UNIVERSITY OF LJUBLJANA
FACULTY OF ECONOMICS

MASTER'S THESIS

THE NEXUS OF STOCK YIELDS, ECONOMIC ACTIVITY AND COMMODITY PRICES

Ljubljana, September 2016

VLADIMIR NIKOLOV

`

AUTHORSHIP STATEMENT

The undersigned Vladimir Nikolov, a student at the University of Ljubljana, Faculty of Economics, (hereafter: FELU), author of this written final work of studies with the title The nexus of stock yields, economic activity and commodity prices, prepared under supervision of Professor PhD Aleš Berk Skok.

DECLARE

1. this written final work of studies to be based on the results of my own research;
2. the printed form of this written final work of studies to be identical to its electronic form;
3. the text of this written final work of studies to be language-edited and technically in adherence with the FELU's Technical Guidelines for Written Works, which means that I cited and / or quoted works and opinions of other authors in this written final work of studies in accordance with the FELU's Technical Guidelines for Written Works;
4. to be aware of the fact that plagiarism (in written or graphical form) is a criminal offence and can be prosecuted in accordance with the Criminal Code of the Republic of Slovenia;
5. to be aware of the consequences a proven plagiarism charge based on the this written final work could have for my status at the FELU in accordance with the relevant FELU Rules;
6. to have obtained all the necessary permits to use the data and works of other authors which are (in written or graphical form) referred to in this written final work of studies and to have clearly marked them;
7. to have acted in accordance with ethical principles during the preparation of this written final work of studies and to have, where necessary, obtained permission of the Ethics Committee;
8. my consent to use the electronic form of this written final work of studies for the detection of content similarity with other written works, using similarity detection software that is connected with the FELU Study Information System;
9. to transfer to the University of Ljubljana free of charge, non-exclusively, geographically and time-wise unlimited the right of saving this written final work of studies in the electronic form, the right of its reproduction, as well as the right of making this written final work of studies available to the public on the World Wide Web via the Repository of the University of Ljubljana;
10. my consent to publication of my personal data that are included in this written final work of studies and in this declaration, when this written final work of studies is published.

Ljubljana, September/28/2016 Author's signature: _________________

`

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

`

INTRODUCTION

• A problem description

The relationship between economic activity and stock prices or stock returns has been a long debated issue among the academics and professionals. Empirical evidence such as that by Fama (1981, 1990) provides considerable support that there is as expected a relationship between economic activity variables and stock returns. According to Fama (1970), Efficient Market Hypothesis (hereinafter: EMH) states that in an efficient market, all the relevant information about the changes in economic factors are completely considered in the current stock prices and investors would not be able to earn anomalous profits in such markets. If the conclusion of EMH is correct, then any economic activity variable should not affect the stock returns in any predictive way, since arbitrage opportunities are impossible and investors are not able to earn risk-adjusted returns that are higher than the market return. Actually, predictability of one asset will allow increasing more in value than another one asset, such a situation would not reflect inefficiency of the market mechanism, if possible excess returns from predictability might come at the cost of high risk and is just a fair compensation for risk-taking, which is consistent with Markowitz (1952) formulation of the portfolio problem as a choice of the mean and variance.

However, Fama and Schwert (1977) concluded that expected stock returns are negatively related to expected inflation as they found a negative relation between aggregate stock returns and short-term interest rates. Further, Campbell and Shiller (1988) were analyzing the relationship among stock prices, earnings and expected dividends and find that ratio of earnings variable to current stock price is powerful in predicting stock returns over several years as they find that a long term moving average of earnings predicts dividends. Current stock prices will be affected by expectations about the future economy because expected inflation and future earnings have a straight relationship with the behavior of the real economy. For example, a decrease in expected inflation will increase real purchasing power and reduce the cost of capital, and with strong corporate profits will stimulate investment spending, this could allow better growth prospects of the economy. Above mentioned empirical evidence gave reasons to support the view that stock prices reflect expectation about the future economy or somehow indicate what will happen to the economy as a whole. Fischer and Merton (1984) documented that movements in stock prices suggest that they lead the economic direction. For example, if the economy is expected to enter into a booming period, the stock market will anticipate this by positive growth of stock prices or when entering in a recession period, the stock market will anticipate this by the downward trend of stock prices.

On the other hand, the commodities price changes play a significance role in a country's economy around the world and they are fundamentals which affect the economic activity in the country. The gold, silver, copper and oil are among the most widely traded commodities on the world market and they are considered as strategic commodities because their prices despite forces of supply and demand are determined by interference of capital markets and finally they affect our daily life. Policy makers and investors would be very interested in understanding the relationships among these four commodities, economic activity, and stock markets. The studies considering commodities find ambiguous relationship between economic activity and them, in case of Pindyck and Rotemberg (1990), they find unidirectional causality from economic activity variables to commodity prices, while conversely in case of Awokuse and Yang (2003), who found that commodities have news content in predicting the direction of inflation, interest rate, and industrial production.

Theoretically, the link of this relationship among stock market, commodities and economic activity is explained by models such as the Present Value Model (hereinafter: PVM) and using of asset pricing models, where the most typically are Capital Asset Pricing Model (hereinafter: CAPM) developed by Sharpe (1964) and Lintner (1965) and Arbitrage Pricing Theory (hereinafter: APT) developed by Ross (1976). The latter two models are the most appropriate solution to estimate the discount rate for the dedicated asset (Fama & French, 2004). These models offer the theoretical framework which provides an explanation of dynamic relationship among the stock market, commodities and economic activity and gives an explanation how any predicted or unpredicted arrival of new information about economic activity variables or commodities will indirectly affect stock prices through its influence on expected future dividends, discount rate, or both.

Understanding of the economic activity and commodities explanatory variables is highly valuable for investors and policy makers. Investors, both individual and institutional want to learn about the behavior of the stock market and discover how the behavior of the stock market is related to the economic activity and commodities, in order to proactively act and to benefit or reduce risk within of economic or policy changes. For policymakers, information that discloses relationship among stock market, economic activity and commodities can be used to predict the path of an economy’s growth and to enhance market rules and regulations. Levine and Zervos (1998) suggest that stock market development plays an important role in predicting future economic growth in emerging markets and this confirms that stock market is important in promoting economic growth.

The empirical works on the relations between economic activity and stock markets can be divided into two main categories. Within the first category, studies explore the impact of economic activity variables on stock prices (Cheung & Ng, 1998). The second category of studies focuses on the relations between the stock market volatility and volatility of explanatory variables (Poon & Granger, 2003). This study is focused on the first category, and the analysis will be conducted in the case of five advanced countries (US, Japan, Germany, UK and Spain) and four emerging countries (Brazil, Russia, Mexico, and

Poland), examining relations among national stock market prices, commodities prices and country economic activity. The reasons why I chose particularly this markets, was that as emerging economies continue to grow and prosper, they contribute tremendously in terms of growth impact on the global economy. Emerging economies are getting a larger influence over the global economy and it was interesting to view how the stock market prices in these economies, are affected by proposed set of economic activity variables (PricewaterhouseCoopers, n.d.).

From conducted literature review in this study, it is clear that the comprehensive researches have been prepared for developed economies. However, in developing countries, researchers which explore relations among economic activity, commodities and stock market are scarce and still ongoing. In the same direction as most of the previous studies, this study will analyze the long-run and short-run relationship among economic activity variables, commodities and the stock market in each country.

Furthermore, the significance of this study is to allocate the suggestion of possible relationship among considered variables on investment decisions. The contribution of the study is dual. Firstly, more recent and higher frequency data is used. The use of monthly data is with the intention to better capture the dynamics of the stock market and commodities, given that stock markets react on time to new information. Secondly, a wide group of countries economic data and the stock market will be used. However, a broader range of country's indices is examined to select possible markets that may be viewed as possible opportunities for investment. The foregoing serves as the primary motivation for this study and the objective are to investigate the relationship among macroeconomic determinants, commodities and stock market movements in the long and short run and their causality.

• Purpose of the Master Thesis

The primary reason for choosing this topic was the curiosity within the current financial crisis, it has dominated the news headlines for the last few years, discussing possible implications, influences, and consequences from the meltdown in the world economy. Always has been recognized that the stock market to some extent reflects what is going in the rest of the economy and it has been interesting to discover which economic activity variables and commodities presumably are most important for influencing stock market prices.

This thesis aims to explore the relations among stock market prices, commodities prices and selected set of economic activity variables based upon the PVM theory, where the specific motivation for each of this variables are discussed in details in next chapter of this study. Set of proposed economic activity variables and commodities including: Index of Industrial Production (hereinafter: IIP), Producer Price Index (hereinafter: PPI), Employee earnings (hereinafter: WAGE) Number of Employees (hereinafter: EMP), Inflation, Confidence Index (hereinafter: CONF) - Consumer Sentiment or Business sentiment, Gold prices, Silver prices, Copper prices and Oil prices. Last four variables indeed are not direct coincident indicators about the aggregate economy. However, copper prices and oil prices is an essential input cost for final products in the economy and gold prices and silver prices how assessing the fair value largely remains a mystery in finance. It was interesting to consider the relationship among stock prices, gold prices, silver prices and other proposed economic activity variables.

The above-mentioned variables were selected for three important reasons. First, while examining the theoretical links among stock market, commodities and economic activity, we expect that these variables might be strongly related to the stock market price changes and commodities prices. Second, filling the gap between employment and the stock market dynamics, to put attention on labor market variables as a driver for stock market returns; and third, that these variables are more frequently available at the monthly level.

The analysis was conducted in the case of five advanced countries (US, Japan, Germany, UK and Spain) and four emerging countries (Brazil, Russia, Mexico, and Poland), examining the relationship between national stock market prices, gold prices, silver prices and their economic activity. The post-crisis period, after 2008, has produced a multi-speed world, as the major developed economies struggle with low growth and high unemployment, while the main emerging economies continue to grow and prosper and have contributed tremendous growth impact on the global economy. In particular, despite the major advanced economies, I include Spain. Germany and Spain are members of euro area, the first is leader of the euro area which has restored growth to pre-crisis levels (before 2008) and did not struggle with high unemployment, while the second grew rapidly before 2008 and during post-crisis period (after 2008) was suffering from depression levels of unemployment and an economy meltdown. The reason why I include Poland in the group of emerging economies is that it is the only country in the European Union which kept growing while its neighbors fell into the global recession that began in 2008. Different behavior between advanced and emerging economies and among emerging economies themselves, may illustrate the fact that emerging stock market not only segmented from developed markets but also segmented from one another and affected more by local rather than global economic factors (Harvey, 1995) and therefore it was interesting to view how the stock market prices in this economies, are affected by proposed set of economic activity variables.

I considered the following two questions in this master thesis. *First,* do the proposed set of economic activity variables included in this thesis share long-run equilibrium relationships with the national stock markets proxies by the general price index, gold and silver prices. Results and empirical evidence of long-run relationship between national stock market prices, gold and silver prices with economic activity variables in this thesis should provide

`

useful guidelines which can be highly relevant, for example, to private investors and institutional investors like pension or mutual funds, both for local and foreign investors, to make effective investment decision. Distinctively for long-term investors, because they base their investment in the stock market on the assumption for earnings growth and appropriate discount rate in line with the future economic performance. Testing long-run relationship with cointegration can enable to measure relative benefits of diversifying investment portfolios internationally. *Second*, provides a better understanding of the national stock markets, gold and silver movements across the emerging market and the developed markets, how they relate the changes in economic activity variables with the changes in stock market prices and whether are experiencing short-run transitory deviations from their long run relationship. I will try to investigate the direction of the relationship between the national stock market prices and the economic activity variables. More specifically, to examine whether the economic activity variables have an effect on the national stock market prices, gold prices and silver prices or they are affected by them.

• Methods of analytical approach

Answers to these two questions will be obtained using different methodologies. The first questions will be answered using the Autoregressive Distributed Lag (hereinafter: ARDL) bound testing procedure of Pesaran and Shin (1999) and Pesaran, Shin and Smith (2001), to find empirical evidence of long-run co-movements between national stock market indexes, gold prices and silver prices and measures of economic activity. To answer the second question and gain more information about transmission mechanism among macroeconomic environment, commodities and stocks I will employ Error-Correction Model (hereinafter: ECM) of ARDL and Granger causality test based on the Toda-Yamamoto (1995) testing procedure.

Time series data in financial markets, for example like equity prices and dividends share theoretical long-run relationships and is believed that these time series data over time have not constant mean and variance, actually they are non-stationary. Relying on such non-stationary time series data may lead to wrongly conclude that two variables are related when in reality they are not (Granger & Newbol, 1974). This phenomenon is well known in the literature as spurious regression discussed by Phillips (1987). The typical method to analyze a non-stationary process is to either detrend or difference the data depending on the type of trend.

As one of the goals of this thesis is in modeling a long-term relationship between economic activity variables, commodities and national stock market indexes, cointegration analysis will be an ideal tool to use. I have focused on using ARDL bound testing approach, which is more convenient to use when there is a mixture of I(0) and I(1) data. For the cointegration procedure first have to be determined for each series the presence of unit roots, to make sure that none of the variables are I(2), this is a precondition for

`

cointegration with ARDL bound testing because such data will invalidate the methodology. Inference in the cointegration model depends on the correct determination of optimal number for time lags, in this model for different variables can be assigned different lag length as they enter the ARDL model. Selection of a different lag length than optimal lag length can cause or generate autocorrelated errors, which restricted the model. ARDL bound testing approach involves "Bounds Test" to check if there is evidence of a long-run relationship between the variables in just a single-equation set-up, making it simple to implement and interpret the results. If the outcome for cointegration is positive, then both long-run and short-run coefficients of the model are estimated simultaneously since it takes into account the Error Correction Term (hereinafter: ECT) in its lagged period, Giles (2013, June 19). **ECT have long run information as they are the lagged values derived from long run cointegration relationship and it tells at what rate it corrects the previous period disequilibrium of the system variables.** Cointegration between variables indicates that causality exists among variables but it fails to show us the direction of the causal relationship. This is the reason why I employed Granger causality test, Granger (1969), to determine the direction of dynamics for the modeling direction of the relationship. Actually, I employed causality test based on the procedure of Toda and Yamamoto (1995). This test uses a modified Wald test which can be applied irrespective of the of whether underlying variables are purely I(0), I(1) or mutually cointegrated, Giles (2013, June 19).

The thesis is structured in the following manner: The first chapter reviews the theoretical outlook of asset price model frameworks and linking the stock market to economic theory. The second chapter explained the relationship among economic activity variables, commodities and stock market prices through theoretical background and provides justification for the inclusion of the six macroeconomic variables and four commodities in this study. Chapter 3 describes the econometric methodology and model specification adopted in the study in addressing the research questions. Chapter 4 describes the data, presents the empirical results and implications. Lastly, Chapter 5 provides the conclusions of the study.

1 THEORETICAL PART

This chapter will provide some basics of asset pricing theory and try to explain and illustrate the dynamical relations among stock market, economic activity, and commodities. The basic theoretical consideration of stock market is suggested by Fama (1965), that only new relevant information is used to explain stock market movements in his EMH which somehow leave investors only to maximize risk-adjusted returns. In the following of basics, the CAPM developed by Sharpe (1964) describes how relates systematic risk and expected return for assets, specifically for pricing of risky securities as stocks. The CAPM framework is widely used for assessing discrepancies in expected returns for different assets considering the risk of those assets and estimates the most appropriate discount rate. The APT is more flexible than CAPM regarding the use of a number of economic activity factors and their expected returns and risk premiums. The last model which is embedded in basic of asset prices is the PVM as a tool for valuing the price of assets by using generated dividends and appropriate discount rates to get present values. The all of the above-mentioned models have their drawbacks originating from the restrictions in the model's inputs and simplified assumptions. The drawbacks of above models can be spot in Shiller (1981) paper which challenged then believed view that news of generated dividend is the most important factor in driving stock market, he found that stock prices are too volatile to be explained by changes in dividends and this overreaction movement in stock prices probably come from some surprising change or changes in dividend and discount rate movements. Most of the puzzle that we face amount to discount-rate variation, which will be an exhibit at the end of this chapter.

1.1 Overview of the Asset Price Models

Understanding behavior of asset prices is not only important for professional investors but also affect the daily life of ordinary people, their choice to save among different asset classes (stocks, bonds, money market securities and commodities) and latter to consume. Asset prices have fundamental meaning for the economic activity, they give notable information for key economic decisions of businesses regarding physical investments in order to raise future output and revenues with the desired result to gain profitable returns. Intuitively, based on the previous investment and increased output, economic activity grow, which output is on the end demanded and consumed. Above mentioned theoretical models dominate the literature of stock market modeling and provide the link between the economic activity and stock prices. The previous work by Gordon (1959), Sharpe (1964) and Ross (1976) have provided a theoretical fundament that may stocks performance be valued. The empirical application of the models, in reality, based on simplified assumptions upon which these models are derived is key weaknesses in the implementation. Consequently, this can lead to asset mispricing and may contribute to financial crises like the recent of 2008 on a global scale and this type of crises can harm the overall economy.

Even through the asset prices models often seems that asset prices reflect fundamental values, but there are events when assets prices have deviated sharply beyond any accurate or rational reflection justified by fundamentals, commonly labeled as bubbles and crashes. In Fama (1991) approach to reviewing the market efficiency regarding controversy that the market is predictable from past returns, he stated that should know more about links between stocks expected returns and economic activity variables and if this expected returns are rational than variations in expected returns should be related to variation in consumption, investment, and savings. Further, Fama (1990) argue that intuition of the EMH is that stock prices are low relative to dividends when discount rates and expected returns are high, and vice versa, so the dividends varies with expected returns, even though the stock market level fluctuates much more than fundamentals like dividends as Shiller (1981) suggest. Considering Fama (1990, 1991), there is no irrationality, the only opportunity to “beat the market” depend on of investors’ risk preferences, how they a different attitude toward the level of risk compared with the market as a whole. Shiller’s (2003) approach is contrary to Fama’s view and argued that it is incorrect since the risk appetite changes which can explain the over-reaction of assets to the relevant economic fundamentals reflects no fundamental psychological principle that people tend always to over-react or to underreact. Additionally, Shiller (2003) explained that EMH may lead to drastically incorrect interpretations of events such as major stock market bubbles. After all, from a theoretical point of view, above mentioned models present a sufficient theoretical foundation for understanding the relationship among stock market, economic activity and commodities and influences among each other.

1.1.1 The Efficient Market Hypothesis (EMH)

With the emergence of the EMH has been proposed a close relation between the fundamental values and the stock prices, suggesting that should always be an equilibrium between them. Fama (1970) presented the first synthesized theoretical interpretation of the researches that had been done so far without theoretical foundation in terms of random walk.

The EMH states that asset prices at any given time reflect all available information’s, further Fama (1970) discussed the mean of available information in the trichotomy approach. Firstly, weak-form informational efficiency, in which the information set are just historical asset prices and that it is impossible to systematically beat the market using them. Secondly, semi-strong form informational efficiency, in which the concern is whether prices efficiently adjust to publicly available information and support the EMH. Finally, strong-form informational efficiency considers whether given investors or groups have monopolistic access to any information for asset formation relevant information and where it is impossible to systematically beat the market using any of that information.

The opinion that asset prices should be impossible to predict if asset prices reflect all relevant information have a long history. Contrary to this opinion lot of empirical studies followed in the early work on predictability by Fama (1965) that first-order autocorrelations of daily returns on the stocks of large firms are positive but that such predictability is with small effect. Fama and Schwert’s (1977) examined the relations between stock returns and inflation and they found that in periods of high short-term interest rates there is the tendency of aftereffects by lower stock-market returns. Campbell and Shiller (1988) found that long moving average of real earnings helps to forecast future real dividends and ratio of this earnings variable to current stock prices is a powerful predictor of the return on stocks when the return is measured over several years. Consistent with the limited predictability over very short horizons, Fama and French (1988)

`

documented that the power of dividend yields to forecast stock returns, measured by regression R^2, increases with the return horizon.

Controversy about market efficiency centers largely on return predictability on the information of history prices. Fama (1991) redefined the 1970 view of weak-form to how well do past returns predict future returns. Predictable anomalies of these empirical results seem to be inconsistent with maintained theories of asset pricing behavior, as Schwert (2002) argue that they indicate either market inefficiency - profit opportunities or inadequacies in the underlying asset-pricing model. According to Fama (1998), consistency with the EMH is for two basic reasons. In the first Fama (1998) argue that the anomalies are chance results, apparent overreaction to information is about as common as underreaction, and the second was that the apparent anomalies can be due to methodology, most long-term return anomalies tend to disappear with reasonable changes in technique. From these results, Cochrane (2011) argue the most of the puzzles and anomalies that we face amount to discount rate variation as price-dividend variation corresponds to discount-rate variation. Further, He questions whether theoretical models are able to generate such high variability in the discount factor, as most applications still implicitly assume expected returns from the CAPM, and therefore that price changes only reveal cash flow news. The most interesting criticism is about Shiller (2003) interpretation of the variation in risk premiums, the variation in risk premiums is too big to be explained with rational expectations across the business cycle. He sees irrational optimism and pessimism in investor's heads due to incorrect information processing as meaning that the market is inefficient and irrational and open to question the presumption that asset markets always work well and that price changes always reflect authentic information.

1.1.2 Present Value Model (PVM)

From the previous section, we understand that EMH states that the price of an asset at some time should fully reflect all the available information at that time. This has often been tested by using the PVM of stock prices as McMillan (2010) to examine returns predictability. One way of explaining the impact of economic activity on the stock prices is the PVM framework, where current stock price is determined by expected future cash flows and the discount rate and all economic activity factors that affect the expected future cash flows or the discount rate are bound to impact the stock price. Humpe and Macmillan (2007) suggest the use of PVM as all macroeconomic factors that influence future expected cash flows or the discount rate should have an influence on the stock price. Further, Humpe and Macmillan (2007) discussed the work of Chen, Roll and Ross (1986) that used a PVM framework to investigate the impact of systematic risk factors upon stock returns, through factor influences on future cash flows or the discount rate of those cash flows.

The theoretical framework for the analysis of the PVM, which we call upon to answer impact of economic activity on stock is analytically discussed in McMillan (2010), where the movement of share prices over time is given by the present value of future cash flows:

$$Pt = \frac{1}{1+R}\left[E_tP_{t+1} + E_tD_{t+1}\right] \quad (1)$$

where P_t is the stock price at time t, Dt is the dividend paid on the stock in time period t, $1=(1 + R)$ is the discount factor, where R is the constant required rate of return on the stock, while E_t is the expectations operator conditioned on information up to t.

A solution to equation (1) is provided by imposing the transversality condition and substituting recursively for all future prices this relates the stock price to discounted expected future dividends, with the discount rate constant and equal to the required rate of return we can obtain one of its variations the Dividend Discount Model (hereinafter: DDM) of stock prices:

$$Pt = Et\left[\sum_{k=1}^{\infty}\left(\frac{1}{1+R}\right)^k D_{t+k}\right] \quad (2)$$

The equation (2) show fundamental value for asset prices and provide a unique price. Then McMillan (2010) follow Campbell and Shiller (1987), should the PVM hold then stock prices and dividends will be cointegrated, with a cointegrating vector *(1, 1/R)*, that is:

$$Pt - \frac{Dt}{R} = \left(\frac{1}{R}\right)Et\left[\sum_{i=0}^{\infty}\left(\frac{1}{1+R}\right)^i \Delta D_{t+1+i}\right] \quad (3)$$

The equation (3) reflects the difference between the stock price and reciprocal required rate of return times the dividend, where this is equal to the expected discounted value of the future changes in dividends. If changes in dividends are stationary, the right-hand side of equation (3), then the left-hand side should also be stationary. In this occurrence, there is a linear combination of stock prices and dividends which are also stationary or the DDM of stock prices should hold when stock prices and dividends are cointegrated. Further, McMillan (2010) discussed that if the expected stock returns are time varying, and then the exact PVM becomes nonlinear, where Campbell and Shiller (1988) suggested an approximate log-linear PVM for use in this case:

$$pt = \frac{k}{1-\rho} + Et\sum_{j=0}^{\infty}\rho^j\left[(1-\rho)d_{t+1+j} - r_{t+1+j}\right] \quad (4)$$

where the lower case letters p, d, r denotes the logarithms of prices, dividends, and the discount rate respectively. The symbols ρ and k denote linearization parameters, which are

$\rho = 1/[exp(d - p)]$ and $k = -log(\rho) - (1-\rho)\ log(1/\rho - 1)$. The equation (4) can be representing in terms of the log dividend-price ratio or dividend yield:

$$dt - pt = \frac{k}{1-\rho} + Et \sum_{j=0}^{\infty} \rho^j [-\Delta d_{t+1+j} - r_{t+1+j}] \qquad (5)$$

Lastly, McMillan (2010) discuss the relationship in equation (5) which states that the dividend-price ratio will be stationary provided that changes in dividends and the discount rate are stationary, and that implicitly log prices and log dividends are cointegrated with a cointegrating vector of $(1, -1)$. Therefore the statistical analysis of equation (5) only testing the stationarity of the log price-dividend ratio and does not require estimation of the cointegrating parameter. In brief, regarding market expectation in equation (5) McMillan (2010) showed that if dividends are expected to grow, then current stock prices will be higher and the dividend yield will be low, while if the future discount rate is expected to be high, then current stock prices will be low and the dividend yield will be high.

This approach of Campbell and Shiller (1988) investigated the determinants of the dividend-price ratio, d_t/p_t . However, according the basic asset pricing theory which postulates that dividend-price ratio should relates expectations of future dividend growth and discount rates. Hence, for simple expression of the dividend-price ratio and assumption of no uncertainty, d_t/p_t can be described as a generalized relationship with constant dividend growth at rate g, and a constant discount rate R, which point to $d_t/p_t = R\text{-}g$. This formula is the most common and uncomplicated expression of a DDM, the so-called Gordon formula.

1.1.3 Capital Asset Pricing Model (CAPM)

Before turning to the cross-section of assets, from previous sections we understand that movement of stock price over time is expressed by the present value of future cash flows generated from owning the stock. One of distinguishes on the stock market is when some specific stock is more highly valued than another at the same time. According to Fama (1990) expected future cash flows and the discount rates are relevant for pricing of stocks. According to Cochrane (2011), “Macro theories” tie discount rates to macroeconomic data, such as consumption or investment. This means that they reflect time preferences in the economic activity as well as a risk premium. Generally, investors are risk-averse, they should demand a higher expected return when there are more risky assets with similar expected return.

The main intuition for CAPM dating back to the pioneer of Modern Portfolio Theory and model of the portfolio, developed by Markowitz (1959). In portfolio model of Markowitz, investors demand compensation for selection of portfolio in the framework of mean and variance for the period of investment. Fama and French (2004) discussed that “investor

`

choose "mean-variance-efficient" portfolios, in the sense that the portfolios 1) minimize the variance of portfolio return, given expected return, and 2) maximize expected return, given variance", where this approach is often called a "mean-variance model".

The CAPM use mathematical consideration of the portfolio model to include weights of a specific asset in portfolio regarding efficiency between mean and variance and take the opportunity of mathematical postulates to translate into a statement that relates risk and expected return by identifying a portfolio that is efficient.

Then, the CAPM developed by Sharpe (1964) and Lintner (1965) probe the effects of risks and how is related to expected returns of an investment relative considering the market portfolio. The CAPM and considered market portfolio have two crucial assumptions regarding basics set of Markowitz portfolio model. According to discussions of Fama and French (2004), the first assumption is complete agreement of risk aversive behavior of investors and they always search to minimize their portfolio risk within a given level of expected return and the second assumption is that all investor borrow and lend at a risk-free rate without condition to amount that is borrowed or lent.

The portfolio theory said that investors search and select portfolios that are efficient in term of the relationship between the mean and variance, and set up along the efficient frontier for portfolios. In short, Fama and French (2004) describe that CAPM assumes market portfolio which must be minimum variance frontier if the asset market is to clear, actually algebraic relation that holds for any minimum variance portfolio must hold the market portfolio. The CAPM algebraic statement when there are N risky assets is as follows:

$$E(Ri) = Rf + [E(Rm) - Rf]\beta im;\ i = 1,..N \qquad (7)$$

In equation (7), *E(Ri)* is the expected return on asset *i*; *Rf* is the risk-free rate of return; *E(Rm)* is the expected return of the market portfolio and *βim* is the market beta of the asset *i*. The above equation (7) express that for an asset *i*, expected return is determined by the risk-free rate *Rf* plus a risk premium, which is the product of premium per unit of beta risk *[E(Rm) – Rf]* times asset's market beta *(βim)*.

Fama and French (2004) discussed that in early test there is rejection of above version of CAPM, where researchers used historical time series data of assets to estimate market beta of that assets and after they found a positive relation in line with theory, but the estimated regressions coefficient suggest that the intercept is greater than the average risk-free rate and the coefficient on beta is less than the average excess market return.

To address the inference problem in cross-section regressions due to the correlation of the residuals, Fama and MacBeth suggest an alternative approach to testing the CAPM. Fama and French (2004) elaborate that this methodology instead of consideration to set only a single cross-section regression of average monthly returns on betas, it estimate month-by-month cross-section regressions of monthly returns on betas. Then Fama and French (2004) explained that methodology calculates the times-series means of the monthly slopes and intercepts, along with the standard errors of the means and finally are used to test whether the average premium for beta is positive and whether the average return on assets uncorrelated with the market is equal to the average risk-free interest rate, which is consistent with theory. Following Fama and French (2004), the correct standard errors of the average intercept and slope can be calculated by the month-to-month variation in the regression coefficients. This methodology becomes standard and is still use to test multi-factor models in cross-section.

1.1.4 The Arbitrage Pricing Theory (APT)

The APT was developed by Ross (1976) as a substitute to the CAPM, where asset's expected returns and covariance instead of to be related to market portfolio return in case of CAPM intended to be related to other random variables which tend to be explanatory for the same asset. According to Huberman and Wang (2005), the slope coefficient in the linear relation between the assets expected returns and the covariance in factor structure is interpreted as a risk premium and is closely connected to mean-variance efficiency which is motivation for the application of the APT. The difference between the APT and CAPM is also perceived when APT use multiple risk factors that may affect an asset's expected return and scale the risk premiums associated with each of these factors. On a fist sight, the APT framework looks comfort in regard used set of risk factors, but there are no theoretical foundations for the factors that should be included in the risk-adjusted return of the assets.

For example, Chen et al. (1986) with the application of the APT framework in their study, analyzed the stock market and economic activity and found that economic forces affect dividend payouts and future cash, where this relationship include both risks that may be either systemic or individually to considered assets. The general algebraic statement of APT model with multiple risk factors is shown as follows:

$$E(Rit) = \lambda 0 + \lambda 1 bi1 \dots . \lambda j bij + \varepsilon it \qquad (8)$$

In equation (8), *E(Rit) is* expected return of asset *i* at time *t*; λ_0 *is* risk-free rate of return; *λj is* assets return sensitivity (price of risk) to economic factor *bj* of asset *i*.; *εit*, the error term, represents unsystematic risk or the premium for risk associated with assets *i* that cannot be diversified.

Furthermore, Huberman and Wang (2005) discussed that the APT helps to different practical applications due to its simplicity and flexibility and point to a three areas of applications: asset allocation, the computation of the cost of capital, and the performance evaluation of managed funds. The motivation to use APT in asset allocation employ link between factor structure and mean-variance efficiency in the case when there are multiple factors. According to Huberman and Wang (2005), this implies the existence of multiple assets that extend the efficient frontier and an investor can construct a mean-variance efficient portfolio with multiple assets. The fact that APT is asset pricing model, should allow the calculation of the cost of capital. Further, Huberman and Wang (2005) point that different studies use different factors and consequently obtain different results and this is a reflection of the main drawback of the APT which theory does not specify what factors to use. Lastly, Huberman and Wang (2005) explain "when using the APT to evaluate money managers, the returns of managed funds are regressed on the factors and the intercepts are compared with the returns on benchmark securities such as Treasury bills".

1.2 What is Best and What Works in Practice

We reviewed the main theoretical asset pricing models that have been first developed and second used to determine fundamental value of assets, especially stock prices. The focus of each model is to explain observed prices or to fit better with the market data considering all their strengths and weaknesses of the model.

The EMH was recognized as a cornerstone of the modern financial theory due to influence in explaining the behavior of the stock market and suggesting that the price should always equal the fundamental value. According to Wilson and Marashdeh (2007), there is market inefficiency in the short-run and it ensures market efficiency in the long-run via equilibrium corrections. Specifically, Wilson and Marashdeh (2007) demonstrated that short-run disequilibrium behavior describes market inefficiency with the possibility to be obtained profits and then consequently arbitrage activity moves the foreign exchange and stock markets to long-run equilibrium, which consistent with market efficiency in the long-run.

Following the review, the PVM assume that the present value of a capital asset is equal to its future cash flows or in the case of stocks right on future dividends, discounted to the present. According to McMillan (2010), the empirical evidence has suggested that the validity of the PVM show weakness that in its simplest form does not hold and the relationship between prices and dividends should be characterized by non-linearity or long-memory in the context of prolonged deviations from the equilibrium.

All economic activity factors that affect future expected cash flows or the discount rate and these cash flows are discounted are influencing the assets. According Humpe and Macmillan (2007), the advantage of the PVM model is that it can be used to focus on the long-run relationship between the stock market and economic activity variables, then they confirm the previous claim with Campbell and Shiller (1988) estimation of the relationship between stock prices, earnings and expected dividends, where they find that a long term moving average of earnings predicts dividends and the ratio of this earnings variable to current stock price is powerful in predicting stock returns over several years. Further, Humpe and Macmillan (2007) point to Campbell and Shiller (1988) that they conclude that these facts make stock prices and return much too volatile to accord with a simple present PVM. The empirical results show that in the long run, the stock prices behave as predicted by the PVM, but in the short-run stock prices can deviate considerably from the model.

The CAPM determined the expected return of asset trough method of calculating the risk associated with holding single assets and related to market risk. Theoretical criticism associated to the CAPM point to underlying assumptions, such as unlimited lending and borrowing at the free risk rate without taxes and transaction cost. According to Fama and French (2004), Roll argues that the CAPM has never been tested and theoretically is not clear which assets can legitimately be excluded from the market portfolio, and limits the assets that are included or excluded in the market portfolio. Fama and French (2004) discussed that CAPM risk-return relation can be used to estimate the cost of capital, the calculation is to estimate an asset's market beta and combine it with the risk-free interest rate and the average market risk premium and to produce an estimate of the cost of equity. Further Fama and French (2004) clarify the considered weaknesses in empirical work of researchers, who found that relation between beta and average return is flatter than predicted by the CAPM and as result, CAPM estimates of the cost of capital for high beta stocks are too high and estimates for low beta stocks are too low.

The application to measure the performance of mutual funds with use of CAPM, Fama and French (2004) clarified with explanation to be estimated the CAPM time-series regression for a portfolio and used the intercept to measure abnormal performance, but the problem is that, because of the empirical failures of the CAPM, even passively managed stock portfolios produce abnormal returns if their investment strategies involve tilts toward CAPM. This pattern means that funds that focus on low beta stocks, small stocks or value stocks will prone to make positive abnormal returns relative to the predictions of the CAPM, even when the fund managers do not have any special talent for picking winning assets.

Finally, Fama and French (2004) suggest continuing with the CAPM as an introduction to the fundamental concepts of portfolio theory and asset pricing which helping to be built more complicated models, but also to warn of simplicity and empirical problems probably invalidate the CAPM use in applications.

Generally, the CAPM due to dependence on underlying assumptions was criticized, which led to the result of the development of APT by Ross (1976). In APT there is not an issue to the same rigid assumptions as in CAPM, it provided an advantage over the CAPM in the ability to specify more than one source of risk for capital assets. Thus the APT was presented as a multi-risk asset pricing model and model shortcomings were identified as the methodological issues that scope the estimation of such a model.

The critique of applying the APT is a problem in specifying the risk factors, which can be constructed by using some variables, such as economic activity data or finding asset portfolio that has a high correlation with a certain risk. In the case of including economic activity variables in APT, the methodology will be to start with estimated covariance matrix of asset returns and considered variables and uses judgment to choose each risk factors.

1.3 Determining the Cash Flow and Discount Rate

Previously considered findings in the behavior of the stock markets, such as predictability, excess volatility and high return premium on assets, create additional need for extensive study what cause this movement in expected returns of assets over time. The belief is that investors update their expectations of future cash flows, in the case of stocks dividends, or discount rates as relevant information's are disclosed. To recall from PVM, since stock prices are equal the present values of future dividends, then stock price movements will be unexpectedly due to the news about future dividends and discount rates. Thus, can be imposed return decomposition into the aggregate market and break the market return into news about future cash flows and news about future discount rates. According to the covariance between individual news components and stock returns, different types of betas can be calculated. Campbell and Vuolteenaho (2004) argued that market return variance considered as market risk symbolized the uncertainty about cash flow shocks and discount rate shocks. Then they take single market beta of an asset from CAPM and break into two components, first connected with cash flow news and second connected with discount rate news. The cash flow beta is a "bad beta" because poor returns are driven by a decrease in cash flow purely are long lasting permanent wealth loss. The discount rate beta is a "good beta", not in absolute terms, but relative to "bad beta" because poor return driven by an increase in discount rate will be compensated by improved prospect for future returns and thus only has a short-lived transitory wealth impact.

The consumption or wealth shocks can generate a shift in risk premium and predictability of returns due to the difference of investors risk preference. As findings for "bad beta" and "good beta" suggest, the anticipation of investors should be more risk averse to cash flow shocks as they will demand a higher risk premium to hold bad beta than to discount rate shocks and holding good beta stocks. The theoretical modeling of assets prices has key relevance in anticipating of cash flow news and discount rate news. Some researchers are focused on discount rates, such as Campbell and Cochrane (1999) focus on time-varying discount rates with changing risk aversion, while other on cash flows, such as Bansal and Yaron (2004), investigating the role of cash flow risk and provide empirical support for the view that the observed aggregate consumption dividend growth process contains a persistent component that imposes long-term risks

Chen, Da and Zhao (2013), analyze both firm and aggregate levels, using alterable cash flow and measures within different horizons. They found in stock returns that there is a significant component of cash flow news and that its importance increases with the investment horizon, where at horizons beyond two years, cash flow news is a more important share of stock returns than is discount rate news. Further, Chen et al. (2013) conclude that previous holds at both the firm and aggregate levels and diversification play a secondary role in affecting the relative importance of cash flow or discount rate news in driving stock returns. In addition, Vuolteenaho (2002) findings suggest that cash flow information's is largely firm-level specific and discount rate information is predominantly driven by systematic, market-wide components. He further shows that cash flow news is more easily diversified away in portfolios than discount rate news.

Campbell, Polk, and Vuolteenaho (2005) explore the systematic risks for value and growth stocks and they find that the cash flows of growth stocks are especially sensitive to temporary variations in aggregate stock prices, driven by variations in the equity risk premium, while the cash flows of value stocks are specially sensitive to permanent variations in aggregate stock prices, driven by market-wide shocks to cash flows. In reality, the both expected cash flows and discount rates are not perceivable and basic procedure is to predict them and to calculate cash flow information's and discount rate information's as functions of the predictive variables.

2 ECONOMIC ACTIVITY VARIABLES SELECTION AND VALIDATION

The news about the changes in economic activity variables and commodities prices are very extensive and often available in public media and creating an opportunity for investors to include them in their calculations of the future stock returns and make an investment decision. Drawing for previous consideration in this study was acknowledged that the stock market is influenced by economic activity variables and commodities prices to the proportion that they impact discount rate and cash flows of stocks. PVM or DDM framework is sound theoretical fundament to inquire into the influence of economic activity variables and commodities prices on stock returns, finding variables that influence both or individually future cash flows and discount rate of assets. For instance, there are numerous cases when researchers used PVM framework for selection of variables of interest. One from them is Chen at al. (1986) who found that stock market returns are significantly explained by considered variables which were selected with PVM. The considered variables are 1) yield spread between long and short-term government bonds, 2) yield spread between corporate high and low-grade bonds, 3) industrial production growth, 4) expected and 5) unexpected inflation. All previously mention empirical evidence examined the impact of the stock market on aggregate investment and largely ignored labor market variables. This large empty space of not using labor market variables is surprising, especially because employment and the stock market are key factors in the understanding of aggregate economic fluctuations, where employees and corporations are connected in the markets for goods and services, labor and capital, and financial assets. Considering aggregate economic conditions, Boyd, Hu and Jagannathan (2005) found that in times of economic expansion the increasing unemployment is “good news”, while during economic recessions is “bad news” for the stock market.

Further, Boyd et al. (2005) define three important levels of relevance for valuing stocks regarding disclosed news of unemployment, where they see applicability can influence future interest rates, stocks risk premium, and corporate dividends and earnings. Specifically, the relative significance of these three levels of relevance is altered over time with conditions of the state of the aggregate economy. For instance, in periods of economic expansion unemployment news influence interest rates and then stock market, while during recessions unemployment new influence future corporate dividends and the stock risk premium.

Other researchers, focuses on selecting economic activity variables which impact volatility of stock market return. According, Flannery and Protopapadakis (2001) found among real economic activity variables that: 1) employment and unemployment, 2)balance of trade and 3) housing starts are strong risk elements for explaining higher volatility of stock returns, but on the other hand is surprising that two favoured performance factor of aggregate economic activity: 1) real GNP and 2) industrial production failure to appear as important risk elements, as the announcements of real GNP are connected preferentially with lower than higher stock return volatility. For example, in the U.S. the unemployment rate news is bundled with WAGE, expressed in weekly hours, and employment in levels, such appearance in public is the very first indicator of economic activity tendency which is announced in each month. Further, these indicators are employed to build the rest of economic activity variables such as industrial production, personal income, and productivity, which are announced late in the month.

This finding allows us to integrate PVM or DDM framework as basic fundament to probe the influence of labor market variables, commodity prices, and stock returns, through the impact on future cash flows or the discount rate of the assets.

2.1 DDM – Earnings

Present stock market prices are strongly affected by all expected future dividends which are a fixed fraction of earnings. According to, Ackert and Smith (1993) may not be true that dividends are reflecting all actual news about economic activity fundamentals. This behavior points to corporations that are managed by executives, who already manage overall operations and resources of entities, and their corporate decisions over time considering directly or indirectly allocation of dividends and may not track the actual economic activity. Further, Lamont (1998) argued that both dividends and earnings can be used to estimate stock returns, because they are safe and individually capable of being recognized as valuable variables, where dividends importance is related to the meaning to possess the shares of some stock, while earnings of corporations are linked with aggregate economic activity conditions as source of news about current business environment.

Recent economic developments in U.S. with house price bubble which led to the financial crisis in 2007 put forward that economy is drawing to the state of a liquidity trap. This can be compared with Krugman (1998) as suggested for the Japanese economy in the period during the late 1990s and early 2000s, which was hurt by a liquidity trap. In that case, no matter what the central bank does with the current money supply, it cannot stimulate the economy to restore full employment. Consideration of labor market variables in this economic environment and their influence to aggregate economic fluctuations will affect stock market prices. As Akerlof, Dickens and Perry (1996) pointed in a period of low inflation labor market have downward nominal wage rigidity, which creates too high wages and too low employment due to the behavior of employers that are reluctant to decrease wages of their employees, because they are afraid of morale and staff retention problems. Further, debtors in periods of financial crises are enforced to decrease their spending when their debt increase, while creditors are reluctant to increase their spending by the identical amount, so the saving are not transferring to the income side to be used for buying goods and services. Higher labor cost, higher unemployment associated with slower growth and falling consumption will put in pressure firms revenues (and earnings).

My intention is to present aggregate earnings as function determined by aggregate revenues and aggregate compensation for employees. I will proxy revenues by a product of IIP times PPI and use a proxy for compensation of employee’s byproduct of wage earnings, times EMP.

2.2 DDM - Earnings Growth

The stock market is generally progressive and dynamic, where the changes in the valuation of stock returns will resume being considered by expectation in economic activity, especially for dividend yield and earnings growth. If we look in essence of stock market returns, fundamentally it can be expressed as adding earning growth and dividend yield together. The study of Campbell and Shiller (1988) confirms the importance of earnings growth and dividend yields in the long-run in affecting stock market returns. As our study will consider different countries, domestic economic activity events will be very important in a relationship with dedicated stock markets. The GDP growth gives the intuition about growing possibilities of the specific stock market, where economic growth of each country can be expressed by 1) the population growth and 2) productivity growth rate and adding together they produce the GDP growth. Population growth is valuable variable for economic growth as implicated employment to grow and consequently to be produced more output, while productivity means to do more output with the fewer employees and can be defined by output per employee per hour. Finally, growth in aggregate output and income, enabled by productivity improvements will be also favorable for the growth of the stock market. Landmann (2004), pointed to Krugman that the three most significant elements for the overall economy are: 1) productivity, 2) income distribution and 3) unemployment, where he cited him with:"If these things are satisfactory, not much else can go wrong; if they are not, nothing can go right. Further, Landmann (2004) explains the main reasons of today that the average employee produces to a greater extent than employees in the past periods. They reasons are due to that today employees have more physical capital, better educated and all that enabled by technical advances related to technological progress. According to, Landmann (2004) considered "fundamental identity", which links: employment, output and labor productivity with pure arithmetic:

$$output = employment \times productivity, \quad (8)$$

which, for small rates of change, can approximately be translated into

$$output\ growth \sim employment\ growth + productivity\ growth. \quad (9)$$

where my intention is to determine GDP growth as a function of employment growth and labor productivity growth, where labor productivity can be expressed as a function of IIP and EMP.

2.3 DDM - Risk-Free Rate of Return

Merton (1973, 1980) suggested that required return demanded by shareholders can be divided into two parts, first is a risk-free element and a second is a risk premium element. The choice of the risk-free rate element in required return on some investing generally is equivalent to the duration of the bond rate which corresponds with dedicated investment period. For instance, in the case of U.S. stock market, the earning yield can be derived when adding, the risk premium of U.S. stock market and bond yield of 10 year Treasury, where the bond is a substitute for the risk-free rate.

As previous was mentioned, researchers found a negative relation between inflation and stock prices, as suggest findings of Fama and Schwert (1977), and Chen et al. (1986). This evidence advocated that in times of increasing nominal inflation, the policy maker increase nominal interest rates and tightened the economic conditions. Consequently, it will lead to a decrease of bonds prices or increase of bond yields and will affect nominal risk-free rate which will on the end of the day increase discount rates in valuation models and more likely put stock market on downside track. Contrary to previous researchers, Glasner

`

(2011) found evidence of opposite relationship between inflation rate and stock returns in the period after financial crises of 2008 which were accompanied by weak demand. He found a positive link between stock prices and expected inflation, and advocated that in weak demand economic conditions the real interest rates decrease due to drop in profit expectations, where the main outcome is to expect inflation to rise over real interest rate in order to create optimism in the economy.

In periods when discount rates experienced increased expectations, the presumption is that stock prices will decline, but in some cases of economic optimism, the counter effect would come from increasing expectations about future cash flows of stocks. According to, Krugman (2011, January 19) four-week moving average of weekly jobless claims is a pretty crude indicator of expected economic performance and fluctuations in long-term US interest rates.

The change in inflation often is connected to changes in nominal interest rates and to any extent changes in the nominal interest rates can influence changes in the discount rates, which successively affect cash flows and consequently stock prices. In this study, I will use the CPI as a proxy for the inflation, where it calculated average changes in prices of domestic goods and services during a specific period of time.

2.4 DDM - Risk Premium

There are attempts to find a relationship between movement in consumer sentiment (confidence) and stock prices. The intuition is that when consumers are optimistic, they purchase or demands more goods and services, which increase spending and stimulate the whole economy and hence stock prices. Further, consumers are also investors and might exist a connection between changes in consumer sentiment and changes in the confidence of individual investors.

Chowdhury (2011) questioning whether stock market risk premium responds to consumer confidence, and he finds that the increase in the equity risk premium essentially considers a provisional fall down in consumer confidence. The empirical analysis of Chowdhury (2011) suggested that the changes in consumer confidence causes changes in the equity risk premium over the analyzed period between 1970 and 2011 and showed that the equity risk premium continues to exist to a greater extent probably because of consumer confidence remains low. Consequently, when the CONF regain to recover and optimism increases the equity risk premium should return to the range which was lower and as a result the required return among stock market investors should also reduce. For risk premium proxy my suggestion is to use National consumer sentiment or confidence indexes like Consumer confidence index by the Conference Board for U.S, which is based on household consumer confidence survey.

2.5 Stock Market and Commodities

Understanding of the relationships among strategic and widely traded commodities (such as gold, silver, copper and oil), economic activity variables and stock market index is in the interest of policy makers, whether it is for commodity consuming or importing countries. Investment in commodities provides an alternative to stock markets, and this fits the need to put under consideration commodity prices, whether investors can switch between commodities and stocks to diversify stock market risk in portfolios.

There are varied findings regarding the direction of the causal link between the widely traded commodities (gold, silver, copper and oil) and economic activity variables. For instance, Pindyck and Rotemberg (1990) find unidirectional causality from economic activity variables to commodity prices, while later contrary, Awokuse and Yang (2003) find that commodities have information on predicting of industrial production, inflation, and interest rate. This mean that increase in commodity prices increased expectations in inflation and lead to tightened monetary policy and increases in interest rates.

On the other hand, interest rates influence commodity prices and their volatility through more economic activity channels. For example, interest rates influence construction which already uses copper and silver to a greater extent among other industrial metals. Further, interest rates influence consumer demand for durables goods, which use industrial metals as silver and copper in their manufacturing processes and finally affect business investment in plant and equipment which use industrial metals likewise. Therefore, the key topic is to understand how economic activity variables related to commodities. In our study, I will use these four commodities: gold, silver, copper and oil as they are among the most widely traded on the world market and are considered as strategic commodities.

2.6 Oil and Copper Prices

The oil price, for example, is determined by the interaction of supply and demand, the forces of the market, and as well by the policies of world commodity organizations such as OPEC. Hamilton (1988) stated that the increase in the cost of production will lead to higher consumer prices and the cost is transferred to the consumer, therefore, it lead to lower demand and consumption since the purchasing power of consumers were dropped. In the view of macroeconomics, lower consumption could lead to the increasing of unemployment due to the reason of lower production. The considerable increase and collapse of crude oil prices in 2008 has expanded public attention and attention in commodities markets. Especially, there is debate in academic and professional community about whether speculation caused dramatic increases in crude oil prices and the cost of energy, or otherwise according to Hamilton (2009) and Kilian (2009), oil prices dramatically raised in 2008 because world demand had been speedily increasing, pushed by growing emerging economies such as China and India and oil prices later collapsed when the financial crises from 2008 caused global demand to dim.

The evidence of empirical analysis regarding influence between oil and stock prices has been varied. For instance, Chen et al. (1986) advocated that oil prices are negatively related to stock returns and are a measure of economic risk for US stock market. Further, Kilian (2009) found that reaction of real growth and inflation due to demand and supply shocks in the crude oil market for the US lead to impact in the discount rate of valuation models for stock returns. Finally, Kilian and Park (2009) suggests that increase in oil prices cause lower stock prices when circumstances are relevant only to particular demand shocks which are attributed to higher demand for oil due to expected shortfall of future oil supply. Contrary, positive shocks to the intense in world demand regarding industrial commodities cause increase in both oil and stock prices, which describes the boom in the stock market and oil prices in 2008 for the US.

Global industrial production has recovered the ground lost during the last recession, with emerging economies are well above the previous peak, but advanced economies are still well below pre-crisis output with high unemployment and rising commodity prices.

The copper is different when compared with other commodities: gold, silver, and oil because it is cheaper, weighty and ample. This attributes of copper influence market participants normally to do not stockpile and speculate on it. According to Lahart (2006), the copper price has a substantial relationship with different segments of economic activity and it is named as metal with a Ph.D. in economics or Dr. Copper due to an accurate indicator of the business cycle. Despite all, copper can be regards as an instrument which measures the real economic activity instead of unreasonable stake on its future value.

Understanding the relation among copper, oil and stock market prices in developed and emerging economies is an important issue to study because as emerging economies continue to grow and success, they will employ a larger influence over the global economy. In the study, I will select these variables, copper and oil prices, as independent to examine how they affect dependent variables of interest: stock index, gold and silver prices.

2.7 Gold and Silver Prices

During the period of time fluctuations in economic activity cause the economy to experienced intervals of growth and contraction. In this altering interval when the economy grows and contracts, the broad stock market indexes upsurge and decline respectively. The backed of economic fluctuation can be presented by public opinion of the investment in gold which stated that it will provide insurance during contractions, where gold maintains its value and during expansions long-established opinion that gold can be used as a hedge against inflation. The past events suggest that during the periods of economic activity contraction and stock market collapse the gold prices always moved higher. Therefore is interesting to discover the influence of gold price fluctuations and stock market prices.

According to, Baur and Lucey (2010) for the long period gold has had a singular character as a hedging instrument, mostly when countries face with uncertainty environment due to economic activity and political instability. In addition, they analyzed the constant and time-varying relationship between stock and gold returns using daily data from 1995 to 2005 for the US, UK, and Germany and found that gold is a hedge against stocks on average and a safe haven in extreme stock market situations. Besides, they also found that gold as safe haven instrument is short-lived and suggested that investors sell gold when stock market volatility is lower. Furthermore, gold and stock price indices are not cointegrated which means that there isn't any long-run co-movement between them. This empirical evidence shows that when there are dramatic negative stock returns, investors acquired gold assets and disposed of it when stock market regain confidence and decrease volatility.

Ziaei (2012) analyzed ASEAN +3 countries and found a significant negative relationship between gold prices and the stock market with the only exception that gold price cannot be considered as a safe haven. According Ziaei (2012), gold and stock market price movements are running in reverse, where essentially means, when gold price grows investors will behave in a particular to pull out their investment from stock market which in turn decreased the price of stocks due to rapid selling and then invest in gold which in turn increase the price of gold due to rapid investment. Further, Barro and Misra (2013) find that volatility of the growth rate of real gold prices comparable to that of stocks is higher in periods with flexible exchange rate like in period from 1975 to 2011 than periods under the classical gold standard.

Moore (1990), questioned whether there is a relationship between gold prices and inflation, he used the leading index of inflation to study the link between inflation and the gold prices since 1970. The empirical evidence suggests that between 1970 and 1988, gold prices and the stock markets prices had a negative correlation, where gold price was rising when stocks prices were declining. But last 15 years the price of gold has not shown any correlation with inflation. The key fact is that gold stocks are held as a store of value and are equal to about 50 years worth of production. The gold is mainly held as an asset rather than actually consumed and is not tied to the flow of production and consumption, what is adding to the easy speculative demand.

Recently, Krugman (2011, September 10) has been studying the prospect of the higher real price of gold, whether is it results to some extent of future inflationary expectations or anything else. He concluded that real price of gold is high in some periods not because of higher expectations of inflation, but due to the low long-term real interest rates.

`

Historically, since the gold peg ended in 1970, real gold prices spike in late 70’s, when was a time of higher nominal interest rates with very high inflation and the real interest rates were near zero or negative, same as today economic environment. Fundamentally, De Long (2011, September 10) concluded that gold pays no dividends or interest and therefore is expensive to hold gold in the portfolio when real interest rates are high, but it is cheap to hold in the portfolio when real interest rates are low. This mean that in periods when real interest rates are high, investors should be assured that prices of gold will rise in order to hold it, otherwise they should sell it.

Looking at gold prices through real interest rates focus will be to understand the relationship with required rate of return and revenues (earnings) in equity valuation model. First, required rate of return is composed of real interest rate, inflation, and a risk premium. Second, revenues (earnings) depend on consumption, where real interest describes the relative price between consumption today and consumption in the future.

Silver divide some of the properties of gold as an investment metal but it is also an industrial metal which is used for industry purpose. According to, Lucey and Tully (2005) empirical evidence of a relationship between gold and silver is in common powerful and persuasive with significant intervals when there is a weak and disrupted relation. This result suggests that in common gold and silver will provide a little advantage when they are jointly held by investors due to their near relationship, but in some periods there is probable justification to hold both metals. Further, investment commodities like gold and silver are analyzed as safe havens by investors in times of economic activity contractions. In this study gold and silver are selected as dependent variables, despite stock index, to examine relations among those two kinds of precious metals and economic activity variables, copper prices and oil prices.

3 STATISTICAL ANALYSIS METHODOLOGY

Here I will present and discussed the econometric methods that I will use in this study in order to answer the previously mentioned research questions with an outline of empirical methods framework. The methodology of determining the long-run, short-run relationships and causality among the selected stock indexes, commodities and economic activity variables in developed and emerging economies are based on Vector Auto Regression (hereinafter: VAR) models, such as ARDL bound testing approach of Pesaran and Shin (1999) and Pesaran et al. (2001), the ECM of ARDL and causality tests considering the Granger causality test based on the Toda and Yamamoto (1995) – (hereinafter: TY) testing procedure. Further, on the end of this chapter, I will provide the model's specification of the hypothesized relationships between the stock, gold and silver prices with economic activity variables, copper and oil prices.

`

3.1 Testing for Stationarity and the Cointegration Framework

Before we started with performing the tests of Cointegration and Granger causality it is essential to reveal the properties of the time series included in considered models, specifically the order of integration. Order of integration is the number of times that the time series has to be differenced, taking the difference between one value of a time-series and a previous value of that time-series, in order to make it stationary or the mean and variance of that time series to become constant and final. Firstly, verifying the order of integration is an essential for analyzing the time series in order to understand the long-run relationships among considered variables and become convinced that none of the considered variables are integrated of order two (I2) because that data will discredit the ARDL cointegration methodology. Secondly, we must determine the maximum order of integration of the considered variables in case of using the TY testing procedure to calculate the extra lags which need to be added to Vector Auto Regression (hereinafter: VAR) model. In this study, I will employ the Augmented Dickey-Fuller (hereinafter: ADF), Dickey and Fuller (1979), and Phillips and Perron (1988) - (hereinafter: PP) unit root tests to calculate the order of integration for each of considered variables and both tests are as a cross-check for result estimations. Namely, Amano and van Norden (1992) suggested that testing unit root with joint procedures can significantly enlarge the validity of the results. The differences between the ADF and PP unit root tests are mostly how they behave toward heteroskedasticity and serial correlation in the error terms. The ADF unit root test in its model add lagged differenced terms to correct higher order serial correlation, while Phillips and Perron (1988) corrects *t*-statistic of the coefficient from the AR(*p*) regression to account for the serial correlation in error term. For the ADF model, I will estimate the most common model which incorporates the both drift and linear time trend as in equation (10):

$$\Delta LY_t = \alpha_0 + \alpha_1 t + \gamma Y_{t-1} + \sum_{i=1}^{p} \beta_i \, \Delta Y_{t-i} + \varepsilon t \qquad (10)$$

The LY is the natural logarithm of the considered variables, $\alpha_{i,}$ β_i and γ are constant coefficients, t is time trend, Δ is first difference operator, εt is the error term and p is the lagged values of ΔLY. The following model for the PP unit root test is in equation (11):

$$\Delta LY_t = \alpha_0 + \alpha_1 t + \gamma Y_{t-1} + \varepsilon t \qquad (11)$$

The parameters of considered variables are the same as defined in the previous ADF test. The null hypothesis for both unit root tests, ADF and PP, is that $\gamma = 0$, which suggests that the considered variable has a unit root or it is non-stationary.

Since the order of integration for considered variables is established and known, next is to utilize the bounds testing approach according to Pesaran et al. (2001) to explore cointegration within the ARDL model in order to check support for the long-run

`

relationship among considered variables. The ARDL bounds testing procedure based on F test is used to check the existence of cointegration and ECM of ARDL will be used to estimate long-run and short-run dynamics among stock indexes, gold and silver prices with economic activity variables, copper and oil prices. The bounds testing approach has a favorable position when it is compared with other multivariate cointegration techniques like maximum likelihood procedure by Johansen and Juselius (1990). Contrary to other cointegration procedures, the ARDL bounds testing model can be relevant regardless of whether the considered variables are with a different order of integration when the model incorporate combination of stationary and non-stationary variables, I(0) or I(1). The ARDL procedure requires testing the stationarity of considered variables in order to be assured that none of the variables is integrated of the second order because it will invalidate the procedure. Further, ARDL model by Pesaran et al. (2001) includes only one equation structure, where considered variables can be set by separate lag order, which finally characterized the model as easy to used and discussed. The fundamental framework for ARDL bounds testing and F test check for cointegration include calculating the following autoregressive (AR) model:

$$y_t = \beta_0 + \beta_1 y_{t-1} + \cdots + \beta_p y_{t-p} + \alpha_0 x_t + \alpha_1 x_{t-1} + \alpha_2 x_{t-2} + \cdots + \alpha_q x_{t-q} + \varepsilon t \quad (12)$$

Giles (2013, March 6) analytically discussed the equation 12, “where εt is a random disturbance term, the presence of lagged values of the dependent variable as regressors will yield biased coefficient estimates and if the disturbance term, εt, is autocorrelated, the regression will also be an inconsistent estimator”. This model is Auto Regression (hereinafter: AR) because the depended variable y_t can be partially described by its lagged values (*p)* and model has one more distributed lag component described by lagged values (*q)* of independent variable x_t, where the following model can be noted as ARDL *(p,q)*.

Considering, generic ARDL model shown in equation (12), we can continue with Giles (2013, June 19) to discuss the analytical model in the case when there are three variables that we are interested: dependent variable *y*, and two explanatory variables x_1 and x_2. The generic approach will be *(k+1)* variables, where there are a dependent variable and *k* explanatory variables. A standard ECM for cointegrated variables expressed the speed of adjustment which occurs after a short-run shock in order to be restored long-run equilibrium among variables. The ECM has the following form:

$$\Delta y_t = \beta_0 + \sum_{i=1}^{p} \beta_i \, \Delta y_{t-i} + \sum_{j=0}^{q1} \gamma j \, \Delta x1_{t-j} + \sum_{k=0}^{q2} \delta_k \, \Delta x2_{t-k} + \varphi z_{t-1} + \epsilon t \quad (13)$$

In equation (13), *z* indicated the speed of adjustment or error-correction term which is derived from residuals of cointegrating regression:

$$y_t = \alpha_0 + \alpha_1 x_{1t} + \alpha_2 x_{2t} + vt \qquad (14)$$

According to Giles (2013, June 19), "the ranges of summation in (13) are from *1* to p, *0* to q_1, and *0* to q_2 respectively. We've now replaced the error-correction term, z_{t-1} with the terms y_{t-1}, $x1_{t-1}$, and $x2_{t-1}$. From (14), we can see that the lagged residuals series would be z_{t-1}= (y_{t-1} - a_0 - $a_1 x1_{t-1}$ - $a_2 x2_{t-1}$), where the *a's* are the regression estimates of the *α's* and formulate an unrestricted ECM":

$$\Delta y_t = \beta_0 + \sum_{i=1}^{p} \beta_i \Delta y_{t-i} + \sum_{j=0}^{q1} \gamma j \, \Delta x1_{t-j} + \sum_{k=0}^{q2} \delta_k \Delta x2_{t-k} + \theta_0 y_{t-1} + \theta_1 x1_{t-1} + \theta_2 x2_{t-1} + \epsilon t \qquad (15)$$

In equation (15) the parameters θ_0, θ_1, θ_2 are the fitting long-run coefficients, while the parameters β_i, γ_j, δ_k are the short-run dynamic coefficients of the ECM of ARDL. According to Pesaran et al. (2001), this type of ARDL model is not restricting the coefficients and it is called a "conditional ECM".

Afterward, we should calculate the proper lag order of dependent (*1* to *p)* and explanatory variables (*0* to q_1 and *0* to q_2) for the model presented in (15). The determination of proper lag order for p, q_1, and q_2 is derived by the employ of selected information criteria's like Akaike's Information Criterion (hereinafter: AIC), Schwarz Information Criterion (hereinafter: SIC) and Hannan and Quinn (hereinafter: HQ). According to Giles (2013, July 24), these information criteria's are based on a high log-likelihood value, which is a measure of the quality of fit of a model and a "penalty" factor for including more lags in the model to achieve this, so the smaller the value of an information criteria the better the result.

Further, the validity of ARDL bounds testing procedure is based on the essential presumption that the error terms in equation (15) have to be serially independent. According to Pesaran et al. (2001), this demand will influence the decision of the lag order for p, q_1, and q_2 of the considered variables in order to be assured that inverse roots of the characteristic equation associated with the model lies inside the unit circle which implies that the model is dynamically stable.

The evidence of cointegration will be confirmed by performing of bounds test in ARDL model among considered variables. Following Giles (2013, June 19) in equation (15) will be carried out an "F-test" of the hypothesis H_0: $\theta_0 = \theta_1 = \theta_2 = 0$, against the alternative that H_0 is not true. The absence of cointegration happen together with zero coefficients for y_{t-1}, $x1_{t-1}$ and $x2_{t-1}$ in equation (15) and rejection of H_0 confirms a long-run relationship among considered variables. The accurate critical values for the "F-test" are at disposal for combination of I(0) and I(1) variables in tabulation of Pesaran et al. (2001), where there are lower and upper bounds on the critical values for the asymptotic distribution of the "F-stat" for different number of considered variables. The lower bound use as a basis presumption that all of the considered variables are I(0), while the upper bound use as a basis presumption that all of the considered variables are I(1).

`

Following Pesaran et al. (2001) when there is a combination of I(0) and I(1) variables the accurate "F-stat" may be lies between lower and upper bound of critical values. Practically, in the case when calculated "F-stat" is below the lower bound, the conclusion is that does not exist cointegration due to the variables should be stationary in levels, while when calculated "F-stat" is above the upper bound the conclusion is that exist co-integration. The results of "F-stat" which lies between the lower and upper bound of critical values pointed to inconclusive cointegration. Additionally can be performed checkup bound test of coefficient before y_{t-1} in equation (15) with the calculation of "t-stat" for hypothesis H_0: $\theta_0 = 0$ against the alternative H_1: $\theta_0 < 0$. However, when are compared "t-stat" for y_{t-1} between tabulated by Pesaran et al. (2001) and calculated, the greater "t-stat" than upper bound supports the existence of cointegration, while "t-stat" below the lower bound pointed to no cointegration.

Finally, Giles (2013, June 19) discussed that after the bounds test confirms existence of cointegration can be estimated relevant long-run equilibrium relation among the variables in equation (14) with ECM from equation (13), where $z_{t-1} = (y_{t-1} - a_0 - a_1x_{1t-1} - a_2x_{2t-1})$ and the $a's$ are the regression estimates of the $\alpha's$ in equation (14). However, from the "conditional ECM" in equation (15) can be calculated long-run influence at the state of long-run equilibrium when $\Delta y_t = \Delta x_{1t} = \Delta x_{2t} = 0$ and then the long-run coefficients for x_1 and x_2 would be $-(\theta_1/\theta_0)$ and $-(\theta_2/\theta_0)$ respectively. In the end, the coefficient (φ) of error correction term in the ECM of ARDL model show the speed of adjustment required to bring back the long-run equilibrium after a short-run disturbance.

3.2 Granger Causality Test

The previous discussion of ARDL bounds testing procedure describes how to detect cointegration and to select the relationship among the considered variables in the long-run and short-run. Given the importance to understand the direction of causality among considered variables can be determined by using the Granger (1969) test which is acceptable when there is no cointegration among considered variables.

Since first time presented in Granger (1969), Granger-causality test is used to find out whether one variable can be applied to predict another variable. Giles (2011, April 29) discussed the Granger-causality test, where the easiest way to understand it, is in case of two variables, X and Y: "X is said to Granger-cause Y if Y can be better predicted using the histories of both X and Y than it can by using the history of Y alone."

Following Giles (2011, April 29), analytical VAR model to test the existence of Granger-causality is presented with equations (16) and (17):

$$Y_t = a_0 + a_1Y_{t-1} + \cdots + a_pY_{t-p} + b_1X_{t-1} + \cdots + b_pX_{t-p} + ut \qquad (16)$$

$$X_t = c_0 + c_1 X_{t-1} + \cdots + c_p X_{t-p} + d_1 Y_{t-1} + \cdots + d_p Y_{t-p} + vt \qquad (17)$$

The regular test is focused on testing Granger non-causality which is a widespread application in economics. For that purpose we are testing hypothesis H_0 that coefficients in equation (16): $b_1, b_2, \ldots, b_p$ *are 0*, against alternative hypothesis H_1: not H_0, where test imply that X does not Granger-cause Y. In a similar manner for equation (17) is testing H_0: $d_1, d_2, \ldots, d_p$ *are 0*, against alternative H_1: not H_0 , where test imply that Y does not Granger-cause X, therefore in both cases, a rejection of H_0 implies that there is Granger causality between variables. In the first case, causality runs from X toward Y, while in the second case causality runs from Y toward X.

The standard Granger-causality tests in VAR models are dependent on presumption associated with considered variables to be stationary. According to Giles (2011, October 25), if the considered variables are non-stationary and no matter they are or not cointegrated, the Wald test statistic for Granger-causality will not have an asymptotic Chi-Square ($\chi 2$) distribution and results will become invalid. A second approach is when there are non-stationary variables and could be first to explore are they co-integrated and if that confirmed, then, in general, would be proposed to continue with Vector Error Correction Model (hereinafter: VECM), rather than to be employed VAR model. The generality of using unit root and co-integration tests is discussed by Pesaran et al. (2001), where this could be subject to pre-testing bias which arises from low power in the significance of the final test, in our case test of Granger-causality. To prevent some of these limitations, TY suggested a modified Wald test procedure test with variables in levels whether they are integrated of a different order or not cointegrated. In their procedure, they suggest adding additional lags derived from variables maximal order of integration (d_{max}) to the accurate lag order p of the VAR model and the specification of estimated VAR become with $p + d_{max}$ lag order. The coefficients of additional lags (d_{max}) are ignored in the Wald test in order to have outstanding asymptotically chi-squared distribution with p degrees of freedom.

Recall the pre-testing bias from previously connected with employing unit roots and cointegration before Granger-causality test, Clarke and Mirza (2006) confirmed that including extra parameters in a procedure which no need of pre-testing, like TY shows little loss of power in contrast to the other possibility of testing through VECM which imply cointegration. Further, according to TY the modified Wald test is justifiable when lag order p for the VAR model is not exceeded by a maximum order of integration for the considered variables included in the model. Additional shortcomings of TY are discussed by Giles (2011, October 25), where this procedure is inefficient and reduces power since extra unnecessary lags are added to the estimated VAR which is actually deliberately over-fitted compared to an accurately specified VAR model. Zapata and Rambaldi (1997) pointed to the problem of the sample when it is with extremely small size due to the test results with poor asymptotically chi-squared distribution and otherwise they preferred TY procedure rather than VECM model.

The basic analytical structure for testing the Granger causality according to TY procedure requires estimating the selected VAR (p + d_{max}) model:

$$Y_t = a_0 + \sum_{i=1}^{p} a_i Y_{t-i} + \sum_{i=p+1}^{p+dmax} b_i Y_{t-i} + \sum_{i=1}^{p} c_i X_{t-i} + \sum_{i=p+1}^{p+dmax} d_i X_{t-i} + ut \; ; \quad (18)$$

$$X_t = e_0 + \sum_{i=1}^{p} e_i X_{t-i} + \sum_{i=p+1}^{p+dmax} f_i X_{t-i} + \sum_{i=1}^{p} g_i Y_{t-i} + \sum_{i=p+1}^{p+dmax} h_i Y_{t-i} + vt; \quad (19)$$

In equation (18) and (19) the a_0, a_i, b_i, c_i, d_i, e_0, e_i, f_i, g_i and h_i are parameters of the estimated mode, d_{max} is the maximum order of integration of considered variables, *ut* and *vt* are white noise error terms of the model and t indexes time. From equation (18), testing that coefficients c_i are not equal *0* for *i=1 to p* confirms Granger-causality from *X* to *Y*, while from equation (19), testing that coefficients g_i are not equal *0* for *i=1 to p* confirms Granger-causality from Y to X. Following Giles (2011, October 25) the model will be estimated after 1) selection of the accurate lag order *p* with some information criteria such as AIC or SIC in order to have dynamically stable model and 2) determination of maximum order of integration d_{max} for the considered variables in the model. Finally, the VAR model with lag order p + d_{max} is estimated and the coefficients of additional lags d_{max} are ignored in the test to ensure classic asymptotic distribution.

3.3 Model Specification

According to considered view that changes in economic activity variables, copper prices and oil prices cause changes in stock prices, gold prices and silver prices (Chen et al., 1986; Lucey & Tully, 2005), this thesis aims to explain the relationship among stock prices, commodities, and economic activity. To do these effect three models were estimated using individually: stock indices, gold prices and silver prices as the assumed dependent variable, with same six economic activity variables, copper and oil prices being used in each model. Hypothesized functional relationships for this empirical research are given below and being used for each country in case of Brazil, Germany, Japan, Mexico, Poland, Russia, Spain, UK and the USA. Following three specifications of stock base model in equation (20), gold base model in equation (21) and silver base model in equation (22) are:

$$STOCKSt = f(COPPERt, OILt, EMPt, IIPt, CONFt, CPIt, WAGEt, PPIt) \quad (20)$$

$$GOLDt = f(COPPERt, OILt, EMPt, IIPt, CONFt, CPIt, WAGEt, PPIt) \quad (21)$$

$$SILVERt = f(COPPERt, OILt, EMPt, IIPt, CONFt, CPIt, WAGEt, PPIt) \quad (22)$$

`

where t denotes the variables at time t, COPPER stands for copper prices, OIL for oil prices, EMP for employment, IIP for industrial production, CONF for confidence index, CPI for inflation, WAGE for employee earnings and PPI for producer prices. The selection of economic activity variables, following Humpe and Macmillan (2007), a PVM model has been used to select and explain the impact of economic activity variables on stock prices in chapter 2. By taking the natural logs of both sides, estimable pre-specified multi-factor APT models are obtained as follows:

$$lnSTOCKSt = A + A_1 lnCOPPERt + A_2 lnOILt + A_3 lnEMPt + A_4 lnIIPt + A_5 lnCONFt + A_6 lnCPIt + A_7 lnWAGEt + A_8 lnPPIt + e_t) \quad (23)$$

$$lnGOLDt = B + B_1 lnCOPPERt + B_2 lnOILt + B_3 lnEMPt + B_4 lnIIPt + B_5 lnCONFt + B_6 lnCPIt + B_7 lnWAGEt + B_8 lnPPIt + u_t) \quad (24)$$

$$lnSILVERt = C + C_1 lnCOPPERt + C_2 lnOILt + C_3 lnEMPt + C_4 lnIIPt + C_5 lnCONFt + C_6 lnCPIt + C_7 lnWAGEt + C_8 lnPPIt + v_t) \quad (25)$$

where all variables are defined as earlier, A,B,C are constant parameters, A_i, B_i and C_i for $i=1,..,8$ are coefficients before independent variables and e_t, u_t and v_t are the white noise error term. This log conversion has been supported by Chen et al. (1986) since the conversion of variables into natural logs can be explained as growth rates on their first difference and elasticity for their coefficients in the long-run relationship through the cointegrating vector. In this chapter, the long-run and short-run relationship for each specified model of stock gold and silver prices with economic activity variables and copper and oil prices are discussed by using cointegration, error correction, and causality analysis. The ARDL approach proposed by Pesaran et al. (2001) is used for co-integration and error correction analysis. For causality analysis, TY test is employed. Having set out the analytical framework with the expected relationships between the stock indices, commodities, and economic activity variables, we move on to estimating the specified models.

4 RESULTS

The empirical analysis was carried out using proposed methodology. The study uses monthly time-series data (1996-2014), with a total of 228 observations for each variable. The data set comprises monthly measures on nine countries: Brazil, Germany, Japan, Mexico, Poland, Russia, Spain, UK and the USA. The variables are stock index (hereinafter: STOCKS), silver prices (hereinafter: SILVER), gold prices (hereinafter: GOLD), copper prices (hereinafter: COPPER), Brent oil prices (hereinafter: OIL_BRENT) except for US and Mexico is using WTI oil prices (hereinafter: OIL_WTI), EMP, IIP, CONF, CPI, WAGE, PPI. The used time series variables are obtained from various international and state statistical sources as described in Table 1.

`

Table 1. Description of Variables

Acronym		STOCKS	EMP	IIP	CONF	CPI	WAGE	PPI
Brazil	**Data source**	FRED	IBGE / SIDRA	FRED	FRED	FRED	FRED	FRED
	Variables	Total Share Prices for All Shares	Employed population	Production in Total Manufacturing	Consumer Opinion Surveys: Confidence OECD Indicator	Consumer Price Index: All Items	Monthly Earnings: All Activities	Total Wholesale Prices
	Value	Index 2010=1	% change YoY	Index 2010=100	Normalised (Normal = 100)	Index 2010=100	Index 2010=1	Index 2010=1
Germany	**Data source**	Quandl	DBB	FRED	FRED	FRED	DBB	FRED
	Variables	DAX performance index	Employed persons	Production of Total Industry	Consumer Opinion Surveys: Confidence OECD Indicator	Consumer Price Index of All Items	Monthly Earnings	Domestic Producer Prices Index: Manufacturing
	Value	Index 1987 = 1000	thousand	Index 2010=100	Normalised (Normal = 100)	% change YoY	Index 2010=100	Index 2010=100
Japan	**Data source**	FRED	FRED	FRED	Cabinet Office, Gov of Japan / ESRI	FRED	FRED	FRED
	Variables	Nikkei Stock Average, Nikkei 225	Employed Population: Aged 15 and	Production of Total Industry	Consumer Confidence Index	Consumer Price Index of All Items	Monthly Earnings: Manufacturing	Producer Prices Index: Total Finished
	Value	index	% change YoY	Index 2010=100	index	% change YoY	Index 2010=1	Index 2010=1
Mexico	**Data source**	FRED	Mexican Institute of Insured Workers: Processing Industries	FRED	FRED	FRED	FRED	FRED
	Variables	Total Share Prices for All Shares		Production in Total Manufacturing	Business Tendency Surveys for Manufacturing: Production	Consumer Price Index: All Items	Monthly Earnings: Manufacturing	Domestic Producer Prices Index: Manufacturing
	Value	Index 2010=1	% change YoY	Index 2010=100	Net Percent	% change YoY	Index 2010=1	Index 2010=100
Poland	**Data source**	IMF / IFS	IMF / IFS	FRED	Quandl	FRED	FRED	FRED
	Variables	Equities index	Employment in Manufacturing	Production of Total Industry	Economic sentiment indicator: All sectors	Consumer Price Index: All Items	Monthly Earnings: Private Sector	Producer Prices Index: Total Industrial Activities
	Value	Index 2010=100	% change YoY	Index 2010=100	composite measure (average = 100)	% change YoY	Index 2010=1	Index 2010=1
Russia	**Data source**	Quandl	IMF / IFS	FRED	FRED	FRED	FRED	IMF / IFS
	Variables	RTS index	Employment in Manufacturing	Production of Total Industry	Business Tendency Surveys for Manufacturing: Confidence Indicators	Consumer Price Index: All Items	Monthly Earnings: All Activities	Producer Prices: All Commodities
	Value	denominated in RUB	Index 2010=100	Index 2010=100	Normalised (Normal = 100)	Index 2010=100	National currency	Index 2010=100
Espana	**Data source**	INE	EMPLEO	FRED	FRED	FRED	TAX	FRED
	Variables	IBEX'35	Employed & Self Employed: in Social Security	Production of Total Industry	Consumer Opinion Surveys: Confidence OECD Indicator	Consumer Price Index: All Items	Wages in Large Companies: Average	Domestic Producer Prices Index: Manufacturing
	Value	Base 1989=3000	% change YoY	Index 2010=100	Normalised (Normal = 100)	% change YoY	% change YoY	Index 2010=100
UK	**Data source**	Yahoo Finance	ONS	FRED	FRED	FRED	FRED	IMF / IFS
	Variables	FTSE 100	Total in employment: All aged 16 over	Production of Total Industry	Consumer Opinion Surveys: Confidence OECD Indicator	Consumer Price Index of All Items	Weekly Earnings: Manufacturing	Producer Prices: All Commodities
	Value	index	level	Index 2010=100	Normalised (Normal = 100)	% change YoY	Index 2010=1	Index, 2010=1
US	**Data source**	Quandl	FRED	FRED	Dairy Marketing and Risk Mngm	FRED	FRED	FRED
	Variables	S&P 500 Index	Production and Nonsupervisory Employees: Total Private	Industrial Production Index	Conference Board's Consumer Confidence Index	Consumer Price Index for All Urban Consumers: All	Weekly Earnings of Production Employees:	Producer Price Index by Commodity for Finished Goods
	Value	index	% change YoY	Index 2012=100	Index 1985=100	Index 1982-84 = 100	U.S. $	Index 1982=100

(table continues)

(continued)

Acronym		GOLD	SILVER	COPPER	OIL_WTI	OIL_BRENT
Commodities	**Data source**	FRED	Quandl	Quandl	FRED	FRED
	Variables	Gold Fixing Price 3:00 P.M. (London time) in London Bullion Market	Silver Futures, Continuous Contract #1 (SI1) (Front Month)	Copper Futures, Continuous Contract #1 (HG1) (Front Month)	Crude Oil Prices: West Texas Intermediate (WTI) - Cushing, Oklahoma	Crude Oil Prices: Brent - Europe
	Value	U.S. $ per Troy Ounce	U.S. $ per Troy Ounce	U.S. $ per Pound	U.S. $ per Barrel	U.S. $ per Barrel

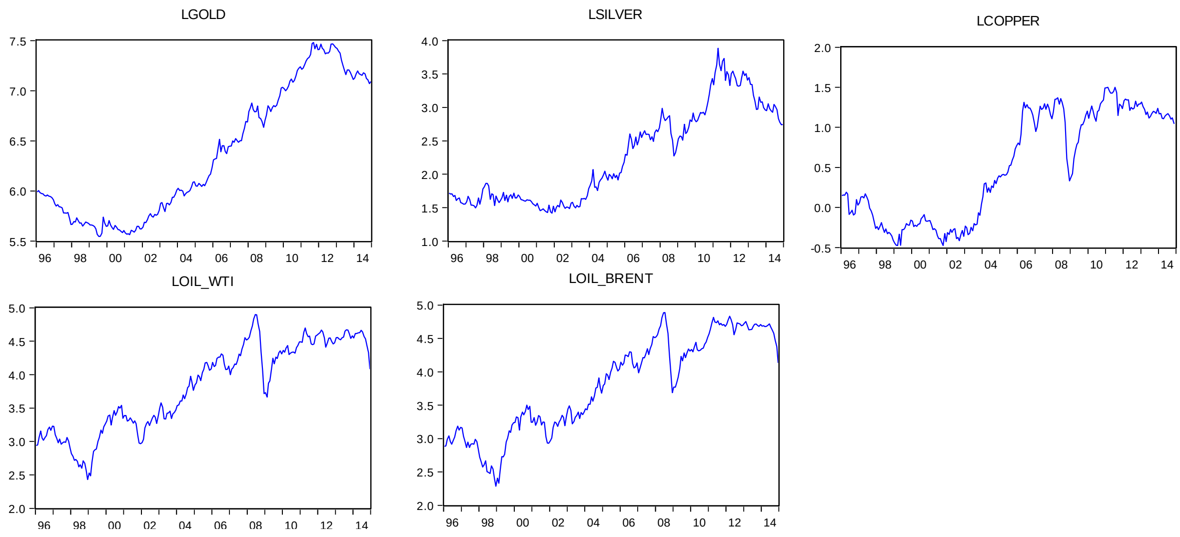
Source: FRED; Quandl; IMF/IFS (nd), *National State Statistical Offices*, n.d.

Variables have been transformed to natural logarithm form and denoted with L" on the beginning of variable name respectively. In some cases, for some variables we use percentage change from a previous year and will be denoted with "CP1" on the beginning of variable name respectively.

All commodities prices from US dollar dominated prices are converted in domestic prices for each country. All data in this study has been analyzed using the statistical package of EViews 9.0.

Prior to testing for Cointegration and Granger causality, it is important to establish the properties of the time series included in the analysis. A graphical representation can give some indication about the properties of considered time series. Figure 1 shows the graphical representation of the evolution of commodities in US dollars during the sample period, while the stock market indices and economic activity variables for each country are presented in Figure 2.

Figure 1. Graphs of Commodities



Source: FRED; Quandal, n.d.

`

Commodities figure illustrates that logarithmic plots of gold, silver, copper and oil prices exhibit upward trends, with a tendency to drift upwards over time. This indicates that these variables are non-stationary in levels and may move together. A drop can be noticed in all commodities around the year 2008 and 2009, referring to the global financial crisis. In general, gold and SILVER have been rising for the entire sample period with the small period of falling at the end of the sample period and have a different pattern from copper and oil prices which have clearly stagnate from 2008 peak to end of the sample period.

The logarithmic plots of stock market indices for each market show evidence of contemporaneous collapses which occurred during information technology boom-bust cycle around 2002 and last financial crises of 2008. During collapses, a deep drop can be noticed in stock markets of developed countries (Germany, UK, and the US) and after these markets tend to move back and exhibit upward trends. In contrast to Japan, we can see that stock market is lower at the end of the sample than in the beginning of the sample period.

The stock prices in developing countries (Brazil, Mexico, and Russia) have been rising for the entire sample period with relatively short periods of falling stock prices. In the logarithmic plots of the IIP, there is an upward trend, higher at the end of the sample than in the beginning of the sample period, in six countries (Brazil, Germany, Mexico, Poland, Russia and the US). For the rest three countries (Japan, Spain, and the UK), IIP is on a declining trend, it is lower at the end of the sample than in the beginning of the sample period.

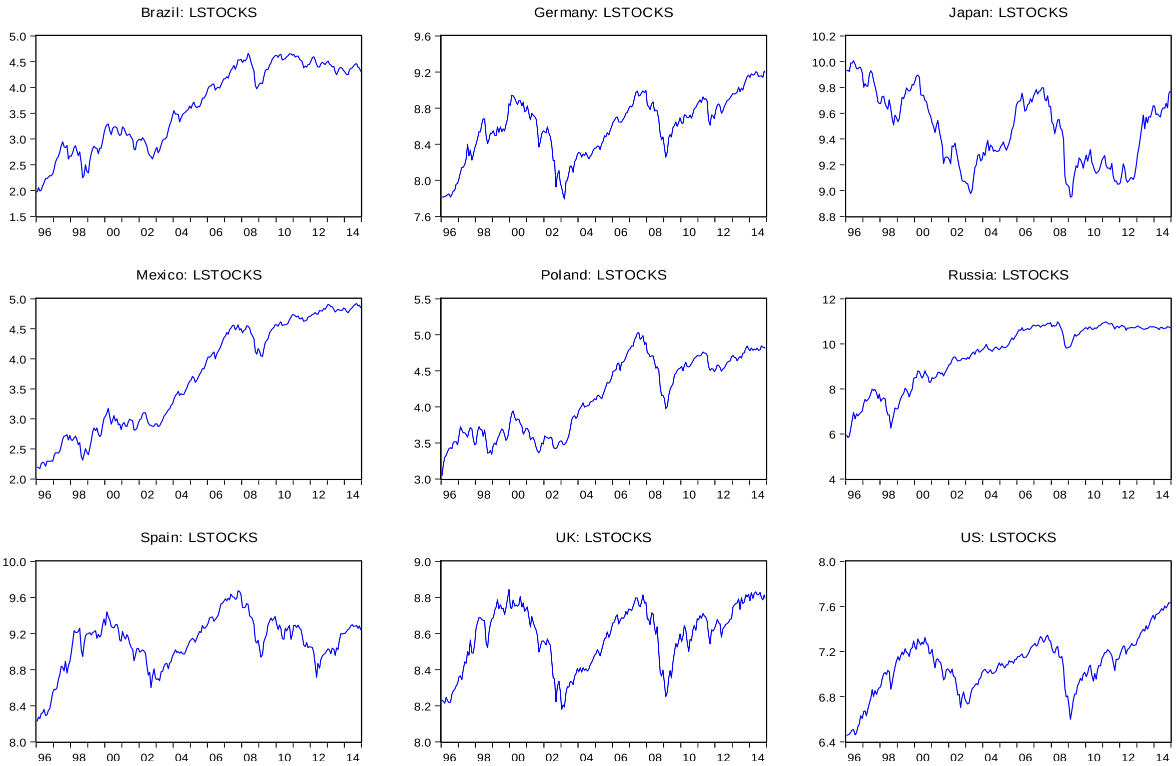
The logarithmic plots of the PPI have an upward trend for all countries except for Japan, where PPI followed the same declining trend as stock prices and IIP. Japan, again have perceived exception from other countries, its logarithmic plot of employees earnings indicate that seems to be oscillating towards the mean, without any upward or downward trend, suggesting that time series could be stationary and the strongest oscillations can be noticed around the year 2008. This graphical representation for Japan and a similar pattern of economic activity variables with stock prices may indicate an impact on the stock prices.

Further, it is useful to look at descriptive statistics which provide a historical behavior of variables of interest. The descriptive statistics for all eleven variables from each country including the mean, the minimum and maximum values, standard deviation, kurtosis, skewness and the Jarque-Bera test are presented in Table 2.

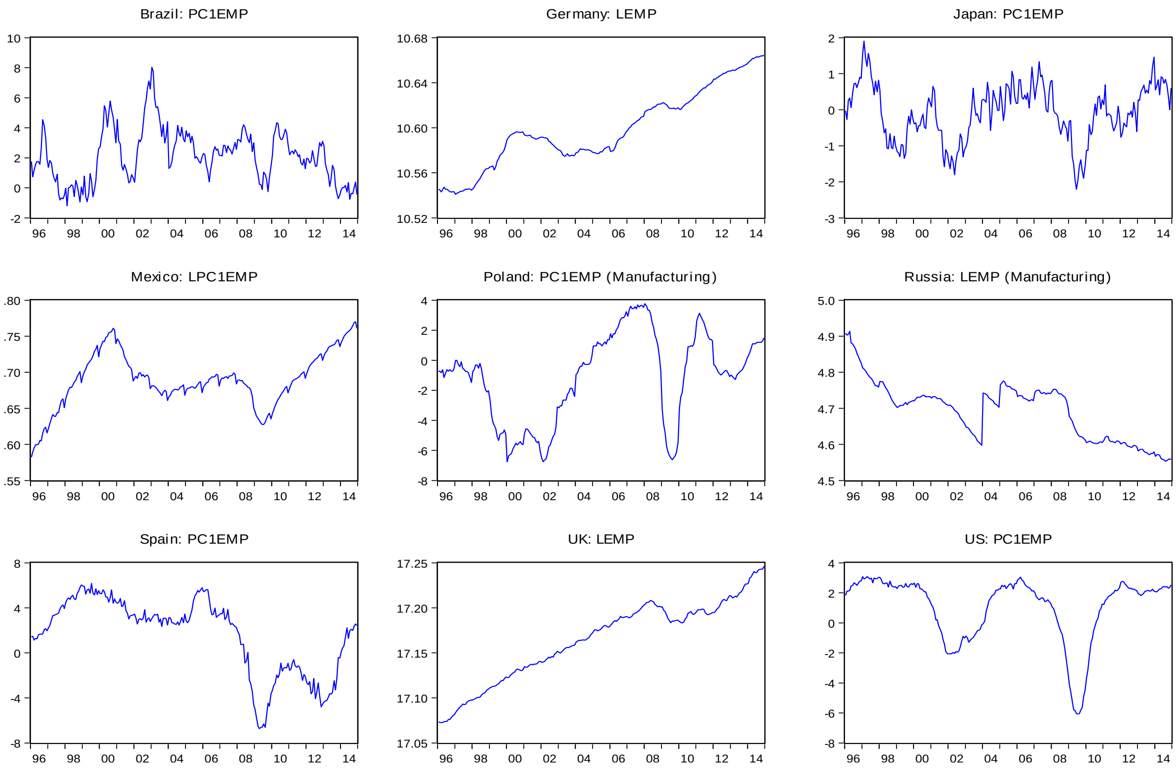
The standard deviations indicate that Russia has the most volatile STOCKS, followed by rest of developing countries (Brazil, Mexico, and Poland) and on the end are developed countries (Germany, Japan, Spain, UK and the US) with the lowest volatility.

Figure 2. Graphs of Stock Markets and Economic Activity

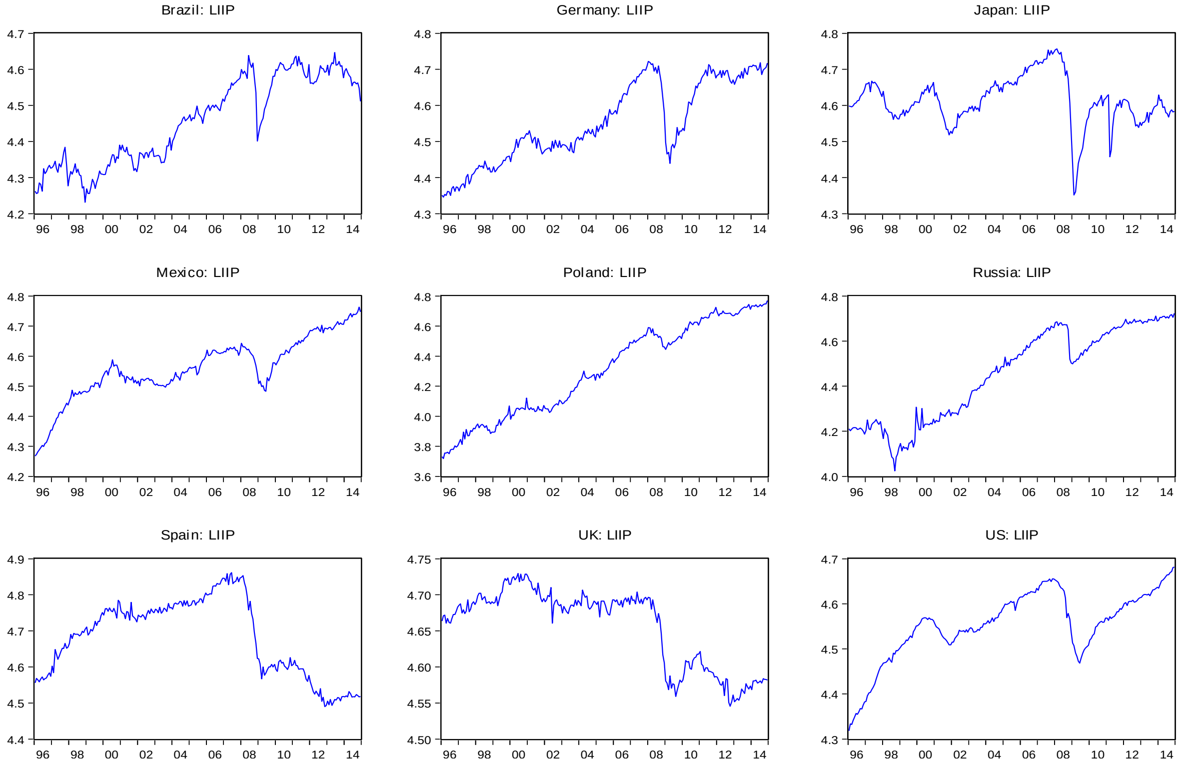
a) STOCKS



b) EMP

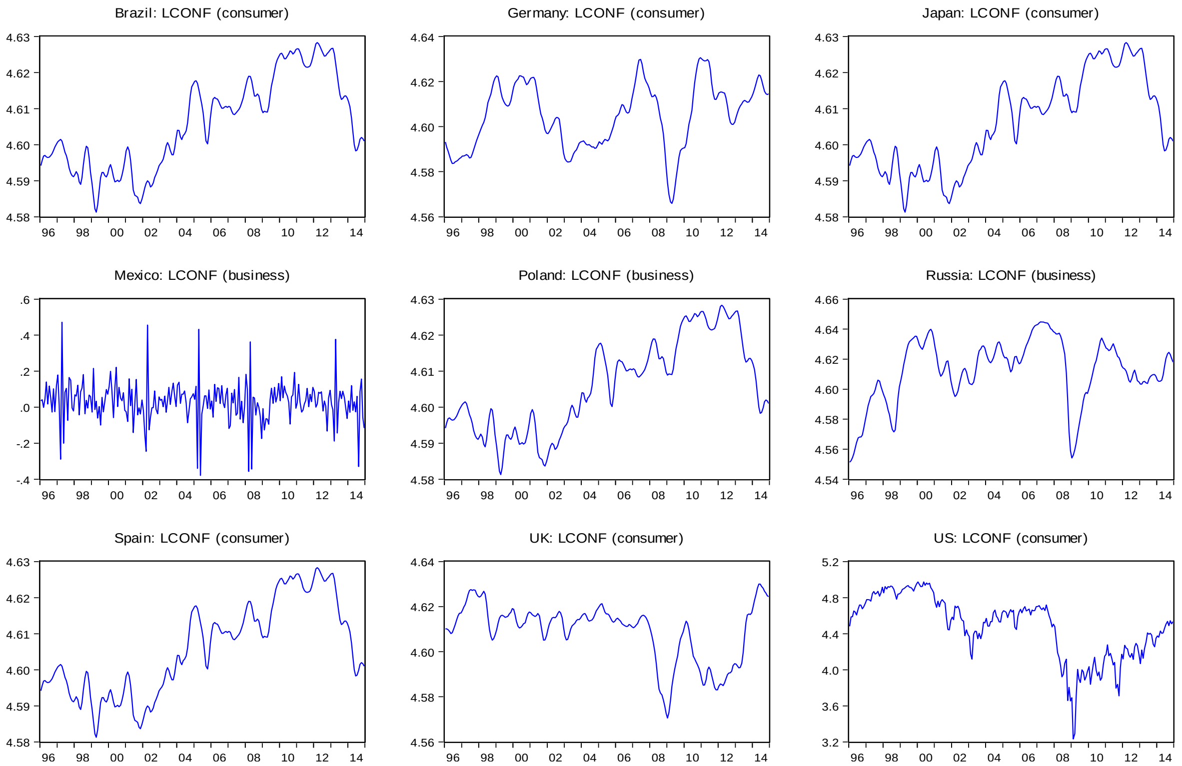


c) IIP



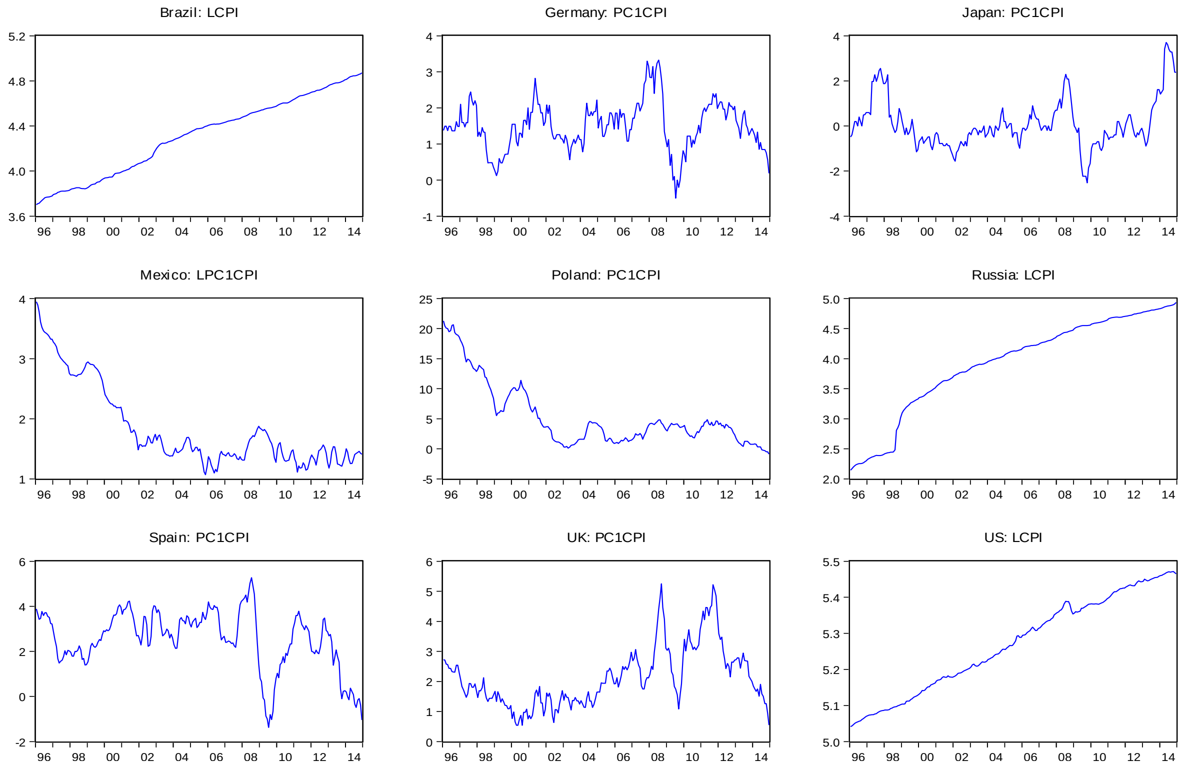
Brazil: LIIP
Germany: LIIP
Japan: LIIP
Mexico: LIIP
Poland: LIIP
Russia: LIIP
Spain: LIIP
UK: LIIP
US: LIIP

d) CONF

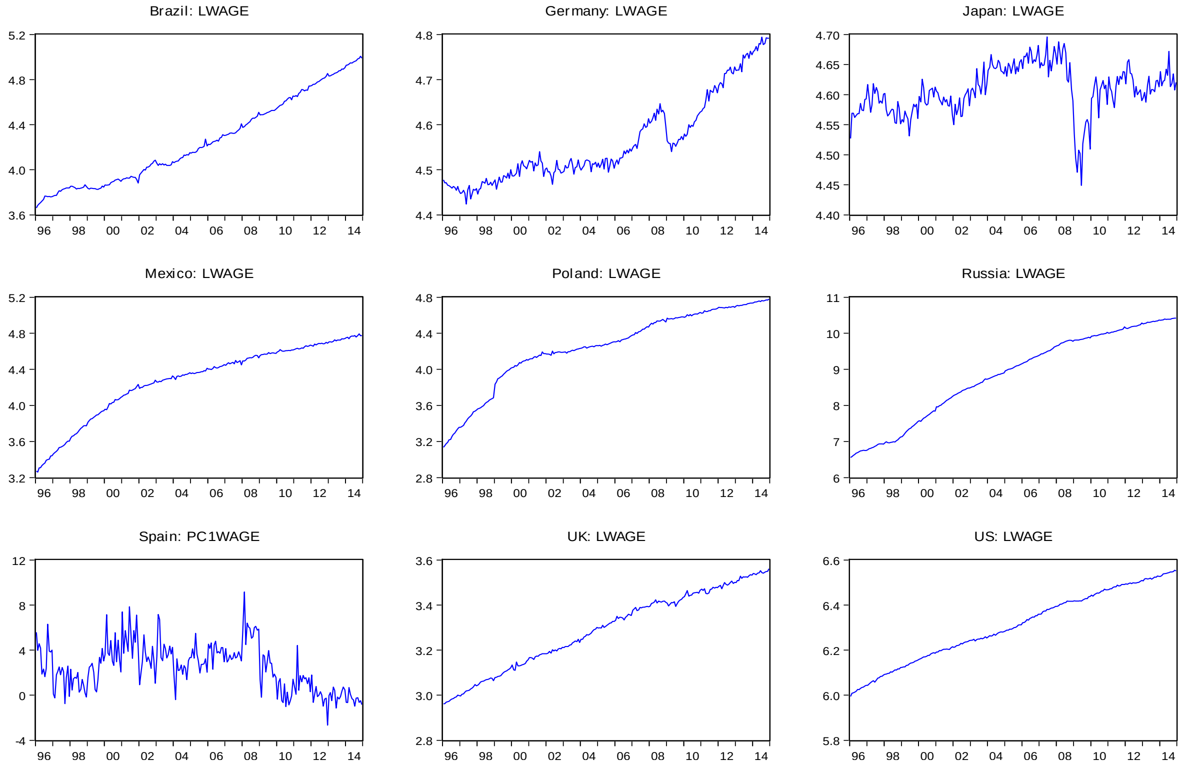


Brazil: LCONF (consumer)
Germany: LCONF (consumer)
Japan: LCONF (consumer)
Mexico: LCONF (business)
Poland: LCONF (business)
Russia: LCONF (business)
Spain: LCONF (consumer)
UK: LCONF (consumer)
US: LCONF (consumer)

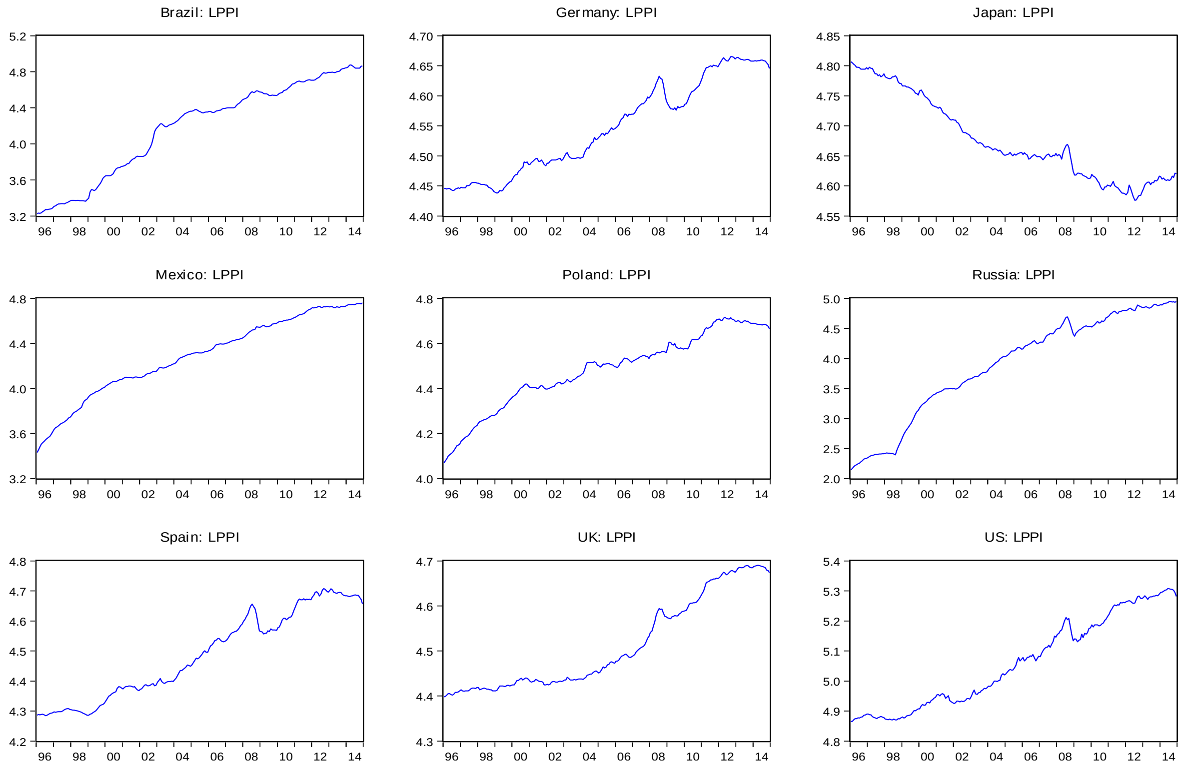
e) CPI


Brazil: LCPI
3.6 4.0 4.4 4.8 5.2
Germany: PC1CPI
-1 0 1 2 3 4
Japan: PC1CPI
-4 -2 0 2 4
Mexico: LPC1CPI
1 2 3 4
Poland: PC1CPI
-5 0 5 10 15 20 25
Russia: LCPI
2.0 2.5 3.0 3.5 4.0 4.5 5.0
Spain: PC1CPI
-2 0 2 4 6
UK: PC1CPI
0 1 2 3 4 5 6
US: LCPI
5.0 5.1 5.2 5.3 5.4 5.5
96 98 00 02 04 06 08 10 12 14

f) WAGE


Brazil: LWAGE
3.6 4.0 4.4 4.8 5.2
Germany: LWAGE
4.4 4.5 4.6 4.7 4.8
Japan: LWAGE
4.40 4.45 4.50 4.55 4.60 4.65 4.70
Mexico: LWAGE
3.2 3.6 4.0 4.4 4.8 5.2
Poland: LWAGE
2.8 3.2 3.6 4.0 4.4 4.8
Russia: LWAGE
6 7 8 9 10 11
Spain: PC1WAGE
-4 0 4 8 12
UK: LWAGE
2.8 3.0 3.2 3.4 3.6
US: LWAGE
5.8 6.0 6.2 6.4 6.6
96 98 00 02 04 06 08 10 12 14

g) PPI



Source: FRED; Quandal; IMF/IFS, *National State Statistical Offices*, n.d.

Moreover, the volatility has varied over the different group of variables; generally, our selected commodities (gold, silver, copper and oil) are more volatile than economic activity variables across all countries.

Furthermore, in developing countries, the standard deviations indicates that the inflation-CPI is more volatile in contrast to the rest of the economic activity variables during the same period, which perhaps may be due to the flexible exchange rate which causing appreciation or depreciation regarding monetary policies in advanced economies that has sent capital flowing in or out of emerging economies respectively, Eichengreen and Gupta (2014).

In table 2, p-values connected with the Jarque-Bera statistics, a test for discontinuation from normality, and samples of skewness and kurtosis are significantly different from *0* and *3* respectively, so the observed distribution of variables of interest is said to be not normally distributed. Low kurtosis value indicates extreme platykurtic, and when compared to a normal distribution, a platykurtic data set has a flatter peak around its mean, what means the data being less concentrated around its mean.

`

Table 2. Descriptive Statistics of the Variables

		Mean	Median	Max	Min	Std. Dev.	Skewness	Kurtosis	Jarque - Bera	Prob.
Brazil	LSTOCKS	3,63	3,68	4,66	1,96	0,80	-0,28	1,67	19,88	0,00
	LGOLD	7,02	7,09	8,19	5,78	0,74	-0,17	1,82	14,44	0,00
	LSILVER	2,93	2,99	4,34	1,58	0,78	-0,13	1,93	11,57	0,00
	LCOPPER	1,17	1,37	2,15	-0,22	0,75	-0,40	1,64	23,68	0,00
	LOIL_BRENT	4,46	4,77	5,57	2,47	0,86	-0,75	2,35	25,65	0,00
	PC1EMP	2,12	2,07	8,03	-1,20	1,78	0,49	3,22	9,74	0,01
	LIIP	4,46	4,47	4,65	4,23	0,12	-0,05	1,53	20,67	0,00
	LCONF	4,61	4,60	4,63	4,58	0,01	0,12	1,82	13,84	0,00
	LCPI	4,31	4,38	4,87	3,70	0,34	-0,16	1,73	16,30	0,00
	LWAGE	4,26	4,19	5,01	3,66	0,38	0,38	1,84	18,07	0,00
	LPPI	4,18	4,36	4,88	3,23	0,52	-0,49	1,85	21,73	0,00
Gwrmany	LSTOCKS	8,59	8,64	9,21	7,79	0,34	-0,46	2,63	9,23	0,01
	LGOLD	6,18	5,87	7,21	5,49	0,55	0,55	1,78	25,67	0,00
	LSILVER	2,09	1,80	3,51	1,29	0,60	0,60	2,08	21,60	0,00
	LCOPPER	0,32	0,16	1,21	-0,59	0,56	0,04	1,36	25,65	0,00
	LOIL_BRENT	3,61	3,64	4,55	2,13	0,63	-0,33	2,05	12,62	0,00
	LEMP	10,60	10,59	10,66	10,54	0,03	0,20	2,15	8,35	0,02
	LIIP	4,55	4,53	4,72	4,35	0,11	0,01	1,71	15,78	0,00
	LCONF	4,60	4,61	4,63	4,57	0,01	-0,25	2,34	6,63	0,04
	PC1CPI	1,49	1,49	3,32	-0,50	0,67	0,07	3,42	1,86	0,39
	LWAGE	4,56	4,52	4,79	4,42	0,10	0,92	2,70	33,00	0,00
	LPPI	4,55	4,54	4,67	4,44	0,08	0,17	1,59	19,81	0,00
Japan	LSTOCKS	9,47	9,50	10,01	8,95	0,28	0,02	1,82	13,31	0,00
	LGOLD	11,03	10,76	11,93	10,25	0,54	0,23	1,49	23,53	0,00
	LSILVER	6,94	6,71	8,30	6,22	0,59	0,32	1,59	22,61	0,00
	LCOPPER	5,18	5,06	6,09	4,29	0,59	0,03	1,36	25,47	0,00
	LOIL_BRENT	8,47	8,52	9,56	7,05	0,63	-0,20	1,78	15,62	0,00
	PC1EMP	-0,08	-0,03	1,91	-2,21	0,79	-0,30	2,66	4,46	0,11
	LIIP	4,61	4,61	4,76	4,35	0,07	-0,46	4,66	34,35	0,00
	LCONF	3,62	3,63	3,84	3,21	0,12	-0,55	3,54	14,28	0,00
	PC1CPI	0,09	-0,10	3,71	-2,52	1,09	1,05	4,47	62,76	0,00
	LWAGE	4,61	4,61	4,70	4,45	0,04	-0,56	3,91	19,87	0,00
	LPPI	4,68	4,65	4,81	4,58	0,07	0,48	1,91	20,16	0,00
Mexico	LSTOCKS	3,70	3,72	4,92	2,17	0,89	-0,11	1,46	23,01	0,00
	LGOLD	8,74	8,49	10,08	7,76	0,79	0,30	1,52	24,31	0,00
	LSILVER	4,64	4,41	6,34	3,56	0,84	0,33	1,65	21,36	0,00
	LCOPPER	2,88	2,86	4,01	1,76	0,80	-0,03	1,26	28,77	0,00
	LWTIOIL	6,19	6,39	7,24	4,72	0,79	-0,25	1,60	21,10	0,00
	LPC1EMP	0,02	0,03	0,14	-0,12	0,06	-0,61	2,80	14,30	0,00
	LIIP	4,56	4,56	4,76	4,27	0,10	-0,52	3,39	11,55	0,00
	LCONF	0,03	0,03	0,47	-0,38	0,11	-0,13	6,97	150,31	0,00
	LPC1CPI	1,84	1,53	3,95	1,07	0,68	1,23	3,35	58,72	0,00
	LWAGE	4,28	4,37	4,79	3,26	0,40	-0,89	2,82	30,31	0,00
	LPPI	4,28	4,32	4,76	3,43	0,35	-0,49	2,33	13,47	0,00

(table continues)

(continued)

		Mean	Median	Max	Min	Std. Dev.	Skewness	Kurtosis	Jarque - Bera	Prob.
Poland	**LSTOCKS**	4,14	4,15	5,03	3,04	0,53	-0,05	1,48	21,97	0,00
	LGOLD	7,56	7,36	8,69	6,90	0,57	0,58	1,85	25,41	0,00
	LSILVER	3,47	3,21	4,86	2,60	0,62	0,58	2,12	20,06	0,00
	LCOPPER	1,71	1,63	2,58	0,84	0,57	0,03	1,36	25,44	0,00
	LOIL_BRENT	5,00	5,09	5,97	3,54	0,64	-0,35	2,09	12,46	0,00
	PC1EMP	-1,12	-0,69	3,76	-6,76	2,98	-0,33	2,06	12,58	0,00
	LIIP	4,30	4,30	4,77	3,72	0,31	-0,13	1,62	18,71	0,00
	LCONF	4,58	4,58	4,81	4,36	0,09	0,30	2,56	5,19	0,07
	PC1CPI	5,28	3,74	21,26	-0,89	5,23	1,48	4,37	100,50	0,00
	LWAGE	4,25	4,28	4,78	3,14	0,42	-0,91	3,04	31,71	0,00
	LPPI	4,48	4,51	4,72	4,07	0,17	-0,53	2,53	12,82	0,00
Russia	**LSTOCKS**	9,53	9,87	10,97	5,84	1,39	-0,86	2,53	30,10	0,00
	LGOLD	9,50	9,42	11,12	7,45	1,03	-0,49	2,39	12,52	0,00
	LSILVER	5,41	5,36	7,20	3,24	1,08	-0,48	2,47	11,60	0,00
	LCOPPER	3,65	3,77	5,07	1,51	1,04	-0,64	2,26	20,99	0,00
	LOIL_BRENT	6,94	7,28	8,28	4,32	1,15	-0,93	2,80	33,24	0,00
	LEMP	4,69	4,72	4,91	4,55	0,08	0,17	2,62	2,38	0,30
	LIIP	4,45	4,51	4,72	4,02	0,20	-0,28	1,59	21,91	0,00
	LCONF	4,61	4,62	4,64	4,55	0,02	-0,87	3,37	30,17	0,00
	LCPI	3,92	4,12	4,93	2,14	0,80	-0,83	2,59	27,54	0,00
	LWAGE	8,84	9,05	10,42	6,56	1,22	-0,42	1,82	19,76	0,00
	LPPI	3,88	4,12	4,95	2,14	0,86	-0,59	2,09	21,13	0,00
Spain	**LSTOCKS**	9,10	9,15	9,67	8,23	0,29	-0,77	3,84	29,10	0,00
	LGOLD	6,18	5,87	7,21	5,49	0,55	0,55	1,78	25,64	0,00
	LSILVER	2,09	1,79	3,51	1,28	0,60	0,59	2,07	21,44	0,00
	LCOPPER	0,32	0,16	1,21	-0,59	0,56	0,04	1,36	25,72	0,00
	LOIL_BRENT	3,61	3,64	4,55	2,13	0,63	-0,33	2,05	12,73	0,00
	PC1EMP	1,61	2,73	6,17	-6,73	3,34	-0,79	2,55	25,66	0,00
	LIIP	4,68	4,70	4,86	4,49	0,11	-0,21	1,73	17,15	0,00
	LCONF	4,61	4,61	4,63	4,57	0,01	-0,87	3,59	32,23	0,00
	PC1CPI	2,53	2,69	5,27	-1,37	1,31	-0,85	3,44	29,31	0,00
	PC1WAGE	2,47	2,60	9,16	-2,65	2,09	0,27	2,72	3,43	0,18
	LPPI	4,49	4,48	4,71	4,28	0,14	0,07	1,54	20,56	0,00
UK	**LSTOCKS**	8,58	8,63	8,84	8,18	0,17	-0,59	2,27	18,34	0,00
	LGOLD	5,86	5,56	7,02	5,07	0,65	0,51	1,66	26,99	0,00
	LSILVER	1,77	1,42	3,39	0,98	0,69	0,60	1,95	24,23	0,00
	LCOPPER	0,01	-0,11	1,05	-0,96	0,65	0,06	1,36	25,66	0,00
	LOIL_BRENT	3,30	3,32	4,37	1,77	0,70	-0,14	1,86	13,11	0,00
	LEMP	17,16	17,18	17,25	17,07	0,04	-0,39	2,19	12,14	0,00
	LIIP	4,66	4,68	4,73	4,55	0,05	-0,66	1,87	28,91	0,00
	LCONF	4,61	4,61	4,63	4,57	0,01	-0,92	3,15	32,08	0,00
	PC1CPI	2,12	1,91	5,25	0,54	0,99	0,96	3,64	38,82	0,00
	LWAGE	3,29	3,31	3,56	2,96	0,17	-0,23	1,80	15,72	0,00
	LPPI	4,51	4,47	4,69	4,40	0,10	0,61	1,77	28,42	0,00

(table continues)

(continued)

		Mean	Median	Max	Min	Std. Dev.	Skewness	Kurtosis	Jarque - Bera	Prob.
US	**LSTOCKS**	7,08	7,11	7,63	6,46	0,25	-0,33	3,22	4,60	0,10
	LGOLD	6,36	6,08	7,48	5,55	0,65	0,35	1,57	24,01	0,00
	LSILVER	2,27	2,01	3,88	1,42	0,70	0,45	1,80	21,20	0,00
	LCOPPER	0,51	0,41	1,50	-0,47	0,67	-0,01	1,32	26,75	0,00
	LOIL_WTI	3,81	3,91	4,90	2,43	0,65	-0,22	1,71	17,55	0,00
	PC1EMP	1,03	2,09	3,08	-6,07	2,16	-1,62	5,05	139,92	0,00
	LIIP	4,55	4,56	4,68	4,32	0,08	-0,92	3,69	36,39	0,00
	LCONF	4,48	4,55	4,97	3,23	0,35	-0,77	3,21	22,68	0,00
	LCPI	5,27	5,27	5,47	5,04	0,13	-0,09	1,66	17,29	0,00
	LWAGE	6,31	6,30	6,55	5,99	0,16	-0,15	1,83	13,78	0,00
	LPPI	5,06	5,04	5,31	4,87	0,15	0,23	1,58	21,21	0,00

Contrary to previous, high kurtosis value indicates extreme leptokurtic, this distribution has higher peaks around the mean compared to a normal distribution, which results in peaks of the data being highly concentrated around the mean.

This means risk is coming from outlier events that extreme observations are much more likely to occur, therefore, conservative investors would probably avoid this type of return distribution.

By knowing which way data is skewed, one can better estimate whether a given data will be more than the mean in the form of "negative skewness" or less than the mean in the form of "positive skewness". Furthermore, if the skewness coefficient is in excess of unity it is considered fairly extreme. Given that the kurtosis of stock indexes, we notice that Spain and U.S. are more than three, while the rest are less than three. The negative numbers of skewness show that stock indexes have a left-skewed distribution, indicating that there are relatively few low values, the most pronounced in Russia and Spain.

Correlation between the variables of interest is very useful in order to understand how they are related to each other regarding employ of Granger-causality test. The correlation matrix is presented in Table 3.

The correlation results among considered variables are exceptional and allowed so further to continued with the elaborate econometric methodology in order to be applied to them. While correlation has been handled with poor believe that it doesn't always mean causation, these results would seem to support the independent view of causality among considered variables in this study, where they pointed merely to positive or negative linear relationship that exists between them.

All commodities show mostly strong, positive correlation between national stock indices, except in the case of Japan where commodities are in a negative relationship with STOCKS. However, these results support that these variables being included in this study.

Table 3. Correlation Matrix

		LSTOCKS	LGOLD	LSILVER			LSTOCKS	LGOLD	LSILVER
	LSTOCKS	1	0,88	0,91		LSTOCKS	1	0,62	0,69
	LGOLD	0,88	1	0,98		LGOLD	0,62	1	0,97
	LSILVER	0,91	0,98	1		LSILVER	0,69	0,97	1
	LCOPPER	0,93	0,94	0,95		LCOPPER	0,67	0,89	0,91
	LOIL	0,88	0,94	0,93		LOIL	0,67	0,88	0,87
Brazil	PC1EMP	-0,01	0,06	0,04	**Germany**	LEMP	0,77	0,90	0,87
	LIIP	0,95	0,90	0,91		LIIP	0,77	0,81	0,84
	LCONF	0,83	0,78	0,80		LCONF	0,73	0,29	0,42
	LCPI	0,93	0,98	0,97		PC1CPI	0,16	0,13	0,19
	LWAGE	0,90	0,96	0,94		LWAGE	0,72	0,90	0,86
	LPPI	0,92	0,98	0,96		LPPI	0,68	0,95	0,93
		LSTOCKS	**LGOLD**	**LSILVER**			**LSTOCKS**	**LGOLD**	**LSILVER**
	LSTOCKS	1	-0,33	-0,30		LSTOCKS	1	0,94	0,95
	LGOLD	-0,33	1	0,96		LGOLD	0,94	1	0,98
	LSILVER	-0,30	0,96	1		LSILVER	0,95	0,98	1
	LCOPPER	-0,10	0,89	0,91		LCOPPER	0,96	0,95	0,95
	LOIL	-0,29	0,88	0,87		LOIL	0,97	0,92	0,92
Japan	PC1EMP	0,45	0,16	0,15	**Mexico**	LPC1EMP	-0,09	-0,01	0,04
	LIIP	0,45	-0,08	-0,01		LIIP	0,88	0,77	0,80
	LCONF	0,32	0,10	0,11		LCONF	-0,07	-0,05	-0,05
	PC1CPI	0,36	0,21	0,17		LPC1CPI	-0,79	-0,65	-0,66
	LWAGE	0,07	0,25	0,30		LWAGE	0,92	0,84	0,83
	LPPI	0,64	-0,84	-0,82		LPPI	0,96	0,91	0,90
		LSTOCKS	**LGOLD**	**LSILVER**			**LSTOCKS**	**LGOLD**	**LSILVER**
	LSTOCKS	1	0,80	0,83		LSTOCKS	1	0,91	0,91
	LGOLD	0,80	1	0,97		LGOLD	0,91	1	0,99
	LSILVER	0,83	0,97	1		LSILVER	0,91	0,99	1
	LCOPPER	0,95	0,89	0,91		LCOPPER	0,95	0,97	0,97
	LOIL	0,88	0,88	0,88		LOIL	0,94	0,97	0,96
Poland	PC1EMP	0,64	0,34	0,39	**Russia**	LEMP	-0,67	-0,82	-0,80
	LIIP	0,93	0,92	0,92		LIIP	0,93	0,88	0,88
	LCONF	0,23	-0,17	-0,12		LCONF	0,50	0,35	0,41
	PC1CPI	-0,59	-0,53	-0,52		LCPI	0,95	0,98	0,97
	LWAGE	0,81	0,83	0,82		LWAGE	0,95	0,97	0,95
	LPPI	0,84	0,89	0,88		LPPI	0,96	0,97	0,96
		LSTOCKS	**LGOLD**	**LSILVER**			**LSTOCKS**	**LGOLD**	**LSILVER**
	LSTOCKS	1	0,33	0,44		LSTOCKS	1	0,29	0,41
	LGOLD	0,33	1	0,97		LGOLD	0,29	1	0,97
	LSILVER	0,44	0,97	1		LSILVER	0,41	0,97	1
	LCOPPER	0,56	0,89	0,91		LCOPPER	0,40	0,92	0,93
	LOIL	0,56	0,88	0,87		LOIL	0,37	0,90	0,90
Spain	PC1EMP	-0,03	-0,79	-0,69	**UK**	LEMP	0,43	0,78	0,78
	LIIP	0,40	-0,61	-0,50		LIIP	-0,12	-0,91	-0,84
	LCONF	-0,16	-0,70	-0,62		LCONF	0,10	-0,59	-0,59
	PC1CPI1	-0,05	-0,32	-0,24		PC1CPI	0,03	0,67	0,69
	PC1WAGE	0,07	-0,48	-0,45		LWAGE	0,41	0,87	0,87
	LPPI	0,53	0,95	0,93		LPPI	0,42	0,97	0,95

(table continues)

(continued)

		LSTOCKS	LGOLD	LSILVER
	LSTOCKS	1	0,43	0,50
	LGOLD	0,43	1	0,97
	LSILVER	0,50	0,97	1
	LCOPPER	0,48	0,92	0,93
	LOIL	0,55	0,89	0,88
US	**PC1EMP**	0,31	-0,08	0,00
	LIIP	0,85	0,50	0,55
	LCONF	0,05	-0,74	-0,67
	LCPI	0,60	0,92	0,90
	LWAGE	0,62	0,91	0,89
	LPPI	0,59	0,96	0,94

In Table 4 are presented results of unit root tests based on ADF and PP procedures in case of levels and the first differences of considered variables modeled with included intercept and trend component. The proposed ADF and PP tests are to investigate that none of the considered variables are I(2). The symbols of ***, ** and * denote the significant at the 1, 5 and 10 percent level, respectively the rejection of the null hypothesis of non-stationarity in level and first differences. Regarding the unit root test results, all variables are treated as stationary in level or integrated of order one with included intercept and trend.

However, after taking the first difference for CONF in UK and Spain are found to be stationary at 10% level for PP unit root test, while in same case ADF unit root test reject non-stationarity at 1% level, which influence decision for CONF in the UK and Spain to treated as I(1). Thus an examination of the long-run relationship between these variables using the ARDL technique does not face the problem as for I(2) or beyond variables in the model, since we have both I(0) and I(1) series. According to unit root test results suggested a maximum order of integration *dmax* for the considered variables in the model should be equal to one and will be used in Granger-causality test employed by TY.

Given that all variables are integrated not more than order one, we proceed to examine whether three models in each country using STOCKS, SILVER and GOLD as presumed dependent variables are cointegrated with the economic activity variables being used in each case: COPPER, oil prices, employment, industrial production, CONF, CPI, WAGE and PPI. An important issue in employing ARDL bounds testing approach to cointegration is the determination of the optimal lag length. In the analysis the maximum lag length was set at six-month which is sufficiently long for monthly data to capture the dynamic relationship, this will be for both the dependent variable and independent variables.

In the next step, the ARDL model which minimizes the value of information criteria will be chosen, for optimal lag determination is using AIC information criteria with testing among options with not included intercept and linear trend, included intercept and included intercept and a linear trend in ECM.

Table 4. ADF and PP Unit Root Results - Constant with Trend

Country	Variable	ADF		PP		Order of Integration @ 5% sig. level
		I(0)	I(1)	I(0)	I(1)	
Brazil	LSTOCKS	-2.217	-11.452***	-2.088	-11.362***	I(1)
	LSILVER	-3.354*	-16.880***	-3.250*	-17.085***	I(1)
	LGOLD	-3.328*	-16.404***	-3.309*	-16.404***	I(1)
	LCOPPER	-2.229	-15.668***	-2.235	-15.668***	I(1)
	LOIL_BRENT	-1.858	-15.173***	-1.858	-15.173***	I(1)
	PC1EMP	-1.996	-7.299***	-2.900	-14.940***	I(1)
	LIIP	-2.634	-16.138***	-2.678	-16.125***	I(1)
	LCONF	-2.046	-7.191***	-1.743	-3.797**	I(1)
	LCPI	-1.691	-7.131***	-1.409	-7.122***	I(1)
	LWAGES	-1.113	-19.209***	-1.141	-19.682***	I(1)
	LPPI	-1.230	-7.030***	-0.854	-7.071***	I(1)
Germany	LSTOCKS	-2.143	-14.096***	-2.354	-14.114***	I(1)
	LSILVER	-2.210	-17.175***	-1,964	-17.191***	I(1)
	LGOLD	-1.933	-13.104***	-2.010	-13.074***	I(1)
	LCOPPER	-2.148	-8.885***	-2.465	-13.931***	I(1)
	LOIL_BRENT	-2.586	-12.471***	-2.635	-12.485***	I(1)
	LEMP	-1.226	-8.906***	-1.471	-9.160***	I(1)
	LIIP	-3.430**	-6.011***	-2.940	-16.628***	I(0) or I(1)
	LCONF	-2.865	-6.168***	-2.643	-4.858***	I(1)
	PC1CPI	-3.716**	-4.675***	-3.008	-16.790	I(0) or I(1)
	LWAGES	-1.529	-14.411***	-1.801	-21.840***	I(1)
	LPPI	-2.717	-6.230***	-2.523	-9.441***	I(1)
Japan	LSTOCKS	-1.831	-11.542***	-1.866	-11.662***	I(1)
	LSILVER	-2.602	-16.634***	-2.460	-16.694***	I(1)
	LGOLD	-2.401	-11.520***	-2.401	-13.095***	I(1)
	LCOPPER	-2.735	-12.724***	-2.445	-12.792***	I(1)
	LOIL_BRENT	-3.073	-11.740***	-2.835	-11.706***	I(1)
	PC1EMP	-2.443	-14.905***	-3.159*	-16.263***	I(1)
	LIIP	-3.316*	-12.591***	-2.980	-12.676***	I(1)
	LCONF	-3.248*	-5.343***	-2.781	-13.985***	I(1)
	PC1CPI	-1.873	-5.963***	-2.375	-12.804***	I(1)
	LWAGES	-3.599**	-4.960***	-4.151***	-21.742***	I(0)
	LPPI	-0.830	-10.612***	-0.232	-10.082***	I(1)
Mexico	LSTOCKS	-2.200	-12.204***	-2.092	-12.165***	I(1)
	LSILVER	-2.041	-17.158***	-1.834	-17.169***	I(1)
	LGOLD	-2.184	-13.270***	-2.226	-13.238***	I(1)
	LCOPPER	-1.914	-8.983***	-2.124	-14.399***	I(1)
	LOIL_WTI	-2.280	-12.414***	-2.160	-12.413***	I(1)
	LPC1EMP	-4.086***	-6.458***	-3.272*	-8.057***	I(0) or I(1)
	LIIP	-2.936	-16.785***	-3.066	-16.940***	I(1)
	LCONF	-21.954***	-12.443***	-21.135***	-284.15***	I(0)
	LPC1CPI	-2.001	-4.914***	-2.623	-9.351***	I(1)
	LWAGES	-6.023***	-15.931***	-4.903***	-23.229***	I(0)
	LPPI	-2.921	-6.537***	-4.216***	-9.242***	I(1) or I(0)

(table continues)

(continued)

Country	Variable	ADF		PP		Order of Integration @ 5% sig. level
		I(0)	I(1)	I(0)	I(1)	
Poland	LSTOCKS	-2,354	-11,565***	-2,445	-11,583***	I(1)
	LSILVER	-2,125	-15,925***	-2,125	-16,031***	I(1)
	LGOLD	-2,121	-14,093***	-2,121	-14,070***	I(1)
	LCOPPER	-2,151	-8,932***	-2,469	-13,929***	I(1)
	LOIL_BRENT	-2,500	-13,219***	-2,737	-13,133***	I(1)
	PC1EMP	-2.834	-5.133***	-2.337	-10.218***	I(1)
	LIIP	-2,065	-22,825***	-2,669	-22,784***	I(1)
	LCONF	-2,536	-15,290***	-2,540	-15,759***	I(1)
	PC1CPI	-2.485	-9.862***	-2.680	-9.880***	I(1)
	LWAGES	-3,946**	-16,786***	-3,792**	-16,736***	I(0)
	LPPI	-2,229	-9,312***	-2,429	-9,316***	I(1)
Russia	LSTOCKS	-2,604	-13,015***	-2,326	-13,046***	I(1)
	LSILVER	-2,268	-15,510***	-2,219	-15,521***	I(1)
	LGOLD	-2,483	-11,731***	-2,416	-11,725***	I(1)
	LCOPPER	-1,917	-13,262***	-2,220	-13,253***	I(1)
	LOIL_BRENT	-1,800	-13,387***	-1,934	-13,392***	I(1)
	LEMP	-2,489	-14,060***	-2,596	-14,060***	I(1)
	LIIP	-2,574	-17,647***	-2,416	-17,759***	I(1)
	LCONF	-3,580**	-8,038***	-3,176*	-3,987**	I(0) or I(1)
	LCPI	-1,717	-5,759***	-1,557	-11,946***	I(1)
	LWAGES	1,189	-15,956***	0,814	-16,330***	I(1)
	LPPI	-0,926	-8,331***	-0,880	-7,276***	I(1)
Spain	LSTOCKS	-2,703	-14,077***	-2,760	-14,069***	I(1)
	LSILVER	-2,212	-17,169***	-1,965	-17,169***	I(1)
	LGOLD	-1,925	-13,128***	-2,004	-13,099***	I(1)
	LCOPPER	-2,144	-8,890***	-2,465	-13,942***	I(1)
	LOIL_BRENT	-2,575	-12,483***	-2,629	-12,497***	I(1)
	PC1EMP	-2,692	-5,691***	-2,108	-17,081***	I(1)
	LIIP	-1,976	-7,203***	-1,849	-19,354***	I(1)
	LCONF	-2,668	-5,281***	-2,276	-3,418*	I(1) or I(2)
	PC1CPI	-1,473	-7,002***	-2,521	-9,640***	I(1)
	PC1WAGE	-2,360	-12,431***	-6,813***	-96,495***	I(1) or I(0)
	LPPI	-2,407	-7,150***	-2,067	-7,020***	I(1)
UK	LSTOCKS	-2,220	-14,791***	-2,405	-14,820***	I(1)
	LSILVER	-2,160	-16,951***	-2,053	-17,035***	I(1)
	LGOLD	-2,558	-12,378***	-2,558	-12,378***	I(1)
	LCOPPER	-2,329	-14,887***	-2,443	-14,901***	I(1)
	LOIL_BRENT	-1,959	-12,977***	-2,472	-12,975***	I(1)
	LEMP	-1,758	-10,080***	-1,732	-10,222***	I(1)
	LIIP	-2,218	-18,937***	-2,441	-18,909***	I(1)
	LCONF	-3.148*	-6.254***	-2.249	-3.143*	I(1) or I(2)
	PC1CPI	-1,892	-13.011***	-2,461	-13.072***	I(1)
	LWAGES	-1,912	-12,161***	-2,460	-28,919***	I(1)
	LPPI	-1,912	-12,161***	-2,460	-28,919***	I(1)

(table continues)

(continued)

Country	Variable	ADF		PP		Order of Integration @ 5% sig. level
		I(0)	I(1)	I(0)	I(1)	
US	**LSTOCKS**	-1,944	-13,633***	-2,200	-13,702***	I(1)
	LSILVER	-2,031	-16,490***	-1,932	-16,528***	I(1)
	LGOLD	-2,314	-13,362***	-2,316	-13,375***	I(1)
	LCOPPER	-2,464	-8,612***	-2,296	-13,429***	I(1)
	LOIL_WTI	-2,478	-11,219***	-2,533	-11,219***	I(1)
	PC1EMP	-3,427**	-4,315***	-2,061	-8,367***	I(0) or I(1)
	LIIP	-3,073	-3,618**	-2,749	-13,884***	I(1)
	LCONF	-2,765	-15,450***	-2,725	-15,589***	I(1)
	LCPI	-1,475	-10,217***	-1,522	-9,212***	I(1)
	LWAGES	-2,029	-15,636***	-2,945	-23,117***	I(1)
	LPPI	-2,464	-11,933***	-2,525	-12,093***	I(1)

Note. *, **, *** indicates the significance at 10%, 5% and 1% significant level, respectively.

Finally, the Q-statistics which is checked for a problem with a serial correlation of model residuals has insignificant results with large p-values for all models, meaning that the selected ARDL models have an absence of serial correlation problem.

According to Giles (2015, January 9), the serial correlation problem exists when there is autocorrelation in the model's residuals, because of the lagged values of the dependent variable that appear as regressors in the model and the parameter estimates won't be consistent.

Therefore, the selected ARDL models could be appropriate to be used for the bounds testing approach to cointegration.

The calculated F-statistics for co-integration are reported in Table 5 and compared with critical values tabulated in Table CI by corresponding trend specification on p.300 by Pesaran et al. (2001). If the calculated f-statistic is above the upper level of the band of I(0) and I(1), the null is rejected, indicated that there is cointegration. Otherwise, if the calculated F-statistic falls below the lower level of the band, the null cannot be rejected, supporting that there isn't cointegration and if the result is within the band, the result is inconclusive. Further, helps in reconfirming the existence of cointegration in compare the t-statistic of the lagged dependent variable of the conditional ECM model in equation (13) with the bounds t-statistic critical value in Table CII by corresponding trend specification on p.303 by Pesaran et al. (2001). The rule is same as used in previous table CI if the calculated t-statistic is above the upper level of the band of I(0) and I(0), the null is rejected and indicated that there is cointegration.

The F-statistic is at least higher than critical upper bound at 10% level of significance in the case of Mexico, UK and the US in all three models when a STOCKS, GOLD, and SILVER are used as dependent variables.

Further, in all three models of Japan and Russia cointegration exists with the exception that models of STOCKS in Japan and SILVER in Russia point to an inconclusive value. F-statistic and t-statistic of lagged dependent variable lies between the critical lower and upper boundary at 10% significance. Japan's STOCKS model have values of F-statistic (3.075) and t-statistic (-3.817), where the lower and upper bounds for the F-test statistic and t-statistic at the 10% significance levels are [2.26; 3.34] and [-3.13; -4.58] respectively in a model with intercept and a linear trend in the ECM. Russia's SILVER model have values of F-statistic (2.322) and t-statistic (-3.874), where the lower and upper bounds for the F-test statistic and t-statistic at the 10% significance levels are [1.66; 2.79] and [-1.62; -4.09] respectively in model with not included intercept and linear trend in the ECM.

As the value of our F-statistic exceeds the upper bound at least at the 10% significance level, restricted with inconclusive F-statistic in Japan's STOCKS model and Russia's SILVER, we can conclude that there is evidence of a long-run relationship in Japan, Mexico, Russia, UK and US between the three models of STOCKS, gold prices and SILVER and economic activity variables.

Evidence for cointegration exists for Poland, Spain and Germany only for STOCKS model. Poland and Spain STOCKS model have calculated F-statistic of 6.012 and 3.209 respectively and compared with bounds testing critical values presented at Table CI (i), with not included intercept and linear trend in the ECM, on p.300 of Pesaran at al. (2001) are higher than critical upper bound at the 1% and 5% significance level, for Poland and Spain respectively. Germany STOCKS model with calculated F-statistic of 2.265 and t-statistic of -3.117 is inconclusive as the values lies between the lower and upper bounds at the 10% significance levels, where the lower and upper bounds for the F-test statistic and t-statistic at the 10% significance levels are [1.66; 2.79] and [-1.62; -4.09] respectively, in model with not included intercept and linear trend in the ECM. Therefore, the null hypothesis of no cointegration can be rejected for Poland and Spain, and with the restricted rejection of no cointegration for Germany STOCKS model.

These imply that a long-run equilibrium relationship exists between STOCKS and economic activity variables in Germany, Poland, and Spain. Brazil SILVER model with included intercept and a linear trend in ECM have F-statistic of 3.547 and suggest only cointegration from three models at 10% significant level compared with Table CI (v) on p.301 of Pesaran et al. (2001).

After determining the presence of co-integration, the next step is to estimate the signs and the magnitudes of the long-run relationship.

4.1 Long-Run and Short-Run Analysis

Table 5. Results of ARDL Cointegration (Bounds Testing) - All Models

Country	Dependent variable	Model		F-statistics	Lagged dependent variable	Outcome
		Optimal lag length	Trend specification		t-statistics	
Brazil	LSTOCKS	AIC (4, 0, 0, 0, 1, 0, 5, 1, 1)	none	2.392	-1.380	not cointegrated
	LGOLD	AIC (1, 5, 1, 0, 3, 0, 2, 4, 1)	none	1.739	-3.536	not cointegrated
	LSILVER	AIC (1, 3, 1, 0, 1, 0, 0, 2, 1)	intercept and linear trend	3.547*	-5.200**	cointegrated
Germany	LSTOCKS	AIC (1, 1, 3, 2, 2, 1, 1, 1, 1)	none	2.265	-3.117	inconclusive cointegrated
	LGOLD	AIC (3, 3, 1, 1, 0, 1, 0, 0, 3)	intercept and linear trend	2.095	-1.566	not cointegrated
	LSILVER	AIC (3, 3, 0, 0, 0, 1, 1, 0, 3)	intercept and linear trend	2.671	-1.998	not cointegrated
Japan	LSTOCKS	AIC (1, 1, 6, 6, 2, 1, 2, 6, 1)	intercept and linear trend	3.075	-3.817	inconclusive cointegrated
	LGOLD	AIC (3, 0, 6, 0, 5, 2, 0, 1, 1)	intercept	4.623***	-5.191**	cointegrated
	LSILVER	AIC (3, 2, 3, 0, 2, 6, 0, 1, 4)	intercept	3.405**	-3.365	cointegrated
Mexico	LSTOCKS	AIC (2, 6, 3, 0, 6, 0, 1, 1, 5)	intercept	5.469***	-6.523***	cointegrated
	LGOLD	AIC (1, 0, 6, 0, 0, 0, 0, 0, 2)	intercept and linear trend	3.871**	-3.250	cointegrated
	LSILVER	AIC (1, 1, 3, 0, 0, 0, 0, 0, 2)	intercept	3.568**	-4.750**	cointegrated
Poland	LSTOCKS	AIC (3, 1, 1, 0, 0, 1, 3, 0, 1)	none	6.012***	-4.579**	cointegrated
	LGOLD	AIC (1, 0, 3, 1, 1, 1, 0, 0, 4)	intercept and linear trend	1.359	-1.990	not cointegrated
	LSILVER	AIC (2, 3, 0, 0, 0, 0, 0, 0, 5)	none	1.588	-3.347	not cointegrated
Russia	LSTOCKS	AIC (1, 0, 0, 0, 0, 1, 5, 0, 0)	intercept and linear trend	3.343*	-3.972	cointegrated
	LGOLD	AIC (2, 4, 1, 1, 2, 3, 3, 0, 0)	intercept	3.433**	-4.870**	cointegrated
	LSILVER	AIC (2, 3, 6, 4, 0, 0, 1, 0, 6)	none	2.322	-3.874	inconclusive cointegrated
Spain	LSTOCKS	AIC (1, 1, 1, 1, 0, 1, 1, 2, 0)	none	3.209**	-4.366**	cointegrated
	LGOLD	AIC (4, 3, 0, 0, 5, 1, 0, 0, 1)	intercept and linear trend	1.690	-2.765	not cointegrated
	LSILVER	AIC (1, 3, 0, 5, 2, 4, 5, 6, 3)	none	1.764	-3.321	not cointegrated
UK	LSTOCKS	AIC (5, 1, 0, 3, 0, 5, 0, 0, 0)	none	2.840*	-1.677	cointegrated
	LGOLD	AIC (5, 6, 3, 0, 4, 0, 0, 6, 0)	intercept and linear trend	4.423**	-5.475**	cointegrated
	LSILVER	AIC (1, 3, 0, 0, 0, 0, 2, 1, 0)	intercept and linear trend	3.497*	5.112**	cointegrated
US	LSTOCKS	AIC (1, 1, 4, 5, 4, 1, 0, 0, 2)	intercept and linear trend	4.587***	-3.654	cointegrated
	LGOLD	AIC (2, 6, 0, 0, 1, 0, 5, 1, 0)	none	4.392***	-4.090*	cointegrated
	LSILVER	AIC (1, 3, 0, 2, 2, 5, 0, 0, 2)	none	4.269***	-5.551***	cointegrated

Note. *, **, *** indicates computed statistic falls above the upper bound value at 10%, 5% and 1% significant level. Asymptotic critical value bounds are obtained from Pesaran et al. (2001)

`

The following section examines the long-run and short-run relation of economic activity variables including copper and oil prices with STOCKS, gold and silver prices. We will examine whether estimated coefficients for each variable individually included in the three models: stock-based, gold-based and silver-based are statistically significant and contributing impact to the long-run and short-run relationships between STOCKS, gold and silver prices separately with considered economic activity variables.

4.1.1 Stock-based model

The STOCKS in eight from nine reviewed countries, except Brazil, is cointegrated with COPPER, oil prices, and economic activity variables. Table 6 reported the results of long-run estimated coefficients of each independent variable included in the equation of ARDL stock-based model for each country. The results show that coefficient of COPPER indicate positive and significant impact on country's STOCKS at 1% level for Mexico, Poland, Russia, Spain, UK and US, where is evident from Table 6 that in the long-run 1% increase in COPPER leads to increase in country's STOCKS of 0.84%, 0.66%, 0,88%, 0.61%, 0.59% and 0.39% respectively.

For Germany and Japan, COPPER indicates positive and significant impact at 5% and 10% level respectively. The coefficient of COPPER indicates that in the long-run 1% increase in COPPER causes the increase in the STOCKS by 1.06% for Germany and 0.17% for Japan. This observation confirms the notions that COPPER are particularly well capable of reflecting economic cycles and the prevailing sentiment in global markets. This may be due to the copper itself is a raw material which is relatively important for economic development. The oil prices have a negative impact on all eight country's STOCKS, but they are significant only for Japan and UK at 5% level. The 1% increase in oil prices causes the decrease in the stock market index by 0.32% and 0.47% for Japan and UK respectively. The other countries results of oil prices coefficients have an insignificant effect on the stock market index, that's mean that oil prices are ineffective to impact stock market index in long-run. The findings are consistent with Cheung and Ng (1998) interpretation that increases in oil prices would influence hike in production cost, so followed a drop in economic activity and finally would lead to a reduction in expected future cash flows.

The relationship between STOCKS and industrial production is positive and very strong across all countries. Germany and Japan Industrial production coefficient are insignificant and ineffective to explain stock market in the long-run. The coefficient of IIP in Mexico, Poland, Russia, Spain, UK and US are significant at least at 10% level and indicates that in the long-run 1% increase in IIP causes the increase in the stock market by 1.14%, 1.35%, 7.33%, 1.22%, 3.37% and 4.80% respectively. This result is consistent, since changes in production activity, through their impact on expected dividends, should in turn influence stock returns. Similar results of positive and significant relationship between STOCKS and

`

industrial production are reported for US, where Fama (1990) explained this by interpretation that the stock market is rational forecast of real sector, while Chen et al. (1986) argued that the positive link considered the value of insuring against real systematic production risk.

The relationship of consumer prices had a different effect in various countries. For example, Mexico and Russia experienced positive and significant impact on the stock market at 5% and 1% significance level respectively, while Poland, Spain, and the US experienced negative and significant impact on the stock market at 5%, 1%, and 1% significance level respectively. For instance in Russia and US, the 1% increase in consumer prices increase and decrease of the stock market index by +2.99% and -23.01% respectively in the long-run. These results indicate that when consumer prices as a proxy for inflation have a positive and significant effect on stock prices means that increase in prices of goods and services stimulates positively economic activity, further corporate earnings and finally stock prices. Contrary, the negative link could be due to the inflation influence when decreases value of money, so further also demand decreases and negatively affect investment activities of the stock market. This negative relation between inflation and stock prices is consistent with Fama (1981) and Mukherjee and Naka (1995).

Table 6.The Long-Run Estimations from ARDL (Stock-Based Model)

Country	Dependent variable: STOCKS									
	COPPER	OIL	EMP	IIP	CONF	CPI	WAGE	PPI	Constant	TREND
Germany	1.062**	-0.355	3.105	1.937	-0.903	0.051	5.293***	-11.467*		
Japan	0.166*	-0.320**	-0.017	1.307	0.982***	-0.017	0.631	10.754***	-52.627***	0.010***
Mexico	0.844***	-0.089	-0.780	1.135***	-0.013	0.178**	0.715	-0.116	-6.075***	
Poland	0.661***	-0.131	-0.014	1.352**	0.859***	-0.031**	-0.625	-0.712		
Russia	0.881***	-0.369	-2.335**	7.329***	-5.512	2.992***	-0.425	-1.457	12.983	-0.022***
Spain	0.605***	-0.407	0.035*	1.220*	0.185	-0.114***	0.052	0.885		
UK	0.591***	-0.469**	-3.661***	3.365*	8.487*	-8.743	0.102	4.004***		
US	0.390***	-0,119	-0,030	4.803***	-0,011	-23.036***	0,645	5.279***	72.967***	0.028***

Note. *, **, *** indicates the significance at 10%, 5% and 1% significant level, respectively. All variables in levels are converted in natural logarithms except variables expressed in percent change from previous year.

PPI indicate positive and significant at 1% level impact on the stock market in Japan, UK, and the US. PPI indicates that when increases 1%, it will cause an increase of stock market index by 10.75%, 4.00% and 5.28% for Japan, UK, and the US respectively. For Germany, PPI has a negative impact on the stock market with significance at 10% level and 1% increase in PPI cause -11.47% decrease of the stock market index in the long-run. The difference between CPI and PPI show different aspects of economic activity. The former index is often relevant to estimate changes in the cost of living, while the latter index is used to estimate real growth by adjusting inflated revenue sources.

The results for coefficients of CONF, which is a leading indicator of economic activity, indicates the positive and significant impact on stock indexes in Japan, Poland, and the UK, the 1% increase in CONF causes an increase of stock indexes by 0.98%, 0.85% and 8.49% respectively in the long-run. These results might be consistent with consumer confidence influence aggregate consumer spending and thus stock prices rise. This could be explained by wealth effect, but there is the possibility of reverse effect when stock prices influence consumer confidence and hence consumer spending.

Germany is the only country, where the estimated coefficient of WAGE is significant at 1% level which indicated a positive impact on the stock market. The 1% increase in WAGE increases the stock market by 5.29% in long-run. Results of employment coefficients are significant in Russia, UK, and Spain, but they have a different impact on the stock market. Spain employment coefficient indicated a positive effect on the stock market in long-run, the 1% increase in employment causes the increase in the stock market by 0.04%. This result is consistent since the increase of employment would cause an upturn in the economy, increased demand for goods and services and thus higher profits and stock prices. Contrary, Russia and UK Employment have significant and strong negative effect on the stock market in the long-run, the 1% increase of employment causes the decrease in the stock market by -2.34% and -3.66% respectively. This surprising result might be due to the shortfall in the level of productivity that has persisted for many years as Pessoa and Van Reenen (2013) argued for the UK. They further explained that this is often assigned to relatively low levels of investment, less output is demanded from each worker and final output per hour was lower. Additionally, they argued that real wage flexibility has helped to maintain employees onto workers as wages declined, while the process can be reversed once the demand grows.

The short-run relationship of economic activity variables, copper and oil prices on the STOCKS is presented in Table 7. As can be seen from the table 7, COPPER has a positive and significant impact on stock indexes across all countries in the short run at 1% level of significance. In the short-run, the 1% increase in COPPER will lead to increase in STOCKS by 0.31%, 0.19%, 0.13%, 0.22%, 0.21%, 0.21%, 0.22%, 0.23 for Germany, Japan, Mexico, Poland, Russia, Spain, UK and US respectively. This is may be due to the fact that investors expect COPPER as an important industrial commodity to moves with the economic activity cycle and consider the ability of copper price movements to predict economic activity.

When short-run coefficients of oil prices are considered for Japan and UK, it is seen that they are again negative as in long-run, but only statistically significant at 5% level for the UK. Further, oil prices have a negative and significant impact on the STOCKS in short-run for Spain at 1% level, Mexico at 5% level and three months lagged coefficient for the US at 10% level. In the short run, the 1% increase in oil prices will lead to a decrease in the STOCKS by -0.16%, -0.10%, -0.04% and -0.06% (3month lag) for Spain, Mexico, UK, and the US respectively. Contrary to previous, oil prices for Poland have positive and significant at 5% level impact on the stock market in short-run. The 1% increase in oil prices will lead to increase in the STOCKS by 0.10% for Poland. Finally, higher oil prices are bad for the world stock market under normal condition, but in the high growth economies, oil price and the stock market can move directly together. Gogineni (2007) supported that oil prices are positively related to the stock price if oil price shocks reflect changes in aggregate demand. He found that oil price changes over a short horizon are positively correlated with the stock market returns in the case when oil price changes are due to changes in expectations of future economic activity.

Table 7. The Short-Run Estimations from ARDL (Stock-Based Model)

Country	Dependent variable: D(STOCKS)									EC(-1)
	D(COPPER)	D(OIL)	D(EMP)	D(IIP)	D(CONF)	D(CPI)	D(WAGE)	D(PPI)	D(TREND)	
Germany	0.306***	-0.061	-7.340**	0.386	7.317***	0.049***	0.138	-5.563***		-0.077***
Japan	0.190***	-0.019	-0.002	0.489***	0.362***	0.008	-0.076	5.140***	0.002***	-0.155***
Mexico	0.128***	-0.096**	-0.189	0.622*	-0.003	-0.037	-0.260	-4.574***		-0.242***
Poland	0.218***	0.103**	-0.002	0.228**	0.284**	0.011	-0.105	-3.493***		-0.169***
Russia	0.208***	-0.087	-0.553*	1.735***	5.413**	0.541	-0.100	-0.345	-0.005***	-0.237***
Spain	0.205***	-0.155***	0.016**	0.127*	6.070***	0.016	0.007**	0.092		-0.104***
UK	0.223***	-0.038**	4.104**	0.271	7.254***	-0.705	0.008	0.323*		-0.081***
US	0.230***	-0,058*(-3)	0,033**(-4)	2,003***(-2)	0,056*	-4.216***	0,118	0.919*(-1)	0.005***	-0.183***

Note. *, **, *** indicates the significance at 10%, 5% and 1% significant level, respectively. The number in parentheses ( ) show lagged term. All variables in levels are converted in natural logarithms except variables expressed in percent change from previous year. D indicates first differences.

Results in Table 7 indicate the positive and significant impact of IIP on the stock market in short-run for Japan, Mexico, Poland, Russia, Spain, and the US two months lag. In the short-run, the 1% increase in IIP will lead to increase in STOCKS by 2.00% (2 months lag), 1.74%, 0.62%, 0.49%, 0.23%, and 0.13%, for US, Russia, Mexico, Japan, Poland and Spain respectively. CPI in the short-run has positive and significant at 1% level impact on the STOCKS in Germany and negative and significant impact at 1% level on the stock market in the US. The 1% increase in CPI will lead to increase in the STOCKS by 0.05% for Germany and decrease in the STOCKS by -4.22% for the US. The PPI in short-run is within the expected, positive and significant impact on the stock market for Japan, UK, and the US one month lag coefficient. The 1% increase in PPI will lead to increase in the STOCKS by 5.14%, 0.92% (1-month lag) and 0.32% for Japan, UK, and the US respectively. Apart from previous, results show negative and significant at 1% level impact of PPI on the stock market for Germany, Mexico, and Poland. In the short-run, the 1% increase in PPI will lead to a decrease in the STOCKS by -5.56%, -4.57% and -3.49% for Germany, Mexico, and Poland respectively. The CONF in short-run is positive and significant in all countries except in Mexico. The 1% increase in CONF will lead to increase in STOCKS by 7.32%, 0.32%, 0.28%, 5.41%, 6.07%, 7.25% and 0.06% for Germany, Japan, Poland, Russia, Spain, UK and US respectively. The WAGE has positive and significant low impact on the stock market in short-run for Spain. The 1% increase in employee earnings will lead to increase in the STOCKS by 0.01% for Spain. The employment in short-run has a positive and significant impact on the stock market for Spain, UK and US (4 months lag), while negative and significant for Germany and Russia. The 1% increase in employment will lead to increase in stock indexes by 0.02%, 4.10%, and 0.03% for Spain, UK and US (4 months lag) respectively, while reverse growth (decrease) in the STOCKS by -7.34% and -0.55% for Germany and Russia respectively.

The short-run adjacent process is examined from the error correction term (ECT) and it is reported in Table 7. The ECT measures the speed at which prior deviations from the equilibrium are corrected in the current period. The ECT coefficient value is between 0 and -1, means that the equilibrium is converging to the long-run equilibrium in response to external shocks. In the case when the ECT value is positive, the equilibrium will be divergent from the reported values of ECM test. In all eight cointegrated stock index-based models, the coefficient of the lagged ECT is negative and significant at the 1% level. The ECT coefficients confirms that deviation from the equilibrium level of stock indexes in the current month for each model will be corrected by 24.2%, 23.7%, 18.3%, 16.9%, 15.5%, 10.4%, 8.1% and 7.7% for Mexico, Russia, US, Poland, Japan, Spain, UK, and Germany respectively.

4.1.2 Gold-based model

In the second model, the GOLD in five from nine reviewed countries, Japan, Mexico, Russia, UK, and the US are cointegrated with COPPER, oil prices, and economic activity variables. Table 8 report the results of long-run estimated coefficients of each independent variable included in the equation of ARDL gold-based model for each country. The results show that coefficient of COPPER indicate the positive and significant impact on GOLD expressed in domestic currency at 1% level for Japan, Russia, UK, US and 5% level for Mexico in long-run. The 1% increase in COPPER leads to increase in GOLD by 0.73%, 0.29%, 0.77%, 0.37% and 0.50% for Japan, Mexico, Russia, UK, and the US respectively in the long-run.

The short-run relationship of economic activity variables, copper and oil prices on GOLD is presented in Table 9. From the short-run relationship of GOLD with COPPER can be seen that COPPER have also positive and significant impact on GOLD in short-run for Japan, Russia, UK and the US at 1% level of significance, while Mexico COPPER have an insignificant impact, they are ineffective to affect GOLD in short-run. The 1% increase in COPPER in short-run will lead to increase in GOLD by 0.11%, 0.12%, 0.10% and 0.09% for Japan, Russia, UK, and the US respectively. The existence of this co-movement between gold and COPPER is confirmed by Pindyck and Rotemberg (1990).

Table 8.The Long-Run Estimations from ARDL (Gold-Based Model)

Country	Dependent variable: GOLD									
	COPPER	**OIL**	**EMP**	**IIP**	**CONF**	**CPI**	**WAGE**	**PPI**	**Constant**	**TREND**
Japan	0.728***	0.123	0.128***	-3.930***	-0.705***	-0.053*	2.486*	-1.042	20.416***	
Mexico	0.286**	-0.233	0.522	-3.616***	0.057	-0.436***	-2.522**	3.914***	19.715***	0.008***
Russia	0.770***	0.183	-3.191***	0.215	-5.950***	0.388	0.050	-0.574	47.123***	
UK	0.371***	0,055	-8.171***	-1.501***	-5.148***	-2.253	-2.924***	0.292	183.127***	0.016***
US	0.503***	-0,088	0.028*	-2.783***	-0.234**	-2,171	5.079***	-0,093		

Note. *, **, *** indicates the significance at 10%, 5% and 1% significant level, respectively. All variables in levels are converted in natural logarithms except variables expressed in percent change from previous year.

They advocated that prices of largely unassociated commodities have a continuous propensity to move together and explained this co-movement as a puzzling phenomenon due to inability to be confirmed by the influence from past, current, or expected future events of economic activity such as inflation, industrial production, interest rates, and exchange rates. In the long-run (Table 8), the oil prices have an insignificant impact on GOLD in all five country gold base models. Actually, they are ineffective to affect GOLD in long-run. When short-run coefficients (Table 9) of oil prices are considered, they have a positive and significant impact on GOLD in short-run in Russia at 1% significant level. In the short-run, the 1% increase in oil prices will lead to increase in GOLD by 0.11% in Russia. The results of the relationship between gold and oil prices in the long-run show that there is not a significant connection between them, they do not have a common trend. This result is obtained with linear exploration and does not consider non-linear relationships that might exist between the price changes of oil and gold. Thai and Youngho (2011) bring evidence of non-linear relationships between the price changes of oil and gold. They used different oil price proxies for investigation and found that the impact of oil price on the gold price is non-linear, that oil price does nonlinearly cause the gold price and can be used to predict the gold price.

In the long-run (Table 8), the relationship between GOLD and IIP are negative and very strong across all countries. Russia’s IIP coefficient is insignificant and ineffective to explain GOLD in long-run. The coefficient of IIP in Japan, Mexico, UK and the US are significant at 1% level and indicates that in long-run, the 1% increase in IIP causes the decrease in the GOLD by -3.93%, -3.62%, -1.50% and -2.78% respectively. In the short-run (Table 9), Japan and US IIP coefficients are insignificant and do not affect GOLD.

Results indicate the negative and significant impact of IIP on GOLD in short-run for Mexico and UK, the 1% increase in IIP will lead to a decrease in GOLD by -0.41% and -0.54% respectively. Industrial production represents a popular measure for aggregate economic activity and it is positively correlated with stocks, so gold can be defined as a hedge due to negatively correlated with industrial production on average. Further, gold can be used as a safe haven in times of aggregate economy stress or turmoil. This finding is consistent with Baur and Lucey (2010) who found that gold is a hedge against stocks on average and a safe haven in downside stock market conditions, while safe haven property is short-lived.

Table 9. The Short-Run Estimations from ARDL (Gold-Based Model)

Country	**Dependent variable: D(GOLD)**									**EC(-1)**
	D(COPPER)	**D(OIL)**	**D(EMP)**	**D(IIP)**	**D(CONF)**	**D(CPI)**	**D(WAGE)**	**D(PPI)**	**D(TREND)**	
Japan	0.111***	0.014	0.005	-0.083	-0.081**	-0.006**	-0072	2.458***		-0.115***
Mexico	0.046	-0.026	0.059	-0.410***	0.007	-0.049***	-0.286*	5.101***	0.001**	-0.113***
Russia	0.119***	0.114***	-0.797***	-0.019	-5.838***	1.558***	0.007	-0.078		-0.136***
UK	0.102***	-0.006	-2.762***	-0.535**	-1.740***	-0.761	-0.988***	2.407**	0.006***	-0.338***
US	0.092***	-0,012	0.004	0.578	-0.033*	3,905***	-1.415*	-0,013		-0.140***

Note. *, **, *** indicates the significance at 10%, 5% and 1% significant level, respectively. The number in parentheses ( ) show lagged term. All variables in levels are converted in natural logarithms except variables expressed in percent change from previous year. D indicates first differences.

The relationship (Table 8) of consumer prices on GOLD had negative and significant effect in the long-run for Japan and Mexico at 10% and 1% level of significance respectively. For instance for Japan and Mexico, the 1% increase in CPI will decrease GOLD by -0.05% and -0.44% respectively. In the short-run (Table 9), again CPI as a proxy for inflation had a negative and significant impact on GOLD, but with near "zero" values for Japan and Mexico. Contrary, consumer prices for Russia and US have a positive and significant impact on GOLD at 1% level of significance. The 1% increase in CPI will lead to increase in GOLD by 1.56% and 3.91% for Russia and US respectively in the short-run. In the short-run GOLD for Russia and US satisfied that price of gold should rise over time above the general rate of inflation-CPI and hence be a hedge against inflation. Japan and Mexico have a negative relationship between CPI and GOLD in short and long-run, it is when inflation increases, the GOLD will decrease. This result was supported with Blose (2010) which found that unexpected changes in the CPI do not affect gold spot prices. The results indicate that investors anticipating changes in inflation expectations should design speculation strategies in the bond markets rather than the gold market. There may be capital flows in a direction from gold to bonds when bond yields increase, bond prices decrease and provide a better alternative than gold. The PPI (Table 8) indicate positive and significant at 1% level impact on gold price for Mexico in the long-run, the 1% increase in

PPI causes an increase of gold price by 3.91%. In the short-run (Table 9), for Japan, Mexico, and the UK, PPI have strong positive impact on GOLD with significance at 1%, 1%, and 5% level, respectively. The 1% increase in PPI causes 2.49%, 5.10% and 2.41% increase in GOLD in the short-run in Japan, Mexico, and the UK respectively. In the long and short-run for Mexico and short-run for Japan and UK GOLD rise over time above the general rate of producer prices and hence be a hedge against real growth adjusted by inflated revenue sources.

CONF (Table 8) indicates the negative and significant impact on GOLD in Japan, Russia, UK and US in the long-run. The 1% increase in CONF causes decrease on GOLD by -0.71%, -5.95%, -5.15% and -0.23% respectively in the long-run. In the short-run (Table 9) same countries also have the negative and significant impact of CONF on GOLD. The 1% increase in CONF will lead to a decrease in GOLD by -0.08%, -5.84%, -1.74% and -0.03% in Japan, Russia, UK, and the US respectively in the short-run. GOLD rises when consumers feel more pessimistic about the future of the aggregate economy and hence decrease their spending. Smaller values of coefficient of consumer confidence for Japan and US indicate that impact of domestic economic conditions expressed by CONF is overcome by their export and operations of multinational companies driven by foreign demand.

In the long-run, the WAGE (table 8) have a positive and significant impact on GOLD in Japan and US, while negative and significant impact in Mexico and UK. The 1% increase in WAGE increases GOLD by 2.49% and 5.08% in Japan and US respectively, while decreases GOLD by -2.52% and -2.92% in Mexico and UK respectively in the long-run. In the short-run (Table 9), Japan's WAGE have an ineffective impact on gold price due to insignificance, while Mexico, UK, and US WAGE have a negative and significant impact on GOLD. The 1% increase in WAGE decreases GOLD by -0.29%, -0.99% and -1.42% respectively in the short-run. Positive correlation of GOLD and WAGE in long-run for Japan and US might be due to expense driver in company's income statements and impact on profits. Contrary, the negative correlation might indicate that decrease in WAGE make consumers feel more pessimistic, decrease their spending, and future of the aggregate economy become less bright. The results in the long-run for employment (Table 8) impacted significantly GOLD in Japan, Russia, UK and the US, but they are different in direction. Japan and US employment indicate the small positive effect on GOLD, while Russia and the UK indicate the strong negative impact on GOLD. In the long–run the 1% increase in employment causes the increase in GOLD by 0.13% and 0.03% in Japan and US respectively, while a decrease in GOLD by -3.19% and -8.17% in Russia and UK respectively. In the short-run (Table 9), employment coefficients have negative and significant at 1% level impact on GOLD in Russia and UK. The 1% increase in employment will lead to a decrease in GOLD by -0.80% and -2.76% for Russia and UK respectively in the short–run. The GOLD in Japan and US are positively correlated with employment in the long-run and have a very small economic impact with values near “zero”. Contrary, GOLD in Russia and UK have a negative correlation with employment and have a strong economic impact which indicated that GOLD will rise when the employment situation show weakness in the short and long–run period.

The short run adjacent process (Table 9) for gold based model is examined from the error correction term (ECT). In all five cointegrated gold based models, the coefficient of the lagged ECT is negative and significant at the 1% level. The coefficient implies that a deviation from the equilibrium level of GOLD in domestic currencies in the current month will be corrected to 33.8%, 14.0%, 13.6%, 11.5% and 11.3% for the UK, US, Russia, Japan, and Mexico respectively.

4.1.3 Silver-based model

In the third model, the SILVER in six from nine reviewed countries, Brazil, Japan, Mexico, Russia, UK and the US are cointegrated with COPPER, oil prices, and economic activity variables. Table 10 reports the results of long-run estimated coefficients of each independent variable included in the equation of ARDL Silver-based model for each country.

The results show that coefficient of COPPER indicate the positive and significant impact on SILVER expressed in domestic currency at 1% level in long-run for countries with cointegrated silver based model. The 1% increase in COPPER leads to increase in SILVER by 0.63%, 0.97%, 0.59%, 1.17%, 0.62% and 0.82% for Brazil, Japan, Mexico, Russia, UK, and the US respectively in the long-run. The short-run relationship of economic activity variables, copper and oil prices with SILVER is presented in Table 11.

In the short-run relationship of SILVER with COPPER can be seen that COPPER have also positive and significant impact on SILVER in Brazil, Japan, Mexico, Russia, UK, and the US at 1% level of significance. The 1% increase in COPPER in short-run will lead to increase in SILVER by 0.5%, 0.46%, 0.40%, 0.33%, 0.48% and 0.45% respectively. Silver shares some of the characteristics of gold as an investment commodity, but it is also an industrial commodity, like copper with the difference that market participants usually do not stockpile copper and they do not speculate on it because it is cheap, heavy and plentiful. The existence of this co-movement between silver and COPPER is within findings by Pindyck and Rotemberg (1990) that prices of largely unrelated raw commodities have a persistent tendency to move together. In the long-run (Table 10), the oil prices have a negative and significant impact on SILVER in three countries, for Japan and UK at 5% level and Mexico at 1% level of significance. The 1% increase in oil prices will lead to a decrease in SILVER by -0.85%, -0.46% and -0.28% for Japan, Mexico, and the UK respectively in the long-run. On the other hand, in the short–run (Table 11) coefficients of oil prices have a positive and significant impact on SILVER in Brazil at 1% level and negative and significant impact in the UK at 5% level of significance. The 1%

`

increase in oil prices will lead to increase in SILVER by 0.18% in Brazil and decrease by -0.07% in the UK in the short-run. SILVER in Brazil have a tendency to move together with oil prices, while in the UK have a negative relationship between silver and oil prices, thus when the oil price decrease silver price will increase. Since higher oil prices are often mentioned as a driver for inflation, the increase in the oil price will lead to an increase in inflation and the next step of interest will be to check the relationship between SILVER with inflation proxies with CPI and other economic activity variables.

Table 10.The Long-Run Estimations from ARDL (Silver-Based Model)

Country	**Dependent variable: SILVER**									
Brazil	**COPPER**	**OIL**	**EMP**	**IIP**	**CONF**	**CPI**	**WAGE**	**PPI**	**Constant**	**TREND**
Brazil	0.629***	-0.243	-0.030	-1.878**	13.920***	-5.723**	1.101	2.346**	-43.817**	0.014**
Japan	0.968***	-0.853**	0.301**	2.442	-0.766	-0.038	-6.800	-9.992***	78.815***	
Mexico	0.592***	-0.462***	0.744	-2.253***	-0.085	-0.537***	-4.387***	6.660***	7.264**	
Russia	1.169***	-1.111	-2.959**	-1.981	6.103***	-0.080	-0.610	2.386		
UK	0.617***	-0.281**	-14.585***	3.254**	-8.158**	-0.246	-1.470	1.491	271.386***	0.019**
US	0.821***	-0,256	0.073***	-1,474	-0.601**	-11.397***	11.775***	-0,408		

Note. *, **, *** indicates the significance at 10%, 5% and 1% significant level, respectively. All variables in levels are converted in natural logarithms except variables expressed in percent change from previous year.

The relationship of consumer prices (Table 10) with SILVER has negative and significant effect in the long-run in Brazil, Mexico and US at 1% level of significance. The 1% increase in CPI will decrease SILVER by -5.72%, -0.54 and -11.40% in Brazil, Mexico and US respectively in the long-run. In the short-run (Table 11), CPI again has a negative and significant impact on SILVER in Brazil, Mexico, UK and the US, while Russia's CPI has a positive and significant impact on SILVER. The 1% increase in CPI in the short-run will lead to a decrease in SILVER by -1.13 %, -0.11%, -3.63% (1-month lag) and -2.38% in Brazil, Mexico, UK, and the US respectively, while in Russia silver price will be increased by 1.31%. In the short-run silver price in Russia satisfied that it should rise over time above the general rate of inflation and hence be a hedge against inflation. The remaining markets have a negative relationship between SILVER and inflation, thus when inflation decrease SILVER will increase. As gold and silver relationship is in general strong and convincing with inflation, Lucey and Tully (2005), also our findings show that gold and silver might have a similar relationship with inflation.

In the long-run (Table 10), the relationship between SILVER and IIP is negative and significant in Brazil and Mexico and positive and significant in the UK. The 1% increase of IIP in the long-run causes the decrease in the SILVER by -1.89% and -2.25% in Brazil and Mexico respectively, while the increase in SILVER by 3.25% in the UK. Brazil and

Mexico coefficients of IIP (Table 11) repeat the same behavior in the short-run with negative and significant at 1% level impact on SILVER. UK and US's one month lagged coefficients of IIP have a positive and significant impact on SILVER in the short-run. The 1% increase in the short-run of IIP decrease SILVER by -0.83% and -0.45% in Brazil and Mexico respectively, while increased SILVER by 0.77% and 2.47% (1-month lag) in UK and US respectively. Silver shares some of the characteristics of gold but it is also an industrial commodity. For example in the short and long-run, in Brazil and Mexico silver can be used as a hedge in times of aggregate economy stress or turmoil due to negatively correlated with industrial production on average, while in UK increase of production will demand more industrial commodities like silver.

Table 11. The short-run estimations from ARDL (Silver-based model)

Country	**Dependent variable: D(SILVER)**									**EC(-1)**
	D(COPPER)	**D(OIL)**	**D(EMP)**	**D(IIP)**	**D(CONF)**	**D(CPI)**	**D(WAGE)**	**D(PPI)**	**D(TREND)**	
Brazil	0.500***	0.176***	-0.005	-0.834***	2.753***	-1.132**	-0.733*	2.190***	0.003*	-0.198***
Japan	0.459***	0.048	-0.007	-0.263	-0.084	-0.004	-0.225	-3.551**		-0.109***
Mexico	0.404***	0.016	0.149	-0.450***	-0.017	-0.107***	-0.876***	4.650***		-0.200***
Russia	0.327***	0.085	-0.413	-0.210	0.646***	1.310***	-0.065	0.095		-0.106***
UK	0.475***	-0.066**	-3.439***	0.767**	-1.924***	-3.631*(-1)	-0.364	7.721***	0.005**	-0.236***
US	0.451***	-0,053	-0.071***(-1)	2,468***(-1)	-0.083	-2.377**	2.456***	3,097***		-0.209***

Note. *, **, *** indicates the significance at 10%, 5% and 1% significant level, respectively. The number in parentheses ( ) show lagged term. All variables in levels are converted in natural logarithms except variables expressed in percent change from previous year. D indicates first differences.

The PPI (Table 10) indicate the positive and significant impact on SILVER for Brazil and Mexico in the long-run, the 1% increase in PPI causes an increase of SILVER by 2.35% and 6.66% respectively. Contrary, in Japan PPI, has a negative and significant impact on SILVER in the long-run, the 1% increase in PPI causes a decrease in SILVER by -9.99% in the long-run. In the short-run (Table 11), Brazil, Mexico, UK and US silver-based models have the positive and significant impact of PPI coefficient on SILVER, while Japan's PPI coefficient once more as in the long run has a negative and significant impact on SILVER. The 1% increase of PPI coefficient causes an increase of SILVER by 2.19%, 4.65%, 7.72% and 3.10% for Brazil, Mexico, UK and the US respectively and a decrease of SILVER by -3.55% for Japan in the short-run. Positive correlation between PPI and SILVER where SILVER rises over time above the general rate of PPI might selects silver as a hedge for inflated revenue sources of companies. Negative correlation between PPI and SILVER for Japan can be explained by Japanese economy has suffered liquidity trap during late 1990's and early 21st century with a period of strong disinflation, Krugman (1998).

The coefficients of CONF indicate positive and significant at 1% level impact on SILVER, in both states, long-run and short-run in Brazil and Russia. The 1% increase in CONF causes an increase in SILVER by 13.92% and 6.10% for Brazil and Russia respectively in long-run, while in short-run 1% increase in CONF increased SILVER by 2.75% and 0.65% for Brazil and Russia respectively. The UK's CONF indicate the negative and significant impact on SILVER in both periods, the 1% increase in CONF decreased SILVER by -8.16% and -1.92% in long–run and short-run respectively. The US CONF has a negative and significant impact on SILVER only in the long-run, the 1% increase in CONF decreased SILVER by 0.60%. For instance, in UK and US, SILVER rise when consumers feel more pessimistic about the future of the aggregate economy, and hence decrease their spending. Contrary, in Brazil and Russia CONF co-movement with SILVER, this may be due to increased prices of commodities as their exporters increase revenue and have a positive impact on spending.

The WAGE coefficient (Table 10) in the long-run have positive and significant at 1% level impact on SILVER in US and negative and significant at 1% level impact on SILVER in Mexico. The 1% increase in WAGE increases SILVER by 11.78% in the US and decrease silver price by -4.39% in Mexico in the long-run. In the short-run (Table 11), the 1% increase in WAGE increases SILVER by 2.46% at 1% level of significance in the US. Contrary, negative and significant relationship exist between Mexico's and Brazil's WAGE and SILVER , the 1% increase in WAGE decrease SILVER by -0.88% and 0.73% for Mexico and Brazil respectively. The positive correlation in the long-run between SILVER and WAGE in the US might be acting as a hedge due to wage expense driver in company's income statements and negative impact on profits. Contrary, the negative correlation for Mexico might indicate that decrease in wages make consumers feel more pessimistic, decrease their spending, and future of the aggregate economy become less bright. The results (Table 10) in the long-run between employment and SILVER are significant in Japan, Russia, UK and US, where Japan and US employment coefficients indicate the small positive effect on SILVER, while Russia and UK employment coefficients indicate the negative and very sensitive impact on SILVER. The 1% increase in employment causes the increase in SILVER by 0.30% and 0.07% in Japan and US respectively, while a decrease in SILVER by -2.96% and -14.59% in Russia and UK respectively. In the short-run (Table 11), employment coefficients have negative and significant impact on SILVER in UK and US one month lag. The 1% increase in employment will lead to a decrease in SILVER by -3.44% and -0.07% (1month lagged) in UK and US respectively. Japan's SILVER positive correlation with employment in long-run might be seen silver as a hedge in the case when employment increase leads to decrease in productivity. Russia and UK SILVER negative correlation with employment have a sensitive impact and indicate that SILVER will rise when the employment situation shows weakness.

`

The short-run adjacent process (Table 11) for silver based model is examined from the error correction term (ECT). In all six cointegrated SILVER based models, the coefficients of the lagged ECT are negative and significant at the 1% level. The coefficients imply that a deviation from the equilibrium level of SILVER in domestic currencies in the current month will be corrected to 23.6%, 19.8%, 20.9%, 20.0%, 10.9% and 10.6% for the UK, Brazil, US, Mexico, Japan, and Russia respectively.

4.1.4 Summary of long-run effects

We examined the long-run relationship for stock, gold and silver based models, where each model includes set of considered economic activity variables enlarged with oil and COPPER. The study employs ARDL bounds testing procedure to analyzed the cointegration among the considered variables.

In the stock-based model, the bounds test confirms that stock prices tend to have a long-run relationship with COPPER, oil prices, employment, industrial production, CONF, CPI, WAGE and PPI across all country models with exception of Brazil model. The results indicate that COPPER has significant and positive relationship with stock prices in all selected country stock-based models in the long-run. The copper price is a powerful variable which related stock prices globally in the long-run because of its linkage with the overall economy and tracks where the economy is headed, Lahart (2006). Similarly, the worldwide results in the most of the selected countries revealed the positive and significant relationship between stock prices and industrial production in the long-run. This link is explained by Fama (1990), where the stock market is a rational forecast of real sector and further Chen et al. (1986) advocated that it reflects the value of insuring against real systematic production risk.

This study provides a country-specific relationship between stock prices with CONF and WAGE in the long-run based on wealth effects, where consumers feel more optimistic about the future of the aggregate economy, so do aggregate consumer spending and stock prices soar. There are a significant and negative relationship between oil and stock prices in Japan and UK in the long-run since oil is an essential input for production usually it would soar production costs, so further fall in economic activity and it would lead to lower expected future cash flows, Cheung and Ng (1998).

The bounds test implies that significant relationship between CPI and stock prices differs in direction among countries, for example in Poland, Spain and US is negative, whilst in Mexico and Russia is positive. The same dissimilar behavior is confirmed in the significant relationship of employment and PPI with stock prices in the long-run. For instance, employment link with stock prices is positive in Spain, while negative in Russia and UK. Further, the PPI link with stock prices is positive in Japan, UK, and the US, while negative in Germany. According to Fama and Gibbons (1982), CPI as proxy for inflation is positively related to stock prices when might indicated a potential increase in real activity and then higher stock returns, while the negative relationship is supported by Fama (1981) and Mukherjee and Naka (1995) and might be due to inflation cause the value of money to decrease and accordingly lower demand leads to a negative effect of saving and investment activities of the stock market. The country-specific results of employment in the long-run, when it is positively related to stock prices is consistent with employment impact would cause an upturn in the economy, so further an increase in aggregate demand and finally would lead to higher profits and stock prices. Contrary, the reverse relationship, negative, is surprising and the result might be due to the shortfall in the level of productivity which persisted for many years and less output is demanded from each worker in the environment of weak aggregate demand (Pessoa & Van Reenen, 2013). The positive relationship between the PPI and stock prices is due to favorable influence on firm's revenues, cash flows and hence stock prices, but the less straightforward reverse relationship can be explained by Japanese economy circumstance which has suffered liquidity trap during late 1990's with period of strong disinflation, Krugman (1998), and negatively related industrial production and rate of inflation, Humpe and Macmillan (2007).

The bounds test of gold-based model confirms that GOLD tend to have a long-run relationship with considered variables in five countries: Japan, Mexico, Russia, UK, and the US. The oil prices have an insignificant impact on all specified models and they are ineffective to affect GOLD in the long-run, but this result is obtained with linear exploration and does not consider non-linear relationships as Thai and Youngho (2011) found that impact of oil price on the gold is nonlinear. In each country model estimated relationships between copper and GOLD are found to be significantly positive in the long-run. Similarly, PPI has country specific significant and positive relationship with GOLD in Mexico in the long-run. The existence of co-movement between gold and copper prices is confirmed by Pindyck and Rotemberg (1990), where largely unassociated commodities have a continuous propensity to move together. Gold price co-movement with PPI can be a hedge against real growth adjusted by inflated revenue sources in case of Mexico.

The major difference in the long-run relationships of the gold-based model relative to the stock-based model is that in the former the industrial production and CONF have a significant and negative link with GOLD in the most of the countries. The behavior of industrial production to be positively correlated with stocks and negatively correlated with gold can find gold as a hedge against stocks on average and a safe haven in downside stock market conditions, Baur and Lucey (2010). Also, the gold hedge instrument can be applied when consumers feel more pessimistic about the future of the aggregate economy, and hence decrease their spending. The country-specific significant and negative relationship is confirmed between CPI and GOLD in Japan and Mexico in the long-run. Blose (2010) found that unexpected changes in the CPI do not affect gold spot prices, indication is that investors design speculation strategies in the bond markets rather than the gold markets

`

and there may be capital flows in direction from gold to bonds in case when bond yields increase, bond prices decrease and provide a better alternative than gold.

The dissimilar significant link between GOLD with employment and WAGE are confirmed in selected countries in the long-run. The employment has a positive influence on GOLD in Japan and US, while in Russia and UK is negative. Further, WAGE has a positive influence on GOLD in Japan and US, while in Mexico and UK is negative. The positive link between GOLD and WAGE might be due to expense driver in company's income statements and impact on profits when they drop and is favorable to hold gold as De Long (2011, September 10) commented that is cheap to hold gold when real interest rates are low than when real interest rates are high. Contrary, the negative link might indicate that decrease in WAGE decreases spending and future of the aggregate economy and profits become less bright. The results when GOLD are negatively related with employment have a strong economic impact and indicate that GOLD will rise when the employment situation shows weakness in the long–run, while the reverse, positive link have a very small economic impact.

The silver-based compared to gold-based model additionally includes Brazil in the long-run relationship of SILVER with considered variables and shares some of the characteristics with both previous summarized, stock and gold based models. As in previous models, the relationship between COPPER and SILVER are found to be significantly positive in the long-run, across all specified countries and is within findings by Pindyck and Rotemberg (1990). The significant negative long-run relationship between oil and SILVER in Japan, Mexico, and the UK and between CPI and SILVER in Brazil, Mexico and US is very similar to oil prices link in the stock-based model and CPI link in the gold-based model. The Oil link can be explained by the rise in production costs for oil prices, followed with lower expected future cash flows and so SILVER behave as an industrial commodity. On the other hand, CPI link might be explained by the preference of bond market rather than the gold market in the case when bond yields increase, Blose (2010), but considering silver to shares some of the characteristics of gold as an investment commodity.

One interesting result about this model, when silver shares some of the characteristics of gold as an investment commodity and as an industrial commodity, can be noticed in the significant long-run relationship between industrial production and CONF with SILVER. The results of the positive link between industrial production in the UK and for CONF in Brazil and Russia might be when silver act as an industrial commodity due to increasing production demand for more industrial commodities like silver and increased prices of commodities lead to higher exporters revenue. The negative link for industrial production in Brazil and Mexico and for CONF in UK and US might be when silver shares some of the characteristics of gold and can be used as a hedge in times of aggregate economy stress when consumers feel more pessimistic about the future of the aggregate economy.

Silver price co-movement above the general rate of PPI can be a hedge against real growth adjusted by inflated revenue sources in case of Brazil and Mexico. The opposite, negative link between PPI and SILVER in Japan which has suffered liquidity trap with a period of strong disinflation, Krugman (1998), might place silver as a hedge in an economy with deflationary pressure on business revenues. Finally, SILVER confirmed the significant positive long-run relationship with employment in Japan and WAGE in the US. This might place silver to be acting as a hedge in the case when employment increase leads to decrease in productivity and wage expense drive negative impact on profits. The reverse results, when SILVER are negatively related to employment in Russia and UK and WAGE in Mexico might place silver to be acting as a hedge when the employment situation shows weakness and decrease in wages affect the downward aggregate economy.

4.1.5 Summary of short-run effects

After estimating the long-run effects of selected models, we follow ECM to check the short-run dynamic relationship among the considered variables in each selected model: stock, gold, and silver based models.

The results of the short-run dynamics of stock-based model confirm the positive and significant relationship, as in long-run, with COPPER across all countries, industrial production and CONF in the most of countries and WAGE with low economic impact in Spain. In the short-run, there is a significant and negative relationship between oil prices and stock prices in Mexico, Spain, UK and the US on 3^{rd} lagged value, while surprisingly reverse, a significant and positive relationship confirmed in Poland. However, higher oil prices are bad for the world stock market under normal condition, but in the high growth state, oil price and the stock market can move directly together, Gogineni (2007).

The dissimilar behavior is confirmed in the significant relationship between CPI and PPI with stock prices in the short-run. The CPI link is positive in Germany, while negative, as in the long-run, in the US. Further, PPI link is positive in Japan, UK, and the US, while negative in Germany, Mexico, and Poland. The ECM dynamics implies that significant short-run relationship between employment and stock prices differs in direction among countries. For instance, it is negative in case of Germany and Russia, while positive in Spain, UK, and the US on 4^{th} lagged value. The UK short-run employment link is positive and differs from that in the long-run, which might be influenced that employment would cause an upturn in the economy and would lead to higher profits and stock prices.

Results indicate the lagged ECT for the estimated stock-based model for all selected countries are both negative and statistically significant and this confirms a valid cointegration between stock prices and considered variables. The coefficient of error term suggests that the highest speed of adjustment have Mexico and Russia, where about 24% of disequilibrium is corrected in the current month, and lowest speed of adjustment have UK and Germany, where about 8% of disequilibrium is corrected in the current month.

`

As it expected as in the long-run relationship, the short-run estimation of gold-base model confirms the positive and significant link between COPPER and PPI with GOLD. From gold selected models in short-run, only Mexico's COPPER have an insignificant impact or they are ineffective to affect GOLD, while PPI link to GOLD is confirmed in Japan, Mexico, and the UK. In the short-run, there is a deviation from the behavior of oil prices that have an insignificant impact on all specified models to affect GOLD in the long-run, where only Russia's oil prices have a positive and significant relationship with GOLD in the short-run.

The result of the short-run dynamics confirms the negative and significant relationship between GOLD and: IIP in Mexico and UK, employment in Russia and UK and WAGE in Mexico, UK, and the US. The US result of negative WAGE link on GOLD in the short-run is opposite than that from the long-run and the reason to hold gold might be due to that decrease in WAGE influence future of the aggregate economy to become less bright. The result of CPI impact on GOLD in the short-run confirms the negative and significant relationship, as in the long-run, in Japan and Mexico. On the other hand, the positive and significant relationship between CPI and GOLD in Russia and the US refer that price of gold rising over time above the general rate of CPI and hence be a hedge against inflation. The lagged ECTs for the estimated gold-based model for all selected countries are both negative and statistically significant and this confirms a valid cointegration between GOLD and considered variables. The coefficient of error term suggests that the highest speed of adjustment has the UK, where about 34% of disequilibrium is corrected in the current month, and lowest speed of adjustment have Japan and Mexico, where about 11% of disequilibrium is corrected in the current month.

The shared market characteristics of silver with stock and gold are also shown in short-run estimations of the silver-based model. The ECM confirms the positive and significant link between COPPER and SILVER in the short–run across all selected models. The results of the short-run dynamics confirms same outcome as in the long-run with difference or additions to: CONF with inefficiency to affect SILVER in US, IIP with inclusion of positive link on SILVER in US on 1st lagged value, PPI with inclusion of positive link on SILVER in UK and US, WAGE with inclusion of negative link on SILVER in Brazil and CPI with inclusion of positive link on SILVER in Russia and negative link on SILVER in UK on 1st lagged value. The dissimilar behavior is confirmed in the significant relationship between oil prices and SILVER in the short-run, where oil prices link is positive in Brazil, while is negative in the UK. The employment link on SILVER is negative in UK and US on 1st lagged value.

The lagged ECTs of the estimated silver-based model for selected countries are both negative and statistically significant which confirms a valid cointegration between SILVER and considered variables. The coefficient of error term suggest that the highest speed of adjustment of disequilibrium which is corrected in the current month has the UK with about 24%, next are the US, Mexico and Brazil with about 20% and the lowest speed have Japan and Russia with about 11%.

4.2 Toda-Yamamoto Causality Analysis

The causality test suggested by TY was used to determine the direction of causality, actually to study the lead-lag relationships between the stock market, commodities, and economic activity variables of interest. The selection of the appropriate lag order of the VAR was determined on the basis of the calculations from EViews 9.0 and testing across output from different information criteria's (AIC, SC, and HQ) in order serial correlation of residuals to be removed. After examining the residuals and apply the LM test for serial independence, optimal lag order (*p*) of each country VAR was specified: 10, 11, 9, 12, 6, 8, 5, 5 and 7 for Brazil, Germany, Japan, Mexico, Poland, Russia, Spain, UK and US respectively. We set up a nine VAR models for each country, including stock prices, GOLD, SILVER, COPPER, oil prices, EMP, IIP, CONF, CPI, WAGE and PPI. The models satisfy the stability condition, as there are no roots lying outside the unit circle in the models, Figure 3.

The correct order of the VAR models for all countries is augmented by "$d_{max} = 1$", which is the maximal order of integration for all considered variables in each country, and then following Giles (2011, April 29), VAR models are re-estimated within the interval $p+1$ with one extra lag which already be treated as exogenous variable and not included in the Wald test. Subsequently, the results are reported in Table 12.

4.2.1 Commodities and stock prices

Four commodities gold, silver, copper and oil are found to be important in determining the stock market indexes in considered countries. Causality analysis implies that gold and SILVER Granger-causes stock market prices in the US, Germany, and Mexico. In Mexico, there is a lack of rejection of the null hypothesis of non-causality at 10% level for GOLD, 12.6% of GOLD Granger non-cause the stock prices in Mexico. In the UK was detected a unidirectional causality, moving from silver to GOLD, CONF and STOCKS at a significant level (LSILVER => LGOLD => LCONF => LSTOCKS). Similarly, Poland has unidirectional causality, moving from silver to gold and stock index at a significant level (LSILVER => LGOLD => LSTOCKS).

Stock prices in Russia and Brazil Granger-causes gold and SILVER at a significant level, augmented with extra feedback from SILVER to STOCKS in case of Brazil, which indicates bi-directional causality between silver and STOCKS in Brazil. For the relation between stock prices with silver and GOLD, Japan and Spain indicate a unidirectional causality, moving from STOCKS to silver and gold prices at significant level (LSTOCKS => LSILVER => LGOLD), where in Spain there is lack of rejection of the null hypothesis of non-causality at 10% level, 13.1% of STOCKS Granger non-cause the SILVER in Spain. The results advocated by Anand and Madhogaria (2012) show different behaviors for gold and stock prices in different markets, they find that in developed countries GOLD cause the stock prices while in emerging countries the stock prices cause the GOLD.

Figure 3. AR Roots Test Results in E-Views

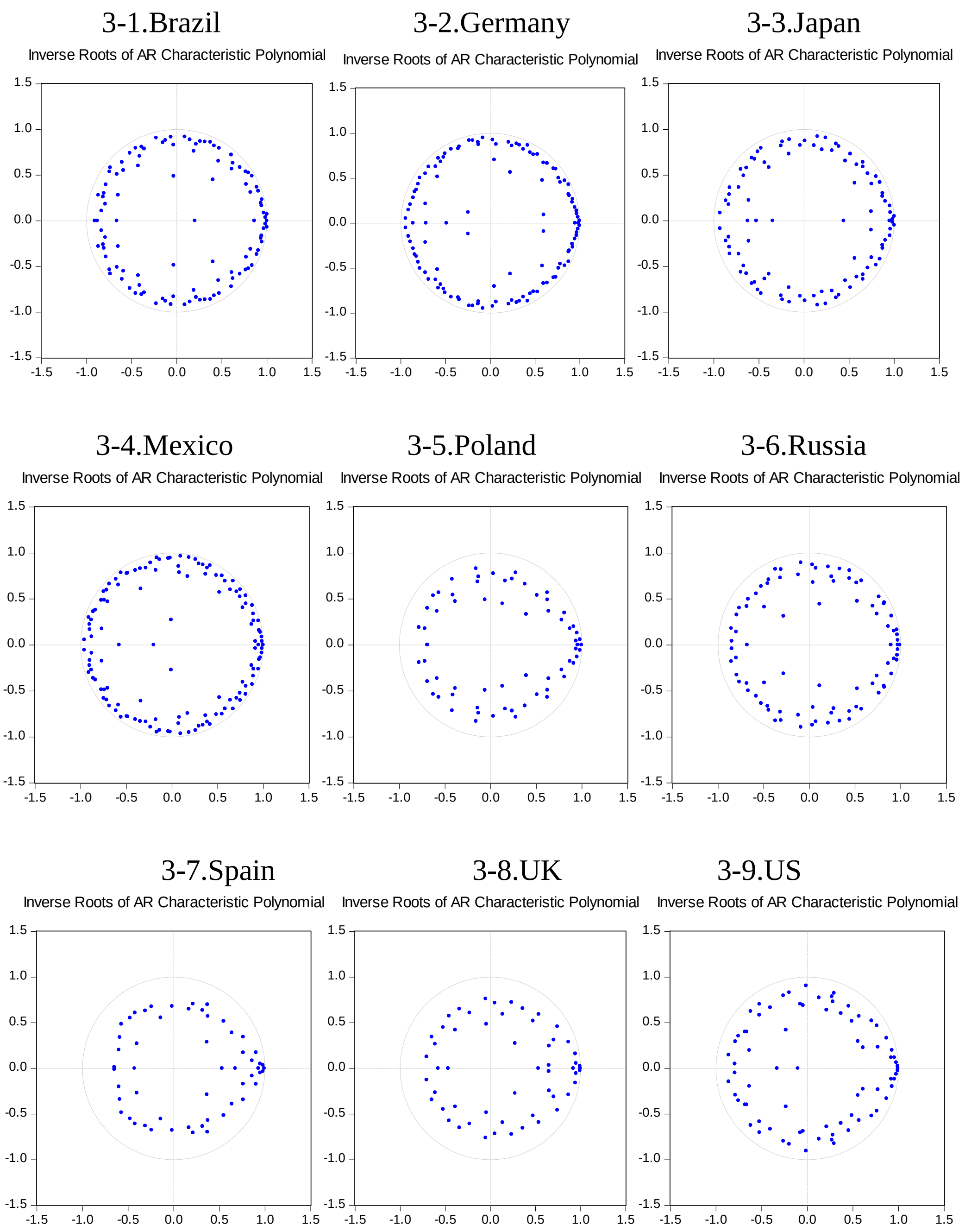


Table 12. The Granger-Causality Test Results

Country	Dependent variable	Independent variables - statistics [p-values]										
		LSTOCKS	LGOLD	LSILVER	LCOPPER	LOIL_BRENT	PC1EMP	LIIP	LCONF	LCPI	LWAGE	LPPI
Brazil	LSTOCKS			0,0056				0,0601		0,0027		
	LGOLD	0,0732										
	LSILVER	0,0508										
	LCOPPER						0,0567		0,1126			0.0187
	LOIL_BRENT		0,1464									
	PC1EMP	0,0052	0,1002	0,1916	0,0125			0,0122		0,0185	0,0051	0,0500
	LIIP	0,1145	0,0167									
	LCONF	0,1649	0,1522	0,1488								0,1824
	LCPI	0,0008									0,0001	0,0073
	LWAGE		0,1976				0,1090	0,0464				
	LPPI		0,0077				0,0469		0,0189			
Germany		LSTOCKS	LGOLD	LSILVER	LCOPPER	LOIL_BRENT	LEMP	LIIP	LCONF	PC1CPI	LWAGE	LPPI
	LSTOCKS		0.0462	0.0446		0.0769		0.1687	0.1969		0.0674	
	LGOLD				0.0996		0.0963	0.1790	0.1168			
	LSILVER	0.1585					0.1083	0.0814	0.0253	0.0791		0.0657
	LCOPPER					0.1306						
	LOIL_BRENT				0.0845				0.0472			0.1065
	LEMP										0.1802	
	LIIP			0.0515						0.1767	0.0889	
	LCONF							0.0210		0.0223	0.0963	
	PC1CPI										0.0643	
	LWAGE				0.0590	0.1745	0.1004	0.1619		0.0853		0.0108
	LPPI	0.0182	0.0122	0.0291	0.0417		0.0068	0.1771	0.0025	0.0486		
Japan		LSTOCKS	LGOLD	LSILVER	LCOPPER	LOIL_BRENT	PC1EMP	LIIP	LCONF	PC1CPI	LWAGE	LPPI
	LSTOCKS		0.1671				0.1341					
	LGOLD			0.0107		0.0820					0.0906	
	LSILVER	0.0792	0.1798				0.0011	0.0540		0.0194	0.1578	0.1711
	LCOPPER	0.0560	0.1617	0.0005		0.1095	0.0472		0.1979	0.0262		0.0337
	LOIL_BRENT		0.1723		0.0019				0.0928			
	PC1EMP			0.1725						0.1919	0.1532	
	LIIP						0.1147					
	LCONF							0.1032				
	PC1CPI			0.1362		0.1630	0.0262		0.1530		0.1919	
	LWAGE						0.0669	0.0000				0.0437
	LPPI	0.1533	0.0926	0.1413	0.0030	0.0046		0.1538	0.1184	0.0440		
Mexico		LSTOCKS	LGOLD	LSILVER	LCOPPER	LWTIOIL	LPC1EMP	LIIP	LCONF	LPC1CPI	LWAGE	LPPI
	LSTOCKS		0.1259	0.0720	0.0019		0.0623	0.1411				
	LGOLD			0.0374		0.1080			0.0248			0.0286
	LSILVER											
	LCOPPER						0.0429	0.1265		0.1890		0.0723
	LWTIOIL	0.0321	0.0086	0.1386	0.0004			0.0606	0.1400	0.0942		0.1081
	LPC1EMP		0.1242			0.0480		0.0432	0.1385			
	LIIP	0.0236			0.0917	0.0818	0.0537		0.1397	0.0243	0.0811	
	LCONF	0.1166					0.1234	0.1368				
	LPC1CPI											0.1103
	LWAGE	0.0002	0.0000	0.0020	0.0743	0.0131	0.0051	0.0423	0.0035	0.0653		0.0016
	LPPI											

(table continues)

(continued)

Country	Dependent variable	Independent variables - statistics [p-values]										
		LSTOCKS	LGOLD	LSILVER	LCOPPER	LOIL_BRENT	PC1EMP	LIIP	LCONF	PC1CPI	LWAGE	LPPI
Poland	LSTOCKS		0.0840							0.0490		
	LGOLD			0.0082								0.1519
	LSILVER		0.0038									0.0380
	LCOPPER	0.0033	0.0534	0.0366						0.0654	0.0787	
	LOIL_BRENT		0.1171				0.0459		0.1123	0.0501		
	PC1EMP					0.0886			0.0307	0.1667	0.0349	
	LIIP	0.0075	0.0300						0.0995		0.0226	
	LCONF		0.1090	0.0649		0.0812		0.0083			0.0065	0.1588
	PC1CPI	0.0746		0.0757			0.1769					0.0297
	LWAGE	0.0796										
	LPPI						0.1653	0.0446				
Russia		LSTOCKS	LGOLD	LSILVER	LCOPPER	LOIL_BRENT	LEMP	LIIP	LCONF	LCPI	LWAGE	LPPI
	LSTOCKS						0.0761	0.0082	0.1892			0.2039
	LGOLD	0.0213			0.1811				0.2019	0.1176	0.0902	
	LSILVER	0.0005	0.0440		0.0263	0.0736					0.0096	0.0084
	LCOPPER	0.0015		0.0784			0.1301		0.0246		0.1115	0.1219
	LOIL_BRENT										0.0673	
	LEMP		0.0351	0.1210	0.0314	0.1222					0.1966	
	LIIP	0.0003	0.0009			0.0109			0.0170			0.0288
	LCONF				0.0561			0.0882		0.1258	0.1071	
	LCPI	0.0000	0.1612								0.0466	
	LWAGE	0.0422	0.2046									
	LPPI	0.0224	0.0238		0.0192	0.0000			0.0001		0.0342	
Spain		LSTOCKS	LGOLD	LSILVER	LCOPPER	LOIL_BRENT	PC1EMP	LIIP	LCONF	PC1CPI	PC1WAGE	LPPI
	LSTOCKS		0.1463									
	LGOLD			0.0045				0.1689				
	LSILVER	0.1313	0.1535		0.1292		0.1634				0.1601	
	LCOPPER		0.0601									
	LOIL_BRENT											
	PC1EMP		0.0378					0.1335				
	LIIP				0.0478	0.0012			0.0199			0.0495
	LCONF		0.0850							0.0437		
	PC1CPI		0.1845					0.0686				
	PC1WAGE			0.1189		0.2073	0.0055	0.0821		0.0778		
	LPPI	0.0369	0.0134	0.1528	0.1094	0.0687			0.0698		0.1217	
UK		LSTOCKS	LGOLD	LSILVER	LCOPPER	LOIL_BRENT	LEMP	LIIP	LCONF	PC1CPI	LWAGE	LPPI
	LSTOCKS								0.0038			
	LGOLD			0.0029		0.1382		0.1311				0.0099
	LSILVER											
	LCOPPER		0.0662									0.1336
	LOIL_BRENT	0.0193	0.0259									0.0953
	LEMP	0.0934						0.0136	0.1463		0.0754	0.1643
	LIIP	0.0098					0.0466		0.0253		0.0875	
	LCONF		0.0811			0.1665	0.1719	0.0655				0.0803
	PC1CPI	0.1778	0.0061	0.1930		0.0694			0.1534		0.0025	0.0085
	LWAGE							0.1428		0.1517		
	LPPI	0.0251				0.0005						

(table continues)

(continued)

Country	Dependent variable	Independent variables - statistics [p-values]										
		LSTOCKS	LGOLD	LSILVER	LCOPPER	LOIL_BRENT	PC1EMP	LIIP	LCONF	PC1CPI	LWAGE	LPPI
US	LSTOCKS		0.0621	0.0242				0.0007			0.2027	
	LGOLD			0.0011	0.1145							
	LSILVER					0.1214						
	LCOPPER									0.0744		
	LOIL_WTI											
	PC1EMP										0.0314	
	LIIP	0.0005	0.0082	0.0026			0.0043					0.0281
	LCONF	0.0119						0.0586				
	LCPI					0.0000		0.0072	0.1780			
	LWAGE								0.1422			
	LPPI					0.0009		0.1433	0.1300			

Note. Values in the table show p-values. “Empty space” means variable in the column does not Granger-cause variables in a row.

The findings between oil and stock prices indicate the existents of a unidirectional causality from oil to stock prices in Germany at 10% significance level. In the case of US, causality was detected moving from oil prices to PPI, IIP and stock prices at a significant level (LOIL_WTI => LPPI => LIIP => LSTOCKS). The reverse causality from stock prices to oil prices is presented in the case of UK and Mexico at a significant level. Similarly at significant level, one way causality moves from 1) stock prices to COPPER and oil prices in Japan (LSTOCKS => LCOPPER => LOIL_BRENT), 2) stock prices to WAGE and oil prices in Russia (LSTOCKS => LWAGE => LOIL_BRENT) and 3) stock prices to CPI and oil prices in Poland (LSTOCKS => PC1CPI => LOIL_BRENT). The oil prices suggest that they are leading indicator of the stock market in Germany and they are effective on stock prices via PPI and IIP in the US. Contrary, oil prices are lagged indicator of the stock market in UK and Mexico, while they are affected by stock prices via COPPER, WAGE and CPI in Japan, Russia and Poland respectively. However, no causal relationship is found in between the oil and stock market in Spain and Brazil. The differences in direction of causality between oil and stock prices were investigated by Kilian and Park (2009), who study the behavior of the stock market as regards to demand and supply shocks in the US. However, Kilian and Park (2009) suggests that increase in oil prices cause lower stock prices when circumstances are relevant to demand shocks, while positive shocks related to increased demand for commodities caused an increase in both oil and stock prices.

The relationship between the copper and stock prices indicated the existents of a unidirectional causality from COPPER to stock prices at a significant level in Mexico. For instance, in Germany COPPER causality moving through WAGE to stock prices (LCOPPER => LWAGE => LSTOCKS). The reverse causality from stock prices to COPPER is presented in the case of Japan, Russia and Poland at a significant level. Similarly at significant level, one way causality moves from:1) stock prices to IIP, CPI and COPPER in US (LSTOCKS => LIIP => LCPI => LCOPPER) and 2) stock prices to PPI, CPI and COPPER in UK (LSTOCKS => LPPI => PC1CPI => LCOPPER). Copper is a widely used as basic material and is important for industrial and economic development. Jaunky (2013) who studied the cointegration and the causal analysis of copper consumption and economic growth in developed countries suggests that policies should provide sufficient copper supply because it is important to sustain long-term development objective. This is because in developed countries, copper consumption and economic growth are co-integrated and copper has a significant effect on economic development in a country. Finally, the copper production may affect the price of copper and thus affecting copper consumption, economic growth of a country and in the end prospect of the stock market.

To summarize, the both, gold and silver are leading indicators of stock markets in US and Germany. Individually, gold is leading indicator of the stock market in Poland and silver is leading indicator of the stock market in Mexico. When it comes to reverse influence, the stock market is leading indicator for both, gold and silver prices in Russia and Brazil augmented by the bidirectional relation between silver and stocks prices. Additionally, stock prices led silver prices and gold via silver prices in case of Japan. The causal framework when GOLD are leading indicator for stock markets in US and Germany, while the stock market is leading indicator for GOLD in Russia and Brazil is consisted with Anand and Madhogaria (2012). The oil prices suggest that they are leading indicator for Stock market in Germany and lagged indicator of Stock market in UK and Mexico. This differences in direction of causality between oil and stock prices were investigated by Kilian and Park (2009), who pointed to demand and supply shocks as underlying causes of oil price changes.

The COPPER suggest that they are leading indicator for the stock market in Mexico, the one of the world Top10 copper mined producers, in Germany, they are effective on stock prices via WAGE, while they are lagged indicator of the stock market in Japan, Russia, Poland. This is consistent with Jaunky (2013) that copper consumption and economic growth are cointegrated and the copper production may affect the price of copper and thus overall economic activity.

4.2.2 Stock prices and economic activity

The results of causal relationships between stock prices and economic activity variables show that stock prices Granger-causes IIP at a significant level in the UK, US, Russia, Mexico, and Poland, whereas there is bi-directional causality between the variables in US and Russia. Furthermore, causality analysis implies that Granger causality runs from stock prices to PPI and IIP in Spain (LSTOCKS => LPPI => LIIP). In other respects, there is reverse causality from IIP to stock prices at a significant level in Brazil. This causality in Brazil, when the STOCKS is not a leading indicator for IIP is contrary to Fama (1991) findings in other dominant stock markets such as the US. Reason for this, can be explained by Gan, Lee, Yong and Zhang (2006), who conclude that “the ratio of capitalization of the stock to GDP in New Zealand, compared with other international stock markets, is relatively small and therefore, the impact of capital markets on the whole economy is also low".

The labor relationship indicates that stock prices Granger-cause employment in UK and Brazil, while employment Granger-cause stock prices in Russia and Mexico. In this sense further, causality analysis implies that Granger causality runs from employment to IIP and stock prices in the US (PC1EMP => LIIP => LSTOCKS) and there is Granger-causality from employment to WAGE and stock prices in Germany (LEMP => LWAGE => LSTOCKS). The findings for the degree of optimism in economy indicate that stock prices cause CONF at a significant level in the US. This is in line with Otoo (1999) and Jansen and Nahuis (2003) who confirms that stock prices are leading indicator that influence consumer confidence. In the UK, the direction of causality runs the other way around from CONF to stock prices. Souleles (2001) find that lagged consumer sentiment is significant in describing the current household spending. So, this provides a link between CONF and stock prices, whereas confidence will influence consumer spending and then the firm's profits. Additionally, when to consider CONF in Russia, Poland, Germany and Spain, there is no genuine causal relationship between it and stock prices, in other words, there is a common third factor that drives the two variables. In this case, causality was detected moving from stock prices via IIP to CONF in Russia and Poland, whereas bi-directional causality exists another way around from CONF via IIP to stock prices in Russia (LSTOCS => LIIP => LCONF). Similarly, in Germany has unidirectional causality from stock prices to PPI, WAGE and CONF (LSTOCS => LPPI => LWAGE => LCONF), while Spain have unidirectional from stock prices to PPI, IIP, CPI and CONF (LSTOCS => LPPI => LIIP => PC1CPI => LCONF).

The relationship between CPI and stock prices found that exist bi-directional causality in Brazil and unidirectional causality from stock prices to CPI at a significant level in Russia and Poland. Other results showed that there is no genuine causal relationship in US, Spain, Germany, and Mexico. Consider first the causality from stock prices, in case of US it runs via IIP to CPI (LSTOCKS => LIIP => LCPI) and in Spain it runs via PPI, IIP to CPI (LSTOCKS => LPPI => LIIP => LCPI). In other respect causality from CPI, in Germany runs via WAGE to stock prices (PC1CPI => LWAGE => LSTOCKS) and in Mexico runs via Consumer IIP, employment to stock prices (LPC1CPI => LIIP => LPC1EMP => LSTOCKS). Furthermore, with a focus on prices is revealed that stock prices Granger-causes PPI at a significant level in UK, Germany, Spain, and Russia. The genuine causal relationship between PPI and stock prices does not exist in US, Mexico, Brazil, Japan, and Poland. In case when originate from PPI it runs via IIP, COPPER and CPI in US, Mexico and Brazil respectively (US: LPPI => LIIP => LSTOCKS; Mexico: LPPI => LCOPPER => LSTOCKS; Brazil: LPPI => LCPI => LSTOCKS). Contrary, causality between stock prices and PPI runs via COPPER and IIP in Japan and Poland respectively (Japan: LSTOCKS => LCOPPER => LPPI; Poland: LSTOCKS => LIIP => LPPI). The change in

`

the PPI indicates that businesses are buying goods and commodities at a different price than the previous period. This change in PPI change the price of the products and this will be reflected in the CPI. The increase in PPI will mean increased business and revenues and can lead to increased corporate profits and affect stock prices. On the other hand, stock price movements lead to changes in economic activity and then affect buying of goods and commodities (PPI).

In Russia, Poland and Mexico there is significant causality that runs from stock prices to WAGE. The reversal causal relationship from WAGE to stock prices at significant level exists in Germany. Further, in UK, Brazil, Japan and Spain there is not genuine causal relationship between stock prices and WAGE (Japan: LSTOCKS => LCOPPER => LPPI => LWAGE; Spain: LSTOCKS => LPPI => LIIP => PC1WAGE; UK: LWAGE => LIIP => LCONF => LSTOCKS; Brazil LWAGE => LCPI => LSTOCKS). The first channel of influence, movements in stock prices lead to changes in economic activity, precisely the volume of production, revenues, and corporate profits, thereby influencing wages of employees. The second channel is the link from changes in wages influence consumer spending and then corporate profits, which finally affect Stock prices.

To summarize, the causality test results show that the stock prices are leading indicator in estimating IIP in UK, US, Russia, Mexico, and Poland, which is consistent with Fama (1991) findings for dominant stock markets. The Brazil inconsistency with Fama (1991), where exists causality from IIP to stock prices can be explained by Gan et al. (2006) due to relatively small stock markets and low impact of capital markets on the whole economy. The findings for the relationship between CONF and stock prices indicate that US stock prices causes CONF and additionally was found that Russia and Poland have bi-directional and unidirectional causality respectively from stock prices via IIP to CONF. The UK direction of causality runs the other way from CONF to stock prices. This results are in line with Otoo (1999), Jansen and Nahuis (2003) who confirm finding that higher stock prices are a leading indicator that increases consumer confidence, while in other respect, Souleles (2001) show that lagged consumer sentiment is explaining the behavior of current household spending, where this result can be influenced by corporate profits and stock prices. The relationship between CPI and stock prices found that exist bi-directional causality in Brazil and unidirectional causality from stock prices to CPI in Russia and Poland. The stock prices caused CPI via IIP in the US, while reverse causality from CPI via WAGE to stock prices exists in Germany. These results are supported by Bruno and Paulo (2011), who found that the Reverse Causality Hypothesis, when inflation is caused by stock returns, is best fitting for the emerging markets, while for the developed markets is mixed. The stock prices are leading indicator in estimating employment in UK and Brazil, and WAGE in Russia, Poland, and Mexico. Contrary, the stock prices are lagged of employment in Russia and Mexico and of WAGE in Germany, The Stock prices are leading indicator in estimating PPI in UK, Germany, Spain, and Russia, while in US, Mexico, Brazil, Japan, and Poland there is not a genuine causal relationship.

4.2.3 Gold prices, silver prices, and economic activity

The Granger-causality test showed that there is unidirectional causality from GOLD to IIP in the case of US, Brazil, Russia and Poland at a significant level. The results for causality between SILVER and IIP confirmed that there is bidirectional causality in Germany, unidirectional causality from SILVER to IIP in the US and reverse unidirectional causality from IIP to SILVER in Japan. Furthermore, the precious metals have no genuine causality with IIP in Mexico, UK, Spain, Brazil, Russia and Japan (Mexico: LGOLD => LWAGE => LIIP; Mexico: LSILVER => LWAGE => LIIP; UK and Spain: LSILVER => LGOLD => LCONF => LIIP; Brazil and Russia: LIIP => LSTOCKS => LSILVER; Japan: LIIP => LWAGE => LGOLD). The findings for relationship between CONF and precious metals indicate that in the UK and Spain causality runs from silver to gold prices and CONF at significant level (LSILVER => LGOLD => LCONF), while in Poland causality runs from gold to silver prices and CONF at significant level (LGOLD => LSILVER = LCONF). In Germany and Mexico results indicate reverse direction; CONF individually causes gold and silver prices in Germany, while CONF cause only GOLD in Mexico.

In respect to labor, variables indicate that GOLD cause employment in Spain, Russia, and Brazil. Additionally, causality runs from silver via GOLD to employment in Spain (LSILVER => LGOLD => PC1EMP) and from silver via stock prices to employment in Brazil (LSILVER => LSTOCKS => PC1EMP). In other respects to causation, in Japan exist causality from employment to silver and gold prices (PC1EMP => LSILVER => LGOLD), while in Germany causality runs from employment to GOLD, PPI and SILVER (LEMP => LGOLD => LPPI => LSILVER). Finally, there is no causal relationship between precious metals and employment in the US. The second labor variable, WAGE causes GOLD in Japan, while opposite direction of causation from both precious metals to employee earning exists in Mexico. There is no causal relationship between precious metals and WAGE in the US, UK, and Poland.

The business prices PPI cause GOLD in UK and Mexico, while causality from PPI via silver to gold prices exists in Poland (LPPI => LSILVER => LGOLD). The precious metals behave differently in Russia, PPI cause SILVER, while GOLD cause PPI. The reverse direction of causality from GOLD to PPI exists in Germany, Japan, Spain, and Brazil. Additionally, there is a bi-directional causality between SILVER and PPI in Germany and causality from silver via GOLD to PPI in Japan and Spain (LSILVER => LGOLD => LPPI). For the relation between consumer prices and precious metals, there is causality from CPI to SILVER in Germany and from CPI via silver to gold prices in Japan (CP1CPI => LSILVER => LGOLD). In UK and Poland causality runs from silver via gold prices to CPI (LSILVER => LGOLD => PC1CPI).

To summarize, selected economic activity variables are sensitive and have predictable power for GOLD in Mexico, Russia, Germany, Japan and the UK, while for SILVER in

Poland, Russia, Germany, and Japan. Individual results between precious metals and economic activity variables show that leading indicator in estimating IIP are GOLD in US, Brazil, Russia, and Poland, while SILVER are in US and Germany. The leading indicators of CONF, pessimism or optimism about the economy in the near future, are GOLD in the UK and Spain, while SILVER in Poland. Conversely, CONF is leading indicator for gold and SILVER in Germany and only GOLD in Mexico. The results of causality between precious metals and labor variables confirmed that gold and SILVER are leading indicator of WAGE in Mexico and individually GOLD are leading indicator of employment in Spain, Russia, and Brazil. In other respects, GOLD is lagged indicator of WAGE in Russia and Japan, and employment in Germany, while SILVER affects labor market as lagged indicator of WAGE in Russia and employment in Japan. Considering consumer and producer prices, the results confirms GOLD as leading indicator for CPI in UK and Poland, while for PPI in Germany, Japan, Spain, Brazil, and Russia. Conversely, GOLD is lagged indicator of PPI in UK and Mexico. Further, the SILVER indicates bidirectional causality with PPI in Germany and they are lagged indicator of CPI in Germany and Japan. Additionally, SILVER are lagged indicator of PPI in Russia and Poland.

CONCLUSION

The study aimed to investigate the relationship among commodity prices of copper and oil, relevant economic activity variables with three based models represented for stock, gold and silver prices in a four emerging economies of Brazil, Mexico, Poland and Russia and five developed economies of Germany, Japan, Spain, UK, and the US. This examined relationship among stock, gold and silver prices with COPPER, oil prices and economic activity variables: EMP, IIP, CONF, CPI, WAGE and PPI using dataset of 228 monthly observations within a period of 1996-2014 year.

The EMH and the asset pricing models-most typically APT imply a relationship between the stock market and economic activity (Fama, 1970; Ross, 1976). However, these theories have been silent about determining which economic factors are likely to influence asset prices. Accordingly Chen et al. (1986), the economic activity variables included in this study were selected based upon the PVM theory which advocates that the price of a stock is the present discount value of the expected future dividend. More specifically, to analyze the long-run, short-run and causal relationship of copper, oil and economic activity variables on stock, gold and silver prices have been applied a ARDL bound test and ECM of ARDL by Pesaran et al. (2001) to determine the long-run and short-run relationships and TY non-granger causality procedure to explore the direction of causation among the variables. Regarding the unit root tests (ADF and PP) indicated that the considered variables under study were I(0) or I(1) processes in all countries, with an exception for CONF of Spain and UK where were found to be inconclusive I(1). Since the considered data have different integration orders, between I(0) and I(1), the cointegration approach of the ARDL and TY non-causality procedure was accordingly utilized for the analysis and they are valid whether the data series are I(0) or I(1), or additionally, there is not verified long-run relationship by the co-integration analysis in case of TY procedure.

The results of ARDL bound test of cointegration to indicate that long-run relationship exists, which implies that variables move together in the long run, among economic activity variables, copper and oil prices with 1) stock prices in Mexico, Poland, Russia, Germany, Japan, Spain, UK and US, 2) GOLD in Mexico, Russia, Japan, UK and US and 3) SILVER in Brazil, Mexico, Russia, Japan, UK, and the US. On the other hand, the estimated ECM supported the obtained results of cointegrated stock, gold, and silver based models in each economy from ARDL bound test which found significance associated with the coefficient of the lagged error-correction term and its expected negative sign. Precisely, after given short-run disequilibrium, assets adjustment speed to correct back to long-run equilibrium in the current month is for 1) stock prices from about 8% in UK and Germany to about 24% in Mexico and Russia, 2) GOLD from about 11% in Mexico and Japan to about 34% in UK and 3) SILVER from about 11% in Russia and Japan to about 24% in UK.

When was considered the stock-based model, the study indicates that two independent commodities in our study, firstly, copper price has a significant positive relationship with stock prices in all selected economies in both periods (short-run and long-run). The second commodity, the oil price has a significant negative relationship with stock prices in UK and Japan in the long-run, and in Spain, Mexico and UK in the short-run, while surprisingly the result in Poland has a significant positive relationship only in the short-run. The copper and oil prices elasticity coefficients of stock prices have shown that the short-run elasticity is lower than the corresponding long-run elasticity which goes to unity and indicating that economies are more responsive in the long-run than in the short-run. However, the results for copper and oil relationship are as expected, since COPPER are powerful variable which is linked with the overall economy and tracks where the economy is headed, Lahart (2006), while higher oil prices are bad for the world stock market under normal condition, but in the high growth state, oil price and the stock market can move directly together, Gogineni (2007).

The country-specific results of IIP and CONF demonstrate a strong significant and positive relationship with stock prices over the long-run and short-run. This is explained by Fama (1990), that the stock market is rational forecast of real sector and Chen et al. (1986) view that stock market reflects the value of insuring against real systematic production risk. While positive confidence makes consumers feel more optimistic about the future of the aggregate economy, so do aggregate consumer spending and stock prices rise. In addition, CPI and PPI gave some inconsistent country-specific results, positive and negative relationship with stock prices in the long-run and short-run. For example, if CPI increases by 1% per month, the US stock prices will decrease -4.2% and -23.1% in the short and long-run respectively, while Russia’s stock prices will increase by 2.99% in the long-run and short-run estimation is inefficient to affect stock prices due to insignificance. Precisely, when CPI and stock prices are positively related, it is supported by an increase in real activity and higher stock returns as Fama and Gibbons (1982) argued, while the reverse is supported by Fama (1981) and Mukherjee and Naka (1995). The positive relationship between PPI and stock prices is influenced by the increase in revenue sources, cash flows and hence stock prices, while reverse can be explained by liquidity trap with strong disinflation and negatively related industrial production and rate of inflation, Krugman (1998), Humpe and Macmillan (2007). Finally, results for labor variables concludes that WAGE have a significant positive relationship with stock prices, where in Germany has a dominant impact in the long-run, while in Spain has an undersized impact in the short-run. The country-specific results of EMP gave some surprising results in the long and short-run. For example, if EMP increases by 1% per month, the UK stock prices will increase 4.1% and decrease -3.7% in the short and long-run respectively. The first result is consistent, when employment would cause an upturn in the economy and would lead to higher profits and stock prices, but latter is surprising, negative result might be due to the shortfall in the level of productivity which persisted for many years and less output is demanded from each worker in the environment of weak aggregate demand (Pessoa & Van Reenen, 2013).

The TY test implies that the directions of causality between stock prices and economic activity, copper and oil prices differs among economies, the results reveal that in Brazil, Mexico, Russia, Germany, UK, and the US were determined causality from independent variables toward stock prices, which means it can be used to predict the stock prices. Conversely, latter does not hold in Poland, Japan, and Spain, independent variables in their economies can’t be used to predict the stock prices.

The gold-based model relationship with considered variables differs from the stock-based model when to compare overall effect of independent variables with stock and gold prices individually. Same as with stock prices, the copper price has a significant positive relationship with GOLD in selected economies in the long-run and short-run, where this co-movement is confirmed by Pindyck and Rotemberg (1990). The oil price are insignificant, so they are ineffective to affect gold price in long-run across economies, while only oil price in Russia has significant undersized positive relationship on gold price in the short-run, but however the lack of a significant relationship can be support with nonlinearity between oil and stock prices, Thai and Youngho (2011).

Conversely from stock prices, the results of IIP and CONF have a dominant significant negative relationship with gold price over the long-run and short-run which support gold as a hedge against stocks on average and a safe haven in extreme stock market conditions, Baur and Lucey (2010). In addition, IIP elasticity coefficients of gold price indicating that are more responsive in the long-run than in the short-run, due to the necessary time that gold price need to respond to IIP changes. The country-specific results of PPI in the long and short-run and CPI in the short-run are significant positively related with gold price and

`

it rises over time above the general level of both, PPI and CPI, so hence gold can be a hedge against PPI and CPI in considered periods. Conversely, CPI has a significant negative relationship with gold price in the long and short-run in Mexico and Japan, this can be supported when investors prefer bond markets rather than the gold markets, in the case when bond yields increase, bond prices decrease and provide a better alternative than gold, Blose (2010). The labor variables, EMP and WAGE gave some inconsistent country-specific results, positive and negative relationship with gold price in the long-run and short-run. The EMP has significant negative and strong impact on GOLD in Russia and UK in the long and short-run, which means that gold price will rise when the employment situation shows weakness, while the significant positive impact on gold price in Japan and US have an undersized effect. Further, when considered the US WAGE, for example, if WAGE increases by 1% per month, the US gold price will decrease -1.4% and increase 5.1% in the short and long-run respectively. The negative link between WAGE and gold price in short-run is consistent with a decrease in WAGE will lead to the less bright aggregate economy, but the positive link might be due to WAGE expense driver in company's and its impact on profits.

Regarding the results from TY test, there are found causality to gold price from CONF and PPI in Mexico; WAGE in Russia; copper price, EMP, and CONF in Germany; oil price and IIP through WAGE in Japan and PPI in the UK, indicating that all of these variables in each economy are sensitive and can be used to predict gold price. In general, the relevance of gold as a hedge against stocks on average and a safe haven in extreme stock market conditions is likely to maintain, as our results could suggest.

Finally, the study showed results of the silver-based model where silver price with considered variables revealed mixed relationship taken from previous two models, stock and gold based models. Same as previous models, copper price confirm significant positive co-movement with silver price in the long and short-run. The country-specific relationship between oil and silver prices is negative in the long-run and show similarity to a stock-based model and can be explained when silver behave as an industrial metal. The most surprising are significant and inconsistent results for the relationship between IIP and CONF with silver price in specific countries, where silver share investment and industrial behavior. For example, in the long and short-run, silver price with IIP and CONF have significant 1) negative and positive relationship respectively in Brazil, while 2) positive and negative respectively in the UK. In the first example, silver behave as a hedge in real economy stress, while when consumers feel optimistic silver price support it. In contrast, the second example due to positively related IIP show silver as an industrial metal, while when consumers feel pessimistic silver price hedge it. The country-specific results in the case of silver price co-movement above the general rate of PPI can be a hedge against real growth adjusted by inflated revenue sources in the long and short-run.

`

Finally, the results from TY test, identify causality from independent variables to silver price in next economies: PPI in Poland; PPI, WAGE, copper and oil prices in Russia, WAGE in Russia; IIP, CONF, PPI and CPI in Germany and IIP, EMP and CPI in Japan, indicating that all of these variables in each of this economy are sensitive and can be used to predict silver price. According to the results, developments of IIP, CONF and PPI should be given more attention, since Granger-cause and ambiguous affect SILVER. For one, SILVER in some situations are more closely to stocks, because it is being used increasingly as an industrial metal and two is might has established some investment similarities with GOLD.

The empirical results showed that economic activity, copper and oil prices formed significant relationships and are important in explaining stock, gold and silver price with selected variable influence, which differ across analyzed economies. Consequently, our conclusions could be especially useful for giving investors more information that they can use to define their investment strategies, as the study reinforces the differences found in stock, gold and silver relationship with considered variables for analyzed economies. The conclusions drawn from the study will be beneficial in two ways. Firstly, contrary to the EMH conclusions, economic activity variables, copper and oil prices points to the possibility of predicted returns based on selecting a stock, gold and silver prices as information becomes available on considered independent variables. Secondly, more specifically selecting a stock, gold and silver prices could lead to a superior earning capability and diversification benefits as economies are individually affected by the different extent of selected independent variables.

`

REFERENCES

1. Ackert, L., & Smith, B. (1993). Stock price volatility, ordinary dividends, and other cash flows to shareholders. *Journal of Finance, 48*(4), 1147-1160.
2. Akerlof, G., Dickens, W., & Perry, G. (1996). The macroeconomics of low inflation. *Brookings Papers on Economic Activity, 27*(1), 1-76.
3. Amano, R., & van Norden, S. (1992). Unit root tests and the burden of proof. *Working Paper, 92*(7), Bank of Canada, Ottawa.
4. Anand, R., & Madhogaria, S. (2012). Is gold a 'safe-haven'? - An Econometric Analysis. *Procedia Economics and Finance, 1*, 24–33.
5. Awokuse, T., & Yang, J. (2003). The informational role of commodity prices in formulating monetary policy: A Reexamination. *Economics Letters, Elsevier, 79*(2), 219-224.
6. Bansal, R., & Yaron, A. (2004). Risks for the long run: A potential resolution of asset pricing puzzles. *The Journal of Finance, 59*(4), 1481–1509.
7. Barro, B., & Misra, S. (2013). Gold returns. *NBER Working Papers* 18759, *National Bureau of Economic Research, Inc*.
8. Baur, D., G., & Lucey, B., M. (2010). Is gold a hedge or a safe haven? An analysis of stocks, bonds and gold. *Financial Review, 45*, 217–229.
9. Bodie, Z., Alex, K., & Alan, J. (2009). *Investments* (8th ed.). New York: McGraw-Hill-Irwin.
10. Blose, L. (2010). Gold prices, cost of carry, and expected inflation. *The Journal of Economics and Business, 62*(1), 35-47.
11. Boyd, J., Hu, J., & Jagannathan, R. (2005). The stock market's reaction to unemployment news: Why bad news is usually good for stocks. *The Journal of Finance, 60*(2), 649-672.
12. Bruno, B., & Paulo, R. (2011). *The stock returns-inflation causality revisited: Analyzing the evidences for 31 developed and emerging countries*. Universidade Federal do Rio Grande do Sul.
13. Campbell, J., & Cochran*e. J.* (1999). By force of habit: A consumption-based explanation of aggregate stock market behavior. *Journal of Political Economy, 107*(2), 205-251.
14. Campbell, J., Polk, C., & Vuolteenaho, T. (2005). Growth or glamour? Fundamentals and systemic risk in stock returns. *NBER Working Papers 11389, National Bureau of Economic Research, Inc*.
15. Campbell, J., & Shiller, R. (1987). Cointegration and tests of present value models. *Journal of Political Economy, 95*(5), 1062–1088.
16. Campbell, J., & Shiller, R. (1988). Stock prices, earnings and expected dividends. *Journal of Finance, 43*, 661-676.
17. Campbell, J., & Vuolteenaho. T. (2004). Bad beta, good beta. *The American Economic Review, 94*(5), 1249-1275.

18. Clarke, J., A., & Mirza, S. (2006). A comparison of some common methods for detecting Granger noncausality. *Journal of Statistical Computation and Simulation, 76*, 207-231.
19. Chen, L., Da., Z., & Zhao, X. (2013). What drives stock price movements? *The Review of Financial Studies*, *26*(4), 841-876.
20. Chen, N., Roll, R., & Ross, S. (1986). Economic forces and the stock market. *Journal of Business*, *59*(3), 383-403.
21. Cheung, Y., & Ng, L. (1998). International evidence on the stock market and aggregate economic activity. *Journal of Empirical Finance, Elsevier*, *5*(3), 281-296.
22. Chowdhury, A. (2011). Do stock market risk premium respond to consumer confidence? *Department of Economics, Working Paper, 6, Marquette University*.
23. Cochrane, J. (2011). Presidential address: Discount rates. *The Journal of Finance, 66(*4), 1047-1108.
24. De Long, J. B. (2011, September 10). Gibson's paradox and the gold boom. *Brad DeLong's Website*. Retrieved October 11, 2014, from http://delong.typepad.com/sdj/2011/09/gibsons-paradox-and-the-gold-boom.html
25. Dickey, D., & Fuller, W. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American Statistical Association*, *74*(366), 427-431.
26. Eichengreen, B., & Gupta, P. (2014). Tapering talk: The impact of expectations of reduced federal reserve security purchases on emerging markets. *World Bank Policy Research Working Paper 6754*.
27. Fama, E. (1965). The behavior of stock-market prices. *Journal of Business*, *38*(1), 34-105.
28. Fama, E. (1970). Efficient capital markets: A review of theory and empirical work. *The Journal of Finance*, *25*(2), 383-417.
29. Fama, E. (1981). Stock returns, real activity, inflation and money. *The American Economic Review*, *71*(4), 545-565.
30. Fama, E. (1990). Stock returns, expected returns and real activity. *The Journal of Finance*, *45*(4), 1089-1108.
31. Fama, E. (1991). Efficient capital markets: II. *The Journal of Finance, 46*(5), 1575-1617.
32. Fama, E. (1998). Market efficiency, long-term returns, and behavioral finance. *Journal of Financial Economics*, *49*(1), 283–306.
33. Fama, E., & French, K. (1988). Dividend yields and expected stock returns. *The Journal of Financial Economics*, *22*(1), 3-26.
34. Fama, E., & French, K. (2004). The capital asset pricing model: Theory and evidence. *The Journal of Economic Perspectives*, *18*(3), 25-46.
35. Fama, E., & Gibbons, M. (1982). Inflation, real return and capital investment. *The Journal of Monetary Economics*, *9*(3), 297-324.
36. Fama, E., & Schwert, W. (1977). Asset returns and inflation. *The Journal of Financial Economics*, *5*(2), 115-146.

37. Fischer, S., & Merton, R. (1984). Macroeconomics and finance: The role of the stock market. *Carnegie-Rochester Conference Series on Public Policy, 21*(1), 57-108.
38. Flannery, M., & Protopapadakis, A. (2001). Macroeconomic factors do influence aggregate stock returns. *The Review of Financial Studies*, *15*(3), 751-782.
39. Gan, C., Lee, M., Yong, H., & Zhang, J. (2006). Macroeconomic variables and stock market interactions: New Zealand evidence. *Investment Management and Financial Innovations, 3*(4), 89-101.
40. Glasner, D. (2011). *The fisher effect under deflationary expectation*. Federal Trade Commission.
41. Giles, D.E. (2011, April 29). Testing for Granger causality. *Econometrics Beat:* Dave Giles' blog. Retrieved June 5, 2016, from http://davegiles.blogspot.mk/2011/04/testing-for-granger-causality.html
42. Giles, D.E. (2011, October 25). VAR or VECM when testing for Granger causality? *Econometrics Beat:* Dave Giles' blog. Retrieved June 5, 2016, from http://davegiles.blogspot.mk/2011/10/var-or-vecm-when-testing-for-granger.html
43. Giles, D. E. (2013, March 6). ARDL models - Part I. *Econometrics Beat:* Dave Giles' blog. Retrieved June 5, 2016, from http://davegiles.blogspot.mk/2013/03/ardl-models-part-i.html
44. Giles, D. E. (2013, June 19). ARDL models - Part II - Bounds tests. *Econometrics Beat:* Dave Giles' blog. Retrieved June 5, 2016, from http://davegiles.blogspot.mk/2013/06/ardl-models-part-ii-bounds-tests.html
45. Giles, D. E. (2013, July 24). Information criteria unveiled. Econome*trics Beat: Dave Giles' Blog. Retri*eved June 5, 2016, from http://davegiles.blogspot.mk/2013/07/information-criteria-unveiled.html
46. Giles, D. E. (2015, January 9) ARDL modelling in EViews 9. *Econometrics Beat: Dave Giles' Blog*. Retrieved June 5, 2016, from http://davegiles.blogspot.mk/2015/01/ardl-modelling-in-eviews-9.html
47. Gogineni, S. (2007). The stock market reaction to oil price changes. *Working Paper, University of Oklahoma, Norman, OK*.
48. Gordon, M. (1959). Dividends, earnings and stock price. *The Review of Economics and Statistics, 41*(2), 99–105.
49. Granger, C. (1969). Investigating causal relations by econometric models and cross-spectral methods. *Econometrica, 37*(3), 428-438.
50. Granger, C., & Newbold, P. (1974). Spurious regression in econometrics. *The Journal of Econometrics*, *2*(2), 111-120.
51. Hamilton, J. (2009). Causes and consequences of the oil shock of 2007-2008. *Brookings Papers on Economic Activity, 2009,* 215-261.
52. Hamilton, J. (1988). A neoclassical model of unemployment and the business cycle. *Journal of Political Economy, 96*(3), 593-617.
53. Harvey, C. (1995). Predictable risk and returns in emerging markets. *Review of Financial Studies, 8*(3), 773-816.

54. Huberman, G., & Wang. Z. (2005). Arbitrage pricing theory. *Federal Reserve Bank of New York Staff Report 2016*.
55. Humpe, A., & Macmillan, P. (2007). Can macroeconomic variables explain long term stock market movements? A comparison of the US and Japan. *CDMA Working Paper, 7*(20).
56. Jansen, W., & Nahuis, N. (2003). The stock market and consumer: European evidence. *Economics Letters, 79*(1), 89-98.
57. Jaunky, V. (2013). Are shocks to copper consumption persistent? *Mineral Economics, 26*(1), 29-38.
58. Johansen, S., & Juselius, K. (19*90).* Maximum likehood estimation and inference on cointegration – With applications to the demand of money. *Oxford Bulletin of Economics and Statistics, 52*, 169-210.
59. Kilian, L. (2009). Not all oil price shocks are alike: Disentangling demand and supply shocks in the crude oil market. *American Economic Review, 99*(3), 1053-69.
60. Kilian, L., & Park, C. (2009). The impact of oil price shocks on the U.S. stock market. *International Economic Review, 50*(4), 1267-1287.
61. Krugman, P. (1998). It's baaack! Japan's slump and the return of the liquidity trap. *Brookings Papers on Economic Activity, 29*(2), 137-206.
62. Krugman, P. (2011, January 19). What's moving interest rates? *Krugman Paul blog: The New York Times*: The conscience of a liberal. Retrieved October 5, 2014, from http://krugman.blogs.nytimes.com/2011/01/19/ whats-moving-interest-rates-2/
63. Krugman, P. (2011, September 10). Golden spikes. Krugman Paul blog: *The New York Times*: The conscience of a liberal. Retrieved October 5, 2014, from http://krugman.blogs.nytimes.com/2011/09/10/golden-spikes/
64. Lahart, J. (2006). Ahead of the tape: Dr Copper. *The Wall Street Journal*. Retrieved October 5, 2014, from http://www.wsj.com/articles/SB114764250116652396
65. Lamont, O. (1998). Earnings and expected returns. *The Journal of Finance, 53*(5), 1563–1587.
66. Landmann, O. (2004). Employment, productivity and output growth. *Paper for World Employment Report 2004, International Labour Organization*.
67. Levine, R., & Zervos, S. (1998). Stock markets, banks, and economic growth. *The American Economic Review, 88*(3), 537-558.
68. Lintner, J. (1965). The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets. *Review of Economics and Statistics, 47*(1), 13–37.
69. Lucey, B., & Tully, E. (2005). The evolving relationship between gold and silver 1978-2002: Evidence from a dynamic cointegration analysis: A note. *IIIS Discussion Paper, 55*.
70. Markowitz, H. (1952). Portfolio selection. *The Journal of Finance, 7*(1), 77–91.
71. Markowitz, H. (1959). *Portfolio selection: Efficient diversification of investments*. New York: John Wiley & Sons, Inc.
72. McMillan, D. (2010). Present value model, bubbles and returns predictability: Sector-level evidence. *Journal of Business Finance & Accounting, 37*(5-6), 668–686.

73. Merton, R. (1973). An intertemporal capital asset pricing model. *Econometrica, 41*(5), 867—887.
74. Merton, R. (1980). On estimating the expected return on the market. *Journal of Financial Economics, 8*(4), 323—361.
75. Mishkin, F. (2004). *The economics of money, banking, and financial Market* (7th ed.). Pearson, Boston.
76. Moore, G. (1990). Analysis: Gold prices and a leading index of inflation. *Challenge, 33*(4), 52-56.
77. Mukherjee, T., & Naka, A. (1995). Dynamic relations between macroeconomic variables and the japanese stock market: An application of a vector error correction model. *Journal of Financial Research, 18*(2), 223-237.
78. Nobelprize.org. Nobel media AB. (2013). *The prize in economic sciences 2013 - Press Release*. Retrieved September 25, 2015, from http://www.nobelprize.org/nobel_prizes/economic-sciences/laureates/2013/press.html
79. Otoo, M. (1999). Consumer sentiment and the stock market. *Board of Governors of the Federal Reserve*.
80. Pesaran, M., & Shin, Y. (1999). An autoregressive distributed lag modelling approach to cointegration analysis. In S. Strom (Ed.), *Econometrics and Economic Theory in the 20th century: The Ragnar Frish Centennial Symposium*, 371-413. Cambridge: Cambridge University Press.
81. Pesaran, M., Shin, Y., & Smith, R. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics, 16*(3), 289–326.
82. Pessoa, J., & Van Reenen, J. (2013). The UK productivity and jobs puzzle: Does the answer lie in wage flexibility? *The Economic Journal, 124*(576), 433-452.
83. Pindyck, R., & Rotemberg, J. (1990). The excess co-movement of commodity prices. *The Economic Journal, 100*(403), 1173-1189.
84. Phillips, P. (1987). Time series regression with a unit root. *Econometrica, 55*(2), 277-301.
85. Phillips, P., & Perron, P. (1988). Testing for unit roots in time series regression. *Biometrika, 75*(2), 335-346.
86. PricewaterhouseCoopers. (n.d.). *The world in 2050*. Retrieved September 10, 2014, from http://www.pwc.com/gx/en/world-2050/beyond-the-brics.jhtml
87. Poon, S., & Granger, C. (2003). Forecasting volatility in financial markets: A review. *Journal of Economic Literature, 41*(2), 478-539.
88. Ross, S. (1976). The arbitrage theory of capital asset pricing. *Journal of Economic Theory, 13*(2), 341-360.
89. Schwert, W. (2002). Anomalies and market efficiency. *NBER Working Papers 9277, National Bureau of Economic Research, Inc*.
90. Sharpe, W. (1964). Capital asset prices: A theory of market equilibrium under conditions of risk. *The Journal of Finance, 19*(3), 425-442.
91. Shiller, R. (1981). Do stock prices move too much to be justified by subsequent changes in dividends? *The American Economic Review, 71*(3), 421-436.

92. Shiller, R. (2003). From efficient markets theory to behavioral finance. *Journal of Economic Perspectives, 17*(1), 83-104.
93. Souleles, N. (2001). Consumer sentiment: Its rationality and usefulness in forecasting expenditure – Evidence from the Michigan micro data. *NBER Working Papers* 8410, *National Bureau of Economic Research, Inc*.
94. Thai, H., & Youngho, C. (2011). Oil and gold: Correlation or causation?. *Economics Bulletin, 31*(3), A31.
95. Toda, H., & Yamamoto, T. (1995). Statistical inferences in vector autoregressions with possibly integrated processes. *The Journal of Econometrics*, *66*(1-2), 225-250.
96. Vuolteenaho, T. (2002). What drives firm-level stock returns? *The Journal of Finance, 57*(1), 233–264.
97. Wilson, E., & Marashdeh, H. (2007). Are co-integrated stock prices consistent with the efficient market hypothesis? *Economic Record, 83*(1), S87–S93.
98. Zapata, H., & Rambaldi, A. (1997). Monte carlo evidence on cointegration and causation. *Oxford Bulletin of Economics and Statistics, 59*(2), 285-298.
99. Ziaei, S. (2012). Effects of gold price on equity, bond and domestic credit: Evidence from ASEAN +3. *Procedia - Social and Behavioral Sciences, 40*, 341-346.

APPENDIX

`

List of Abbreviations:

EMH - Efficient Market Hypothesis
PVM - Present Value Model
CAPM - Capital Asset Pricing Model
APT – Arbitrage Pricing Theory
DDM - Dividend Discount Model
IIP - Index of Industrial Production
PPI – Producer Price Index
WAGE - Employee Earnings
EMP - Number of Employees
CPI – Consumer Price Index
CONF – Confidence Index
STOCKS – Stock Index
SILVER - Silver Prices
GOLD - Gold Prices
COPPER - Copper Prices
OIL_BRENT - Brent Oil Prices
OIL_WTI - WTI Oil Prices
AR - Auto Regression
VAR – Vector Auto Regression
VECM - Vector Error Correction Model
ARDL – Autoregressive Distributed Lag
ECM – Error-Correction Model
ECT - Error Correction Term
TY – Toda & Yamamoto Test
ADF – Augmented Dickey-Fuller Test
PP – Phillips and Perron Test
AIC – Akaike's Information Criterion
SIC – Schwarz Information Criterion
HQ - Hannan and Quinn Criterion