ISSN 1308 - 7800 Volume 38, No. 3 September 2017

Journal of Economic Cooperation & Development

Statistical Economic and Social Research and Training Centre for Islamic Countries (SESRIC)

ISSN 1308 – 7800 Volume 38, No.3, September 2017

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Contents

EDITORIAL NOTE

Following the brainstorming session on 'Promoting the Journal of Economic Cooperation and Development' organized by SESRIC in its headquarter on 10 April 2017, Ankara, Republic of Turkey and which hosted 33 delegates from OIC institutions, ministries, universities, and governmental institutions of 12 OIC Member Countries, I am pleased to inform you that SESRIC has considered restructuring the editorial board by increasing the number of its referees and has taken a new stand in revamping the Journal's content by expanding the scope of its subjects, mainly economics, statistics and social issues which are of immediate concern to the developing countries, including the OIC countries. By signing a Memorandum of Understanding (MoU) with the Social Sciences University of Ankara (ASBÜ) on June 9th, 2017, the Journal would literarily benefit from the academic team of the said university and would widen the scope of speeding up the process of welcoming more papers from scholars in the OIC countries as well as academicians worldwide.

I am also honored to present you with this Issue of the Journal of Economic Cooperation and Development – September 2017 on the theme 'Market variables'. The articles in this issue have been selected based on the following themes: Stock and Common markets, Insurance, Macroeconomic Variables, Finance, Investment and Economic Development'. It is worthwhile noting that most of the OIC economies are dependent on some specific markets, mostly oil, agriculture, industrial and hardware commodities. There is, therefore, no doubt that the exports as well as the imports of those commodities play a critical role in the prospects of growth and development in these countries. Yet, the large share of primary commodities in output and exports brings about a significant exposure of the national economy to the risks of external shocks, such as the fluctuating trends in international prices and/or adverse seasonal factors. This, in turn, affects economic growth and long-term policy making of OIC countries.

This September issue contains six noteworthy articles which accord a detailed analysis of stock market fluctuations, Benefits of Social Insurance, Price Volatility of Food and Agricultural Commodities, Validity of International Fisher Effect, Macroeconomic Variables, Investment and Economic Development and Moves towards an Islamic Common Market.

The first article investigates the responses of the Sudanese stock market to fluctuations in exchange rate, inflation and crude oil price. Consistent with turbulent macroeconomic environment in Sudan during the past few years, the article illustrates that the country has experienced higher levels of fluctuations especially in the post-secession period. The paper concludes with the fact that the fluctuations are greatly attributed to oil shocks and exchange rate

fluctuations. These results can be used to adjust other market actions to prevent contagion risks in the event of market crashes or crises and the macroeconomic fluctuations. The paper, thus, recommends that a better management of volatility and appropriate policies represent good starting points in order for the market to play a significant role in readjusting the national economy

The second article uses a panel micro data set from Indonesia to investigate whether households are able to smooth their consumption against idiosyncratic health shocks and to examine the mitigating effects of a social health insurance programme for the poor on such shocks. It has been found that Indonesian households manage to keep consumption smooth after deterioration in adult health. Further investigation reveals heterogeneous effects of the social insurance programme. While it plays a trivial role in protecting rural households, the effect of the health intervention is stronger in urban areas of the country partly due to supply-side factors.

The third article notes that rapid price increase in food/agricultural commodities has gained attention after the "Price Spike" in 2007-2008 and that the same trend was observed in 2010 due to which it increases concern about the volatility in commodity prices. This article, therefore, aims to investigate the factor affecting volatility of selected food and agricultural commodities. It estimates that the mean and the volatility effect of exchange rate and interest rate are transmitted across all the commodities used in the study. Volatility in the price of fertilizer is only transmitted on the volatility of sunflower oil. Later, analysis shows that past price has significant impact on current prices for all the commodities except for soybean oil, sunflower oil and cotton.

The fourth article investigates the validity of the International Fisher Effect in the West African Monetary Zone (WAMZ). A cointegrating relationship has been observed in fifteen out of the twenty country pairs; indicating evidence of common stochastic drift in nominal exchange differentials and exchange rates change. However, the assumptions necessary for the validity of very weak International Fisher Effect were met for only between Ghana and Cape Verde and between Ghana and Sierra Leone at five percent significance level; an evidence of lack of macroeconomic coordination. It is important to note that macroeconomic coordination is necessary condition for currency union and seen as alternative to member countries meeting the convergence criterion.

The fifth article examines the effects of macroeconomic variables and investment rate on economic development in Nigeria for the 1980-2014 period. It also examines how the interaction between macroeconomic variables and investment affect economic development to ascertain whether the effects of investment on economic development vary with the level of macroeconomic variables. The study found overwhelming evidence that the impact of investment rate on economic development varies with the level of four

macroeconomic variables except real interest rate. The implication is that macroeconomic variables help to explain variation in economic development and investment rate indicating that better performance of macroeconomic variables and more investment rate seem to be much more applicable in the process of economic development than more investment rate in the midst of poor macroeconomic environment.

The sixth and last article provides the first systematic and comprehensive evaluation of the TPS signatories' potential to increase trade by applying five different trade indexes suggested in the literature. The findings reveal different characteristics of the TPS countries and shed light on their potential for enhancing economic cooperation. In general, the results are in favor of the establishment of a Preferential Trade Agreement among the OIC members.

Amb. Musa KULAKLIKAYA
Editor-in-chief

Journal of Economic Cooperation and Development, **38**, 3 (2017), 1-44

Understanding Stock Market Fluctuations: Evidence from Sudan

Suliman Zakaria Suliman Abdalla[1]

This paper investigates the responses of the Sudanese stock market to fluctuations in exchange rate, inflation and crude oil price. The paper employs a bi-varaite vector autoregressive-generalized autoregressive conditional heteroscedasticity model recently developed by Ling and McAleer (2003).The dataset is divided into two sub-periods, before and after the secession of South Sudan in July 9, 2011. The empirical results show that the returns on KSE index are significantly affected by their own past values suggesting some evidence of short-term predictability in KSE index changes. In addition, significant effect of a one-period lagged of returns on crude oil price, inflation and exchange rate on KSE returns is provided. Consistent with turbulent macroeconomic environment in Sudan during the past few years, the paper illustrates that KSE has experienced higher levels of fluctuations especially in the post-secession period. The paper concludes that the fluctuations of KSE index are greatly attributed to oil shocks and exchange rate fluctuations. These results are of great interest and have important implications for investors and policymakers. For example, policy-makers can use such results to adjust their actions to prevent contagion risks in the event of market crashes or crises and the macroeconomic fluctuations. The paper recommends that a better management of KSE volatility and appropriate policies to increase its efficiency represent good starting points in order for the market to play a significant role in the national economy.

Keywords: Exchange rate, inflation, oil price, fluctuations, Khartoum stock exchange

1. Introduction

Why do world's economies go through cycles of economic contraction and expansion? To what extent do different types of internal and external shocks play a role in driving fluctuations in aggregate economic

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activity? What are the main transmission mechanisms through which these shocks are propagated between different economies? These kinds of questions are all very critical for a better understanding of how well an overall economy is performing and of course, this involves issues related to decisions of various agents in the economy[2]. Different schools of thought and many economists offer a wide range of theoretical models to address these questions with special attention given to the cyclical behavior of key macroeconomic aggregates[3]. This has led to a plethora of empirical literature examining the impact of both internal and external shocks[4] on aggregate economic activity. For example, one strand of literature reports that external shocks, such as terms of trade shocks, oil price shocks, interest rate fluctuations, stock markets crashes, climate shocks and natural disaster represent main sources for better understanding of the economy performance (see, e.g., Kose and Riezman, 2001; Broda, 2004; Edwards, 2006; Calderon and Levy-Yeyati, 2009; Sosa and Cashin, 2009; Morita, 2013, among others). In contrast, other strand of literature reveals that internal shocks, such as domestic supply shocks, monetary policy shocks, investment-specific technology shocks[5], weak institutions and political instability have larger impact relative to that of external shocks (see, e.g., Hoffmaister and Roldos, 2001; Dejong et al., 2000; Aisen and Veiga, 2006; Fisher, 2006; Hirata et al., 2007; Justiniano and Primiceri, 2008; Klomp and de Haan, 2009; Allegret et al., 2012, among others).

One active branch of literature regarding the fluctuations of world economies has been focusing on understanding the predictability of

[2] For instance, van Dijk (2004) indicated that the consumption and saving decisions of private individuals; investment, production and sales decisions of the industrial sector; and monetary and fiscal policy decisions of the banking and government sector are all based on forecasts of future developments of economic variables which depend, to a large extent, on the state of the business cycle.

[3] According to macroeconomic literature there is always a driving force behind these fluctuations, some sort of shock or disturbance that causes the cycle. The latter may be volatile market expectations about future sales and profits according to Keynesian Business Cycle Theory; fluctuations in monetary growth rate as illustrated by Monetarists Theory; unanticipated fluctuations in aggregate demand according to New Classical Theory; some kind of nominal price/wage rigidities according New Keynesian Theory; and random shocks to total factor productivity that results from technological change according Real Business Cycle Theory.

[4] In this regard, various kinds of shocks have been historically documented and the current macroeconomic fluctuations literature distinguishes between nominal and real shocks, demand and supply shocks, domestic and external shocks, country specific and global shocks, etc.

[5] Technology shocks refer broadly to exogenous "changes in production functions or, more generally, the production possibilities of profit centers" (Hansen and Prescott 1993).

stock market movements based on the behavior of a number of macroeconomic fundamentals. It is worth mentioning at this juncture that the theoretical framework of this link is based on many economic and financial theories, such as quantity theory of money (Fisher, 1928; Friedman, 1956), market efficiency theory (Fama, 1965), capital asset pricing model (Sharpe, 1964), and arbitrage pricing theory (Ross, 1976). For example, according to market efficiency theory, in efficient stock markets, all the relevant information about the changes in macroeconomic fundamentals is fully reflected in the current stock prices and hence, investors would not be earned abnormal profits in such markets. Several empirical studies have investigated this relationship by considering a wide range of macroeconomic fundamentals[6] with greater emphasis given to the impact of fluctuations in economic growth, inflation, industrial production, exchange rate and interest rate (see, Cozier and Rahman, 1988; Levine and Zervos, 1996; Errunza and Hogan, 1998; Hooker, 2004; Chiarella and Gao, 2004, Dritsaki, 2005; Ewing and Thompson, 2007; Leon and Filis, 2008; Rangel, 2011). The general conclusion is that if the overall economy performs well then the stock market is likely to do the same in terms of market returns and volatility. A clear understanding of the robustness and magnitude of this relationship has important implications for policy makers, investors and other stock market participants. For example, policy makers are interested in the main driving forces of stock market fluctuations in their evaluation of the economy; a task that represents a significant part in the process of monetary policy formulation. On the other hand, it allows stock market practitioners to fine tune their investment strategies and risk management.

Although there has been a growing interest in modeling this relationship in developed economies and to some extend in emerging economies, little attention has been given in developing countries[7] whose economies are especially vulnerable to a wide range of fluctuations due to many factors. These include, large external shocks, volatile macroeconomic policies, political instability, poorly developed insurance and financial

[6] Some other factors like macroeconomic mismanagement, political instability, and natural disaster are also considered.

[7] Agénor et al., (2000) provided two reasons to account for this. First, limitations on data quality and frequency could be constraining factors in some cases. Second, developing countries tend to be prone to sudden crises and marked gyrations in macroeconomic variables, often making it difficult to discern any type of "cycle" or economic regularities.

markets, and weak institutions[8], among others. Existing empirical literature has generally agreed on a consensus view that fluctuations in aggregate economic activity in developing countries are quite different from the ones observed in developed countries in the sense that they are generally characterized by low magnitude and higher volatility (see for example, Kose and Riezman, 1999; Agenor et al. 2000; Allegret et al. 2012). There is no doubt that more attention is needed to document the stylized facts regarding macroeconomic fluctuations and the performance of financial institutions in developing countries. This will be useful at least in two aspects. First, to examine whether similar empirical regularities are observed across countries at different levels of income (Agenor et al., 2000). Second, this type of analysis may have important policy implications in the design of stabilization and adjustment programs (Agenor and Montiel, 1996).

Within this context, the current study tries to address the question: How the Sudanese stock market (the Khartoum Stock Exchange, KSE) responds to changes in fundamental economic forces? In particular, the study focuses on the fluctuations of inflation, exchange rate and crude oil price. The remainder of this paper is organized as follows. Section 2 illustrates the motivation and significance of the study. Section 3 discusses the theoretical considerations and provides some empirical literature. Section 4 provides some facts about the stock market in Sudan. Section 5 introduces the empirical framework, while Section 6 describes the data and provides their statistical properties and motivation for empirical framework. Section 7 discusses the empirical results. Finally, Section 8 concludes the paper and provides some recommendations.

2. Motivation and significance

Since its independence from Britain in 1956, Sudan has experienced significant swings in aggregate economic activity resulting from different political, socio-economic and financial turbulences. While it was a relatively good time during 1950s and 1960s, Sudan economy has undergone significant fluctuations during the successive decades. The situation has worsened over the last few years after the secession of the

[8] For example, Kose and Riezman (1999) showed that a highly and unstable domestic macroeconomic environment is one of the primary reasons for the poor growth of African countries.

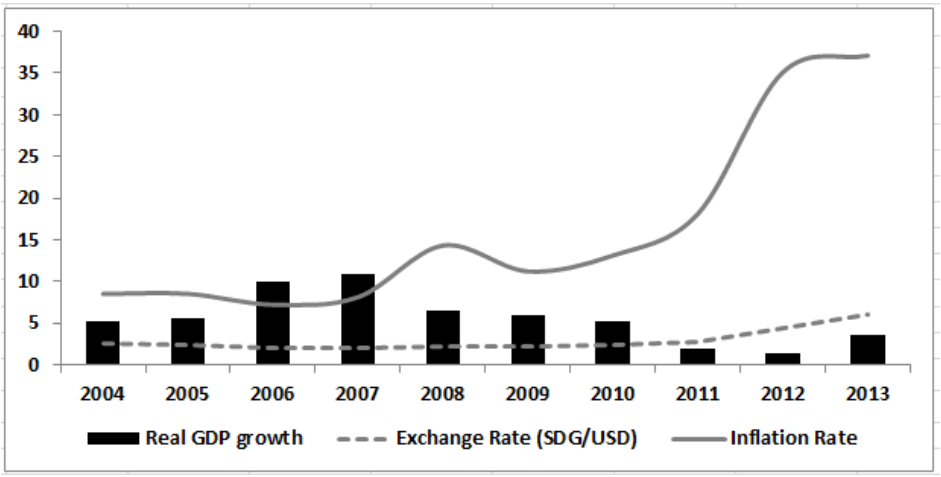
South Sudan in July 9, 2011. All these turbulent events have contributed to creating severe macroeconomic imbalances and deteriorating considerably the economic conditions in Sudan. To adjust to this new economic reality, strong policy responses are required if the economy is to be put onto a sustainable growth path in the future. Although the sources of macroeconomic fluctuations and their potential impacts have still not been tackled in a comprehensive macroeconomic model (to the best of author's knowledge), some interesting studies and considerable empirical literature have emerged to evaluate the overall level of economic activity usually in terms of single driving forces and to suggest some policy options. However, these policy options have not been quite effective in restoring macroeconomic stability; the economy is still experiencing double-digit inflation, unstable exchange rate, large external and internal deficits, and low growth rate (see Figure 1). So, it seems timely for policy makers in Sudan to question what has gone wrong and what has been forgotten in an attempt to put it right in their future policy priorities. It is worth mentioning at this juncture that policy discussions usually assign a relatively minor role to the dynamic behavior of Khartoum stock exchange. Strictly speaking, a wide range of important questions have not been addressed yet, including for example: How does the Sudanese stock market react to the wide range of fluctuations which hit the Sudanese economy during the past few years? Do these fluctuations affect stock returns and volatility? If so, what are the major driving forces behind this volatility? Are the driving forces domestically originated or imported from outside? Therefore, it is timely for the policymakers to have answers to these types of questions which to a large extent involve issues related to macroeconometric modeling.

Consistent with the turbulent macroeconomic environment in Sudan over the past few years, Khartoum stock exchange is also exposed to some degree of fluctuations. For example, based on GARCH methodology [9] Abdalla and Winker (2011) indicate that the KSE experienced an explosive conditional volatility of returns; a result that is unusual for stock market behavior. For the policy makers, to effectively manage such higher volatility they have to first understand the major driving forces behind it. A better understanding of how well KSE is

[9] Over the past few years this methodology has been applied extensively for the Sudanese stock market (see, e.g., (Abdalla, 2011, 2012, 2013, 2014; Abdalla and Winker, 2012).

performing represents a good starting point given the fact that stock market serves as a reliable barometer of the economy's health. Such empirical research may have several practical implications for investors, portfolio managers and policy makers. Considering investors, for example, a clear understanding of the dependencies between these economic forces can help them in explaining the flow of information which significantly affects their investment decisions. For policy makers, this type of analysis may be very useful in assessing the informational efficiency of stock market. It may also provide very useful insight into the way that volatility shocks originated in these variables are transmitted to stock market and therefore they can assess the degree and persistence of these innovations over time to adopt proper policies and forecast the full impact of their decisions. For portfolio hedgers, it is crucial to spell out how markets are linked over time to develop an effective hedging strategy. Finally, the importance of this empirical investigation is enhanced considering the fact that correlations are time-varying.

Figure 1: Selected Macroeconomic Variables for Sudan (2004-2013)



Source: Central Bank of Sudan (Annual Report, various issues)

3. Theoretical considerations and empirical literature

As mentioned in the introductory section, the potential impacts of macroeconomic fundamentals on stock market performance are based on a wide range of economic and financial theories. Of course, discussing these theories is not the objective of this study. Instead, this section briefly outlines some theoretical considerations on the response of stock markets to the movements in the crude oil price, exchange rate, and inflation. This is also accompanied with touching some empirical works.

3.1 On the relationship between crude oil price and stock market

The rationale for the possible oil price impact on stock prices can be explained by at least two transmission channels. First, as the economic theory suggests that the price of a share at any point in time is exactly equal to its discounted future cash flow[10], any factor that could alter the expected discounted cash flows should have a significant effect on these share prices[11]. In this regard, as crude oil along with capital, labor and materials represent key inputs in the production of many goods and services, any oil price increase would result to increased production costs of companies, restraining profits and in greater extend, would cause a decrease in shareholders' value. Hence, any oil price increase should be accompanied by a decrease in the stock prices (See, e.g., Apergis and Miller, 2009; Arouri and Nguyen, 2010; Ciner, 2001; Filis et al., 2011; Nandha and Faff, 2008; Sadorsky, 1999; Sukcharoen et al., 2014). Second, oil price fluctuations may also affect the discount rate used in standard equity valuation models. Rising oil prices are often indicative of inflationary pressures which central banks typically control by raising interest rates, with the subsequent negative effect on share prices via the discount rate (Huang et al., 1996; Miller and Ratti, 2009; Mohanty et al., 2011). Consequently, the impact of increasing oil prices on the stock markets of net oil-importing countries should be negative.

[10] These discounted cash flows reflect economic conditions (inflation, interest rates, production costs, income, economic growth, investor and consumer confidence, and so on) and are then affected by macroeconomic events that may be influenced by oil price changes (Arouri, 2011).

[11] In a pioneering empirical evidence focusing mainly on the standard cash-flow dividend valuation model, Jones and Kaul (1996) show that oil price shocks had a detrimental effect on four developed equity markets (Canada, the UK, Japan and the US) during the post-World War II period.

In contrast, increasing oil prices should have a positive influence on the stock markets of oil-exporting countries in the form of higher income and wealth effects. Additionally, financilisation of oil markets and intensive crude oil trading can also amplify the transmission of oil price shocks to the real economy (see, Creti et al., 2013).

A large body of empirical literature now exists; with the bulk of this literature focusing on developed countries. The results are generally mixed and inconclusive. A number of studies document significant negative impact of oil price fluctuations on stock market returns (see, e.g., Kling, 1985; Jones and Kaul, 1996; Sadorsky, 1999; Ciner, 2001; Wei, 2003; Park and Ratti, 2008; Kilian and Park, 2009; Miller and Ratti, 2009; Chen, 2010; Elder and Serletis, 2010; Masih et al., 2011; Basher et al., 2012). In contrast, some others report positive response of stock markets to oil price shocks (see, e.g., Faff and Brailsford (1999), Sadorsky (2001, 2003), El-Sharif et al. (2005), Zhu et al. (2011), Arouri and Rault (2012), and Li et al. (2012),. One possible explanation for this lack of conclusive results might be that the oil–stock prices link is not stable over time (Aloui et al., 2012; Broadstock et al., 2012; Filis et al., 2011). In this regard, Moya-Martínez et al., (2014) argues that this connection might have experienced dramatic changes in recent years due to factors such as the existence of stock market and/or oil price bubbles, episodes of geopolitical instability, increasing corporate hedging activity or the recent global financial crisis.

3.2 On the relationship between inflation and stock market

Regarding the inflation-stock return relation, many economists thought, until the mid-1970s, that the two variables should be positively related. This idea was loosely based on the Fisher's (1930) hypothesis[12] that nominal asset returns should reflect expected inflation. However, several studies since then have discovered that the real stock return–inflation relation in the post-war U.S. and several European countries is significantly negative. There are also different hypotheses have been proposed to rationalize a negative co-movement between inflation and

[12] The generalized Fisher hypothesis or effect states that equities are a claim against real assets of the company and can serve as a hedge against inflation. When inflation is pronounced, investors would sell financial assets in exchange for physical or real assets such as stocks. If that takes place, the prices of equities should reflect fully the expected inflation, and the relationship between the two variables (inflation and stocks or equities) should be positive.

stock returns. These include, (i) inflation illusion hypothesis by Modigliani and Cohn (1979) which argues that investors undervalued stocks in the 1970s because they used nominal interest rates to discount cash flows and also excluded capital gains that accrued to firms with fixed rate debt liabilities; (ii) Feldstein (1980) real after-tax hypothesis which posits corporate profits vary inversely with inflation as a result of higher effective tax rates due to higher inflation; (iii) Fama (1981) proxy hypothesis that holds that the negative association between stock market returns and inflation rates is not a causal relationship, but a spurious result of the dual effect because inflation acts as a proxy for real economic activity variables in models that relate stock returns to inflation; (iv) the risk premium hypothesis by Devereux and Yetman (2002), and more recently (v) Anari and Kolari (2010) show through simulation that nominal discount rates can have a negative impact on stock values in the short run due to inflation premium included in the discount rate (Alagidede and Panagiotidis, 2010)

Empirically, a large body of empirical literature exists on the movement of stock market prices in response to inflation changes, but conclusions have been widely debated. Several studies document that stock returns and inflation are negatively correlated (Linter, 1975; Bodie, 1976; Jaffe and Mandelker, 1976; Nelson and Schwert, 1977; Fama and Schwert, 1977, Hu and Willett, 2000; Hagmann and Lenz, 2004; Patra and Poshakwale, 2006). On the other hand, some others found a positive relationship[13] (Cagan, 1974; Choudhry, 1998). Explanations of negative (or positive) relation can be found as in Hess and Lee (1999) who showed that the relationship between stock returns and inflation can be either positive or negative, depending on the source of the inflation in the economy. They concluded that the negative stock returns-inflation relationship is due to supply shocks which reflect real output shocks while the positive relationship is due to demand shocks, are mainly due to monetary shocks. However, some empirical investigations provide no significant relationship (see e. g., Hardouvelis, 1988; Pearce and Roley, 1988; Spyrou, 2001; Joyce and Read, 2002; Payne, 2006; Jareno, 2008).

[13] In theory, there is a case to support the view that since the rate of inflation means an increase in the general level of prices, and since common stocks can be considered as capital goods, then the stock prices should move with the general level of prices. So, when the general inflation rate increases, common stocks should also increase to compensate investors for the decrease in the value of money. In this framework, it is expected that there is a positive relationship between the inflation rate and stock prices (Omran and Pointon, 2001)

3.3 On the relationship between exchange rate and stock market

Theoretical impact of exchange rate movements on the performance of stock market [14] can be explained by the "flow-oriented" approach (Mundell, 1963, 1964; Dornbusch and Fisher, 1980; Gavin, 1989) which assumes that the currency fluctuations affect international competitiveness and the balance of trade position, and consequently the real income and output of an economy, which in turn affects current and future cash flows of companies and their stock prices. According to this approach when exchange rate depreciates, the competitiveness of exports will increase, and the input cost of imports will increase, thus, depreciation will cause positive (negative) effect for export (import) firms and increase (decrease) their stock prices; however, appreciation will cause negative (positive) effect for export (import) firms and decrease (increase) their stock prices. It is very clear that the impact of exchange rate fluctuations on stock market performance would depend on both the degree of openness of domestic economy and the degree of the trade imbalance.

On the empirical front, a number of studies have been conducted to explore the relationship between exchange rates and stock prices. However, the results have been quite mixed regarding the sign and the direction of causality between the two variables (see, e.g., Aggarwal, 1981; Soenen and Hennigar, 1988; Bahmani-Oskooee and Sohrabian, 1992; Roll, 1992; Smith, 1992; Bodnar and Gentry, 1993; Dropsy and Nazarian-Ibrahimi,1994; Choi and Prasad, 1995; Prasad and Rajan, 1995; Ajayi and Mougoue, 1996; Fang and Loo, 1996; Abdalla and Murinde, 1997; Kwon et al., 1997; Malliaropulos, 1998; Kanas, 2000; Nieh and Lee, 2001; Hatemi-J and Irandoust, 2002; Ehrmannet et al., 2011; Katechos, 2011, among others). In contrast, some studies find that there is no significant relationship (see, e.g., Solnik, 1987; Jorion, 1990, 1991; Chow et al., 1997; Yang and Doong, 2004, among others).

[14] It is generally argued that the relationship between exchange rates and stock prices has important implications, especially from the viewpoint of recent large cross-border movement of funds and investments.

4. Some facts about the Stock Market in Sudan

The Sudanese stock market was established in 1995 with technical assistance provided by the Common Market for Eastern and Southern Africa (CoMESA)[15]. Securities traded in the market are ordinary shares and investment units[16]. Furthermore, a substantial number of mutual funds and Government Investment Certificates (GICs)[17] are also traded. Orders are handled through brokers during trading hours and share prices are quoted in Sudanese Pound (SDG). Trading in securities is taking place in two markets, the so called primary and secondary markets[18]. Although the market switched from manual to computer-based trading in January 2012, trading still occurs for only one hour (10:00 am to 11:00 am) and brokers must be physically present at the exchange (IMF, 2014).

As a part of the financial system of Sudan, the market operates on the basis of Islamic *Shariaa* and is supervised and regulated by the Central Bank of Sudan[19]. The key feature of Islamic *Shariaa* practices in Khartoum Stock Exchange is that it is aimed to offer investment portfolios from common stocks of listed companies which ideally satisfy three basic criteria: (i) legitimate field of economic activity; (ii) interest-

[15] Member states are: Burundi, Comoros, Democratic Republic of Congo, Djibouti, Egypt, Eritrea, Ethiopia, Kenya, Libya, Madagascar, Malawi, Mauritius, Rwanda, Seychelles, Sudan, Swaziland, Uganda, Zambia and Zimbabwe.

[16] An investment unit is a proportional accounting share in the total net assets of an open end investment fund (Investment funds are the institutions of collective investment which serve as framework for collection of money funds. Collected money funds are then invested in various assets). The investment unit value is an indicator of how successful a fund is, and the changes of this value depend on the fluctuation of prices of securities and other property that the fund has invested in.

[17] Government investment certificates (GICs) are medium-term securities, based on various contracts financed by the Ministry of Finance of Sudan via the *istisna*, *murabaha* and *ijara* tools. Issuance of these *sukuk* is similar to the conventional securitization, where the Ministry of Finance acts as the originator. GICs are based on a limited *mudarabah*, which means that the raised money is invested solely in the projects stipulated in the original contract.

[18] The Primary Market deals with the trading of new securities. When a company issues securities for the first time (i.e. IPO), they are traded in the Primary Market through the help of issuing houses, dealing /brokerage firms, investment bankers and or underwriters. The acronym IPO stands for Initial Public Offering, which means the first time a company is offering securities to the general public for subscription. Once the securities (shares) of a company are in the hands of the general public, they can be traded in the Secondary Market to enhance liquidity amongst holders of such financial securities. Thus, the Secondary Market facilitates the buying and selling of securities that are already in the hands of the general public (investors).

[19] For more explanations about the ideas of Islamic banking see for example, Venardos (2010).

free dealings in both assets and liabilities, and (iii) the dominance of real assets. Thus, e.g., a company must not be engaged in the production of illegitimate goods like alcoholic drinks; it must not deal with interest rate financing as a means to leverage its capital structure through fixed debt liabilities, or generate interest income from investment securities; and since a company's shares represent equity rights in its assets, the latter should be real assets, not liquid money or receivable debt as they cannot be sold freely at a profit like real goods, real estate and machinery (Hassan and Lewis, 2007).

As consequences of these rules, the composition of assets traded at the KSE differs substantially from other stock markets. In particular, due to the regulations imposed by Islamic *Shariaa*[20] practices a separate class of investment vehicles on the KSE is provided by the so called Government *Musharakah*[21] Certificates (GMCs), which represent an Islamic equivalent to conventional bonds (also known as *Shahama* bonds). *Shahama* bonds offer a way for the government to borrow money in the domestic market instead of printing more banknotes. After one year, holders of GMCs can either liquidate them or extend their duration. These bonds are backed by the stocks of various companies owned by the Ministry of Finance. Consequently, they might be considered as asset-backed securities. The profitability of GMCs depends on the financial results of the companies in the underlying portfolio. It can reach up to 33 per cent per annum. Hence, the profit of GMCs is variable rather than fixed. The government issues these bonds on a quarterly basis and their placement on the market is done usually very fast- in just six days.

Despite its short history KSE has contributed a number of benefits to the investment climate in Sudan, among which, it promoted the auditing profession as one of the listing requirement of any company to submit audited accounts for the latest two years and every year after listing. And, also enhanced awareness in securities investment as manifested in the increasing number of the investment funds in the country (Onour, 2010).

[20] For a detailed discussion of the Islamic Shariaa principles and its practices on stock exchange see for example, El-Gamal (2006) and Ayub (2007).

[21] Musharakah' is a word of Arabic origin which literally means sharing. In the context of business and trade it means a joint enterprise in which all the partners share the profit or loss of the joint venture. It is an ideal alternative to the interest-based financing with far reaching effects on both production and distribution (Usmani, 1998).

When it comes to look at the market size, it is very important to point out that it is relatively small even compared to many stock markets in the Arab region; the number of listed companies is few and most stocks are infrequently traded, market capitalization and traded value are very low (See Table 1 and Figure 2). Banks, communications and certificates sectors dominate the trading activity of the market in terms of trading volume and number of shares (see Tables 2 and 3). The market is currently listing 59 companies with a total market capitalization of SDG 11,758.06 (2,243.90 $US million) million (Arab Monetary Fund, 2014). Although, the amount of capitalisation is very small, but it shows considerable increase, especially during the past few years (see Figure 3). The overall performance of the market is measured by the KSE index, which is a market capitalization-weighted index. In September 2003, the KSE index was established and listed in the Arab Monetary Fund database. At the end of the first month the index closed at 961.74 points.

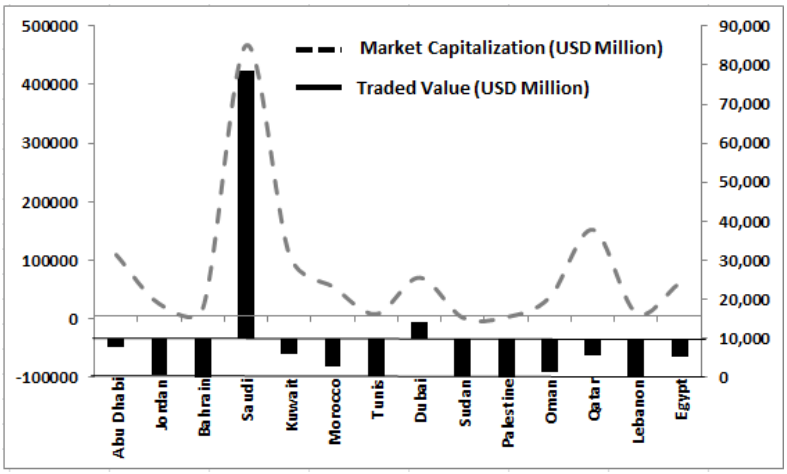
Table 1: Trading activity in selected Arab stock markets, End-2013

	Number of Shares Traded (In Million)	Daily average shares traded (Million)	Daily Average Value Traded (Million $U.S.)	Relative Market Capitalization (% of Total)	Stocks Traded Turnover Ratio (%)	Number of Listed Companies
Abu Dhabi Securities Market	17,044.68	304.369	131.0	9.68	7.05	66
Amman Stock Exchange	526.55	9.079	12.9	2.28	2.9	240
Bahrain Bourse	440.20	7.590	2.2	1.63	0.7	47
Saudi Stock exchange	10,993.02	180.213	1,287.4	41.28	16.8	163
Kuwait Stock Exchange	17,507.68	265.268	90.7	9.57	5.5	210
Casablanca Stock Exchange	94.15	1.569	44.5	4.89	4.8	75
Algeria Stock Exchange	0.034	0.0014	11.0	0.01	0.21	2
Tunis Stock Exchange	54.43	0.878	3.5	0.76	2.5	65
Dubai Financial Market	40,746.10	690.612	240.0	6.24	20	55
Damascus Securities Exchange	2.24	0.064	0.1	0.09	0.29	22
Khartoum Stock Exchange	**32.87**	**0.522**	**3.1**	**0.20**	**8.6**	**59**
Palestine Stock Exchange	91.58	1.607	2.5	0.29	4.4	49
Muscat Securities Market	1,735.10	29.408	26.4	3.25	4.2	131
Qatar Exchange	591.88	10.205	98.1	13.48	3.7	42
Beirut Stock Exchange	20.40	0.352	2.8	0.93	1.5	28
Egyptian Exchange	10,270.00	168.361	89.7	5.43	8.9	212

Source: Arab Monetary Fund.

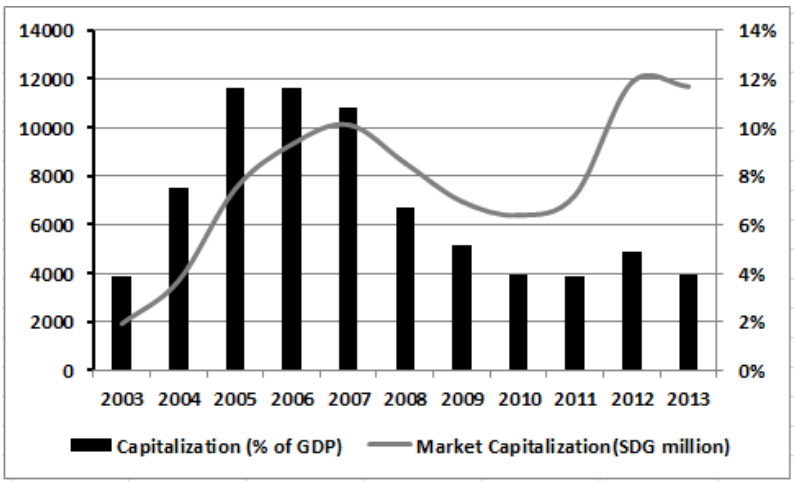
Despite its rapid growth in terms of market capitalization, KSE is characterized as highly concentrated market as only few companies constitute significant contribution of both capitalization and traded value around 90% of the total market capitalization. And, also can be regarded as an illiquid market as the shares of only few companies are tradable.

Figure 2: Trading Activity in Selected Arab Stock Markets, End-2013



Source: Arab Monetary Fund

Figure 3: Market Capitalization for the KSE (2003-2013)



Source: Central Bank of Sudan (Annual report, various issues)

Table 2: No. of Shares (million) by Sectors (2002 –2013)

Years	Banks	Insurance	Commerce	Industry	Agriculture	Communication	Services	Funds	Certificates	Others
2002	1926.566	0.0067	2130.592	0.0164	0	0	0	0	0	3.0553
2003	8950.99	0.0004	790.228	0.0544	0	0	0	0	0	4.1844
2004	1506.397	0.0074	650.9387	21.6722	0	0	0	0.0308	0.1021	6.9789
2005	848.351	0.0021	848.0048	21.501	0	0	0	0.8458	0.3081	12.6575
2006	7146.345	0.0018	316.0161	28.0363	0	0	0	1.4334	1.4724	74.4771
2007	9283.037	8.0397	22.6046	2.056	0.0435	88.5736	1.9954	2.7172	2.0165	0.475
2008	195.7864	0.078	0.9087	1.0072	0.0679	78.1495	5.5248	4.9769	2.4211	0.0873
2009	85.0252	0.1689	1.48	39.3634	0	36.583	2.0034	4.2289	3.4177	0.089
2010	144.346	0.13389	0.2135	2.88556	0.00705	12.49552	1.36723	1.79111	4.0589	5.09979
2011	64.42859	1.39631	0.10922	13.6168	0.00008	21.84176	0.21574	7.33345	3.89207	4.90361
2012	165.1817	0.0942	0.0627	0.1313	0	5.8242	1.2666	5.7936	5.1166	0.0199
2013	12.5216	1.7148	0.066	0.0308	0	43.8405	5.7097	1.4473	6.9833	16.974
Period Average (%)	**84.90**	**0.03**	**13.33**	**0.36**	**0.0003%**	**0.80**	**0.05**	**0.09**	**0.08**	**0.36**

Source: Central Bank of Sudan (Annual reports, various issues) and own calculation

Table 3: Volume Trading (SDG million) by Sectors (2002 –2013)

Years	Banks	Insurance	Commerce	Industry	Agriculture	Communication	Services	Funds	Certificates	Others
2002	13.594	0.023	9.123	0.005	0	0	0	10.754	108.853	106.703
2003	39.7	0.001	1.946	0.016	0	0	0	7.414	62.663	132.364
2004	7.805	0.004	39.29	38.958	0	0	0	2.767	113.702	245.197
2005	11.095	0.008	18.309	48.2	0	0	0	47.116	194.408	897.697
2006	91.4	0	22.3	57	0	0	0	120.2	799.9	977.3
2007	139.7	1.9	22	4	0.1	432.2	0.8	130.3	1068.5	0.1
2008	135.8	1.8	6.2	0.8	0.1	320.1	7.6	123.5	1283.2	0.04
2009	81.5	0.1	15.1	25.4	0	122.5	0.9	164.8	1836.3	0
2010	145.94	0.07	0.5	2	0.01	23.23	0.93	81.4	2157.93	10.31
2011	114.728	35.473	0.216	8.746	0.001	32.148	0.299	302.481	2059.139	9.394
2012	41.2	0.1	0.4	0.2	0	9.2	0.6	308.1	2713.7	0.03
2013	9.9	1.6	0.5	0.01	0	95.9	23.6	71.7	3679.7	2.4
Period Average (%)	**3.77**	**0.19**	**0.62**	**0.84**	**0.001**	**4.68**	**0.16**	**6.20**	**72.76**	**10.78**

Source: Central Bank of Sudan (Annual reports, various issues) and own calculation

5. Empirical Framework

For modelling the responses of the Sudanese stock market to the fluctuations in crude oil prices,, inflation, and exchange rate, a VAR(1)-GARCH(1,1) model [22] proposed by Ling and McAleer (2003) is employed. In this model, there are two distinct equations, the first one for the conditional mean and the second one for the conditional variance. The interest is mainly in the second equation as it provides estimates of volatility transmission.

The conditional mean equation can be expressed as follows:

$$\begin{cases} R_t = \mu + \Pi R_{t-1} + \varepsilon_t \\ \varepsilon_t = H_t^{1/2}\eta_t \end{cases} \quad (1)$$

where

$R_t = \left(r_t^s, r_t^{\mathrm{F}}\right)'$ where r_t^s are the returns on the general market index and r_t^{F} represents the returns of (oil price, inflation, and exchange rate). So when the interest is to look at the impact of oil price fluctuations on stock market performance, this vector can be written as follows: $R_t = (r_t^s, r_t^o)'$. For the impact of exchange rate fluctuations it can be $R_t = (r_t^s, r_t^{ex})'$. Finally $R_t = \left(r_t^s, r_t^{inf}\right)'$ is used when examining the impact of inflation fluctuations. For explaining the rest of this methodology, F is used to indicate that one of the three variables (oil price, inflation, and exchange rate) is used.

[22] This model has two major advantages. First, it has an analysis advantage since it has relatively less excessive in parameters and allows the modeler to focus more on the estimation of meaningful and interpretable parameters. Second, it permits a multivariate analysis of conditional volatility of the series under investigation as well as of conditional cross effects and volatility spillovers between the series. This model has previously been used to study the dynamic properties of different financial and economic phenomena, such as international tourism demand and volatility (Chan et al., 2005), dynamic relationship between stock market returns and exchange rate fluctuations (Abdalla, 2013; Boubaker and Jaghoubi, 2011), conditional correlations in volatility of rubber spot and futures returns (Chang et al. 2011), Shock and Volatility transmissions between bank stock returns (Chaibi and Ulici, 2014), return and volatility transmission between gold and stock sectors (Kumar, 2014). It appears to provide meaningful and interpretable coefficients.

$\mu = (\mu_t^s, \mu_t^{\mathrm{F}})'$ is the vector of constant terms.
Π is a (2×2) matrix of coefficients allowing for cross-sectional dependency of conditional mean between stock market and (oil price, inflation, and exchange rate) of the following form:

$$\Pi = \begin{pmatrix} \Pi_{11} & \Pi_{12} \\ \Pi_{21} & \Pi_{22} \end{pmatrix}$$

$\varepsilon_t = (\varepsilon_t^s, \varepsilon_t^{\mathrm{F}})'$ is the vector representing the error terms of the conditional mean equations.

$\eta_t = (\eta_t^s, \eta_t^{\mathrm{F}})'$ is a sequence of independently and identically distributed $(i.i.d)$ random errors;

$H_t = \begin{pmatrix} h_t^s & h_t^{s\mathrm{F}} \\ h_t^{s\mathrm{F}} & h_t^{\mathrm{F}} \end{pmatrix}$ is the matrix of conditional variances of stock and returns of (oil price, inflation, and exchange rate) with h_t^s and h_t^{F} being the conditional variances of r_t^s and r_t^{F} respectively. Their time series dynamics are modelled as follows:

$$h_t^s = C_s^2 + \beta_{s1}^2 h_{t-1}^s + \alpha_{s1}^2 (\varepsilon_{t-1}^s)^2 + \beta_{s2}^2 h_{t-1}^{\mathrm{F}} + \alpha_{s2}^2 (\varepsilon_{t-1}^{\mathrm{F}})^2 \quad (2)$$

$$h_t^{\mathrm{F}} = C_{\mathrm{F}}^2 + \beta_{\mathrm{F}1}^2 h_{t-1}^{\mathrm{F}} + \alpha_{\mathrm{F}1}^2 (\varepsilon_{t-1}^{\mathrm{F}})^2 + \beta_{\mathrm{F}2}^2 h_{t-1}^s + \alpha_{\mathrm{F}2}^2 (\varepsilon_{t-1}^s)^2 \quad (3)$$

According to Eqs. 2 and 3, negative and positive shocks of equal magnitude have identical effects on conditional variances. The equations also show how volatility is transmitted over time. The cross values of error terms, $(\varepsilon_{t-1}^{\mathrm{F}})^2$ and $(\varepsilon_{t-1}^s)^2$, represent the return innovations in the (oil price, inflation, and exchange rate) and to the corresponding stock price at time $(t-1)$, and thus capture the impact of direct effects of shock transmission. The transfer of risk is accounted for by the lagged conditional volatilities, h_{t-1}^{F} and h_{t-1}^s. To guarantee stationarity, the roots of the equation $|I_2 - AL - BL| = 0$ must be outside the unit circle where the expressions $(I_2 - AL)$ and BL satisfy some other identifiability conditions as proposed by Jeantheau (1998). L is a lag polynomial, I_2 is a (2×2) identity matrix, and A and B are defined as:

$$A = \begin{pmatrix} \alpha_{s1}^2 & \alpha_{s2}^2 \\ \alpha_{F2}^2 & \alpha_{F1}^2 \end{pmatrix} \text{ and } B = \begin{pmatrix} \beta_{s1}^2 & \beta_{s2}^2 \\ \beta_{F2}^2 & \beta_{F1}^2 \end{pmatrix}$$

The conditional covariance between returns of each of the three variables (oil price, inflation, and exchange rate) and stock market in the bivariate VAR(1)-GARCH(1,1) is modeled as:

$$h_t^{sF} = \rho * \sqrt{h_t^s} * \sqrt{h_t^F} \quad (4)$$

where ρ is the constant conditional correlation (CCC) coefficient.

Overall, the proposed empirical model simultaneously allows capturing both return and volatility spillover effects between (oil price, inflation, and exchange rate) and stock market. Note that the CCC assumption can be viewed as restrictive given that correlation coefficient is likely to vary over time according to changes in economic and market conditions. The quasi-maximum likelihood estimation (QMLE) method of Bollerslev and Wooldridge (1992) is used to estimate the empirical model in order to take into account the fact that normality condition is often rejected for majority of macroeconomic and financial series.

6. Data and preliminary analysis

6.1 The data used for the Analysis

The data used in the analysis of this study consist of daily observations on crude oil price and the closing value of the KSE index. Monthly data on KSE index, exchange rate, inflation rate are also used. Crude oil prices expressed in USD per barrel for Brent spot prices to represent the international crude oil market given that they are serving as pricing benchmark for two thirds of the world's internationally traded crude oil supplies (see Aloui et al., 2013; Maghyereh, 2004). To look at the impact of the secession of South Sudan on July 9, 2011, the paper uses a sub-period analysis by splitting the whole sample period into two sub-periods (before and after the secession). Table 4 provides the description and sources of the variables.

Table 4. Variables included, their frequency, period and sources

Variable	Frequency	period	Source
KSE index	Daily	2/8/2008-20/10/2014	KSE database
KSE index	Monthly	9/2003-10/2014	KSE database
Exchange rate	Monthly	9/2003-10/2014	Central Bank of Sudan
Inflation rate	Monthly	9/2003-10/2014	Central Bank of Sudan
Crude oil prices	Daily	2/8/2008-20/10/2014	the US Energy Information Administration

Daily (monthly) returns on the variables are computed as percentage by taking the difference in logarithm of two successive values as follows:

$$r_t^{\mathrm{F}} = log\left(\frac{P_t^{\mathrm{F}}}{P_{t-1}^{\mathrm{F}}}\right) * 100 \quad (5)$$

$$r_t^{s} = log\left(\frac{P_t^{s}}{P_{t-1}^{s}}\right) * 100 \quad (6)$$

Equ. 5 is used for calculating the returns of oil prices, exchange rate and inflation. P_t^s and $r_t^s in$ Equ. 6 denote daily (monthly) closing values of the KSE index and their returns respectively.

6.2 Descriptive Statistics of KSE index and crude oil prices

To specify the distributional properties of the variables and their returns during the sample period, some descriptive statistics are reported in Tables 5 and 6. It is very clear that returns on oil prices and KSE index have very small means (very close to zero). In view of the value of standard deviation (an indication of unconditional variance in the return series) regarding the mean value, the results show that oil prices, inflation, and exchange rate are characterized by higher volatility and risky nature in comparison with KSE returns. The results also indicate that all series do not conform to normal distribution but display positive skewness (the distribution has a long right tail), in addition to that, a highly leptokurtic distribution is also observed for all returns series. The Jarque-Bera (JB) statistic confirms that the returns distribution is non-normal at a p-value of almost 1% in all cases (except for inflation variable in post-secession period). As for comparing the behavior of the KSE index before and after the secession of South Sudan, Table 5 indicates that the average value of the KSE index in post-secession

period is greater and with higher volatility. This feature is also true for the returns series (Table 6) but with less volatility. ARCH-LM test results provide strong evidence for rejecting the null hypothesis of no ARCH effects indicating that the variance of the residuals series of returns on the variables under investigation is non-constant. The presence of ARCH effects is a justification to use the GARCH methodology.

Figures 4-6 display the KSE index, crude oil prices, inflation, exchange rate and their returns. To some extent, there seems to be some comovements between the KSE index and the three variables during most of the time, except for some relatively short sub-period (end of 2011 up to the beginning of 2012) where there was no significant change in the index returns. For all returns series, there is evidence for volatility clustering a phenomenon indicating that large changes tend to be followed by large changes, and small changes tend to follow small changes. This characteristic suggests the possibility of return and volatility spillover effects between the two markets and makes GARCH types models to be the preferred methodology for modeling such time series (Francq and Zakoian, 2010).

Table 5: Summary statistics for crude oil prices, exchange rate, inflation and KSE index

Measures	Oil Prices	KSE Index		Inflation Rate		Exchange Rate	
		Before	After	Before	After	Before	After
Mean	95.79	2586.14	2673.09	10.4621	35.3103	2.3175	4.3576
Std. dev.	22.39	168.81	300.64	4.4406	9.8817	0.2191	1.1757
Maximum	143.95	3077.12	3423.37	21.800	47.900	2.7816	5.6958
Minimum	33.37	2353.20	2365.02	1.7000	18.900	2.0051	2.6789
Skewness	-0.79	0.24	0.77	0.1399	-0.5062	0.0752	-0.3368
Excess Kurtosis	2.86	2.38	2.47	2.4518	1.7165	1.8107	1.7159
Jarque-Bera	185.25[a]	23.75 [a]	91.88 [a]	1.4992	4.3427	5.6881[a]	3.4028
No. of Observations	1770	934	827	95	39	95	39

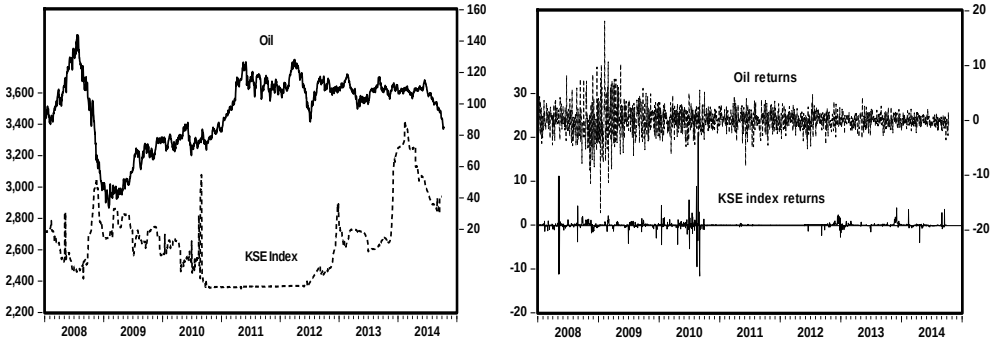
Note: [a] denotes statistical significance at the 1% significance level.

Table 6: Summary statistics for returns on crude oil prices, exchange rate, inflation and KSE index

Measures	Oil Prices	KSE Index		Inflation Rate		Exchange Rate	
		Before	After	Before	After	Before	After
Mean	-0.0052	-0.0148	0.0263	1.7808	2.0533	0.0266	1.9205
Std. dev.	2.1535	1.3585	0.4222	40.6697	11.956	1.5518	6.9098
Maximum	18.1297	21.1228	3.3937	189.712	31.536	6.4437	37.314
Minimum	-16.8320	-11.6074	-3.9978	-151.634	-31.408	-5.5912	-0.299
Skewness	0.0947	2.8156	1.7141	0.6002	0.0599	0.7655	4.0779
Excess Kurtosis	11.0428	97.4340	42.407	9.4970	4.0247	7.3963	19.787
Jarque-Bera	4770.65 [a]	347912 [a]	53851.8 [a]	170.972[a]	1.7297	84.879[a]	566.01[a]
ARCH(30)	416.14	316.83		32.172		44.204	
No. of Observations	1770	934	827	95	39	95	39

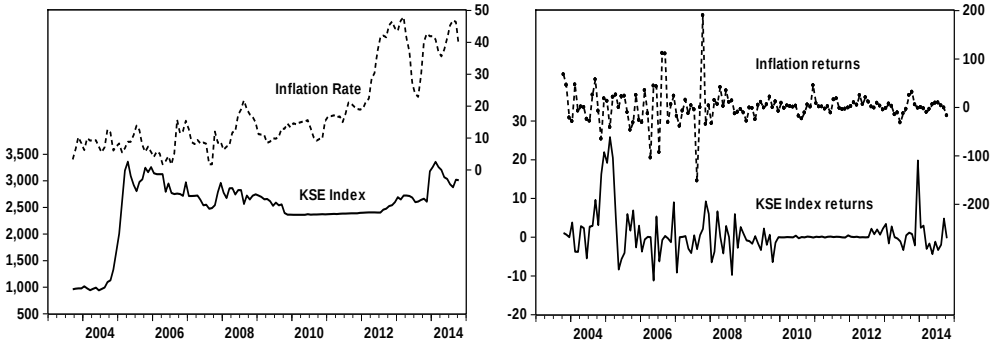
Note: ARCH(30) refers to the empirical Engle (1982) test for conditional heteroscedasticity up to order 30
* [a] denotes statistical significance at the 1% significance level.

Figure 4: Crude oil price and KSE index (January 2, 2008 – October 20, 2014)



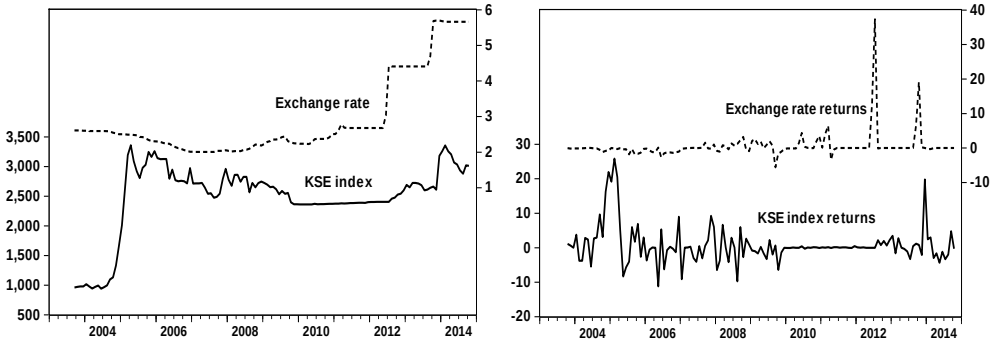
Source: Khartoum stock exchange and the US Energy Information Administration (EIA) database

Figure 5: Inflation rate and KSE index (September 2003 – October 2014)



Source: Khartoum stock exchange and the Central Bureau of Statistics (Sudan)

Figure 6: Exchange rate and KSE index (September 2003 – October 2014)



Source: Khartoum stock exchange and the Central Bank of Sudan

7. Empirical Results

Given the results of ARCH-LM test in the previous section, it is now possible to proceed with modeling the responses of the Sudanese stock market to fluctuations in crude oil prices, inflation, and exchange rate by employing a VAR(1)-GARCH(1,1) model. The proposed model is estimated using maximum likelihood method under the assumption of multivariate normal distributed error terms. The log likelihood function is maximized using Marquardt's numerical iterative algorithm to search for optimal parameters. Beside the estimation output of the VAR(1)-GARCH(1,1) model, diagnostics test results are also provided to see

whether there still ARCH effects left in the estimated model[23]. The results of returns and volatility spillovers are presented in Tables 7-9.

When considering crude oil price fluctuations, the empirical findings in Table 7 document that KSE index returns is significantly affected by its own past returns suggesting some evidence of short-term predictability in KSE index changes. This finding is consistent with some existing literature in this regard (see, e.g., Arouri and Nguyenk 2010; Arouri et al., 2012; Elder and Serletis, 2008; Shambora and Rossiter, 2007). But when inflation and exchange rate are considered, the significant of short term predictability is not confirmed (see Tables 8-9).

Table 7: Estimation results of VAR(1)-GARCH(1,1) model for oil price and stock market returns

Variables	Before Secession	After Secession	Full Sample Period
Conditional mean equation			
Constant	-0.1173***	-0.0005*	-0.0085***
Return(-1)	0.2132***	0.4412***	0.8343***
Oil(-1)	0.0033*	0.0004	-0.0017***
Conditional variance equation			
Constant	0.0499***	0.0008**	0.00012***
$(\varepsilon_{t-1}^{s})^2$	2.7693***	13.0857***	3.66881***
$(\varepsilon_{t-1}^{o})^2$	0.04726***	0.03713***	0.04525***
h_{t-1}^{s}	0.4286***	0.01603***	0.63243***
h_{t-1}^{o}	0.9481***	0.95261***	0.95362***
Diagnostics			
ARCH(30)	9.1875	4.0775	15.231
$LB^2(12)$	10.028	3.8519	24.633

Note: ARCH(30) and $LB^2(12)$ refer to the empirical statistics of the Engle (1982) test for conditional heteroscedasticity up to order 30 and the Ljung-Box test for autocorrelation of order 12 applied to the standardized residuals.
*, **, and *** indicate the rejection of the null hypothesis of associated statistical tests at the 10%, 5%, and 1% levels respectively.

[23] If the variance equation of GARCH model is correctly specified, there should be no ARCH effect left in the residuals.

Regarding the returns spillover effects in the conditional mean equations, Table 7 indicates that a one-period lagged oil returns, oil (-1) parameter, significantly affects the current value of returns on the KSE index for the first sub-period and for the full sample period, In contrast, the autoregressive term of oil is insignificantly different from zero during the post secession period. When inflation and exchange rate are considered, the results show that their lagged values are statistically significant specially, in the post secession period.

Table 8: Estimation results of VAR(1)-GARCH(1,1) model for inflation and stock market returns

Variables	Before Secession	After Secession	Full Sample Period
Conditional mean equation			
Constant	0.0612	0.5288***	0.1385**
Return(-1)	0.1406	-0.1218	0.1733
INF(-1)	0.0058	0.1013***	0.0122***
Conditional variance equation			
Constant	-0.0096	0.3759	-0.0007
$(\varepsilon_{t-1}^{s})^2$	0.4149***	2.6545**	1.3618***
$\left(\varepsilon_{t-1}^{inf}\right)^2$	0.2143***	0.2542*	0.1994***
h_{t-1}^{s}	0.6825***	-0.0518	0.5089***
h_{t-1}^{inf}	0.8085***	0.3919**	0.8145***
Diagnostics			
ARCH(5)	43.253	0.3134**	15.315
$LB^2(12)$	55.356	0.5756*	14.415

Note: ARCH(5) and LB2(12) refer to the empirical statistics of the Engle (1982) test for conditional heteroscedasticity up to order 5 and the Ljung-Box test for autocorrelation of order 12 applied to the standardized residuals.
*, **, and *** indicate the rejection of the null hypothesis of associated statistical tests at the 10%, 5%, and 1% levels respectively.

Table 9: Estimation results of VAR(1)-GARCH(1,1) model for exchange rate and stock market returns

Variables	Before Secession	After Secession	Full Sample Period
Conditional mean equation			
Constant	0.0419	0.2209*	0.02424
Return(-1)	-0.0052	-0.0267	-0.0041
EXR(-1)	0.0179	0.0892***	0.1329***
Conditional variance equation			
Constant	-0.0143***	-0.0297	0.0612
$(\varepsilon_{t-1}^{s})^2$	0.3813***	2.0628**	0.5936***
$(\varepsilon_{t-1}^{ex})^2$	-0.0727**	1.1513**	0.6822***
h_{t-1}^{s}	0.7071***	0.4518**	0.6685***
h_{t-1}^{ex}	1.1206***	1.2168***	1.1624***
Diagnostics			
ARCH(5)	25.768	0.4765*	11.324
$LB^2(12)$	50.825	0.7596**	10.608

Note: ARCH(5) and LB2(12) refer to the empirical statistics of the Engle (1982) test for conditional heteroscedasticity up to order 5 and the Ljung-Box test for autocorrelation of order 12 applied to the standardized residuals.
*, **, and *** indicate the rejection of the null hypothesis of associated statistical tests at the 10%, 5%, and 1% levels respectively.

When it comes to the shock dependence and volatility persistent (ARCH and GARCH coefficients[24]), the results of Table 7 indicate that they are statistically significant in all cases when oil price returns are considered. These coefficients are significant for most cases when the focus is on the impact of inflation and exchange rate (see Tables 8 and 9). In empirical finance literature, it is stylized fact that volatility persistent is attained when the sum of ARCH and GARCH coefficients is less than one. For example, the summation of these coefficients is 0.99, 0.98 and 0.99 for the crude oil returns for three periods respectively. On the other hand, the results show that the sum of these coefficients is more than one for returns on KSE in all cases, indicating that volatility can be considered as an explosive process especially after the secession of South Sudan. These results are completely consistent with the turbulent

[24] In Table 7 for example, ARCH coeffiencts are $(\varepsilon_{t-1}^{s})^2$ and $(\varepsilon_{t-1}^{o})^2$. While GARCH terms are h_{t-1}^{s} and h_{t-1}^{o}.

macroeconomic environment in Sudan over the last few years. Additionally, the results suggest that the current conditional volatility of KSE index returns depends on past shocks affecting return dynamics since ARCH-terms are significant for all sub-periods. This suggests that the conditional variance of stock market does not only depends on its immediate past values and innovations but also on those of the oil market, inflation, and exchange rate fluctuations as previously hypothesized. A closer inspection of the above coefficients reveals that in general, conditional volatility is changing very rapidly as the ARCH-terms measuring the impact of past shocks on conditional volatility are large in size (especially after the secession).

The empirical findings regarding the volatility transmission between oil and stock market the results indicate that the conditional volatility of returns on KSE index is affected by innovations in the oil market as indicated by the significance of the coefficient of $(\varepsilon_{t-1}^{o})^2$. It is also affected by what is going on inflation and exchange rate, given the statistical significance of the terms $\left(\varepsilon_{t-1}^{inf}\right)^2$ and $(\varepsilon_{t-1}^{ex})^2$respectivelly. Apparently, a shock originating from the oil market, inflation, or exchange rate leads to increase stock returns volatility. In addition, there is strong evidence to suggest that past volatility of the oil market, inflation and exchange rate is transmitted to stock market because the coefficients associated with h_{t-1}^{o}, h_{t-1}^{inf}, h_{t-1}^{ex} are statistically significant.

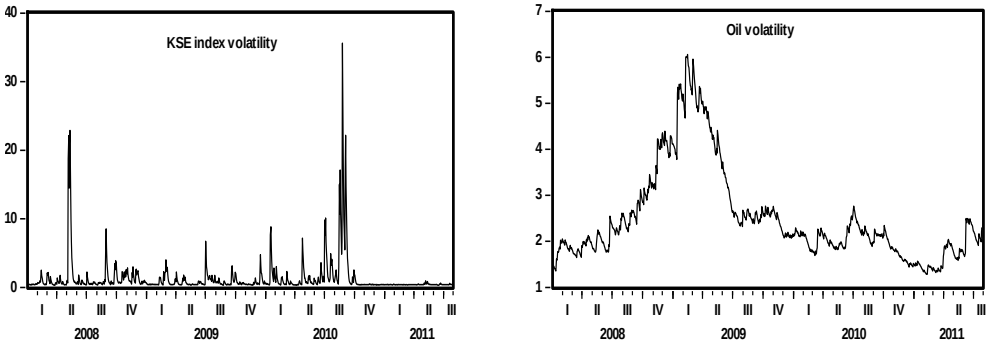
Some diagnostics tests such as the Ljung–Box (LB) test for autocorrelation and ARCH LM test for ARCH effects are reported to validate the estimates of the VAR-GARCH model. LB statistic suggests that the null hypothesis of no autocorrelation cannot be rejected for most cases; thus, the residuals are free of autocorrelation (except for inflation and exchange rate in post secession period[25]). The ARCH-LM test suggests that the null hypothesis of no ARCH effects cannot be rejected for most cases, implying that the residuals do not suffer from the ARCH effects which means that VAR(1)-GARCH(1,1) has effectively captured

[25] This result can be justified by the low number of observations.

the ARCH effects (except for inflation and exchange rate in post secession period.

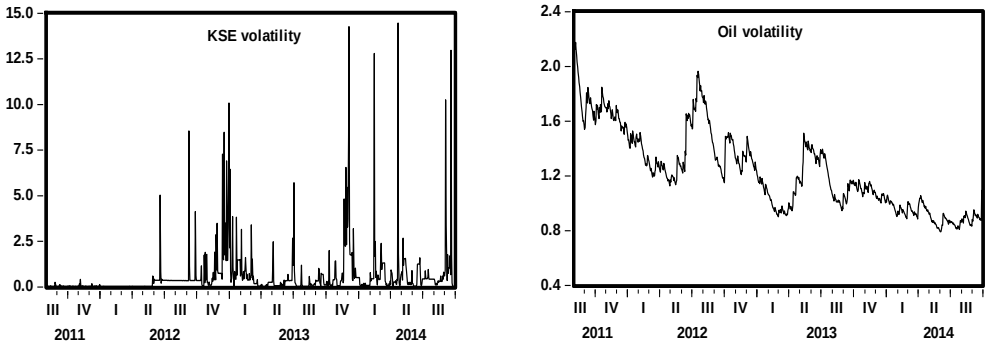
Estimated conditional volatility graphs (as conditional standard deviation) for the returns on KSE index accompanied with volatility of returns on crude oil price, exchange rate and inflation rate are provided in Figures. 7-12. It is obvious that KSE index returns experienced higher levels of volatility in post-secession period confirming the results of the conditional mean and variance equations of Tables 7-9.

Figure 7: Volatility of Crude oil prices and KSE index
(Before the Secession of South Sudan)



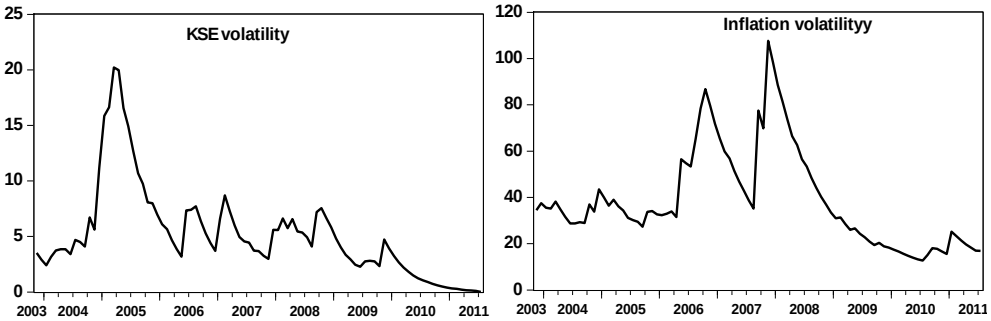
Source: Khartoum stock exchange and the US Energy Information Administration (EIA) database

Figure 8: Volatility of Crude oil prices and KSE index
(After the Secession of South Sudan)



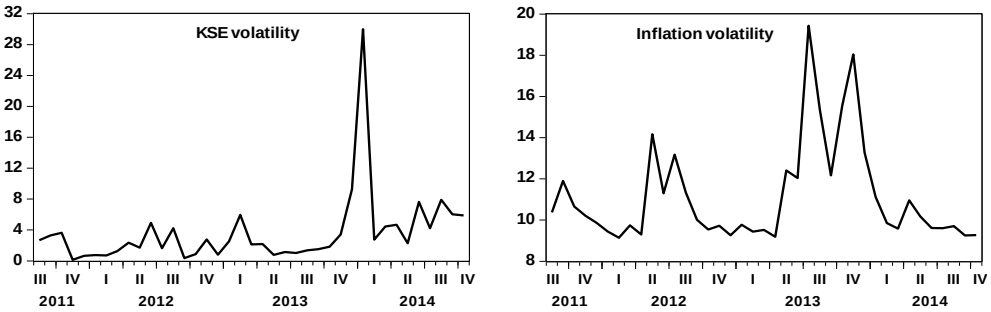
Source: Khartoum stock exchange and the US Energy Information Administration (EIA) database

Figure 9: Volatility of inflation and KSE index
(Before the Secession of South Sudan)



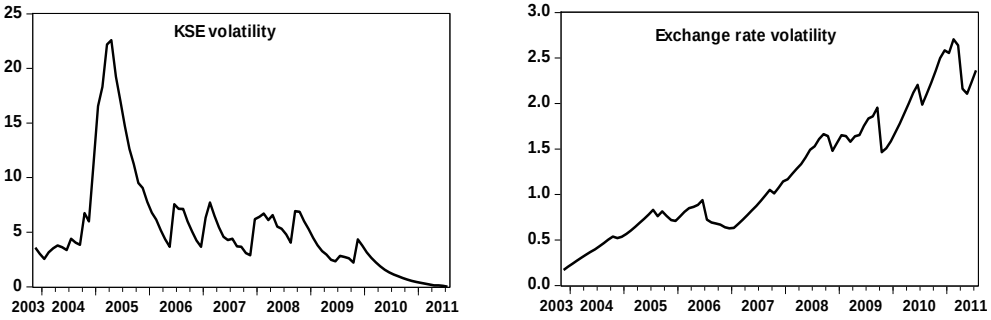
Source: Khartoum stock exchange and the Central Bureau of Statistics (Sudan)

Figure 10: Volatility of inflation and KSE index
(After the Secession of South Sudan)



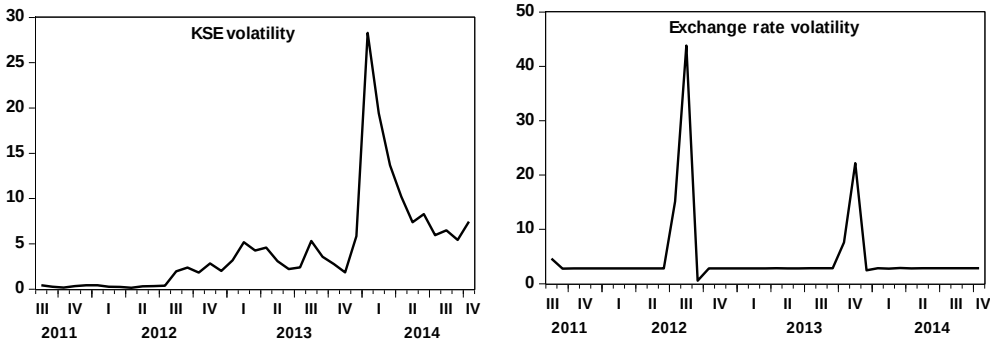
Source: Khartoum stock exchange and the Central Bureau of Statistics (Sudan)

Figure 11: Volatility of exchange rate and KSE index
(Before the Secession of South Sudan)



Source: Khartoum stock exchange and the Central Bank of Sudan

Figure 12: Volatility of exchange rate and KSE index
(After the Secession of South Sudan)



Source: Khartoum stock exchange and the Central Bank of Sudan

8. Conclusion and policy recommendations

To sum up, this paper provides evidences that the Sudanese stock market has experienced higher levels of fluctuations consistent with the turbulent macroeconomic environment in Sudan during the past few years, especially after the secession of South Sudan in 2011. It shows that these fluctuations are greatly explained by oil shocks and exchange rate fluctuations. Little evidence is found for inflation rate movements. It is worth mentioning at this juncture that although a wide range of policy options have been suggested over the past few years the Sudanese economy is still experiencing a lot of macroeconomic difficulties (double-digit inflation, unstable exchange rate, large external and internal deficits, and low growth rate). So, it seems timely for policy makers to question what has gone wrong and what has been forgotten in an attempt to put it right in their future policy priorities. Within this context, it is recommended that forward-looking macroeconomic policies should put greater emphasis on domestic resource mobilization by enhancing the performance of financial institutions. Curbing KSE volatility and increasing its efficiency represent good starting points in order for the market to play a significant role in the national economy. To that end, the paper presents the following recommendations: (i) Policy-makers in the Central Bank of Sudan are required to enhance monetary policy transparency to ensure symmetric information between monetary policymakers and other economic agents, (ii) Market regulators can introduce some margin regulations to discourage investors from excessive speculation by making future trading more

costly, (iii) Regulators should adopt circuit breakers (such as trading halts and daily price limit) to temporarily suspend trading activity if price movements exceed certain thresholds. This provides time for traders to re-evaluate market conditions in times of panic selling and to bolster their liquidity and credit, (iv) Public awareness about KSE activities should be strengthened through regular and intensive educational and promotional campaigns programs. These may include: embarking on vigorous campaigns through digital press, newspapers, radio programs, TV campaigns, social networking sites to reach out to as wide a target audience as possible; creating a dedicated website to provide general information about market activities, this also could include a guide for questions that potential investors should ask themselves before taking investment decisions; hosting forums and workshops on themes pertinent to the market performance where business community can learn about the requirements, anticipated benefits and costs of listings on the market; expanding the geographic coverage of the educational programs to include not only the public and business community in the Khartoum city but also to the general public in other states of the country. (v) To attract significant portion of the potentially large amount of financial wealth exists outside the Sudanese financial system, the geographic coverage of educational programs should be expanded to include the general public not only in the Khartoum state but also in other states of the country, and (vi) Policy makers should put greater emphasis on enhancing information disclosure and transparency by developing a new disclosure regime and transparency standards which lead to timely, consistent, complete and accurate information about KSE activities.

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Journal of Economic Cooperation and Development, **38**, 3 (2017), 45-76

The Consumption-Health Nexus Revisited: Examining the Benefits of Social Insurance for the Poor in Indonesia

Inggrid[1] and Pei Fun Liem[2]

Households in developing countries are typically more vulnerable to illness episodes. This paper uses a panel micro data set from Indonesia to investigate whether households are able to smooth their consumption against idiosyncratic health shocks and to examine the mitigating effects of a social health insurance programme for the poor on such shocks. We find that Indonesian households manage to keep consumption smooth after deterioration in adult health. These findings are robust to various health measures and different specifications. The difference-in-differences (DiD) estimator shows a marginal effect of the insurance programme on insuring household consumption from major health problems. Further investigation reveals heterogeneous effects of the social insurance programme. While it plays a trivial role in protecting rural households, the effect of the health intervention is stronger in urban areas of the country. We argue that supply-side factors seem to be partly responsible for this finding.

Keywords: consumption smoothing, health shocks, social health insurance

1. Introduction

The provision of equitable access to health care for all people has become a global and national development agenda after the implementation of the United Nations resolution on universal health coverage (UHC) in December 2012. Social health insurance which provides protection to the beneficiary against health events is a usual instrument of government to achieve this ambitious goal. Yet, in the

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context of developing countries, it is the seminal contribution of Murdoch in 1995 that challenges the net benefits of formal insurance to society. He argues that individuals and households in this economy are able to cope with any type of income risks as a result of the availability of sophisticated risk-coping strategies among themselves.

Under the assumption that households are risk aversion, Chetty and Looney (2006) derive a simple model of risk and insurance to show that the welfare gains of social insurance in a low-income economy, indeed, come from its capability in eliminating the use of costly risk management techniques by households when they cope with income shocks, such as reduction in human capital investments. The authors further conclude that the understanding of why and how households smooth their consumption is imperative in assessing the welfare effects of social insurance programmes.

The main objectives of this paper are therefore to advance research on the risk and formal insurance debate. The first part of the study will revisit consumption insurance in the presence of unintended health events. There are at least three important caveats to keep in mind when addressing this issue. A primary concern is how to find a proper health measure. A widely used health measure is self-reported health status. Despite the merit of this measure to predict subsequent mortality among adults and closely relate to productivity, self-reported measures of health are subject to measurement errors. Basically, this can happen due to different health valuations among individuals even though they have the same level of health in reality. The differences in socioeconomic status to some extent explain this health assessment gap. Interestingly, better educated and higher income persons are more likely to report that they have some health problems (Strauss and Thomas, 1995; Currie and Madrian, 1999; Lindeboom and van Doorslaer, 2004).

Gertler and Gruber (2002) suggest that limitations to perform activities of daily living (ADLs) provide a better alternative to reflect health changes since they are more objective. The two earlier studies that employ this health measure show that households in Indonesia are only able to smooth their consumption when they cope with mild health shocks, but they fail to smooth consumption against severer health risks (Gertler and Gruber, 2002; Gertler et al., 2009). Nevertheless, it is further confirmed that the ADLs measures are more suitable for older

populations (Genoni, 2012). For this reason, we complement the ADLs with two additional health indices, that is, illness symptoms and a drop in body mass index (BMI).

The next issue is related to the presence of unobservable variables leading to co-movement between consumption and health. For example, extreme drought may affect production and consumption, and it may also change health status because of the variation in the disease environment. A widely-accepted procedure for dealing with these problems is to include community fixed effects. Given the panel structure of our dataset, we also apply a fixed effect strategy to account for these omitted factors.

The last challenge is that the endogeneity of health itself. As pointed out by Gertler and Gruber (2002), the ADLs measures, however, can identify different types of acute exogenous health problems that are correlated with changes in labour market outcomes and consumption decisions. Therefore, these measures considerably do a good job in addressing the possibility of reverse causality between consumption and health.

While existing studies in this literature have largely focused on understanding the theory of risk-sharing within groups such households and communities, we add one important feature to distinguish this paper from them by examining the role of a social health insurance programme in protecting household consumption against health changes. In particular, we investigate whether beneficiaries of a social health insurance programme are protected from the negative effects of health shocks on the degree of consumption smoothing before and after the introduction of the programme. Therefore, our study relies on a difference-in-differences (DiD) approach.

To do so, we use the introduction of the Indonesian Askeskin in 2005, a publicly-financed health insurance programme for the poor. The programme was targeted to poor households. Beneficiaries of the programme are entitled to fully-subsidised health care services in primary health facilities and public hospitals. Given its very generous coverage, Askeskin can reasonably be expected to not only have an imperative effect on the consumption of medical care (Sparrow et al., 2013), but also on the consumption of other budget items, such as

transportation, electricity, and other costs related to the care of a sick household member at home (Wagstaff, 2010). This implies that the Askeskin programme could have an important role on consumption insurance during the health crisis.

The remainder of the paper is structured as follows. Section 2 discusses the formal model of risk-sharing and reviews some empirical evidence in this area. Section 3 describes health insurance systems in Indonesia and the Askeskin programme. Section 4 gives an overview of the Indonesian data and health measures. Section 5 discusses the estimation strategy and limitations of the study. Section 5 presents the main findings and a variety of sensitivity tests. Section 6 concludes.

2. Consumption Smoothing: Theories and Empirical Evidence

The model of consumption smoothing predicts that the level of household consumption solely responds to the realisation of aggregate risks instead of idiosyncratic risks (e.g. illness, changes in household income). While households still have to carry some risk, they share this exposure within their respective groups, implying that the marginal utility of consumption is strongly correlated across the groups. Achieving full consumption risk-sharing within a group (i.e. households or communities) or finding a Pareto efficient allocation of risk, however, is the main task of social planners because it is derived from the social planner problem.

Let us formalise our model as Cochrane (1991), Mace (1991), Townsned (1994), and Ravallion and Chaudhuri (1997). Basically, the model is built on the three following assumptions: preferences are additive over time and across households, consumption and leisure are separable, and discount rates are constant among households. Consider a community with J households, households' common information at time t is represented by the realisation of state of the world s_t with $s_t \in \{1,2,\dots,S\}$, and $\pi(s_t)$ denotes the probability that state s_t occurs. A social planner attempts to maximise a weighted sum of households' expected lifetime utilities as follows:

$$\max_{\{c_{jt}(s_t)\}} \sum_{j=1}^{J} \lambda_j \sum_{t=1}^{\infty} \sum_{s_t=1}^{S} \rho_t \, \pi(s_t) u_j\left[c_{jt}(s_t), \delta_{jt}(s_t)\right] \qquad (1)$$

where c_{jt} indicates the level of consumption of household j at time t, λ_j is the planner's weight of household j satisfying $0 < \lambda_j < 1$, $\delta_{jt}(s_t)$ represents a preference shock, and ρ_t is the rate of time preference.

The feasible budget constraint is that the aggregate community consumption has to be less than or equal to the aggregate community endowment (income) for each time and each state, or

$$\sum_{j=1}^{J} c_{jt}(s_t) \leq \sum_{j=1}^{J} y_{jt}(s_t), \forall_{s_t}, \forall_t \quad (2)$$

The Pareto-efficient allocation of risk within the community is solved by the standard optimisation of the first order conditions to yield a solution as:

$$\lambda_j u'[c_{jt}(s_t), \delta_j(s_t)] = \hat{\mu}_{(s_t)}, \forall_{s_t}, \forall_t \quad (3)$$

where $\hat{\mu}_{(s_t)} = \frac{\mu_{(s_t)}}{\rho_t \pi_{(s_t)}}$, and $\hat{\mu}_t$ is the Lagrange multiplier measuring the aggregate community constraints in period t. Therefore, given the Pareto weights and aggregate community consumption, the marginal utility is equalised across households.

Assume now that each risk-averse household has a constant absolute risk aversion (CARA) utility function as:

$$u_j[c_{jt}(s_t), \delta_{jt}(s_t)] = -\frac{1}{\sigma}\exp[-\sigma\big(c_{jt}(s_t) - \delta_{jt}(s_t)\big], \sigma > 0 \quad (4)$$

where σ is the Arrow-Pratt measure of constant absolute risk aversion. When we substitute equation (3) into (4) and take logarithms, it follows that the level of consumption of household j at time t is:

$$C_{jt}(s_t) = \left[-\frac{1}{\sigma}\right] log\hat{\mu}_{(s_t)} + \left[\frac{1}{\sigma}\right] log\lambda_j + \delta_{jt}(s_t) \quad (5)$$

The aggregation of equation (5) over all households in the community gives:

$$C_{jt}(s_t) = \bar{C}_t(s_t) + \left[\frac{1}{\sigma}\right]\left[log\lambda_j - \bar{\lambda}\right] + [\delta_{jt}(s_t) - \bar{\delta}_t(s_t)] \quad (6)$$

where

$$\bar{C}_t(s_t) = \frac{1}{J}\sum_{j=1}^{J} C_{jt}(s_t) \qquad \bar{\lambda} = \frac{1}{J}\sum_{j=1}^{J} log\ \lambda_j \qquad \bar{\delta}_t(s_t) = \frac{1}{J}\sum_{j=1}^{J} \delta_{jt}(s_t)$$

Alternatively, a more convenient way to express equation (6) is in the form of the first difference operator as:

$$\Delta C_{jt}(s_t) = \Delta\bar{C}_t(s_t) + [\Delta\delta_{jt}(s_t) - \Delta\bar{\delta}_t(s_t)] \quad (7)$$

The key implication of equation (7) is: when the assumption of full consumption insurance continues to hold, and we are able to control for the changes in the aggregate community consumption, idiosyncratic income risks that are uncorrelated with preference shifts should not determine the growth rate of household consumption.

A large number of empirical studies testing the above model show mixed results. A first strand of literature has reached a strong consensus that there is partial consumption smoothing (Townsend, 1994; Kochar, 1995; Skoufias and Quisumbing, 2005; Islam and Maitra, 2012). In contrast, some papers reject the model of full consumption insurance and suggest that households cannot manage to maintain their consumption constant in the face of health shocks (Dercon and Krishnan, 2000; Wagstaff, 2010; Beegle et al., 2008; Linnemayr, 2010). Another study highlights the heterogeneity of consumption smoothing

with respect to different economic strata and the degree of shocks. A study in rural China by Jalan and Ravallion (1999) concludes that wealthier households are better able to isolate the negative impact of health shocks than poorer households. Mohanan (2013) takes advantage of exogenous variation in exposure to health shocks due to bus accidents in India to reveal evidence of consumption smoothing for basic needs (food, housing, festivals) but this does not apply to education spending. His study which employs a quasi-experimental study design further shows that Indian households demand for borrowing and debt as the coping strategies to protect consumption from health shocks.

In the context of Indonesia, a pioneering paper by Gertler and Gruber (2002) confirms that households can only smooth consumption against mild health shocks, but they fail to smooth consumption in the presence of severe health risks. A recent study of Genoni (2012), however, has challenged these findings. She focuses on finding an exogenous source of variation in health and uses changes in the prices of health inputs as the instruments for the ADLs. This research points to the existence of full consumption insurance. She explains that this is made possible by intra-household labour substitution and inter-household transfers. The study warns that loosening the problems of reverse causality and omitted variables may result in different outcomes.

Gertler et al. (2009) extent Gertler and Gruber's analysis and question whether access to microfinance institutions helps households cope with serious health problems. They do emphasize the benefits of microfinance programmes in insuring consumption. Using different household survey datasets, Sparrow et al. (2014) strengthen these findings to conclude that poor households in rural areas of Indonesia rely on informal coping mechanisms when exposed to major health changes. Borrowing and depleting assets along with informal support from extended families become significant risk-sharing instruments among the poor.

That the informal risk-sharing arrangement plays a central role in household strategies raises some concerns about the effectiveness of formal health insurance programmes. This type of programmes could potentially crowd out the existing informal strategies and could make others worse-off. This becomes increasingly important if the implementation of the social health insurance programme does not

provide universal coverage. For instance, there are only some households from a private group-based informal risk-sharing arrangement fully covered by a social health insurance programme. These protected households have an incentive to break down the arrangement and leave unprotected households more vulnerable to shocks. Under the circumstances, a community base health insurance offers greater advantages than individual protection (Dercon, 2002).

3. The Indonesian Health Insurance System and Askeskin

The setting for our analysis is the Indonesian health insurance situation during the period 2000-2007. Prior to the National Social Security System reforms in late 2004, the Indonesian health insurance market targeted formal sector workers through the establishment of health insurance for both civil servants (Askes) and private sector employees (Jamsostek). Although the membership of Askes and Jamsostek is mandatory, these occupational health insurance schemes are not comparable in some aspects. Unlike Askes, Jamsostek does not cover catastrophic health treatments. The other special feature of Jamsostek is that it offers an opt-out clause. Therefore, private companies are allowed to utilise another scheme as long as it can provide (at least) equal protections as Jamsostek does. Based on the National Socioeconomic Survey (Susenas) data in 2007, it was reported that Askes and Jamsostek only covered about 6.00 per cent and 2.00 per cent of the population. Yet, this coverage is relatively large compared to the share of private insurance companies and other schemes, accounting for approximately 3.00 per cent of the population in the same period (Rokx et al., 2009).

Apart from the abovementioned health insurance programmes, the government of Indonesia, indeed, has also encouraged community participation in maintaining and financing their own health care. This effort has been promoted since the early 1970s by the introduction of a voluntary community-based health programme (known as Dana Sehat). Dana Sehat primarily covers farmers, fishermen, and students in the rural areas of Indonesia. The scheme allows households to pay the premium either in cash or in-kind to the bank or the committee of Dana Sehat. Since 1994, the central government has initiated to protect the poor by means of a health card programme, allowing card holders to obtain free services in all public health facilities. Following the 1997-1998 Asian economic crisis, a social safety net programme in the health

sector (known as JPS-BK) was launched. The JPS-BK programme provides free basic health care and finances various maternal and child health care services to eligible poor households (Hirose, 2008).

Under a new government's social security system flagship, Indonesia introduced a mandatory social health insurance for the poor (known as Askeskin) in 2005. The programme was intended to increase access to health care services for low-income families. Although the government fully subsidises the monthly premium of Rp. 5,000 (approximately USD 0.55) per participant, beneficiaries of Askeskin are entitled to very generous health care benefits. These include free outpatient primary care in the primary health centres (Puskesmas) and free inpatient care in the third class at a public hospital. It also provides special health care services, such as obstetric care services, mobile health services, immunisation, and pharmaceuticals. Askeskin was able to extend its health service coverage to reach remote areas and isolated islands of the country.

The selection of Askeskin beneficiaries used a combination of geographic (district) and individual targeting. The central government determined the Askeskin quotas for each district based on poverty data from the Central Bureau of Statistics (BPS). Village leaders took responsibility to trace the poor and proposed their names to the district governments. In other words, eligible individuals were selected at the district level in principle.

However, Askeskin was confronted with some difficulties in the initial phase of its implementation. For example, to identify eligible beneficiaries, some districts preferred to use the household welfare criteria suggested by the National Family Planning Coordinating Board (BKKBN) rather than the poverty criteria of BPS. Another concern is that people could use the JPS-BK health cards and village poverty letters (SKTM) to claim the Askeskin benefit package because of the delay in the distribution of Askeskin cards. Moreover, some individuals refused to take part in the programme because they had to bear some indirect costs (e.g. the cost of making a picture for the membership card) and had to undergo long-distance travel to reach health facilities (Sparrow et al., 2013).

In 2005, BPS renewed the database of poor households by conducting a social economics data survey (known as PSE-05). Poor households were classified on the basis of fourteen components, measuring different aspects of household well-being, such as housing materials, the use of sanitary systems, access to clean water, nutrient intake, ownership of durable assets, and labour force participation. A weight was assigned to each dimension. Subsequently, a household poverty index was calculated by summing up all those fourteen components. The possible index scores ranged from 0 to 1, where a value of 1 indicated the most impoverished households. In accordance with this new index, households were divided into four strata: very poor, poor, near poor and non-poor households wherein the first three groups were eligible for Askeskin.

Askeskin was targeted to cover 36.1 million poor people in the first year. In fact, it covered 60 million beneficiaries with the total actual costs amounted to approximately Rp. 3.6 trillion. Askeskin was renamed into Jamkesmas or health insurance for the entire population in 2008. It was estimated to reach about 35 per cent of the population (approximately 76.4 million beneficiaries). Jamkesmas, however, became the rudiment of the Indonesian universal health care by 2015 (Hirose, 2008; Rokx et al., 2009).

4. Data and Health Measures

We use the last two-wave panels of the Indonesian Family Life Survey (IFLS) in this study.[3] The IFLS is an ongoing longitudinal survey representing 83 per cent of the Indonesian population. The sampling design of the survey is stratified based on provinces and urban-rural areas. The sample consists of 321 enumeration areas that are randomly selected within 13 provinces. The random selection of households in each enumeration area makes use of a representative sampling frame from Susenas of the BPS.
The third wave of the IFLS survey administered in 2000 was able to contact over 10,400 households. This dataset serves as the baseline data for our study. In 2007, the IFLS4 survey successfully interviewed more

[3] We use additional data from the second wave of the survey to construct the health measures and the consumption variable.

than 13,500 households, retaining over 95 per cent of the households from the previous wave.

The IFLS collects detailed micro-level data at the individual and household levels. The consumption module, which records 37 food and 19 non-food items, makes great efforts in order to obtain accurate values of household consumption. Each household was asked explicitly to recall both monetary expenditures on these items and transactions involving consumption from own production. A new module collecting information on assistance from public transfer programmes helps us to identify beneficiaries of Askeskin.

The extensive documentation of the health module allows us to generate multiple health shock measures. The first measure is a dummy variable taking a value of 1 if the household head reported illness symptoms during the past 4 weeks of the survey. Our self-reported illness symptoms reflect not only minor health problems (e.g. headache, coughing, fever, etc) but also severer health problems (e.g. heart disease, diabetes, and hypertension). The change in illness symptoms will be 0 if the household head does not move from ill to healthy or *vice versa*, 1 if the household head shifts from reporting illness to not having any illness symptoms, and -1 if the household head changes his/her health valuation from healthy to ill.

A well-trained nurse records various measures of physical health for each household member, including his/her height and weight. This enables us to calculate a household head's body mass index (BMI), a more objective measure of health. It is equal to weight (in kilograms) divided by height (in metres) squared. We define a BMI shock if the heads' BMI changes exceed one standard deviation of the BMI-change distribution. We generate a dummy variable indicating that the head experiences a sizeable drop in BMI. As the variant of anthropometric measures, BMI is clearly related to energy intake which varies over the life course. It may capture both longer and shorter term dimensions of nutritional status. It has also been proven that BMI embodies the maximum physical capacity independent of energy intake. Hence, for some jobs that require sustained physical efforts, it is an important pathway through which health may influence worker's productivity. On the contrary, this claim seems to be less relevant for many jobs that do not need maximum physical efforts (Strauss and Thomas, 1998).

Our final health measure is a change in the index of activities of daily living (ADLs) which represents a change in a person's functional status.[4] It diagnoses 2 limitations in personal care (i.e. ability to bathe and dress) and 8 limitations in a range of motion activities (i.e. walk a kilometre and 5 kilometres; bow, squat, and kneel; sweep; stand up from sitting on the floor; get up from a sitting position on a chair; draw a pail of water; and carry a heavy load). The severity of each activity limitation is represented by three codes, a value of 1 denotes can do it easily, 3 if can do it with difficulty, and 5 if unable to do it. We generate a ADLs index for a person based on a scoring algorithm of the RAND Medical Outcomes Study (RAND-MOS) with the possible values ranging from 0 to 1.[5] It takes a value of 1 if the individual can perform all ADL items without any difficulties, and zero if the individual cannot perform any ADL items. A change in the ADLs index represents the change in the ADLs index value from the previous period.

5. Identification Strategy and the Limitation of the Study

The main hypothesis to be tested in this paper is whether households exposed to the Askeskin programme are better able to smooth their consumption against unexpected health shocks. The baseline empirical specification, thus, resembles the key idea of a difference-in-differences (DiD) model as follows:

$$\begin{aligned} C_{jct} = {} & \alpha + \beta_1 A_t + \beta_2 HI_{jc} + \beta_3 H_{jct} + \beta_4 (A_t * HI_{jc}) + \beta_5 (A_t * H_{jct}) \\ & + \beta_6 (HI_{jc} * H_{jct}) + \beta_7 (A_t * HI_{jc} * H_{jct}) + \sum_k \beta_8 X_{jct} \\ & + \varepsilon_{jct} \end{aligned} \quad (8)$$

where C_{jct} is the change in log (non-medical care) consumption per capita for household *j* in community *c* at time *t*.[6] A_t is equal to 1 when year is 2007. The dummy variable HI_{jc} is the participation status of the

[4] The fourth wave of the IFLS survey collected 13 ADL items, and 5 new items as the measures of the instrumental activities of daily living (IADLs). To maintain consistency, we only use 10 ADL items collecting in all survey rounds.

[5] The ADLs index for person i is calculated as the following: $Health_i = \frac{Score_i - Min\ Score}{Max\ Score - Min\ Score}$

[6] We deflate the nominal value of the consumption data by using the World Development Indicators's urban consumer price index series. It is in fixed 2005 prices.

household in the Askeskin programme. We define the treatment household if at least one member of the household is covered by Askeskin. The coefficient of β_3, measuring the idiosyncratic health shocks, should be equal to zero if there is consumption smoothing. In other words, health shocks will not affect the growth in consumption. β_4 captures the average treatment effect of Askeskin on consumption growth. The coefficient of β_5 indicates the further effect of health shocks for uninsured households. β_6 explains the differences in the change in consumption due to the variability in health shocks between beneficiaries and non-beneficiaries of the Askeskin programme. β_7 is the coefficient of interest. It measures whether participation in the Askeskin programme enables the household to better able to insure against health shocks. If the Askeskin programme does enhance benefits, the coefficient β_7 should be positive and statistically significantly different from zero. A vector of covariates to control for secular trends and seasonal variability, X_{jct}, includes the household head's and spouse's age and education, the change in household composition, and the agricultural household. The last term, ε_{ict}, is the error term.

Our first concern with estimating equation (9) is the presence of state dependency. If there is state dependency, the shape of the utility function and the consumption function will vary with health status despite in the state of full insurance. That is to say that the state of health is correlated with preference shifts and thus with the disturbance term, leading to biased coefficient estimates (Cochrane, 1991; Gertler and Gruber, 2002). Furthermore, Finkelstein et al. (2009) point out that the presence of state dependence could also lead to a false assessment of the true benefits of health insurance. In the case of positive state dependence, a decline in the marginal utility of consumption following negative health shocks (e.g. additional consumption on transport costs due to hospital visit), the benefits of health insurance would tend to underestimate the true benefits. In contrast, the overestimation of health insurance benefits would become plausible under negative state dependence. To test the likelihood of the shift in household preferences is due to the illness of the head, we include spouses' health measures in our model. We expect that the inclusion of these measures will not affect household consumption (Gertler and Gruber, 2002).

Another critical methodological challenge is the classical endogeneity problem in health status. Although our self-reported ADLs composite index is less prone to this simultaneity bias, the other subjective health measure (i.e. illness symptom) may offer better health assessments. The intuition is the following: while measurement errors in self-reported health bring a downward bias to the estimated coefficient on health, the endogeneity of self-reported health status tends to give an upwardly biased coefficient. Therefore, given the opposite direction of the bias, it will cancel each other out and yield a valid estimate of the coefficient (Bound, 1991). We combine both subjective and objective health measures to evaluate the consistency of our results.

A further exercise is devoted to examine income effect arising from the introduction of the Indonesian unconditional cash transfers programme (BLT henceforth) in the second semester of 2005. Since this social protection programme is also targeted to poor households, we anticipate any potential confounding effects between the two interventions by performing an additional analysis without including beneficiaries of BLT.

The aforementioned empirical strategy, however, leaves us with one major limitation because we are unable to hold the assumption of the DiD method. The validity of the difference-in-differences method rests on the assumption that the implementation of Askeskin is not driven by the pre-existing differences in the ability of households to insure their consumption against illness. This assumption is more likely to be violated in our context. Beneficiaries of Askeskin are the poor. By nature, this group is arguably more vulnerable to unexpected shocks. By directly comparing the outcomes of the two groups, our results would overestimate the true impact of the Askeskin programme. Yet the availability of the dataset prevents us from controlling for such differences in the pre-programme observable characteristics between the insured and uninsured groups.

6. Results

6.1 Sample Description

Before going further into the estimation results, we take a look at the data first. We restrict our sample to younger heads (below 66 years old) since they are more likely to actively participate in the labour market, and a serious illness will cause them to lose more income. Table 1 presents means, standard deviations for the characteristics of the sample. The data sets are presented for three groups: the entire sample, uninsured and insured households. The results of the table show a few differences between the characteristics of households with Askeskin and those are not. Specifically, households covered by the health insurance programme tend to have lower levels of non-medical consumption per capita, a larger household size, and approximately half of them are the recipients of the unconditional cash transfers programme (i.e. BLT). Looking at the characteristics of household heads and their spouses, lower levels of educational attainment and a less favourable change in body mass index for the insured group are also noticed. We raise some doubts about the validity of our self-reported illness symptoms because the lion's share of the two groups reported a change in illness symptoms between the two survey periods. Using a different data set, Gertler and Gruber (2002) also find that more than half Indonesian people reported an illness symptom in the survey. They conclude this evidence as an indication that people take into account many small health problems that do not need expensive medical treatment.

Table 1. Descriptive statistics of the characteristics of uninsured and insured households

Variable	All	Uninsured	Insured
log of HH non-medical consumption	6.5582	6.6242	6.2338
	(1.3531)	(1.3711)	(1.2106)
log of HH size	1.7644	1.7584	1.7940
	(0.3835)	(0.3845)	(0.3772)
Female head of HH	0.0111	0.0102	0.0157
	(0.1049)	(0.1004)	(0.1245)
HH covered by BLT	0.1910	0.1277	0.5021
	(0.3931)	(0.3338)	(0.5004)
Head's characteristics:			
Age	47.0375	46.8874	47.7754
	(8.9287)	(8.9153)	(8.9644)
The highest level of education: primary school	0.5155	0.4905	0.6381
	(0.4998)	(0.5000)	(0.4809)
The highest level of education: lower secondary school	0.0851	0.0864	0.0787
	(0.2791)	(0.2810)	(0.2694)
The highest level of education: upper secondary school	0.1632	0.1760	0.1001
	(0.3696)	(0.3809)	(0.3004)
The highest level of education: tertiary school	0.0670	0.0774	0.0157
	(0.2500)	(0.2673)	(0.1245)
Work in agriculture	0.3835	0.3713	0.4435
	(0.4863)	(0.4832)	(0.4972)
Health status measures:			
Change in ADL index	0.0025	0.0022	0.0038
	(0.0851)	(0.0840)	(0.0903)
BMI drop	0.3482	0.3360	0.4077
	(0.4764)	(0.4724)	(0.4918)
Change in illness symptoms	0.7427	0.7402	0.7554
	(0.4372)	(0.4386)	(0.4302)
Spouse's characteristics:			
Age	41.8066	41.7713	41.9800
	(9.3340)	(9.2907)	(9.5491)
The highest level of education: primary school	0.5172	0.4993	0.6052
	(0.4998)	(0.5001)	(0.4892)
The highest level of education: lower secondary school	0.0962	0.1021	0.0672
	(0.2949)	(0.3029)	(0.2506)
The highest level of education: upper secondary school	0.1151	0.1283	0.0501
	(0.3192)	(0.3345)	(0.2182)
The highest level of education: tertiary school	0.0418	0.0474	0.0143
	(0.2002)	(0.2126)	(0.1188)
Health status measures:			
Change in ADL index	-0.0086	-0.0088	-0.0077
	(0.0932)	(0.0906)	(0.1053)
Observations	4136	3437	699

Notes: N=4136. Non-medical consumption is in Rupiah. Mean from IFLS3 and IFLS4. Standard deviations are in parentheses.

We now turn our attention to the patterns of health care expenditures. Households with critical and immediate medical needs have to spend a large share of their budget for health care if they are not covered by any health insurance programmes. Table 2 shows that the budget share of health care expenditure raises with the average monthly total household expenditure, implying a positive income elasticity of health expenditures.[7] It is further revealed that the share of health care expenditures across expenditure quintiles fairly decreased between 2000 and 2007 (from 1.97 per cent to 1.89 per cent respectively). There are at least three main reasons to explain this finding. First, perhaps the growth in non-medical expenditure was faster than the growth in medical expenditure. Second, there was a substantial decline in health care spending. Since it is the product of prices and quantities, this reduction means that households pay lower prices (a price effect) due to the Askeskin intervention. Lastly, this indicates that households either utilise less health care services or, very unlikely, experience less illness.

Table 2. The distribution of monthly health expenditures by expenditure groups (percent)

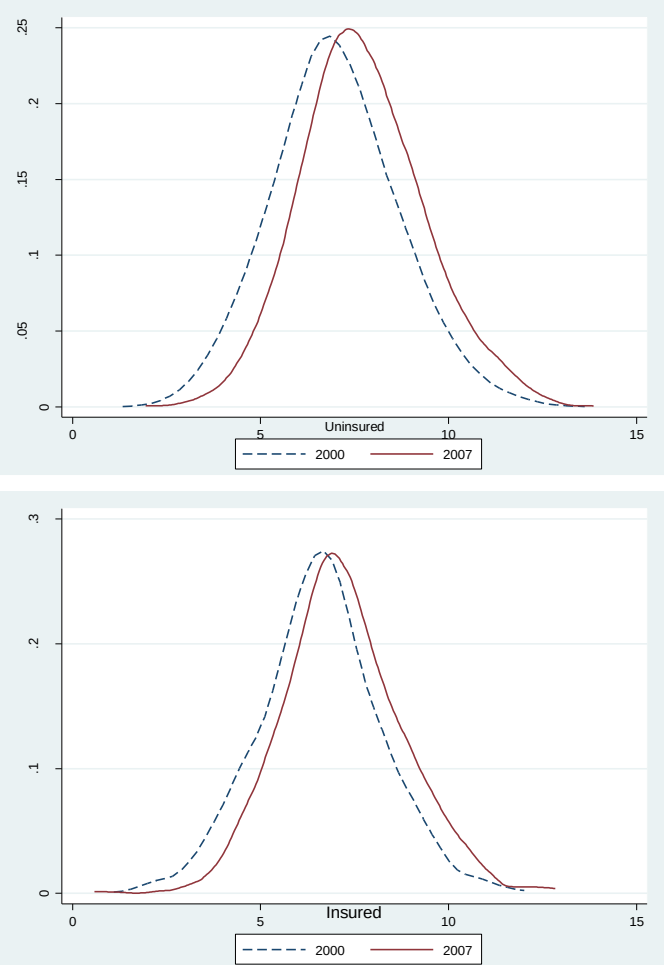
	percent of total expenditure		**percent of non-food expenditure**	
	2000	2007	2000	2007
Quintile1(poorest)	1.342	1.351	3.829	3.943
Quintile2	1.899	1.538	4.719	4.075
Quintile3	2.005	1.598	4.459	3.856
Quintile4	2.38	2.028	4.993	4.375
Quintile5 (richest)	3.443	2.485	5.39	4.658
Rural	1.708	1.92	4.43	4.579
Urban	2.117	2.022	4.434	3.976
Total	1.97	1.888	4.431	4.281

To have a clearer view of the trend in the health care expenditures around the reform, Figure 1 gives the plots of health care expenditure per capita before and after the introduction of Askeskin between the uninsured and insured groups. The two figures show that the

[7] In low-income countries, it is more preferable to express financial burden of health as the share of non-food instead of food expenditures because the latter accounts for a large fraction of the poor's consumption basket (O'Donnell et al., 2007).

distributions of health care expenditure per capita for all households have markedly shifted to the right after the reform, signifying an increase in the demand for health care services. Nevertheless, the pattern has been less obvious for the insured group in the bottom of the health expenditure distribution.

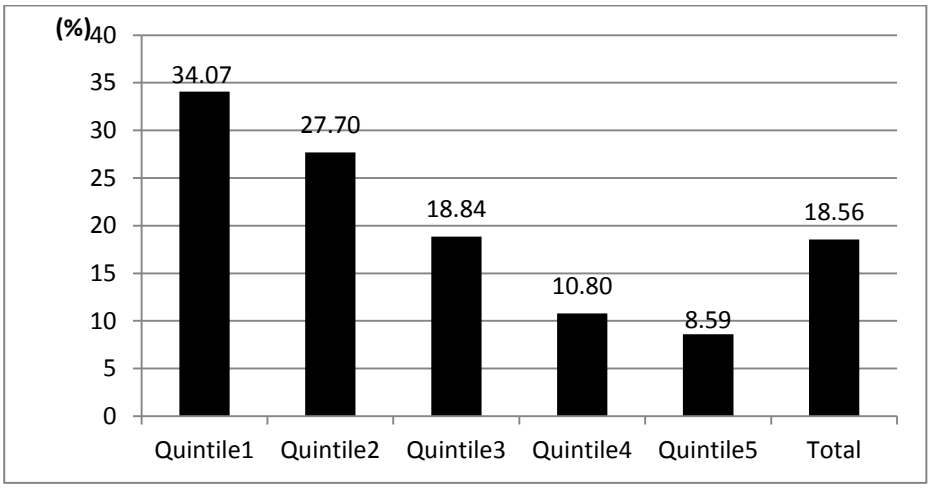
Figure 1. Density of (log) health care expenditures per capita of the uninsured and insured groups before and after the Introduction of Askeskin



Having discussed Indonesian experience with the household health expenditure patterns, we now evaluate whether the targeting system of Askeskin has accurately identified its beneficiaries. Although it is not perfect, the targeting method of Askeskin is considerably successful in

selecting its beneficiaries. In 2007, Askeskin covered 61.77 per cent of the first two poorest consumption quintiles. Nevertheless, there were also sizeable leakages of benefits to the non-poor, about 8.59 per cent (Figure 2). Households in rural areas enjoyed higher coverage rates as compared to households in urban areas, about 10.59 per cent as opposed to 7.97 per cent. Overall, Askeskin was estimated to cover at around 18.56 per cent of the entire sample.

Figure 2. Askeskin coverage by consumption quintile in 2007



6.2 Baseline Results

The basic consumption smoothing results are presented in Table 3. Let us focus first on the results for the ability of households to insure their consumption against health shocks. The coefficients on the three health measures are statistically insignificant, suggesting the existence of full insurance. Although the evidence does not contradict the full insurance model, the coefficient on illness symptoms does not show the expected sign, that is to say an illness is associated with higher levels of consumption (column 2). The finding is remarkably consistent with that reported by Gertler and Gruber (2002) based on a different Indonesian data set. They argue that the change in self-reported illness symptoms is weakly correlated with the change in labour-supply, and it is, therefore, unlikely to have any effects on household consumption. Households remain able to smooth their consumption as a result of large reductions

in BMI. Specifically, a drop in BMI would lower consumption by almost 3.67 per cent on average.

The last two columns of Table 3 examine the impact of ADLs changes on the change in household consumption. We replicate a similar model as Gertler et al. (2009) in column 4. We find that the coefficient on the ADLs index is 0.08. This implies that if an illness causes the household head to move from being able to perform all physical activities to being able to perform none of them, consumption would decrease by 7.84 per cent. Our result poses a challenge to the estimate of Gertler et al. (2009) which concludes that households are unable to insure their consumption as a result of the changes in ADLs. In particular, they find that households would reduce their consumption by almost 22 per cent. This noticeable difference could be related to the fact that Gertler et al. (2009) use the data sets collected during the financial crisis, in which it brought down the purchasing power of households. Our argument seems to be supported by Beegle et al. (1999). Utilising the same data source, their study shows unambiguous evidence that the crisis caused substantial declines in the level of household expenditure.

Table 3. Effects of heads' health shocks on changes in non-medical consumption and mitigation by Askeskin

Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
post05	0.248***	0.305***	0.282***		0.249***
	(0.0494)	(0.0946)	(0.0661)		(0.0535)
Insurance	-0.265***	-0.0656	-0.244**		-0.205***
	(0.0782)	(0.165)	(0.102)		(0.0779)
post05* insurance	-0.0947	-0.225	-0.141		-0.0836
	(0.104)	(0.204)	(0.138)		(0.104)
ADL				0.0784	0.121
				(0.252)	(0.385)
ADL*insurance					-1.050
					(0.847)
ADL*post05					0.0221
					(0.530)
ADL*insurance*post05					1.444
					(1.162)
BMI			-0.0367		
			(0.0688)		
BMI*insurance			0.0594		
			(0.157)		
BMI*post05			-0.119		
			(0.103)		
BMI*insurance*post05			0.217		
			(0.218)		
Symptom		0.121			
		(0.0815)			
Symptom*insurance		-0.195			
		(0.186)			
Symptom*post05		-0.0654			
		(0.106)			
Symptom*insurance*post05		0.192			
		(0.238)			
Constant	6.495***	6.272***	6.402***	6.315***	6.372***
	(0.0336)	(0.531)	(0.533)	(0.533)	(0.531)
N	4,136	4,136	4,136	4,136	4,136
R-squared	0.150	0.176	0.176	0.171	0.175

Notes: N=4136. Robust standard errors are in parentheses (clustered at the household level). All specifications are robust to the inclusion of covariates.
*** p<0.01, ** p<0.05, * p<0.1

Regardless of its imprecision, however, we should carefully interpret the coefficient of ADLs. The ADLs measures were originally developed to assess the health status of older adults. It is still an open question

whether the ADLs index is also relevant to studying the health conditions of younger populations. This is a very plausible reason since both groups react in different ways to health shocks. It is generally accepted that older individuals tend to experience more severe and more permanent health problems than younger persons. Furthermore, the ADLs index cannot precisely differentiate illness events in terms of their duration and severity, whereas these will lead to distinctive adjustment mechanisms. For instance, a transitory health shock is more likely to be insured than a longer-term illness because the former could just imply temporary reductions in labour supply. In a similar way, persons who report the same limitations in the ability to carry a heavy load for 20 metres may suffer from very different types of illness (Genoni, 2012).

We now turn to the impact of the Askeskin programme. The interaction between the dummy for the health insurance programme and the post-reform dummy represents the treatment effects of Askeskin. According to the table, we obviously see that the impact of the programme on the consumption growth is not statistically different from zero. Before controlling for covariates, the difference-in-differences estimate shows that the beneficiary households had close to 9.47 per cent lower consumption growth than the non-beneficiary households. This implication remains consistent with the inclusion of the health measures. Notably, those who reported changes in illness symptoms seem to have been strongly adversely affected than the two other illnesses, in particular there would be a smaller rate of consumption growth with 22.50 per cent for the Askeskin beneficiaries.

Moving on to the role of Askeskin in enabling households insure against idiosyncratic health shocks. The mitigating effect of Askeskin on health shocks is captured by the interaction terms between the dummy for the treatment effect and each health shock measure. The results show that Askeskin has a trivial role in mitigating these adverse health shocks. However, it is notable that the estimated coefficients are all positive, suggesting that the participants of Askeskin have a greater ability to protect their consumption during illness. These findings are robust to the inclusion of our three health shock measures.

6.3 Tests for State Dependency and the Confounding Effects of the Unconditional Cash Transfers (BLT)

As noted earlier, the model of consumption smoothing will be held if there is no state dependency, to the extent that health shocks will not change the underlying preferences of other household members. In our case, the illness of the head could be associated with the illness to other household members. Hence, the changes in household consumption refer to the wide changes in household tastes. We test this hypothesis by incorporating in our model a change in the ADLs index of the spouse. The inclusion of the change in the spouse's ADLs index has neither effects on consumption nor substantial changes in the coefficient on the head's ADLs index. The coefficient on the spouse's ADLs index is not statistically significant, whereas the coefficient on the change in the head's ADLs is still insignificant despite its magnitude decreases by almost half from 0.12 to 0.07 (Table 4 column 1). The evidence should not be surprising because the correlation coefficient between the illness of the head and the illness of the spouse is very low, around 0.06. The data discussion implies that the state dependency is not driving our findings.

An alternative explanation of our baseline results could be derived from the confounding effects of the unconditional cash transfers (i.e. BLT) programme. This anti-poverty program was launched a few months following the commencing of Askeskin and shared identical targeting systems. To isolate the potential spill over effects of BLT, we exclude BLT-eligible households and re-estimate our models. We find that the coefficients on Askeskin are still insignificant, but they fall noticeably. As compared to the treatment effects from the baseline estimates (9.47 per cent and 8.36 per cent), it currently varies between 4.16 per cent to 6.14 per cent (Table 4, column 2 and 3).

Table 4. Tests for state dependency and confounding effects of BLT

Variable	**(1)**	**(2)**	**(3)**
post05	0.273***	0.294***	0.270***
	(0.0638)	(0.0539)	(0.0588)
insurance	-0.151*	-0.218**	-0.137
	(0.0862)	(0.101)	(0.102)
post05*insurance	-0.258**	-0.0416	-0.0614
	(0.123)	(0.148)	(0.148)
ADL	0.0677		0.162
	(0.533)		(0.406)
Spouse's ADL	-0.449		
	(0.367)		
ADL*insurance	-0.981		-1.828*
	(0.858)		(1.079)
ADL*post05	0.224		-0.100
	(0.819)		(0.598)
ADL*insurance*post05	0.354		3.133
	(1.449)		(2.044)
Constant	6.137***	6.549***	6.259***
	(0.657)	(0.0352)	(0.579)
N	3,134	3,346	3,346
R-squared	0.206	0.165	0.189

Notes: Robust standard errors are in parentheses (clustered at the household level).
*** p<0.01, ** p<0.05, * p<0.1

This finding provides a rough sketch of the evidence that the BLT programme also partly contributes to the growth of household consumption. Another aspect of the result is that household consumption is more sensitive to the income effects of BLT than of Askeskin: without controlling for the health shocks covariates, the treatment effect of Askeskin decreases dramatically by 5.31 per cent (i.e. 9.47-4.16).[8] Nonetheless, we cannot disentangle the channel through which this impact occurs. Perhaps the income support component of the BLT programme which constitutes an additional in unearned non-labour income induces a pure income effect and ultimately loosens the budget constraint of the beneficiary households. The second channel may work through labour supply. Assuming that leisure is a normal good for the beneficiaries, the transfers possibly will produce a reduction in labour supply within the participant households. From this direction, we

[8] We also perform a supplementary analysis to test the impact of BLT on the change in household consumption. We find that the effects of BLT are insignificant but somewhat larger than that of Askeskin. The results are not reported here.

understand that the net effect of the programme is ambiguous. Yet this relationship is not well-established in developing countries.

6.4 Geographic Disparities: Urban and Rural Areas

So far we have seen that Askeskin cannot completely protect household consumption. A seminal contribution in the health policies literature by Filmer et al. (2000) sheds light on the weak links that may explain the ineffectiveness of health policy interventions in developing countries. One possibility is that the public spending is not enough allocated to the intervention itself (such as a limited number of health providers) and because of highly-fragmented public health infrastructure which its availability is concentrated in urban areas of the country (World Bank, 2007). Another channel is due to a low quality of health care services *per se*. A stark example of this claim is the lack of professionalism among health care professionals (e.g. noncompliance with health standards and protocols and high rates of absenteeism among the health care workforce). Intriguingly, Chomitz et al. (1998) elucidate that the real problem in Indonesia also involves the difficulty in staffing (i.e. a very high number of unfilled positions for rural health workers).

To deal with this issue, we run two separate regressions, one for the urban sample and one for the rural sample. Table 5 displays the findings. The treatment effect of Askeskin for the urban area demonstrates that the consumption growth of the beneficiary group is approximately 2.87 per cent lower than the non-beneficiary group (column 1). By contrast, it is almost 9.76 per cent for the rural area (column 2). Nevertheless, the findings suggest that the impact of Askeskin is not statistically different from zero for both groups.

There are contradictory effects of Askeskin on insuring household consumption from health shocks. Considering an illness shock one at a time, Askeskin does completely protect the consumption changes arising from the ADLs changes of urban household heads. Conversely, for the rural sample, any illness that affects a head's ability to function physically, such as receiving an Askeskin benefit, has not received full protection, but the coefficient gives the wrong sign.

Table 5. Heterogeneity tests: urban-rural sample

Variable	**(1)**	**(2)**
post05	0.338***	0.163**
	(0.0827)	(0.0778)
insurance	-0.191	-0.219**
	(0.123)	(0.102)
post05*insurance	-0.0287	-0.0976
	(0.162)	(0.143)
ADL	0.256	0.290
	(0.635)	(0.446)
ADL*insurance	-2.224**	0.0212
	(1.016)	(1.256)
ADL*post05	-0.411	-0.0104
	(0.753)	(0.861)
ADL*insurance*post05	3.657**	-0.227
	(1.653)	(1.756)
Constant	5.492***	6.628***
	(0.846)	(0.710)
N	1,892	2,244
R-squared	0.260	0.146

Notes: Robust standard errors are in parentheses (clustered at the household level).
*** p<0.01, ** p<0.05, * p<0.1

What we have learned from our econometric results? *A priori*, the urban-rural treatment effect differences could be attributable to supply-side problems. There is a long-standing issue that rural areas in developing countries are commonly characterised by inadequate and inferior quality of health infrastructure or difficulties in reaching health facilities. In such settings, the beneficiaries of a social health insurance programme are more likely to bypass the benefits of the programme and try to find treatment elsewhere (e.g. self-treatment, general medical practitioners, etcetera). By doing this, households have to finance their own health spending, and this may have serious economic consequences, including a change in their consumption patterns.

7. Conclusion

This paper has re-examined the theory of consumption smoothing and has investigated whether a rapid expansion of social health insurance in Indonesia protects household consumption when they are exposed to unexpected health shocks. Three measures of health shock are employed: a change in illness symptoms, a drop in body mass index, and a change in activities of daily living index.

The evidence does not contradict the hypothesis of consumption insurance, stating that households are able to insure their consumption against the negative effect of health shocks. These findings are robust to various health measures and different specifications. We interpret these results as a indication that there are well-functioning of informal insurance within a community in Indonesia. However, there remains a fundamental question of how households in those communities can manage to keep their consumption smooth in the presence of illnesses. Studying strategies used by households to isolate a certain type of idiosyncratic health risks will be a fruitful area for future research.

Another important feature of this study is the treatment effects of Askeskin. Our findings demonstrate a marginal effect of Askeksin on the growth of household consumption. The result also confirms that the programme gives a stronger impact on a change in consumption patterns of urban beneficiaries. To be precise, the role of Askeskin in protecting household consumption during illness episodes suggests that it can only protect urban households. How could such targeted demand-side intervention perform far below expectations? A classic explanation will point to the supply-side problems. Just like any other developing countries, rural areas of Indonesia commonly experience the lack of quality and quantity of health infrastructure which contributes to low utilization of health care services among the population. Under these settings, a social health insurance programme cannot effectively improve health service usage. Thus, strengthening supply-side interventions is supposed to be the prerequisite condition for enhancing the benefits of the social health insurance programme. Yet, a comprehensive study on this issue is needed to reveal weak links in the chain between the availability of health infrastructure and the effectiveness of demand side interventions.

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Journal of Economic Cooperation and Development, **38**, 3 (2017), 77-120

Price Volatility of Food and Agricultural Commodities: A Case Study of Pakistan

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Rapid price increase in food/agricultural commodities has gained attention after the "Price Spike" in 2007-2008. Again the same trend was observed in 2010 due to which it increases concern about the volatility in commodity prices. This study aims to investigate the factor affecting volatility of selected food and agricultural commodities. Monthly data from April 1983 to April 2013 is taken for analysis. GARCH (1, 1), GJR (1, 1) and EGARCH (1, 1) models are estimated for all the variables using normal and Student-t distribution. The results conclude that the mean and the volatility effect of exchange rate and interest rate are transmitted across all the selected commodities. Volatility in the price of fertilizer is only transmitted on the volatility of sunflower oil. Later, analysis shows that past price has significant impact on current prices for all the commodities except for soybean oil, sunflower oil and cotton.

Key words: Food and agricultural commodities, Price volatility, Exchange rate, interest rate, fertilizer, GARCH models

JEL: Q22, Q110, C220

1. Introduction

The prices of major food and agricultural commodities have risen dramatically since the end of 2006 to middle of 2008 both internationally and domestically. These prices of food and agricultural commodities were characterized by price volatility and presented serious challenges to market participants such as consumer, producers and investors. They have affected growth at the macroeconomic level of the

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developing countries more than developed economies. (Aizenman & Marion, 1993; Ramey & Ramey, 1995). Moreover, the large food and agricultural commodity price swings has negative effect on balance of payments, imports and exports, government budget, inflation, and poverty (Roache, 2010).

The observed variability in global food and agriculture commodity prices over the period 2006-2009, comprising the 2006-2008 price spike has revived the debate about the causes and consequences of such sharp and pronounced price variations. In a number of studies, economists such as Abbot *et al.* (2008), Mitchell (2008), Cooke and Robles (2009) and Gilbert and Morgan (2010a) have discussed the factors behind the global 'price spike' of 2008. These involved changes in supply and demand factors. On the demand side, the fast economic growth in Asian economies and particularly in China was emphasized. On the supply side, the underinvestment in agriculture as well as low commodity inventory levels of recent years were mentioned as contributory factors. Other macroeconomic and financial factors were considered to influence food and agricultural commodity price volatility includes: changes in oil prices, changes in the world money supply, and changes in the value of the dollar. Other factors which were also quoted include climate change, trade policies, the feedback between price expectation and market responses and speculation in futures and options trading in food and agriculture commodity markets (Mitchell, 2008; Cooke & Robles, 2009; Gilbert & Morgan, 2010a).

In case of Pakistan, food and agricultural price index have shown volatility during the period of 2006-2008 and the price of almost every food and agricultural commodity has risen to a historical high over the past few years (Hye, Malik, & Mashkoor, 2010; Hye & Siddiqui, 2010). The prices of the main food staples like wheat, maize and rice have increased sharply. The prices of meat, fruits, vegetables, oils and ghee also have risen sharply with a double increase in the prices of butter and milk (Hye & Siddiqui, 2010). According to FAO-OECD (2011), volatility in food and agriculture commodity prices in developing countries like Pakistan are caused by high energy costs, high oil prices and weather conditions. Other factors like exchange rates, interest rates and fertilizer prices are also considered for causing fluctuations in food and agricultural commodity prices (Mushtaq et al. 2011 and Hye et al., 2010).

This paper focuses on sources of food and agriculture commodity price volatility in Pakistan. It investigates whether the key macroeconomic factors can explain variations of the shocks that drive the evolution of food and agriculture commodity prices by using GARCH models.

The structure of the paper is as follows: Section 2 presents the empirical review. Section 3 presents model specification and methodology. Section 4 shows data and preliminary analysis. Section 5 reports estimated GARCH models. Section 6 provides a conclusion.

2. Empirical Review

In empirical literature, many studies have discussed sources of food and agricultural commodity price volatility.

Increase in agricultural input prices, namely fertilizer and crude oil increases the expenditures of producers, which ultimately raises the prices of agricultural outputs (Herrmann, 2009). High cost of domestic food production is due to the high cost of inputs, especially fertilizer and transportation cost. It will shift a large number of farmers with high potential agricultural crops to high global food prices that generate more revenue. Due to which the necessary food and agricultural items will be ignored and producers will only harvest the crops that generate maximum revenue. Baffes (2007) have found significant effect of crude oil or diesel on agricultural commodities. Balcombe and Rapsomanikis (2008) have found significant transmission of the volatility of oil and fertilizer prices to agriculture commodities. Abbott et al., (2008) have found set of macroeconomic factors including petroleum prices, exchange rate variations, and aggregate demand measured by the GDP and trade of a country, that causes all food prices to change together in the same general pattern. Harri and Hudson (2009), Gardebroek and Hernandez (2012) and Trujillo-Barrera et al. (2012) have found the impact of oil prices on corn. Onour and Sergi (2011), Du et al. (2011) and Nazliogluet et al. (2012) have found a price transmission between oil and corn and oil and wheat. OECD (2009) reports have indicated a strong association between oil price volatility and price volatility of agriculture commodity markets. Hatchet-Bourdon (2011) has observed a correlation between crude oil price volatility and agriculture commodity market price volatility. Han & Nayga (2012) has analyzed the association between the volatilities of grain and oil prices.

Balcombe (2009) has considered volatility in exchange rate as an important factor that causes volatility in agricultural prices. All the commodities that are internationally traded, including agricultural commodities and food items are influenced by the exchange rate. Devaluation of the local currency with respect to the currency of trading partner affects prices at which commodities are sold and eventually influences the profits of the producer. Volatility in exchange rate affects the prices and ultimately decreases the returns. Mushtaq *et al.* (2011) have shown the existence of a long run effect of exchange rates on wheat prices. Frank & Garcia (2010) have concluded that the agricultural commodity markets are more dependent on exchange rate volatility and crude oil price volatility. Ott (2010) has found that volatility in exchange rates and crude oil prices causes volatility in agricultural commodity prices. Similar analysis has done by Campiche *et al.* (2007) and Yu, Bessler and Fuller (2006) for corn, sorghum, palm oil, vegetable oil, sugar and soybean. They have concluded that shocks caused by volatility in exchange rates affect the prices of some commodities more than the other.

Calvo (2008) has found that agricultural commodity prices are affected by a small change in interest rates that played a significant role during the price boom in 2006-2008. Frankel (2006) has argued that high real interest rates are the cause of high real commodity prices. He has concluded that there was considerable impact of monetary policy on commodity prices. Interest rates can affect food prices, particularly if market players anticipate interest rate volatility to continue (Frankel, 2006). Roache (2010) has indicated the factors that cause low frequency volatility in spot prices of food commodities includes the interest rate with other factors. Miguez and Michelena (2011) have analyzed the key aspect like inflation, inventories, exchange rates, interest rate, income growth, weather and speculations affect the agriculture commodity price volatility.

3. Model Specification and Methodology

In order to study sources of food and agriculture commodity price volatility in Pakistan, the family of GARCH models is used. These are GARCH models are specified as follows:
Mean equation

$$r_t = c + \sum_{p=1}^{l} \delta_p r_{t-p} + \sum_{q=1}^{m} \gamma_q \varepsilon_{t-q} + \psi_1 u_{INT,t} + \psi_2 u_{U,t} + \psi_3 u_{EX,t} + \psi_4 u_{CROIL,t} + \varepsilon_t \quad (3.1)$$

Variance equations

GARCH (1, 1)

$$\sigma_t^2 = \omega_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1} + \psi_1 u_{INT,t}^2 + \psi_2 u_{U,t}^2 + \psi_3 u_{EX,t}^2 + \psi_4 u_{CROIL,t}^2 \quad (3.2)$$

GJR-GARCH (1, 1)

$$\sigma_t^2 = \omega_0 + \alpha_1 \varepsilon_{t-1}^2 + \gamma_1 \varepsilon_{t-1}^2 I_{[\varepsilon_{t-1}<0]} + \beta_1 \sigma_{t-1}^2 + \psi_1 u_{INT,t}^2 + \psi_2 u_{U,t}^2 + \psi_3 u_{EX,t}^2 + \psi_4 u_{CROIL,t}^2 \quad (3.3)$$

EGARCH (1, 1)

$$\log \sigma_t^2 = \omega_0 + \beta_1 \log \sigma_{t-1} + \alpha_1 [\theta V_{t-1} + \gamma_1 \{ |V_{t-1}| - E|V_{t-1}| \}] + \psi_1 u_{INT,t}^2 + \psi_2 u_{U,t}^2 + \psi_3 u_{EX,t}^2 + \psi_4 u_{CROIL,t}^2 \quad 3.4)$$

Where r_t represents the price return series, $u_{INT,t}$, $u_{U,t}$, $u_{EX,t}$ and $u_{CROIL,t}$ are the residuals of interest rate, urea, exchange rate and crude oil respectively. Whereas, in variance equation residual squares of interest rate, urea, exchange rate and crude oil are represented by $u_{INT}^2, u_U^2, u_{EX}^2$ and u_{CROIL}^2 respectively.

This study used ARMA (p, q) model for the identification of the appropriate lag length for conditional mean and variance specifications. Maximum log likelihood estimation with standard error based on a least square process is employed. Gaussian and student "t" distribution is used to get the best fitted model. For the estimation of parameters BFGS-BOUNDS is applied. This method is efficient for unconstrained optimization as followed by Broyden (1970). BFGS converges for an optimum quadratic Taylor expansion. After finding appropriate lag length of the return series residuals and residual squares of all the series

are saved. Secondly, the LM - ARCH test is applied to analyze the presence of ARCH effect in the residuals of each series. Set of diagnostic tests are applied to check the best fitted lag length for the GARCH models, based on the information criterion (Akaike criteria, Shibata criteria, Schwartz Bayesian criteria and Hannan-Quinn criteria), that is to be minimized. The best fitted ARMA model is the one for which GARCH model is converging towards the normal distribution. Q-statistics and Q^2-statistics of Ljung-Box-Pierce test is applied to check the correlation and the volatility clustering. Following Tse (2002) to observe conditional heteroskedasticity Residual Based Diagnostic (RBD) test is also applied. Conditional mean and conditional variance is also saved for the volatility modelling of the food and agricultural series under observation.

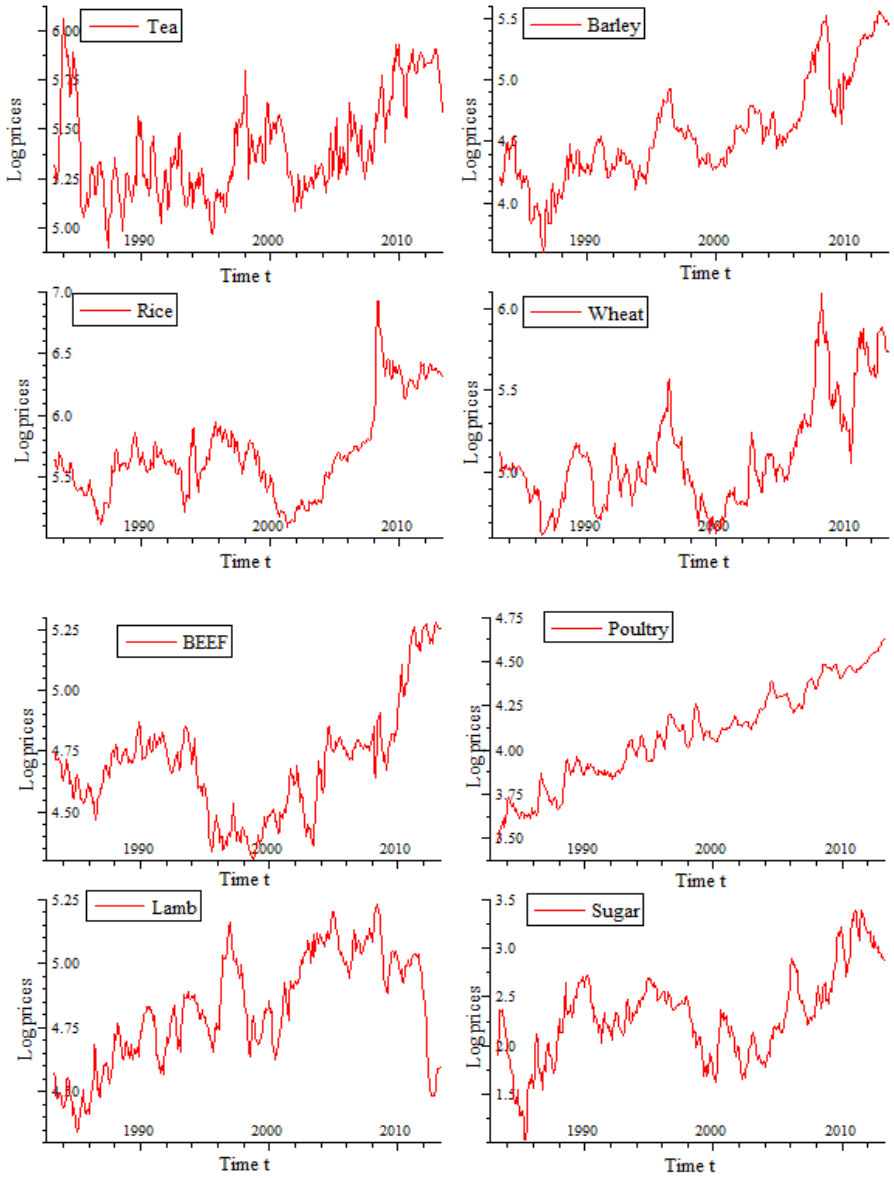
4. Data and Preliminary Analysis

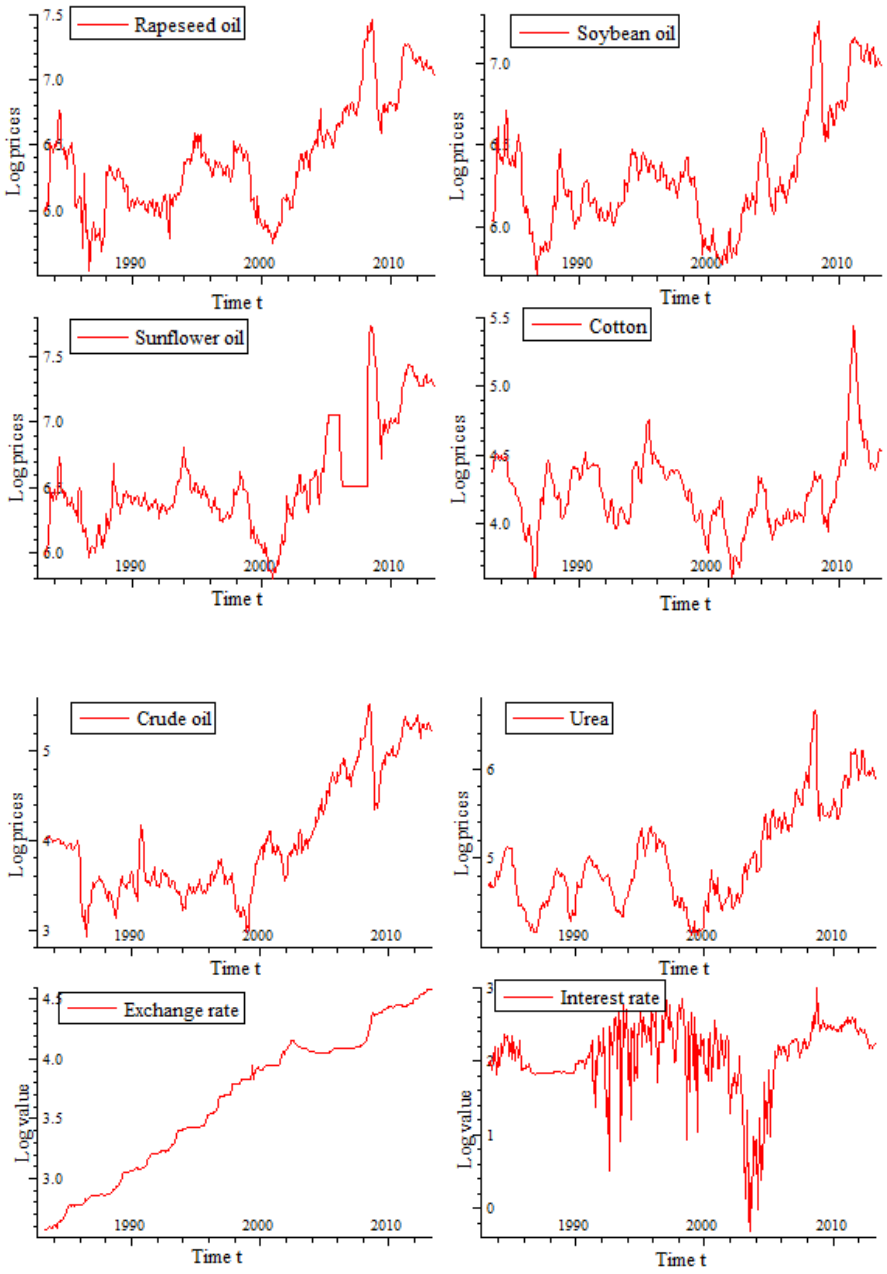
In this study monthly data from April 1983 till April 2013 of selected food and agricultural commodities for Pakistan is used for analysis. The data is taken from the IMF, World Bank, IFS and State Bank of Pakistan. Monthly data on all the commodities are measured in US dollar. Price data of tea, barley, rice, wheat, beef, poultry, lamb, sugar, rapeseed oil, soybean oil, sunflower oil and cotton are taken. Whereas, data on the price of crude oil, price of urea, exchange rate and interest rate is also considered to investigate sources of food and agricultural prices. For the analysis of the behavior of price series returns are calculated by taking the first difference of the logarithm of monthly prices for each commodity:

Figures 4.1 show plots of monthly price series of beef, lamb, poultry, rice, wheat, sugar, tea, rapeseed oil, soybean oil, sunflower oil, cotton, barley, crude oil, urea, exchange rate and interest rate. They reveal general upward trend for the selected period.

Figure 4.1: Monthly Price Series of Food and Agricultural Commodities and Key Factors

The Monthly price series at logarithmic level showing a general upward trend.



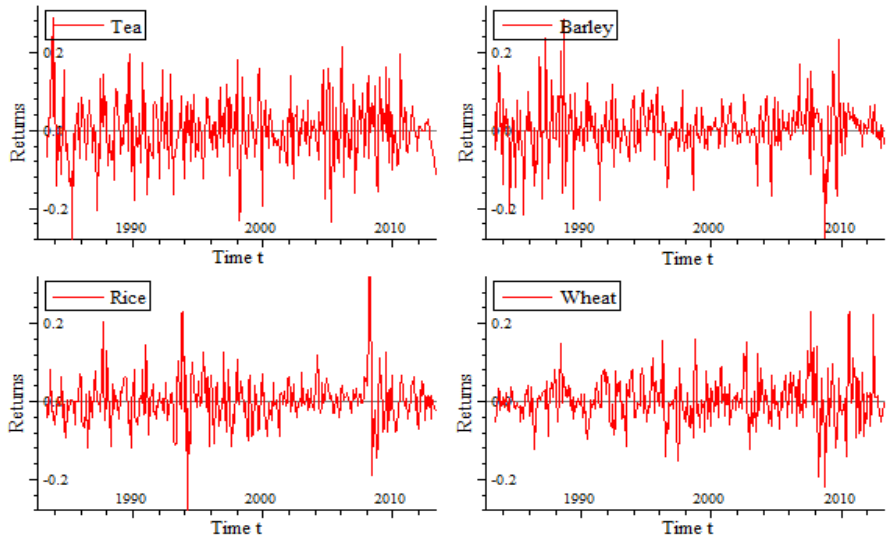


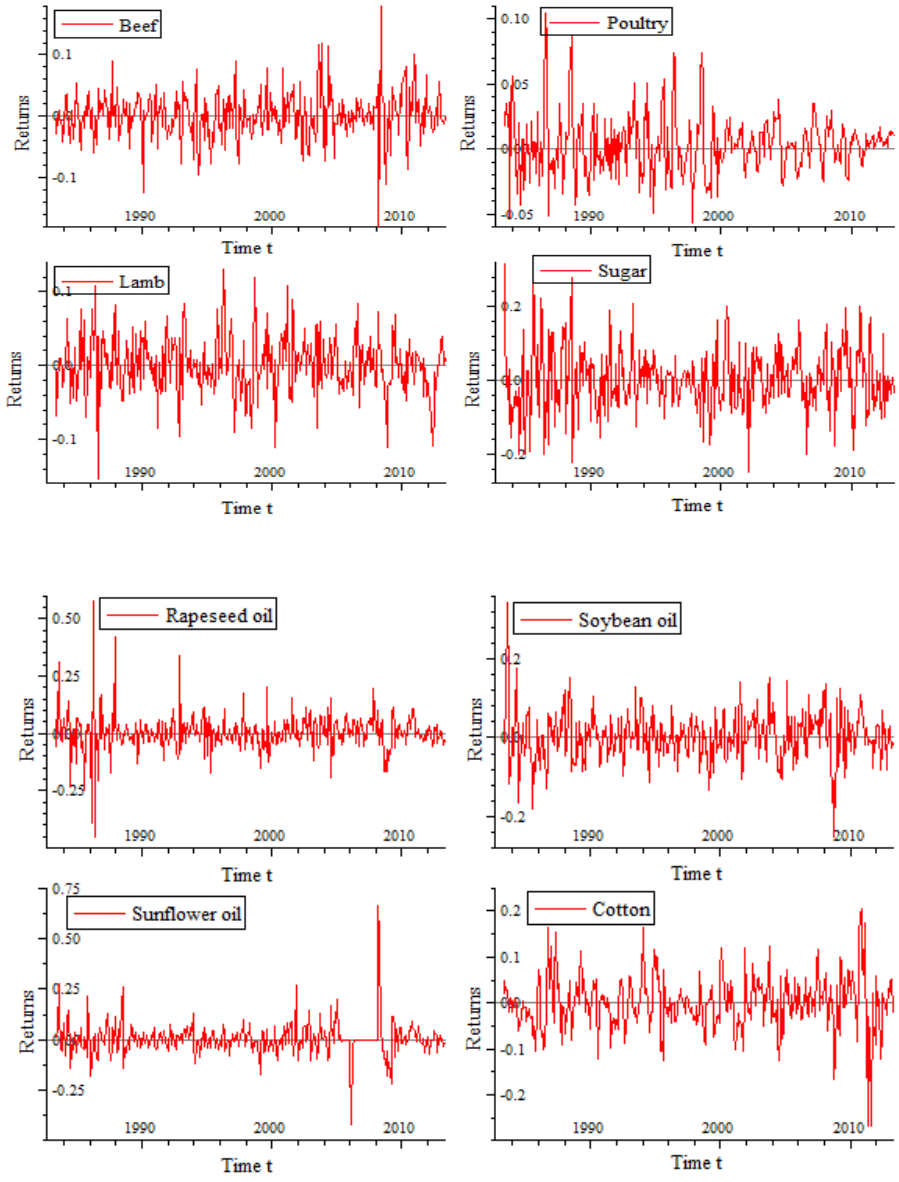
The plots of monthly return series are shown in figure 4.2. These clearly show the time varying volatility and do not show any fix pattern. All the return series shows high fluctuation and slowly return back to their

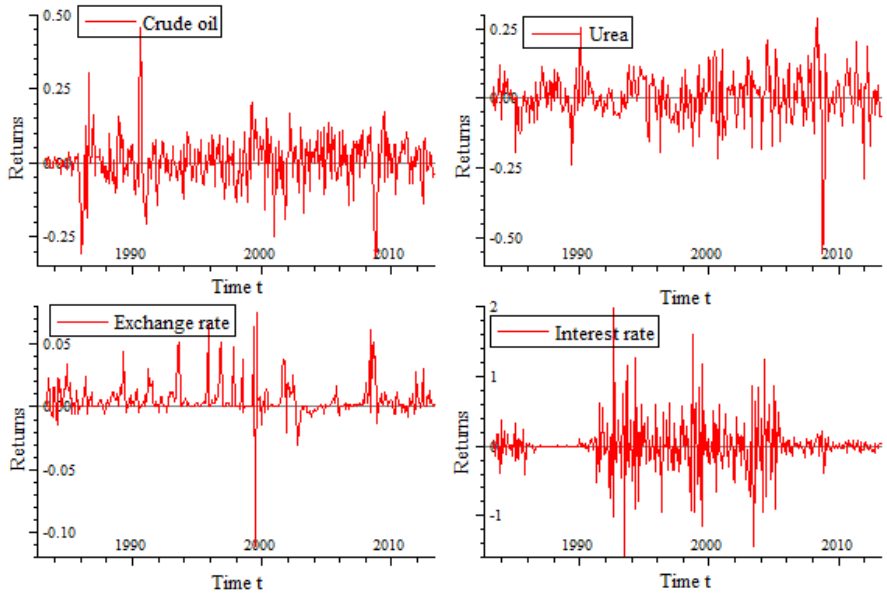
means. It is clearly shown that the variance of a return series of prices is not fixed over time. The volatility clustering is exhibited in a return series showing periods of high and low volatilities, indicating ARCH effect.

Figure 4.2: Return Series of Food and Agricultural Commodities and Key Factors

The return series shows no definite pattern, and are reverting towards the mean. These exhibit volatility clustering.



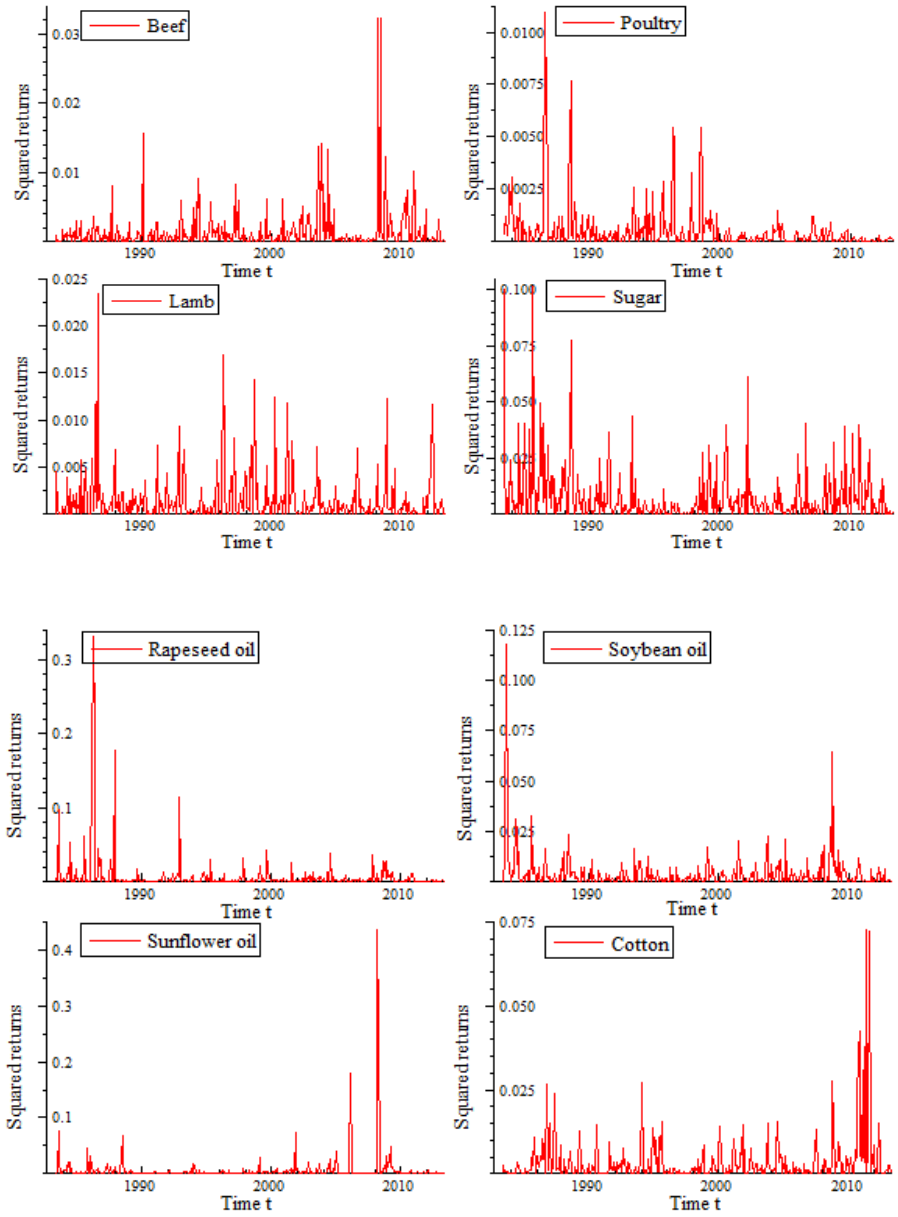

Beef
Returns
0.1
-0.1
1990
2000
2010
Time t
Poultry
0.10
0.05
-0.05
Lamb
Sugar
0.2
-0.2
Rapeseed oil
0.50
0.25
-0.25
Soybean oil
Sunflower oil
0.75
Cotton

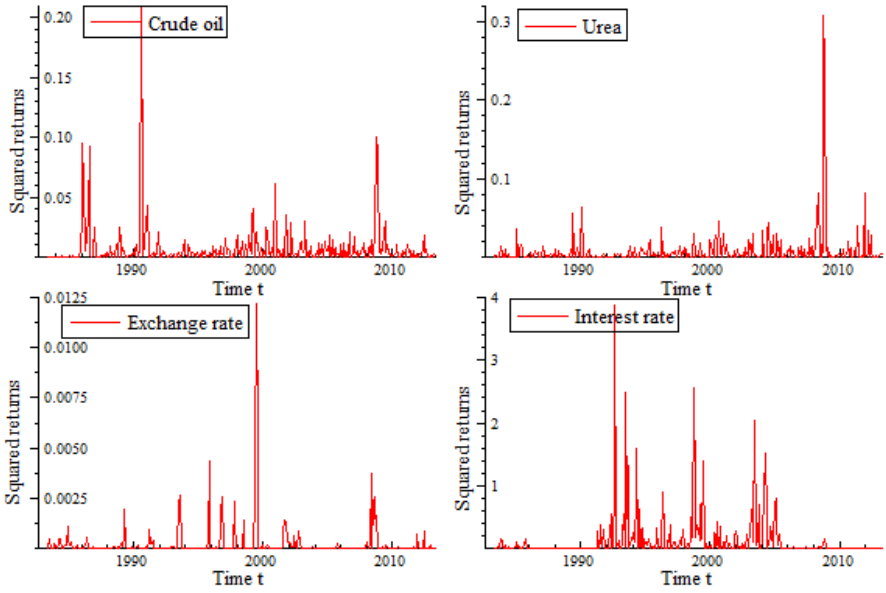


In figure 4.3, squared returns indicate variations in volatility. Brief periods of high volatility are more visible from the squared returns taken as a measure of volatility. Higher order serial correlation is observed through the plots of squared returns.

Figure 4.3: Squared Return Series of Food and Agricultural Commodities and Key Factors

The squared return series shows the periods of high and low volatility





Summary statistics of price return series (r_{it}) is shown in Table 4.2. All the series are characterized with excess kurtosis and skewness, which is the feature of high frequency data. A series is said to be normally distributed if the value of its skewness is close to zero. Rice, wheat, beef, poultry, sugar, rapeseed oil, soybean oil, sunflower oil, exchange rate and interest rate are positively skewed[5] and significant at 1% (see. Table 4.2). Whereas, tea, barley, lambs, cotton, crude oil and urea are negatively skewed[6] and statistically significant. Non normality of data distribution is clearly indicated for all the series. Secondly, the value of excess kurtosis[7] in Table 4.2 helps to analyze the peak of the return price series distribution. The series of rice, beef, rapeseed oil, sunflower oil, crude oil, urea, exchange rate and interest rate have indicated high kurtosis. Higher values of kurtosis indicate that the data distribution of these series is leptokurtic[8]. It also indicates that there is a high probability of having extreme values in the distribution. The high value

[5] $Skewness = \frac{E[(y-u)^3]}{\sigma^3}$. When the value of skewness is positive and greater than zero, it is positively skewed with a tail longer at right end.

[6] Series with a longer tail on left side, with a value less than zero is defined as negatively skewed.

[7] $Excess\ Kurtosis = \frac{E[(y-u)^3]}{\sigma^3} - 3\ \ or\ Fisher\ Kurtosis$

$where, y\ indicates\ the\ observation\ with\ mean\ u\ and\ \sigma\ shows\ standar\ deviation$

[8] Leptokurtic is sharper than normal distribution with a heaver tail.

of the excess kurtosis further indicates that the data show a heavier tail than the normal distribution.

Table 4.2: Descriptive statistics for returns (r_t) of series

	Minimum	Mean	Maximum	Standard deviation	Skewness	Excess Kurtosis	Jurque-Bera
Tea	-0.2799	0.0007	0.2897	0.0783	-0.0186	0.9828	14.5100
Barley	-0.2742	0.0035	0.2832	0.0691	-0.1182	2.4806	93.1380
Rice	-0.2813	0.0019	0.41169	0.06239	1.20220	8.60850	1198.30000
Wheat	-0.21926	0.00170	0.22946	0.05868	0.41652	2.41980	98.23900
Beef	-0.17966	0.00141	0.17943	0.03707	0.03114	3.28900	162.32000
Poultry	-0.05707	0.00318	0.10461	0.02225	0.66366	2.17920	97.66100
Lamb	-0.15305	0.00008	0.13036	0.03807	-0.00314	1.20010	21.60400
Sugar	-0.24741	0.00270	0.31845	0.08796	0.27599	0.67892	11.48400
Rapeseed Oil	-0.45438	0.00287	0.57580	0.08355	0.63882	11.52600	2017.30000
Soybean Oil	-0.25344	0.00265	0.34303	0.06142	0.28698	2.94960	135.44000
Sunflower Oil	-0.42206	0.00358	0.66076	0.07941	2.14150	19.38700	5913.20000
Cotton	-0.26908	0.00040	0.20561	0.05829	-0.08248	2.89900	126.47000
Crude oil	-0.31678	0.00335	0.45803	0.08452	-0.13954	3.66900	203.09000
Urea	-0.55492	0.00328	0.28625	0.08797	-1.15920	7.11960	840.96000
Exchange Rate	-0.11032	0.00562	0.07488	0.01426	0.24835	15.95900	3824.20000
Interest Rate	-1.57860	0.00070	1.96640	0.35878	0.42856	6.17260	582.53000
Critical value Jurque-Bera	1%	5%	10%				
	9.21	5.99	4.61				

Whereas, tea, barley, wheat, poultry, lambs, sugar, soybean oil and cotton shows a value less than 3 for kurtosis. A value lower than 3 shows that there is less probability of extreme values and these series are platykurtically distributed[9]. It implies that the distributions of return series are not normal.

In Jarque Bera test (JB) the null hypothesis under consideration is that the series are normally distributed. The null hypothesis of normality of JB statistics are rejected for all return series as the calculated value in Table 4.2 is greater than the critical value of 1%, 5%, and 10% level of significance suggesting that all the distributions of a return series are non-normal.

[9] Platykurtic distribution is flatter than normal distribution.

Overall descriptive statistics show that the distributions of price return series are skewed, leptokurtic and platykurtic. It concludes that the price return series of Pakistani market show non normal distribution which is the main characteristic of the data set of most of the emerging markets (Choudry, 1996).

KPSS test at a level and at the first difference with constant for unit root for the stationarity of the return series is used. The results of unit root tests are shown in Table 4.3. All series are non-stationary at the level as the calculated values are greater than the critical values at 1%, 5%, and 10% level of significance. At first differenced return series of rice, wheat, beef, poultry, sugar, rapeseed oil, soybean oil, sunflower oil, exchange rate, tea, barley, lamb, cotton, crude oil, urea and interest rate are stationary at 1% level of significance.

Table 4.3: Unit root test

Kwiatkowski–Phillips–Schmidt–Shin (KPSS)				
	Log Level		**Log First Difference**	
	with constant	**with constant and trend**	**with constant**	**with constant and trend**
Tea	4.9944	1.65987	0.01962	0.0164259
Barley	11.2406	1.72147	0.0593445	0.0216872
Rice	7.21935	2.03134	0.0930032	0.0357157
Wheat	7.93214	1.82813	0.107774	0.0282508
Beef	5.76777	3.00973	0.23447	0.0377548
Poultry	16.6182	1.17962	0.0369913	0.0338716
Lamb	9.6491	1.03139	0.149932	0.0574777
Sugar	6.41088	1.78359	0.0410028	0.0375264
Rapeseed Oil	9.83891	2.18872	0.0450457	0.0327789
Soybean Oil	7.47396	2.34956	0.0705844	0.0376475
Sunflower Oil	8.2425	1.96624	0.0373904	0.0302492
Cotton	1.32349	1.01585	0.0684311	0.0357745
Crude oil	11.761	3.28156	0.168624	0.0272404
Urea	9.10884	1.97848	0.0681359	0.031068
Exchange Rate	17.2971	1.83328	0.167393	0.0740553
Interest Rate	1.66404	0.79407	0.00872	0.00850
critical value	1%	5%	10%	
with constant	0.739	0.463	0.347	
with constant and trend	0.216	0.146	0.119	
Note: All series are non-stationary at level and are stationary at first difference at 1% critical value				

In order to test conditional heteroskedasticiy, Lagrange Multiplier test and the Ljung-Box test are employed on return series of rice, wheat, beef, poultry, sugar, rapeseed oil, soybean oil, sunflower oil, exchange

rate, tea, barley, lamb, cotton, crude oil, urea and interest rate and .macroeconomic factors. The Ljung-Box–Pierce Q-statistics and Q2-statistics are significant, showing there is serial correlation in residuals and square residuals. The LM test shows strong evidence that the squared residuals exhibit an ARCH effect. These results, support for the estimation of a conditional heteroscedasticity model for food and agriculture commodity prices.

Table 4.4: (a) ARCH Effect Diagnostic

		ARCH TEST			Q-STATISTICS				Q-STATISTICS		
	ARCH (1-2)	ARCH (1-5)	ARCH (1-10)		On Returns				On squared Returns		
	F(2,355)	F(5,349)	F(10,339)	Q(5)	Q(10)	Q(20)	Q(50)	Q(5)	Q(10)	Q(20)	Q(50)
Tea	7.3254	4.1859	2.5666	25.7864	36.6372	62.088	151.766	20.6245	25.7626	40.8455	64.618
	(0.0008)**	(0.0010)**	(0.0053)**	(0.0000982)**	(0.0000654)**	(0.0000034)**	(0.0000)**	(0.0009536)**	(0.0040729)**	(0.0038991)**	(0.0800362)**
Barley	12.506	5.3585	3.4248	26.0272	34.2781	42.3605	105.338	35.1645	46.8204	92.4591	144.506
	(0.0000)**	(0.0001)**	(0.0003)**	(0.0000882)**	(0.0001657)**	(0.0024813)**	(0.0000080)**	(0.0000014)**	(0.0000010)**	(0.0000000)**	(0.0000000)**
Rice	35.482	15.163	7.5504	50.0978	65.8433	86.8228	144.272	86.2966	88.8900	90.6369	100.791
	(0.0000)**	(0.0000)**	(0.0000)**	(0.0000)**	(0.0000)**	(0.0000)**	(0.0000)**	(0.0000000)**	(0.0000000)**	(0.0000000)**	(0.0000279)**
Wheat	10.056	4.1426	2.4165	26.5722	39.4901	49.3374	84.9637	25.4564	33.1676	52.4578	108.383
	(0.0001)**	(0.0011)**	(0.0087)**	(0.0000691)**	(0.0000208)**	(0.0002753)**	(0.0014841)**	(0.0001137)**	(0.0002553)**	(0.0000976)**	(0.0000034)**
Beef	14.307	7.1982	4.0405	24.5758	40.7535	64.95	95.7265	34.0669	37.1655	40.2718	65.9114
	(0.0000)**	(0.0000)**	(0.0000)**	(0.0000440)**	(0.0000125)**	(0.0000012)**	(0.0001065)**	(0.0000023)**	(0.0000530)**	(0.0046146)**	(0.0651129)**
Poultry	62.085	24.749	11.996	108.321	157.056	259.009	454.052	100.285	109.379	111.79	200.276
	(0.0000)**	(0.0000)**	(0.0000)**	(0.0000000)**	(0.0000000)**	(0.0000000)**	(0.0000000)**	(0.0000000)**	(0.0000000)**	(0.0000000)**	(0.0000000)**
Lamb	4.6451	2.9631	1.7237	32.3622	45.1031	55.7783	82.466	14.3221	17.382	38.0595	57.2712
	(0.0102)*	(0.0124)*	(0.0741)	(0.0000050)**	(0.0000021)**	(0.0000314)**	(0.0026129)**	(0.0136879)*	(0.0663273)	(0.0087085**)	(0.2234390)
Sugar	8.5151	4.8309	4.8067	26.3505	27.6429	37.3614	64.4607	19.0465	47.8144	58.6336	131.364
	(0.0002)**	(0.0003)**	(0.0000)**	(0.0000763)**	(0.0020587)**	(0.0105871)*	(0.0820284)	(0.0018841)**	(0.0000007)**	(0.0000116)**	(0.0000000)**

Note: p-values are shown in brackets, * shows the 5% level of significance and ** shows significance at 1%. Q-Statistics is the Ljung-Box statistics based on standardized residual and square of standardized residuals up to lag 50 with H_0: no serial correlation. LM-ARCH (n) Lagrange multiplier test for ARCH effect up to order n, its H0: series is not subject to ARCH effect.

Table 4.4: (b) ARCH Effect Diagnostic

		ARCH TEST			Q-STATISTICS				Q-STATISTICS		
	ARCH (1-2)	ARCH (1-5)	ARCH (1-10)		On Returns				On Squared Returns		
	F(2,355)	F(5,349)	F(10,339)	Q(5)	Q(10)	Q(20)	Q(50)	Q(5)	Q(10)	Q(20)	Q(50)
Rapeseed Oil	61.008	26.703	13.321	7.70880	13.0631	34.1052	54.0044	90.3753	95.5766	123.522	145.131
	(0.0000)**	(0.0000)**	(0.0000)**	(0.1730315)	(0.2201640)	(0.0254218)*	(0.3240075)	(0.0000000)**	(0.0000000)**	(0.0000000)**	(0.0000000)**
Soybean Oil	8.6854	5.8310	5.5184	42.836	44.4819	48.0388	100.382	20.0956	34.4739	42.8566	58.6111
	(0.0002)**	(0.0000)**	(0.0000)**	(0.0000000)**	(0.0000027)**	(0.0004201)**	(0.0000312)**	(0.0011992)**	(0.0001535)**	(0.0021354)**	(0.1889040)
Sunflower Oil	33.951	14.095	6.9088	44.7221	55.7812	61.782	117.625	49.2322	49.6959	52.3056	81.0673
	(0.0000)**	(0.0000)**	(0.0000)**	(0.0000000)**	(0.0000000)**	(0.0000038)**	(0.0000002)**	(0.0000000)**	(0.0000003)**	(0.0001027)**	(0.0035571)**
Cotton	7.6403	19.176	10.406	101.135	110.469	150.769	177.686	82.0900	130.165	132.599	146.283
	(0.0006)**	(0.0000)**	(0.0000)**	(0.0000000)**	(0.0000000)**	(0.0000000)**	(0.0000000)**	(0.0000000)**	(0.0000000)**	(0.0000000)**	(0.0000000)**
Crude oil	30.024	13.938	7.2441	47.3662	67.4613	93.5737	113.854	71.1438	82.5977	90.7382	128.248
	(0.0000)**	(0.0000)**	(0.0000)**	(0.0000)**	(0.0000)**	(0.0000)**	(0.0000007)**	(0.0000)**	(0.0000)**	(0.0000)**	(0.0000)**
Urea	40.195	19.54	10.113	57.4195	64.6547	97.9101	176.969	65.9271	79.8173	81.4722	102.594
	(0.0000)**	(0.0000)**	(0.0000)**	(0.0000000)**	(0.0000000)**	(0.0000000)**	(0.0000000)**	(0.0000000)**	(0.0000000)**	(0.0000000)**	(0.0000171)**
Exchange Rate	68.977	27.388	13.417	12.4698	13.9419	23.2497	46.0303	116.84	119.64	129.042	161.249
	(0.0000)**	(0.0000)**	(0.0000)**	(0.0288883)*	(0.1756581)	(0.2767007)	(0.6333764)	(0.0000000)**	(0.0000000)**	(0.0000000)**	(0.0000000)**
Interest Rate	17.483	7.2811	8.3589	72.4735	97.214	115.195	173.278	52.4649	128.38	163.664	177.061
	(0.0000)**	(0.0000)**	(0.0000)**	(0.0000000)**	(0.0000000)**	(0.0000000)**	(0.0000000)**	(0.0000000)**	(0.0000000)**	(0.0000000)**	(0.0000000)**

Note: p-values are shown in brackets, * shows the 5% level of significance and ** shows significance at 1%. Q-Statistics is the Ljung-Box statistics based on standardized residual and square of standardized residuals up to lag 50 with H_0: no serial correlation. LM-ARCH (n) Lagrange multiplier test for ARCH effect up to order n, its H0: series is not subject to ARCH effect.

5. Estimated GARCH Models

In order to find the best fitted model for each return series of food and agricultural commodity and other factors, initially we estimate the n-GARCH, t-GARCH, EGARCH and GJR-GARCH models. Results of GARCH (1, 1), EGARCH (1, 1) and GJR-GARCH (1,1) model with normal distribution for twelve foods and agricultural commodities and factors affecting their volatilities are reported in Table 5.1 (a & b) and Table 5.2 (a & b) in Appendix A.

To investigate the effect of the explanatory variables on the price returns, residuals of crude oil, urea, exchange rate and interest rate (R_{croil}, R_u, Rex, R_i ,respectively) are added in the mean equation and residual squares of crude oil, urea, exchange rate and interest rate (SqR_{croil}, SqR_u, SqRex, SqR_i ,respectively) are added in the variance equation. The effect of explanatory variables on food and agricultural commodities is estimated for GARCH (1, 1), EGARCH (1, 1) and GJR (1, 1), with normal and Student-t distribution (see Table 5.3 (a & b) and Table 5.4 (a & b) in Appendix A).

GARCH models with explanatory variables show the predicted significance of α_1 for all commodities except for tea, wheat, beef and rapeseed oil. Furthermore, the coefficient of β_1 is high (close to 1) and shows strong significance for all the commodities which implies that a shock to volatility is persisted for long duration. The estimated parameter γ_1 indicates that the asymmetric effects is insignificant and negative for sugar and cotton; implying that there is no leverage and asymmetric effects. Whereas, γ_1 is significant and negative for soybean oil and sunflower oil. This implies that there is leverage effect, but no asymmetry. Normally test applied concludes that the model is negatively skewed for tea, barley and beef series, whereas all the other commodities are positively skewed. The value of excess kurtosis is high for rapeseed oil and sunflower oil return series, which indicates the distribution is leptokurtic with higher probability of extreme value, whereas all the other commodities are platykurtically distributed. The JB test also indicates that the standardized residual shows non-normal distribution. Moreover, the LM-ARCH test demonstrates no model specification error. The Q-statistic for the standardized residuals and Q^2-statistic for squared standardized residuals shows no or little sign of

serial autocorrelation and volatility clustering. Furthermore, the Residual Based Diagnostic Test of Tse (2002) indicates no heteroscedasticity.

For the sample period 1983:4 to 2012:4, EGARCH model is preferred to be the best fit for return price series of tea and beef. In case of barley, rice, wheat, poultry, lamb and rapeseed oil GARCH model is the best fit. For the remaining commodities (sugar, soybean oil, sunflower oil and cotton) GJR-GARCH model performed better than the other models. The coefficients in the mean equation show that the prices of barley, beef, lamb and rapeseed oil are positively and significantly affected by crude oil prices. Whereas, the volatility of crude oil prices has a significant positive effect on the volatility of cotton prices. A significant negative impact on the variations in sunflower oil and wheat market is observed as crude oil is an important input for their production. These results provide evidence that changes in international crude oil prices effect the domestic markets (Zhang *et al.,* 2010). Results are evident of volatility transmission from the crude oil market to food and agricultural market in Pakistan. In Pakistan economy the transmission from high crude price do not directly affect the production, rather indirectly through the high cost of food processing, transportation and distribution. Similarly, high input cost due to the use of tractors and tube well in harvesting leads to higher food and agricultural prices in Pakistan. These results are consistent with the finding of Ali, Ramzam, Razi and Bhatti (2012) for wheat, rice and chicken. Azeem, Munawwar and Mushtaq (2012) also found a negative relationship between Pakistan's wheat prices and international crude oil prices. This may be due to the government's unstable and inconsistent economic policies that lead to rise the general price level of the economy. Even if the price of crude oil is reduced internationally, but the sectors that use crude oil as an input, never reduce their output prices (Ali *et al.,* 2012; Azeem *et al.,* 2012).

The coefficients in the mean equation show that the prices of barley, wheat and soybean oil are positively and significantly affected by the exchange rates. The results show that the volatility of exchange rates do not affect the price volatilities of any commodity in Pakistan. An Increase in the price of inputs like fertilizer directly affect the output price, therefore urea is taken as a representative. Results show that in the mean equation of returns urea positively and significantly affects the coefficients of rice, sugar, rapeseed oil and sunflower oil. Furthermore, the volatility urea prices is transmitted to price volatility of sunflower

oil. The interest rate has negative and significant effect on the mean price of beef and poultry. Further, positive and significant effect on the mean price of wheat is also observed. The volatility of interest rate affects negatively on the volatility of beef prices only.

Considering the effect of past price on current price, strong positive evidences are found for all the commodities except for soybean oil, sunflower oil and cotton. Volatility analysis shows a significant and positive effect of lagged volatility on the volatility of poultry prices. Whereas the negative and significant effect on the price volatility of barley, lamb, sunflower oil and cotton is observed due to past price volatility. It is clear from the high GARCH value and volatility analysis that the current prices are more dependent on the past (old) event and their effect is of long duration.

6. Conclusion

In this study, sources of food and agriculture commodity price volatility in Pakistan is investigated through GARCH models. For this purpose, monthly data from April 1983 till April 2013 of selected food and agricultural commodities for Pakistan is used for analysis. Results show crude oil prices are positively and significantly affecting the mean prices of barley, beef, lamb and rapeseed oil. Whereas, volatility of crude oil prices is positively affecting the price volatility of cotton and negatively effects the volatility of sunflower oil and wheat prices. These results indicate that changes in international crude oil prices affect the Pakistani goods market. The exchange rate has a positive and significant effect on mean prices of barley, wheat and soybean oil. The exchange rate volatility does not affect the price volatilities of any commodities selected in this study. The prices of urea positively and significantly affect the mean prices of rice, sugar, rapeseed oil and sunflower oil. Volatility of urea prices is only transmitted on the price volatility of sunflower oil. The interest rate has negative impact on the beef and poultry prices, whereas, it has a positive and significant effect on mean prices of wheat. The volatility of interest rate impacts negatively on the volatility of beef prices. Subsequently, analysis shows that price volatility has significant impact on current prices for all the commodities except for soybean oil, sunflower oil and cotton in Pakistan.

The farmers should be encouraged to use the hedging instruments to reduce the price volatility. Uncertainty in weather conditions, heavy/low rains and floods effect the crop production, low stocks of grains and delayed shipments of the imported edible oil is the source of high prices. Policies need to be developed to control the volatile nature of food/agricultural prices, which is directly effecting the low income group. Whereas, prices of grains can be stabilized by stabilizing the value of Pakistani rupee. So the government should give attention to sustain agricultural sector and agricultural volatility by involving individual institution that will ultimately help to increase GDP. Subsidy on agricultural and food sector inputs will reduce impact of the high cost on small producers and it may also help to attain a general equilibrium level that ultimately reduces the price of food. Developing countries, including Pakistan needed to develop flexible policies and increase investment in the agricultural sector that would boost growth to meet the increasing need of food for the growing population.

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Appendix A

Table 5.1: (a) GARCH (1, 1) Model for Individual Series

	Tea	**Barley**	**Rice**	**Wheat**	**Beef**	**Poultry**	**Lamb**	**Sugar**
Model	ARMA (2, 3)	ARMA (2, 3)	ARMA (2, 1)	ARMA (1, 0)	ARMA (2, 1)	ARMA (1, 2)	ARMA (2, 0)	ARMA (1, 0)
Specifications	t-GARCH (1, 1)	t-GARCH (1, 1)	t-GARCH (1, 1)	t-GARCH (1, 1)	t-GARCH (1, 1)	t-GARCH (1, 1)	t-GARCH (1, 1)	n-GARCH (1, 1)
Mean Equation								
C	0.000275	0.005876	0.001023	-0.000615	0.000872	0.004228	0.000170	-0.000218
t-prob	0.872300	0.028400	0.652400	0.852800	0.646600	0.004300	0.942200	0.967500
AR(1)	-0.207830	0.874844	0.703357	0.245373	0.210163	0.397071	0.302338	0.243416
t-prob	0.001800	0.000000	0.000700	0.000000	0.000300	0.009100	0.000000	0.000000
AR(2)	0.713983	-0.785430	-0.280306		-0.072156		-0.045344	
t-prob	0.000000	0.000000	0.000000		0.198800		0.388200	
MA(1)	0.412858	-0.643273	-0.393246			0.236158		
t-prob	0.000000	0.000000	0.068300			0.116900		
MA(2)	-0.869539	0.515341				0.123561		
t-prob	0.000000	0.000000				0.204500		
MA(3)	-0.309733	0.111723						
t-prob	0.000000	0.111400						
Variance Equation								
C	0.001176	2.419234	3.080723	2.048525	1.849499	0.000000	5.781901	0.000179
t-prob	0.094500	0.123900	0.045400	0.191200	0.117600	1.000000	0.130400	0.224400
α(1)	0.221185	0.182563	0.261568	0.114276	0.141340	0.069682	0.204533	0.087828
t-prob	0.020300	0.027800	0.006000	0.038000	0.049200	0.006400	0.083300	0.005900
β(1)	0.595857	0.798348	0.685648	0.838163	0.725777	0.927044	0.388469	0.887660
t-prob	0.000500	0.000000	0.000000	0.000000	0.000000	0.000000	0.223700	0.000000
Student (DF)	6.533039	3.519292	4.016960	4.546079	5.559765	9.686879	6.176436	
t-prob	0.015500	0.000000	0.000100	0.001100	0.000500	0.063700	0.012800	
α(1)+β(1)| α(1)+β(1)+γ(1)[10]	0.817040	0.980910	0.947220	0.952440	0.867120	0.996730	0.593000	0.975490
Log Likelihood	438.550000	515.604000	581.441000	551.882000	710.793000	969.144000	694.645000	395.708000
Akaike Criteria	-2.380835	-2.808912	-3.185784	-3.032670	-3.909960	-5.339688	-3.820252	-2.170600
Schwarz Criteria	-2.272887	-2.700965	-3.099426	-2.967907	-3.834397	-5.253330	-3.744689	-2.116627
Shibata Criteria	-2.382323	-2.810401	-3.186743	-3.033219	-3.910697	-5.340647	-3.820989	-2.170979
Hannan-Quinn	-2.337913	-2.765991	-3.151446	-3.006922	-3.879915	-5.305350	-3.790206	-2.149139

[10] α(1)+β(1)+γ(1) is for GJR-GARCH model

Table 5.1: (b) GARCH (1, 1) Model for Individual Series

	Rapeseed Oil	**Soybean Oil**	**Sunflower Oil**	**Cotton**	**Crude oil**	**Urea**	**Exchange Rate**	**Interest Rate**
Model	ARMA (1, 0)	ARMA (1, 0)	ARMA (2, 0)	ARMA (1, 1)	ARMA (0, 1)	ARMA (3, 3)	ARMA (3, 0)	ARMA (0, 3)
Specifications	n-GJR (1, 1)	t-GARCH (1, 1)	t-GARCH (1, 1)	t-GARCH (1, 1)	n-EGARCH (1, 1)	t-GARCH (1, 1)	t-EGARCH (1, 1)	t-GARCH (1, 1)
Mean Equation								
C	0.001605	0.002139	-0.000971	-0.002574	-0.005328	0.004711	0.001930	-0.000099
t-prob	0.680400	0.585600	0.734400	0.498900	0.054200	0.338100	0.000200	0.892300
AR(1)	0.081151	0.299812	0.225698	0.299243		0.619897	0.401188	
t-prob	0.093200	0.000000	0.000000	0.004300		0.053600	0.000000	
AR(2)						-0.738434	0.041373	
t-prob						0.000900	0.531900	
AR(3)						0.099793	0.050708	
t-prob						0.572500	0.371700	
MA(1)				0.270674	0.310213	-0.276385		-0.333847
t-prob				0.011400	0.000000	0.395600		0.000000
MA(2)						0.642519		-0.049006
t-prob						0.000600		0.405900
MA(3)						0.050403		-0.029838
t-prob						0.778700		0.524200
Variance Equation								
C	4.206131	2.605837	17.117957	2.792065	0.000000	0.001851	0.000000	0.000001
t-prob	0.000200	0.239900	0.051400	0.046300	1.000000	0.053400	1.000000	1.000000
α(1)	0.078256	0.072645	1.000000	0.231741	0.181332	0.262104	-0.289169	1.000000
t-prob	0.007300	0.078900	0.071000	0.013300	0.421000	0.053100	0.000400	0.003100
β(1)	0.765239	0.844251	0.356086	0.683727	0.990026	0.485583	0.893397	0.538828
t-prob	0.000000	0.000000	0.001400	0.000000	0.000000	0.009100	0.000000	0.000000
γ(1)	0.232487							
t-prob	0.001700							
θ(1)					-0.069009		0.102831	
t-prob					0.294800		0.427400	
θ(2)					0.764323		0.888949	
t-prob					0.000000		0.000000	
Student (DF)		8.335187	2.538609	5.702489		4.886020	3.274801	3.005050
t-prob		0.009600	0.000000	0.023500		0.000700	0.000000	0.000000
α(1)+β(1)| α(1)+β(1)+γ(1)[11]	0.959739	0.916900	1.356090	0.915470	1.171358	0.747690	0.996100	1.538830
Log Likelihood	436.216000	531.010000	526.653000	599.012000	406.648000	427.878000	1220.381000	166.509000
Akaike Criteria	-2.390089	-2.916721	-2.892517	-3.288958	-2.220266	-2.315989	-6.724341	-0.880606
Schwarz Criteria	-2.325321	-2.851952	-2.827748	-3.213395	-2.144703	-2.197247	-6.616394	-0.794248
Shibata Criteria	-2.390633	-2.917264	-2.893060	-3.289695	-2.221003	-2.317784	-6.725830	-0.881565
Hannan-Quinn	-2.364336	-2.890967	-2.866764	-3.258913	-2.190221	-2.268775	-6.681419	-0.846268

[11] α(1)+β(1)+γ(1) is for GJR-GARCH model

Table 5.2: (a) Diagnostic Test for GARCH (1, 1) Model for Individual Series

	Tea	Barley	Rice	Wheat	Beef	Poultry	Lamb	Sugar
Normality Test								
Skewness	0.079790	-0.222370	0.672770	0.545280	-0.382670	-0.241180	0.170500	-0.048153
p-value	0.534850	0.083697	0.000000	0.000022	0.002916	0.060663	0.184790	0.708000
Excess Kurtosis	1.136600	2.686900	2.668500	1.667000	3.480300	0.841290	1.163500	0.354710
p-value	0.000009	0.000000	0.000000	0.000000	0.000000	0.001035	0.000006	0.166600
Jarque-Bera	19.760000	111.260000	133.970000	59.522000	190.470000	14.107000	22.050000	2.026400
p-value	0.000051	0.000000	0.000000	0.000000	0.000000	0.000864	0.000016	0.363060
Q-Statistics on Standardized Residuals								
Q(5)			4.475810	0.837732	4.862490	6.278900	5.827930	1.372700
p-value			[0.1066819]	[0.9333192]	[0.1821478]	[0.0433065]*	[0.1202885]	[0.8489265]
Q(10)	7.448330	7.128290	7.989080	8.039960	12.337000	23.386800	16.482600	2.921740
p-value	[0.1893750]	[0.2112724]	[0.3335578]	[0.5301241]	[0.1367899]	[0.0014593]**	[0.0359704]*	[0.9673169]
Q(20)	23.235900	13.630100	26.928700	18.165500	27.465000	62.666300	27.898000	10.978700
p-value	[0.0792582]	[0.5537500]	[0.0591223]	[0.5114100]	[0.0706767]	[0.0000004]**	[0.0636249]	[0.9245522]
Q(50)	92.879200	67.445700	69.534600	40.449400	64.691800	173.274000	56.487500	30.797900
p-value	[0.0000354]**	[0.0167535]*	[0.0179689]*	[0.8027183]	[0.0542658]	[0.0000000]**	[0.1875255]	[0.9804828]
Q-Statistics on Squared Standardized Residuals								
Q(5)	6.785330	1.722860	2.913910	6.378660	2.093800	7.992200	3.709460	5.210500
p-value	[0.0790641]	[0.6318639]	[0.4050900]	[0.0945728]	[0.5531672]	[0.0461732]*	[0.2945948]	[0.1570166]
Q(10)	8.221050	6.708720	6.402940	9.222920	3.611080	9.896220	5.491970	11.180000
p-value	[0.4121810]	[0.5683605]	[0.6021926]	[0.3238409]	[0.8903997]	[0.2723853]	[0.7039291]	[0.1917070]
Q(20)	20.023100	26.719300	17.071700	20.404100	6.883720	13.900000	36.347100	18.079500
p-value	[0.3315223]	[0.0844134]	[0.5181838]	[0.3105336]	[0.9910708]	[0.7355853]	[0.0063675]**	[0.4504279]
Q(50)	63.418500	96.261600	41.500500	59.961000	26.457100	48.797200	54.275200	58.884600
p-value	[0.0671323]	[0.0000445]**	[0.7346716]	[0.1153120]	[0.9951172]	[0.4408046]	[0.2476522]	[0.1349151]
ARCH TEST								
ARCH(1-2)	1.826200	0.025858	0.683540	0.619640	0.462660	2.123800	0.448720	0.313720
p-value	[0.1625]	[0.9745]	[0.5055]	[0.5387]	[0.6300]	[0.1211]	[0.6388]	[0.7309]
ARCH(1-5)	1.428100	0.356000	0.594700	1.230200	0.413770	1.382700	0.666330	1.006900
p-value	[0.2134]	[0.8783]	[0.7041]	[0.2944]	[0.8391]	[0.2301]	[0.6492]	[0.4135]
ARCH(1-10)	0.901650	0.673070	0.643860	0.818620	0.338210	0.505710	0.543290	1.078300
p-value	[0.5318]	[0.7495]	[0.7759]	[0.6109]	[0.9702]	[0.8858]	[0.8589]	[0.3781]
Residual based diagnostic								
RBD(2)	1.237590	-0.313595	-0.060119	-0.341200	2.409050	50.093400	-8.838740	0.513363
p-value	[0.5385935]	[1.0000000]	[1.0000000]	[1.0000000]	[0.2998341]	[0.0000000]	[1.0000000]	[0.7736146]
RBD(5)	6.612950	1.045610	1.659690	6.890390	4.123650	-22.801600	4.905260	5.522160
p-value	[0.2510534]	[0.9588035]	[0.8939390]	[0.2289206]	[0.5317542]	[1.0000000]	[0.4275514]	[0.3555225]
RBD(10)	8.578350	6.118970	8.764570	9.030900	5.937550	4.025180	6.433910	16.452900
p-value	[0.5725316]	[0.8051709]	[0.5545830]	[0.5291740]	[0.8204820]	[0.9462039]	[0.7775863]	[0.0873812]

Note: * shows the 5% level of significance and ** shows significance at 1%. Q-Statistics is the Ljung-Box statistics based on standardized residual and square of standardized residual up to lag 50 with H_0: no serial correlation. LM-ARCH (n) Lagrange multiplier test for ARCH effect up to order n, its H_0: series is not subject to ARCH effect. JB (Jarque Bera) test H_0: series is normal

Table 5.2: (b) Diagnostic Test for GARCH (1, 1) Model for Individual Series

	Rapeseed Oil	Soybean Oil	Sunflower Oil	Cotton	Crude oil	Urea	Exchange Rate	Interest Rate
Normality Test								
Skewness	0.338080	0.316550	5.339300	-0.033660	-0.217370	-0.756070	4.529800	3.533100
p-value	0.008548	0.013810	0.000000	0.793460	0.090883	0.000000	0.000000	0.000000
Excess Kurtosis	3.882700	1.698200	70.478000	0.869130	0.689350	2.805700	34.276000	39.858000
p-value	0.000000	0.000000	0.000000	0.000701	0.007183	0.000000	0.000000	0.000000
Jarque-Bera	232.990000	49.268000	76217.000000	11.399000	9.963200	152.380000	18854.000000	24579.000000
p-value	0.000000	0.000000	0.000000	0.003348	0.006863	0.000000	0.000000	0.000000
Q-Statistics on Standardized Residuals								
Q(5)	0.449135	7.370060	3.689700	6.647270	3.927090		0.668564	3.100910
p-value	[0.9782601]	[0.1175774]	[0.4496252]	[0.0840320]	[0.4159629]		[0.7158517]	[0.2121509]
Q(10)	3.305100	9.243770	6.931410	14.560800	7.412210	8.515190	2.324930	6.846070
p-value	[0.9509616]	[0.4150831]	[0.6442603]	[0.0682696]	[0.5942848]	[0.0744282]	[0.9396934]	[0.4450812]
Q(20)	16.752300	13.708300	11.421200	31.250800	25.372200	29.068900	21.883300	29.478400
p-value	[0.6066439]	[0.8004211]	[0.9088550]	[0.0269220]*	[0.1486509]	[0.0102282]*	[0.1892493]	[0.0303613]*
Q(50)	45.453600	53.795800	52.265000	57.648000	57.121800	78.288700	51.694800	61.679300
p-value	[0.6177004]	[0.2958518]	[0.3483413]	[0.1604622]	[0.1988991]	[0.0011194]**	[0.2955434]	[0.0739068]
Q-Statistics on Squared Standardized Residuals								
Q(5)	3.634840	4.205550	0.168354	6.576790	4.435180	1.376070	0.528775	0.605223
p-value	[0.3036904]	[0.2401067]	[0.9825287]	[0.0866827]	[0.2181454]	[0.7111528]	[0.9125257]	[0.8952358]
Q(10)	6.151480	6.114020	0.289105	9.546600	14.189100	3.868430	0.958538	0.763137
p-value	[0.6302686]	[0.6344614]	[0.9999838]	[0.2983003]	[0.0769683]	[0.8687946]	[0.9984970]	[0.9993478]
Q(20)	12.981900	10.057200	0.456381	17.605200	23.627200	12.175400	73.220200	25.497500
p-value	[0.7926481]	[0.9300241]	[1.0000000]	[0.4819313]	[0.1676262]	[0.8380499]	[0.0000000]**	[0.1118154]
Q(50)	53.431600	27.016900	11.916200	47.519400	46.964900	38.913700	77.271800	27.583700
p-value	[0.2735119]	[0.9937711]	[1.0000000]	[0.4924399]	[0.5152274]	[0.8222822]	[0.0046817]**	[0.9921098]
ARCH TEST								
ARCH(1-2)	0.708680	1.237800	0.029811	1.001100	0.171810	0.365260	0.093733	0.166720
p-value	[0.4930]	[0.2913]	[0.9706]	[0.3685]	[0.8422]	[0.6943]	[0.9105]	[0.8465]
ARCH(1-5)	0.788470	1.966300	0.031634	1.296200	0.926680	0.270460	0.108150	0.113150
p-value	[0.5585]	[0.0831]	[0.9995]	[0.2650]	[0.4637]	[0.9291]	[0.9905]	[0.9894]
ARCH(1-10)	0.667390	1.157600	0.026473	0.918730	1.446800	0.356970	0.102220	0.071498
p-value	[0.7546]	[0.3188]	[1.0000]	[0.5159]	[0.1583]	[0.9638]	[0.9998]	[1.0000]
Residual based diagnostic								
RBD(2)	1.667440	7.238770	0.052895	1.300760	5.115080	1.817610	0.021133	0.432463
p-value	[0.4344312]	[0.0267992]	[0.9738992]	[0.5218469]	[0.0774952]	[0.4030059]	[0.9894894]	[0.8055489]
RBD(5)	3.795140	7.024360	0.150346	6.832980	10.092200	2.076030	0.083496	0.518440
p-value	[0.5792719]	[0.2188353]	[0.9995581]	[0.2333612]	[0.0726638]	[0.8385279]	[0.9998960]	[0.9914325]
RBD(10)	6.330680	11.048500	0.250990	9.972830	16.954000	3.705040	0.345620	0.721150
p-value	[0.7867579]	[0.3537558]	[0.9999998]	[0.4428804]	[0.0753891]	[0.9596736]	[0.9999989]	[0.9999623]

Note: * shows the 5% level of significance and ** shows significance at 1%. Q-Statistics is the Ljung-Box statistics based on standardized residual and square of standardized residual up to lag 50 with H_0: no serial correlation. LM-ARCH (n) Lagrange multiplier test for ARCH effect up to order n, its H_0: series is not subject to ARCH effect. JB (Jarque Bera) test H_0: series is normal

Table 5.3: (a) GARCH (1, 1) Modelling and Factors Effecting Volatility

	Tea	**Barley**	**Rice**	**Wheat**	**Beef**	**Poultry**
Model	ARMA (2, 3)	ARMA (3, 3)	ARMA (2, 3)	ARMA (1, 3)	ARMA (2, 1)	ARMA (1, 1)
Specifications	n-EGARCH (1, 1)	n-GARCH (1, 1)	n-GARCH (1, 1)	n-GARCH (1, 1)	t-EGARCH (1, 1)	t-GARCH (1, 1)
Mean Equation						
C	0.002268	-0.001643	-0.000300	0.001049	-0.001450	-0.000955
t-prob	0.350100	0.510300	0.910200	0.549400	0.365900	0.048800
Rcroil	-0.003926	**0.079640**	-0.042237	-0.008316	**0.061500**	-0.003961
t-prob	0.895700	**0.007200**	0.168800	0.747400	**0.000000**	0.522700
Rex	-0.280251	**0.262956**	-0.455654	**0.463099**	0.144770	0.028193
t-prob	0.074400	**0.003800**	0.091900	**0.002900**	0.258800	0.620300
Ru	0.012458	0.037407	**0.126906**	0.027490	0.001241	0.003971
t-prob	0.658500	0.204500	**0.000000**	0.441600	0.955100	0.520800
Ri	**-0.019864**	0.001417	-0.001402	**0.020394**	**-0.008621**	**-0.007592**
t-prob	**0.000500**	0.823800	0.857300	**0.003500**	**0.024100**	**0.006000**
Lagged CondM	**0.630128**	**0.869554**	**1.770410**	**0.647853**	**1.187496**	**1.121253**
t-prob	**0.015600**	**0.000000**	**0.000100**	**0.000600**	**0.000000**	**0.000000**
AR(1)	**0.552140**	**-0.580784**	**0.769914**	**0.946654**	**-1.000000**	**0.811548**
t-prob	**0.005800**	**0.004200**	**0.001900**	**0.000000**	**0.000000**	**0.000000**
AR(2)	-0.489195	-0.899320	-0.416297		-0.013006	
t-prob	0.018600	0.000000	0.040800		0.835500	
AR(3)		-0.401970				
t-prob		0.042900				
MA(1)	**-0.479026**	**0.628401**	**-1.000000**	**-0.866977**	**0.979315**	**-0.961775**
t-prob	**0.005500**	**0.001600**	**0.000000**	**0.000000**	**0.000000**	**0.000000**
MA(2)	0.473527	0.988513	0.678205	-0.126682		
t-prob	0.027700	0.000000	0.003700	0.129800		
MA(3)	-0.124294	0.432963	0.031026	-0.035315		
t-prob	0.097900	0.032500	0.791400	0.605900		
Variance Equation						
C	0.000000	1.835683	3.809330	2.112167	0.000000	0.136676
t-prob	1.000000	0.003600	0.001100	0.005600	1.000000	0.290900
SqRcroil	0.880751	-0.005982	0.002196	**-0.016221**	-17.430403	-0.000516
t-prob	0.916300	0.230200	0.799800	**0.000000**	0.082200	0.624000
SqRex	-100.000000	-0.003067	0.144914	-0.008169	82.390333	0.055075
t-prob	0.547600	0.865800	0.667300	0.780100	0.772500	0.207000
SqRu	3.000308	0.005416	-0.008784	0.007163	9.193257	-0.001218
t-prob	0.661600	0.145700	0.314900	0.283000	0.226100	0.213400
SqRi	-0.410239	-0.000259	0.000038	-0.000267	**-0.831344**	0.000038
t-prob	0.239200	0.057300	0.906400	0.069200	**0.023300**	0.622200
Lagged CondV	-52.096306	**-0.103255**	-0.039208	-0.004733	-100.000000	**0.327140**
t-prob	0.275800	**0.000000**	0.682600	0.911100	0.665200	**0.047200**
α(1)	1.176278	**0.097406**	**0.323885**	0.036421	0.802665	**0.235363**
t-prob	0.127700	**0.000100**	**0.000000**	0.158500	0.129600	**0.020100**
β(1)	**0.990800**	**0.991151**	**0.624360**	**0.932157**	**0.469657**	**0.396124**
t-prob	**0.000000**	**0.000000**	**0.000000**	**0.000000**	**0.001100**	**0.024000**
θ(1)	-0.023473				0.041552	
t-prob	0.531200				0.544200	
θ(2)	0.428289				0.423854	
t-prob	0.016600				0.002400	
Student (DF)					8.433904	11.242758
t-prob					0.010300	0.154500
α(1)+β(1)/ α(1)+β(1)+γ(1)[12]	2.167078	1.088560	0.948240	0.968580	1.272322	0.631490
Log Likelihood	431.908000	512.749000	578.706000	560.274000	714.332000	986.696000
Akaike Criteria	-2.282824	-2.737497	-3.109476	-3.012633	-3.857398	-5.387200
Schwarz Criteria	-2.056135	-2.521602	-2.904376	-2.818328	-3.641504	-5.203690
Shibata Criteria	-2.289143	-2.743247	-3.114683	-3.017323	-3.863149	-5.391398
Hannan-Quinn	-2.192688	-2.651653	-3.027924	-2.935374	-3.771554	-5.314233

[12] α(1)+β(1)+γ(1) is for GJR-GARCH

Table 5.3: (b) GARCH (1, 1) Modelling and Factors Effecting Volatility

	Lamb	**Sugar**	**Rapeseed Oil**	**Soybean Oil**	**Sunflower Oil**	**Cotton**
Model	ARMA (2, 0)	ARMA (3, 3)	ARMA (3, 3)	ARMA (2, 0)	ARMA (2, 0)	ARMA (2, 3)
Specifications	t-GARCH (1, 1)	n-GJR (1, 1)	t-GARCH (1, 1)	n-GJR (1, 1)	n-GJR (1, 1)	n-GJR (1, 1)
Mean Equation						
C	0.000473	0.003025	0.001256	0.006189	-0.000430	0.000669
t-prob	0.474200	0.219600	0.633800	0.166700	0.891100	0.830700
Rcroil	**0.042803**	0.008337	**0.098328**	0.055792	-0.019087	0.023462
t-prob	**0.001400**	0.877100	**0.003300**	0.074000	0.396100	0.451700
Rex	-0.098262	-0.118415	0.011179	**0.259919**	0.108979	-0.015001
t-prob	0.156100	0.698300	0.963000	**0.037900**	0.468800	0.916500
Ru	0.003765	**0.163614**	**0.093928**	0.041963	**0.093408**	0.045460
t-prob	0.787400	**0.001200**	**0.004100**	0.250800	**0.021300**	0.127500
Ri	-0.001806	0.010830	-0.000635	0.001772	0.002981	0.001016
t-prob	0.498700	0.336200	0.949800	0.834500	0.683000	0.864500
Lagged CondM	**1.958054**	**1.022506**	**1.012391**	-0.538844	0.035333	0.401070
t-prob	**0.000000**	**0.000000**	**0.000400**	0.401600	0.932500	0.398800
AR(1)	**-0.311667**	**0.856912**	**0.284580**	**0.531171**	**0.411213**	**0.658905**
t-prob	**0.000000**	**0.000000**	**0.000000**	**0.008100**	**0.000700**	**0.000000**
AR(2)	-0.168914	0.875720	0.009504	-0.193408	-0.161641	-0.815656
t-prob	0.000300	0.000000	0.889900	0.105900	0.109600	0.000000
AR(3)		-0.777928	-0.870649			
t-prob		0.000000	0.000000			
MA(1)		**-0.871416**	**-0.284528**			-0.370292
t-prob		**0.000000**	**0.000000**			0.112200
MA(2)		-0.901384	-0.047717			0.738040
t-prob		0.000000	0.386500			0.000000
MA(3)		0.797508	0.947201			0.211964
t-prob		0.000000	0.000000			0.317600
Variance Equation						
C	12.171101	0.000382	7.164106	0.000000	3.649995	1.992625
t-prob	0.002800	0.357100	0.437700	1.000000	0.000000	0.000900
SqRcroil	0.004528	0.035075	0.010703	0.006016	**-0.013469**	**0.014149**
t-prob	0.106600	0.376100	0.780700	0.124500	**0.000500**	**0.021400**
SqRex	0.029081	0.138436	2.157008	-0.034697	-0.028969	-0.021796
t-prob	0.200200	0.696300	0.418200	0.548900	0.382600	0.666200
SqRu	0.001741	-0.010836	0.030420	0.016170	**0.022848**	0.003990
t-prob	0.324100	0.697700	0.644100	0.067700	**0.000000**	0.535200
SqRi	0.000071	-0.000494	0.007657	0.000420	-0.000103	0.000053
t-prob	0.285500	0.563000	0.348900	0.168300	0.358300	0.726900
Lagged CondV	**-1.259163**	0.076215	0.125905	0.051155	**-0.078040**	**-0.140668**
t-prob	**0.003100**	0.562700	0.568000	0.603100	**0.001000**	**0.022600**
α(1)	**0.372048**	**0.177569**	0.171705	**0.093717**	**0.140113**	**0.249840**
t-prob	**0.008100**	**0.032700**	0.310300	**0.026500**	**0.001200**	**0.000000**
β(1)	**0.994868**	**0.726425**	**0.629037**	**0.872651**	**0.960321**	**0.825897**
t-prob	**0.000000**	**0.000000**	**0.001400**	**0.000000**	**0.000000**	**0.000000**
γ(1)		-0.121846		-0.162047	-0.067735	-0.095297
t-prob		0.263300		0.000100	0.000000	0.168500
Student (DF)	7.388074		2.401002			
t-prob	0.085300		0.000000			
α(1)+β(1)/ α(1)+β(1)+γ(1)[13]	1.366920	0.782148	0.800740	0.804321	1.032699	0.980440
Log Likelihood	712.826000	412.084000	501.462000	542.438000	459.622000	606.569000
Akaike Criteria	-3.865701	-2.172689	-2.669235	-2.919102	-2.459011	-3.258715
Schwarz Criteria	-3.682190	-1.945999	-2.442545	-2.735591	-2.275500	-3.042820
Shibata Criteria	-3.869898	-2.179007	-2.675553	-2.923299	-2.463208	-3.264466
Hannan-Quinn	-3.792734	-2.082553	-2.579099	-2.846135	-2.386044	-3.172871

[13] α(1)+β(1)+γ(1) is for GJR-GARCH

Table 5.4: (a) Diagnostic Test for GARCH (1, 1) Modelling and Factors Effecting Volatility

	Tea	Barley	Rice	Wheat	Beef	Poultry
Normality Test						
Skewness	-0.020163	-0.23559	0.45617	0.31592	-0.11505	0.01517
p-value	0.875380	0.066881	3.88E-04	1.40E-02	0.37087	0.90605
Excess Kurtosis	0.414060	1.1403	1.6711	0.92837	1.7972	0.59063
p-value	0.106380	8.72E-06	7.19E-11	2.94E-04	2.41E-12	0.02127
Jarque-Bera	2.596100	22.835	54.372	18.916	49.244	5.24640
p-value	0.273070	1.10E-05	1.56E-12	7.80E-05	2.03E-11	0.07257
Q-Statistics on Standardized Residuals						
Q(5)				1.613150	1.50318	2.56614
p-value				[0.2040499]	[0.4716153]	[0.4634567]
Q(10)	9.198560	6.60951	4.67836	8.11273	9.7788	10.99380
p-value	[0.1014014]	[0.1580198]	[0.4563796]	[0.2299603]	[0.2014583]	[0.2020530]
Q(20)	20.904900	9.74274	23.3874	17.8307	23.3032	40.09200
p-value	[0.1398938]	[0.7807397]	[0.0762545]	[0.3339016]	[0.1396374]	[0.0020279]**
Q(50)	90.317600	64.3758	77.7006	38.7101	61.6395	122.81800
p-value	[0.0000715]**	[0.0241661]*	[0.0017689]**	[0.7684698]	[0.0743887]	[0.0000000]**
Q-Statistics on Squared Standardized Residuals						
Q(5)	10.060300	4.51525	1.98484	5.05315	2.86271	2.88152
p-value	[0.0180602]*	[0.2109344]	[0.5755586]	[0.1679463]	[0.4132807]	[0.4102552]
Q(10)	14.616300	9.82186	4.96053	6.72725	5.63167	7.09625
p-value	[0.0670492]	[0.2777526]	[0.7617866]	[0.5663255]	[0.6884124]	[0.5262848]
Q(20)	26.516000	36.9939	13.0021	20.7451	14.8833	10.80480
p-value	[0.0885319]	[0.0052502]**	[0.7914456]	[0.2924684]	[0.6699607]	[0.9024543]
Q(50)	73.753600	100.71	37.0058	43.9046	43.2787	41.58410
p-value	[0.0098553]**	[0.0000131]**	[0.8753232]	[0.6412859]	[0.6663876]	[0.7315850]
ARCH TEST						
ARCH(1-2)	1.723300	0.96715	0.34748	1.7123	0.25611	0.12414
p-value	[0.1800]	[0.3812]	[0.7067]	[0.1820]	[0.7742]	[0.8833]
ARCH(1-5)	1.923900	0.85472	0.39545	1.0425	0.58965	0.53023
p-value	[0.0897]	[0.5118]	[0.8519]	[0.3924]	[0.7079]	[0.7534]
ARCH(1-10)	1.534600	0.95682	0.49186	0.67385	0.5358	0.78450
p-value	[0.1255]	[0.4812]	[0.8951]	[0.7487]	[0.8645]	[0.6438]
Residual based diagnostic						
RBD(2)	5.895610	3.20717	0.862393	3.61906	16.1609	0.11139
p-value	[0.0524546]	[0.2011744]	[0.6497312]	[0.1637311]	[0.0003095]	[0.9458254]
RBD(5)	14.910300	4.16143	2.15905	6.10789	1.10841	2.62676
p-value	[0.0107527]	[0.5264160]	[0.8267283]	[0.2958622]	[0.9533565]	[0.7572959]
RBD(10)	35.565500	7.76805	6.51142	8.37384	25.8656	11.20300
p-value	[0.0000999]	[0.6514813]	[0.7706238]	[0.5923712]	[0.0039252]	[0.3419260]

Table 5.4: (b) Diagnostic Test for GARCH (1, 1) Modelling and Factors Effecting Volatility

	Lamb	Sugar	Rapeseed Oil	Soybean Oil	Sunflower Oil	Cotton
Normality Test						
Skewness	0.301770	0.043420	0.666850	0.253770	2.259000	0.028219
p-value	0.018916	0.735570	0.000000	0.048394	0.000000	0.826270
Excess Kurtosis	0.785280	0.319410	8.921900	1.130800	22.252000	0.536620
p-value	0.002197	0.212920	0.000000	0.000010	0.000000	0.036383
Jarque-Bera	14.714000	1.643400	1220.700000	23.044000	7733.400000	4.367200
p-value	0.000638	0.439680	0.000000	0.000010	0.000000	0.112640
Q-Statistics on Standardized Residuals						
Q(5)	2.706250			1.792070	2.366920	
p-value	[0.4391670]			[0.6166615]	[0.4998229]	
Q(10)	8.558860	2.430830	3.884410	2.839640	7.091640	12.140100
p-value	[0.3808640]	[0.6570624]	[0.4218754]	[0.9440140]	[0.5267780]	[0.0329172]*
Q(20)	16.765900	8.663470	14.809600	8.725470	15.683900	31.880600
p-value	[0.5392506]	[0.8519860]	[0.3912935]	[0.9657669]	[0.6146006]	[0.0066834]**
Q(50)	43.189500	31.328700	53.418600	50.430500	51.856900	52.453600
p-value	[0.6699260]	[0.9243294]	[0.1562126]	[0.3775867]	[0.3259107]	[0.2073950]
Q-Statistics on Squared Standardized Residuals						
Q(5)	3.369510	5.377780	5.417790	4.039500	0.207096	8.031770
p-value	[0.3380847]	[0.1461341]	[0.1436394]	[0.2572306]	[0.9764357]	[0.0453597]*
Q(10)	5.945800	6.498050	7.146470	5.805940	0.539511	14.650200
p-value	[0.6533031]	[0.5916236]	[0.5209157]	[0.6689586]	[0.9998220]	[0.0663155]
Q(20)	26.891200	13.622400	20.873900	10.621000	1.457000	20.587900
p-value	[0.0810585]	[0.7533528]	[0.2858246]	[0.9097438]	[0.9999999]	[0.3007092]
Q(50)	50.103000	48.177400	97.854200	50.304800	24.106900	45.984700
p-value	[0.3899539]	[0.4656655]	[0.0000289]**	[0.3823150]	[0.9984408]	[0.5557833]
ARCH TEST						
ARCH(1-2)	1.041100	0.615950	2.320200	0.726450	0.018897	0.521550
p-value	[0.3541]	[0.5407]	[0.0997]	[0.4843]	[0.9813]	[0.5941]
ARCH(1-5)	0.633230	1.157700	1.676000	2.107300	0.040554	1.628900
p-value	[0.6745]	[0.3297]	[0.1397]	[0.0641]	[0.9991]	[0.1516]
ARCH(1-10)	0.599060	0.667450	1.003200	1.482300	0.050769	1.176300
p-value	[0.8146]	[0.7546]	[0.4403]	[0.1443]	[1.0000]	[0.3057]
Residual based diagnostic						
RBD(2)	2.373560	1.487060	2.150860	3.458030	0.162740	1.241160
p-value	[0.3052023]	[0.4754317]	[0.3411506]	[0.1774587]	[0.9218525]	[0.5376332]
RBD(5)	3.267680	4.037120	12.073300	6.407440	0.213144	10.141800
p-value	[0.6587931]	[0.5440848]	[0.0337964]	[0.2685665]	[0.9989658]	[0.0713154]
RBD(10)	7.532770	4.981760	30.581600	11.643700	0.459238	19.154500
p-value	[0.6743709]	[0.8923929]	[0.0006877]	[0.3096077]	[0.9999956]	[0.0383436]

Note: * shows the 5% level of significance and ** shows significance at 1%. Q-Statistics is the Ljung-Box statistics based on standardized residual and square of standardized residual upto lag 50 with H_0: no serial correlation. LM-ARCH (n) Lagrange multiplier test for ARCH effect up to order n, its H_0: series is not subject to ARCH effect. JB (Jarque Bera) test H_0: series is normal

Journal of Economic Cooperation and Development, **38**, 3 (2017), 121-144

Validity of International Fisher Effect in the West African Monetary Zone

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This paper investigates the validity of the International Fisher Effect in the West African Monetary Zone (WAMZ). The conventional Engle-Granger and fractional cointegration tests were employed on nominal exchange differentials and exchange rates change of all the countries within the WAMZ except Liberia due to lack of data. We observed cointegrating relationship in fifteen out of the twenty country pairs; indicating evidence of common stochastic drift in nominal exchange differentials and exchange rates change.

However, the assumptions necessary for the validity of very weak International Fisher Effect were met for only between Ghana and Cape Verde and between Ghana and Sierra Leone at five percent significance level; an evidence of lack of macroeconomic coordination. It is important to note that macroeconomic coordination is necessary condition for currency union and seen as alternative to member countries meeting the convergence criterion. These findings are seen as setback to the common currency agenda of WAMZ because the findings signify lack of macroeconomic coordination among would-be currency union countries, which is a necessary condition for conduct of monetary policy.

Keywords: International Fisher Effect, West African Monetary Zone, Fractional Integration

JEL Classification: G15, E40, E43, C22

Introduction

An understanding of the relationship between exchange rates, interest rates, and other macroeconomic variables such as inflation rates is very important to the monetary authorities and central banks. This is because

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central banks dwell on coordination of these indicators to formulate monetary policy and management of foreign exchange. The movements in these variables are also critical to the activities of investors, arbitrageurs, speculators and other stakeholders in the international money market.

The International Fisher Effect (IFE) posits that the difference in interest rates between countries predicts the expected exchange rates between their currencies. In other words, differences in nominal interest rates between two countries for example should be proportional to an appreciation or depreciation in value of the respective currencies of these two countries. The IFE theory suggests that at any point in time, a country with relatively higher nominal interest rates should experience depreciation in value of its currency because high nominal interest rates reflect high expected inflation. This ensures that no investor in either country is better off with the same level of investment. In principle, if IFE holds, then an investor in a country with relatively higher nominal interest rate, although will benefit from the higher returns on his investment, should experience a reduction in the overall value of his investment and vice versa. In brief, the theory asserts that the higher interest rate country's currency is expected to depreciate until the real returns of investments are equalized across countries. The implication is that an uncovered interest arbitrage would be a profitless transaction.

With the proposed formation of West Africa Monetary Zone (WAMZ), it has become imperative to examine the validity of IFE. According to Arghyrou, Gregoriou and Kontonikas (2009), the validity of IFE implies the equality of real interest rate, which is necessary for effectiveness of monetary and fiscal policy. This paper contributes to macroeconomic convergence in the WAMZ by investigating the validity of IFE, which is missing in WAMZ macroeconomic convergence literature.

The findings revealed that nominal exchange differentials and exchange rates change of fifteen out of the twenty country pairs cointegrate. We however observed validity of very weak IFE for only between Ghana and Cape Verde and between Ghana and Sierra Leone at five percent significance level.

In the next section, background of the WAMZ is reviewed together with recent developments. Section 3 presents related studies and empirical

evidence on the validity of the international fisher effect. The final section explores the IFE in the WAMZ and conclusions drawn thereof.

The West African Monetary Zone

Over the last forty years, most economies in Sub-Saharan Africa have been characterised by exchange rate instability, financial fragility and high inflation. This was due to fixed exchange rates that were in operation almost across the globe, with occasional adjustments made by respective monetary authorities. The consequence of the fixed exchange rate regime was severe terms of trade shocks, particularly to primary commodity exporting African countries, which also resulted in over-valued exchange rate (Alagidede Tweneboah & Adam, 2008; Badiane & Makombe, 2014).

Although, contemporary look at the continent's growth performance leads to the conclusion that Africa is at a historical crossroads, which could lead to convergence with emerging markets, and ultimately with advanced economies (Sy, 2016) as against earlier view diverging from rather than converging on the industrialized world (Easterly & Levine, 1997; World Bank, 2003), the catching-up seems slower than expected. Pervasive corruption and implementation of inappropriate policies enhanced the development of parallel market for foreign exchange and other goods, speculative activities in agricultural trade, and smuggling of essential goods to neighbouring African countries (Kargbo, 2003; Collier, & Dercon, 2013). The elimination of national currencies and their replacement by a common regional currency continues to be a topical subject. The reasons for doing so range from the quest to promote regional solidarity and integration, and that independent national currencies may be subject to destabilizing speculation.

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Under the auspices of ECOWAS, the heads of states of member countries adopted the ECOWAS monetary cooperation programme in 1987 to accelerate the process of integration within the sub region.

This programme entails the adoption of collective policies designed to achieve a harmonised monetary system. A single monetary zone was envisioned by member states by 2003, under which members will have to meet convergence criteria which include the following:

a. A ceiling on central bank financing of budget deficits of 10% of the previous year's tax revenue
b. The maintenance of single digit inflation for all countries
c. Restriction of the budget deficit to no more than 4% of GDP, and thereafter to 3%
d. Countries with floating exchange rates were to reduce variability of nominal exchange rates to less than 10% and thereafter to 5%

However, participating countries have failed to meet these criteria necessary to sustain the monetary union. As a result of the inability to meet these criteria, a second monetary zone made up of fewer countries was agreed to facilitate the whole process of integration. The West African Monetary Zone (WAMZ) was created in April 2000 with the signature of the Accra Declaration by the leaders of Gambia, Ghana, Guinea, Liberia, Nigeria and Sierra Leone. The objective of the West African Monetary Zone is to establish a monetary union characterized by a common central bank that will ensure the implementation of common monetary and exchange rate policies. The setting up of WAMZ has been motivated by the need to ultimately merge the two regional bodies: : L'Union Economiqueet Monetaire Ouest Africaine (UEMOA) and WAMZ; which will eventually lead to the adoption of a common ECOWAS currency (Balogun, 2008).

Similarly, WAMZ set out ten convergence criteria made up of four primary and six secondary criteria. The primary criteria are deeming to be the necessary condition for the introduction of the common currency. The four Primary Criteria to be achieved by each member country are:

a. A single-digit inflation rate at the end of each year
b. A fiscal deficit of no more than 4% of the GDP
c. A central bank deficit-financing of no more than 10% of the previous year's tax revenues
d. Gross external reserves that can give import cover for a minimum of three months.

The six Secondary Criteria to be achieved by each member country are:

a. Prohibition of new domestic default payments and liquidation of existing ones.
b. Tax revenue should be equal to or greater than 20 percent of the GDP.
c. Wage bill to tax revenue equal to or less than 35 percent.
d. Public investment to tax revenue equal to or greater than 20 percent.
e. A stable real exchange rate.
f. A positive real interest rate.

The WAMZ countries were due to reach the final convergent point before the year 2015 and issue a common currency to be called the *ECO*. This target was missed and now no more but single ECOWAS currency in 2020. The processes leading to this goal are already in motion. The challenge is the collective attainment of the primary convergence. This is evident from the status of compliance with primary convergence criteria from 2001-20012 presented in Table 1. The launching of monetary union in WAMZ has been postponed thrice following the poor performance in achieving the convergence criteria (Oshikoya & Tarawalie, 2010).

Table 1: Status of compliance with each Primary convergence criteria

Country Performance on the Primary Criteria- Dec 2001 - 2012							Status of compliance with each Primary convergence criteria by all countries-Dec 2001-2012			
	Gambia	Ghana	Guinea	Liberia	Nigeria	Sierra Leone	Inflation	Budget deficit	Central Bank financing of budget deficits	Gross External Reserves/Import Cover
2001	2	1	3	n.a	3	2	**3**	1	4	3
2002	1	0	2	n.a	3	2	**2**	1	2	3
2003	1	2	0	n.a	2	0	**0**	1	1	3
2004	3	1	0	n.a	3	2	**1**	1	3	4
2005	3	2	2	n.a	3	2	**1**	2	5	4
2006	4	2	1	n.a	4	2	**3**	3	3	4
2007	4	2	2	1	4	2	**2**	3	6	4
2008	4	0	1	3	3	2	**2**	4	4	3
2009	3	2	1	4	3	1	**3**	2	4	5
2010	2	3	0	4	2	1	**3**	0	3	5
2011	3	4	2	3	3	1	**2**	3	6	5
2012	3	3	2	3	3	2	**3**	2	6	5

Source: West Africa Monetary Institute, 2013

Note: The left panel of Table 1 presents the number primary convergence criterial satistfied by each member country from 2001 to 2012 and the right panel reports number of countries satisfying each criteria relating to the four basic criteria from 2001 to 2012.

Literature Review

IFE is one of the five interest rates parity conditions that results from arbitrage activities apart from the purchasing power parity, Fisher effect, interest rate parity, and the Expectations theory. The international fisher effect is the combination of the theory of purchasing power parity and the generalized Fisher effect (Sundqvist, 2002). It is therefore noteworthy to present a brief discussion of the fisher effect and the purchasing power parity and eventually establishing the connection between the IFE and these two theories.

The Fisher Effect

The Fisher hypothesis, initiated by Fisher (1930), suggests that there is a positive correlation between nominal interest rates and expected inflation. This was made on the basis that a permanent change in inflation rate will cause an equal change in the nominal interest rate, implying that real interest rates are constant and unaffected by monetary measures. The Fisher effect can be defined as a one-to-one relationship between nominal interest rates and expected inflation, leaving real interest rates independent of the inflation rate (Ray, 2012). Evidence of the Fisher hypothesis has been tested using the basic version of the equation below:

$$r_t = a + \beta n_t \qquad (1)$$

Since the hypothesis predicts a one to one relationship, β is expected to be equal to one (1), and $a$equal to zero, in order to conclude for a strong Fisher effect. If βis positive but not equal to one, then there is evidence of the weaker form of the Fisher effect. Bajo-Rubio et al (2003) reports the contributions made by Moazzami (1991), Mishkin (1992), Peláez (1995) , Crowder (1997) , Bajo-Rubio and Esteve (1998), or Koustas and Serletis (1999) in establishing some empirical evidence, following the early work of Rose (1988).

According to Westerlund (2008) in spite of the recent advances in econometric methodology for testing long-run relationships using co-integration techniques coupled with the wide acceptance of the Fisher effect in theory, the hypothesized long-run one-for-one relationship between inflation and nominal interest rates has proven very difficult to

establish empirically. Several empirical analyses have been done and various models have been proposed and tested (using data from both developed and developing countries) for the Fisher effect.

The Purchasing Power Parity (PPP)

The purchasing power parity states that the spot exchange rates between currencies will change the inflation rates between domestic and foreign countries. The basic concept underlying this theory is the law of one price. Thus, in effect the position of the PPP is that forces of arbitrage will result in the equalisation of prices of goods measured in the same currency. Purchasing power parity comes in two versions: the absolute version and the relative version. Alessandria and Kaboski (2004) states that, although Absolute purchasing power parity (PPP) is best known, it is one of the most easily rejected ideas in economics. Among the reasons include: transport cost, non-tradable goods, imperfect information and the substantial differences in the general price levels across countries so that the same basket of goods sells for a different price depending on the country in which it is sold. Price levels are strongly positively correlated with real per capita GDP, so that consumers in low-income countries pay considerably less for the same basket of goods than consumers in high-income countries. Nonetheless, it is argued that the weaker form of PPP, which is the relative PPP is expected to hold even in the presence of these distortions (Pilbeam, 2006). Thus in simple terms, the relative version of the PPP states that exchange rate between two countries will adjust by the inflation differential. Algebraically this relationship is expressed as:

$$\%\Delta S = \%\Delta P_h - \%\Delta P_f \quad (2)$$

$$\frac{S_{t+1} - S_t}{S_t} = \%\Delta P_h - \%\Delta P_f \quad (3)$$

Where $\%\Delta S$, is the percentage change in the spot rate between the two countries, $\%\Delta P_h$ is the domestic inflation rate and $\%\Delta P_f$ is the foreign inflation rate. In sum, according to Pilbeam (2006), PPP performed better for countries that are geographically close to one another and where trade linkages are high, that is, less trade restrictions and minimal transport cost. Thus, the PPP reported minimal deviations among between countries like France and Germany, Italy and Germany and

between the UK and Germany. However, the overall evidence on the PPP hypothesis was not impressive, Deviations of the PPP from some exchange rates was substantial and persistent. A number of factors have been identified to explaining the poor performance of the PPP hypothesis. Among them as noted earlier are transport cost, impediments to trade and imperfect competition. Others are statistical problems, differences in the level of productivity (Balassa, 1964; Samuelson,, 1964); and capital and goods market.

The International Fisher Effect

The brief review of the fisher effect and the purchasing power parity reveals a link between the Fisher effect, the PPP and the IFE. Whiles the fisher effect looks at the relationship between interest rates and inflation, PPP establishes a relationship between inflation rate differentials and exchange rates. The IFE then comes in to link exchange rates to interest rates. The simplified equation of the international fisher effect is given as:

$$S_e = S_o \times \left[\frac{1+Rh}{1+Rf}\right]. \quad (4)$$

Where "*Rh*" is interest rates in home country, "*Rf*" is interest rates in foreign country, "*Se*" is the future spot rate whiles "*So*" is the spot rate.
When the IFE holds, the currency with the lower interest rate is expected to appreciate relative to the currency in the higher interest rate. However, it does not mean that the interest rates differential is an accurate predictor of the spot rate. This condition means that over time the prediction errors will cancel out. The real rates of interest of the international fisher effect should lean toward equilibrium because of arbitrage (Shapiro &Atulya 2009).

Based on this hypothesis put forward by IFE, does available evidence present results that are consistent with the theory? In their study, Aliber and Stickney's(1975) found that the international Fisher effect to hold, in the long term, in study of seven industrialised countries(Belgium, Canada, France, West Germany, Netherlands, Switzerland and the United Kingdom) and six Latin American countries (Argentina, Brazil, Chile, Colombia, Mexico and Venezuela) for the period 1966 to 1971.

Empirical test of the IFE was carried out in the United States by Carmichael and Stebbing (1983). With a sample of 3-month T-bill rates between first quarter of 1953 to fourth quarter of 1978, they found evidence in support of the international fisher hypothesis. In another study by the same authors, this time with a sample of 5-year industrial debenture yield between 1963 to 1981 in Australia, evidence was found in support of the hypothesis. Moazzammi (1991), used the same sample of data employed by Carmichael and Stebbing (1983), examined the presence of a long-run relationship between nominal interest rates, real interest rates and the inflation rate. Moazzammi found that the data used by Carmichael and Stebbing supports the presence of a long-run relationship between the nominal interest rate (before and after tax) and the inflation rate as suggested by the Fisher Hypothesis. However, by using error correction modelling approach that distinguishes the long-run coefficients from the coefficients that are short-run in nature, found no evidence in support of IFE both in the US and Australia. The differences in results are clearly as a result of the different statistical methods used over the same sample.

A test of the IFE theory was conducted by Thomas (1985). He examined results of purchasing future contracts of currencies with higher interest rate that contained discounts (relative to the spot rate) and selling futures on currencies with low interest rate that contained premiums. As indicated earlier, If the IFE theory holds, currencies with high interest rate should depreciate while the low interest rate currencies should appreciate, therefore yielding insignificant profits by the transactions. However, Thomas found that 57 percent of the transactions created by this strategy were profitable. The average gain was higher than the average loss.

Woodward (1992) examined yields of index bonds over the period 1982 to 1990 and found no evidence to support the IFH in Britain. Similarly, Choudhry (1997) found no evidence in support of the IFH in both Belgium and France, whiles little evidence was found in Germany over the period 1955 to 1994.

A study by Shalishali and Ho (2002) examined the IFE in 8 industralised countries: Canada, France, Germany, Japan, Netherlands, Sweden, Switzerland and UK by using quarterly data covering the period between 1972 and 1996. Employing OLS regression, they concluded

that while the theory holds for some countries, it does not hold for others, nevertheless, in most cases the theory holds except for a few instances. Their study also revealed that while the IFH holds between two countries, when these same countries are interchanged as home and foreign country, different results is obtained. They attributed this to trade restrictions between countries. Crowder (2003) uses data on short-term nominal interest rates and inflation rates collected from eight industrialized nations between January 1960 to August 1993. The results indicate that the Fisher relation has a great deal of support with all eight countries exhibiting cointegration between nominal rates and inflation.

Review of related studies also present some mixed results. Ersan (2008) tested the presence of IFE by examining the effect of interest rate differences on the behaviour of exchange rates among group of five countries: Turkey and the G-5 countries of United States, United Kingdom, Japan, France and Germany. Although He found evidence in support of the IFH for all pairs of countries, the magnitude of the effect is found to be lower than expected which indicates that there might be other factors in economy, such as inflation rates, that affect the exchange rate movements.

Utami and Inanga (2009) applied a test of the IFE to four countries: USA, Japan, Singapore, and the UK, using Indonesia as the "home country". Data involved yearly interest rates and interbank offer rates between 2003 and 2008. Regression results showed that interest rate differentials had positive but no significant effect on changes in exchange rate for the USA, Singapore, and the UK relative to that of Indonesia. On the other hand, interest rate differentials had negative significant effect on changes in exchange rates for Japan.

A study by Shalishali (2012) applied regression analysis to historical exchange rates and interest rate differentials for eight selected countries in Asia. Each of the country was used both as a home country and a foreign country. While the IFE theory holds for some of the countries, it was rejected in others. It was realised that the IFE was not supported when some countries used as home countries were interchanged to foreign countries. He suggested that the different results may be as a result of some impediments to trade that may hinder adjustment of exchange rates between countries. This is supported by Shalishali and

Ho (2002), who also found similar results when countries were interchanged.

Finally, Ray (2012) also examined the existence of IFE between USA and some selected Asian countries: India, Korea and Japan. Interestingly the findings of Ray support that of Shalishali (2012). Interest rate differentials were regressed on inflation rates between the first quarter of 2001 to second quarter of 2012. Existence of partial Fisher effect was found in the USA, whiles none was evidenced in India, Korea and Japan. Similar to the findings of Shalishali (2012), when each country is treated interchangeably as home country and foreign country to demonstrate the direction of International fisher Effect, mixed results were obtained. The theory holds when some countries were used as home country but was refuted when they were used as foreign countries. Ray found that when USA is treated as foreign country, the theory holds between all Japan-USA, Korea-USA and India-USA.

Methodology and Data Collection

The IFE postulates that $\frac{S_{t+1}-S_t}{S_t}=\frac{i_D-i_f}{1+i_f}$, where S_t and S_{t+1} are the exchange rate of domestic currency per unit of foreign currency at time t and $t+1$ respectively. i_D and i_f are nominal interest rates of domestic country and foreign countries respectively.

To test for IFE, the relative change in exchange rate is regressed against nominal interest rate differential among the selected country pairs, mathematical, we write

$$e_t=\alpha+\delta\lambda_t+\varepsilon_t \qquad (5)$$

where $e=\frac{S_{t+1}-S_t}{S_t}$, $\lambda=\frac{i_D-i_f}{1+i_f}$ and ε is the error term.

The necessary condition for IFE to hold is the existence of cointegration between e and λ, that is, if $Y_t=\left[e_t\lambda_t\right]'$, then the long-run IFE restriction on Y_t is that $\beta'Y_t=e_t-\lambda_t$, ε_t, is stationary, $I(0)$. In addition, we except the cointegration vector to be close to one for full

International Fisher effect, thus $\beta = \begin{bmatrix} 1 & -1 \end{bmatrix}$ and $\alpha = 0$. If δ is significantly different from zero but less than one and $\alpha = 0$, we have partial IFE. The latter conditions are the sufficient conditions.

According to Barkoulas, Baum, and Oguz (1999), the conventional way of testing cointegration among variables which only allow for an integer order of integration in the equilibrium error process is restrictive and ad hoc assumption.Thisis because a fractionally integrated error correction term is mean-reverting and covariance non-stationary though not exactly as I(0) which is mean reverting and covariance stationary , therefore, in spite of its significant persistence in the short run, the effect of a shock to the system eventually dissipates, so that an equilibrium relationship among the system's variables prevails in the long run. On this basis, we employ fractional cointegration which relaxes this rigid limitation by allowing a fractional differencing parameter, d. In this case, we are able to distinguish between the cases where the equilibrium errors are really non-mean reverting and where they are actually mean reverting but exhibiting significant persistence in short run. The value of *d* is estimated for the equilibrium error from a cointegrating regression and the null hypothesis *d* =1 tested against the alternative *d* <1.

Following Granger and Joyeux (1980); Hosking (1981); Joyeux (2010). Coleman and Sirichand (2011) equation (1) is can be modeled as a fractionally cointegrated,
I(*d*), process

$$(1-L)^d(\varepsilon_t - \mu) = z_t \tag{6}$$

where L is the lag operator, d is fractional difference parameter, μ is the unconditional mean of ε_t, and z_t is stationary with zero mean and finite variance. A flexible parametric process of order (p,d,q) called the ARFIMA (p,d,q) model incorporates both long-term and short-term memory.

$$\Theta(L)(1-L)^d(\varepsilon_t - \mu) = \Psi(L)z_t \tag{7}$$

where $\Theta(L)$ and $\Psi(L)$ are autoregressive and moving average polynomials, respectively, with rootsthat lie outside the unit circle and z_t is Gaussian white noise. ε_t is mean reverting provided $d \in \left[-0.5 \;\; 1 \right)$ and fractional cointegration is established. The process of establishing fractional cointegration analysis involves two steps. First, the IFE equation (1)is estimated with ordinary least squares; then the residual series, ε_t, is used to estimate the differencing parameter, d .To estimate d and perform hypothesis testing, a semi-parametric procedure suggested by Geweke and Porter-Hudak (1983)is employed[3].

Data

The data for this study is monthly cross exchange rate and nominal interest rate time series data from 1998M02 to 2012M08 for Cape Verde, the Gambia, Ghana, Nigeria and Sierra Leone. Liberia and Guinea are members of WAMZ but excluded from this study due to the non-availability of the required data. The nominal interest is measured by Treasury bill (T-bill) rate. The exchange rates and nominal interest rate were extracted International Monetary Fund- International Financial Statistics (IFS) database.

Cointegration Test

To test whether relative change in exchange and nominal interest rate differential among the selected country pairs are cointegrated, we first test for the existence of unit roots in the stochastic process generating these series. We employed ADF-GLS and ADF to test for unit root and KPSS for stationarity. The ADF-GLS is a variant of ADF proposed by Elliott, Rothenberg and Stock (1996), which is more efficient than the usual ADF in handling the parameters pertaining to the deterministic term. The results showed that all the derived variable e and λ are of $I(1)$ and non-stationary. The unit root results are not report for want of space but available upon request.

[3] See Barkoulas, Baum, and Oguz (1999) for details of the spectra regression of GPH

We proceed to test for presence of cointegration between paired countries using both conventional cointegration test by employing Engle-Granger two-step test (ADF test) and Fractional cointegration using GPH test to estimate the d parameter. The results are presented in columns 3 and 4 of Table 1. The results from the conventional cointegration test show that the relative change in exchange rate and nominal interest rate differential of the country pairs are cointegrated (for every X/Y, X is the domestic country and Y, the foreign country) except Cape Verde/Gambia, Cape Verde/Ghana, Cape Verde/Sierra Leone, Gambia/Cape Verde, Gambia/Sierra Leone, Ghana/Cape Verde and Nigeria/Cape Verde. In general, the conventional cointegration (Engle-Granger) rejected seven out of the twenty pair-wise country combinations. As indicated, the conventional cointegration is restrictive and therefore fraction cointegration is conducted on all the country pairs and reported in column three of Table 1. The results identified two additional country pairs, Cape Verde/Ghana and Ghana/Cape Verde, to be cointegrated. The results show that the relative change in exchange rate and nominal interest rate differential of the country pairs of all the WAMZ countries considered in this study have common stochastic drift except Cape Verde/Gambia, Cape Verde/Sierra Leone, Gambia/Cape Verde, Gambia/Sierra Leone and Nigeria/Cape Verde. The Cape Verde departure from most of the WAMZ countries is not surprising since it is of observer status and its currency is pegged against the Euro.

Table 2: Pair wise International Fisher Effect Test-Fractional and Engle-Granger Cointegration

Domestic	Foreign	Fractional Cointegration	Engle - Granger	The OLS regression estimates of Equation (1) for paired Countries	
		GPH Test	ADF	α	δ
Cape Verde	Gambia	0.27 [0.10]	-2.881	0.00[0.51]	0.05[0.03]
Cape Verde	Ghana	0.42**[0.03]	-2.72	-0.00[0.58]	0.06[0.01]
Cape Verde	Nigeria	-0.07[0.67]	-3.08**	-0.01[0.02]	0.02[0.55]
Cape Verde	Sierra Leone	0.12[0.61]	-2.59	0.01[0.26]	0.11[0.11]
Gambia	Cape Verde	0.16[0.52]	-2.09	0.00[0.61]	0.04[0.01]
Gambia	Ghana	-0.13**[0.04]	-3.32**	-0.01[0.00]	0.03[0.02]
Gambia	Nigeria	-0.26**[0.01]	-6.32***	-0.00[0.01]	-0.00[0.87]
Gambia	Sierra Leone	0.02[0.91]	-2.78	0.00[0.61]	0.02[0.21]
Ghana	Cape Verde	-0.27**[0.01]	-2.77	0.00[0.35]	0.05[0.01]
Ghana	Gambia	-0.25**[0.02]	-3.51**	0.01[0.00]	0.03[0.01]
Ghana	Nigeria	-0.36***[0.00]	-4.22***	-0.00[0.74]	0.05[0.07]
Ghana	Sierra Leone	-0.22**[0.04]	-3.64***	0.01[0.15]	0.09[0.01]
Nigeria	Cape Verde	0.17[0.30]	-2.81	0.01[0.01]	0.02[0.51]
Nigeria	Gambia	-0.07[0.70]	-4.65***	0.00[0.01]	-0.00[0.95]
Nigeria	Ghana	-0.24**[0.02]	-3.17**	0.00[0.40]	0.01[0.77]
Nigeria	Sierra Leone	0.02[0.92]	-3.41**	0.02[0.01]	0.16[0.02]
Sierra Leone	Cape Verde	-0.26**[0.04]	-3.66***	-0.01[0.33]	0.10[0.08]
Sierra Leone	Gambia	-0.22[0.12]	-5.46**	-0.00[0.86]	0.09[0.09]
Sierra Leone	Ghana	-0.40***[0.00]	-7.37***	-0.00[0.31]	0.09[0.03]
Sierra Leone	Nigeria	-0.28**[0.02]	-5.12***	-0.01[0.03]	0.15[0.01]

Note: ** indicate s significance at 5% level and *** indicates significance at 1%

As the IFE postulates, we expect our long-run vector to be close to one for full International Fisher effect, thus $\beta = \begin{bmatrix} 1 & -1 \end{bmatrix}$ and $\alpha = 0$. If δ is

significantly different from zero but less than one and $\alpha = 0$, we have partial IFE. The OLS estimates recorded in column 5 and 6 of Table 1 show that full international fisher effect does not hold in any of the country pairs; however, there are identified cases where partial IFE holds. Four cases of partial IFE were identified at 5% significance level: Cape Verde/Ghana, Ghana/Cape Verde, Ghana/Sierra Leone and Sierra Leone/Ghana. We further observed that the IFE holds for country pairs; Ghana/Nigeria, and Sierra Leone/Cape Verde at 10% significant. The evidence from the literature shows that full international fisher effect is not empirically supported and therefore partial IFE is not surprising (Ray, 2012; Hatemi-J and Irandoust, 2008).Though the δ is significantly different from zero, the magnitude of δ ranges from 0.05-0.10 which are far below the expected value of $\delta = 1$ making it "weak partial IFE". The implication is that there is little evidence of the validity of international fisher effect in the WAMZ and that nominal interest rate differentials do not largely offset exchange rate changes. An indication of lack of macroeconomic coordination necessary for smooth take-off of the currency union, which fit well in the literature on macroeconomic coordination for WAMZ, see example, Adam et. al (2010) and Alagidede et. al (2008).

Conclusion

This paper examines the validity of IFE in the West African Monetary Zone by applying conventional cointegration and fractional cointegration techniques.The results suggest that fifteen out of the twenty country pairs have their relative changes in exchange rate and nominal interest rate differentials cointegrated as indicated by both conventional and fractional cointegration. Therefore, there is a stable long-run relationship between relative changes in exchange rate and nominal interest rate differentials in the WAMZ.

However, the assumptions necessary for the validity of weak IFE were met for only between Ghana and Cape Verde and between Ghana and Sierra Leone at 5% significance level. The implications are that nominal interest rate differentials do not offset exchange rate changes in WAMZ, which is important for smooth function of currency union. The IFE theorem posit that real interest rates must be same among the countries and there must be an existence of integrated capital markets. That is,

high level of capital mobility or capital flow freely across borders. The inability of West Africa countries to activate the existing protocols under ECOWAS Trade Liberalisation Scheme (ETLS), occasional political instability and homogenous nature of their economic structures hinder integration of WAMZ countries and thereby, the insufficient empirical evidence to indicates that IFE hold among WAMZ countries.

These findings are seen as setback to the common currency agenda of WAMZ. Macroeconomic coordination among would-be currency union countries is a necessary condition for the conduct of monetary policy. The evidence of lack of exchange rate coordination partly confirms non-readiness of WAMZ for smooth and sustained take-off of the common currency. Thus, postponement of take-off again from 2015 to 2020 was prudent. To avert future postponement, policies aimed at removing nuisance restrictions should be pursued by WAMZ. In addition, treaties and protocols contained in ECOWAS ETLS should be activated.

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Journal of Economic Cooperation and Development, **38**, 3 (2017), 145-168

Macroeconomic Variables, Investment and Economic Development in Nigeria: A Prognosis

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The paper examines the effects of macroeconomic variables and investment rate on economic development in Nigeria for the 1980-2014 period. It also examines how the interaction between macroeconomic variables and investment affect economic development to ascertain whether the effects of investment on economic development varies with the level of macroeconomic variables. Out of the five macroeconomic variables selected based on Maastricht Criteria indicators that measure a country's macroeconomic stability, fiscal deficit relative to GDP and real exchange rate have positive impact on economic development, while inflation rate and government debt relative to GDP have negative impact on economic development. However, real interest rate has no statistically significant impact on economic development in Nigeria. Moreover, the study found overwhelming evidence that the impact of investment rate on economic development varies with the level of four macroeconomic variables except real interest rate. The implication is that macroeconomic variables help to explain variation in economic development and investment rate indicating that better performance of macroeconomic variables and more investment rate seem to be much more applicable in the process of economic development than more investment rate in the midst of poor macroeconomic environment. Based on the findings, the paper made some policy recommendations.

Keywords: Macroeconomic variables, economic development, investment rate

JEL Classification: E69, O11, E31

1. Introduction

The macroeconomic policies adopted by a country determine the predictability of the domestic macroeconomic environment in-terms of

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resource allocation decisions, investment and economic growth. A stable macroeconomic environment enhances the capacity of a country to cope with both internal and external shocks, provides opportunities for hedging risks and offers various choices of fiscal, monetary and exchange rate policies. But macroeconomic instability in the form of volatility of key macroeconomic variables or unsustainability of their behaviours is often the outcome of poor macroeconomic policies (see Serven & Montiel, 2004). Theoretical and empirical literature contend that the behaviours of macroeconomic variables such as inflation rate, real interest rate, real exchange rate, fiscal deficit relative to GDP and government debt relative to GDP are fundamental in the development process of any economy.

Hence, many developing countries strive to adopt policies (fiscal, monetary and exchange rate policies) that will guarantee favourable performances of these variables with a view to achieving macroeconomic stabilization and ultimately economic development. Todaro and Smith (2009) opine that the major goals of macroeconomic stability include; controlling inflation, restoration of fiscal balance and elimination of current accounts deficits. Thus, the International Monetary Fund and the World Bank are the two principal catalysts in the stabilization and adjustment policies of most developing countries through the provision of international private lending and multilateral development assistance.

Several developing economies traditionally experience greater macroeconomic instability than developed economies because of their inability to minimize their vulnerability to external shocks and accelerate economic development. The Maastricht Criteria[3] highlighted five indicators that measure a country's macroeconomic stability to include low and stable inflation rate (within 3%), low currency fluctuation (within 3%), low long-term interest rate (within 9%), low budget deficit relative to GDP (within 3%) and low government debt relative to GDP (within 60%). Analogously, Serven and Montiel (2004) and Basci (2012) also enumerated these variables as the main indicators of macroeconomic stability.

[3] The Maastricht Criteria are the five convergence criteria that the European Union members should meet before they can enter the third stage of the Economic and Monetary Union and adopt the euro as their currency. It was named after a city called 'Maastricht' in Netherlands where the Treaty on European Union was signed on 7th February, 1992.

Although Nigeria's desire to attain economic diversification and development is commendable, but its actualization would remain a mirage if the relationship between macroeconomic variables and economic development remain unclear. Infact, the capacity of a country to drive the process of economic diversification and development depends (to a large extent) on the progressive relationship between macroeconomic variables and the development process. The performances of macroeconomic variables in Nigeria in the past three decades revealed that the average inflation rate were 20.89%, 32.06, and 12.23% in the 1980s, 1990s and 2000s, respectively. These rates were far higher than the recommendation by the Maastricht Criteria and could have adverse effects on economic development in Nigeria. Theoretical and empirical evidence suggest that low and stable inflation rate are necessary to stimulate investment rate, financial development and economic growth because they create healthy demand in the marketplace, encourage long term contracts, stabilize government tax revenue and individual liabilities. Conversely, high and volatile inflation rate have adverse effects on investment rate, financial development and economic growth because they distort resource allocation (see Bruno & Easterly, 1998; Rousseau & Wachtel, 2001; Bittencourt, 2011b).

Furthermore, the real exchange rate[4] of Nigeria depreciated greatly in the past three decades, averaging 992.03 in 2000s compared to 249.15 in 1990s and 16.89 in 1980s. Vieira et al. (2013) found that economic growth is negatively related to a high exchange rate fluctuation, but positively correlated with a moderately volatile exchange rate. Aghion et al. (2009) and Elbadawi et al. (2012) also reported a negative correlation between real exchange rate appreciation and economic growth. Albeit, Hua (2012) and Tang (2015) found no significant positive correlation between real exchange rate and economic growth, but they argued that the fluctuations in real exchange rate could result in a positive or negative impact on economic growth. Also, Serven (2003) and Bleaney and Greenaway (2001) found that real exchange rate and its volatility has negative impact on investment rate.

[4] The real exchange rate between the Naira and the USD is the product of the nominal exchange rate of the Naira against the USD and the ratio of prices between the two countries. The core equation is RER=eP^*/P, where, e is the nominal Naira-Dollar exchange rate, P^* is the average price of a good in Nigeria, and P is the average price of the good in the United States.

Similar trends have also been recorded in real interest rate, fiscal deficit relative to GDP and government debt relative to GDP as these macroeconomic variables have been experiencing upward movement in Nigeria since the 1980s. Hassan et al. (2011) documented that high interest rate adversely affect the real sector of the economy, just as a very low or negative interest rate is deleterious to investment and economic growth. Ball and Mankiw (1995) argued that high budget deficit affects saving, investment, interest rate, trade balance, exchange rate and long-term economic growth. Since fiscal deficit reduces national savings, they necessarily reduce investment or/and net exports, and by reducing net exports, high fiscal deficit creates a flow of assets abroad, thereby inducing firms to invest less and foreigners to acquire less domestic products. Furthermore, high and rising fiscal deficit that is financed by domestic borrowing could crowd-out potential private investments, but if financed by external borrowing, the national debt and debt service payments increase and have adverse effects on the economy. Though Reinhart and Rogoff (2010b) found that the effects of government debt on economic growth is positive until government debt exceeds 90% of GDP, but Dritsaki (2013) opined that the impact of government debt on economic growth could be positive or negative depending on their uses. On the other hand, Karagol (2002); Panizza and Presbitero (2014); Eberhardt and Presbitero (2015) reported that government debt is negatively related to investment, economic performance and economic development. This analysis reveals that macroeconomic variables have effects on both investment rate and economic growth. Fischer (1993) argued that reduction in investment is one of the channels through which macroeconomic factors adversely affect economic growth.

In Nigeria, empirical evidence on the relationship between these macroeconomic variables and economic development remains unclear, even though macroeconomic stabilization is a sine qua non for economic diversification and development. Thus, the specific objectives of this study include: (i) to examine the effects of macroeconomic variables on economic development in Nigeria (ii) to examine the effects of investment rate on economic development in Nigeria (iii) to determine how the interaction between macroeconomic variables and investment rate affect economic development in Nigeria.

In this regards, the contributions of this study to existing literature are enormous. Firstly, it unfolds the effects of macroeconomic variables on economic development. Interestingly, the study finds that out of the five macroeconomic variables, fiscal deficit relative to GDP and real exchange rate have positive impact on economic development, while inflation rate and government debt relative to GDP have negative impact on economic development. However, real interest rate has no statistically significant impact on economic development in Nigeria. Secondly, the study uncovers the impact of investment rate on economic development. It finds evidence to conclude that investment rate help to explain variations in economic development. Finally, it unearths how the interaction between macroeconomic variables and investment rate affect economic development. This is important because it reveals whether the impact of investment rate on economic development varies with the level of macroeconomic variables. Fundamentally, the study finds that the impact of investment rate on economic development varies with the level of all the macroeconomic variable except real interest rate.

Besides this introduction, the remaining parts of the paper is divided into four sections. Section 2 examines the theoretical and empirical issues while section 3 presents the methodology employed in the study. Section 4 contains the empirical results and findings, and the last section concludes the study with some policy recommendations.

2. Theoretical and Empirical Issues

Theoretical and empirical literature suggest that a stable macroeconomic environment is a prerequisite for economic growth and development while volatility in key macroeconomic variables or unsustainability of their behaviours could result in economic retardation. Thus, the Maastricht Criteria enumerated five indicators that measure a country's macroeconomic stability to include low and stable inflation rate; low currency fluctuation; low long-term interest rate; low budget deficit relative to GDP; and low government debt relative to GDP. For instance, Fischer (1993) found that inflation rate has negative effects on economic growth through reduction in investment and productivity growth. He added that even long-term low inflation rate is unnecessary for high growth, the same way high inflation rate is inconsistent with sustained economic growth. Similarly, Barro (1996); Bruno and Easterly (1998) documented that high and volatile inflation rate has negative and

deleterious effects on the economy, while low or moderate inflation rate has mild effect on the economy. Also, Rousseau and Wachtel (2001); Boyd et al. (2001); Bittencourt (2011b) also reported the adverse effect of high and volatile inflation rate have on financial development and investment. Thus, higher inflation rate are associated with higher inflation variability, greater stock return variability, less long-run financial activity, lower long-run levels of real economic activity and slower long-run growth rates. Although, a growing empirical literature suggests that a threshold exists beyond which the effects of inflation rate on the economy are more venomous, but there are overwhelming support for a negative inflation-growth nexus.

The relationship between fiscal deficit relative to GDP and economic activity has been documented in theoretical and empirical literature. Fischer (1993) documented a negative effect of fiscal deficit on economic growth through a reduction in both capital accumulation and productivity growth. Ball and Mankiw (1995) also argued that high budget deficit affects saving, investment, interest rate, trade balance, exchange rate and long-term economic growth. Thus, fiscal deficit reduces national savings, they necessarily reduce investment or/and net exports, and by reducing net exports, high fiscal deficit creates a flow of assets abroad, thereby inducing firms to invest less and foreigners to acquire less domestic products. Furthermore, high and rising fiscal deficit that is financed by domestic borrowing could crowd-out potential private investments, but if financed by external borrowing, the national debt and debt service payments increase and have adverse effects on the economy. Conversely, Garrison and Lee (1997) found that fiscal deficit has positive impact on the real GDP per capita growth. They argued that the inclusion of investment (saving) rate in a regression could reduce the significance of the coefficient of fiscal deficit because the only role left for budget deficit is that of as a signal of poor management of the economy by the government.

Although Reinhart and Rogoff (2010b) found that the effects of government debt on economic growth is positive until government debt exceeds 90% of GDP, but a growing empirical literature suggests that government debt relative to GDP has negative impact on economic growth. Dritsaki (2013) opined that the impact of government debt on economic growth could be positive or negative depending on their uses. While Spilioti and Vamvoukas (2015); Egert (2015) found that

government debt has positive effects on economic growth, Karagol (2002); Panizza and Presbitero (2014); Eberhardt and Presbitero (2015) reported that government debt is negatively correlated with investment and economic growth. On the relationship between real interest rate and economic growth, Hassan et al. (2011) found that both high and very low or negative interest rate are deleterious to investment, economic growth and adversely affect the real sector of the economy.

The literature on the link between real exchange rate/volatility and economic performance are mixed. Hua (2012) and Tang (2015) found no significant positive correlation between real exchange rate and economic growth, but argued that the fluctuations in real exchange rate could result in a positive or negative impact on economic growth. Vieira et al. (2013) found that high exchange rate fluctuation is negatively related to economic growth while a moderately volatile exchange rate is positively correlated with economic growth. Aghion et al. (2009) and Elbadawi et al. (2012) also found negative correlation between real exchange rate appreciation and economic growth.

This analysis shows that the effects of each macroeconomic variable on the economy depends on the level (high or low) of each variable. It also shows the absence of previous empirical studies that have extensively examined the effects of five macroeconomic variables such as inflation rate, real interest rate, real exchange rate, fiscal deficit relative to GDP and government debt relative to GDP on economic development in Nigeria. It also revealed the absence of previous studies that show how the interaction between these five macroeconomic variables and investment rate affect the economy. These are some of the gaps this present study intends to fill.

3. Data and Method

3.1 Data

All the annual data for the period 1980-2014 used in this paper are sourced from the World Development Indicators of the World Bank (2016) except fiscal deficit relative to GDP that were obtained from the Central Bank of Nigeria Statistical Bulletin (2014). Economic development is proxied by real GDP per capita (see Menyah et al., 2014; Chortareas et al., 2015), investment rate is proxied by gross fixed capital

formation as a ratio of GDP (see Demetriades & Law, 2006); human capital is proxied by average years of schooling (see Beck & Levine, 2004). Based on Maastricht Criteria, the macroeconomic variables selected in this study include; inflation rate, real exchange rate, real interest rate, fiscal deficit as a ratio of GDP and government debt as a ratio of GDP (also see Fischer, 1993; Garrison & Lee, 1995; Vieira et al., 2013; Egert, 2015).

3.2 Empirical Strategy

The study uses the standard baseline growth regression and introduced macroeconomic variables as additional explanatory variables. Thus, the specification shows that variation in a country's real GDP per capita can be explained by the level of investment, human capital growth and augmented with macroeconomic variables which is consistent with Solow (1956). This model is an empirical representation of the Solow's growth model (also see Rousseau & Wachtel, 2002; Rousseau & Yilmazkuday, 2009). Hence, the baseline model is specified as follows:

$$Y_t = \beta_0 + \beta_1 INV_t + \beta_2 HCA + \beta_3 DEF + \delta' MCV_t + \varepsilon_t \qquad (1)$$

where: Y= real GDP per capita; INV= investment as a ratio of GDP; HCA= human capital growth; DEF = fiscal deficit relative to GDP[5]; MCA= macroeconomic variables such as inflation rate, real exchange rate, real interest rate and government debt as a ratio of GDP; ε = error term; $\beta_0, \beta_1, \beta_2, \beta_3, \delta$ = coefficients. All the variables except inflation rate, real interest rate and fiscal deficit are in natural logarithm.

In order to determine the effects of the interaction terms of macroeconomic variables and investment rate, each of the macroeconomic variables is interacted with investment rate in the following models:

[5] Fisher (1993) argued that budget deficit/surplus relative to GDP captures government influence on the economy because it is a signal of good or poor management of the economy. According to Barro (1991), an alternative measure of government influence on the economy is government consumption expenditure as a ratio of GDP. But Rousseau and Yilmazkuday (2009) argued that government consumption expenditure as a ratio of GDP is inefficient in many developing countries.

$$Y_t = \varpi_0 + \varpi_1 INV_t + \varpi_2 HCA_t + \varpi_3 DEF_t + \varpi_4 INV_t * INF_t + \mu_t \quad (2)$$

$$Y_t = \theta_0 + \theta_1 INV_t + \theta_2 HCA_t + \theta_3 DEF_t + \theta_4 INV_t * INT_t + + \mu_t \quad (3)$$

$$Y_t = \lambda_0 + \lambda_1 INV_t + \lambda_2 HCA_t + + \lambda_3 DEF_t + \lambda_4 INV_t * RER_t + \mu_t \quad (4)$$

$$Y_t = \psi_0 + \psi_1 INV_t + \psi_2 HCA_t + \psi_3 DEF_t + \psi_4 INV_t * DEF_t + \mu_t \quad (5)$$

$$Y_t = \delta_0 + \delta_1 INV_t + \delta_2 HCA_t + \delta_3 DEF_t + \delta_4 INV_t * DEB_t + \mu_t \quad (6)$$

where: INF= inflation rate; INT= interest rate, RER= real exchange rate; DEF= fiscal deficit as a ratio of GDP and DEB= government debt as a ratio of GDP.

Through the interaction between investment rate and each of the macroeconomic variables, the marginal effects of changes in the two variables can be captured through the partial derivatives of the real GDP per capita equation with respect to investment rate given as follows:

$$\frac{\partial Y_t}{\partial INV_t} = \varpi_1 + \varpi_4 INF_t \quad (7)$$

$$\frac{\partial Y_t}{\partial INV_t} = \theta_1 + \theta_4 INT_t \quad (8)$$

$$\frac{\partial Y_t}{\partial INV_t} = \lambda_1 + \lambda_4 RER_t \quad (9)$$

$$\frac{\partial Y_t}{\partial INV_t} = \psi_1 + \psi_4 DEF_t \quad (10)$$

$$\frac{\partial Y_t}{\partial INV_t} = \delta_1 + \delta_4 DEB_t \quad (11)$$

Thus, when the two coefficients (ϖ_1, ϖ_4) in the partial derivatives in Equation 7 are positive, it implies that more of investment rate and inflation rate would increase real GDP per capita. But when one of the estimated coefficients is negative while the other is positive, it means that the growth effect of investment rate vary with the rate of inflation. Hence, it would be necessary to evaluate the derivative within the

sample. The partial derivative is calculated at the minimum, mean and maximum rate of inflation within the sample of the study. If the marginal effect turns out positive, it implies that inflation rate is not detrimental to investment rate, but if the marginal effect turns out negative or zero, it implies that inflation rate is venomous to investment rate. Similar procedure would be applied to other macroeconomic variables in Equations 8-11 with a view to ascertaining whether the rate of investment varies with each of the variables.

4. Empirical Results

4.1 Descriptive Statistics and Correlation Analysis

The summary of descriptive statistics reported in Table 1 reveal that the average real GDP per capita in Nigeria for the 1980-2014 period was USD699.19 while the average investment rate was 12.96% of GDP. The average human capital growth was 5.15 and fiscal deficit averaged -2.95 of GDP during the period. The average inflation rate and government debt as a ratio of GDP were 19.74% and 54.05%, respectively. This analysis revealed that fiscal deficit as a ratio of GDP, interest rate and government debt relative to GDP fall within the Maastricht Criteria recommendations while inflation rate and real exchange rate were higher during the period. Furthermore, the correlation analysis presented in the lower Panel of Table 1 reveals that investment rate, fiscal deficit, interest rate and real exchange rate are positively correlated with real GDP per capita while inflation rate and government debt are negatively related to real GDP per capita in Nigeria.

Table 1: Descriptive statistics and correlation analysis

	Y	**INV**	**HCA**	**DEF**	**INF**	**INT**	**RER**	**DEB**
Mean	699.185	12.959	5.148	-2.948	19.741	-0.790	485.549	54.051
Maximum	1098.04	35.221	5.200	0.790	72.835	25.282	4831.94	228.37
Minimum	494.239	5.459	5.000	-6.730	5.382	-43.57	0.403	7.450
Standard Dev.	188.664	6.650	0.077	2.074	17.919	16.626	835.788	57.792
Y	1.000							
INV	0.168 (0.335)	1.000						
HCA	-0.072 (0.679)	-0.370 (0.029)	1.000					
DEF	0.394 (0.019)	-0.384 (0.023)	0.229 (0.187)	1.000				
INF	-0.406 (0.015)	-0.098 (0.574)	0.106 (0.543)	-0.101 (0.565)	1.000			
INT	0.219 (0.204)	-0.080 (0.646)	-0.029 (0.867)	-0.059 (0.737)	-0.471 (0.004)	1.000		
RER	0.427 0.010	-0.155 (0.375)	0.239 (0.166)	0.121 (0.489)	-0.073 (0.675)	0.209 (0.227)	1.000	
DEB	-0.503 (0.002)	-0.122 (0.486)	-0.147 (0.398)	-0.375 (0.026)	0.520 (0.001)	-0.053 (0.001)	-0.158 (0.363)	1.000

Notes: Probability values in parenthesis. Y =real GDP per capita, INV= investment rate as a ratio of GDP; HCA= human capital growth; DEF= fiscal deficit as a ratio of GDP; INF= inflation rate; INT= real interest rate; RER= real exchange rate; DEB= government debt as a ratio of GDP

4.2 Unit Root Test

To ascertain the order of integration of the variables, the study conducted unit root test using both the Augmented Dickey Fuller (ADF) and Philip-Perron (PP) tests. The results reported in Table 2 indicate that all the variables are integrated at order zero [I(0)] at 1%, 5% or 10% significant levels. Thus, we cannot reject the null hypotheses of no unit root in the series implying that the variables are stationary.

Table 2: Unit root test results

	Augmented Dickey Fuller (ADF)		Philip-Perron (PP)	
Variables	**Level [I(0)]**	**1st Difference [I(1)]**	**Level [I(0)]**	**1st Difference [I(1)]**
Y	-2.960**	-4.744***	-2.943**	-4.741**
INV	-2.932**	-5.526***	-2.853**	-5.401***
HCA	-2.991**	-5.656***	-3.047**	-5.656***
DEF	-3.168**	-6.933***	-3.159***	-17.228***
INF	-3.202**	-5.992***	-3.108**	-12.874***
INT	-5.951***	-7.069***	-5.973***	-32.626***
RER	-2.972**	-5.657***	-2.906**	-7.061***
DEB	-3.461**	-4.880***	-3.517**	-4.880***

Notes: ***, ** and * indicate statistically significant at 1%, 5% and 10% levels, respectively, and a rejection of the null hypothesis of no unit root. Y =real GDP per capita, INV= investment rate as a ratio of GDP; HCA= human capital growth; DEF= fiscal surplus/deficit as a ratio of GDP; INF= inflation rate; INT= real interest rate; RER= real exchange rate; DEB= government debt as a ratio of GDP

4.3 The Effects of Macroeconomic Variables on Economic Development

Starting with the baseline model, the regression results presented in Table 3 (Column 1) reveal that investment rate and fiscal deficit enter with positive and statistically significant coefficients at 5% level implying that investment rate and fiscal deficit enhance real GDP per capita in Nigeria. Thus, a percentage increase in investment rate would increase real GDP per capita by 0.26 percent, while a unit increase in fiscal deficit would also increase real GDP per capita by 0.07 percent in Nigeria. However, the coefficient of human capital growth was not statistically significant at 5% level suggesting that human capital growth does not explain variation in real GDP in Nigeria. These results are not due to the presence of heteroscedasticity, autocorrelation or multicollinearity because the standard errors are heteroscedasticity-corrected using Newey-West. Also, the study used Variance Inflation Factor (VIF) and correlation analysis to check for multicollinearity and the mean VIF of 1.21 suggests absence of multicollinearity. The correlation analysis reveals that the highest correlation among the explanatory variables is 0.38 (see Table 1). Multicollinearity cannot be said to exist in a model when the mean VIF is less than 5 or the correlation among the independent variables is less than 0.90.

Table 3: Estimation results the effects of macroeconomic variables on economic development

Dependent Variable: Real GDP per capita (Y)

Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Constant	9.774** (4.356)	8.915** (4.197)	8.922** (4.278)	11.861*** (2.616)	13.447*** (2.437)
INV	0.256** (0.122)	0.232** (0.111)	0.255** (0.113)	0.465*** (0.075)	0.398*** (0.067)
HCA	-2.238 (2.577)	-1.636 (2.499)	-1.680 (2.548)	-4.104** (1.618)	-4.776*** (1.469)
DEF	0.074*** (0.024)	0.067*** (0.019)	0.072*** (0.021)	0.059*** (0.013)	0.045*** (0.012)
INF		-0.005*** (0.013)	-0.003* (0.018)	-0.049*** (0.011)	-0.004** (0.001)
INT			-0.003 (0.002)	0.013 (0.015)	0.018 (0.014)
RER				0.077*** (0.016)	0.073*** (0.011)
DEB					-0.114*** (0.052)
R^2	0.354	0.455	0.483	0.779	0.828
$\overline{R}^2$	0.292	0.383	0.394	0.732	0.784

Notes: ***, ** and * indicates statistically significant at 1%, 5% and 10%, respectively. Heteroscedasticity-corrected and robust standard errors in parenthesis. INV= investment rate as a ratio of GDP; HCA= human capital growth; DEF= fiscal surplus/deficit as a ratio of GDP; INF= inflation rate; RER= real exchange rate; INT= real interest rate; DEB= government debt as a ratio of GDP

In Column 2, inflation rate was included in the regression as additional explanatory variable. The sign and significance of the coefficients of investment rate and fiscal deficit remain unchanged (though the size of the coefficients somewhat decrease) which implies that investment rate and fiscal deficit continue to have positive impact on real GDP per capita despite the inclusion of inflation rate in the model. But it reveals that inflation rate enters with a negative and statistically significant coefficient at 1% level connoting that inflation rate is deleterious to rea GDP per capita in Nigeria. The standard errors of this model are robust and heteroscedasticity-corrected using Newey-West while the mean VIF of 1.18 suggests absence of multicollinearity in the model.

In Column 3, additional explanatory variable namely real interest rate was included in the regression and the results reveal that the coefficient of real interest rate is not statistically significant at 5% level which means that real interest rate cannot explain variation in real GDP per capita in Nigeria. The coefficients of investment rate and fiscal deficit continue to be positive and statistically significant at 5% level (the size of the coefficients increase) while the coefficient of inflation rate remains negative and statistically significant at 10% level. It is important to note that the addition of real interest rate in the regression increases the size of the coefficients of investment rate and fiscal deficit and decreases the statistical significance of inflation rate. The standard errors of this model are robust and heteroscedasticity-corrected using Newey-West while the mean VIF of 1.31 suggests absence of multicollinearity in the model.

In Column 4, real exchange rate was included in the model as additional explanatory variable and the results show that real exchange rate enters with a positive and statistically significant coefficient at 1% level implying that real exchange rate enhance real GDP per capita in Nigeria. The coefficients of investment rate and fiscal deficit continue to be positive and statistically significant at 5% level while the coefficient of inflation rate remains negative and statistically significant at 1% level. Though the inclusion of real exchange rate in the regression increases the size of the coefficients of investment rate, but it increases the size and statistical significance of the coefficient of inflation rate, and the coefficient of human capital growth turns negative and statistically significant at 5% level. These results are robust to heteroscedasticity, autocorrelation or multicollinearity because the standard errors are heteroscedasticity-corrected using Newey-West, while the mean VIF is 1.52.

Finally, Column 5 has all the five Maastricht criteria variables in the model with the inclusion of government debt relative to GDP as additional explanatory variable. It is shown that the coefficient of government debt is negative and statistically significant at 5% level suggesting that government debt reduces real GDP per capita in Nigeria. The sign and significance of other variables remain unchanged (only the size of the coefficients change), with investment rate, fiscal deficit and real exchange rate positively related to real GDP per capita while inflation rate and human capital growth are negatively related. These

results are not due to the presence of heteroscedasticity, autocorrelation or multicollinearity because the standard errors are robust and heteroscedasticity-corrected using Newey-West. Also, the study used Variance Inflation Factor (VIF) and correlation analysis to check for multicollinearity and the mean VIF of 1.66 suggests absence of multicollinearity. The correlation analysis reveals that the correlation between inflation rate and government debt of 0.52 seem the highest among the explanatory variables (see Table 1). Since the VIF is less than 5 and the correlation among the independent variables is less than 0.90 multicollinearity cannot be said to exist in a model.

The findings of this study reveal that out of the five Maastricht criteria variables, fiscal deficit relative to GDP and real exchange rate have positive impact on economic development while inflation rate and government debt relative to GDP have negative impact on economic development. But real interest rate has no significant impact on economic development. Of the set of conditioning variables, investment rate has positive impact on economic development, while human capital growth has negative impact on economic development. The finding on investment rate in this study is consistent with theory and empirical studies such as Harris (1997) and Demetriades and Law (2006) that documented a positive impact of investment rate on GDP per capita growth rate. Growth theory suggests that increase in capital accumulation or investment rate is a major factor in explaining growth as well as accounting for differences in the standard of living among countries. The findings on the relationship between fiscal deficit relative to GDP and economic development confirmed Garrison and Lee (1995) who also found that both investment and fiscal deficit have positive impact on per capital GDP growth. Analogously, Karagol (2002); Panizza and Presbitero (2014); Eberhardt and Presbitero (2015) also found that government debt is negatively related to investment, economic performance and economic development. This study sheds new light on the relationship between real exchange rate and economic development. Although Hua (2012) and Tang (2015) found no significant positive correlation between real exchange rate and economic growth but they argued that the fluctuations in real exchange rate could result in a positive or negative impact on economic growth.

4.4 The Effects of Interaction of Macroeconomic Variables and Investment Rate on Economic Development

Table 4 reports the regression results of the interaction terms between each of the macroeconomic variables and investment rate. Starting from Column 1, fiscal deficit is interacted with investment rate to ascertain whether the impact of investment rate on real GDP per capita varies with the level of fiscal deficit. The coefficient of the interaction term is not statistically significant at 5% level suggesting that the impact of investment rate on real GDP does not vary with the level of fiscal deficit. In Column 2, inflation rate is interacted with investment rate to ascertain whether the impact of investment rate on real GDP per capita varies with the rate of inflation. It is shown that the coefficient of the interaction term enters with a negative and statistically significant coefficient at 1% level implying that the impact of investment rate on real GDP per capita varies with the rate of inflation. The economic implication of this result is that investment rate increases real GDP per capita more at lower rate of inflation than at higher rate of inflation in Nigeria. In Column 3, real interest rate is interacted with investment rate to ascertain whether the impact of investment rate on real GDP per capita varies with the level of real interest rate. The coefficient of the interaction term enters with a positive and statistically significant coefficient at 10% suggesting that the impact of investment rate on real GDP per capita varies with the level of real interest rate.

Table 4: Estimation results of the effects of interaction of macroeconomic variables and investment rate on economic development

Dependent Variable: Real GDP per capita (Y)

Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Constant	13.388*** (4.184)	8.292** (4.220)	9.312** (4.243)	14.027*** (3.114)	12.836*** (3.061)
INV	0.616** (0.315)	0.261** (0.115)	0.285** (0.122)	0.356*** (0.082)	0.286** (0.113)
HCA	-4.935* (2.689)	-1.689 (2.503)	-1.989 (2.501)	-5.167** (1.914)	-4.001** (1.840)
DEF	-0.188 (0.167)	0.066*** (0.020)	0.078*** (0.023)	0.067*** (0.017)	0.048* (0.025)
INV*DEF	0.112 (0.074)				
INV*INF		-0.019*** (0.006)			
INV*INT			0.019* (0.001)		
INV*RER				0.026*** (0.007)	
INV*DEB					-0.089** (0.043)

Notes: ***, ** and * indicates statistically significant at 1%, 5% and 10%, respectively. Heteroscedasticity-corrected and robust standard errors in parenthesis. INV= investment rate as a ratio of GDP; HCA= human capital growth; DEF= fiscal surplus/deficit as a ratio of GDP; INV*DEF= interaction of investment rate as a ratio of GDP and fiscal surplus/deficit as a ratio of GDP; INV*INF= interaction of investment rate as a ratio of GDP and inflation rate; INV*RER= interaction of investment rate as a ratio of GDP and real exchange rate; INV*INT= interaction of investment rate as a ratio of GDP and real interest rate; INV*INT= interaction of investment rate as a ratio of GDP and government debt as a ratio of GDP.

Furthermore, real exchange rate is interacted with investment rate in Column 4 to ascertain whether the impact of investment rate on real GDP per capita varies with the level of real exchange rate. The results reveal that the interaction term enters with a positive and statistically significant coefficient at 1% level suggesting that the impact of investment rate on real GDP per capita varies with the level of real exchange rate. Finally, the regression in Column 5 interacted government debt as ratio of GDP with investment rate to ascertain whether the impact of investment rate on real GDP per capita varies with the level of government debt. The results show that the interaction term enters with a negative and statistically significant coefficient at 1%

level implying that the impact of investment rate on real GDP per capita varies with the level of government debt. The economic implication of this result is that investment rate increases real GDP per capita more at lower level of government debt than at higher level of government debt in Nigeria. These results are robust to heteroscedasticity, autocorrelation or multicollinearity because the standard errors are heteroscedasticity-corrected using Newey-West. The findings seem to indicate that macroeconomic variables do not only explain variations in economic development, but they also matter in as much as they improve or reduce the rate of investment. Thus, better macroeconomic variables and more investment rate will contribute to the process of economic development than more investment rate in the midst of poor macroeconomic environment.

4.5 Robustness Checks

For robustness checks of the regression results of the interaction terms of each of the macroeconomic variables with investment rate, each of the macroeconomic variables is lagged by one period and then interacted with investment rate and the results are reported in Table 5. It is shown that the coefficient of the interaction term of lagged fiscal deficit and investment rate is positive and statistically significant at 1% level. The interaction term of lagged inflation rate and investment enters with a negative and statistically significant coefficient at 5% level. While the interaction term of lagged real interest rate and investment is not statistically significant at 5% level, but the interaction term of lagged real exchange rate and investment enters with a positive and statistically significant coefficient at 1% level. Finally, interaction term of lagged government debt relative to GDP and investment rate enters with a negative and statistically significant coefficient at 5% level. The results are similar to the results obtained with the interaction between current macroeconomic variables and investment rate, except that the interaction term of fiscal deficit is now statistically significant at 1% level. These results are robust to heteroscedasticity, autocorrelation or multicollinearity because the standard errors are heteroscedasticity-corrected using Newey-West. The findings suggest that one period lagged of macroeconomic variables matter in the process of economic development in as much as they improve or reduce the rate of investment.

Table 5: Estimation results of the effects of interaction of lagged values of macroeconomic variables and investment rate on economic development

Dependent Variable: Real GDP per capita (Y)

Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Constant	10.798** (3.684)	9.645** (4.298)	9.264** (4.139)	12.334** (3.012)	11.897*** (3.098)
INV	0.355*** (0.127)	0.248** (0.123)	0.285** (0.128)	0.345*** (0.073)	0.303*** (0.104)
HCA	-2.949 (2.202)	-2.105 (2.575)	-1.959 (2.474)	-4.137** (1.805)	-3.416* (1.845)
DEF	0.049*** (0.018)	0.069*** (0.020)	0.078*** (0.021)	0.056** (0.022)	0.057** (0.023)
INV*laggedDEF	0.023*** (0.008)				
INV*laggedINF		-0.017** (0.008)			
INV*laggedINT			0.017 (0.001)		
INV*laggedRER				0.026*** (0.005)	
INV*laggedDEB					-0.099** (0.039)

Notes: ***, ** and * indicates statistically significant at 1%, 5% and 10%, respectively. Heteroscedasticity-corrected and robust standard errors in parenthesis. INV= investment rate as a ratio of GDP; HCA= human capital growth; DEF= fiscal surplus/deficit as a ratio of GDP; INV*laggedDEF= interaction of investment rate as a ratio of GDP and lagged fiscal surplus/deficit as a ratio of GDP; INV*laggedINF= interaction of investment rate as a ratio of GDP and lagged inflation rate; INV*laggedRER= interaction of investment rate as a ratio of GDP and lagged real exchange rate; INV*lagged INT= interaction of investment rate as a ratio of GDP and lagged real interest rate; INV*laggedDEB= interaction of investment rate as a ratio of GDP and lagged government debt as a ratio of GDP.

5. Conclusion and Policy Options

The paper sought to provide answer to three basic questions: What are the effects of macroeconomic variables on economic development? What is the impact of investment rate on economic development? How do macroeconomic variables affect the impact of investment rate on economic development? The study used baseline growth regression for 1980-2014 data of Nigeria. The five macroeconomic variables were

selected based on Maastricht Criteria indicators that measure a country's macroeconomic stability. Out of the five macroeconomic variables, fiscal deficit relative to GDP and real exchange rate have positive impact on economic development, while inflation rate and government debt relative to GDP have negative impact on economic development. However, real interest rate has no statistically significant impact on economic development in Nigeria. It was also found that investment rate has positive and significant impact on economic development. Finally, with the exception of real interest rate, the study found overwhelming evidence that the impact of investment rate on economic development varies with the level of macroeconomic variables in Nigeria. The results of this study are robust and not due to heteroscedasticity, autocorrelation or multicollinearity because the standard errors are heteroscedasticity-corrected using Newey-West while the Variance Inflation Factor (VIF) and correlation matrix depict absence of multicollinearity.

The findings of this study seem to indicate that macroeconomic variables do not only explain variations in economic development, but they also matter in as much as they improve or reduce the rate of investment. It does appear that the interaction between macroeconomic variables and investment rate has been neglected by previous studies even though it is important in the process of economic development. Thus, "better macroeconomic variables, more investment rate" seem to be much more applicable proposition to the process of economic development than "more investment rate in the midst of poor macroeconomic variables environment". The implication of this study is that macroeconomic variables help to explain variation in economic development and investment rate, hence government should embark on macroeconomic policies that can promote a better performance of these variables with a view to achieving sustainable economic development.

Acknowledgement: The author wishes to appreciate the support from Universiti Sains Malaysia (USM) through USM Fellowship Award 2/15.

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Journal of Economic Cooperation and Development, **38**, 3 (2017), 169-198

Moves Towards an Islamic Common Market: An Evaluation of Potentials

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The Organization of Islamic Cooperation members had proposed the establishment of an Islamic Common Market among themselves in the early 1970s. This notion currently listed among the core objectives of the Organization and, to this end, the members adopted the TPS agreement in 1990. This study provides the first systematic and comprehensive evaluation of the TPS signatories' potential to increase trade by applying five different trade indexes suggested in the literature. The findings reveal different characteristics of the TPS countries and shed light on their potential for enhancing economic cooperation. In general, the results are in favor of the establishment of a Preferential Trade Agreement among the OIC members.

1. Introduction

Possibly motivated by the spiritual and cultural connections among themselves, in the early 1970s, the members of the Organization of Islamic Cooperation (OIC) had proposed the establishment of an Islamic Common Market (ICM) among themselves. However, since the establishment of a Common Market requires some preliminary condition satisfied and the OIC members as a group had met none, the member countries set the establishment of the ICM as their ultimate goal and agreed to take initial necessary steps for the future realization of the ICM**.** Now, the enhancement of intra-OIC economic and trade cooperation and the establishment of the ICM are listed among the core objectives the Organization (OIC, 2008).

Several agreements, programs and plans have been adopted during the past years leading towards the realization of the ICM, among which the Trade Preferential System among the Member States of the OIC (hereafter TPS), adopted in 1990, can be shown as the most relevant.

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The realization of the TPS would create a Preferential Trade System among the OIC countries. Currently, the agreement is signed by 40 of the 57 members of the OIC. The Agreement was expected to come into force in 2016 among the twelve of the signatories which have concluded all the required steps. These countries are Bahrain, Bangladesh, Jordan, Kuwait, Malaysia, Morocco, Oman, Pakistan, Qatar, Saudi Arabia, Turkey and the United Arab Emirates (UAE) (hereafter TPS countries).

Over the past years, a number of studies has investigated the proposed ICM and offered policy recommendations for its successful implementation (Dabour, 2004; Hassan & Islam, 2001; Hassan, Sanchez, & Hussain, 2010; Mohd Amin & Hamid, 2009; SESRTCIC, 2003; Zaman & Khan, 1983; Zeinelabdin & Ugurel, 1998). However, the TPS agreement, which is the most likely predecessor for the ICM, has not taken enough attention and the signatories' potential to increase economic cooperation has not been systematically and comprehensively studied. Particularly, the factors that usually looked for during the PTA negotiations for evaluating the potentials of PTA signatories to increase trade, such as the strength of trade relations, the degree of complementarity between the export and import structures of the signatories, the concentration (diversification) of exported products and export markets has not been accounted for. We fill these gaps in the literature by applying five different indexes to the trade flows of the TPS countries. To provide more precise results, we use the most recent trade data and the highest level product disaggregation available. Moreover, we also provide an up-to-date review of the economic cooperation activities among the OIC members, which is not present in the literature. The results shed light on the potential of the TPS countries in enhancing economic cooperation among themselves.

The rest of the paper is organized as follows: The next section provides a review of the economic cooperation activities among the OIC members. The third section provides a brief review of the literature on the ICM and TPS. The fourth section outlines methodologies used and data sources. The fifth section provides results while the last section concludes and offers policy recommendations.

2. Economic Cooperation Activities among the OIC Countries

2.1 Calls for the Establishment of an Islamic Common Market

The Organization of Islamic Cooperation (OIC), established in 1969, aims to achieve a higher level of cooperation among its members and protect its members' interests in the global arena. The Organization was acting as a political forum at the outset, but the role of economic cooperation in the development of interstate relations was recognized by the members very soon and several strategies in this regard in the early years of the Organization[2].

In 1974, during the second Islamic Summit Conference, the members announced a substantial target, the establishment of an Islamic Common Market (ICM) among the OIC themselves. A Common Market (also called Single Market) is a relatively advanced level in the preferentialism activities and can only be realized after Preferential Trade System, Free Trade Area and Customs Union have established. Since the OIC countries had not even realized the preliminary schemes, the members agreed to choose a step-by-step approach and the establishment of the ICM unofficially set as members' ultimate goal.

In 1997, during the 8th Islamic Summit held in Tehran, the necessity of the ICM once again stressed and the establishment of the ICM highlighted as a profound step towards strengthening Islamic solidarity. In 2008, the Charter of the Organization modified and strengthening intra-Islamic economic and trade cooperation and the establishment of the ICM listed among the core objectives of the Organization (OIC, 2008).

It is worth to noting that apart from politicians, religious leaders of the Islamic World such as the Imam (Leader) of the Grand Mosque in Makkah (Arab News, 2008) and supreme leader of Iran, Ayatollah Sayyed Ali Khamenei (OIC, 1997), have also called for the establishment of the ICM over the past years.

[2] See Ihsanoglu (2010) and Kayaoglu (2015) for more detailed discussion on the history, structure, objectives and roles of the OIC.

2.2 Agreements and Plan of Actions *en route* to an Islamic Common Market[3]

The OIC members have concluded several agreements, programs, and plans to build the fundaments of an ICM from the 1970s onwards[4]. In 1977, the members signed the General Agreement on Economic, Technical and Commercial Cooperation with the objective of encouraging capital and investment flows and stimulating exchange of information and skills among the member countries. The agreement came into force in 1981 and followed by the signing of the OIC Plan of Action to Strengthen Economic Cooperation (POA) - a ten-chapter document in which each chapter was devoted to a specific area of cooperation[5]. The POA was highlighting problems in each cooperation area and setting objectives and program of action for each sector to facilitate its application. Nevertheless, lack of political will and dissimilarities between the political and economic structure of the Islamic Countries hindered successful implementation of both of the agreements (Ihsanoglu, 2009). Furthermore, Ihsanoglu (2009) argues that the POA itself was suffering from a number of flaws, such as the absence of a time frame, specific quantitative targets and priority settings. He argues that the nonexistence of these factors had turned the POA into a "declaration of intention rather than a plan". These limitations addressed in the OIC Ten-Year Program of Action (TYPOA) adopted in 2005, during the chairmanship of Ihsanoglu himself to the OIC.

The level of intra-trade among a group of countries is commonly used for assessing the economic significance of countries to each other and for evaluating the level of cooperation. One of the objectives of the TYPOA was to increase intra-OIC trade to 20 percent from the prevalent 15 percent during the next ten years. In spite of the conflicts and civil wars in Islamic countries like Syria and Iraq, which stand on the center of the traditional trade routes, the intra-OIC trade could be raised to 19.9 percent in 2014, slightly below the target (SESRIC, 2015). Even though there might be reasons other than the collaborative work and

[3] The author is thankful to Mr. Nabil Dabour (SESRIC) and Mr. Ahmet Okur (COMCEC) for providing additional information about the agreements, which was not readily available.
[4] See SESRTCIC (2003) and Dabour (2004) for the detailed review of the agreements.
[5] The Plan of Action revised in 1994 to incorporate the changes in the world economy.

commitment of the member countries for the increase in intra-OIC trade, such as the implementation of non-TPS Preferential Trade Agreements (PTAs) among the OIC countries, this progress should be stressed as a significant achievement. For comparison, intra-trade among the ASEAN countries, a group of countries that have established an FTA among themselves in 1992 and have undergone serious trade negotiations and reforms, amounted to 24.1 percent in 2014 (ASEAN, 2016).

During the 13th Islamic Summit in April 2016, the OIC countries adopted the Program of Action covering years 2016-2025 (OIC, 2016). The Program highlights the importance of trade for development and mentions the level of intra-trade among the countries as insufficient. However, it does not include any quantitative targets as was in the TYPOA. Instead, the Istanbul Declaration announced at the Summit, which is more of a statement rather than a plan, calls the members to increase the intra-OIC trade to 25% during the upcoming ten years by implementing the TPS agreement and other instruments. This factor makes the Program subject to Ihsanoglu's critics and can be seen as its limitation.

2.3 The Trade Preferential System of the OIC countries (TPS)

The establishment of a Common Market requires some preliminary levels of economic cooperation be achieved. To this end, some of the OIC members signed the TPS agreement in 1990. The TPS aims to promote trade among the OIC countries through the exchange of tariff, para-tariff, and non-tariff measures. It consists of three different agreements and only after their signing and ratification at least by the same ten OIC members the legal basis of the TPS could be finalized. These agreements are the Framework Agreement on the TPS, which provides general principles in the formation of the TPS; the Protocol on the Preferential Tariff Scheme for TPS (PRETAS), which outlines tariff reduction schemes; and the TPS Rules of Origin, which describes eligible products for tariff discounts under the agreement.

To date, 17 members of the OIC have concluded the legal basis of the agreement[6]. However, the countries concluded the legal basis also had to inform the COMCEC about the schedule of application of the tariff reductions and reduction applied products (COMCEC, 2011). As of March 2016, 12 countries[7] have fulfilled this requirement, which are Bahrain, Bangladesh, Jordan, Kuwait, Malaysia, Morocco, Oman, Pakistan, Qatar, Saudi Arabia, Turkey and the UAE. Now, the implementation of the TPS depends on the conclusion of legislative and administrative measures in the signatory countries, which was expected to be finalized by 2016 (MODT, 2016).

3. Previous Studies on ICM and the TPS

To date, a considerable amount of literature has investigated the proposed ICM. Among these studies, the study done by Zaman and Khan (1983) seems to be the first. The authors review the developments of the world economic situation, political and socio-economic structures of the OIC member countries and trade and financial linkages between the OIC countries. They conclude that increasing cooperation among the members would be productive.

The study conducted by Zeinelabdin and Ugurel (1998) can be shown as the first comprehensive review of the economic cooperation activities among the OIC countries and the notion of ICM. Along with Zeinelabdin and Ugurel (1998), other in-depth studies, such as studies by Hassan and Islam (2001), SESRTCIC (2003), Dabour (2004) and Hassan et al. (2010) also review the economic cooperation activities among the OIC countries, put emphasis on the diverse economic and political structures of the Islamic countries, advocate a gradual approach, stress the need for increasing intra-OIC trade and strong political will for the formation of the ICM[8].

[6] The complete list of the signatories of the TPS agreements is available from the webpage of the COMCEC at http://www2.comcec.org/UserFiles/File/TPS-OIC/TPS-OIC-Sign.pdf (Accessed on February 23, 2017)

[7] As of February 2017, Iran and Syria have also submitted concession lists to the COMCEC. However, the estimations for the study had been carried out earlier than Iran's submission and, hence, we are not able to include Iran to the study. Syria's membership has been suspended due to human rights violation in the country, which restricts it from participating in the TPS.

[8] Hassan (2001) and Hassan et al. (2010) also provide review of other PTAs among the OIC members, such as ECO, GCC, SAARC and etc.

As mentioned above, the implementation of the TPS would satisfy the first step towards the establishment of the ICM. In this regard, the TPS can be regarded as the most likely predecessor of the ICM. However, despite its importance in the establishment of the ICM, only limited attention has been paid to the empirical evaluation of the TPS countries' potential in enhancing trade. Indeed, to the best of our knowledge, only three studies have been devoted to the issue over the 25 years of negotiation period.

Mohd Amin and Hamid (2009) apply the Revealed Comparative Advantage index (RCA) to the export flows of five of the signatories of the PRETAS (Jordan, Malaysia, Pakistan, Turkey and the UAE). They find the level of tariffs in the areas with comparative advantage low and show this as a promising factor towards the realization of the ICM. An application of the RCA index can also be found in Mohd Amin, Hamid, and Md. Saad (2011). However, it should be noted that the RCA index is not designed to evaluate the potential of countries to gain from a PTAs, but to measure country's relative advantage in production of specific products (WITS, 2014; World Bank, 2010).

The level of diversification of the exported products among the partners is often measured to evaluate prospects for expanding trade among PTA signatories. In this view, if the partners are exporting more diversified products to each other, then the members can enhance exports in more products, which can escalate the expansion of trade. Mohd Amin et al. (2011) evaluate the concentration and diversification of exports in 6 signatories of the PRETAS (Egypt, Jordan, Malaysia, Oman, Saudi Arabia, and Syria) and find small potentials for increasing trade. However, they are not following the generally recommended method for assessing concentration (diversification) level of export structures, which is the Herfindahl-Hirschman Product Concentration (HHPC) index (Mikic & Gilbert, 2009; WITS, 2014; World Bank, 2010). Additionally, the authors carry out the estimations in a relatively aggregated level (SITC 4-digit level), which may not provide precise evaluation of diversification and concentration levels in their studied countries.

One other way of evaluating trade expansion potentials is to estimate how PTA signatories' export distributed among themselves. If the export of a member is predominantly concentrated in some of the

countries, then benefits from a PTA would depend on the economic situation in those countries. If, for instance, any economic crisis takes place in those countries, then this might negatively affect the exporting country. The evaluation of export market concentration is done by applying the Herfindahl-Hirschman Market Concentration (HHMC) index. Both the HHPC and HHMC indexes are based on the independent works of Hirschman (1945) and Herfindahl (1950). Dennis and Shepherd (2011) and Ergüzel, Tunahan, and Esen (2016) apply these methods to assess product and market concentration in various regions.

When the realization of a PTA considered, one of the most looked factors is the strength of trade relations among the PTA participants. If trade relations among the participants have been powerful over the past years, then the chances to increase trade among the members are assumed to be higher.

In the literature of the recent years, two different approaches[9] are used to evaluate strength of trade relations - the Trade Intensity Index (TII) proposed by Brown (1947) and Kojima (1964), and relatively new index, the Growth Orientation of Markets Index (GOMI) outlined in Reis and Farole (2012). In TII, the obtained results depend on the volume of export among the considered countries and their share in the world trade, and in the GOMI the results depend on the dynamics of export growth among the considered pairs and the world. Some illustrative applications of the TII can be found in Ng and Yeats (2003), De Castro (2012), Iapadre and Tajoli (2014), and the GOMI in Varela (2013), García-Herrero et al. (2014) and Kathuria et al. (2016).

Another way of evaluating the potential of the PTA signatories to expand trade is to measure the level of match between the PTA signatories' export and import structures. If the level of match among the partners is high, then it is said that chances for gaining from a PTA are strong as the PTA members can trade more products with each other. The evaluation of the degree of similarity is done by applying the Trade Complementarity Index (TCI), which was proposed by Michaely (1996)

[9] Another, yet less empirical way of evaluating significance of trade relations among countries is to look at their share in each other's total trade. This will provide result equal to numerator of the TII index. See SESRIC (2015) for the detailed analysis of the OIC members' share in Intra-OIC trade flows.

and has since been applied in numerous PTA related studies, such as by Ng and Yeats (2003), De Castro (2012) and Pasha and Imran (2015).

Yet, to the best of our knowledge, none of the indexes outlined above (HHPC, HHMC, TII, GOMI, and TCI) has been applied to assess the potentials for trade expansion among the TPS countries. Hence, the questions about the potentials of the TPS countries to expand trade remain widely unanswered. This study feels these gaps in the literature by applying the above-mentioned indexes to the export and import flows of the TPS countries.

4. Methodology

4.1 Trade Intensity Index (TII)

The TII is used to evaluate the strength of trade relations among the signatories of PTAs. Following WITS (2014) and Jafarli (2015), the modified form of the TII can be shown as below:

$$TII_i = \left[\frac{\frac{x_{i,TPS}}{X_i}}{\frac{x_{wTPS}}{X_w}} \right] * 100$$

Where x_{iTPS} is the value of export from country *i* to the TPS countries, X_i is the total export of country *i.* The denominator also follows the same logic, where *w* represents the world.

The value of the TII ranges from zero to infinity. If the values are greater than hundred, then it is said that the country's export expansion to its pair is more intense than its export expansion to the world (WITS, 2011).
To account for the possible seasonality in the export and import flows of the studied countries, we have estimated the TII for four years – 2010, 2011, 2012 and 2013 - and will report the results as a simple average (i.e. divided by four) [10].

[10] The results for all studied years are available from the author upon request.

4.2 Growth Orientation of Markets Index (GOMI)

One another way of evaluating the strength of trade relations is to look into growth dynamics of exports between the considered countries and the world, which is done by employing the GOMI. The general formula of the GOMI is as below:

$$GOMI = CAGR_{ij} - CAGR_{wj}$$

$$CAGR_{ij} = 100 * \left[\left(\frac{X_{ijt_2}}{X_{ijt_1}} \right)^{\frac{1}{t_2 - t_1}} - 1 \right]$$

$$CAGR_{wj} = 100 * \left[\left(\frac{X_{wjt_2}}{X_{wjt_1}} \right)^{\frac{1}{t_2 - t_1}} - 1 \right]$$

Where CAGR is the Compound Annual Growth Rate – a year-after-year growth of exports among the considered pairs, X_{ijt} is the value of total exports from exporter country i to importer country j at time t and X_{wjt} is the value of total exports from the world (w) to country j at time t.

If the export of the considered country grows more than the export of rest of the world in partner's market ($CAGR_{ij} > CAGR_{wj}$), then the GOMI takes positive value. In this case, it is said that the exporter is well-positioned to increase its exports in the considered country than the world in average. Intuitively, singing a PTA among these countries would stimulate export growth further. On the other hand, negative values ($CAGR_{ij} < CAGR_{wj)}$) of the GOMI indicate that the exporter did not grow in the importer's market as the world did, and can signal potentials for the exporter to grow its share in the importer's market. The values of the CAGR also depend on the n^{th} root of the total growth rate among the countries, where $n = t_2 - t_1$.

For eight of the TPS countries, we have estimated the GOMI for four recent years, 2011-2015. Due to unavailability of data, we have estimated the index for Bangladesh and Saudi Arabia for years 2009-2013, and for Kuwait and the UAE for years 2010-2014.

4.3 Trade Complementarity Index (TCI)

The TCI is used to measure the level of match between PTA signatories' export and import structure. If the value of complementarity is high, then potentials to gain from trade liberalization is assumed as strong. The mathematical definition of the TCI can be shown as below:

$$TCI = \left[1 - \sum_{k=1}^{n} \left| \frac{m_{jk}}{M_j} - \frac{x_{ik}}{X_i} \right| \right] * 100$$

Where m_{jk} is the value of the import of the product *k* by country *j*; M_j is the country *j*'s total import; x_{ik} is the value of export of product *k* from country *i;* and X_i is country *i*'s total export.

The value of the index changes between zero and one hundred, where values above 40 suggest a higher degree of match in export and import structures of the studied countries.

Usually, small countries have relatively more concentrated export structures than larger countries. Due to this, the TCI may return high values for small countries, which can be misleading. To avoid confusion and provide a better comparison, we do not calculate the TCI for Bahrain, Kuwait, Qatar and the UAE. All of these countries are relatively smaller in size and have oil-dominated export baskets. To provide more precise estimations, we have estimated the TCI at HS 6-digit level (HS 6), which is usually the highest level of disaggregation in international trade statistics. As in the TII, we account for seasonality by estimating the index for four years (2010-2013).

4.4 Herfindahl-Hirschman Product and Market Concentration Indexes (HHPC and HHMC)

The level of concentration and diversification of the exported products and export markets of the countries are measured by applying the HHPC and HHMC indexes, respectively. The normalized forms[11] of the HHPC and HHMC for the TPS countries can be shown as below:

[11] If not normalized, then the value of the index changes between 1 and 10000. See Hirschman (1945) and Herfindahl (1950) for more details.

$$HHPC_i = \left[\frac{\sum_{k=1}^{n_i}\left(\frac{x_{ikTPS}}{X_{iTPS}}\right)^2 - \frac{1}{n_i}}{1 - \frac{1}{n_{iTPS}}}\right] * 100$$

$$HHMC_i = \left[\frac{\sum_{j=1}^{n_i}\left(\frac{x_{ij}}{X_{iTPS}}\right)^2 - \frac{1}{m_i}}{1 - \frac{1}{m_i}}\right] * 100$$

In HHPC, x_{ikTPS} is the value of the exported product k from a TPS country i to other TPS countries; X_{iTPS} is the total export of the country i to the TPS countries; and n_{iTPS} is the total number of products exported from country i to the TPS members.

In HHMC, x_{ijTPS} is the value of the exports from a TPS country i to a TPS country j; X_{iTPS} is the total export of the country i to TPS countries; and m_{iTPS} is the number of TPS countries (markets) country i exports.

The values of the HHPC and HHMC change between zero and unity, where values close to unity indicate the concentration of exported products (export markets) and values close to zero diversification of the exported products (export markets), respectively. For the HHPC, we have used HS 6-digit level trade data. We account for seasonality by calculating these indexes for years 2010-2013.

4.5 Data Sources

The estimation of all of the indexes has been carried out by using the World Integrated Trade Solutions Software (WITS, 2014), which extracts data on trade flows from the UN COMTRADE database. Due to unavailability of reported data for some of the countries for recent years, we have done all of the estimations by using mirrored data.

5. Results

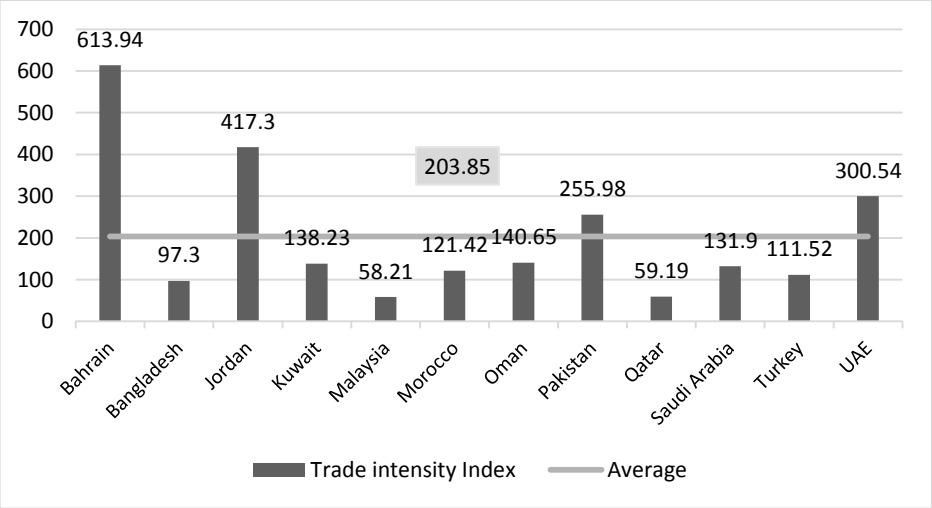
5.1 Results from the TII and the GOMI

Figure 1 reports the results from the TII. A brief look at the results suggests an intense trade relation among TPS countries throughout the studied years, as the results for nine out of the dozen countries are higher than the benchmark value of 100 percent. The average value of the index for the TPS countries reaches to 203.5 percent, which suggests that trade among the TPS countries was about two times more than what would be expected based on their trade relations with the rest of the world. By contrast, Yeats (1998) finds intensity between the MERCOSUR countries and between the MERCOSUR and the AFTA countries less than 100 percent. The results obtained from the study of Pigato and Gourdon (2014), who studies China-Eastern Africa trade relations, are also less than the results for the TPS countries.

The index reaches its peak in the case of Bahrain, with a value of about 614 percent. The value of the index for Jordan (417.3), the UAE (300.5) and Pakistan (255) are significantly high as well. Among the studied countries, index values only for Malaysia and Qatar are considerably lower than 100 percent.

The results from the GOMI (Table 1) suggest that, on average, the TPS countries' export to themselves grew 6.67 percent more than the world's export to the region during the considered years.

Figure 1: Trade Intensity among the TPS Countries



The highest average export growth rate among the TPS countries observed for the UAE, whose export to the TPS region grew 25.34 percent more than the world's. Remarkably, the levels of export growth of Turkey and the UAE have not been lower than the world's export growth level in any of the TPS countries' markets, which give the clues of significant trade expansion from these countries to the TPS countries. By contrast, Kathuria et al. (2016), García-Herrero et al. (2014), and Reis and Farole (2012) do not observe always positive values in their studies on the trade relations of Bangladesh, Chile, and Pakistan with their regional partners.

On the country basis, the highest values of the GOMI recorded for the exports of Saudi Arabia to Bahrain (50.78 percent), the UAE to Turkey (48.61 percent) and Bahrain to Bangladesh (45.39 percent). These results indicate that if the TPS agreement would take place, due to established strong relations, these countries would benefit more in terms of trade expansion.

On the other hand, the highest average import increase took place in the markets of Bahrain (12 percent) and Oman (10.84 percent). Remarkably, on average, imports from the TPS countries increased more than the imports from rest of the world in all of the countries' cases, as none of the average results returns negative value.

Among the studied countries, only Malaysia's and Pakistan's average exports to the TPS was below than zero during the observed years, by -1.35 and -1.92 percent, respectively. On the country basis, the lowest values of the GOMI observed for the exports of Pakistan to Turkey (-15.44 percent), Morocco to the UAE (-15.05) and Bahrain to Malaysia (-14.37 percent). These results signal that these exporting countries did not fully utilize potentials for trade expansion with their partners.

The results from the GOMI also reveal interesting characteristics of trade relations among the TPS countries. Firstly, for some of the countries (e.g. Bahrain-Saudi Arabia, Bangladesh-UAE, Morocco–Oman) we record high growth rates in both directions. Secondly, for group of the countries (e.g. Bahrain–Malaysia, Jordan–Malaysia) we observe lower than expected growth rates in both directions. Thirdly and interestingly, for some of the countries, we record opposite growth trends in export flows. For instance, export growth from Kuwait to Morocco was 8.52 percent lower but from Morocco to Kuwait 22.88 percent higher than the world level. The cases of the UAE with Malaysia, Morocco and Oman, and the case of Qatar and Pakistan are also examples to this trend.

Table 1: The Growth Orientation of the Individual TPS Countries

		EXPORTERS												TPS Average
		Bahrain	Bangladesh	Jordan	Kuwait	Malaysia	Morocco	Oman	Pakistan	Qatar	S. Arabia	Turkey	UAE	
IMPORTERS	Bahrain		0.18	23.2	-5.68	-3.76	13.36	9.41	1.6	7.3	50.78	2.78	44.93	12
	Bangladesh	45.39		4.61	-6.22	-2.76	7.94	13.82	-1.17	4.34	- - - -	4.6	11.53	7.46
	Jordan	0.4	4.16		-9.54	-12.46	-11.74	-5.06	2.17	12.64	1.66	6.5	37.46	2.18
	Kuwait	22.86	2.99	22.76		3.07	22.88	-5.97	1.25	8.46	0.24	3.39	28.75	9.22
	Malaysia	-14.37	4.76	-1.88	13.96		5.64	14.59	4.19	-3.36	-2.25	8	34.76	5.34
	Morocco	11.17	1.1	7.47	-8.52	0.31		20.21	0.31	2.1	-0.29	13.54	15.3	5.22
	Oman	-2.56	6.96	9.94	8.63	4.55	28.91		3.25	3.36	22.94	16.59	27.49	10.84
	Pakistan	1.63	0.56	7.05	7.8	-12.37	0.57	14.13		16.71	-7.02	2.58	10.92	3.55
	Qatar	-13.19	-0.52	8.54	5.07	4.31	21.76	7.75	-8.9		-1.86	17.29	8.75	4.08
	S. Arabia	23.89	6.04	9.85	9.12	-0.29	18.51	6.62	0.89	-2.81		7.75	35.64	9.6
	Turkey	28.74	3.73	8.79	-2.21	6.8	12.18	7.89	-15.44	3.87	-8		48.61	7.91
	UAE	17.41	41.64	4.08	6.17	-3.62	-15.05	-11.42	-11.21	1.7	3.18	5.8		3.22
TPS Average		10.11	5.97	8.7	1.55	-1.35	8.75	6	-1.92	4.53	5.39	7.4	25.34	6.67
World		-4.79	10.76	0.91	12.07	-1.33	4.17	-2.84	-2.10	-3.12	2.61	0.95	13.36	2.56

The results of the TII and GOMI may be influenced by factors that do not depend on countries, such as remoteness of the partners from each other, and also from the presence of barriers to trade among countries, which can either be because of tariff or non-tariff measures (NTMs). Since the TPS encompasses the abolishment of NTMs as well, it may be further simulate the trade exchange among some of the TPS countries.

In general, the obtained results suggest that, on average, the TPS countries have strong relations with the rest of the members. In this view, forming a PTA among the TPS countries would be enforcing present strong trade relations and be in the benefit of strengthening economic cooperation.

5.2 Results from the TCI

The results obtained from the TCI are presented in Table 2. The averages of the results indicate high complementarity in the export structures of the TPS8 countries as the average value of the index is above 47 percent. Among the studied countries, Turkey's and Malaysia's average complementarity with rest of the TPS8 countries are particularly high, both above 60 percent. In comparison, De Castro (2012) finds complementarity for the BRIC (Brazil, Russia, India, and China) countries, which have more advanced and diversified export structure than the TPS8 countries, below than 60 percent. The results in Pasha and Imran (2015) and Ng and Yeats (2003) are either far below than 60 percent or values at this level are very rare. Among the rest of the TPS8 countries, Morocco's complementarity (48.62) is higher than the average level for the TPS8 countries (47.49).

Table 2: The Trade Complementarity among the TPS8 Countries

		Exporters								**Average**
		Bangladesh	Jordan	Malaysia	Morocco	Oman	Pakistan	S. Arabia	Turkey	
Importers	Bangladesh		44.69	58.04	50.21	39.82	51.76	38.79	58.8	48.87
	Jordan	31.86		57.77	47.96	40.39	45.07	39.51	66.68	47.03
	Malaysia	31.21	43.27		48.67	48.72	41.42	47.39	61.07	45.96
	Morocco	31.69	43.83	64.55		47.24	46.43	46.21	65.46	49.34
	Oman	30.38	41.32	59.46	46.12		40.42	39.86	61.93	45.64
	Pakistan	30.79	45.05	60.41	49.72	39.06		38.13	61.38	46.36
	S. Arabia	32.82	64.11	58.66	50.01	38.24	45.47		67.71	51
	Turkey	31.15	43.27	62.5	47.68	47.31	42.07	45.96		45.71
Average		31.41	46.5	60.2	48.62	42.97	44.66	42.26	63.29	**47.49**

In general, higher values for the TCI can be expected for countries which have a more diversified export structures. This possibility is confirmed by the findings of this study. On the one hand, comparatively higher values of the TCI observed for the Newly Industrialized Countries in the study - Malaysia, Morocco, and Turkey, and on the other hand, the lowest average value observed for Bangladesh, which is the only Least Developed Country in the study.

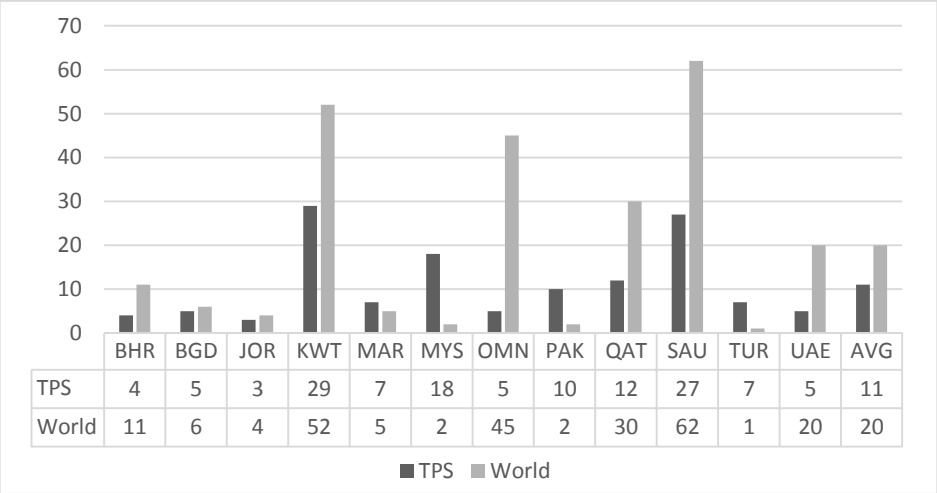
On a country basis, the highest level of complementarity observed between Turkey and Saudi Arabia, where the indicator is equal to 67.71 percent. Jordan's complementarity with Saudi Arabia (64.11) is also remarkable. On average, Saudi Arabia, Morocco, and Bangladesh's import match with the TPS8 countries' export at the highest rate, 51, 49.34 and 48.87 percent, respectively. These results indicate that if the TPS agreement would take place and if the trade-related costs are not higher among the traded pairs, these three countries' trade liberalization towards the TPS8 countries would expand trade more than the remaining countries.

5.3 Results from the HHPC and HHMC

The results obtained from the HHPC index are presented in Figure 2, where the name of countries indicated with their ISO-3 codes[12]. As can be seen from the figure, the average (AVG) of the TPS countries market concentration is equal to 11 percent, which suggests that, in general, the individual TPS countries' exports to the TPS market are not concentrated in fewer products. However, their exports to the world are more concentrated (20 percent) and the concentration levels are diverse.

[12] BHR – Bahrain, BGD – Bangladesh, JOR – Jordan, KWT – Kuwait, MAR – Morocco, MYS – Malaysia, OMN – Oman, PAK – Pakistan, QAT – Qatar, SAU – Saudi Arabia, TUR – Turkey, UAE – United Arab Emirates. AVG - the average of results.

Figure 2: The Product Concentration Levels of the Exports of the TPS countries



	BHR	BGD	JOR	KWT	MAR	MYS	OMN	PAK	QAT	SAU	TUR	UAE	AVG
TPS	4	5	3	29	7	18	5	10	12	27	7	5	11
World	11	6	4	52	5	2	45	2	30	62	1	20	20

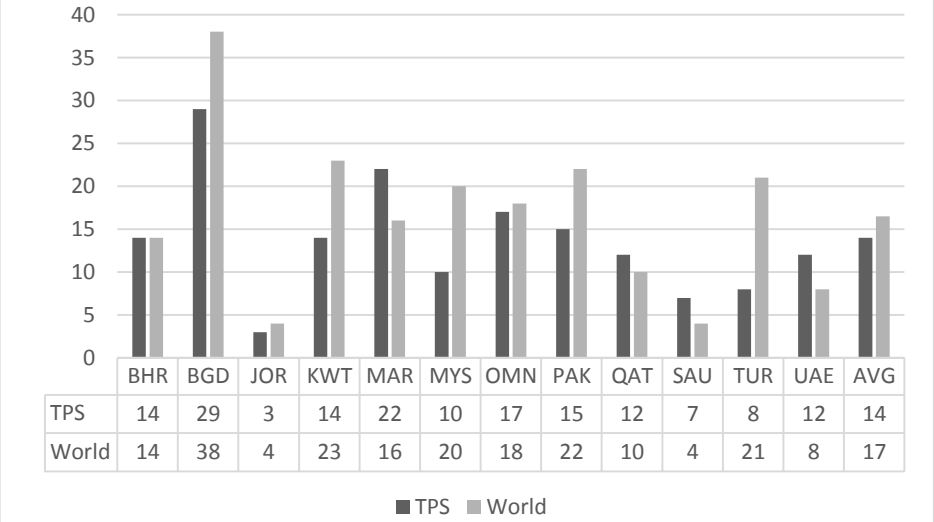
Jordan (3 percent), Bahrain (4 percent), Bangladesh, Oman and UAE (all 5 percent) have the highest level of diversified exports to the TPS markets, which indicate that these countries can expand exports to the TPS countries in a number of products. Interestingly, export structures of all of these countries to the world are more concentrated than their export to the TPS countries. Particularly, in the case of Oman, the concentration of exports in the world market (45 percent) is significantly higher than its product concentration in the TPS countries (5 percent).

The highest level of product concentration in the TPS countries' markets was observed for Kuwait (29 percent), Saudi Arabia (27 percent) and Malaysia (18 percent). This indicates that these countries may experience export expansion in few products only, which will also depend on the market circumstances. Among these countries, product concentrations of Saudi Arabia (62 percent) and Kuwait (52 percent) in the world market are especially high, which reflect their dependence of from exports of fewer products and their vulnerability to trade shocks. On the other hand, the highest level of product diversification in the world markets observed for Turkey (1 percent), Malaysia and Pakistan (both 2 percent). These results suggest high potential for these countries to diversify their exports in the TPS countries.

Our findings for Jordan, Kuwait, Morocco, Oman and Saudi Arabia are consistent with the findings of Dogruel and Tekce (2011) who studies product concentration in selective Middle East countries for years 1991-2009. In comparison, Mohd Amin et al. (2011) find export expansion potential for Jordan only.

Figure 3 reports the results from the HHMC index. Similar to the findings from the HHPC index, the average of the results suggest less concentration of the individual TPS countries in aggregate TPS market (14 percent), and relatively more market concentration in the world market (17 percent). This suggests that, in general, the TPS countries are not highly depended on fewer countries for exports. However, concentration levels of the individual TPS countries are various.

Figure 3. The Market Concentration Levels of the TPS countries



	BHR	BGD	JOR	KWT	MAR	MYS	OMN	PAK	QAT	SAU	TUR	UAE	AVG
TPS	14	29	3	14	22	10	17	15	12	7	8	12	14
World	14	38	4	23	16	20	18	22	10	4	21	8	17

The highest level of market diversification recorded for Jordan (3 percent), Saudi Arabia (7 percent) and Turkey (8 percent), which suggest a potential for export expansion in majority of the TPS countries. Intuitively, the total export flows from these countries may not be significantly affected if trade shocks take place in some of the TPS countries. However, Turkey's market concentration in the world (21 percent) is significantly higher than its concentration in the TPS

countries. On the other hand, the highest level of market concentration in the TPS countries observed for Bangladesh (29 percent), Malaysia (22 percent) and Oman (18 percent). This suggests that export expansion for these countries can be expected in fewer of the TPS countries, which will also depend on the economic situation in those countries.

Among the TPS countries, the highest level of market concentration in the world market observed for Bangladesh, Kuwait, and Pakistan (38, 23, 22 percent, respectively). Similarly, these results indicate the dependence of these countries from few trade partners and their vulnerability to economic situations in those countries. On the other hand, the lowest values observed for Jordan, Saudi Arabia (both 4 percent), and the UAE (8 percent), which suggest the opposite.

6. Summary and Policy Recommendations

6.1 Summary

This study is devoted to the OIC members' long-aspired dream, the establishment of an Islamic Common Market (ICM). At the outset, we provide a brief but up-to-date review of the economic cooperation activities among the OIC countries, particularly focusing on the nation of ICM and the main agreement in this regard, the TPS. We highlight the increase in intra-OIC trade to 20% as a remarkable achievement, but the absence of specific targets in the newly adopted program as its limitation.

The outcomes of the empirical estimations are diverse and change from country to country. However, in all of the estimations, the averages of the results are in favor of the establishment of a Preferential Trade Agreement (PTA) among the TPS countries. The findings from the first two empirical tools suggest that, on average, the individual TPS countries had two times more intense relations with the rest of the members than what would be expected, and the levels of export growth among them have been higher than their export growth levels in the world market. Remarkably, the export growth levels of Turkey and the UAE have not been below than the world's export growth level in any of the TPS countries. These results indicate that forming a PTA among the TPS countries would be increasing present intense trade relations and be in the benefit of strengthening economic cooperation.

In our next empirical study, we observed a high level of average complementarity in the export and import structures of the TPS countries, which is in favor of forming a PTA as well. Among the studied countries, the average complementarity of the Newly Industrialized Countries in the study (Malaysia, Morocco, and Turkey) are particularly high, which indicate that these countries would expand exports more if trade-related costs (tariffs and NTMs) decreased. We also find that the trade liberalization of Saudi Arabia, Morocco and Bangladesh towards the TPS countries would expand trade more than other countries. Remarkably, the levels of trade intensity, compound growth, and complementarity among the TPS countries are higher than the levels observed among the members of previous preferentialism schemes, such as the MERCOSUR and the BRIC.

Lastly, we evaluate the product and market concentration levels of the TPS countries in the TPS and world market. The average of the results suggests less concentrated product and market structures for the TPS countries. Specifically, Jordan found to have the highest level of market and product diversification, which suggest that it has more potential to increase trade in majority of the TPS countries and in more products. However, the TPS countries have a relatively higher level of product and market concentration in the world market than in the TPS market. In some of the countries' cases, the concentration levels are particularly high, suggesting vulnerability of some of the countries to trade shocks and economic situation in a small number of countries.

6.2 Policy Recommendations

To date, the most profound step taken for the establishment of the ICM is the singing of the TPS, which will satisfy the first level in the preferentialism activities. However, without an active involvement of the OIC, some of the OIC members have already established comparatively higher levels of preferentialism schemes among themselves. For example, the GCC members already formed a Common Market, and the members of the GAFTA are in the process of establishing a Customs Union. In today's world, PTAs are not only signed among the countries and union-country type agreements become more and more common. In this connection, the establishment of ASEAN-China, GCC-Singapore, MERCOSUR-Israel type trade agreements between GCC, GAFTA and the rest of the OIC countries

under the sponsorship of the OIC would boost trade cooperation between the OIC members and also provide another basis for the establishment of the ICM. As a matter of fact, currently, Jordan, Malaysia and Turkey are in hard negotiations with the GCC to establish a PTA among themselves.

As in the many aspects of social life, the globalization has also changed the view of the international trade. If before the 1960s cross-border trade was mainly taking place between countries, today, according to UNCTAD (2013), as much as 80 percent of the global trade occurs among the Trans National Corporations (TNCs). In this regard, encouraging investment flows from capital reach OIC countries (such as the GCC member countries) to the investment-hungry OIC countries, such as transitional economies or the Least Developed Countries, and facilitating the establishment of the branches of the TNCs from the OIC countries in those countries would be in the benefit of increasing economic cooperation. This can be achieved, for example, by updating the related agreement on investment matters signed in 1981 to reflect the current world conditions[13] and by organizing an OIC level business networking events.

As discussed above, some of the TPS countries, especially the GCC countries, have a relatively more concentrated export structure, which makes them vulnerable to trade shocks and limits their chances to enhance trade. This issue can be handled by either horizontal or vertical diversification of exports. The horizontal diversification refers to the harmonization of the share of the exported products in the export basket without adding new products to the basket but the vertical diversification requires the inclusion of new products to the export basket. Because of long-term development implications, the vertical diversification is more preferable. The vertical diversification can be achieved by creating appropriate competition climate in home countries and by encouraging trade in non-traditional export sectors. This would result with more diversified and innovative products that can compete in global market and decrease dependence from few products.

According to the terms of the TPS agreement, the Non-Tariff Measures (NTMs) among the TPS countries will be abolished upon the

[13] See Dabour (2004) for the description of the agreement.

commencement of the TPS (COMCEC, 2016). However, the elimination of the NTMs among the PTA signatories are one of the major difficulties as the NTMs increasingly used as a protectionist tool in place of the discounted tariffs (WTO, 2012). This fact is also correct for the GAFTA countries (ESCWA, 2015). In this regard, to facilitate the successful implantation of the TPS, a special attention would be needed to the elimination of the NTMs as, otherwise, discounts in tariffs may not be translated into increases in cross-border trade.

In a concluding remark, it worth to noting that currently there are 423 Preferential Trade Agreements which have already entered into force (WTO, 2016). Yet, many of these agreements have not been properly implemented and, therefore, have played a limited role in the improvement of economic cooperation among their signatories. If the TPS realized, one more PTA will be added to the list. However, whether it will bring positive changes to the lives of the OIC citizens as the EU, NAFTA, ASEAN and MERCOSUR did, or will gather dust on the shelves of history, will be depend on the political will, level of involvement and commitment of the TPS signatories.

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