0.0017 (0.179)	-0.0010 (0.271)	-0.0020 (0.089)*
size	0.336 (0.035)**	0.483 (0.00)***	0.533 (0.00)***	0.527 (0.014)**	0.364 (0.17)	0.092 (0.669)	0.359 (0.043)**
leverage	-2.075 (0.185)	-5.711 (0.00)***	-7.437 (0.00)***	-11.963 (0.00)***	-12.394 (0.00)***	-15.889 (0.00)***	-7.669 (0.00)***
Pseudo R^2	0.0400	0.0683	0.0917	0.1347	0.1678	0.2196	R^2 = 0.1529
Shapiro–Wilk test: statistic=0.939*** Shapiro–Francia test: statistic= 0.932***							
Inter-quantile comparison of the coefficient of CSR_score, p-values							
30th Quant	0.352						
40th Quant	0.562	0.773					
60th Quant	0.303	0.589	0.376				
70th Quant	0.584	0.985	0.849	0.513			
80th Quant	0.583	0.913	0.812	0.741	0.908		

*Note: A constant term is included, but not reported. The numbers in parentheses are p-values. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.*

Table 4

Regression results with ROE as the performance measure

	Quantile regressions						OLS
	20th Quant	**30th Quant**	**40th Quant**	**60th Quant**	**70th Quant**	**80th Quant**	
CSR_score	-0.083 (0.04)**	-0.094 (0.001)***	-0.089 (0.003)***	-0.082 (0.056)*	-0.090 (0.052)*	-0.102 (0.037)**	-0.122 (0.024)**
assetgrow	0.028 (0.522)	0.036 (0.192)	0.071 (0.006)***	0.028 (0.381)	0.079 (0.068)*	0.038 (0.268)	-0.010 (0.819)
salegrow	-0.0016 (0.677)	-0.0025 (0.317)	-0.0059 (0.013)**	-0.0024 (0.401)	-0.0076 (0.055)*	-0.0043 (0.164)	0.0011 (0.81)
size	1.230 (0.006)***	1.549 (0.00)***	1.631 (0.00)***	1.045 (0.058)*	0.892 (0.284)	0.520 (0.467)	0.291 (0.664)
leverage	-0.718 (0.869)	-1.068 (0.749)	-1.253 (0.709)	-1.488 (0.762)	4.462 (0.557)	9.601 (0.153)	10.504 (0.09)*
Pseudo R^2	0.0545	0.0701	0.0674	0.0345	0.0298	0.0365	R^2 =0.0450
Shapiro–Wilk test: statistic=0.689*** Shapiro–Francia test: statistic=0.669***							
Inter-quantile comparison of the coefficient of CSR_score, p-values							
30th Quant	0.731						
40th Quant	0.880	0.849					
60th Quant	0.985	0.784	0.856				
70th Quant	0.905	0.940	0.981	0.826			
80th Quant	0.762	0.879	0.805	0.693	0.765		

Note: Same as in Table 3.

Table 5

Regression results with EPS as the performance measure

	Quantile regressions						OLS
	20th Quant	**30th Quant**	**40th Quant**	**60th Quant**	**70th Quant**	**80th Quant**	
CSR_score	-0.0024 (0.03)**	-0.0026 (0.013)**	-0.0033 (0.01)***	-0.0030 (0.123)	-0.0059 (0.031)**	-0.0089 (0.004)***	-0.0060 (0.001)***
assetgrow	0.0014 (0.248)	0.0033 (0.001)***	0.0028 (0.01)***	0.0021 (0.193)	0.0010 (0.582)	0.0028 (0.128)	0.0031 (0.045)**
salegrow	-0.00009 (0.399)	-0.00027 (0.002)***	-0.00023 (0.02)**	-0.00019 (0.211)	-0.00010 (0.561)	-0.00028 (0.106)	-0.00027 (0.078)*
size	0.032 (0.012)**	0.050 (0.00)***	0.062 (0.00)***	0.071 (0.005)***	0.077 (0.02)**	0.110 (0.003)***	0.078 (0.001)***

leverage	-0.015 (0.903)	-0.111 (0.298)	-0.196 (0.173)	-0.189 (0.413)	-0.434 (0.15)	-0.480 (0.159)	-0.488 (0.019)**
Pseudo R^2	0.0598	0.0637	0.0609	0.0691	0.0843	0.1158	R^2 =0.1283
Shapiro–Wilk test: statistic= 0.885*** Shapiro–Francia test: statistic=0.879***							
Inter-quantile comparison of the coefficient of CSR_score, p-values							
30th Quant	0.848						
40th Quant	0.498	0.488					
60th Quant	0.776	0.831	0.872				
70th Quant	0.253	0.239	0.331	0.193			
80th Quant	0.076*	0.081*	0.113	0.109	0.223		

Note: Same as in Table 3.

Table 6

Regression results with GP as the performance measure

	Quantile regressions						**OLS**
	20th Quant	**30th Quant**	**40th Quant**	**60th Quant**	**70th Quant**	**80th Quant**	
CSR_score	-0.061 (0.087)*	-0.073 (0.007)***	-0.037 (0.039)**	-0.025 (0.356)	-0.011 (0.826)	-0.017 (0.814)	-0.024 (0.539)
assetgrow	0.0261 (0.356)	0.0268 (0.201)	0.0974 (0.00)***	0.0694 (0.033)**	0.0163 (0.685)	-0.0004 (0.995)	0.0618 (0.066)*
salegrow	-0.0029 (0.266)	-0.0031 (0.109)	-0.0099 (0.00)***	-0.0079 (0.008)***	-0.0035 (0.346)	-0.0022 (0.697)	-0.0070 (0.036)**
size	0.975 (0.004)***	0.933 (0.001)***	0.269 (0.468)	-0.307 (0.555)	-0.629 (0.431)	-0.326 (0.825)	0.375 (0.44)
leverage	-6.019 (0.068)*	-8.056 (0.003)***	-6.479 (0.056)*	-2.284 (0.629)	-11.211 (0.106)	-13.576 (0.273)	-9.222 (0.041)**
Pseudo R^2	0.0321	0.0407	0.0386	0.0356	0.0511	0.0699	R^2 =0.0534
Shapiro–Wilk test: statistic=0.954*** Shapiro–Francia test: statistic=0.950***							
Inter-quantile comparison of the coefficient of CSR_score, p-values							
30th Quant	0.650						
40th Quant	0.477	0.161					
60th Quant	0.098*	0.085*	0.173				
70th Quant	0.073*	0.053*	0.071*	0.550			
80th Quant	0.044**	0.060*	0.078*	0.399	0.591		

Note: Same as in Table 3.

A COMPARATIVE STUDY OF THE VOLATILITY AND EFFICIENCY OF COMMODITY FUTURES INDEX ROLL METHODS

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Abstract

Given the size of the commodity index market, rollovers require large numbers of contracts to be purchased and sold on rollover dates. Index providers are careful in choosing their roll methods in order to minimize volatility and maximize the market efficiency of their indexes. This study investigates the efficiency of various roll methodologies compared to their respective continuous futures series. We compare roll methodologies to see whether they have similar volatility and efficiency characteristics as naïve rolling. Daily settlement prices for 15 commodities (precious metals, metals, agriculture, and energy) from each of five index providers (Credit Suisse (CS), Merrill Lynch (ML), Dow Jones – UBS (DJUBS), Diapson (DCI) and Standard and Poor's – Goldman Sachs (GS)) were collected and analyzed. Daily prices for a continuous series of futures contracts (Continuous Futures Series) representing each of the aforementioned commodities is used as a benchmark. Results show that any differences that indexes have with their continuous futures series are dependent on the type of commodity and not on a particular roll methodology. Thus, an investor/ETP investing in commodities should not worry about the roll methodology used by an index provider.

Keywords: futures, contracts, rollover, diversification

JEL Classification: G11, G13, G19

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1. Introduction

Investors who hold portfolios with long positions in stocks and bonds seek alternative investments that will provide diversification opportunities. Commodity returns exhibit negative or weak correlations with stock and bond market returns and hence, diversification potential. A long buy and hold strategy could be very expensive for retail investors attempting to purchase physical commodities. An alternative to investing in physical commodities is commodity futures. However, futures contract trading presents challenges to retail investors. Contracts expire periodically. A futures-based buy and hold strategy involves selling the current contract when it expires and buying the next available contract. Also, many retail investors lack the knowledge or the financial capability to invest directly via the commodity futures market.

Financialization of commodities via exchange traded products (ETPs) and index investing have enabled retail investors to access previously inaccessible commodities markets. The number of ETPs has increased over time. Currently, over 100 ETPs that track or invest in commodities (ETFdb.com, n.d.) are traded. Thus, retail investors have opportunities for exposure to commodity returns. Most of these indexes are created using futures contracts. Returns on commodity indexes are based upon futures prices of their underlying commodities. Indexes are priced continuously, while futures contracts have finite maturities. Thus, indexes must continuously rollover futures contracts. A naïve rollover strategy is to continuously hold a current month's futures contract until it expires and then purchase the next active contract (hence, the continuous futures series or CFS). This strategy can be difficult or expensive to implement. Expiring month contracts can be thinly traded and experience high price volatility.

Additionally, the US Commodity Futures Trading Commission (2015) estimates the volume of commodity index trading to be $138 billion. Given the size of the commodity index market, rollovers require that large numbers of contracts be purchased and sold on rollover dates. Index providers are careful in choosing their roll methods in order to minimize volatility and maximize the market efficiency of their indexes.

To avoid the pitfalls of rolling on expiration dates, many commodity index providers roll their contracts much earlier. Some

also avoid the expiration month entirely and roll contracts in the preceding month. Others use contracts from multiple months and roll over a longer period (multiple days) rather than a single day to reduce volatility.

Exchange Traded Products (ETPs) provide investors exposure to commodity returns. Investors who purchase ETPs assume that they are getting the same performance as a CFS. However, it is possible that a roll methodology could introduce inefficiency in the index. This study compares the performance of various roll methodologies to that of the continuous futures series.

2. Discussion and Literature Review

Commodity returns are negatively correlated with those of stocks and bonds (Gorton and Rouwenhorst, 2006). Büyükşahin, Haigh, and Robe (2010) find weaker correlations between stocks and commodities even in the long-term. Thus, adding commodities to traditional stock and bond portfolios provides portfolio diversification in the short-term (Garcia-Feijoo, Jensen, and Johnson, 2012) and in the long-term (Bansal, Kumar, and Verma 2014). Just as stock index-based products provide investors exposure to stock market returns, commodity index-based products provide exposure to commodity returns.

Index providers use different roll methodologies while creating their indexes. For fifteen individual commodities, we analyze the extent to which indexes introduce additional inefficiencies when compared to the respective continuous futures series (CFS). As indicators of market inefficiencies, we examine the difference in means and volatilities between indexes and their respective CFSs and test serial correlations and day-of-the week effects. Most energy and agricultural indexes have lower standard deviations than their CFS counterparts. For metals and energy indexes, serial correlations are consistent with the respective CFS, but results are inconsistent in agricultural commodities. Thus, no additional inefficiencies are introduced by the index providers for metals and energy. However, agricultural commodities across index providers exhibit inefficiencies. This suggests that differences between commodity indexes and their respective continuous futures series are dependent upon the type of commodity rather than the roll methodology.

3. Data

Data for this study ranges from 15 January 2002 through 28 August 2011. Daily settlement prices for 15 commodities: (gold, silver, aluminum, copper, lead, nickel, corn, cotton, soybeans, sugar, wheat, live cattle, lean hogs, natural gas, oil) from each of five index providers (Credit Suisse (CS), Merrill Lynch (ML), Dow Jones – UBS (DJUBS), Diapson (DCI) and Standard and Poor's – Goldman Sachs (GS)) are collected and analyzed. Daily prices for a continuous series of futures contracts (Continuous Futures Series) representing each of the aforementioned commodities is used as a benchmark.

Rollover methodologies differ among the index providers with respect to the roll dates used, the number of days used to roll the contracts and the choice of the futures contracts. Table 1 summarizes the roll methodologies that are included in the study.

Table 1

Roll methodologies

Commodity Index Provider	Contracts	Rollover Period
Credit Suisse (CS)	Equal weights in the first, second, and third nearby contract	5th to last business day of the previous month and runs to the 9th business day
Diapson (DCI)	From first to second nearby contract	Last 3 business days of the previous month
Dow Jones UBS (DJUBS)	From the first to the second nearby contract	Begins on the fifth and ends on the ninth business day of each month
Merrill Lynch (ML)	From the second to the third nearby contract	1st – 15th business days of each month
S&P Goldman Sachs (GS)	From the first to the second nearby contract, but rolling every other month	Begins on the fifth and ends on the ninth business day of each month
Continuous Futures Series (CFS)	From the first to the second nearby contract	On expiration of the first nearby contract

Credit Suisse indexes invest equally in contracts that fall within the first three months. They roll contracts over a 15-day period, which starts on the 5th to last business of the previous month and runs to the 9th business day of the current month at a roll rate of 1/15 each business day. Merrill Lynch rolls contracts from the 2nd month to the 3rd month, at the rate of 1/15 each business day, over a 15-day period from the 1st to the 15th business day of the month. Diapson

rolls contracts from the current month to the next month. The rollover period is the last 3 business days of the previous month. Dow Jones UBS rolls contracts from the current month to the next month between the 5th through the 9th business days of the current month. S&P Goldman Sachs rolls contracts forward from the current to the next month from the 5th through the 9th business day of the month and rolls every other month.

4. Methodology

An efficient rollover methodology will not create serial correlations between successive daily price changes or exhibit a day-of-the-week effect (Ma, Mercer, and Walker, 1992). Day-of the-week effect is identified from their model:

$$r_{it} = a + B_{TU}D_{TU} + B_W D_W + B_{TH}D_{TH} + B_F D_F + e_i \quad (1)$$

where r_{it} is the *i*th time series of the daily return for the daily price change series. D_i represents the daily dummy and its coefficient measures the difference between the Monday return (measured as "*a*") and returns from the other days of the week.

4. Results

Results indicate that most metals indexes are similar to their continuous futures series. They follow similar distribution characteristics. Additionally, for metals, indexes maintain the directional significance serial correlation found (or lack thereof) in the continuous futures series. Most metal indexes also maintain the day-of-the-week effect (or lack thereof) as found in the respective CFS.

Energy indexes maintain the serial correlation found in their respective CFSs. Except for one oil index, they don't demonstrate a day-of-the-week effect if such is not found in the CFS. While there are no distinguishing differences in means of both commodities with their respective CFS, they have significantly lower standard deviations (SD) than their corresponding CFSs.

Agricultural commodity indexes have similar means and, except for live cattle and corn, similar day-of-the-week effects as their respective CFS. However, most have lower standard deviations than their respective CFSs and demonstrate inconsistent serial correlation compared to the respective CFS.

5.1 The Payoff Distribution

Comparative results of the payoff distribution for each of the six series are presented in Table 2. The series means and standard deviations are calculated for all 15 commodities across the five providers and the continuous futures series. For all series and all providers, the difference in means between each index and its respective continuous futures series is not statistically significant. In the remainder of this section, the focus will be on the standard deviations.

Table 2

Index average returns and standard deviations

Gold	**AVG**	**SD**	**Nickel**	**AVG**	**SD**	**Wheat**	**AVG**	**SD**
CSCBGCE	0.0001	0.0156*	CSCBNIE	0.0006	0.0258	CSCBKWE	0.0002	0.0185*
DCIGCER	0.0007	0.0121	DCINIER	0.0005	0.0257	DCIWHER	-0.0002	0.0214*
DJUBSCE	0.0002	0.0119	DJUBSNI	0.0005	0.0260	DJUBSWH	-0.0003	0.0210*
MLCXGCE	0.0007	0.0119	MLCXLNE	0.0006	0.0259	MLCXW.E	-0.0001	0.0206*
GSGCEXR	0.0007	0.0119	GSIKEXR	0.0005	0.0261	GSWHEXR	-0.0003	0.0210*
CFS	0.0008	0.0119	CFS	0.0005	0.0262	CFS	0.0004	0.0219
Silver	**AVG**	**SD**	**Corn**	**AVG**	**SD**	**Live Cattle**	**AVG**	**SD**
CSCBSIE	0.0008	0.0212	CSCBCNE	-0.0005	0.0433*	CSCBLCE	0.0001	0.0086*
DCISIER	0.0008	0.0217	DCICNER	0.0000	0.0203*	DCILCER	0.0000	0.0097*
DJUBSSI	0.0008	0.0212	DJUBCNE	-0.0001	0.0186*	DJUBSLC	-0.0001	0.0096*
MLCXSIE	0.0008	0.0212	MLCXC.E	0.0000	0.0183*	MLCXLCE	0.0001	0.0090*
GSSIEXR	0.0008	0.0212	GSCNEXR	-0.0001	0.0186*	GSLCEXR	-0.0001	0.0095*
CFS	0.0009	0.0213	CFS	0.0005	0.0195	CFS	0.0002	0.0108
Aluminum	**AVG**	**SD**	**Cotton**	**AVG**	**SD**	**Lean Hog**	**AVG**	**SD**
CSCBALE	0.0001	0.0145	CSCBCTE	0.0002	0.0175*	CSCBLHE	-0.0002	0.0137*
DCIAHER	0.0001	0.0151	DCICTER	-0.0001	0.0187*	DCILHER	Insufficient data	
DJUBALE	0.0001	0.0146	DJUBCTE	-0.0001	0.0186*	DJUBSLH	-0.0006	0.0154*
MLCXLAE	0.0001	0.0146	MLCXALE	X	X	MLCXLHE	-0.0002	0.0144*
GSIAEXR	0.0000	0.0147	GSCTEXR	-0.0001	0.0186*	GSLHEXR	-0.0006	0.0154*
CFS	0.0002	0.0148	CFS	0.0004	0.0213	CFS	0.0002	0.0210
Copper	**AVG**	**SD**	**Soybean**	**AVG**	**SD**	**Natural Gas**	**AVG**	**SD**
CSCBHGE	0.0008	0.0197	CSCBSYE	0.0005	0.0162*	CSCBNGE	-0.0008	0.0273*
DCICAER	0.0007	0.0192*	DCBSOER	0.0006	0.0160*	DCINGER	-0.0010	0.0306*
DJUBSHG	0.0007	0.0199	DJUBSSY	0.0005	0.0165*	DJUBNGT	-0.0010	0.0295*
MLCXLPE	0.0008	0.0192*	MLCXS.E	0.0006	0.0163*	MLCXNGE	-0.0009	0.0282*
GSICEXR	0.0008	0.0193	GSSOEXR	0.0005	0.0165*	GSNGEXR	-0.0013	0.0311*
CFS	0.0007	0.0199	CFS	0.0005	0.0172	CFS	0.0002	0.0351

Lead	AVG	SD	Sugar	AVG	SD	Oil	AVG	SD
CSCBHGE	0.0008	0.0236	CSCBSBE	0.0005	0.0207*	CSCBOLE	0.0005	0.0209*
DCICAER	0.0006	0.0235	DCISBER	0.0004	0.0219*	DCICOER	0.0005	0.0217*
DJUBSHG	0.0007	0.0239	DJUBSSB	0.0003	0.0219*	DJUBCLE	0.0002	0.0222*
MLCXLPE	X	X	MLCXSBE	0.0005	0.0212*	MLCXCLE	0.0004	0.0218*
GSICEXR	0.0007	0.0240	GSSBEXR	0.0003	0.0220*	GSCLEXR	0.0002	0.0228*
CFS	0.0007	0.0241	CFS	0.0005	0.0371	CFS	0.0006	0.0246

*Notes: *Significant at p = 5%; X indicates insufficient data.*
The first letters of the indexes listed in this exhibit indicate their correspondence to the indexes discussed in the paper as follows: CS – Credit Suisse, DCI – Diapson, DJUBS – Dow Jones UBS, ML – Merrill Lynch, GS – S&P Goldman Sachs, and CFS – Continuous Futures Series.

Precious metals. For gold and silver, only the CS gold index has a significantly higher standard deviation than the continuous futures series. For all other gold and silver indexes, there is no statistical difference in the SD with the CFS.

Metals. The DCI and ML copper indexes have significantly lower standard deviations than the continuous futures series. For all other metals, the differences between the indexes and the continuous futures series are not significant.

Energy. The oil and natural gas standard deviations for all index providers are significantly lower than their respective continuous futures series.

Agriculture. All agriculture commodities have significantly lower standard deviations than their respective continuous futures series.

Summary of payoff distributions. Most metal indexes (except for DCI and ML for copper and CS gold) do not have significantly different standard deviations than from those of their respective continuous futures series. Natural gas, oil, and all agriculture commodities have significantly different standard deviations than their respective continuous futures series. Of the total of 75 series (5 providers, 15 commodities), only three indexes (CS gold and corn and DCI corn) have significantly higher standard deviations than the continuous futures series. Overall, 46 indexes representing 10 of the 15 commodities had significantly lower standard deviations when compared to the continuous futures series. In the following sections, index efficiency is compared to the continuous futures series.

5.2 Index Efficiency: Serial Correlations

The results of the serial correlations tests are presented in Table 3. Here we break them down by commodity category.

Precious metals. For precious metals (gold and silver), none of the indexes exhibit statistically significant serial correlations. The continuous futures series also does not exhibit a significant serial correlation.

Metals. Among the metals indexes, aluminum exhibits a statistically significant negative serial correlation for all providers, as does the aluminum continuous futures series. Lead has a positive serial correlation for all providers, as does the lead continuous futures series. The copper and nickel indexes across all providers do not have significant serial correlations. Their respective continuous futures series also do not.

Energy. Both oil and natural gas indexes across all providers have significant, negative serial correlations. Their respective continuous futures series also have significant negative serial correlations.

Agriculture. For corn, the continuous futures series and indexes that are provided by DJUBS, ML and GS have significant positive serial correlation while DCI's index has a negative serial correlation. For live cattle, significant, positive correlation is observed in the case of the DJUBS and GS and the CFS.

For cotton, the DJUBS and GS indexes exhibit a significant positive serial correlation. The positive serial correlation found in the continuous futures series for cotton is not significant.

For wheat and sugar, only DCI indexes have significant negative serial correlations. The respective continuous futures series for these commodities do not have significant serial correlations.

Table 3

One-period lag serial correlations for indexes and futures continuous series

	Index					
Commodity	**CSCBGCE**	**DCIGCER**	**DJUBSCE**	**MLCXGCE**	**GSGCEXR**	**CFS**
Gold	-0.032	-0.009	0.014	0.013	0.012	0.010
Silver	0.015	-0.006	0.017	0.016	0.015	0.014
Aluminum	-0.046*	-0.066*	-0.040*	-0.043*	-0.046*	-0.042*
Copper	-0.085	-0.083	-0.081	-0.074	-0.074	-0.085
Lead	0.045*	0.048*	0.046*	X	0.046*	0.050*
Nickel	0.001	0.006	0.001	-0.004	0.002	0.000

	Index					
Commodity	**CSCBGCE**	**DCIGCER**	**DJUBSCE**	**MLCXGCE**	**GSGCEXR**	**CFS**
Corn	-0.014	-0.045*	0.045*	0.043*	0.045*	0.037*
Cotton	0.009	0.022	0.037*	X	0.037*	0.016
Soy-beans	-0.021	-0.002	-0.021	-0.018	-0.021	0.004
Sugar	-0.025	-0.039*	-0.026	-0.028	-0.027	-0.007
Wheat	0.017	-0.035*	-0.008	-0.007	-0.009	-0.013
Live Cattle	0.011	-0.030	0.036*	0.002	0.037*	0.053*
Lean Hogs	0.007	X	-0.006	-0.003	0.002	0.006
Natural Gas	-0.039*	-0.062*	-0.048*	-0.036*	-0.051*	-0.045*
Oil	-0.052*	-0.059*	-0.046*	-0.045*	-0.045*	-0.039*

*Notes: *Significant at p = 5%; X indicates insufficient data.*
The first letters of the indexes listed in this exhibit indicate their correspondence to the indexes discussed in the paper as follows: CS – Credit Suisse, DCI – Diapson, DJUBS – Dow Jones UBS, ML – Merrill Lynch, GS – S&P Goldman Sachs, and CFS – Continuous Futures Series.

Summary Serial Correlations. The direction of effects of serial correlation from series to series is consistent and significant for aluminum, copper, oil, natural gas, and lead.

Thus, for all metals and energy if the CFS had a significant serial correlation, the indexes also maintained the significance and direction of the serial correlation. If the CFS did not have a significant serial correlation, the indexes did not have a significant serial correlation.

For the two agricultural commodities which had significant serial correlation in the CFS, the serial correlation was not maintained in all the respective indexes. Of the five agricultural commodities which had no significant serial correlation in the CFS, three demonstrated significant serial correlation in at least one of the indexes, and two maintained no significant serial correlation.

5.3 Index Efficiency: Day-of-the-Week

The results of the day-of-the-week tests are presented in Table 4. Here we break them down by commodity category.

Precious metals. The continuous futures series does not have a significant coefficient for any day of the week. This is maintained for all indexes for silver and all indexes for gold (except for the Tuesday effect for CS gold).

Metals. For aluminum, the GS index has a significant negative coefficient for Monday while the coefficient for the corresponding continuous futures series is not significant. All other metals indexes

do not have significant Monday coefficients. S&P Goldman Sachs, CS and the continuous futures series for aluminum have significant positive coefficients for Wednesday. All aluminum indexes have significant coefficients for Thursday, including the continuous futures series. The CFS and all indexes for aluminum do not have a significant Friday effect.

All indexes for lead and copper, including the CFS, do not exhibit a day-of-the-week effect. For nickel, the CFS and all indexes except ML have significant positive coefficients for Friday. None of the nickel indexes, including the CFS, demonstrates any significant effect for rest of the days.

Agriculture. The GS index for corn has a significant positive coefficient for Wednesday while the corresponding continuous futures series coefficient is not significant. All indexes for cotton, soybeans, sugar, and wheat do not have significant day-of-the-week coefficients.

The CS index for live cattle has a significant coefficient for Monday, while the corresponding continuous futures series does not. Credit Suisse, DCI and ML indexes have significant negative coefficients for Thursday. The corresponding live cattle index for the continuous futures series does not have a significant coefficient.

All lean hog indexes and their corresponding CFS have significant positive coefficients for Wednesday, Thursday, and Friday.

Energy. For natural gas, all indexes have significant negative coefficients for Thursday, including the corresponding futures series. For oil, DCI's index has a significant coefficient for Thursday while the corresponding continuous futures series does not.

Summary of day-of-the-week effect. The significance of the Monday effect is almost nonexistent across indexes and commodities. Only the GS aluminum and CS live cattle indexes have significant Monday effect. For other days of the week, the results are different across indexes and commodities. Credit Suisse gold has a significant Tuesday effect; the CS, ML and GS aluminum, ML corn and all lean hog indexes except DCI, have a significant Wednesday effect. All indexes for aluminum, the DCI oil index, all natural gas indexes, the CS, DCI, and ML live cattle indexes and all lean hog indexes except DCI have a Thursday effect. All nickel indexes except ML, and all lean hog indexes except DCI have a significant Friday effect.

Results of other days are mixed. For eight commodities, there are no effects in the CFS that are maintained in the indexes. In two of

the three series that have a significant day of the week, T, W, or TR, in the CFS the effect is maintained in all indexes. For four commodities, there are no effects in the CFS, but effects are found in at least one of the indexes for one of the days. Inefficiency is found in only 4 of 15 commodities when such inefficiency is not found in the CFS.

Table 4

Day-of-the-week regression coefficients

Commodity	Index	Day of the Week				
		M	TU	W	TH	F
Gold	CSCBGCE	-0.0010	0.0016*	0.0016	0.0012	0.0009
	DCIGCER	0.0009	-0.0010	0.0000	-0.0006	0.0004
	DJUBSCE	0.0008	-0.0009	0.0001	-0.0006	0.0005
	MLCXGCE	0.0009	-0.0010	0.0001	-0.0006	0.0004
	GSGCEXR	0.0009	-0.0010	0.0001	-0.0006	0.0004
	CFS	0.0011	-0.0011	0.0000	-0.0007	0.0004
Silver	CSCBGCE	0.0009	-0.0005	0.0007	-0.0013	0.0005
	DCIGCER	0.0005	-0.0002	0.0012	-0.0010	0.0013
	DJUBSCE	0.0007	-0.0003	0.0009	-0.0011	0.0009
	MLCXGCE	0.0008	-0.0004	0.0009	-0.0011	0.0008
	GSGCEXR	0.0008	-0.0004	0.0008	-0.0011	0.0007
	CFS	0.0009	-0.0003	0.0007	-0.0011	0.0006
Aluminum	CSCBGCE	-0.0010	0.0013	0.0016*	0.0018*	0.0009
	DCIGCER	-0.0008	0.0008	0.0014	0.0016*	0.0007
	DJUBSCE	-0.0010	0.0012	0.0014	0.0018*	0.0006
	MLCXGCE	-0.0008	0.0011	0.0014	0.0017*	0.0004
	GSGCEXR	-0.0012*	0.0014	0.0017*	0.0020*	0.0010
	CFS	-0.0010	0.0014	0.0017*	0.0019*	0.0008
Copper	CSCBGCE	0.0014	-0.0012	-0.0011	-0.0017	0.0009
	DCIGCER	0.0007	-0.0003	-0.0003	-0.0006	0.0010
	DJUBSCE	0.0011	-0.0010	-0.0009	-0.0014	0.0012
	MLCXGCE	0.0014	-0.0006	-0.0008	-0.0011	-0.0001
	GSGCEXR	0.0010	-0.0004	-0.0004	-0.0007	0.0006
	CFS	0.0009	-0.0009	-0.0006	-0.0011	0.0014
Lead	CSCBGCE	0.0009	0.0001	0.0001	-0.0010	0.0004
	DCIGCER	0.0008	0.0000	0.0000	-0.0010	0.0003
	DJUBSCE	0.0005	0.0001	0.0006	-0.0007	0.0009
	MLCXGCE	0.0008	0.0002	0.0002	-0.0008	0.0003
	GSGCEXR	0.0006	0.0001	0.0004	-0.0005	0.0007
	CSCBGCS	0.0005	0.0001	0.0005	-0.0006	0.0011
Nickel	CSCBGCE	-0.0013	0.0016	0.0029	0.0017	0.0032*
	DCIGCER	-0.0018	0.0020	0.0032	0.0021	0.0038*
	DJUBSCE	-0.0014	0.0015	0.0028	0.0019	0.0033*
	MLCXGCE	-0.0011	0.0012	0.0026	0.0017	0.0026
	GSGCEXR	-0.0015	0.0016	0.0030	0.0020	0.0033*
	CFS	-0.0015	0.0017	0.0029	0.0019	0.0034*

Table 4 continued

Commodity	Index	Day of the Week				
		M	Tu	W	TH	F
Corn	CSCBGCE	-0.0010	0.0009	0.0021	-0.0017	0.0010
	DCIGCER	0.0005	-0.0018	0.0011	-0.0005	-0.0014
	DJUBSCE	-0.0006	-0.0001	0.0021	0.0007	0.0000
	MLCXGCE	-0.0004	-0.0005	0.0018	0.0007	-0.0002
	GSGCEXR	-0.0008	0.0000	0.0022*	0.0008	0.0002
	CFS	0.0001	-0.0003	0.0020	0.0004	-0.0001
Cotton	CSCBGCE	-0.0005	0.0012	0.0009	0.0011	0.0005
	DCIGCER	-0.0007	0.0000	0.0019	-0.0002	0.0013
	DJUBSCE	-0.0005	-0.0001	0.0014	-0.0001	0.0008
	MLCXGCE	X	X	X	X	X
	GSGCEXR	-0.0005	-0.0001	0.0015	-0.0001	0.0007
	CFS	0.0007	-0.0009	0.0009	-0.0007	-0.0009
Soybeans	CSCBGCE	0.0003	-0.0002	0.0012	0.0001	0.0001
	DCIGCER	0.0006	-0.0004	0.0006	-0.0001	-0.0002
	DJUBSCE	0.0004	-0.0003	0.0011	0.0001	-0.0002
	MLCXGCE	0.0005	-0.0003	0.0010	0.0001	-0.0003
	GSGCEXR	0.0002	-0.0002	0.0013	0.0002	0.0001
	CFS	0.0000	0.0000	0.0015	0.0003	0.0005
Sugar	CSCBGCE	-0.0002	0.0020	0.0011	-0.0004	0.0009
	DCIGCER	-0.0008	0.0022	0.0020	0.0002	0.0018
	DJUBSCE	-0.0007	0.0023	0.0016	0.0001	0.0010
	MLCXGCE	-0.0002	0.0020	0.0012	0.0000	0.0007
	GSGCEXR	-0.0006	0.0022	0.0015	0.0000	0.0009
	CFS	-0.0010	0.0013	0.0021	0.003	0.0011
Wheat	CSCBGCE	0.0004	-0.0016	0.0009	0.0000	-0.0005
	DCIGCER	-0.0004	-0.0006	0.0016	-0.0007	0.0003
	DJUBSCE	0.0001	-0.0012	0.0010	-0.0010	-0.0007
	MLCXGCE	0.0002	-0.0011	0.0009	-0.0009	-0.0007
	GSGCEXR	-0.0001	-0.0009	0.0013	-0.0008	-0.0003
	CFS	0.0008	-0.0013	0.0010	-0.0012	-0.0007
Live Cattle	CSCBGCE	0.0008*	-0.0008	-0.0008	-0.001*	-0.0007
	DCIGCER	0.0006	-0.0010	-0.0009	-0.001*	-0.0004
	DJUBSCE	0.0004	-0.0003	-0.0006	-0.0008	-0.0005
	MLCXGCE	0.0007	-0.0006	-0.0007	-0.001*	-0.0006
	GSGCEXR	0.0004	-0.0004	-0.0006	-0.0009	-0.0006
	CFS	0.0001	0.0004	0.0001	-0.0002	0.0001

Table 4 continued

Commodity	Index	Day of the Week				
		M	Tu	W	TH	F
Lean Hogs	CSCBGCE	-0.0018	-0.0002	0.0023*	0.0025*	0.0033*
	DCIGBER	X	X	X	X	X
	DJUBSCE	-0.0024	0.0002	0.0029*	0.0028*	0.0029*
	MLCXGCE	-0.0017	-0.0004	0.0024*	0.0024*	0.0031*
	GSGCEXR	-0.0027	0.0005	0.0032*	0.0031*	0.0036*
	CFS	-0.0014	0.0001	0.0025*	0.0018*	0.0035*
Natural Gas	CSCBGCE	0.0005	-0.0018	0.0003	-0.0047*	-0.0003
	DCIGCER	0.0004	-0.0017	0.0005	-0.0054*	-0.0008
	DJUBSCE	0.0005	-0.0019	0.0005	-0.0054*	-0.0006
	MLCXGCE	0.0004	-0.0021	0.0003	-0.0047*	-0.0002
	GSGCEXR	-0.0002	-0.0012	0.0010	-0.0054*	0.0002
	CFS	0.0014	-0.0006	0.0001	-0.0048*	-0.0008
Oil	CSCBGCE	-0.0004	-0.0010	0.0017	0.0021	0.0015
	DCIGCER	-0.0004	-0.0011	0.0020	0.0023*	0.0015
	DJUBSCE	-0.0009	-0.0010	0.0021	0.0022	0.0024
	MLCXGCE	-0.0006	-0.0011	0.0020	0.0022	0.0023
	GSGCEXR	-0.0012	-0.0008	0.0024	0.0024	0.0026
	CFS	-0.0001	-0.0013	0.0015	0.0014	0.0017

*Notes: * Significant at p = 5%; X indicates insufficient data.*
The first letters of the indexes listed in this exhibit indicate their correspondence to the indexes discussed in the paper as follows: CS – Credit Suisse, DCI – Diapson, DJUBS – Dow Jones UBS, ML – Merrill Lynch, GS – S&P Goldman Sachs, and CFS – Continuous Futures Series.
Day-of the-week effect is identified from the following model suggested by Ma et. al. (1992): $r_{it} = a + B_{TU}D_{TU} + B_W D_W + B_{TH}D_{TH} + B_F D_F + e_i$*, where* r_{it} *is the* i_{th} *time series of the daily return for the daily price change series.* D_i *represents the daily dummy and its coefficient measures the difference between the Monday return (measured as "a") and returns from the other days of the week.*

6. Conclusions

Various index providers use different methods to roll their futures contracts. Indexes roll their contracts on different days, for a different number of days, and use different months for the futures contracts. The objective of a roll methodology is to mimic the change in the commodity price without introducing additional volatility or inefficiency.

This study demonstrates that all indexes have no distinction in means with their respective CFS. Metals have volatility similar to that

of their respective CFS. However, energy and agricultural indexes demonstrate lower volatility than their respective CFS.

In most cases, indexes are efficient if such efficiency as measured by the day-of-the-week effect is demonstrated in the CFS. Results are similar for metals and energy using serial correlation but inconsistent for agricultural commodity indexes.

This study indicates that different returns volatility and inefficiency as compared to the CFS is mostly not dependent on the roll methodology but on the type of commodity investigated. Thus, investors or ETP providers should choose between index providers based on the roll methodology.

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THE IMPACT OF INVESTMENT DIVERSIFICATION ON FINANCIAL PERFORMANCE OF COMMERCIAL BANKS IN ETHIOPIA

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Abstract

Commercial banks play an important role in the development of a country. A sound, progressive and dynamic banking system is a fundamental requirement for economic development. Thus, the purpose of this study was investigating the impact of investment diversification on financial performance of 17 Ethiopian Commercial Banks covering the period of 2013-2017.Quantitative research approach was used and the data was analysed by using panel random effect regression model. The finding of the study shows that investment in financial assets, government security, insurance, loan portfolio and investment size have positive significant impact on financial performance of Banks in Ethiopia. Whereas, interest and exchange rate volatility have negative significant impact on financial performance of commercial Banks in Ethiopia. The study concludes that investment diversification positively affects the financial performance of commercial banks in Ethiopia. Therefore, banks should focus its work to promote the confidence in portfolio diversification, develop marketing policies that encourage its use and establish the best combination of assets that can yield an efficient portfolio.

Keywords: economic development; efficient portfolio; risk management

JEL Classification: F63, G11, G32

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1. Introduction

Commercial banks play an important role in the development of a country. A sound, progressive and dynamic banking system is a fundamental requirement for economic development (Vossen, 2010). A sound and profitable banking sector is better able to withstand negative shocks and contribute to the stability of the financial system. Bank profits provide an important source of equity especially if re-invested into the business. This should lead to safe banks, and as such high profits could promote financial stability (Flamini et al, 2009).

According to Gupta (2011) putting all your eggs in one basket is a risky decision. Therefore, an important principle of investment is to diversify investment portfolio. Spreading investments over multiple, unrelated investments reduce the risk of a sudden, unexpected outcome. In a diversified portfolio, a loss (risk) in one investment is offset by gains from another investment.

With respect to previous research studies different researchers examined this issue in different countries and sectors their findings were mixed for instance Perez (2015), argues that the effect of asset diversification on financial performance remains theoretical and differing in conclusions and as a result, it triggers scholarly debate. Perez (2015) concludes that those commercial banks which do have higher trading assets percentage normally have with them higher risks. A similar argument is shared by Lins and Servaes (2002) who assert that firms which have more diversified assets tend to have less profit than firms which have non-diversified assets. Muñoz and Sanchez (2011), while examining diversification from geographical aspect, asserts that there is a negative link between profitability of a firm and its market expansion to cover large geographical area. Elefachew and Hrushikesava, (2016) on their study the effect of industrial diversification on financial performance of selected banks from Ethiopia, reveals that industrial diversification was found to have a negative and significant effect on both return on asset and equity. On the contrary, Ishak and Napier (2006) argue that diversification does not result to reduced firm value, but rather, value of a firm tends to increases through increased diversification. Booth and Fama (1992) acknowledge that the incremental revenues as a result of diversification are higher for less-capital stocks than for other assets. This is because small-cap stocks have volatile returns and their risk is easily diversified away, as they have low correlations with

other assets. Mutega (2016) asserts that asset diversification has a positive and significant impact on financial performances of commercial banks in Kenya. Kipleting and Bokongo (2016) also conclude that investment diversification has positive impact on the financial performance of commercial banks in Kenya. From the above reviewed results, we can easily conclude that the effect of investment diversification on financial performance remains contradictory so it needs further investigation by considering different investment portfolios currently applied by Ethiopian Commercial banks.

While we see in Ethiopian context to the best knowledge of the researchers only one study conducted by Elefachew and Hrushikesava (2016), the effect of industrial diversification on financial performance of selected banks from Ethiopia and the finding reveals that industrial diversification was found to have a negative and significant effect on both return on asset and equity. Under this study only one aspect of investment diversification i.e loan diversification is considered, so it needs further empirical evidence by considering other investment portfolios. As a result, it worthwhile to investigate the impact of investment diversification on financial performance of Ethiopian Commercial banks so as to determine whether investment diversification has an impact of either reducing or increasing the overall financial performance of the commercial banks operating in Ethiopia.

2. Literature review

2.1 Theoretical framework

Modern Portfolio Theory, Arbitrage Pricing Theory and Capital Market Theory were used for this study as a theoretical framework these theories acknowledge that diversification as important for risk mitigation and increasing returns. The theories advocate for evaluation of portfolio diversification for maximization of returns. According to these theories, spreading investments throughout stocks that are not related can maximize firm's potential revenues irrespective of whether there is economic growth or not.

2.2 Empirical review

This section presents previous empirical evidences which are related with the effect of investment diversification on financial performance in different countries and sector.

Kahloul and Hallara (2010) carried out an investigation on how diversification risk and performance were related. Sixty nine (69) large firms in France were target for this study and the study period was from 1995 to 2005. The methodology was centered on both univariate and multivariate analysis. Sample included all 69 non-financial firms' selected based on size, total period and industrial activity. The data collected was cross sectional and time series hence regression analysis technique was employed to analyses panel data. The resulting findings nullified the diversification-performance relationship. The finding further revealed that total risk was linearly unrelated with diversification. However, specifically, ownership structure has the potential of intervening on the association between performance and diversification as well as that of diversification and risk. There is a possibility that ownership nature can be relevant in having a detailed knowledge of diversification, risk and performance relationships.

Turkmen and Yigit (2012) explored diversification in banking and its effect on banks' performance using evidence from Turkey. The study analyzed 40 commercial banks' data. Financial performance was measured using Return on Assets and Return on Equity with location diversification being assessed using the Herfindahl Index (HI). Geographical diversification was measured using Herfindahl Index which involved squaring market share and summing market share of each bank in each market. The study found that diversifying credit portfolios influenced the risk level of banks with losses in one sector or one location being compensated from the gains obtained from the other sectors or locations.

Maina (2013) investigated the product diversification effect on financial performance of microfinance companies. Main aims of this study was to identify the types of diversification in the Kenyan microfinance market and how they relate to performance. The study adopted a descriptive survey design using secondary data obtained from financial records of Microfinance institutions and Central Bank of Kenya. Major research findings indicated that the diversification indicator, ROA indicator and ROE indicator were on a growth pace from 2008 to 2012. However the study failed to identify the nature of product diversification whether horizontal, vertical or corporate since each one of them has its own impact on the financial performance.

Kamwaro (2013) examined the relationship between investment portfolio choice and profitability of investment companies

listed in the Nairobi securities exchange. This study took a descriptive research design approach. The study entailed a census of all the investment companies listed in the Nairobi Securities Exchange. There are five investment companies listed in Nairobi Securities Exchange. The study covered a period of three years starting in the year 2012 to year 2014.The study used secondary data sources available at the companies" books of account and the NSE or Capital Market Authority offices. The study used the multiple linear regression equation and the method of estimation was Ordinary Least Squares (OLS) so as to establish the effect of portfolio composition on financial performance of investment companies listed in Nairobi Securities Exchange. The study revealed that portfolio composition affects the financial performance of investment companies listed in the Nairobi Securities Exchange.

Kipleting and Bokongo (2016) investigated the effect of investment diversification on the financial performance of commercial banks in Kenya. The study used an exploratory research design. The population of interest in this study consisted of 40 commercial banks. Secondary data was collected using data collection sheets as the main data collection tool and interview schedule as the primary data. Data collection sheets were used to collect data guided by the objectives of the study. The data collected was analyzed using explanatory and inferential statistics and multiple regression. The study concluded that a majority of the banks over the years had in practice employed the use of insurance investment on the financial performance of commercial banks in Kenya.

Mutega (2016) investigated the effect of asset diversification on financial performance of commercial Banks in Kenya the study used descriptive research design and the population of this study was 43 commercial banks in Kenya. Secondary data on financial performance and asset diversification was collected from commercial banks' annual reports. The study was limited to a time scope of 5 year starting 2011 to the year 2015. Quantitative data gathered was analyzed descriptively and used of inferential statistics. Financial asset, loan, cash and cash equivalent and other investments are used as independent variables and the finding of the study reveals that all independent variables has a positive and significant impact on financial performances of commercial banks in Kenya.

Elefachew and Hrushikesava (2016) examined the effect of industrial diversification on financial performance of selected banks

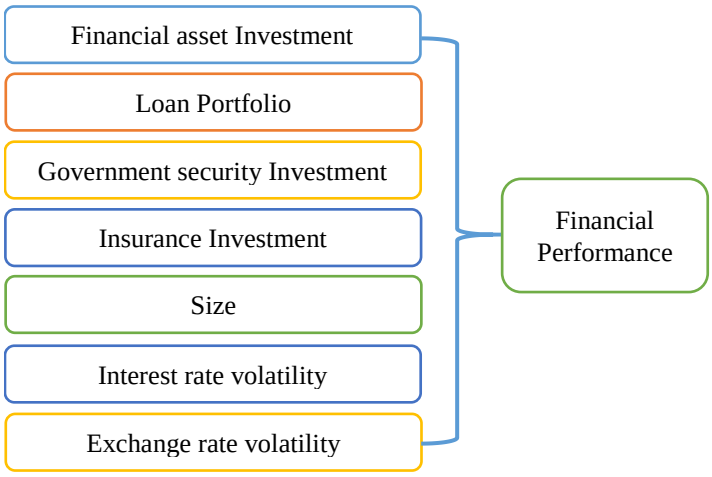
from Ethiopia. The data consists 6 years' period from 2008/09-2013/14 for ten private and two government commercial banks. Overall, the banks could be said to have diversified their loan portfolios among different industries in Ethiopia. The fixed effects model was used to estimate the regression and industrial diversification was found to have a negative and significant effect on both return on asset and equity. As per the review of the literature, there are a number of empirical studies conducted on the impact of corporate diversification on financial performance of banks and other sectors but their findings remain inconclusive, therefore, it needs further empirical evidence by considering the economic, financial, regulatory and operating context of Ethiopia.

2.3. Conceptual framework of the study

In this section a simplified conceptual framework that postulates the relationship between investment diversification and financial performance is presented. As shown in Figure 1 financial performance of banks affected by investment on Financial asset, Loan, Government security Insurance and size of investment. In addition, macroeconomic variables (interest rate volatility and exchange rate volatility) are also included.

Figure 1

Conceptual framework of the study



3. Materials and methods

Quantitative research design was used to generalize about the effect of investment diversification on financial performance of banks. The data required for analysis was driven from audited financial statement of banks over the study period 2013-2017 and the data required for macroeconomic variables were obtained from annual report of National Bank of Ethiopia (NBE). To examine effect of investment diversification on financial performance of banks the study employs panel data procedures since the sample contains data across banks and over time. Using panel data provide many advantages such as (i) controlling for individual heterogeneity, (ii) giving more informative data, more variability, less collinearity among the variables, more degrees of freedom and more efficiency, and (iii) eliminating biases resulting from aggregation over firms or individuals Baltagi (1995). As noted in Brook (2008) the general form of the panel data model can be specified as follows:

$$Y_{it} = \alpha + \beta x_{it} + \varepsilon_{it}$$

In this equation, y_{it} represents the dependent variable, and x_{it} contains the set of explanatory variables in the model. The subscripts i and t denote the cross-sectional and time-series dimension, respectively. Also α is taken to be constant over time t and specific to the individual cross-sectional unit i.

The following regression model will be used to establish the relationship among the study variables.

$$ROA_{it} = \beta 0 + \beta 1(FIN.ASSETS)_{it} + \beta 2(Loan)_{it} + \beta 3(Gov.Sec)_{it} + \beta 4(INI)_{it} + \beta 5(Size)_{it} + \beta 6(IRV)t + \beta 7(ERV)t \ldots \varepsilon$$

where: ROA = return on asset; FIN.ASSETS = Financial Assets; Loan = Loans portfolio; Gov.Sec = Investment on government security; INI = Insurance Investment; Size = Investment Size; IRV = Interest rate volatility; ERV = Exchange rate volatility; β0 = regression constant; β1, β2, β3 and β7=coefficients associated with predictor variables ε=Residual (error) term.

4. Results and Discussion

4.1. Result of Regression Model

Prior to see the result of regression analysis diagnostic (misspecification) tests such as the assumption of homoscedasticity, tests for autocorrelation, test for normality and test for multicollinearity were conducted to ensure that the data fits the basic assumptions of classical linear regression model or not, and the result of all tests satisfy the basic assumptions of linear regression model. The result obtained by the random effect model is reported as follows:

Table 4

Regression Result

Dependent Variable ROA

Sample:2013 2017
Included Observations:85
Cross-sections included: 17

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.094570	0.091813	-1.030028	0.3062
FIN.ASSETS	0.122674	0.042040	2.918040	0.0046*
LOAN	0.080916	0.023385	3.460112	0.0009*
GOV.SEC	0.174200	0.046907	3.713720	0.0004*
INI	0.539411	0.066443	8.118429	0.0000*
SIZE	0.018633	0.008578	2.172093	0.0329**
IRV	-0.018528	0.008596	-2.155471	0.0342**
ERV	-0.009049	0.003471	-2.607282	0.0110**
R-squared	0.534296	F-statistic		12.62013
Adjusted R-squared	0.491959	Prob(F-statistic)		0.000000

and, denotes significant at 1% and 5% respectively*
Source: Financial statements of banks, NBE reports and own computation

The estimation result of random effect panel regression model is presented in table 4.1 indicates that R-squared and the Adjusted-R squared statistics of the model was 53% and 49% respectively, the result indicates that the changes in the independent variables explain 49% of the changes in dependent variables. That is investment in financial asset, loan portfolio, investment on government security, investment on insurance, size of investment, interest rate volatility

and exchange rate volatility collectively explain 49% of the changes in return on asset. The remaining 51% of changes of return on asset was explained by other variables which are not included in the model. Thus, these variables collectively are good explanatory variables of the return on asset of commercial banks in Ethiopia. The regression F-statistic and the p-value of zero attached to the test statistic reveal that the null hypothesis that all of the coefficients are jointly zero should be rejected. Thus, it implies that the independent variables in the model were able to explain variations in the dependent variable.

The regression result in table 4.1 shows that, investment on financial assets, loan portfolio, investment on government security, investment on insurance and size of investment has positive and significant relationship with return on asset. Among the significant variables, investment on financial assets, loan portfolio, investment on government security, investment on insurance were significant at 1% significance level since the p-value was 0.0046, 0.0009, 0.0004 and 0.0000 respectively. Whereas size of investment was significant at 5% significance level since the p-value was 0.0329.

In contrary, there were inverse relationships between interest rate volatility and exchange rate volatility against return on asset as far as the coefficients for those variables are negative. Thus the increase of those variables will lead to a decrease in return on asset. In general, as per the regression results provided in Table 4 all explanatory variables have significant impact on return on asset.

4.2. Analysis

Under this section some of the main implications of the results are discussed based on the regression result which indicates the relationship of dependent and independent variables presented in Table 4. The result obtained under this study is analyzed as follows**.**

- **Investment on Financial Assets**

H_1 predicts significant positive relationship between financial asset investment and return on asset of banks, as expected the coefficient of financial assets which was measured by the ratio of financial asset investment to total investment portfolio was positive and statistically significant at 1% significance level (p-value = 0.0046). The coefficient of financial asset investment implies that if investment in financial asset increased by 1% return on asset increased by 12.3%. The positive coefficient indicates that financial assets are easily liquidized compared to other tangible assets including real

estate, commodities, and are tradable on financial markets so an increase in company's financial assets, results to increase in its net worth. The finding was also consistent with previous studies of Cernas (2011) and Mutega (2016).

- **Loan Portfolio**

H_2 predicts significant positive relationship between loan portfolio and return on asset of banks, as expected the coefficient of loan portfolio which was measured by the ratio of loan portfolio to total investment portfolio was positive and statistically significant at 1% significance level (p-value = 0.0009). The coefficient of loan portfolio implies that if investment in loan increased by 1% return on asset increased by 8%. The positive coefficient indicates that loan portfolio constitutes the major asset and the predominant basis of income, the result was consistent with Dang (2011), he argued that loan portfolio has a positive relationship with bank profitability when the loan portfolio is of high quality. In addition, Koch and MacDonald (2000) confirm managing loan portfolio effectively and the credit endeavors of a bank are key to its soundness and safety. in addition, the finding was consistent with Morsman (2003), Bismark and Chengyi (2015), Nduwayo (2015), Perez (2015) and Mutega (2016).

- **Investment on Government Security**

H_3 predicts significant positive relationship between investment on government security and return on asset of banks, as expected the coefficient of government security which was measured by the ratio of investment on government security to total investment portfolio was positive and statistically significant at 1% significance level (p-value = 0.0004). The coefficient of government security implies that if investment in government security increased by 1% return on asset increased by 17 %. The positive coefficient indicates that investment on government security such as Treasury bills and Bonds are considered to be significantly safer investments compared to the other asset classes given that the likelihood of a government running out of money and defaulting on its interest payments are very low since it can print more money or borrow more, the result was consistent with Kipleting and Bokongo (2016).

- **Insurance Investment**

H_4 predicts significant positive relationship between insurance investment and return on asset of banks, as expected the coefficient of insurance investment which was measured by the ratio of investment on insurance to total investment portfolio was positive and

statistically significant at 1% significance level (p-value = 0.0000). The coefficient of insurance investment implies that if insurance investment increased by 1% return on asset increased by 53%. The positive coefficient indicates that in Ethiopia most of banks have sister insurance company there are potential gains within the reduction of risk from bank enlargement into insurance business. The result was consistent with Kipleting and Bokongo (2016).

- **Investment Size**

H_5 predicts significant positive relationship between investment size and return on asset of banks, as expected the coefficient of investment size which was measured by the natural logarithm of total investment in birr was positive and statistically significant at 5% significance level (p-value = 0.0329). The coefficient investment size implies that if insurance investment increased by 1% return on asset increased by 1.86%. The positive coefficient indicates that economies of scale and synergies arise up to a certain level of size. The result was consistent with Kamwaro (2013) who acknowledges that size of the company investment positively impacted in the financial performance of investment companies in Kenya.

- **Interest Rate Volatility(IRV)**

H_6 predicts significant negative relationship between interest rate volatility and return on asset of banks, as expected the coefficient of interest rate volatility which was measured by standard deviation of annual money market interest rate was negative and statistically significant at 5% significance level (p-value = 0.0342). The coefficient interest rate volatility implies that if interest rate volatility increased by 1% return on asset decreased by 1.85%. The negative coefficient of interest rate volatility indicates that the volatility in money market interest rate creates reinvestment and refinancing risks arising from fluctuations in interest rates, due to the maturity mismatch between banks assets and liabilities. This finding is consistent with Gathigia (2016), and Bagh et.al, (2017).

- **Exchange Rate Volatility (ERV)**

H_7 predicts significant negative relationship between exchange rate volatility and return on asset of banks, as expected the coefficient of exchange rate volatility which was measured by standard deviation of annual money market interest rate was negative and statistically significant at 5% significance level (p-value = 0.0110). The coefficient interest rate volatility implies that if interest rate volatility increased by

1% return on asset decreased by 0.9%. The negative coefficient of exchange rate volatility indicates that increased macroeconomic instability heightens the risk faced by commercial banks and which affects the return on asset of banks negatively. The finding is consistent with Gathigia (2016).

5. Conclusions

This paper examines the effect of investment diversification on financial performance of commercial operating in Ethiopia. The data consists 5 years' period from 2013-2017 for 16 private and one government commercial banks. The random effects model was used to estimate the regression and the result shows that investment in financial asset, loan portfolio, investment in government security, insurance investment and size of investment have a positive and statistically significant relationship with financial performance of commercial banks which was measured by return on asset. This implies that spreading investments over multiple, unrelated investments reduce the risk of a sudden, unexpected outcome and in a diversified portfolio; a loss (risk) in one investment is offset by gains from another investment. Whereas the macroeconomic variables interest rate volatility and exchange rate volatility has a negative and statistically significant relationship with financial performance of commercial banks which was measured by return on asset. This implies that volatility in money market interest rate creates reinvestment and refinancing risks arising from fluctuations in interest rates, due to the maturity mismatch between banks assets and liabilities and the volatility in exchange rate heightens the risk faced by commercial banks and which affects the financial performance of banks negatively. The study recommended that banks should focus its work to promote the confidence in portfolio diversification, develop marketing policies that encourage its use and establish the best combination of assets that can yield an efficient portfolio.

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THE INCIDENCE OF INSURANCE ON ECONOMIC GROWTH IN ITALY, FRANCE, UNITED KINGDOM AND ROMANIA

Bianca COSTACHE*

Abstract

This research paper is focused on an important topic in the economic literature, more precisely how the insurance sector impacts the overall economic growth. The objective of the study is to identify, analyse and evaluate the effects of the insurance sector on economic growth for three countries: France, United Kingdom and Italy, with data collected for the period 1984-2016 and also for Romania with data for 2008 - 2017. The results of the study proved to be important as they indicate the variation in the effects of insurance instruments due to the peculiarity of each economy and the way in which each economy responds to a positive impact from the insurance sector.

Keywords: DP; gross written premiums; cointegration; causality

JEL Classification: C32, G220, O410

1. Introduction

Insurance has an significant economic potential in the process of macroeconomic expanding of countries that represents an opportunity and this requires capitalization by the regulatory authorities. This study aims to identify and assess the effects of the insurance sector on economic growth. This approach will be achieved through an econometric model, which aims to assess the intensity and direction of influence of this economic branch.

In view of this analysis, the following countries are considered: France, United Kingdom, and Italy. State selection has as a starting point an article in the form of a Note issued by EIOPA (2018), which presents the ranking of countries in terms of gross non-life-to-GDP written premiums in the European Union for the second quarter of 2017, thus providing a homogeneous study group. In parallel with

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these emerging insurance countries, we will analyze Romania economy's situation, for which the data set is composed of quarterly data for the 2009-2015 period. In order to conduct the analysis, we used different econometric tests and methods to quantify the impact of the insurance industry on the entire economy. The results of the study are important, as they allow the formulation of proposals for guidance of insurance instruments in the direction of stimulating economic growth.

2. Literature Review

This research analyses the relationship between the activity of the insurance sector and the economic growth. Given that no consensus has so far been reached on this issue, as Sen (2007) developed in his research, it is important to continue analysing this correlation. In fact, so far this relationship has been analysed in many specialized studies in the economy, but this causal relationship is not clearly defined. On the one hand, researchers show that the development of the insurance sector is driving economic growth, and on the other hand, they indicate that the macroeconomic change of a state determines the expansion of the insurance market. So, despite the wide range of studies in the literature that tried to clarify the issues regarding the relationship between these two factors, this issue remains an opportunity that needs clarification.

Thus, Outreville (1990) and Outreville (1996) has shown that the rate of economic growth is characterized by the contribution of the insurance market in that economy. Further, he illustrated the importance of civil liability insurance and life insurance in the development of economies and their growth. In addition, Skipper (1997) concluded that insurance contributes to the economy through the following aspects: (i) promotes financial stability and reduces people's mistrust in the economy; (ii) has the capability to replace government security programs; (iii) facilitates economic exchanges; (iv) mobilizes economies; (v) leads to more efficient risk management; (vi) encourages the reduction of losses and (vii) facilitates the allocation of capital.

In the following period, Webb et al. (2002) illustrated how life and civil liability insurers can contribute to economic growth due to the following: (i) life insurance may increase productivity by reducing demand for liquidity and by making more efficient use of available

resources; (ii) civil liability insurers present an additional risk financing option, with the potential to reduce the likelihood of firm financial constraints and firm bankruptcy costs; this positively affects investment decisions in an economy; (iii) insurers have the potential to stimulate investment profits, reducing the costs of risk financing.

In addition, the factors that influence the development of the insurance sector vary according to each economy in particular in which this causality is studied. According to Zietz (2003), among the main factors that have been identified as determinants of insurance demand are: demographic, macroeconomic, social and psychological, institutional, as well as those derived from insurance companies.

3. Data and Methodology

The study approaches a way of analysing the causality between different types of insurance (gross written premiums for life, non-life and total insurance, noted gwp_life, gwp_non_life and gwp_total) and economic growth (noted gdp) at national level, through the VAR model, respectively the VECM model, as well as the impulse-response function.

The four data series were taken over for 32 years (1984-2016) from the official OECD database (life / non-life and total insurance) and Eurostat (GDP growth rate) for three states: France, Italy, United Kingdom and Romania. To model the four variables and to get the relationship of influence between each insurance instrument and economic growth, we will use the Eviews 7 program. The use of cointegration as a case study methodology is motivated by the need to represent long-term causal relationships between insurance instruments and economic growth.

4. Results

In order to analyse the cointegration of data series, we need to study the stationarity of the variables as well as the integration order. Using the Augmented Dickey Fuller test meets both conditions. Further, we will use the ADF test to determine the data series integration order used in the model, and the results of running this test indicate that all four time series are 1st order integrated. The next step is to check the cointegration of each of pairs surveyed, namely: growth rate of GDP and the growth rate of life / general and total life insurance.

Running the VAR model involves selecting the appropriate number of lags for each model, and this was done by considering the Likelihood Ratio, Final Prediction Error, Akaike information criterion, Schwarz information criterion and Hannan-Quinn information criterion.

The next step is to analyze the results of the Johansen Test to illustrate the long-term relationship between each pair of variables analysed, and for this it is necessary that the data series be non-static but also integrated by the same order, as evidenced by the results of the ADF test.

Johansen's test results indicate that there is a long-term relationship between growth of insurance and economic growth for all analysed countries: France, Italy and the UK. After lag selection, the patterns are run by using VAR for data series pairs where we have not observed cointegration relationships, respectively rewriting them as VECM for cointegration.

Table 1

VAR / VECM equations

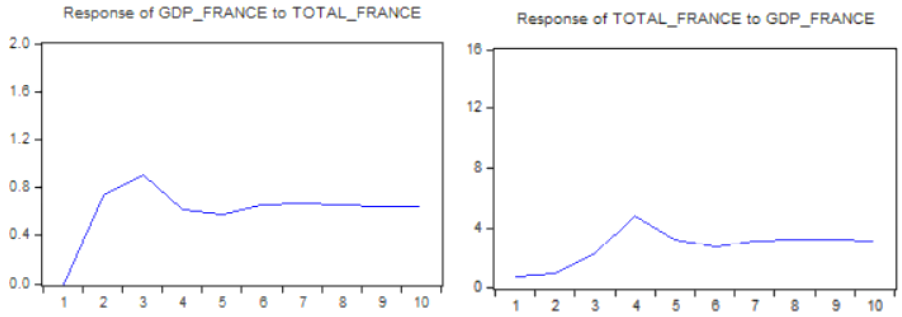
	gdp_gwp_life	**gdp_gwp_non_life**	**gdp_gwp_total**
France	D(GDP) = C(1)*(GDP(-1) + 1.41322393835*LIFE(-1) - 28.5794317956) + C(2)*D(GDP(-1)) + C(3)*D(GDP(-2)) + C(4)*D(LIFE(-1)) + C(5)*D(LIFE\(-2)) + C(6)	D(GDP) = C(1)*(GDP(-1) - 21.0413866862*NON_LIFE(-1) + 126.325873193) + C(2)*D(GDP(-1)) + C(3)*D(GDP(-2)) + C(4)*D(NON_LIFE(-1)) + C(5)*D(NON_LIFE(-2)) + C(6)	D(GDP) = C(1)*(GDP(-1) - 0.184491870117*TOTAL(-1) - 2.0644111883) + C(2)*D(GDP(-1)) + C(3)*D(GDP(-2)) + C(4)*D(TOTAL(-1)) + C(5)*D(TOTAL(-2)) + C(6)
Italy	D(GDP) = C(1)*(GDP(-1) - 0.282112720018*LIFE(-1) + 0.275915048397) + C(2)*D(GDP(-1)) + C(3)*D(GDP-2)) + C(4)*D(GDP(-3)) + C(5)*D(LIFE(-1)) + C(6)*D(LIFE(-2)) + C(7)*D(LIFE(-3)) + C(8)	D(GDP) = C(1)*(GDP(-1) - 0.472710361959*NON_LIFE(-1) - 1.70986559566) + C(2)*D(GDP(-1)) + C(3)*D(GDP(-2)) + C(4)*D(GDP(-3)) + C(5)*D(NON_LIFE(-1)) + C(6)*D(NON_LIFE(-2)) + C(7)*D(NON_LIFE-3)) + C(8)	D(TOTAL) = C(1)*(TOTAL(-1) - 2.28998848265*GDP(-1) - 0.453527355766) + C(2)*D(TOTAL(-1)) + C(3)*D(TOTAL(-2)) + C(4)*D(TOTAL(-3)) + C(5)*D(GDP(-1)) + C(6)*D(GDP(-2)) + C(7)*D(GDP(-3)) + C(8)
United Kingdom	D(GDP) = C(1)*(GDP(-1) - 0.240211592908*LIFE(-1) - 2.11951284532) + C(2)*D(GDP(-1)) + C(3)*D(LIFE(-1)) + C(4)	D(GDP) = C(1)*(GDP(-1) - 0.418725079175*NON_LIFE(-1) - 3.72587805956) + C(2)*D(GDP(-1)) + C(3)*D(NON_LIFE(-1)) + C(4)	D(TOTAL) = C(1)*(TOTAL(-1) - 2.52061152216*GDP(-1) - 10.5768996808) + C(2)*D(TOTAL(-1)) + C(3)*D(GDP(-1)) + C(4)

Source: Authors' work

For France, the first C(1) negative coefficient (-0.4930) with a significant probability (0.0242), indicates the existence of a causal relationship between the insurance sector and economic growth.. The coefficients obtained for the models ran for Italy determine that we can state the presence of causality from insurance to macroeconomic growth in the long run. With respect to UK models, we have obtained the causality of insurance on long-term economic growth.

Figure 1

Impulse – response function for France

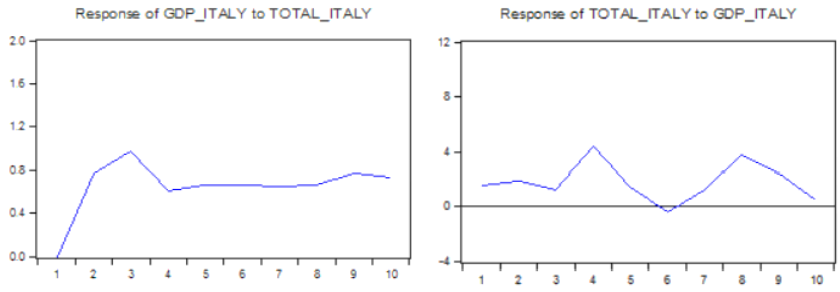


Source: Authors' work

For France, the graphs are similar; in the first case, the positive impact of insurance on the growth rate of GDP determines an accelerated increase in macroeconomic progress in the first periods so that the trend is kept constant and also an impulse given by total insurance leads to a positive influence of economic growth.

Figure 2

Impulse – response function for Italy

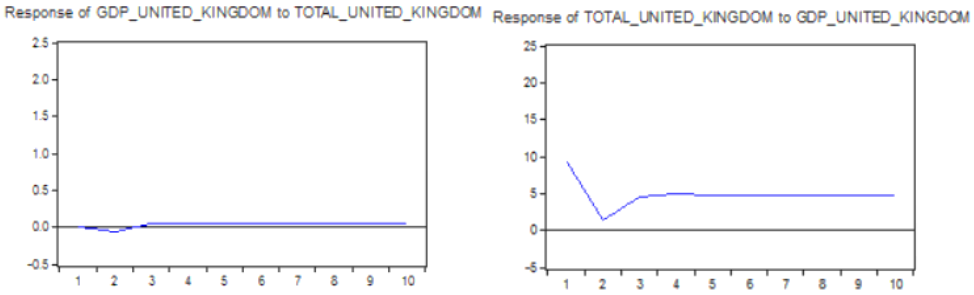


Source: Authors' work

In the case of the model drawn up for Italy, the similarity of the economic growth reaction in response to a positive influence of insurance is observed as in the case of France. Instead, we can observe the fluctuations in the growth rate of insurance as a response to the positive contribution of economic growth.

Figure 3

Impulse – response function for United Kingdom



Source: Authors' work

The impulse - response functions show that the growth rate is most strongly influenced by the growth of the insurance sector in the case of the French and Italian economies. The analysis of Granger test indicates the highest causality between economic growth and the growth of insurance instruments for the Italian economy.

Table 2

Selection of statistically significant results of the Granger test

	Null hypothesis	Prob
France	GDP does not Granger Cause LIFE	**0.0285**
Italy	GDP does not Granger Cause NON_LIFE	**0.0009**
	LIFE does not Granger Cause GDP	**0.0221**
	DGDP does not Granger Cause LIFE	**0.0007**
	DGDP does not Granger Cause TOTAL	**0.0006**

Source: Authors' work

We note the lack of favourable outcomes for the UK, for which we have not identified causal relationships between the growth rate of GDP and that of insurance. In order to achieve the econometric study for Romania, we considered time series with quarterly data for the period between Q1 2008 and Q3 2017,

denominated in national currency. Thus, we analysed the causal relationship between the growth rate of GDP and the growth rate of life, non-life and total life insurance using the VAR and VECM model, impulse response and Granger, Johansen, and Wald tests in Eviews.

Therefore, the results of the Johansen test indicate cointegration in all three models considered. This indicates the economic growth response to the use of insurance as an instrument in the development process of Romania. We will further use VECM models for all models considering the long-term relationship between growth and the growth of overall and total life insurance.

Table 3

VECM equations

	gdp_gwp_life	**gdp_gwp_non_life**	**gdp_gwp_total**
Romania	D(GDP) = C(9)*(LIFE(-1) + 9.0581695627*GDP(-1) - 10.8060604241) + C(10)*D(LIFE(-1)) + C(11)*D(GDP(-1)) + C(12)*D(LIFE(-2)) + C(13)*D(GDP(-2)) + C(14)*D(LIFE(-3)) + C(15)*D(GDP(-3)) + C(16)	D(GDP) = C(1)*(GDP(-1) - 0.944460466777*NON_LIFE(-1) + 27.0653145117) + C(2)*D(GDP(-1)) + C(3)*D(NON_LIFE(-1)) + C(4)*D(GDP(-2)) + C(5)*D(NON_LIFE(-2)) + C(6)*D(GDP(-3)) + C(7)*D(NON_LIFE(-3)) + C(8)	D(GDP) = C(9)*(TOTAL(-1) - 0.229255173643*GDP(-1) - 23.4499765191) + C(10)*D(TOTAL(-1)) + C(11)*D(GDP(-1)) + C(12)*D(TOTAL(-2)) + C(13)*D(GDP(-2)) + C(14)*D(TOTAL(-3)) + C(15)*D(GDP(-3)) + C(16)

Source: Authors' work

After compiling the VECM equations, we analyse the coefficients C(1) - the correction term for each of the three models to determine the nature of the causality between the variables.

Table 4

Coefficients values

		gdp_gwp_life		**gdp_gwp_non_life**		**gdp_gwp_total**	
		Coef	**Prob**	**Coef**	**Prob**	**Coef**	**Prob**
Romania	**C(1)**	-0.3710	0.3689	0.0281	0.4491	**-2.0022**	**0.0011**

Source: Authors' work

From the observation of the results of Table 4 for the estimated models, we can confirm the presence of long-term causality given by total insurance on economic growth. The results of applying the Wald test for the three estimated models indicate the presence of short - term causality only in the gdp – gwp life model.

Table 5

Results of Wald test for gdp_gwp_life model

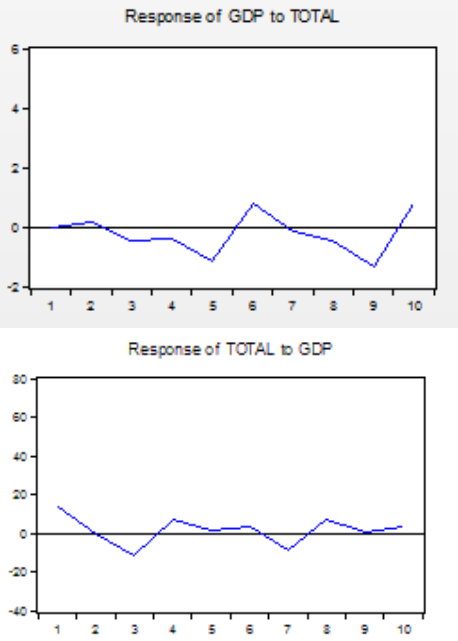
gdp_gwp_life	Prob
Chi-square	**0.0000**
Null Hypothesis: **C(5)=C(6)=C(7)=0**	

Source: Authors' work

In order to identify the model in which each variable is manifested by the influences of the opposite variable, we use the impulse-response functions.

Figure 4

Impulse – response function for Romania



Source: Authors' work

According to Figure 4, a positive impact of total insurance is reflected in low growth rates, and total insurance responds similarly to the first chart in the case of a positive influence of insurance, but the fluctuations are of low intensity.

Table 6

Results of Granger test for Romania

	Null hypothesis	Prob
Romania	NON_LIFE does not Granger Cause GDP	0.0006
	GDP does not Granger Cause NON_LIFE	0.0038
	TOTAL does not Granger Cause GDP	0.0004
	GDP does not Granger Cause TOTAL	0.0019

Source: Authors' work

Thus, we observe the bidirectional causal relations between general insurance and economic growth, respectively between total insurances and economic growth in case of Romania.

5. Conclusions

The analysis of the entire set of results for all four states included in the study indicates the causal relationship between insurance and economic growth. Thus, in France we have causal relations from economic growth to insurance, we have not achieved a relationship of cointegration in the UK, and in Italy and Romania we have achieved bidirectional causality.

The bidirectional causal relationship between insurance and economic growth in Romania is also confirmed by the results of the study by Cristea et al. (2014). However, the author asserts that the profile of a Romanian insured potential is defined and outlined by the Romanian society, by the factors that are directly related to the disposable income, the way of life, the level of knowledge, the civilization and the culture.

In the case of Romania, although the bidirectional causal relationship between insurance and economic growth is supported by the results of the Johansen test which demonstrated long-term causality and the Wald test confirming short-term causality, the results of impulse-response functions indicate low fluctuations in growth of GDP from the impacts of insurance.

It is further recommended to support strategies that are designed to strengthen the regulatory framework for insurance operations. It is also recommended to promote educational programs aimed at dispersing the benefits of insurance and focusing consumer

interest on insurance should be in the attention of both the government and the regulatory bodies.

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