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Contents

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The financial stability index – An insight into the financial and economic conditions of Romania

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Abstract. *The goal of this paper is to quantify the index of financial stability linking it with macroeconomic indicators for Romanian economy. The index is intended to analyze the relationships between the main indicators of the banking sector and the most relevant macroeconomic indicators. The Financial Stability Index synthetizes the balance state and evolution of a complex of financial variables as well as the impact of the banking system stability upon the real economy. In this paper we intend to construe the Financial Stability Index (FSI) by using the VAR auto regressive method.*

Keywords: financial, stability, index, nonperforming loans, banking.

JEL Classification: C43, C53, E50.

1. Introduction

In this paper we intend to approach the notions of financial stability applicable to the current economic context from a predictable perspective for a short future period of time. For this purpose hereinafter we will define and quantify the Financial Stability Index (FSI) as a mean of studying the convergence of the financial and banking system in the general current macroeconomic context.

This indicator is intended to project the most representative financial and banking indicators used in the real economy. The data frequency taken into account is quarterly, and for the cases where these data were unavailable we had to resort to their seasonal extrapolation.

Taking as a reference point the notion of financial stability as outlined in the published literature, we intend to analyze the theoretical notions aimed at identifying the main financial and banking indicators considered to be truly relevant for both micro-economics and macro-economics. In choosing their selection criteria we have taken into account the Romanian banking system specifics related to:

- Its systemic structure.
- The mostly used current financial operations and the types of the beneficiaries of these financial services.
- The banking industry regulations aimed at directly stabilizing the financial market.

In establishing and interpreting the indicators that define the financial stability we have also taken into consideration several aspects from the "Report on Financial Stability" published by the National Bank of Romania in April 2016.

2. Theoretical aspects

2.1. Financial stability – concept and importance

There are numerous definitions of "financial stability", most of them having in common the fact that the financial stability implies the lack of those episodes (crises) that disturb the financial system and render it incapable of adjusting itself to the stress factors.

The necessity to define the notion of "financial stability" has emerged within the actual context of economic development pursuant to the deep financial crisis that affected the whole world economy. The mechanisms that trigger a financial crisis are identified on the same time with the mechanisms that help rebalance the finance relationships existent in the period of building up confidence in and relaunching the real economy. "The National Committee for Financial Stability" (CNSF) was created for this purpose in Romania in 2007.

In the process of defining the notion of "financial stability" we will take into consideration both references from the official institutions involved in keeping the financial relationships balance and the most representative definitions substantiated by published literature.

Thus, The Central European Bank has stated that *"financial stability is a state whereby the build-up of systemic risk is prevented"*. From this organization's point of view *"systemic risk can best be described as the risk that the provision of necessary*

financial products and services by the financial system will be impaired to a point where economic growth and welfare may be materially affected". (https://www.ecb.europa.eu/ecb/tasks/ stability/html/index.en.html)

Therefore, a certain financial system is considered to be stable when it is capable of rather facilitating than preventing economy performance and dissipating the financial imbalances appeared as a result of some internal system developments, adverse or significant unforeseen events (Schinasi, 2004).

The World Bank considers that "*the true value of financial stability is best illustrated in its absence, in periods of financial instability. During these periods, banks are reluctant to finance profitable projects, asset prices deviate excessively from their intrinsic values, and payments may not arrive on time. Major financial and banking instability can lead to bank runs, hyperinflation, or a stock market crash. It can severely shake confidence in the financial and economic system*". (http://www.worldbank.org/en/publication/gfdr/ background/financial-stability)

The Governor of the National Bank of Romania, Mugur Isărescu, in his paper "Prices Stability and Financial Stability" (2006), writes that financial stability has both a wide and a limited sense. In a wide sense, with reference to the general performance of the financial system, financial stability is the situation when the financial system is able to efficiently attract and allot monetary assets as well as to absorb "shocks" without damaging the real economy. In a limited sense (in the sense of avoiding crises), financial stability is the situation when banking crises do not occur, and the assets prices and especially the interest rate are highly stable (Isărescu, 2006).

Taking into account all the above definitions, we can conclude there is no widely accepted definition of the notion of financial stability, but there are various interpretations of this concept. In the published literature financial stability has been frequently explained by examples of financial instability situations and their generating factors being given. Thus Goodhart (2006) defines financial instability as a situation where there exist high default rates and low profit rates in the banking system. Among the financial instability generating factors there are the overly optimistic economic forecasts that lead the financial and banking organizations into acquiring very high risk portfolios. Therefore these institutions become vulnerable to systemic shocks and are in danger of going into payment default. (Bhattacharya et al., 2011; Brunnermeier, 2008)

There are however three elements unanimously accepted: the financial system components, the risks that affect these components and contagion.

The financial system components are:
1. Financial markets (monetary market, capital market).
2. Financial intermediaries (banks, insurance companies).
3. Financial infrastructure (payment systems, clearing houses).

These components allow an efficient allotment of the resources in an economy if the risks that could affect them and the entire system are detected.

The main risks are:
1. A slowdown of the economy dynamics (could cause losses for the banks due to the difficulties in paying back the loans as a result of diminished sales or wages);
2. Variations in the price of the financial assets (could cause financial losses to the investors);
3. Decline of an economy sector that previously represented a focal point for banks and investors.

Should this kind of risks spread between economy sectors, domestically or internationally, independently from the structural connections or current disturbances, contagion occurs.

The loss of financial stability takes place when the financial system components have been affected by the inter-sectorial spread risk. (Dănilă, 2011).

2.2. Prudential measures

In order to keep the financial stability under control, macro and micro prudential measures must be separately enforced by the central banks on the one hand and financial institutions on the other hand. In this process the particularities of each national economy must be observed (Brunnermeier et al., 2009).

In order to prevent and discard the financial instability generating risks within the Romanian banking system, "The Macroprudential Measures Adopted by the National Bank of Romania Regarding the Implementation of Capital Buffers" came into force in 2016. In this context and on the recommendation of the National Committee for Financial Stability, "*the National Bank of Romania introduced additional capital requirements consisting of: the capital conservation buffer; the countercyclical capital buffer; the capital buffer for other systemically important institutions (the O-SII buffer); the systemic risk buffer. The activation the above mentioned capital buffers is expected to be beneficial both for each credit institution by increasing the resilience to possible adverse developments, as well as for the whole banking sector by strengthening the financial stability"*. (http://www.bnr.ro/The-macroprudential-measures-adopted-by-the-National-Bank-of-Romania-regarding-the-implementation-of-capital-buffers-13733.aspx).

These measures are intended to strengthen the banking system against the external shocks generated by external financial imbalances and alleviate the economy's cyclical evolution shocks. Within the context of a potential future financial crisis, these measures are intended to sustain the real economy financing and diminish the crisis effects. These measures are enforced in accordance with the "Basel III" set of reformed measures related to capital adequacy. "Basel III" sets out standards for the banking system aiming at creating a better capital base by requiring the increase of the minimal common equity and minimal level 1 own funds. On the same time strict eligibility criteria for instruments determining the level 1 own funds have been adopted.

For this purpose, The National Bank of Romania (NBR) introduced further requirements for:
1. Cover for risks, especially for those highlighted during the crisis period such as exposures in the trading book.
2. Counterparty credit risk, securitized exposures and securitization exposure;

3. Limitation of the leverage effect as an additional measure for the capital requirements calculated by taking risks into account.
4. Set out of an international financial liquidity standard able to confer resistance to shocks/liquidity crisis on a short term (30 days) and a solid structural liquidity standard for a long term (one year). (Report on Financial Stability, NBR, 2011)

The Bank for International Settlements, through "Basel III" Agreement, has set out measures in connection with micro and macro-prudential policies aiming at:
1. Preventing an excessive pile up of risks generated by external factors and market deficiencies in order to alleviate financial cycle fluctuations (temporal dimension).
2. Increasing the financial sector resistance and limiting the contagion effects (transversal dimension) – micro-prudential measures.
3. Encouraging a general perspective at system level in the financial regulation field in order to create an adequate incentives set for the market players (structural dimension) – macro-prudential measures.

The two approaches of the supervision complement each other in the sense that an increased bank resistance to the contagion effect ensures a lower systemic risk. (http://www.bis.org/bcbs/basel3.html)

2.3. Correlation between the financial stability and real economy

Financial stability is essential for economic growth because most transactions in the real economy are concluded through the financial and banking system. This system is able to ensure the real economy growth by being capable of financing it (De la Torre et al., 2012). There is an interdependence between the financial and banking system and the real economy. Starting from this interdependence we have developed and quantified the financial and banking stability index (ISFB) which is the main subject of this paper.

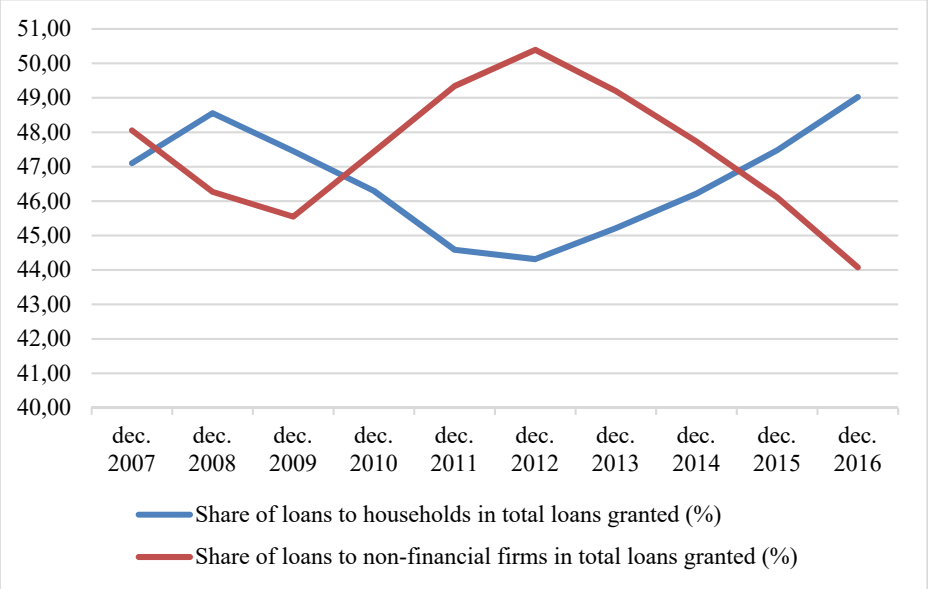
Pursuant to the measures enforced post-crisis by the decision factors in the financial and banking systems, the credit institutions in Romania have consolidated their resistance to adverse shocks and registered significant progresses in cleaning up their balance sheets (The National Bank of Romania, Financial Stability Report, 2016).

Real economy financing has flourished due to the loans granted in Romanian lei. As per The Financial Stability Report issued by The National Bank of Romania in April 2016, 67% of the loans granted to non-financial companies between January and December 2015 were in domestic currency. In the population segment, the new loans in lei represented 90% of the loans granted by banks. In 2016 there was a + 4% variation of the credit stock in national currency and of – 11% variation of the loans in foreign currency (European Commission, Country Report Romania 2017, p. 9).

The loans in foreign currency do not pose a flux problem anymore; their weighting diminished from 52.5% to 48.2% for the non-financial companies between December 2014 and December 2015 and from 60.7% to 51.3% for population (Figure 1 and Figure 2).

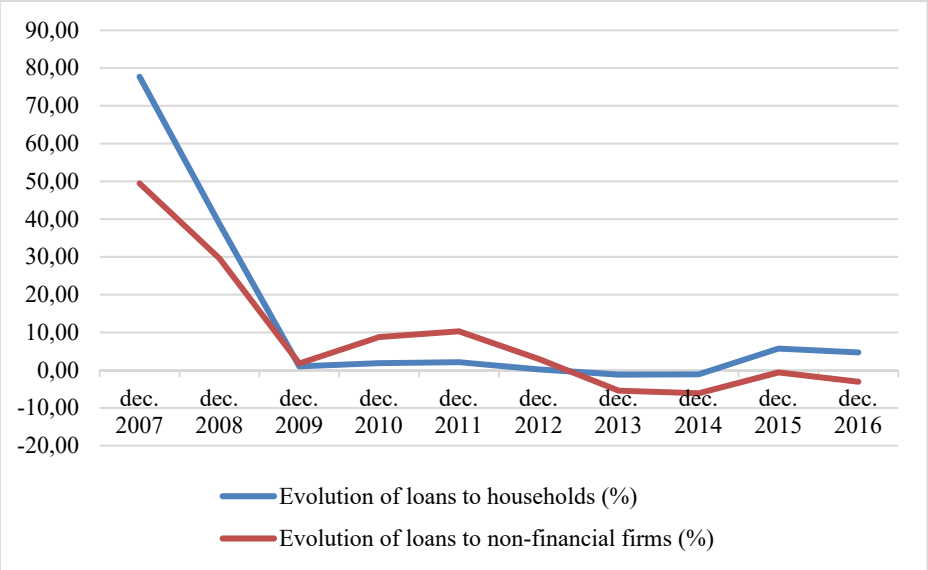
Nonetheless the weighting of loans granted in foreign currency, although on a descending trend, is still important.

Figure 1. *Evolution of the share of loans granted to households and non-financial firms*



Source: Personal processing in Excel based on NBR data.

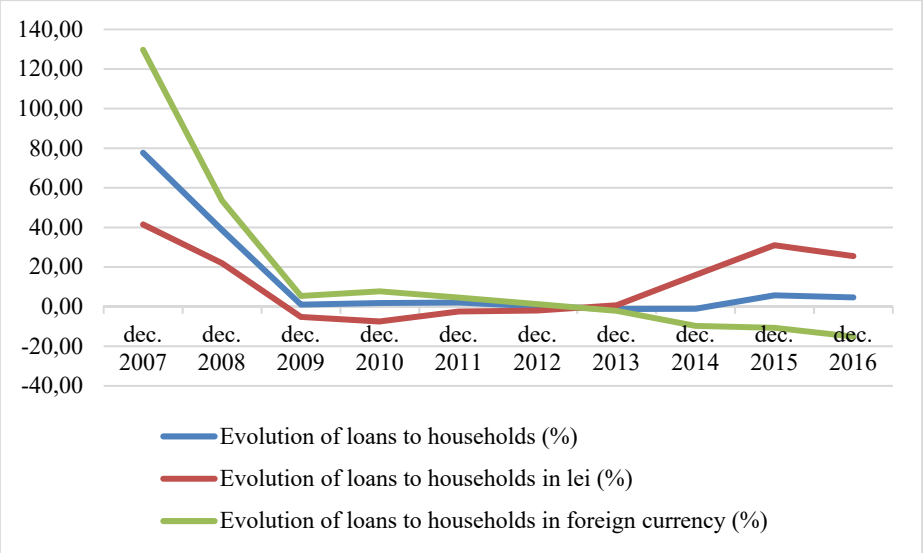
Figure 2. *Evolution of the volume of loans granted to non-financial firms*



Source: Personal processing in Excel based on NBR data.

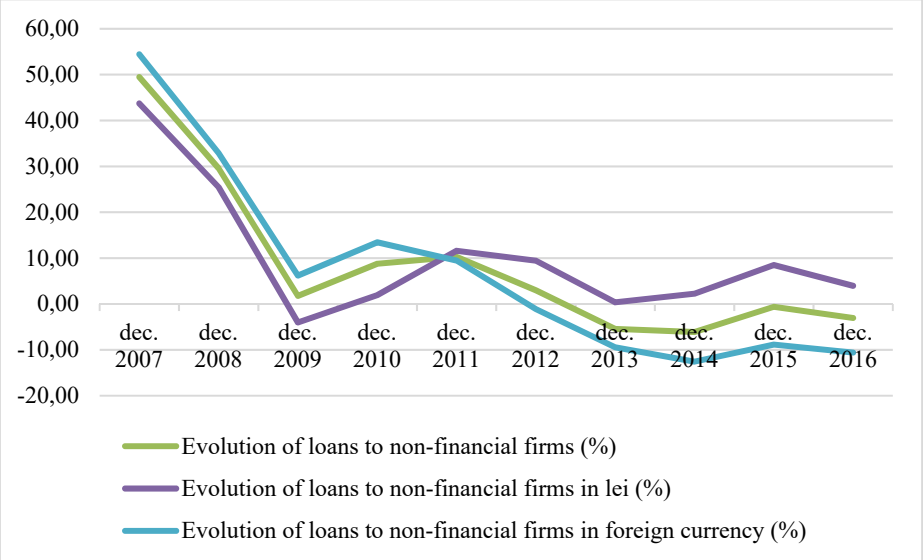
In 2015 the banks granted loans to population and less to the companies and this situation was the same in 2016. As per Country Report Romania 2017 issued by European Commission, the loans given to companies have continued to diminish (-3.1% from year to year in December 2016). (Figure 3 and Figure 4).

Figure 3. *Evolution of loans in lei and foreign currency granted to households*



Source: Personal processing in Excel based on NBR data.

Figure 4. *Evolution of loans in lei and foreign currency granted to non-financial firms*

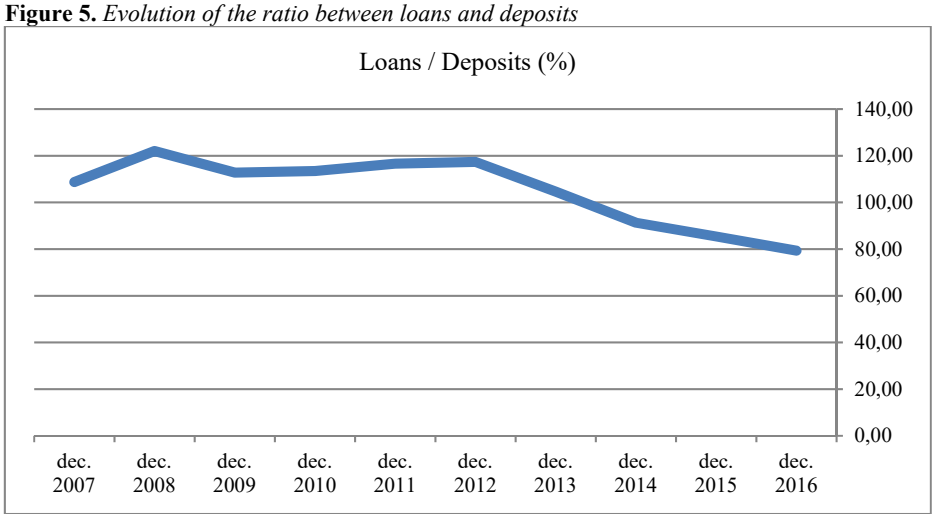


Source: Personal processing in Excel based on NBR data.

The loan demand remained low because the resident companies adjusted their balance sheets and preferred to reinvest their profits (Country Report Romania 2017 issued by European Commission). The financing strategies of the most important banks do not take into consideration a change of their business models in the next two years. They intend to maintain the existing structure in regard with the debtors and lending in lei. Financing from headquarters kept on diminishing in an orderly way thus minimizing the banking sector dependency on external sources.

According to The National Bank of Romania, the weighting between loans and deposits has been on a descending trend since 2012: it represented 79.34% in December 2016 compared to 117.3% in December 2012 or 122.03% in December 2008 (Figure 5). The level of this weighting has been forecasted by banks and does not pose risks from macro-prudential perspective.

Figure 5. *Evolution of the ratio between loans and deposits*



Source: Personal processing in Excel based on NBR data.

The fact that the financial and banking system has a very important role in real economy is undeniable; its smooth operation naturally determines economic growth and guarantees the financing of the best investment opportunities which lead to capital accrual and positively distributed risks. Prior to the 2008 international finance crisis, the international financial system had experienced an extremely accelerated development that proved unhealthy later on and created financial and macroeconomic imbalances. Thus, The National Committee for Financial Stability (CNSF) definitely imposes the need for financial supervision both from a micro- and macro-prudential point of view. On the same time the lack of an action framework was evident although it would have been necessary for forecasting possible imbalances in the nearest future.

Thus, the target of the macro-prudential measures is to ensure the optimal activity of the financial system and prevent its possible imbalances. In this way financial stability is achieved on the same time with the systemic risk reduction.

The National Committee for Financial Stability (CNSF) was also created out of the necessity of harmonizing the Romanian regulations with EU requirements in regard with financial crisis management. On June 1, 2008 "*The Memorandum of Understanding on Cooperation between the Financial Supervisory Authorities, Central Banks and Finance Ministries of the European Union on Cross-Border Financial Stability*" entered into force.

2.4. Correlation between real economy and non-performing loans

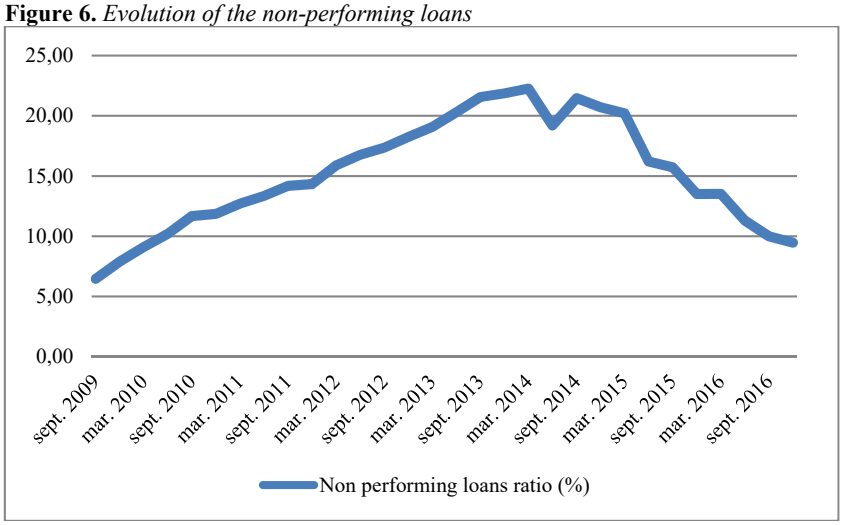
There is a direct connection between the factors that make a loan to become non-performing and those that trigger economic crises. This means the degradation of the economic climate is a result of diminished profit generating and financial activities and responsible with creating cash flows in economy (Nir, 2013).

If we have a look at the risk provisions calculation methodology and the fact that they are covered by the bank profit, we can conclude that a growing rate of non-performing loans will increase risk provisions and implicitly decrease the financial institution profit. In this way the bank is not willing anymore to take new risks by granting new loans. The lack of financing in the real economy generates financial blockages that directly affect the "healthy" companies too. These firms are, in turn, subjected to cash flow pressures and insolvency threats.

The economic climate deterioration due to payment blockages and underfinanced economy automatically leads to a decrease in the price of financial and real estate assets and securities. This degradation closes the vicious circle and has repercussions upon the commercial banks balance sheets. This time pressure is put on guarantees value leading implicitly to an increase in credit risk provisions and a decrease of economy financing potential.

In Romania in 2016 the non-performing loans volume diminished as a result of balance sheet relieve and impaired assets sale. As a result of the Resolution Plan for the Non-Performing Loans implemented by the National Bank of Romania in 2014, non-performing loans volume strongly decreased with approximately 12% - from the peak of 22.26% registered in February 2014 to 10% in October 2016 (Figure 6). As a supplementary measure to those enforced in 2014, in April 2016 the National Bank of Romania requested the banks completely cover the non-performing loan risk provisions (loans more than 180 days past due, non-guaranteed loans or loans for which there was a very low possibility to recover the guarantee) in order to facilitate the balance sheets relieve.

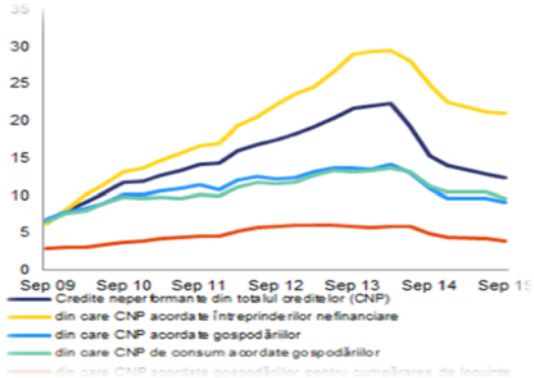
Figure 6. *Evolution of the non-performing loans*



Source: Personal processing in Excel based on NBR data.

In spite of this, banks are still affected by the companies and consumer credit risk exposure, these kind of loans being the most afflicted with repaying problems (Figure 7).

Figure 7. *The structure of non-performing loans by types of beneficiaries*



Source: European Commission, Country Report Romania 2017, p. 21.

From this perspective we consider the study of the non-performing loans rate to be very useful because this rate is an indicator of the degree to which the financial needs are covered and implicitly the volume of the companies profit and the level of macroeconomic growth. Thus, the economic forecasts for the near future are easier to create, the multiplier monetary and banking effect being inert within real economy. The ability of commercial banks to diminish the non-performing loans rate, demonstrated in the post-crisis period, has rapidly attracted the money supply increase and implicitly an increase of their capability of covering the real economy financing needs. Consequently, the basis for an ascending macroeconomic trend has been created.

From the analysis of the non-performing loans rate we can notice its gradual decrease due to a discard of the banks exposure to the defaulting clients corroborated with the proper risk management of the default claims not yet discarded.

3. Data series and research methodology

In this paper we intend to construe the Financial Stability Index (FSI) by using the VAR auto regressive method. The VAR type models are used for forecasting the interconnected time series systems and analyzing the innovations' dynamic impact upon the variable system. In ISF construing the financial and banking variables are pondered with the answer estimated by the VAR model, cumulated for two quarters, to the shock impulse of these financial and banking variables upon GDP. We can notice the GDP answer is stronger if staggered by two quarters.

Considering that the financial variables evolutions are often divergent and highly volatile, one of the approach the published literature proposes is the drawing up of an aggregated index of these variables – the Index of Financial Conditions (IFC) – capable of demonstrating the relationship between the financial and banking system and real economy, evaluating, from a historic point of view, how restrictive or relaxed the financial conditions are and offering, on the same time, information in regard with the economic activity

evolution on a short term. Thus Andreea Muraru (2015) draws up an Index of Financial Conditions (IFC) using three methodologies: weighted averages starting from the impulse-answer functions extracted from an auto regressive vector (VAR) estimated for the considered financial variables and Gross Domestic Product (GDP), main components analysis (ACP) and the dynamic common factors model (DFM).

In his paper "Financial Conditions Indexes: A Fresh Look after the Financial Crisis", Jan Hatzius (Hatzius et al., 2010) drew up an innovative Index of Financial Conditions. He introduced in evaluations some quantitative and survey indicators that had not been used before and data series estimation techniques applicable for a long period of time.

In 2013 Ho and Lu (International Monetary Fund) drew up a financial conditions index for Poland. Through this index they created a correlation between the financial conditions in this country and its Gross Domestic Product (GDP) growth. In their work two methods were used: the factorial analysis and auto regressive factor. The paper conclusion is related to the short term prediction ability depending on the financial growth conditions for the GDP, growth owed to the importance of the financial sector in the economic evolution of Poland.

In a research conducted by Deutsche Bank economists (Hooper et al., 2014) a number of 38 variables are used for drawing up the Index of Financial Conditions (IFC). These variables are pondered with the oscillating level of their correlation coefficient with GDP evolution. In the paper a comparison is made between the Indexes of Financial Conditions calculated by distinct methods and on the basis of various data sets. The main conclusion of this research is the indicators have a similar behavior for a long time with no regard to the content and methodology used for their calculus.

Taking into account the subjects of the published literature, the objectives of this paper and the local economy specifics, we have chosen relevant variables from the national financial environment, foreign financial environments with major influence upon our national economic environment and local macroeconomic indicators. The selected variables are the following:

GDP (Gross Domestic Product) – It measures the monetary value of final goods and services produced in a country in a given period of time (a quarter or a year). It has been chosen as a base for the measurement of the macroeconomic results of a country.

ROBOR (Romanian Interbank Offer Rate) – The interest rate at which banks lend to each other in Romania. This indicator has been selected because of the influence it exerts upon the real economy financing needs. The interests levied by the banks are connected to this indicator.

REER (Real Effective Exchange Rate) – It has been selected because the exchange rate changes have an impact upon economic growth.

NPL (Bank Non Performing Loans to Total Gross Loans) – The non-performing loans rate in total loans granted. It has been chosen because of its influence on the banks lending policies and their willingness to take credit risks.

ROE (Financial Profitability Rate) – It has been selected because of the influence it exerts on assuming the decision of taking risks in connection with the financing the real economy

ROA (Economic Profitability Rate) – It has been chosen because the lending decision and its profitability level are very important in assuming the decision of financing the real economy.

LEV (Leverage Effect) – It has been chosen due to its capacity of reflecting an adequate capitalization of the banking system and implicitly its willingness to finance the real economy.

ASE (Bank Assets) – It has been selected due to its capacity of reflecting the real economy financing granted by the banking sector.

VIX – Index that describes the investors' unwillingness to take risks. It measures the prospected volatility on short term based on options having as a support the S & P 500 Index.

EURIBOR (Euro Interbank Offered Rate) – The EURIBOR rates are based on the interest rates at which a panel of European banks borrow funds from one another. It has been chosen because it influences the interest of the loans granted in EURO.

IPC (Index of Consumer Prices) – It has been selected because it examines the evolution of the weighted average of *prices* of a basket of *consumer* goods and services, such as transportation, food and medical care.

NET EXPORT (Net Export Volume) – It has been chosen because of its ability of illustrating the competitive capacity of real economy.

In this paper FSI has been estimated by the method of autoregressive vector and construed with a quarterly frequency. The period considered is between the first quarter of 2004 and the fourth quarter of 2016. In composing this index we have taken into consideration the quantification of the impact of indicators' variation upon GDP. In VAR estimate there are included 12 financial and banking variable indicators with quarterly frequency.

The reactions to impulse are presented in Figure 8. The GDP strongly answers after a two-quarter period, so we have opted for a ponderation of the variables with the cumulated answer to it. After extracting the cumulated answers to impulse, we have construed the financial stability index (FSI) according to the calculating formula:

$$FSI = 0{,}101 \times ROBOR - 0{,}180 \times REER - 0{,}089 \times NPL - 0{,}374 \times ROE + 0{,}141 \times ROA - 0{,}055 \times LEVERAGE - 0{,}273 \times ASSETS + 0{,}100 \times SBUG - 0{,}900 \times VIX + 0{,}164 \times EURIBOR + 0{,}246 \times IPC + 0{,}042 \times EXPNET$$

Where the attributed statistical weight is the cumulated answer of the two-quarter GDP to an impulse of a standard deviation within the variable (see Table 1).

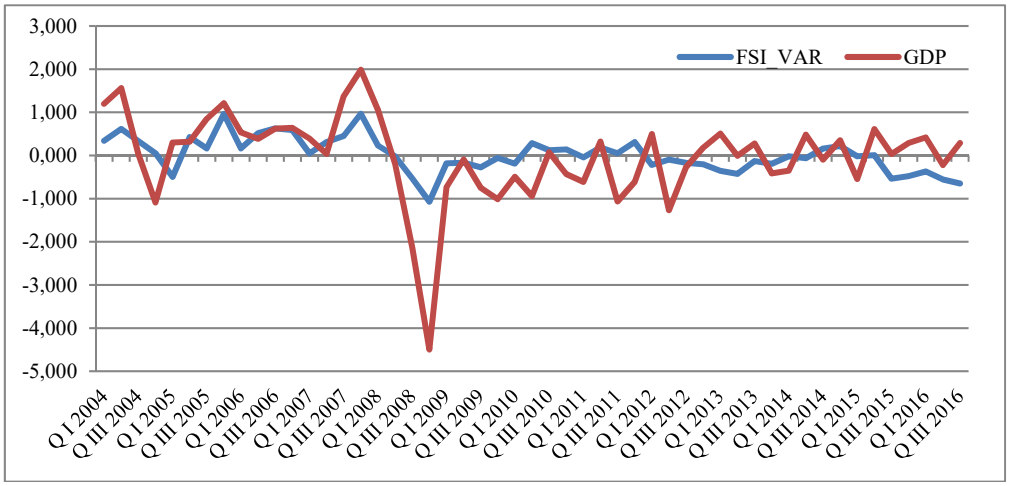
Table 1. *Second-quarter response coefficients*

Period	ROBOR	REER	NPL	ROE	ROA	LEV	ASS	DEFBUG	VIX	EURIBOR	IPC	EXPNET
1	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	(0.00000)	(0.00000)	(0.00000)	(0.00000)	(0.00000)	(0.00000)	(0.00000)	(0.00000)	(0.00000)	(0.00000)	(0.00000)	(0.00000)
2	0.101253	-0.180125	-0.089080	-0.374141	0.141384	-0.055933	-0.273411	0.100650	-0.090011	0.164389	0.246859	0.042883
	(8.03680)	(5.87506)	(19.2035)	(117.448)	(46.6433)	(0.96987)	(1.54142)	(0.12395)	(0.11869)	(0.11012)	(0.11404)	(0.09102)
Cholesky Ordering: PIB ROBOR REER NPL ROE ROA LEV ASS DEFBUG VIX EURIBOR IPC EXPNET												
Standard Errors: Analytic												

Source: Personal processing in Eviews.

The values of the index calculated in this way satisfactory correlates with GDP growth rate. The highest correlation rate (0.58%) was noticed when the FSI was one quarter behind GDP. Thus, the effect is visible in economy with one quarter delay.

Figure 8. *The FSI evolution estimated correlated with real GDP growth*



Source: Personal processing in Excel.

Analyzing the evolution of FSI we can identify its correlation with the moments of economic crisis from the first quarter of 2008 - the first quarter of 2009, when the composite index recorded a sharp decline accentuated by the worsening financial conditions, especially the ROBOR growth and the budget deficit.

Period	FSI_VAR	GDP
1st Q 2008	0,229	1,9863
2nd Q 2008	-0,018	1,0524
3rd Q 2008	-0,531	-0,1982
4th Q 2008	-1,071	-2,1283
1st Q 2009	-0,183	-4,4965

Also, there are significant FSI decreases in the context of the Euro zone sovereign debt crisis, in 2011-2012:

Period	FSI_VAR	GDP
3rd Q 2011	0,053	0,3219
4th Q 2011	0,311	-1,0648
1st Q 2012	-0,218	-0,6137
2nd Q 2012	-0,097	0,4960
3rd Q 2012	-0,171	-1,2688
4th Q 2012	-0,203	-0,2686

FSI also captures the unfavorable financial environment during the political and military conflict in Ukraine in 2013-2014.

Period	FSI_VAR	GDP
4th Q 2013	-0,193	0,2779
1st Q 2014	-0,018	-0,4154
2nd Q 2014	-0,062	-0,3513
3rd Q 2014	0,158	0,4822

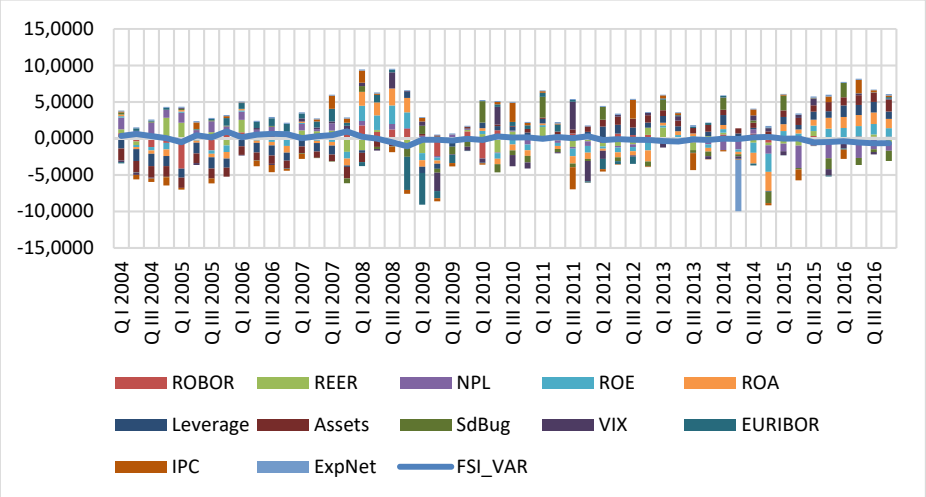
From the FSI analysis we notice few significant time frames within the studied financial environment and indicators. Thus, the period prior to the second quarter of 2008 registered a positive evolution of the existent financial conditions, a fact that explains the significant positive GDP evolution. This was followed by the worsening of these conditions starting with the external financial crisis in the third quarter of 2008.

In the period before the financial crisis the FSI had been notably influenced by the high financial intermediation level. This fact reflected in the ROA and ROE positive evolution within the banking system (a low weighting of the non-performing loans in total loans granted and an increase in the banking assets) accelerates the GDP increase. The worsening of the financial stability in 2008 is reflected by the VIX index and the decrease of EURIBOR interest. However, at the end of 2008, the Central European Bank increases the monetary policy rates in order to reduce the turbulences generated by the capital movements on the Romanian market under the external factors influence. This lead to FSI decrease.

In the period post-2009 the financial conditionîs have gone through ups and downs, even if the GDP evolution has been negative compared to the one in the pre-crisis period. Thus, the FSI quantified positive effects influence the real economy with a two-quarter delay in GDP evolution.

The general effects of EURIBOR decrease and implicitly of the real economy financing costs decrease have a positive influence upon the FSI and GDP evolution. Even though this is not found in banking assets increase (in absolute numbers), the relaunch of the real economy financing leads to an accelerated clean-up of commercial banks balance sheets from non-performing loans. This clean-up has also had as a result the decrease of the non-performing loans rate in the banking system starting from the second quarter of 2014 to till date.

Figure 9. *Contribution of financial variables to estimated FSI evolution*



Source: Personal processing in Excel.

In the components decomposition of FSI (see Figure 9) we observe a highly share of negative influence of the NPL increasing trend on FSI. If this indicator did not influence through its presence FSI until the fourth quarter of 2009, its share starts to increase

afterwards, the peak of its negative influence on FSI being largely manifested until the second quarter of 2014 when, in fact, commercial banks are starting large-scale operations of clearance of its balance sheets. As a result of this, the recovery of lending activity in particular can be noticed by the accelerated increase of the influence of the bank assets on the positive evolution of FSI due to the assumption of credit risks by the commercial banks and in fact the financing of the real economy. An improvement of the balance sheet situation of commercial banks is manifested by the increase of the ROE and ROA influence, even if this is not yet in a favorable evolution, on FSI. This is in strict accordance with the obvious trend of financial disintermediation due in particular to the withdrawal of the financing lines granted by the mother banks. According to the National Bank of Romania, financial intermediation decreased from 39% in 2008 to 29% in 2016.

In this context, according to the evolution of FSI, starting with the fourth quarter of 2014, we are witnessing another model of economic development based on a financing that comes mainly from internal resources and liquidities resulting from fiscal relaxation. Due to the risk aversion generated by credit portfolio degradation, the direct financing provided by commercial banks to the real economy was replaced by investments in state-backed assets - in particular in government securities. At the same time, the withdrawal of commercial banks' financing lines was replaced by the increase in deposits attracted from the domestic economic environment and from the population.

4. Conclusions

In summary, the activity of establishing a financial stability or financial stress composite index is useful from two points of view (Stancu et al., 2017):

1. It ensures a correlation between financial variables and real economy allowing the various historic “financial crises” episodes to be identified. The analysis of the correlation illustrates the contribution of each of the financial variables to the real economy evolution. In this context, the Financial Stability Index (FSI) reveals the impact of the economic and financial policies that aim at mitigating the financial crises.
2. It enables a short term prognosis about the real economy evolution. This is estimated by projecting, for the very next period of time, the real economy evolution (GDP_{t+1}) on the basis of GDP_t and FSI_t in the current period of time.

The purpose the FSI creation is to emphasize the status of the real economic environment with a specific focus on the Romanian economy and specificity of Romanian banking system. In this sense, I have selected 12 data series including financial sector indicator which reflects the status of the Romanian financial sector as well as international indexes to quantify the influence of the international environment toward the Romanian economy.

The utility of the FSI is highlighted especially during the economic crises periods when we may find a close correlation between FSI and GDP. Toward this correlation of the FSI with the real economic environment we note some aspects closely related to the transformation of the development model, with strict reference to the evolution of GDP and the financial context. The transformation of the pattern of economic growth is about diversifying of the funding sources. Compared to the period before the 4th quarter of

2014, we are witnessing a surplus of liquidity due to fiscal relaxation measures and an increase in cash availability available to the population. In the analysis of the ISF components, I would like to note some developments in real context. Thus, although the evolution of banking assets records oscillating developments in the period after the second quarter of 2014, this is due to the de-recognition of non-performing assets in the balance sheets of commercial banks. This fact led, especially since the first quarter of 2015, to an apparent decoupling of the financial stability index of GDP growth, especially since GDP growth has been strongly encouraged since 2015 also due to fiscal policy elements, with financial conditions moving on a second plane in influencing real economic developments.

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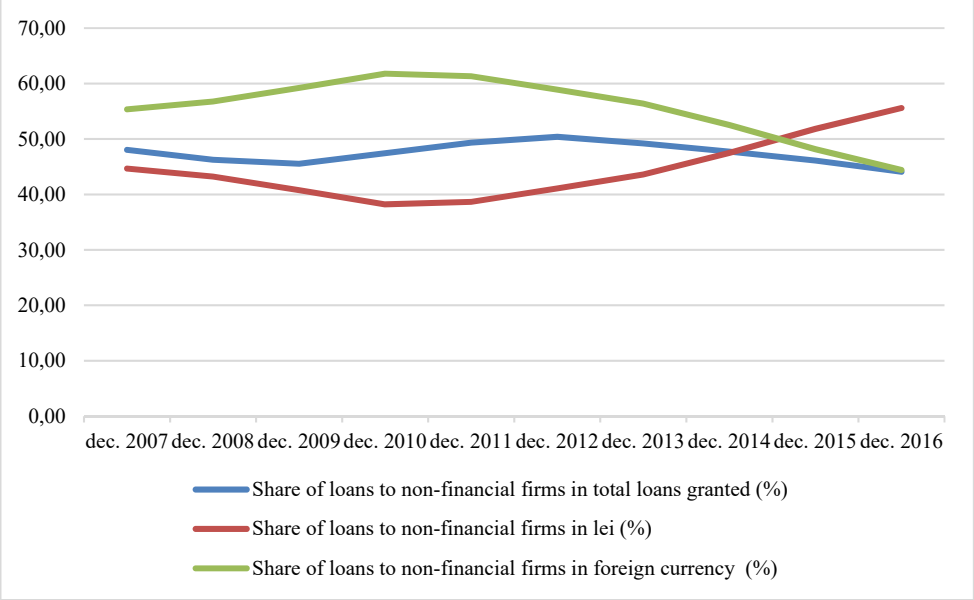
Annex

Table 2. *Structure of loans granted in Romania during 2007-2016*

Date	Evolution of loans to households (%)	Share of loans to households in total loans granted (%)	Evolution of loans to non-financial firms (%)	Share of loans to non-financial firms in total loans granted (%)	Evolution of loans to households in lei (%)	Share of loans to households in lei (%)	Evolution of loans to households in foreign currency (%)	Share of loans to households in foreign currency (%)	Evolution of loans to non-financial firms in lei (%)	Share of loans to non-financial firms in lei (%)	Evolution of loans to non-financial firms in foreign currency (%)	Share of loans to non-financial firms in foreign currency (%)
Dec. 2007	77,70	47,10	49,46	48,05	41,51	46,95	129,69	53,05	43,7	44,7	54,44	55,35
Dec. 2008	38,73	48,56	29,57	46,27	21,95	41,27	53,59	58,73	25,5	43,2	32,89	56,76
Dec. 2009	1,02	47,45	1,76	45,55	-5,20	38,73	5,40	61,27	-4,0	40,8	6,18	59,23
Dec. 2010	1,88	46,30	8,76	47,44	-7,46	35,18	7,78	64,82	1,9	38,2	13,45	61,79
Dec. 2011	2,11	44,59	10,28	49,34	-2,42	33,62	4,57	66,38	11,6	38,7	9,47	61,33
Dec. 2012	0,20	44,31	2,96	50,39	-1,91	32,91	1,26	67,09	9,4	41,1	-1,13	58,90
Dec. 2013	-1,16	45,22	-5,43	49,20	0,71	33,53	-2,08	66,47	0,3	43,6	-9,46	56,39
Dec. 2014	-1,09	46,22	-6,12	47,73	15,98	39,32	-9,70	60,68	2,2	47,5	-12,57	52,51
Dec. 2015	5,71	47,48	-0,60	46,11	31,05	48,75	-10,70	51,25	8,5	51,8	-8,84	48,16
Dec. 2016	4,71	49,02	-3,05	44,08	25,57	58,46	-15,13	41,54	4,0	55,6	-10,60	44,41

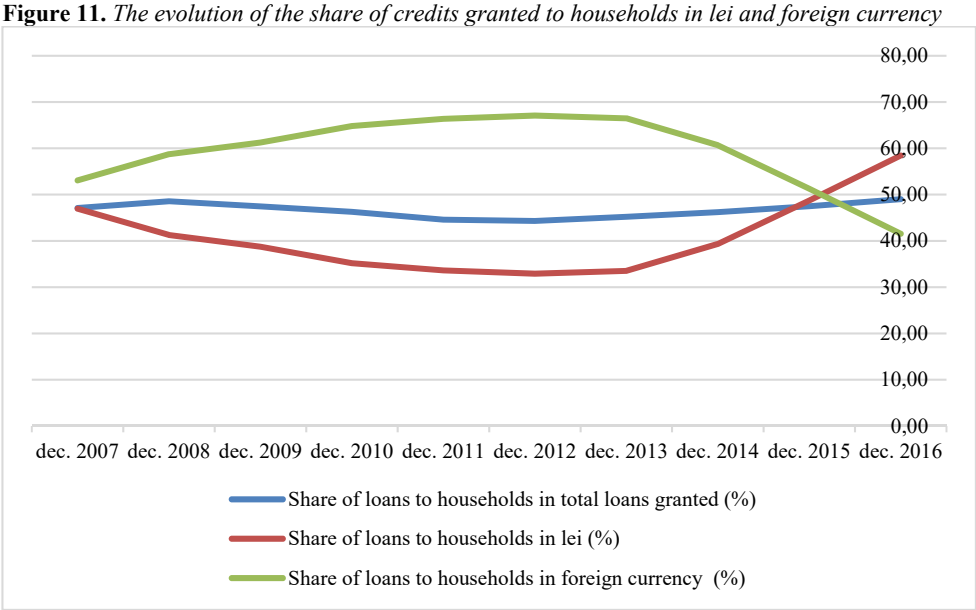
Source: Personal processing in Excel based on NBR data.

Figure 10. *The evolution of the share of credits granted to non-financial firms in lei and foreign currency*



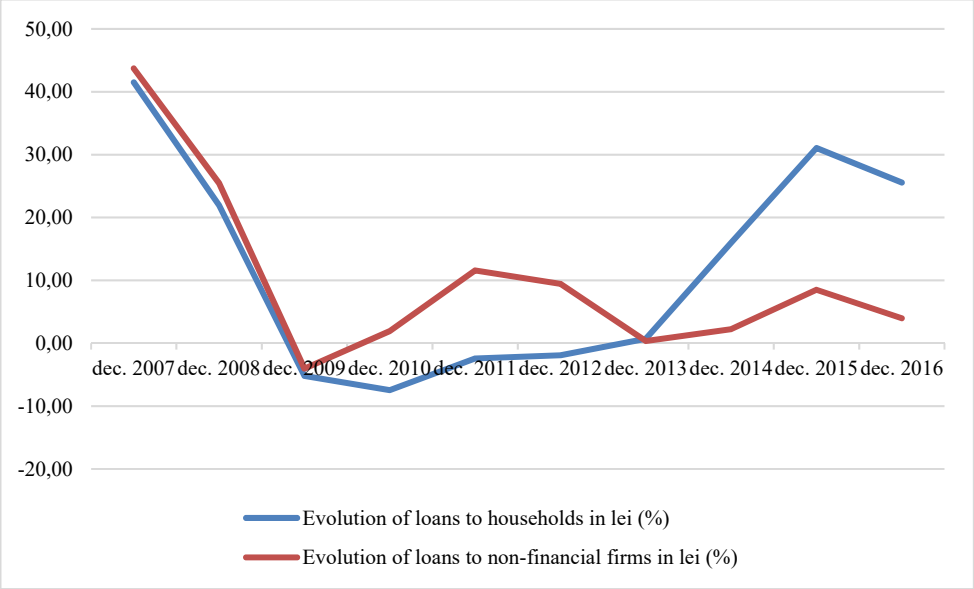
Source: Personal processing in Excel based on NBR data.

Figure 11. *The evolution of the share of credits granted to households in lei and foreign currency*



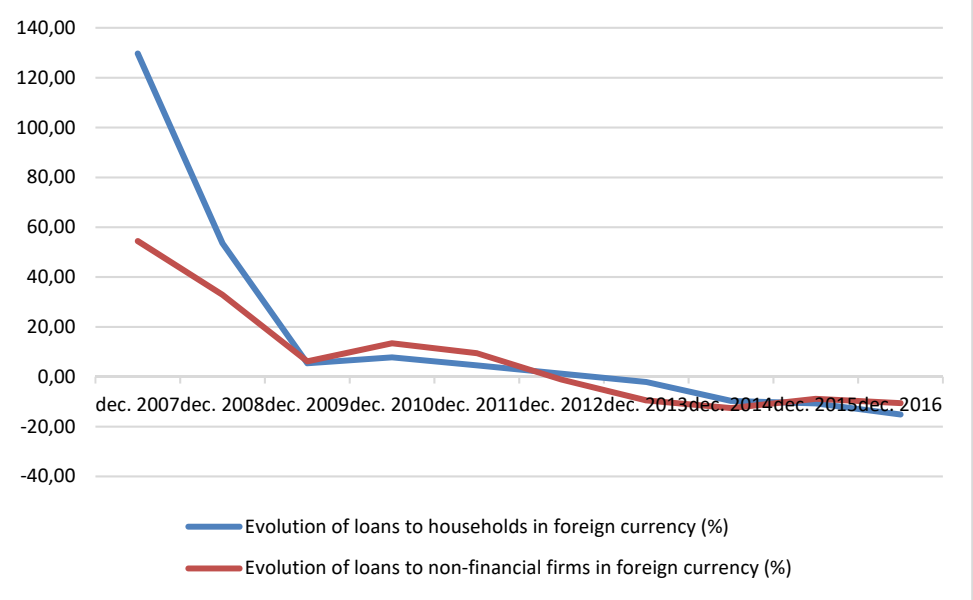
Source: Personal processing in Excel based on NBR data.

Figure 12. *The evolution of the loans granted in lei to households and non-financial firms*



Source: Personal processing in Excel based on NBR data.

Figure 13. *The evolution of loans granted in foreign currency to households and non-financial firms*



Source: Personal processing in Excel based on NBR data.

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The strategy for reducing unemployment. Employment in the European Union

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Abstract. *The issue of employment is a problem in the European Union as in every Member State. Unemployment may rise or fall depending on the economic and social strategy of each country, but also on job qualification and supply. Within the European Union, there is a strategic program that provides for the full reduction of unemployment, massive investment to provide jobs for the absorption of some of the unemployment, and the preparation, diversification and upgrading of the quality of the workforce. The main objective of the European Union is to find a strategy that will lead to the absorption of unemployment in the member countries so that besides economic growth, better living conditions will be ensured for all employees. In this article, the authors have proposed to make a trip, to present the European Union's strategy with significant data showing the concern of the member countries so that the reduction of unemployment is ensured. The free movement of persons in the European Union is a factor that ensures welfare increases due to wage uniformization. The analysis is also related to unemployment among male and female sexes, showing that it is higher among women. An analysis of the generations of the occupied or unoccupied population in the European Union is another element that is interesting and important and is carefully dealt with by the authors in this article. It is highlighted for each country the unemployment situation, and there is also a preoccupation to make a comparative study that will ultimately ensure the closure of the unemployed population. Free movement of people acts in a twofold sense, namely, countries with less economic potential and investment opportunities to create lesser jobs and countries that have a strong economy, an economy that can offer a significant number of jobs. In the first category of countries we meet with Romania has the advantage of feeling less the effects of the unoccupied population in the sense that they are looking for jobs in other countries. One non-retortionary question would be what would happen to Romania if the population, people working in Spain, Italy and other countries would still remain in Romania. In the other countries, based on the qualification of the unemployed labor force and the jobs offered, a paradox follows: some countries, Spain, Portugal, the UK, even Germany, although they have more than moderate unemployment, accept labor from Eastern European countries. The authors conclude on the prospect of implementing a uniform strategy to ensure that all EU Member States can absorb labor.*

Keywords: employment, unemployment, absorption, employed population, unoccupied population.

JEL Classification: E23, J63, J65.

Introduction

The level of unemployment and its rate is a topical issue both in the European Union and in each of its Member States.

Unemployment is a negative factor that accompanies economic development throughout its course. Unemployment is general and no national economy, no state can come out of the impact of this phenomenon. The possibility of employment depends on the complexity of the economy, on the investments made, on generating jobs and, thus, on employment, but also on the specialization that should be in line with the structure of a national economy.

On the other hand, the demographic evolution of a country is a possibility to determine, in one way or another, the change in the unemployment rate. The unemployment rate is seen as a share of the active population. In this respect, the country's demographic change has fluctuated and, in many circumstances, has been able to contribute to raising or reducing the unemployment rate.

There are countries, especially in Europe, with a declining birth rate, in which contingent members of society are becoming increasingly small and then, if the economy is complex and offers jobs, unemployment is reduced. But there are also countries with very high birth rates, especially those in Asia, where high birth rates can create additional labor resources,

In this article we refer to the situation in the European Union and, by way of comparison, to the situation in Romania. From this point of view, we can consider that unemployment, its level and rate have a cyclical evolution, generally correlated with the general business cycle.

Literature review

Agrawala and Matsab (2013) have proven that companies are choosing conservative financial policies, largely to mitigate workers' exposure to the risk of unemployment. Amaral and Ice (2014) studied the impact of unemployment insurance duration on the unemployment rate. Anghelache (2017) elaborated a complex analysis of Romania's post-December economic and social situation, being a guide for research on macroeconomic indicators, population and labor developments. Anghel et al. (2017) conducted an analysis of the evolution of the unemployment rate in Romania, highlighted the number of unemployed, gender structure and age groups of the unemployment rate and studied the effects of unemployment on economic growth. Blanchard (2006) reviewed developments on unemployment and on theoretical fronts and considered that the average European unemployment rate hides a high degree of heterogeneity between countries. Costain and Reiter (2008) studied the correlation between business cycles and unemployment insurance, as well as the possibilities of calibrating appropriate models. Couch et al. (2013) studied the economic and health consequences of long-term unemployment. Daly et al. (2012) assessed the extent to which the natural rate of unemployment and the underlying causes of the change have changed. Dube et al. (2010)

investigated the effects of minimum wages on income and employment in low-wage economy sectors. Hagedorn et al. (2013) found that the prolongation of unemployment benefits raises salary balances and leads to a strong contraction in job creation, employment and rising unemployment. Krause and Uhlig (2012) considered that, by calibrating unemployment benefits to approximate legislation before and after the reforms, there was a considerable reduction in unemployment and its duration with the end of the transition after about three years. Kroft and Notowidigdo (2016) investigates how marginal welfare gains from rising unemployment benefit rates vary according to the economic cycle. Moreno-Galbis and Tritah (2016) elaborated a study on the impact of immigrants on the occupancy rate using an instrumental strategy based on historical settlement patterns in host countries and occupations by country of origin. Rogerson (2008) conducted a 45-year comparative analysis of hours worked in mainland Europe and the United States, concluding that they drop 45% in Europe versus the United States, due to the much lower market services sector. Silva and Toledo (2009) analyzed the consequences of changes in the cost of turnover on long-term labor market outcomes.

Research methodology, data, results and discussions

A factor in the evolution of unemployment is labor market policy and demographic change, as well as short-term or long-term influences on the development of a country's economy.

In 2014, in the total of the European Union of 28 countries (27, but data remain for the total of EU member states), unemployment was 10.2%, decreasing by 0.8%, reaching 9.4% in 2015. This decrease in unemployment was also recorded in 2016 when it decreased by another 0.7%, reaching 8.7%.

If we look into the complexity of the Member States and the evolution of unemployment, we will see that in 2014 and 2015 it has tended to decline, especially since we had periods between 2005 and 2008 when unemployment has fallen permanently, reaching 6.9% in 2008 which fluctuatingly followed an upward course in the coming periods.

In 22 of the 28 countries of the European Union, between 2014 and 2015, unemployment had a downward trend, with the most pronounced being 2.4% in Spain, 2.2% in Bulgaria, 1.9% in Ireland. Opposite to this trend, the highest increase in unemployment was registered in Finland, where it grew by 0.7% and Luxembourg with a 0.4% increase.

At 24.9% and 22% respectively, countries such as Greece and Spain, which had the highest unemployment rate among all EU Member States, were countries. This increase was recorded in 2015, and in the case of Greece it was explained by the prospect of the possible Greek bankruptcy of the Greek nation. In the case of Spain, an unemployment paradox in the sense that the highest unemployment rate among all EU countries assimilates, according to the European Free Trade Directive, most intra-European immigrants working. As an example, we can even mention Romania, of which more than 1.5 million people are working in a concrete way every time in Spain.

In other EU countries, we find low levels of unemployment. In this respect, in Malta the rate is 5.4%, in the United Kingdom 5.3%, in the Czech Republic 5.1% and in Germany 4.6%.

In 2014 and 2015, the unemployment rate for men and women was different, with women averaging 10.1%, while men were 9.5%.

An essential issue in the analysis of unemployment is the age categories of unemployed people entering the labor market. Thus, in the group of people aged 15-24, we usually encounter the highest unemployment rate, because access to the labor market is more difficult. Many of those in this age group are in the study period, which certainly excludes them from the category of those who are in the workplace.

An analysis term would be that people in this group recorded a double unemployment rate compared to those in the 25-74 age group. We have used the term "74 years" that the European Union has insinuated on a permanent basis, suggesting that for the work efficiency, work in this area, it is necessary to use, as far as possible, the older age group.

Another way of analyzing the unemployment rate would be to try to define ways in which the youth unemployment rate should be reduced. Of course, in 2014-2015 the unemployment rate was somewhat lower in young people but still registered a very high level in this category.

A high youth unemployment rate reflects the difficulties young people have in finding a job, but also because of incompatibilities between the training of young people and the jobs offered.

However, it is necessary for this group to be given greater importance in terms of greater assimilation into the workplace and ensuring, through lifelong learning, a faster improvement through the transfer to the workforce. We are always talking about generational exchange but in the labor market this generational exchange should not exist because the process is continuous and uninterrupted and it is based on the possibility of professional reconversion where there are professions and especially the possibility of creating alternative jobs to satisfy, as far as possible, the desires of the generation that we analyze.

There is a reason or cause for which the youth unemployment rate is very high. At present, some of the young unemployed are among the population of this age. We can say that it is slightly erroneous to consider the whole population without taking into account the situation of those who are in the process of training and those who, for other reasons, do not yet opt for a job until the age of 18. From this point of view, the analysis of the European Union, although pertinent, does not appear sufficiently clear from this point of view.

We can refer to the fact that a recent EU directive states that additional attention needs to be paid to the use of highly qualified or qualified people aged over 65. This aspect is also paid attention to the fact that, according to some rules, the retirement age would be the age of professional apology, but from the point of view of the labor market reality it results that in some areas, surely depending on the health and biological condition of the

individuals, -in a period of about 10 years, i.e. up to the age of 75, the workforce in this category must be used as it has increased efficiency and can provide two aspects in two ways. On one hand, the attraction and development of other younger generations to improve, and on the other hand through productivity, work efficiency (I refer to intellectuals) can produce more, more consistent and more useful for the whole society.

Looking long-term, the unemployment rate is likely to stir up polemics. Apart from the financial and social side, the effects of long-term unemployment should not always be seen in a negative way when we look at age groups. Others argue, on the contrary, that it should be treated negatively as the younger generation, the new generation, as it is customary to say, would find it harder to work.

As a response to the two trends of analysis, we can conclude by the fact that there is a solution field through the complex development of a country's economy. This implies that those who invest to invest in areas with skilled labor force and those who prepare the workforce prepare it for jobs where jobs are available.

The data we present relates to the evolution of unemployment in the 28 European countries, over a 10-year period selected over significant years. This presentation takes into account the evolution of total unemployment, between men and women, resulting in the fact that from 2005 to 2015 unemployment in men has been sustained. Thus, in 2005 it was 8%, in 2008 it was 6.6%, then it increased to 10.4% in 2012 and 10.8% in 2013, after which it started again to decrease, respectively from 10.1% 2014 in 2015 to 9.3% with the same trend in 2016. In 2005, unemployment in 2005 was 9.5%, declining in 2008 by 7.5% and then increasing two consecutive years in 2012 and 2013 to 10.5% and 10.9% respectively, with an improvement trend in 2014 – 10.3%, 2015 – 9.5% and a similar period in 2016 and 2017.

The unemployment rate in the age group up to 25 years apparently followed the same course but with very high rates. Thus, in 2005 it was 19%, with a decrease in 2008 to 15.9%, but with a steep jump to 23.3% and 23.7% in 2012 and 2013 respectively. And in this age group we meet downward trend in 2014 (23.2%), 2015 (20.4%) and 2016 below 20%.

The unemployment rate recorded for this age range for the 25-74 year old population was moderate: 7.7% in 2005, 5.9% in 2008, 9.1% in 2012, 9.5% in 2013, 9% in 2014 and 8.3% in 2015 and 7.9% respectively in 2016.

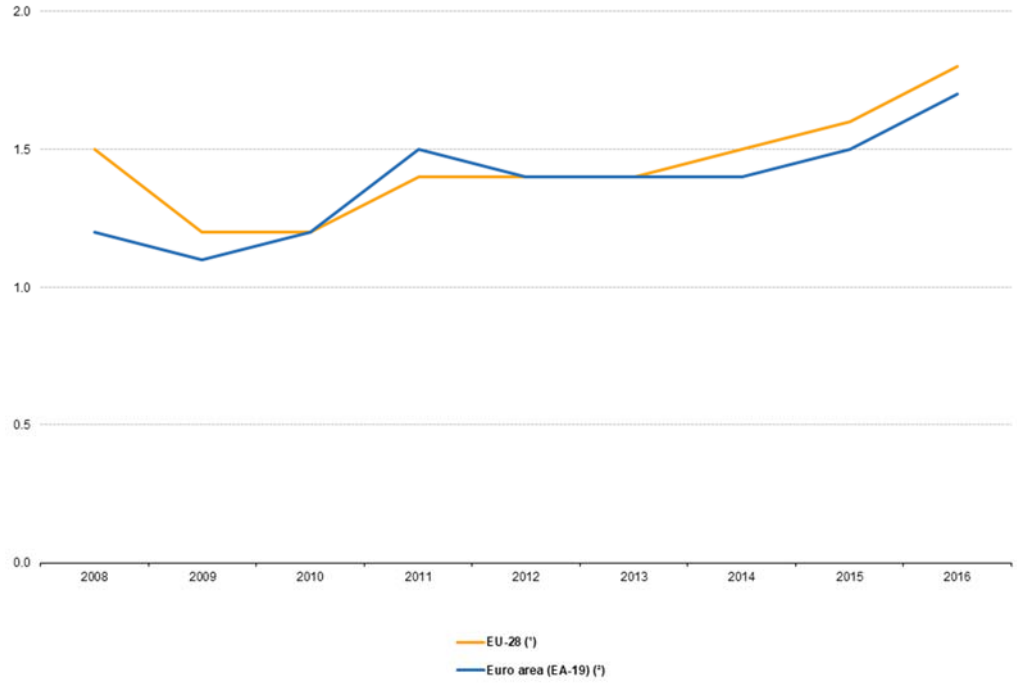
In the long run, there is a reduction in the unemployment rate and, in the long run, an even more pronounced reduction. In the two situations I mentioned, it is very clear that the unemployment rate can be improved by both job creation and the relative growth trend of the population.

An important element in the analysis of unemployment is vacancies or vacancies. There is a clear policy in the European Union that vacancies are of utmost importance for the unemployed. Of course, places are vacant by going to unemployment, retirement or economic restructuring. In the European Union countries it is evident that, as a rule, in relation to the level of unemployment, there are always a number of vacancies in the

period 2003-2007 to 2.2% of the total employment. The rate of these jobs declined further as a result of leaving the labor market or limiting investment opportunities and, consequently, the provision of new jobs.

Job vacancy is a continuous process and reached 1.6% in 2014 after having recorded the highest vacancies in 2008.

Figure 1. *Job vacancy rate, 2008-2016 (%)*



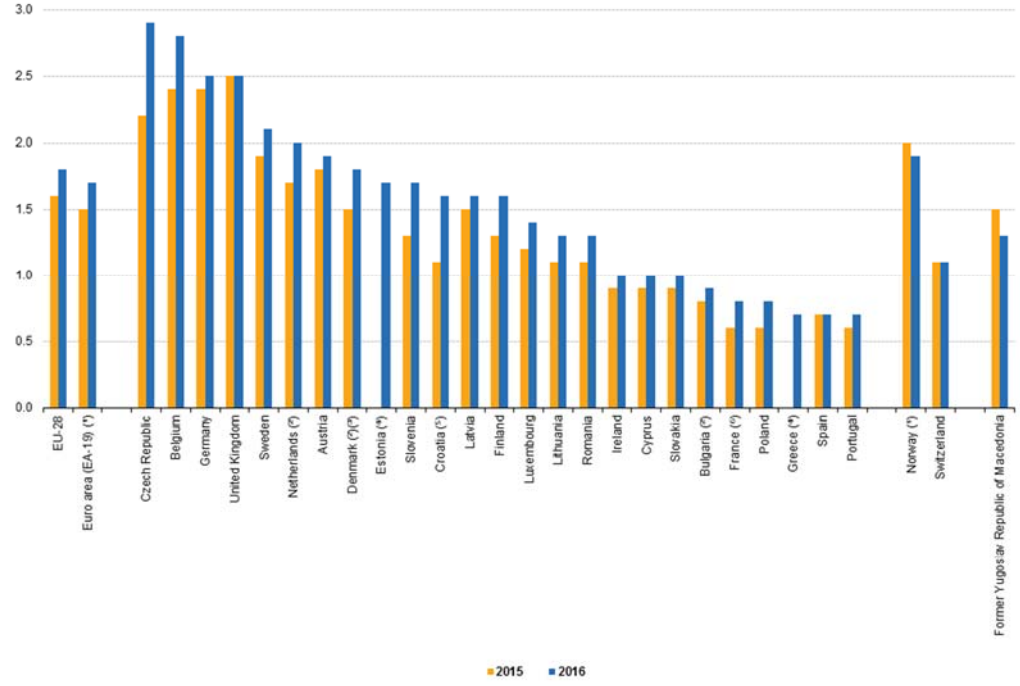
Note: NACE Rev. 2 Sections B to S.
(*) 2008 and 2009: EU-27.
(*) Estimates.
Source: Eurostat (online data code: jvs_a_rate_r2)

Source: Eurostat.

Within the European Union, some Member States had a higher rate of vacancy in 2014, with high rates ranging from Germany – 2.9%, Malta – 2.5%, the UK – 2.3% and Belgium – 2, 2%. In other countries, vacancies were very low, ranging from 1% to 1.2%, these levels being recorded in most countries (15 states among the EU Member States).

In the following graph, Figure 2, the vacancies on the states are presented.

Figure 2. *Job vacancy rate, 2015 and 2016 (%)*



Note: NACE Rev. 2 Sections B to S. Italy, Hungary and Malta: not available.
(*) Estimates.
(*) Provisional.
(*) NACE Rev. 2 Sections B to N.
(*) 2015: not available.
(*) Break in series.
(*) Units with 10 or more employees.

Source: Eurostat.

As far as Romania is concerned, vacancies are around 0.6%, being very small compared to the number of employees working in the national economy. But this indicator of vacancies as well as the unemployment rate would be seriously affected if the European Union Directive on the free movement of persons was not implemented. We say this because at present, almost 3 million Romanians are active in other places in Europe.

Regarding Romania, the unemployment problem is very much dependent on the investments that will be made in the national economy to create jobs, as well as on the level of Romanian emigration in the European Union.

Conclusions

From the study made by the authors some conclusions are drawn. Firstly, there is a need for a medium and long-term, not only a short, EU employment strategy to limit, if possible, unemployment. Secondly, it should be taken into account that the efforts of the European Union are complemented by the individual efforts of the member countries in the same sense. An overwhelming conclusion is that major EU countries are required to invest in joint economic and social objectives so as to create jobs that are able to absorb

labor and reduce the unemployment rate. Last but not least, we can conclude that an essential element in the more efficient use of unemployed or unoccupied people is the improvement of qualitative qualifications as well as a policy on professional reconversion.

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Economic value of portfolio diversification: Evidence from international multi-asset portfolios

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Abstract. *We examine alternative approaches of measuring portfolio diversification, and test the empirical relation between diversification and the future risk-adjusted performance in a cross-section of international multi-asset portfolios. We use the Woerheide and Persson measure as a weight-based diversification measure, the conditional diversification measure as a risk-based diversification measure, and the effective number of bets (ENB) as a factor based diversification measure. We find that only the ENB measure is a significant predictor of the future Sharpe ratios. The economic gains of diversification, as measured by the ENB measure, are large and robust to the investor's risk aversion and investment horizon.*

Keywords: portfolio, diversification, effective number of bets, unsystematic risk.

JEL Classification: G10, G11, G12.

1. Introduction

The benefits of portfolio diversification are well established in the investment theory. Diversification of investment portfolios reduces the unpriced idiosyncratic risks without affecting the expectation of future returns. Consequently, diversification improves the expectation of future risk-adjusted returns. Surprisingly, there is no unique and broadly accepted quantitative measure of portfolio diversification (Meucci, 2009). The earliest works on diversification focused on identifying the minimum number of assets that would make a portfolio reasonably diversified (Beck, Perfect and Peterson, 1996; Elton and Gruber, 1977; Evans and Archer, 1968; Statman, 1987). This naïve approach to diversification ignores the distribution of portfolio weights and the correlations between asset returns. More sophisticated measures of portfolio diversification attempt to address these issues, and the these measures can be classified in three categories– measures based on portfolio weights, measures based on the risk structure of the asset returns, and the measures based on the allocation across the underlying risk factors.

The first category of diversification measures are the based on the distribution of portfolio weights. The portfolios in which a considerable proportion of the total capital is allocated to relatively few assets are considered poorly diversified. Conversely, the portfolios that allocate the capital uniformly across a large number of assets are considered well diversified. The concertation of portfolio weights is usually measured using either the Shannon entropy measure (Bera and Park, 2008; Vermorken, Medda and Schroder, 2012) or the Herfindahl-index (Hamza et al., 2006; Kacperczyk, Sialm and Zheng, 2005; King, 2008; Kumar, 2007; Woerheide and Persson, 1992). Maximizing diversification under such a definition leads to an equally weighted portfolio allocation. However, the limitations of the equally weighted portfolio are obvious. First, it is possible that the portfolio assets may be strongly correlated. In this case, investing across large number of strongly correlated assets yields little diversification benefit. Second, the composition of the investment universe may induce bias in the equally weighted portfolio allocation. For instance, in most equity markets, small cap stocks far outnumber the large cap stocks. Consequently an equally weighted portfolio of all stocks would be tilted towards small-cap stocks. The second category of diversification measures attempt to address these issues by incorporating the information about the weight concentration, volatility and correlation structure of portfolio assets. Notable examples include the Goetzmann-Li-Rouwenhorst measure (Goetzmann, Lingfeng Li and Rouwenhorst, 2005), the diversification ratio (Choueifaty and Coignard, 2008), and the conditional diversification benefits measure (Christoffersen et al., 2012). In general, these measures suggest that a portfolio is poorly diversified if the portfolio weights are concentrated over a few assets and/or if the portfolio constituents are highly correlated with each other.

Roll (2013) notes that in the presence of multiple underlying risk factors, the empirical correlation between two assets can be low even when their returns are driven by the same risk factors. Therefore, in order to achieve effective portfolio diversification, investors must seek to distribute their portfolio exposures uniformly across large number of uncorrelated risk factors, rather than diversifying across a large number of stocks or asset classes. Several studies employ principal component analysis to extract the underlying

risk factors (Frahm and Wiechers, 2013; Lohre et al., 2012). The problem with approach is that regardless of the portfolio allocation most of variance is explained by the first few principal component factors, and therefore there is little variation in portfolio diversification values. In addition, these factors are linear combinations of the original assets, and generally bear no resemblance to the original assets. To overcome these problems, Meucci (2015) recommends the minimum linear torsion procedure to extract risk factors for any given investment universe. The minimum linear torsion procedure generates risk factors which are the closest orthogonal representation of original assets. In addition, the volatility of the risk factors is constrained to be same as the volatility of the original assets. This ensures that the first few factors do not dominate the rest of the factors, as is the case with principal component based factors.

In this analysis we compare the three types of diversification measures and examine their relation with future risk-adjusted performance of international multi-asset portfolios. We use the Woerheide and Persson measure (Woerheide and Persson, 1992) as a weight based measure of portfolio diversification; the conditional diversification measure of Christoffersen et al. (2012) as a risk-based measure of portfolio diversification and the effective number of bets measure as a factor-based measure of portfolio diversification. In addition, we measure the economic value of superior diversification for different levels of relative risk-aversion and for different investment horizons.

2. Data

We use weekly returns of thirty assets belonging to multiple asset classes, namely, equities, currencies and bonds. The sample period of the study extends from April 2, 1999 to May 9, 2014. The sample period ranges from 2 April 1999 to 9 May 2014. Table 1 lists the sample assets and provides some descriptive statistics. The U.S. three month Treasury bill rate is used as the risk-free rate. All data are sourced from the Bloomberg database.

3. Diversification measures

3.1. The Woerheide and Persson measure

The Woerheide and Persson (1992) measure (WPM) is based on the Herfindahl Index of portfolio weights. It is calculated as one minus the sum of squared portfolio weights.

$$\text{WPM} = 1 - \sum_{i=1}^{N} w_i{}^2 \qquad (1)$$

where w_i is the portfolio weight of the i^{th} portfolio constituent and N is the number of portfolio constituents. The WPM is minimized to a value of zero when the entire portfolio capital is allocated to a single asset, and it is maximized to a value of $(N-1)\ /\ N$ when all assets have the same portfolio weight, i.e. $w_i = 1/N, \forall i$.

3.2. The conditional diversification measure (Christoffersen et al., 2012)

Under the assumption of normally distributed asset returns, the conditional diversification measure (CDM) is defined as

$$CDM = 1 - \frac{\sqrt{w^T \Sigma w}}{w^T \sigma} \quad (2)$$

where: w the column vector of portfolio is weights $\{w_1, w_2, .., w_N\}$ and σ is the column vector of asset volatilities $\{\sigma_1, \sigma_2, .., \sigma_N\}$

Table 1. *Dataset and descriptive statistics*

Description	Country	Asset Class	Mean Return	Std. Deviation
Euro USD Spot Exchange Rate	EU	CURRENCY	1.65	10.23
Yen USD Spot Exchange Rate	Japan	CURRENCY	1.08	10.37
Pound USD Spot Exchange Rate	United Kingdom	CURRENCY	0.25	9.36
Australian dollar USD Spot Exchange Rate	Australia	CURRENCY	2.5	13.36
Swiss franc USD Spot Exchange Rate	Switzerland	CURRENCY	3.44	11.01
Canadian dollar USD Spot Exchange Rate	Canada	CURRENCY	2.12	8.92
Mexican Peso USD Spot Exchange Rate	Mexico	CURRENCY	-2.02	10.05
New Zealand dollar USD Spot Exchange Rate	New Zealand	CURRENCY	3.18	13.61
Swedish Krona USD Spot Exchange Rate	Sweden	CURRENCY	1.61	12.15
Russian Ruble USD Spot Exchange Rate	Russia	CURRENCY	-1.89	8.34
S&P 500 Index	United States	EQUITY	2.53	18.83
S&P TSX Composite Index	Canada	EQUITY	7.4	23.6
FTSE 100 Index	United Kingdom	EQUITY	0.95	21.35
Nikkei 225 Index	Japan	EQUITY	0.4	21.89
CAC 40 Index	France	EQUITY	2.18	25.21
S&P ASX 200 Index	Australia	EQUITY	6.68	24.54
Hong Kong Hang Seng Index	Hong Kong	EQUITY	4.77	23.62
Swiss Market Index	Switzerland	EQUITY	4.67	20.51
Deutscher Aktien Index	Germany	EQUITY	6.23	26.82
Bovespa Index	Brazil	EQUITY	8.96	40.06
Bloomberg/EFFAS US Govt. Bond Index	United States	BONDS	5.03	4.66
Bloomberg/EFFAS Germany Govt. Bond Index	Germany	BONDS	6.34	10.76
Bloomberg/EFFAS Austria Govt. Bond Index	Austria	BONDS	6.66	11.17
Bloomberg/EFFAS UK Govt. Bond Index	United Kingdom	BONDS	5.35	10.67
Bloomberg/EFFAS Australia Govt. Bond Index	Australia	BONDS	8.14	12.59
Bloomberg/EFFAS Canada Govt. Bond Index	Canada	BONDS	7.29	9.09
Bloomberg/EFFAS Japan Govt. Bond Index	Japan	BONDS	2.86	10.84
Bloomberg/EFFAS Denmark Govt. Bond Index	Denmark	BONDS	6.74	11.9
Bloomberg/EFFAS France Govt. Bond Index	France	BONDS	6.48	11.06
Bloomberg/EFFAS New Zealand Govt. Bond Index	New Zealand	BONDS	9.25	13.22

Notes: The mean return and standard deviation are reported as annualized percentage. The sample period is April 2, 1999 to May 9, 2014.

3.3. The effective number of bets

We extract orthogonal risk factors from the original asset returns using the minimum linear torsion (MLT) procedure of Meucci et al. (2015). Let η represent a $M \times T$ matrix of original assets returns, where M is the number of assets in the investment universe and T is the number of periods. Then, the returns of orthogonal risk factors can be represented by a matrix $\eta_F = A'\eta$, where A is a transformation matrix obtained by applying MLT on the original asset returns. We refer the reader to Meucci et al. (2015) for the details of implementation of the MLT procedure.

The MLT procedure ensures that the new factors represent the closest uncorrelated representation of original assets, and the volatilities of the new factors is same as the volatilities of the original assets. Therefore, the covariance matrix of factor returns, Σ_F can be represented as a diagonal matrix $D^2 = \text{diag}(\Sigma)$, where Σ is the covariance matrix of original assets. The smallest linear transformation is derived by minimizing the squared tracking errors between the new factor returns and the original asset returns. Formally the optimization problem can be stated as

$$A^* = \text{argmin}_A \left(TE\{r_{F_1}, r_1\}^2 + \ldots . + TE\{r_{F_N}, r_N\}^2\right) \quad (3)$$

where: N is the number of returns and $TE(\cdot)$ denotes the tracking error function. Solving for the sum of squared tracking error we get

$$\sum_{i=1}^{N} TE\{r_{F_k}, r_k\}^2 = \sum_{i=1}^{N} \text{Var}\left(r_{F_k} - r_k\right) = \sum_{i=1}^{N} \text{Var}(a_k' r - e_k' r)$$

$$= \sum_{i=1}^{N} \text{Var}([a_k - e_k]' r) = \sum_{i=1}^{N} [a_k - e_k]' \, \Sigma \, [a_k - e_k]$$

$$= \text{tr}([A - I_N]' \, \Sigma \, [A - I_N]) = \text{tr}(A'\Sigma A - A'\Sigma - \Sigma A + \Sigma)$$

$$= \text{tr}(A'\Sigma A - A'\Sigma - \Sigma A + \Sigma) = \text{tr}(D^2) + \text{tr}(\Sigma) - 2\text{tr}(A'\Sigma)$$

where: a_k is the kth column of matrix A and e_k is the kth elementary vector. Since D^2 and Σ, to minimize the sum of squared tracking error, we need to maximize $\text{tr}(A'\Sigma)$. We use the principal component decomposition of $\Sigma = P\Lambda^2 P'$, P is a matrix of eigenvectors and Λ^2 is matrix of eigenvalues. Then, we can expand $\text{tr}(A'\Sigma)$ as

$$\text{tr}(A'\Sigma) = \text{tr}(DD^{-1}A'P\Lambda \, \Lambda P') \quad (4)$$

Let $Q' = D^{-1}A'P\Lambda$, then Equation (4) can be rewritten as

$$\text{tr}(A'\Sigma) = \text{tr}(Q'\Lambda P'D) \quad (5)$$

where: Q satisfies the property $QQ' = I_N$. Next, we compute singular value decomposition of $\Lambda P'D$ as

$$\Lambda P'D = USV' \quad (6)$$

where: U and V are orthogonal to each other. S is the diagonal matrix containing singular values of $\Lambda P'D$. Substituting the value of $\Lambda P'D$ in Equation (5), we obtain

$$\text{tr}(Q'\Lambda P'D) = \text{tr}(Q'USV') = \text{tr}(V'Q'US) \quad (7)$$

where: $Z = V'Q'U$ satisfies $ZZ' = I_N$. Substituting $Z = V'Q'U$ in Equation (7), we obtain

$$\text{tr}(V'Q'US) = \text{tr}(ZS) = \sum_{k=1}^{N} z_{kk}s_{kk} \leq \sum_{k=1}^{N} s_{kk} \quad (8)$$

Clearly, Equation (8) is maximized when $z_{kk} = 1, \forall k$ or $Z = I_N$. Solving for Q' we get

$$Z = V'Q'U = I_N$$

$\mathrm{Q}' = \mathrm{UV}'$

Since $\mathrm{Q}' = \mathrm{D}^{-1}\mathrm{A}'\mathrm{P}\Lambda$, we can solve for the transformation matrix A as follows

$\mathrm{Q}' = \mathrm{D}^{-1}\mathrm{A}'\mathrm{P}\Lambda$

$\mathrm{UV}' = \mathrm{D}^{-1}\mathrm{A}'\mathrm{P}\Lambda$

$\mathrm{A} = \mathrm{P}\Lambda^{-1}\mathrm{UV}'\mathrm{D}$

Therefore the optimal transformation matrix A is

$$\mathrm{A} = \mathrm{P}\Lambda^{-1}\mathrm{UV}'\mathrm{D} \tag{9}$$

Any portfolio of the original assets, represented by a vector of portfolio weights w, can now be represented as an equivalent portfolio of the MLT risk factors with a transformed weight vector $\mathrm{w_F} = \mathrm{A}'\mathrm{w}$.

Since the risk factors are orthogonal to each other, the portfolio variance, σ_P^2, can be calculated as the sum of the squares of weighted volatilities of the individual risk factors.

$$\sigma_P^2 = \sum_{i=1}^{N} w_{F_i}^2 \sigma_{F_i}^2 \tag{10}$$

where: w_{F_i} and σ_{F_i} are the weight and the volatility of the i^{th} risk factor. The percentage risk contribution of the i^{th} risk factor, RC_{F_i}, can be calculated as

$$RC_{F_i} = \frac{w_{F_i}^2 \sigma_{F_i}^2}{\sigma_P^2} \tag{11}$$

The effective number of bets (ENB) measure indicates how the portfolio risk is distributed across the various risk factors, and it is calculated as

$$\mathrm{ENB} = \exp\left(-\sum_{i=1}^{N} RC_{F_i}\, ln\left(RC_{F_i}\right)\right) \tag{12}$$

If the entire portfolio risk is contributed by a single factor, the ENB is minimized to a value of one (least diversified portfolio). Conversely, when all risk factors contribute equally to the overall portfolio variance, the ENB is maximized to a value of *N* (most diversified portfolio).

4. Empirical analysis

We simulate a cross-section of portfolios by generating 10,000 unique randomly generated portfolio weight vectors. The portfolio dimension is allowed to vary randomly from 1 to 30. The calculations of the CDM and ENB measures require an estimate of the covariance matrix of asset returns. We use the shrinkage estimator of Ledoit and Wolf (2004) with a rolling window of 104 weekly returns (approximately two years) to estimate the covariance matrix of asset returns. The initial 104 weeks of data in our sample period comprises the burn in sample for initializing the first covariance matrix estimate. In the remaining period (688 weeks), for each week we calculate the portfolio diversification measure for each of the 10,000 portfolios using all three diversification measures.

Next, we test the relation between the diversification level and future risk-adjusted performance by using Fama-Macbeth regressions. We carry out a series of cross-sectional regressions, wherein, for each week *t*, the Sharpe ratios for the period *t* to *t*+*h* are regressed on the diversification measures calculated at end of week *t*. Five future horizons are considered: one month (*h*=4), one quarter (*h*=13), one year (*h*=52), two years (*h*=104) and five years (*h*=260). For each future horizon, the time-series average of the regression slopes is calculated, and we test whether it is statistically different from zero by using the standard *t*-test with the Newey-West (NW) standard errors (Newey and West, 1987). The selection of lag length for the computation of NW standard errors is based on the automatic bandwidth selection procedure of Newey and West (1994). Table 2 reports the result of the Fama-Macbeth regressions. Regardless of the choice of the diversification measure the average regression slopes are positive for all future horizons. This suggests that, on an average, improving portfolio diversification does tend to improve the future risk-adjusted performance. However, for the WPM and CDM measures the relation between portfolio diversification and future Sharpe ratios is not statistically significant. In contrast, when portfolio diversification is measured using the ENB measure, the relation between diversification and future Sharpe ratios is statistically significant and robust across all investment horizons. The Average R^2 values for ENB regressions are also higher than those obtained in regressions using the WPM and CDM measures. This suggests that ENB performs better than the WPM and CDM measures in explaining the cross-sectional variations in future Sharpe ratios. Notably, across all diversification measures the explanatory power tends to decline with an increase in the investment horizon as indicated by a monotonic decline in the *t*-statistics.

To measure the economic value of portfolio diversification, we use a two stage procedure. In the first stage, we construct diversification decile portfolios to sort and classify the cross-section of portfolios into different levels of diversification. At the end of each week, we sort the portfolios into deciles based on their diversification as measured by the WPM, CDM or ENB measures. Then, we construct diversification decile portfolios, $\delta_d, d = 1,2,..10,$ to represent each decile. For any diversification decile, d, δ_d is the equally weighted portfolio all portfolios in the d^{th} decile, with $d = 1(10)$ denoting the lowest (highest) level of diversification. Note that the portfolios falling in the d^{th} decile can vary for different periods. In the second stage, we use the utility equivalence procedure of Fleming et al. (2003) to measure the economic gains of switching from a lower diversification decile portfolio to a higher diversification decile portfolio. Consider an investor with an initial wealth W_0 and a coefficient of relative risk aversion γ. Further, assume that this investor can choose to buy-and-hold any one of the ten diversification decile portfolios, δ_d. Following Fleming et al. (2003), we assume a quadratic utility function, $U(r_{d,t})$, for weekly returns defined as

$$U(r_{d,t}) = W_0\left((1 + r_{d,t}) - \frac{\gamma}{2(1+\gamma)}(1 + r_{d,t})^2\right) \tag{13}$$

where: $r_{d,t}$ is the return of the δ_d portfolio for week t and $U(r_{d,t})$ is the utility realized from the return $r_{d,t}$. Given the economic utility function of Equation (13), we estimate a

constant Δ_γ such that when a constant fee Δ_γ is subtracted from the weekly returns of the diversification decile portfolio $\delta_d, d = 2, 3, .., 10$, the utility derived from the δ_1 and δ_d portfolios are equalized. This is represented formally as

$$\sum_{t=1}^{T} U(r_{1,t}) = \sum_{t=1}^{T} U(r_{d,t} - \Delta_\gamma) \quad d = 2, 3, \dots, 10 \tag{14}$$

where: T is the number of weekly periods. The constant Δ_γ can be interpreted as the maximum weekly premium that a risk-averse investor is willing to sacrifice to switch from the lowest diversification portfolio, δ_1, to one of the more diversified portfolios, $\delta_d, d = 2, 3, .., 10$.

Table 2. *Regression of future Sharpe ratios with the diversification measures*

	Following Month	Following Quarter	Following Year	Following 2-Years	Following 5-Years
Panel A: Woerheide and Persson measure (WPM)					
Average R^2	1.25%	1.87%	3.03%	3.53%	2.40%
Coefficient	5.92	1.87	1.75	1.89	1.03
t-statistic	1.58	1.11	1.19	1.06	0.36
Panel B: Conditional diversification measure (CDM)					
Average R^2	1.27%	2.08%	3.37%	4.25%	3.49%
Coefficient	51.64	19.94	16.45	16.07	11.24
t-statistic	1.61	1.54	1.49	1.21	0.89
Panel C: Effective number of bets (ENB)					
Average R^2	3.14%	4.63%	4.88%	7.12%	7.95%
Coefficient	26.08	16.43	12.96	11.73	8.16
t-statistic	2.71**	2.50**	2.13**	2.01**	1.88*

Note: Coefficient denotes the average slope of the regressions. The *t*-statistics are calculated using the Newey-West standard errors. * / ** denote the significance at the 10% / 5% levels.

Table 3 reports the annualized values of Δ_γ for different diversification measures and for different levels of the relative risk aversion parameter, γ. Following Fleming et al. (2003), we use $\gamma = 1(10)$ to represent investors with low (high) level of relative risk aversion.

Since the Δ_γ premiums are always positive, a risk-averse investor would always prefer a higher diversification portfolio $\delta_d, d = 2, 3, \dots, 10$ over the least diversified δ_1 portfolio. If there is a positive relation between the level of portfolio diversification and the economic utility derived by the investor, one would expect that the premium for switching from δ_1 to δ_m would be lower than the premium for switching from δ_1 to δ_n if $m < n$. In other words, if δ_n has a better diversification than δ_m, the investor should prefer δ_n over δ_m. Clearly such a relation does not hold when the portfolio diversification is measured using the either the WPM or the CDM measure, as the Δ_γ values do not increase monotonically with the level of diversification. For instance, when portfolio diversification is measured using the WPM, an investor with low risk aversion (Δ_1) is willing to pay an annualized fee of 38.6 basis points to switch from δ_1 to δ_3, but only 3.6 basis points to switch from δ_1 to δ_4. Similar observations can be made when the portfolio diversification is measured using the CDM. However, when the portfolio diversification is measured using the ENB measure, the Δ_γ premiums increase monotonically with the level of diversification.

Regardless of the level of relative risk-aversion, in all comparisons, the premium for switching from δ_1 to δ_m is lower than the premium for switching from δ_1 to δ_n if $m < n$.

In addition, the magnitude of diversification premium is the largest when portfolio diversification is measured using the ENB measure. For instance, an investor with low (high) risk aversion would be willing to pay 93 (429) basis points per annum to switch from the least diversified portfolio to the most diversified portfolio ($\delta_1 \; to \; \delta_{10}$) when portfolio diversification is measured using the ENB measure.

Table 3. *Annualized diversification premium*

	Annualized Premium to switch from δ_1 to $\delta_d, d = 2, 3, .., 10$					
	WPM		*CDM*		*ENB*	
Risk Aversion	Δ_1	Δ_{10}	Δ_1	Δ_{10}	Δ_1	Δ_{10}
$\delta_1 \; to \; \delta_2$	0.090	0.150	0.104	0.156	0.120	0.798
$\delta_1 \; to \; \delta_3$	0.386	0.799	0.073	0.857	0.455	1.407
$\delta_1 \; to \; \delta_4$	0.036	0.331	0.131	0.343	0.490	2.073
$\delta_1 \; to \; \delta_5$	0.121	0.526	0.136	0.573	0.608	2.534
$\delta_1 \; to \; \delta_6$	0.070	0.228	0.158	0.243	0.617	2.684
$\delta_1 \; to \; \delta_7$	0.108	0.269	0.036	0.284	0.641	2.891
$\delta_1 \; to \; \delta_8$	0.329	0.301	0.115	0.307	0.668	2.993
$\delta_1 \; to \; \delta_9$	0.156	0.171	0.120	0.187	0.712	3.175
$\delta_1 \; to \; \delta_{10}$	0.265	0.339	0.159	0.342	0.931	4.293

Note: This table reports annualized return, Δ_γ, that a risk-averse investor would be willing to pay to switch from the δ_1 portfolio to one of the $\delta_d, d = 2, 3, .., 10$ portfolios. γ is the degree of relative risk aversion, with γ =1 (10) representing an investor with low (high) risk aversion.

5. Conclusion

Diversification of investment portfolios reduces the unpriced idiosyncratic risks without affecting the expectation of future returns. Therefore, on an average, better portfolio diversification should lead to better risk-adjusted performance. We test the empirical relation between portfolio diversification and the future risk-adjusted performance. The absence of a unique quantitative measure of diversification has motivated diverse approaches to achieve portfolio diversification. We use three alternative approaches of measuring portfolio diversification in our tests – the Woerheide and Persson measure as a portfolio weight-based diversification measure, the conditional diversification measure as a risk-based diversification measure, and the effective number of bets (ENB) as a factor based diversification measure. There is evidence that the ENB measure is a statistically significantly predictor of the future Sharpe ratios. The economic gains of diversification, as measured by the ENB measure, are large and robust to the investor's risk aversion and choice of investment horizon. When the portfolio diversification is measured by the ENB measure, we estimate that an investor with low (high) risk aversion would be willing to pay 12 to 93 (79 to 429) basis points per annum to capture the benefits of diversification.

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Inflation convergence among the next eleven economies: Evidence from asymmetric nonlinear unit root test

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Abstract. *The purpose of the present paper is to investigate whether or not inflation convergence exists among the Next-Eleven (N-11) country members which are Bangladesh, Egypt, Indonesia, Iran, South Korea, Mexico, Nigeria, Pakistan, the Philippines, Turkey and Vietnam, employing the asymmetric nonlinear unit root procedure of Sollis (2009). The data set involves monthly consumer price indices of N-11 countries for the period from January 1995 to April 2015 and the inflation rate differential of each country is calculated in order to test inflation convergence. The empirical results indicate that there exists inflation convergence among the economies of Bangladesh, Indonesia, Iran, South Korea, Mexico, the Philippines, Turkey and Vietnam. It is suggested that a common monetary policy would be designed and a successful monetary union would be constituted for these countries.*

Keywords: inflation convergence, asymmetric nonlinear unit root test, next-eleven countries.

JEL Classification: C22, E31.

1. Introduction

Price stability and effective monetary policies are the major issues for both developed and developing countries in terms of economic development. The Central Banks of the countries implement effective monetary policies that aim at the maintenance of the price stability and the encouragement of macroeconomic stability in general. As mentioned by Kisswani and Nusair (2014), inflation convergence serves as an indicator of the degree of good markets integration and is taken by policy-makers to mean reduction in inflation rate differentials between countries. The integration of good markets provides the inflation convergence and so inflation rates and prices do not differ across a group of similar countries.

In other respects, the inflation rate differential is associated with the growth rate differentials and because of the differences in the level economic development, the level of prices could be different across a group of similar countries. According to Cuestas and Ramlogan-Dobson (2013), if there are differences in the rate at which inflation returns to its baseline following a shock, policymakers will be confronted with the design of a monetary policy for diverse or even conflicting economic environments. Consequently, policy aimed at stimulating growth may not jeopardize price stability in one country but has the opposite effect in another with further knock-on effects in that country.

The convergence hypothesis of inflation relies on unit root tests in time series framework. The rejection of the unit root indicates that any shock to inflation rate differentials that causes deviations from the equilibrium dies out and is expressed as the empirical evidence that the inflation rate differentials are converging to their equilibrium situation.

The Next-Eleven (hereafter, N-11) economies were first identified by the Goldman Sachs Investment Bank and Jim O'Neil in 2005 as an alternative to BRIC (Brazil, Russia, India and China) economies. The N-11 grouping involves Bangladesh, Egypt, Indonesia, Iran, South Korea, Mexico, Nigeria, Pakistan, the Philippines, Turkey and Vietnam. The main criteria that Goldman Sachs used for the N-11 grouping were macroeconomic (price) stability and openness of trade and investment policies. The main characteristics of N-11 economies are that they share growing populations associated with remarkable industrial potential. N-11 economies also have common features in terms of high economic potential.

The extant literature on inflation convergence is mostly interested in many advanced economies and Organization of Economic Co-Operation and Development (OECD) economies. Especially, most of the studies investigate inflation convergence in European Union and Euro Area economies. In other respects, there exist a few serious attempts to test inflation convergence hypothesis for the other economies. Although inflation convergence has been well studied in advanced economies there do not exist

any contributions to inflation convergence in N-11 economies. Therefore, this study attempts to fill the gap by testing inflation convergence in N-11 economies.

The main goal of the present paper is to investigate whether or not inflation rate differentials in N-11 economies are persistent, in other words, whether or not inflation convergence exists among the N-11 country members. The present paper differs from the extant literature in the following way: to the best of our knowledge, it is the first study that examines the issue of inflation convergence in the context of N-11 economies, employing the asymmetric nonlinear unit root procedure of Sollis (2009) to investigate the stationary of inflation rate differentials.

The remainder of the paper is organized as follows: in Section 2 we discuss the literature review and in Section 3 we present the econometric methodology. Section 4 contains the data description and empirical results of the study. The fifth and last section includes conclusions.

2. Literature review

As mentioned above, there exist fewer empirical studies on inflation convergence in the other economies except the advanced economies such as those of the European Union and the Euro Area. Koćenda and Papell (1997) investigated the inflation convergence for the European Union using panel regression approach and reported that there exists inflation convergence within the European Union.

Holmes (2002) also examined the long-run inflation convergence among the European Union countries using panel unit root and cointegration approach and found out strong evidence of inflation convergence for the sample countries during 1983-1990. Spiru (2008) used the univariate and panel unit root tests to explore the inflation convergence for Central and Eastern European (CEE) economies and remarked that the inflation rate differentials of CEE economies, as candidate economies, are converging to the European Union economies.

Busetti et al. (2007) investigate the convergence of inflation rate differentials among the European Union economies using the standard Augmented Dickey-Fuller (ADF) unit root test. They divided the sample period into two: 1980-1997 and 1998-2004 and they found out evidence of inflation convergence only over the 1980-1997 period. Kiswani and Nusair (2011) also used linear and nonlinear unit root tests the inflation convergence for Asian economies, i.e. China, Indonesia, Japan, Malaysia, the Philippines, Singapore, South Korea and Thailand, relative to the United States and Japan. Their empirical findings support the validity of inflation convergence among Asian economies.

Gregoriou et al. (2011) investigated inflation convergence among the Euro Area economies using linear and nonlinear unit root tests and remarked that there exists inflation convergence among the Euro Area economies according to the results of

nonlinear unit root test. Lopez and Papell (2012) also examined the inflation convergence among the Euro Area economies using panel unit root test. Their empirical findings support the strong empirical evidence for inflation convergence among the Euro Area economies.

Giannellis (2013) used threshold unit root test to explore inflation convergence for the Euro Area economies. The empirical findings of Giannellis's (2013) study indicated that there did not exist inflation convergence for some of the Euro Area economies, i.e. Germany and France.

Cuestas and Ramlogan-Dobson (2013) explored the inflation convergence for the Caribbean economies using linear and nonlinear unit root tests. They reported that inflation convergence was in existence for the Caribbean economies. Anoruo and Murthy (2014) used nonlinear unit root tests to investigate the issue of inflation convergence for the Central African Economic and Monetary Community (CEMAC), i.e. Cameron, Central African Republic, Chad, Equatorial Guinea, Gabon and the Republic of Congo. Their findings suggest strong evidence of inflation convergence among the economies within CEMAC.

3. Econometric methodology

Empirically, the issue of inflation convergence could be investigated by exploring the stationarity of the inflation differentials series through the unit root tests. If the inflation differential series follows a unit root process, it would imply that the inflation rate of a country differs persistently from the average inflation rate of all countries. It is well known that conventional unit root tests such as Augmented Dickey-Fuller (ADF) have weakness in terms of persistent failure to reject the null of a unit root.

Kapetanios et al. (KSS) (2003) develop a new strategy of testing for a unit root in the nonlinear exponential smooth transition autoregressive (STAR) framework. Hereunder, in KSS test, the null hypothesis of the unit root is tested against the nonlinear exponential smooth transition autoregressive (ESTAR) but globally stationary process. Furthermore, the nonlinear behavior of the series displays symmetric adjustments for positive and negative deviations towards the equilibrium level.

Sollis (2009) proposes an alternative to KSS nonlinear unit root test, referred to as an asymmetric ESTAR (AESTAR) model, which allows for symmetric or asymmetric stationary ESTAR nonlinearity under the alternative hypothesis. The main advantage of the Sollis (2009) test is that the nonlinear behavior of the series displays symmetric or asymmetric adjustments for positive and negative deviations towards the equilibrium level.

The AESTAR model of Sollis (2009) employs both an exponential function and a logistic function as follows:

$$\Delta y_t = \left[1-\exp\left(-\theta_1 y_{t-1}^2\right)\right]\left\{\left[1+\exp\left(-\theta_2 y_{t-1}\right)\right]^{-1}\gamma_1 + \left(1-\left[1+\exp\left(-\theta_2 y_{t-1}\right)\right]^{-1}\right)\gamma_2\right\} y_{t-1} + \varepsilon_t$$
$$\theta_1 \geq 0, \quad \theta_2 \geq 0 \tag{1}$$

where: ε_t is i.i.d. random variable with zero mean and unit variance, y_{t-1} is the transition variable and θ_1 is the transition parameter which determines the speed of mean reversion between two regimes. On the other hand, if $\gamma_1 \neq \gamma_2$, the nonlinear behavior of the series displays asymmetric adjustment for positive and negative deviations towards the equilibrium level.

The unit root hypothesis can be tested against the alternative hypothesis of globally stationary symmetric or asymmetric ESTAR nonlinearity by testing $H_0 : \theta_1 = 0$. Under the null hypothesis γ_1, γ_2 ve θ_2 parameters are unidentified, so testing the null hypothesis $H_0 : \theta_1 = 0$ is not feasible and we cannot use the conventional methods. To overcome this problem, Kapetanios et al. (2003) suggest taking first-order Taylor series approximation to derive an auxiliary regression and Sollis (2009) follows the same strategy to get the auxiliary regression computing a first-order Taylor series approximation to the AESTAR model under the null. The auxiliary regression is obtained as following computing the first-order Taylor expansion around $\theta_1 = 0$:

$$\Delta y_t = \delta_1 y_{t-1}^3 + \delta_2 y_{t-1}^4 + \varepsilon_t \tag{2}$$

Henceforth, the null hypothesis $H_0 : \theta_1 = 0$ becomes $H_0 : \delta_1 = \delta_2 = 0$ in the preceding representation. The auxiliary regression model can be estimated using OLS method and lagged values of Δy_t could be added to model (2) to eliminate the autocorrelation problem in residuals and ensuring "white noise" errors.

The null hypothesis of unit root is tested against the alternative hypothesis of stationary symmetric or asymmetric ESTAR nonlinearity using an F-type test. Sollis (2009) highlights that the standard critical values cannot be used and derives the asymptotic distribution of the F-test of $H_0 : \delta_1 = \delta_2 = 0$.

Once the null hypothesis of unit root has been rejected against the alternative stationary of symmetric or asymmetric ESTAR nonlinearity, then, the null hypothesis of symmetric ESTAR nonlinearity can be tested against the alternative of asymmetric ESTAR nonlinearity using model (3) by testing $H_0 : \delta_2 = 0$ against $H_1 : \delta_2 \neq 0$ with a standard F-test. The standard F critical values can be asymptotically applicable if and only if OLS estimate of δ_1 is negative.

As mentioned Kapetanios et al. (2003), the modelling deterministic components such as intercept and intercept/trend in auxiliary regression model (in nonlinear models) is

obvious, so we use de-meaned and de-trended data. From this point of view, there also exist three cases of F-test statistic for Sollis (2009) test: i) raw data case $\left(F_{AE}\right)$; ii) de-meaned data case $\left(F_{AE,\mu}\right)$ and iii) de-trended data case $\left(F_{AE,t}\right)$. Similarly, in the test of symmetric ESTAR nonlinearity versus asymmetric nonlinearity is referred to F_{as}, $F_{as,\mu}$ and $F_{as,t}$ for raw data, de-meaned data and de-trended data cases, respectively.

4. Data and empirical results

The data set involves monthly consumer price indices (2010=100) of N-11 countries for the period from January 1995 to April 2015, a total of 244 observations and consists of Bangladesh, Egypt, Indonesia, Iran, South Korea, Mexico, Nigeria, Pakistan, the Philippines, Turkey and Vietnam. The data are obtained from the International Financial Statistics (IFS) database. We calculate inflation rates from consumer price indices of N-11 countries using the $\ln\left(P_t/P_{t-1}\right)\times 100$ formula where P_t denotes the value of the consumer price indices of each country at time t and finally, in order to test inflation convergence, we define the inflation rate differential of each country as following:

$$d_{i,t} = \pi_{i,t} - \overline{\pi}_t \tag{3}$$

where: $d_{i,t}$ represents the inflation rate differential of *i.* country at time t, $\pi_{i,t}$ denotes the inflation rate of *i.* country at time t and $\overline{\pi}_t$ is the average rate of inflation for N-11 countries during the same period.

The descriptive statistics for the inflation rate differentials of each country are reported in Table 1. As seen in Table 1, the mean values for inflation rate differentials ranged from a low of -0.576 percent for South Korea to a high of 1.283 percent for Turkey. The standard deviation values of inflation rate differentials ranged from a low of 0.493 percent of the Philippines to a high of 1.958 percent for Turkey. Furthermore, the inflation rate differentials are positively skewed with the exception of Bangladesh, South Korea, Pakistan and the Philippines. The Jarque-Bera test statistics are statistically significant at the 5% level with the exception of Pakistan. Also, the plots of inflation rate differentials are presented in Figure 1.

Figure 1. *Plots of inflation rate differentials*

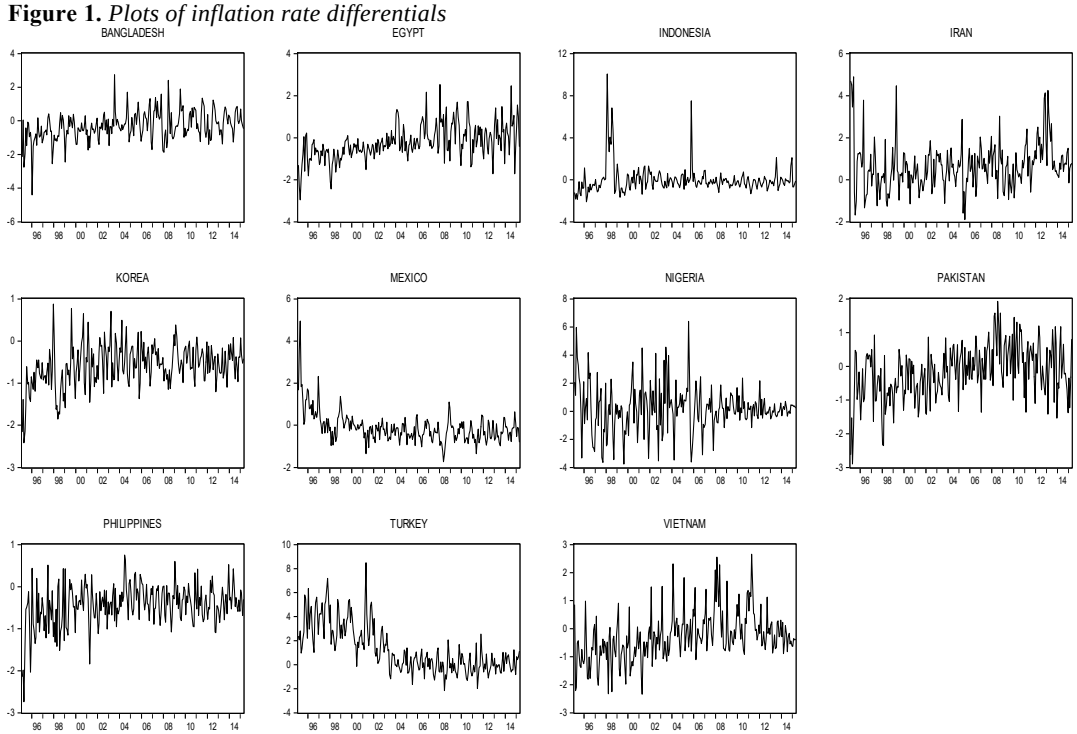

Table 1. *Descriptive statistics for inflation rate differentials*

	Bangladesh	Egypt	Indonesia	Iran	South Korea	Mexico	Nigeria	Pakistan	the Philippines	Turkey	Vietnam
Mean	-0.31379	-0.22481	-0.01673	0.64750	-0.57624	-0.11094	0.19986	-0.17262	-0.43836	1.28354	-0.27742
Median	-0.36983	-0.32670	-0.20615	0.54289	-0.55852	-0.18452	0.14667	-0.20330	-0.41388	0.79501	-0.34866
Maximum	2.74614	2.53005	10.05247	4.89376	0.87370	4.94854	6.39176	1.92732	0.74843	8.49337	2.65800
Minimum	-4.39971	-2.95866	-2.08050	-1.88675	-2.41327	-1.73193	-3.75872	-2.89694	-2.73839	-2.14515	-2.34333
Std. Dev.	0.85143	0.82054	1.31108	1.11484	0.49776	0.71781	1.60148	0.79132	0.49370	1.95857	0.85801
Skewness	-0.17424	0.33204	3.93831	1.10867	-0.31656	2.45792	0.37294	-0.27494	-0.81076	0.97798	0.59693
Kurtosis	5.54846	4.07545	24.73313	5.56857	4.12280	15.23258	4.74932	3.34456	5.25613	3.42367	4.21093
Jarque-Bera	66.98797	16.17541	5410.496	116.58040	16.82284	1759.738	36.61661	4.26359	78.15902	40.55331	29.27783
Probability	0.00000	0.00031	0.00000	0.00000	0.00022	0.00000	0.00000	0.11862	0.00000	0.00000	0.00000
Observations	243	243	243	243	243	243	243	243	243	243	243

We employ the Sollis (2009) nonlinear asymmetric unit root $\left(F_{AE}\right)$ test using raw data for inflation rate differentials of N-11 country members and also investigate whether shocks have symmetric or asymmetric effects for countries in which the unit root test is rejected using F_{as} test. We summarize the empirical results in Table 2.

Table 2. *The results of Sollis nonlinear asymmetric unit root test for raw data*

	Lag length	$\hat{\delta}_1$	$\hat{\delta}_2$	F_{AE}	F_{as}
Bangladesh	2	-0.10836	-0.01722	16.44997*	14.15238**
Egypt	11	-0.03849	-0.00892	1.66060	-
Indonesia	7	-0.01672	0.00114	13.74844*	3.08127
Iran	12	-0.07869	0.01540	4.02349*	3.21717
South Korea	11	-0.54041	-0.35199	8.23678*	16.47191**
Mexico	11	-0.08746	-0.00134	4.62164*	0.00620
Nigeria	11	-0.01162	0.00095	0.71278	-
Pakistan	11	-0.03460	-0.00314	0.38292	-
The Philippines	5	-0.43296	-0.20741	5.10069*	6.39498**
Turkey	0	-0.00261	-0.00044	12.62672*	0.38354
Vietnam	2	-0.08246	-0.00455	9.95074*	0.37042

Note: * and ** denote the rejection of the null hypothesis of unit root and the rejection of the null hypothesis of symmetric ESTAR nonlinearity, respectively at the 5% significance level. The numbers of maximum lags are determined as 12 and the optimal lag lengths are determined through Akaike Information Criterion (AIC).

The results presented in Table 2 indicate that the null hypothesis of unit root is rejected for the cases of Bangladesh, Indonesia, Iran, South Korea, Mexico, the Philippines, Turkey and Vietnam at the 5% significance level. On the other hand, the null hypothesis of unit root cannot be rejected for the cases of Egypt, Nigeria and Pakistan. Thus, the results state the rejection of null hypothesis of unit root, on the side of a nonlinear and globally stationary process in all cases, except Egypt, Nigeria and Pakistan.

Based on the empirical results, inflation does not have persistent characteristics in N-11 economies except Egypt, Nigeria and Pakistan, so there exists inflation convergence among the economies of Bangladesh, Indonesia, Iran, South Korea, Mexico, the Philippines, Turkey and Vietnam. It is possible to design a common monetary policy and to constitute a successful monetary union for these countries. But the inflation is more persistent for Egypt, Nigeria and Pakistan, so the monetary policies which are convenient for the other countries might not be appropriate for Egypt, Nigeria and Pakistan.

According to the empirical results of F_{as} test, symmetric ESTAR nonlinearity versus asymmetric nonlinearity cannot be rejected for Indonesia, Iran, Mexico, Turkey and Vietnam, but is rejected for Bangladesh, South Korea and the Philippines at the 5% significance level. This implies inflation rates of Indonesia, Iran, Mexico, Turkey and Vietnam display symmetric adjustments for positive and negative deviations towards the equilibrium level. On the other hand, inflation rates of Bangladesh, South Korea and the Philippines show asymmetric adjustments for positive and negative deviations towards the equilibrium level.

5. Conclusions

The purpose of present paper was to investigate whether or not inflation rate differentials in N-11 economies are persistent, in other words, whether or not inflation convergence exists among the N-11 country members. The data set involves monthly consumer price indices (2010=100) of N-11 countries for the period from January 1995 to April 2015. First, we calculate inflation rates from consumer price indices of N-11 countries and then calculate the inflation rate differential of each country in order to test inflation convergence.

The present paper differs from the extant literature in the following way: to the best of our knowledge, it is the first study that examines the issue of inflation convergence in the context of N-11 economies, employing the asymmetric nonlinear unit root procedure of Sollis (2009) to investigate the stationary of inflation rate differentials.

The empirical results indicate that the null hypothesis of unit root is rejected for the cases of Bangladesh, Indonesia, Iran, South Korea, Mexico, the Philippines, Turkey and Vietnam, and the null hypothesis of unit root cannot be rejected for the cases of Egypt, Nigeria and Pakistan. Therefore, there exists inflation convergence among the economies of Bangladesh, Indonesia, Iran, South Korea, Mexico, the Philippines, Turkey and Vietnam.

According to these results, it can be implied that inflation rates across N-11 countries appear to be converging over time. Besides, it can be implied that it is possible to design a common monetary policy and to constitute a successful monetary union for Bangladesh, Indonesia, Iran, South Korea, Mexico, the Philippines, Turkey and Vietnam. There exists a suitable and necessary condition to establish a common central bank for these countries.

On the other hand, inflation rates of Indonesia, Iran, Mexico, Turkey and Vietnam display symmetric adjustments for positive and negative deviations towards the equilibrium level, but inflation rates of Bangladesh, South Korea and the Philippines show asymmetric adjustments for positive and negative deviations towards the equilibrium level. These results support that the effect of a negative shock is different from a positive shock for Bangladesh, South Korea and the Philippines. Consequently, policymakers should be especially watchful when a negative shock occurs.

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Bitcoin as digital money: Its growth and future sustainability

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Abstract. *This paper examines the comprehensive idea about the growth and future sustainability of bitcoin as a cryptocurrency. The transaction volume of bitcoin is used as the growth of the bitcoin and the bitcoin log return is used for testing the volatility which is helpful for the future sustainability of bitcoin. The study period says that the growth of bitcoin's transaction volume is an increasing trend as more day to day transaction is minting with the exchange of Bitcoin. The study also uses ARCH & GARCH methodology to know the volatility of this emerging digital currency, and the GARCH result shows that it is a highly volatile currency. As a result, most of the governments have not given their legal status for the use of bitcoin in their country. But if bitcoin will be stable in the future, then it is easily accepted through worldwide and in the long run, people will have more faith in the cryptocurrency technology and its usability.*

Keywords: digital money, bitcoin, cryptocurrency, volatility.

JEL Classification: G12, G18, G32.

1. Introduction

Money is nothing but a technological solution to solve the problem that the society faces on Barter. So it changes its form from traditional Barter to Digital money. One of the greatest innovations in the modern era that money's destiny is to become digital. A large number of digital currencies are there, but bitcoin is most important due to its highest market capitalization, as of 10th August 2017 the market capitalization of bitcoin has crossed 48 percent among all cryptocurrency which is around 55 billion US dollar (coinmarketcap.com). Here the main focus is on "bitcoin." It is a decentralized digital money is an online payment system invented by an anonymous person(1) using the pseudonym "Satoshi Nakamoto" in 2009. The first unit was issued through open-source software. bitcoins are not printed like fiat money, but instead, are "mined" using computing power cryptography technology. Recently bitcoin has attracted much attention. Its use in the form of payment system for goods and services has grown, and merchants have an incentive to accept it due to its lower transaction fee, i.e., less than 2-3% typically imposed by credit card processors (Chakravorti et al., 2007), and instant transfer from one account to other. Despite a big increase in the number of merchants accepting bitcoin, the virtual currency doesn't have much momentum in retail transactions. The main aim of the currency is trading goods and services, especially in the virtual market (where bitcoins are accepted). In this paper, the study tries to find out the growth and future sustainability of bitcoin. Here the present study uses the ARCH and GARCH methodology for measuring the volatility nature of bitcoin and provides various information regarding its use in various economy.

The rest of the paper is organized as follows. Section 2 explores some past studies regarding bitcoin. Section 3 describes the data sources and methodology for measuring the Volatility of bitcoin. Empirical analysis of results is examined in section 4. In Section 5 the study highlights some issues regarding the future sustainability of bitcoin. Finally, Section 6 gives some concluding remarks.

2. Review of literature

Nakamoto (2008) explore bitcoin as a peer-to-peer version electronic cash that allows online payments to be sent directly from one party to another without going to a financial institution. Mark (2011) argue that the digital currency is something different from government issued currency as it is issued by the private parties and circulate only through the internet. Murali (2013) in his study, state that bitcoin is a currency of the new generation emerged when people's confidence loose on the fiat currency. Christen (2013) tries to point out the illegal activities of bitcoin, and found that silk road an online marketplace for the illegal trading of drugs and other goods and services receive payment only on bitcoin. Dwyer (2014) establishes that current digital currencies such as bitcoin is helpful for double-spending problem and create finality of transactions. Where the average monthly volatility of returns on bitcoin is higher than for gold or a set of foreign currencies in dollars, but the lowest monthly volatilities for bitcoin are less than the highest monthly volatilities for gold and the foreign currencies**.** Flitter (2014) examines

the illegal activities of bitcoin that US marshals services suspended the trading through bitcoin in 2013 and seized worth of $3.6 million to $27 million of bitcoin within 6 months from the silk road (unlawful activities doing with the exchange of BTC). Yermack (2014) tries to know the volatility of bitcoin and found that bitcoin's exchange rate volatility in 2013 was 142% than other currencies which fall between 7% and 12%. Bouoiyour et al. (2014) confirm the extremely speculative nature of bitcoin without neglecting its usefulness in case of trade transactions. Cheah and Fry (2015) examine the speculative bubbles in bitcoin market by taking log-return series and BDS test and shows that by comparing other asset class the fundamental value of BTC is zero and it exhibits high volatility so, there are more chances of speculative bubbles. From BDS test they highlight that it is significant for the dependency in the log-return. Dyhrberg (2016a) attempts to measure the volatility of bitcoin against gold and dollar, again Dyhrberg (2016b) says that bitcoin has hedging capabilities against FTSE (financial times stock exchange index) and US dollar by applying the asymmetric GARCH methodology. The result shows that bitcoin can be clearly used as a hedge against stocks in the FTSE. Bouri et al. (2017) argue that bitcoin is an effective diversifier against all asset.

From the above literature, the study observed that most of the studies have focused on defining bitcoin, its volatility and how it works? But none of the studies discuss the future sustainability of bitcoin. As a result, the present study differs from the previous literature in particular on the ground of specific focus on the comprehensive account of its growth and volatility nature and how various countries are accepting it as a digital currency for its usability regarding future sustainability.

3. Data and methodology

The study is based on weekly secondary time series data starting from 17thAugust 2010 to 29th August 2017. The variables like price and transaction volume of bitcoin are used for the empirical analysis. The database is sourced from core financial data, blockchain.info. The closing price of bitcoin is converted into log series, and the transaction volume is converted to change in natural logarithm value of transaction volume. The bitcoin price is converted to returns using the first differences of the natural logarithm of bitcoin prices.

3.1. Methodology

This study makes use of some well-known time series tests such as Augmented Dickey-Fuller test and Phillips-Perron tests to know the stationarity of the data. Further, Autoregressive conditional heteroscedasticity (ARCH), Generalized autoregressive conditional heteroscedasticity (GARCH), models are estimated to measure the magnitude of the volatility of bitcoin.

3.1.1. The ARCH Test

Engle (1982) developed a Lagrange multiplier test to find the presence of ARCH effects in the time series process generating variables. This test is a fast step test to move ahead of GARCH and other test in the ARCH family. This model allows time-varying volatility in the process. The ARCH (p) model can be specified as

$\mu_t = \xi_t \sigma_t, \xi_t iid\ N(0,1)$

$\sigma_t^2 = \psi + \psi_1 \mu_{t-1}^2 + \psi_2 \mu_{t-2}^2 + \cdots \ldots \ldots \ldots + \psi_p \mu_{t-p}^2$

Where $\psi > 0, \psi_i \geq 0, i > 0$.

Here the null hypothesis is that ψ_i=0 for all *i*, means there is absence of ARCH effects in the bitcoin value. Alternative hypothesis is that at least one coefficient of ψ should be statistically significant.

3.1.2. The GARCH Model

The GARCH model was a generalization of the ARCH model. It was developed by Bollerslev (1986) and Taylor (1986). A GARCH (1, 1) model can be expressed in the equation as follows

$\sigma_t^2 = \alpha_0 + \alpha_1 u_{t-1}^2 + \beta \sigma_{t-1}^2$

Here, σ_t^2 is the conditional variance of bitcoin, because its value at time *t* depends upon the past information. These information are u_{t-1}^2 indicating the ARCH effect and β_{t-1}^2 as the GARCH effect. Interestingly, the variance of σ_t^2 is heteroscedasticity while retaining the assumption of homoscedasticity for error variance. The coefficient a_1 measures the change in the conditional variance (σ_t^2) given the volatility of previous period. Similarly, the coefficient β measures the response of conditional variance due to change in the fitted variance of previous period. The coefficient α+β show the degrees of persistency in the volatility. The higher value of joint coefficient, say 0.90 indicates the higher degrees of lagged influence on the conditional variance of the bitcoin value. In other words, large shock in the past is going to affect its current conditional variance largely. This phenomenon is termed as "volatility clustering" in the financial economics. The GARCH model is more effective compared to ARCH model because there is more possibility of violating non-negativity condition in the later model. This model can be extended to higher order lag to get a better forecast of conditional variance. Extending the model to p and q period, the GARCH (p, q) can be specified as

$$\sigma_t^2 = a_0 + \sum_{j=1}^{p} \alpha_j u_{t-p}^2 + \sum_{i=1}^{q} \beta_i \sigma_{t-q}^2$$

4. Empirical results

4.1. Volatility of bitcoin

To test the volatility some preliminary unit root test has been done to check the time series properties of the variables. It is known that the data needs to be stationary to run the ARCH and GARCH model for testing the volatility of bitcoin. For the stationarity of data, the study has used the well-known Augmented Dicky Fuller (ADF) and Phillips-Perron test (PP). The result of both the tests has been shown in the below Table 1.

Table 1. *Unit Root Test*

Variables	ADF	PP
Lnvalue (At Level)	2.812 (0.056)	2.286 (0.176)
∆lnvalue (1st Difference)	12.860*** (0.000)	13.263*** (0.000)
Lntransaction (At Level)	2.662 (0.080)	2.523 (0.110)
∆lntransaction (1st Difference)	23.822*** (0.000)	24.330*** (0.000)

Source: Author's own calculation, Note: *** denote statistical significance at 1% level. The values in parentheses shows P-value.

ADF test. In Table 1, the ADF test shows that the lnvalue series is nonstationary at the level. The test statistics (2.812) is less than the critical value at 1% and 5% level of significance. Thus the model is unable to reject the null hypothesis. However, the first difference of the lnvalue series is stationary at 1% level of significance as the test statistics (12.860) is greater than the critical value. Similarly, ADF test for lntransaction series shows that the data is non-stationary at the level as the test statistics (2.662) is less than the critical value. But the lntransaction variable is stationary at first difference. The test statistics value (23.822) is higher than the critical value at 1% level of significance, which reveals that lntransaction series is stationary at first difference.

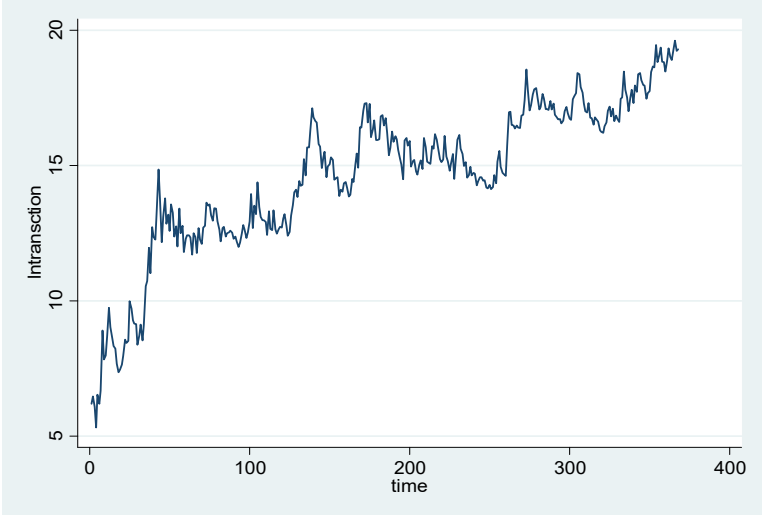
PP-test. The result of PP-test is also present in Table 1, which states that the lnvalue and lntransaction are non-stationary. After taking the first difference of this two variable the test statistic values at first difference is 13.263 and 24.330 respectively for lnvalue and lntransaction. These values strongly suggest that the two variables are stationary at the first difference.

The result of PP test also supports the result of ADF test that the data become stationary at 1st difference. The result of ADF and PP tests for the study period was non-stationary at their initial levels, but become stationary after the first difference, it means both the data series being characterized of order I(1).

4.1.1. Growth and volatility of bitcoin

Here growth of bitcoin is measured regarding transaction of bitcoin on a weekly basis and the volatility of bitcoin is measured through its weekly fluctuating price volume. Volatility is a measure of risk and uncertainty involved in the process of price development. Thus, high volatile instruments have lesser exposure to be held by the public. In the meantime, it increases the interest of business holder to hold that instrument since speculation is involved in the pricing process. The logic is simple; the high volatile assets takes the future path which is unexpected and unpredictable.

Figure 1. *Weekly Transaction(ln) volume*

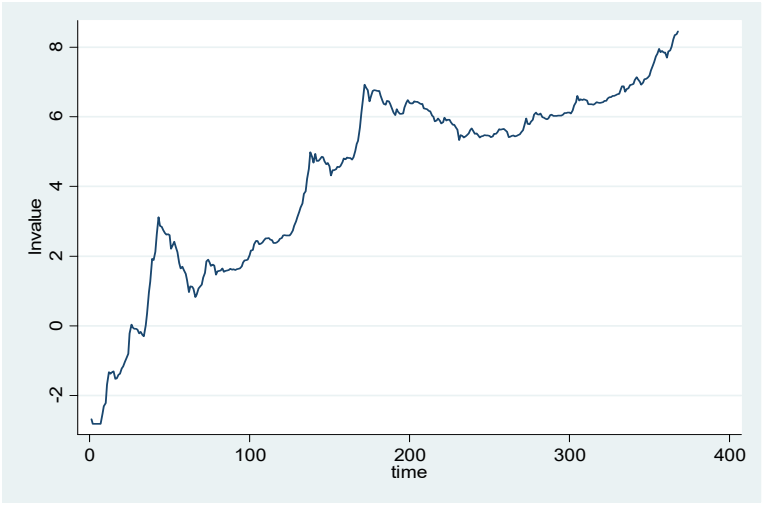


Source: Author's own calculation.

The value changes so frequently that it creates disincentive among the public to keep that asset. This measure is more popular in the financial debt and equity markets (Predeshu and Stancu, 2011) although, macroeconomic variables such as inflation, interest rate, etc. We use this measure to know the uncertainty associated with their movement. In the recent time, there has been a lot of interest in the concept of 'bitcoin,' and highly debated. There has been unprecedented growth in the use of bitcoin as it is evident from the Figure 1.

The total volume of weekly transactions has increased at an increasing trend over time. As a result, we can say that the growth of bitcoin transaction volume is an increasing trend as more day to day transaction is minting with the exchange of bitcoin.

Figure 2. *Weekly Bitcoin Price Value(ln)*



Source: Author's own calculation.

From Figure 2. It is clearly, measures the rising trend in the bitcoin transaction volume over the time. This increasing trend necessitates the measure of the volatility of the bitcoin. The volatility of bitcoin is measured as the change in the log price of bitcoin. The price of bitcoin is measured through the demand of and supply for the bitcoin. Measuring volatility of bitcoin will not only help to know the uncertainty and risk associated with the movement of bitcoin price, but it also helps to see the incentive for the people to use it in their day to day transactions. The consensus is that higher the volatility of bitcoin price lowers the incentive for the public to use in the transactions. The sudden fall in the bitcoin price creates a loss for the user regarding the declining worth of the bitcoin currency and vice-versa. This type of price behavior of bitcoin might create declining confidence among user to use as a currency in the payment. The volatility of bitcoin price is measured through a simple statistical calculation of 'standard deviation' of a particular series. Further, persistence in the volatility is measured through the time series model such as ARCH and another test in the GARCH family(2).

Table 2. *Descriptive statistics of Bitcoin over the full sample period, as well as two subsample periods*

Sample period	N	Mean	SD	Max	Min	Kurt	Skew
17/8/10 to 29/8/17	368	4.291	2.655	8.451	-2.813	-0.159	-0.859
17/8/10 to 29/10/13	168	1.889	2.063	5.314	-2.813	-0.208	-0.477
5/11/13 to 29/8/17	200	6.309	0.684	8.451	5.330	0.848	0.986

Table 2 reports the descriptive statistics of bitcoin. We divide the whole sample according to the hike of the graphical representation. The full sample period suggests that the mean return of bitcoin is positive with high standard deviation, low kurtosis, and negative skewness value. From the second subsample, the mean return is higher, and standard deviation of bitcoin returns are lower compared to the first subsample, where the kurtosis and positive skewness are much greater in the second subsample period. The low standard deviation in the second subsample period indicates that the volatility is reducing in the recent period than before. As a result, it is easily acceptable by the investors and users. However, the recent role of volatility and volume of transaction goes against the general consensus of the researcher. This creates debate in the researcher sphere regarding the sources of recent development in the bitcoin price. There could be several possible sources that drive the price and transaction volume. One of the reasons might be the speculation in the bitcoin prices. The high volatility could be a major source for the investor to gain from it. As a result, there is an increase in the transaction volume which in turn increases the price of bitcoin. This new currency has served more often as a financial asset rather than a currency. This is due to its limited supply (Nakamoto, 2009) and wide fluctuations in the value.

The ARCH test is necessary before running a GARCH model. The test result shows that there is evidence of ARCH effects indicating that there is presence of persistence in the return volatility of bitcoin. Table 3 represents the result of ARCH test which shows that the lagged volatility coefficient is significant at 1% level of significance. The current return volatility of bitcoin is significantly influenced by its previous two weeks' return volatility.

Table 3. *ARCH test of bitcoin return*

Lags(p)	Null hypothesis	Chi square	Prob.
2	No ARCH effects	54.309***	0.000

Note: *** denotes 1% level of significance.

However, it is suggested that the GARCH test gives more robust result in assessing the volatility of a return series. Here the GARCH (1, 1) model best describes the volatility of the weekly bitcoin returns. Table 4 illustrates the result of variance equation that shows both the α and β coefficient is significant at 1% level of significance. It means the conditional variance of bitcoin return dependents positively on the square error terms in the previous period and its conditional variance in the previous period. In other words, the current volatility in the bitcoin return can be explained by the previous volatility.

Table 4. *Volatility in bitcoin return*

	Coefficient	Standard Error	Z-statistics	Probability
Mean Equation				
Lnvalue	0.154	0.004	3.46	0.001
Variance Equation				
ARCH(1) (α)	0.279	0.043	6.47***	0.000
GARCH(1) (β)	0.702	0.259	27.04***	0.000
Total Observation=367				

Note: ***denote 1% level of significance.

The coefficient value of α+β is 0.98 which indicates that there is the presence of high persistence in the volatility. Furthermore, the coefficient value of α (0.27) in the GARCH model shows that the volatility reacts 27 percent to the market movements. Again, there is no evidence of a spike in the volatility of bitcoin return as the value of α coefficient (0.27) is relatively lower than the coefficient β (0.70). The coefficient value of β indicates that the past variance can be helpful to explain the current variance of bitcoin by 70 percent. Interestingly, the long run average volatility of bitcoin return is 0.004 which is too low compared to financial instruments. This time dependency in the conditional variance is mainly due to an increase in the volume of transactions and fluctuations in the prices of bitcoin due to new news into the market. Unlike conventional money, it has attracted an investor to use for their investment purpose. This speculative behavior has led to a further rise in the volatility of bitcoin price. Like debt instrument, the bitcoin has paid some return to the investor whenever the price goes high. However, it is not to be confused between fixed income debt instrument and bitcoin in respect of return promises in future dates. Moreover, this new currency has similar functional quality as the gold has in the gold market. However, it departs in one point from the gold metal by being a medium of payment.

5. Bitcoin and its future sustainability

5.1 Fall of Mt.Gox (Dark side of bitcoin)

Mt.Gox (Magic: **T**he **G**athering, **Online** e**X**change) it was initially started by Jed Mccaleb in 2009 and started bitcoin trading from July 2010 by exchanging bitcoin with real money. Initially, in November 2010, bitcoins exchange rate was USD 0.5= 1BTC, but in February 2011 it par with US Dollar at $1=BTC. But in March 2011 Mccalab sold Mt.Gox to Mark Karpeles after that he became CEO of the exchange. It was world's No.1 Tokyo based online spot to buy and sell bitcoins trading exchanges[3] (Anders, 2014). But due to the loss of more than $450 million BTC belonging to both costumes and company as the hackers leaked the usernames and passwords. As a result, more than thousands of bitcoin trading account were inaccessible, and Mt.Gox suspended all trading's and closed its exchange services.

5.2. Silk road (marketplace)

Silk Road was an online black market knowing for illegal trading activities, it is also known as bitcoin-dollar online drug bazaar, and this website was specially designed for unlawful transaction activities. In 2011 most of the illegal trading (drugs, malicious software, child pornography, weapons,) activities on Silk Road were done through the digital currency known as bitcoin, because due to the easiest transaction process without knowing the parties. Ross William Ulbricht was the creator of the Silk Road, and due to this illegal activities Ulbricht was arrested, and Silk Road was shut down on October 2013 by Federal Bureau of Investigation (FBI). The bureau initially ceased 26000 bitcoins valued $3.5 million and then 144000 bitcoin worth $28.5 million of that time. And from Ulbricht's computer FBI again ceased 144342 bitcoins. A total valued of $87 million bitcoin was ceased during that time(4). So, in May 2015, William was sentenced to life imprisonment without any possibility of escape due to the illegal money laundering activities. (Christin 2012), mentioned the proportion of bitcoin activities in major exchanges and Silk Road during the period from mid-2011 to end of 2012 and stated that 1.35 million BTC were exchanged on the dark market. Comparing that to other exchanges total bitcoin trading was 29.6 million over the same period. It shows that over total trading percentage Silk Road transaction captured 4.5% of all traded bitcoin. But when Christin takes some external factor into account the bitcoin transaction activities could double from 4.5% to 9% in Silk Road. He also found that 24400 items were sold through bitcoin during six months of that period among which 13000 items includes illegal drugs. Due to this fraudulent scheme the users' faith on bitcoin declines, they think that this kind of illegal activities might continue in the future and tries to restrict them on investing bitcoin.

5.3. Role of government

Bitcoin spread its way whole over the world, but still many countries are in a dilemma of their official decision to give it legal permission or not. At the same time some countries mark positive sign for the use of bitcoin (USA, UK etc.) and some did not give the legal permission to use it in their territory (Bangladesh, India, Bolivia, Ecuador, Russia etc.), (Pagliery, 2014).

Bangladesh
The central bank of Bangladesh from September 2014 strictly banned the use of bitcoin and any other virtual currency in the country, as it is not a legal tender of any country and there is risk involved in using the bitcoin. The authority also said that if anybody caught by using the virtual currency, he/she could be punished under the countries anti-money laundering controlling act 2012.

Bolivia (Central South America)
Bolivia's central bank **El Banco Central de Bolivia** announced that it is illegal to use any type of virtual currencies if it is not issued by any central authority or regulated by any central bank of that country.

China
Bitcoins are not totally banned in China, as Chines government neither support nor oppose bitcoin. On 5th of December 2013, People's Bank of China prohibited the

financial institution and its employees who are engaged in the bitcoin activities, but there is no restriction for common individual's on bitcoin trading and mining (ECB 2012). After that now China is the world's largest bitcoin trading market as many of the chines bitcoin exchange platform still working and trading bitcoins (OKCoin, BTCC, Huobi). If it is safely operated in the future, then the Chinese government may support the legality of bitcoin in the country.

Ecuador
The National Assembly of Ecuador strictly banned the use of bitcoin and any kind of decentralized digital currencies. As the country is building a national electronic cash system so, they have to protect their home currency.

Iceland
Iceland has not banned all cryptocurrencies. In May 2014 it only banned Foreign exchange trading with bitcoin, but still, the people of Iceland are using the Cryptocurrency, i.e. Auroracoin. As a result, the Central Bank of Iceland issued a legal status of digital currency to protect the Icelandic currency.

India
The first bitcoin exchange in India was BTCX India, but it did not survive any longer due to loss of its banking partner. On 28 December 2013, the Deputy Governor of RBI said that in recent India is not planning to legalize bitcoin. But the Governor of RBI Raghuram Rajan recently (on December 2014) in an interview to ND TV spoke out that sooner or later India might test the flavor of digital currency like bitcoin, but it will take time because now most of the revenue of India comes from seigniorage activities.(5) So in case of India bitcoin is not fully banned, only officially the use of bitcoin is not allowed, but individuals can buy and sell bitcoin in India. Recently on May 2015, Zebpay started bitcoin mobile wallet in the country for its users to buy, sell and transact on bitcoin and every week the company experiencing that at least 500 users are opening their bitcoin wallet through Zebpay app.

Russia
The finance minister of Russia banned the digital currency, i.e., Bitcoin but not the blockchain as he knew that blockchain technology is very important for the development of various internet services and said that Ruble is the only official currency. The main goal is to protect their citizens from fraud and prevent money laundering and tax evasion activities by providing a red signal to cryptocurrency.

Vietnam
The government of Vietnam announced that bitcoin is not a legitimate payment method. So, the Government made it illegal for both its people and the financial institution by stating that the use of cryptocurrencies might help in increasing the money laundering activities.

Countries accepting BTC

America
In 2013, the US Treasury classified bitcoin as a decentralized convertible virtual currency. The US district court also classified bitcoin as a currency, and the government also imposes a tax on bitcoin business. The major countries in America accepting BTCs are US, Brazil, Mexico, Canada, etc.

Australia

In 2013, governor of the reserve bank of Australia (RBA) said that there is no law against the legality of bitcoin, and no one would stop the people of this country for doing transaction with bitcoin (Hazelman, 2013). And the tax office of Australia considered bitcoin as property. As a result, the Government imposes a tax on the usage of bitcoin. Australian tax office decides bitcoin is an asset, for capital gain tax purpose not as currency.

European Union

In the Europe, 61% of the population is using the internet. As a result, we can say that the European Union is a fertile land for the usability of bitcoin. But the European Union has not issued any official regulation regarding the legality of bitcoin. A few nations (UK, Germany, Finland, Italy, Spain, etc.) are allowing bitcoin as a cryptocurrency, where other nations (Iceland, Denmark) are not taken any decision regarding the legality of bitcoin (Pagliery, 2014).

6. Conclusion

From the above discussion of the study, it is interesting that the transaction growth of bitcoin is an increasing trend, as some people are more excited about bitcoin due to its underlying technology, and others are excited about its commercial possibilities. The study convinced that technologically bitcoin is deep, novel, interesting, and based on sound principles, but the high volatility GARCH result shows that it is a highly speculative currency. As a result, most of the governments are not giving their legal status for the use of bitcoin in their country due to its illegal nature and hacking of trading exchanges (Anders, 2014). But if bitcoin will be stable in the future, then it is easily accepted through worldwide and the security issue problem can be easily resolved, as we know more stability currency dominants other currencies. We believe that in the long run people will more faith in the cryptocurrency technology, but doing the mastery of technology is more important work for the investors and the users.

Notes

(1) No one knows who Satoshi is? May be a group of software developer or a single person. Still the Identity is unknown.

(2) The persistency is defined as the lagged effects in a particular series, particularly, when current period volatility of an instrument is influenced by its past volatility significantly.

(3) https://anders.io/the-troublesome-history-of-the-bitcoin-exchange-mtgox/

(4) Silk road activities: https://en.wikipedia.org/wiki/Silk_Road_(marketplace)

(5) http://www.coindesk.com/indias-central-bank-one-day-use-digital-currency-chief-says/

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Target P/E ratio determinants in the Turkish Stock Market: Earning volatility effect

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Abstract. *This paper investigates that what are the determinants of target PE in the case of Turkish Stock Market. The general outputs: i) Projected dividend yield is the dominant factor on PE. ii) Boosted investments and growing top-line raise PE ratio. iii) PE ratios come down as companies' financial leverage and working capital needs grow. iv) Although stabilizing foreign exchange risks and gross profit margins with the aid of hedge tools and product diversity of the companies decreases the acceleration of profitability, it eventually augments PE ratio. Data from Borsa İstanbul covering 2000-2014 term have been modeled by GMM.*

Keywords: PE, earning volatility, dividend yield, working capital, leverage.

JEL Classification: C33, C58, D53, L11.

1. Introduction

After the development of the discounted dividend growth model of Gordon and Shapiro (1956), many studies on PE have been carried out. For stock market investors, PE is the most commonly used ratio in the global sense. It has become widespread amongst investors through being calculated practically, being comprehended easily and giving pay-back period. While investors use other methodologies in valuation, the final value is generally tested with PE in order to get roughly pay-back period.

The valuation of stocks has become an attractive issue for a long while. Although the US has a broaden literature in this sense, the market value concept for the Turkish companies has been gaining importance since the 1980s. Twenty years ago, while profit maximization for the Turkish companies was vital, today maximization of market value has been adopted by the company shareholders in an increasing trend. The increase or decrease in the value of companies in the United States is a key performance indicator for the partners, managers, suppliers, creditors and employees. The companies give the employees their share as a success bonus, they can pay their debt in mergers by capital raise, and share of the company may be given as borrower loan collateral. This new concept shows itself in Turkey nowadays.

Those motivations augment the importance of company valuation methodologies. PE is the earliest valuation methodology. In this sense, it is significant to pinpoint the factors affecting PE in the market. Thus, it is crucial to determine the target market multiples for the managers who want to augment their companies' market value as a strategic goal. Factors influencing PE ratio are important for employees who want to get more bonus by increasing corporate value. In terms of investors, it is inevitable that which level of PE of a company preparing IPO or trading at stock exchange is fair. Lastly, for policy makers wishing to improve economic welfare of a country, the fair PE ratio is solemn for determining whether or not investors' resources can be used efficiently.

(Gordon and Shapiro, 1956; Crag, Johnson and Joy, 1987; Beaver and Morse, 1978; Jaffe, Keim, and Westerfield, 1989; Zorowin, 1990; Leibowitz and Kogelman, 1990; Constand, Freitas, and Sullivan, 1991; Nikbakht and Polat, 1998; Barnes, 2001; Afza and Tahir, 2012; Reilly, Griggs, and Wong, 1983) made outstanding works in related to PE and other market multiples. When looking at the literature, scholars are generally concerned about the relationship between PE and dividend growth, realized or expected growth of earning and systematic risks. Some studies claimed that the relationship between accounting policies and PE is at a level that can change investors' point of view.

Model outputs show that the expected dividend yield for investors is very critical for the Turkish market. Also, aggressive profit expansion for Turkish companies is seen as a source of value growth. However, the model outputs show that sustainable and stable profitability levels climb the corporate value even if bringing low growth. When a

maximization of market value becomes more important in the Turkish market, the companies will need to make more foreign exchange and commodity hedging in order to reduce cost of capital and improve corporate value.

This study contributes to the literature in different ways. The risk perception in the literature is generally defined as systematic risk. In this work, companies' leverage ratios and earning volatilities have been taken as other risk tools. When companies work with high working capital need, even if they can generate net profits in the income statements, the profits are lost and cash cannot be generated in the cash flow statements. It is unlikely that the two companies with the same profitability will have similar PE due to the fact that the company that needs more working capital produces less cash in the bottom line. Therefore, our model adds working capital needs of the companies to the equation which is not taken into account in the literature. It is also inevitable that the PE ratios are influenced by lagged values. This is because the lagged value of them has a psychological effect for the investors. Thus, we contribute to the literature by incorporating in the lagged value of the dependent variable.

The rest of the work is as follows: In the second part, the relevant literature will be given. In the third part, model, variables and data will be introduced. The fourth part is devoted to the presentation of GMM regression findings. In the conclusion section, the findings will be given as a summary and discussed.

2. Brief literature

There are many studies in the literature in order to pinpoint the factors affecting PE ratios. Especially after developing the discounted dividend growth model Gordon and Shapiro (1956), PE has been continuously examined as a vital tool in corporate valuation.

Beaver and Morse (1978),'s results were one of the first studies in this area. Scholars measured the relationship between earning growth, beta, accounting policies and PE. According to this, scholars claimed that the earning growth has diminishing effect over years. The companies with low earning growth can have high PE. This means that investors perceive current profitability as a temporary situation. There can be both positive and negative relationship between firms' betas and PE. They argued that 50% of PE is made up by accounting policies in addition to the earning growth and risk.

Crag, Johnson, and Joy (1987), examined the relationship between PEs of 117 firms traded between 1970-1975 and stock valuation method (FIFO-LIFO), accelerated depreciation, asset growth, systematic risk and asset size. Analysts argued that if PEs are heavily dependent on accounting policies, portfolio managers may remove such companies from their portfolios.

Jaffe, Keim and Westerfield (1989), found a negative relationship between PE and the size of a company in their study. They corrected the "look-ahead bias" problem by using the market value in the period which companies declared their profits while calculating PE.

Zorowin (1990), claimed that only 15% of variation of PE can be explained by the accounting policies. Analyst said that short and long-term realized earning growth has a positive impact on PE, while the dominant variable explaining variation of PE amongst cross sections is the long-term expected growth of earning.

Leibowitz and Kogelman (1990), argued that there is no significant relationship between ordinary growth expectancies and PE, unless there is a sizeable growth that can separate the company from the market.

Constand, Freitas, and Sullivan (1991), studied the rapidly rising PEs of Japanese firms from 1979 to 1989. The basic hypothesis of the study was that of PE would depend on the risk level, the expected growth rate and the sustainable dividend payout ratio. While the risk factor was pinpointed as the main factor affecting PE, a weak relationship was found between dividend growth and PE. Analysts argued that the very low growth rate of Japanese companies would be effective in this case.

Nikbakht and Polat (1998), argued that PE will decline with the uptrend in standard deviation of profitability in their work. Analysts also found a positive relationship between expected growth rate of profitability and PE.

Barnes (2001), examined the relationship between earnings and cash flow volatility, size, leverage, profitability, investment, sales growth and Tobin q (market to book ratio). Earning and cash flow volatility and leverage led to the decline in q. A positive correlation between the other variables and q factor was found in this work.

Afza and Tahir (2012) tried to determine the factors affecting PE through pooled OLS method with the data of 25 firms that were traded at Karachi stock exchange between 2005-2009. According to analysts, the two dominant variables on PE are dividend pay-out ratio and Tobin q.

Reilly, Griggs, and Wong (1983), investigated the variables influencing PE with the S&P500 quarterly data stretched from 1963 to 1980. A positive relationship between PE and dividend payout ratio, realized profitability growth and dividend growth was found. In addition, the variables of business failure rate, risk free, inflation rate and earning volatility had a negative effect on PE.

3. Model, variables and data

3.1. Model

While using the panel data set, with the assumption that the dependent variable is affected by the lagged value of it, the model is transformed into a dynamic panel. In

case of using dynamic panel data, Generalized Method of Moments developed by (Arellano, 1991) is applied to eliminate the endogenous problem. According to (Baltagi, 2005), the application of OLS in the dynamic panel data results in bias and inconsistent coefficients. The heterogeneous structure of the panel data poses a problem of endogeneity. The GMM eliminates endogeneity and changing variance problem by using instrument variables and first differences method. The use of first differences in the model produces a solution to the cross section dependency and non-stationary problem. The GMM is the top-level data modeling system that takes into consideration dynamic structure of many economic relationships.

Main model;

$$y_{it} = a_i + \varphi y_{i,t-1} + \beta Earning\ Volatility_{it} + \psi X_t + u_{it} \quad (1)$$

$$y_{it} = a_i + \beta_1 y_{i,t-1} + \beta_2 Dividend\ Yield(1)_{it} + \beta_3 Leverage_{it} +$$

$$+ \beta_4 Working\ Capital_{it} + \beta_5 Earning\ Volatility_{it} + \beta_6 Size_{it} + \beta_7 Profitability_{it} +$$

$$+ \beta_8 Investment_{it} + \beta_9 Sales\ Growth_{it} + u_{it}$$

y_{it} symbolizes PEs of the firms.

While a_i defines fixed effects, X_t is the vector of control variables.

3.2. Variables

While calculating PE, the average market value of the companies for each year is divided by the average net profit of the companies for the current and following year. Thus, instead of using a single market value, the average market value has been used to take into account the general pattern of the market. In addition, the effect of realized and expected profitability has been incorporated in. Explanations on the variables used in the study are summarized in Table 1.

Table 1. *Variables*

Code	Variable	Explanation	Term
P/E	Price to Earnings Ratio	Average Market Cap$_{it}$/Average (Net Income$_{it}$, Net Income$_{i(t+1)}$	2000-2014
Divy	Dividend Yield	Gross Dividend$_{it}$/Market Cap Before Excluded Dividend$_{it}$	2000-2014
Lev	Leverage	Average Financial Debt$_{it}$/Average Asset$_{it}$	2000-2014
WC	Working Capital	Net Working Capital$_{it}$/Asset$_{it}$	2000-2014
EarnVol.	Earning Volatility	Forward Standard Deviation of 8 quarter EBITDA$_{it}$/ Forward Average of 8 quarter EBITDA$_{it}$	2000-2014
Size	Ln(Asset)	Ln(Asset) $_{it}$ or Ln(Enterprise Value) $_{it}$	2000-2014
Prof.	Profitability	Net Income$_{it}$/Shareholder Equity$_{it}$	2000-2014
Inv	Investment	Investment$_{it}$/ Asset$_{it}$	2000-2014
Sales	Sales Growth	(Net Sales$_{it}$ – Net Sales$_{i(t-1)}$)/ Net Sales$_{i(t-1)}$	2000-2014

3.3. Data

In the article, 2,148 firm-year data of 186 companies traded at Borsa Istanbul between 2000-2014 have been used. Financial indicators of the companies are obtained from annual and interim independent audit reports, investor relations, annual reports, Bloomberg and Finnet Data Provider. In order to be able to obtain PEs formed with healthy pricing, it has been tried to take sampling of the firms with enough transaction volume. The companies with less than 5% free float are not included in the sampling. The holding, financial institutions, investment trusts and banks have been excluded from the sample because it is aimed to examine the pattern of industrial companies. The mean, standard deviation and correlation matrix for the dependent and independent variables used in the model are shown in Table 2.

Table 2. *Mean, standard deviation and corelations*

Variable	Median	Average	Std.	Corelations								
Full Sample				1	2	3	4	5	6	7	8	9
1 P/E	1,6	-1,3	98,2	1,000								
2 Dividend Yield	0,00	0,02	0,04	0,018	1,000							
3 Leverage	0,21	0,27	0,36	-0,009	-0,165	1,000						
4 Working Capital	0,20	0,22	0,17	-0,050	0,009	-0,011	1,000					
5 Earning Volatility	0,27	0,55	6,81	0,001	-0,021	-0,004	0,007	1,000				
6 Ln(Asset)	19,0	19,0	1,7	-0,008	0,136	-0,064	-0,252	-0,008	1,000			
7 Profitability	10,6	12,8	21,8	0,017	0,177	-0,085	0,034	-0,008	-0,016	1,000		
8 Investment	0,08	0,19	0,52	0,012	0,001	-0,011	-0,108	0,013	-0,018	0,630	1,000	
8 Sales Growth	0,17	0,39	3,31	0,029	-0,010	-0,008	-0,030	-0,006	-0,019	0,000	0,181	1,000
N = 2.148												

4. Findings

The two regressions made before interpreting the regression output should pass the necessary tests. There are 3 important tests in GMM models in the literature. These are the Wald test, which measures the significance of the model globally, the Aerallano Bond Test, which tests the autocorrelation, and the Sargan Test, which measures the validity of the instrument variables used in the model. Firstly, it is seen that the model coefficients according to the Wald test are not zero at the same time. The Aerallano bond test has found no autocorrelation at the second order. Due to the fact that the Sargan test probability is above 0.05, the instrument variables used in the model are not related to the error of the model; are related to independent variables. This indicates that the instrument variables can solve the endogeneity problem in the model.

It is seen that the PEs are negatively affected from the previous level. According to the model outputs, all other factors are fixed, in the average, the companies' PEs, which are in the rising trend in the previous year have to be expected to decline in the current period. As the dividend yields of the companies raise, the PE ratios seem to boost. This situation is also in accordance with the Gordon Growth model. It is important for the

investors whether or not the company has a dividend policy. The firms can augment their PE ratios that can be valid in both IPO-M&A and reduce the cost of capital by distributing regular dividend. Increased financial indebtedness level of companies is accompanied by high leverage. It is seen that the foreign loans account for major part of the loans of the Turkish companies. Profitability of the companies operating at high leverage may be significantly reduced when there is abrupt movements in the currencies. So, this means that the dividend distribution potential of the company decreases. Accordingly, high leverage is perceived as high risk by the market, so, as the leverage of the companies enhances, all other factors are constant, PE ratios decrease, in the average.

Although the second model does not provide meaningful data, the PE ratios have declined in the first model when companies' working capital requirements augment. The uptrend in working capital need may induce companies to borrow in order to close cash deficit. Boosted working capital need is being perceived high risk level by the market and eventually it decreases PE ratios of the firms.

Earning volatility of the companies has been measured by getting the standard deviation of EBITDA over the next 8 quarters from the current data. The standard deviation has been scaled by dividing the average of EBITDAs obtained in the same period and a more rational benchmarking methodology has been established. In addition, instead of past volatility, it has been tried to measure the effect of future or expected volatility. In both models, the uptrend in earning volatility induces low PE ratios. For many partners, the increase in company profit is important. However, if there is high volatility in the boosted profits, this may have negative effects on the company value. The slight but more stable earnings growth may has more positive impact on the corporate value. Accordingly, stabilizing the profitability of companies with the aid of foreign exchange or commodity hedge tools can increase the PEs of companies. The level of stabilization profit that Turkish companies can obtain through foreign exchange hedges both in foreign currency positions and in raw material imports increases the value of the company by reducing cost of capital.

The size of the firms has been measured in two different ways. While ln(asset) is being used in the first case, ln(enterprise value) is being utilized in the second case. In both models, it has been seen that the size effect improves PE ratios. The perception of low risk level of blue-chip companies at investors is seen as the biggest plausible reason for this result.

PE is also influenced by the expectation of investors. Accordingly, the companies' high investment expands their PE levels. Likewise, the rise in top-line raises the PEs of the companies with the anticipation of growth in profitability and dividends. Interestingly, in the first model the increase in return on equity has reduced the PE level.

Table 3. *The effect of earning volatility and control variables on price to earning ratio (P/E), 2000-2014*

	Dependent Variables	
	Price to earning ratio (PE)	Price to earning ratio (PE)
PE (-1)	-0.004***	-0.003***
Dividend Yield (1)	9.375***	6.354***
Leverage	-1.055***	-0.821***
Working Capital	-0.995***	-0.271
Earning Volatility	-0.013***	-0.015***
Size	0.481***	1.580***
Profitability	-0.007***	-
Investment	0.309***	0.102***
Sales Growth	0.820***	0.831***
Cross Sections	186	186
Periods	15	15
Number of Observations	2.148	2.148
AR(2) Probability	0.58	0.59
Sargan Test Probability	0.23	0.27
Wald Test Probability	0.00	0.00

Note: All regressions are figured out by GMM based on first order differences. Variables: PE = Price to Earning Ratio, Size(1) = Ln(Asset), Size(2) = Ln(Enterprise Value), Profitability = Net Income/Shareholder Equity. Stars represent confidence intervals respectively 1%, 5%, and 10%.

5. Concluding remark

PE has been one of the most used ratios by investors since 1930. It is utilized in the valuation of stocks, IPO, and the mergers and acquisitions. It has become widespread amongst investors through being calculated practically, being comprehended easily and giving pay-back period. When looking at the historical trends of the stocks, the factors that influence the target multiple and the models that can find out the target multiple are crucial for the investors. This is also vital for the main shareholders who want to climb the value of the company.

PE is generally affected by the financial data of the firms. Firstly, the lagged value of PE has effect on the current level. This confirms the tendency of rising markets to fall.

According to the Gordon growth model, the value of the stock is directly related to the dividend yield. This implies a strong relationship between PE and dividend yield. Model suggests that dividend yield has a dominant influence on PEs of Turkish companies. The average dividend yield at the Borsa Istanbul hovers at 2%. As the companies increase their dividend yield, valuation multiples also augment and cost of capital declines. This means that distributing regular dividends to the investors is very important for the value of the companies. In the United States, the companies distribute dividend for every quarter, and in an environment where interest rates are at 2%, the average dividend yield fluctuates at around 2%. Distributing of the profits also strengthens the company's reputation for its investors.

Moreover, the PEs of the firms increase, as investments and net sales of the companies augment. So, this means that the market players price expectation growth rate in order to form PE. This result affirms Gordon's basis thesis.

The Gordon growth model claims that apart from the earning growth and dividend payout ratio, rising risk has a negative impact on the PE. According to the model outputs, PEs decrease as the leverage of companies increases. The uptrend in leverage bodes the bankruptcy risk of the firms. This has a negative effect on market multiples. The increase in the working capital need is also a sign of risk levels of the companies and it decreases PE ratios, all other factors are fixed, in the average. In other words, even if the company has a strong net profit, it may lose its net profit due to investment in working capital and cannot generate cash in the bottom line. Investors seem to take this into account working capital effect in the target PE formation.

In addition, the uptrend in earning volatility causes low PE ratios. For the Turkish firms, the rise in company profits is too vital. However, if there is high volatility in the boosted profits, this may have negative effects on the company value. The slight but more stable earning growth may has more positive impact on the corporate value. Stabilizing the profitability of companies with foreign exchange or commodity hedges can increase the PEs of companies. The level of stabilization profit that Turkish companies can obtain through foreign exchange hedges both in foreign currency positions and in raw material imports increases the value of the company by reducing cost of capital.

The model only takes into account the PE ratio as market multiple. How other market multiples such as EV/EBITDA are influenced by similar variables may be important for further studies. Also, there may be one-off transactions like the profit/loss of real estate sales. Throughout the sample, the elimination of one-offs can allow healthier outcomes. Moreover, the differentiation of companies' depreciation policies also prevents the standardized net profit level for all samples. Establishing a similar amortization policy for all companies can help to identify healthier PEs.

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Wavelets based multiscale analysis of select global equity returns

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Abstract. *This paper examines the relationship between Indian equity prices other developed markets, in the time-scale domain, using wavelets based multiscale analysis and cross wavelet analysis. Stock markets are analyzed at different levels of resolution which makes it possible to perform a scale by scale analysis enabling us to detect the correlation and cross-correlation structures at time periods with high frequency oscillations and also the relatively low frequency structures. There seems to be a weak integration between BSE and other developed markets at almost all levels of time-scale resolution and a strong relationship between French and German Markets. Analyzing the stock returns at different multiscale resolution makes it easier for agents dealing with different trading horizons.*

Keywords: wavelets, wavelet cross-correlation, multiresolution analysis, Daubechies filter.

JEL Classification: C40, G15, F15, F30.

Introduction

Frequency domain techniques like spectral analysis and Fourier based methods are more suited to study economic and financial datasets that exhibit a cyclical behavior. Fourier methods allow us to analyze the frequency components of the time-series by enabling us to quantify the importance of various frequency components of the time-series under investigation. This provides the researcher access to particular frequency information about the time-series, which makes it easier to infer certain information like the length of a business cycle and the phase lag behavior of the time-series, Masset (2008). But, spectral methods require the data to be stationary, and very often, in the case of economic and financial data, there is a presence of strong non-stationary pattern; e.g. long-memory, jumps etc. in case of the presence of volatility. Also, the time information is completely lost and the assumption of natural periods and stationarity are problematic since economic time-series is characterized by variation in frequencies and non-natural periods. These drawbacks of spectral methods are easily mitigated by the use of time-scale decomposition techniques using wavelet base multiresolution analysis, as wavelet analysis possesses the ability to separate the dynamics in a time-series over different time scales and horizons. A time-series signal, at first observation, might look stationary but a deeper analysis of the signal with excellent time localization, made possible by the use of windowed Fourier transforms of wavelet filters, might help detect the presence of discontinuities. Hence, at a finer and detailed level of signal analysis, presence of non-stationarity could be detected, Capobianco (2000).

Therefore, multiresolution analysis, which by allowing us to analyze the data at different scales of resolution, is definitely a good choice for economic and financial time-series analysis as it gives us the information about both time-space and frequency-varying components of the signal. The information extracted using highly time-localized wavelet windows, from non-stationary financial time-series, can be very useful due to the importance of the information available from the local features of the signal. Wavelet methods, therefore, are most suitable for the analysis of non-stationary financial and economic time-series due to its capability of breaking down the information into different layers of resolution and its time-scale localization properties. Moreover, wavelets are very handy in spotting the exact location in time of regime shifts, discontinuities, and isolated shocks to the dynamical system, Ramsey (1998). The capability of wavelet analysis to decompose a time-series on different time scales and at the same time preserve time localization is one of the main reasons for its induction into economic and financial research. One possesses a better understanding about the time-series and the dynamic market mechanisms behind the time-series by analyzing the time-series at different levels of resolution. This framework of analysis also allows us to isolate many interesting structures and other features of economic and financial time-series, which previously would not have been possible by the use of traditional time domain and Fourier based methods.

The increasing interest, in wavelet analysis, by economic researchers, and its applicability in areas like time-scale decomposition, forecasting, density estimation etc. have led to the emergence of various wavelet based techniques for the analysis of non-stationary financial time-series, Crowley (2005). Wavelet based multiresolution analysis is ideal for

the analysis of high frequency data generated by financial markets, providing valuable information for trading decisions, as the analyst can focus on a particular time scale where trading patterns are considered important. Therefore, wavelet analysis has tremendous potential in economics and finance, as relationships between different variables can be analyzed in time-frequency space, allowing one to analyze the relationships between variables at different frequencies and, simultaneously, the corresponding information about the evolution of a variable in time.

The application of wavelet theory was limited to the analysis of deterministic functions, as most of it was applied in the areas of engineering and the natural sciences. The application of wavelet analysis to study the behavior of stochastic processes, which characterize the underlying system in economics and finance, is relatively new. In the next section we review some of the important contribution of wavelet based methods to the field of economic and financial research.

Literature review

The Nineties saw the introduction of wavelet based approaches in statistics. Nason and Silverman (1994) introduced discrete wavelet transforms for statistical applications. Percival and Walden (2000), provides a detailed introduction to wavelets methods for time-series analysis. The maximal overlap discrete wavelet transform (MODWT), Percival and Walden (2000), is particularly suitable in analyzing economic and financial data. This method is a modification of the discrete wavelet transform where the transform loses the property of orthogonality, but since it has the ability to analyze non-dyadic processes; it is very much suited for the analysis of financial time-series. Correlation analysis in state-space is made possible by wavelet coherence analysis, Grinsted et al. (2004).

The application of wavelet methods, particularly in the field of economics and finance, is described by Gencay et al. (2001). High frequency foreign exchange rates were analyzed by Ramsey and Zhang (1995) using waveform dictionaries and a matching pursuit algorithm. Ramsey and Lampart (1998) found that the relationship between money and income varies according to scale. At higher scale levels, money supply Granger caused income and at lower scale, income granger caused money supply. The multiresolution analysis of high frequency Nikkei stock market data, using the matching pursuit algorithm of Mallat and Zhang (1993), is carried out by Capobianco (2004). Hidden periodic components are unearthed using the algorithm.

Maximal overlap discrete wavelet transform is applied by Crowley and Lee (2005) to analyze the frequency components of European business cycles. Date from countries with lesser degree of integration exhibited non-similar frequency components. The lead-lag relationship between the Dow Jones Industrial Average stock price series and the index of industrial production series of the US is analyzed by Gallegati (2008), using wavelet correlation and cross-correlation methods. At lower frequencies, stock market returns lead economic activity as reflected in IIP series. Since increase in timescale is associated with lower frequency bands, the leads in stock market returns increases with the increase in scale.

Conraria and Soares (2011) study business cycle synchronization across the European union-15 and Euro-12 countries using wavelet analysis. France and Germany are found to be highly synchronized with other European countries and French business cycle leads German business cycle as well as the business cycles from the rest of the European countries.

The comovements between the stock markets of the US, Germany, UK and Japan were analyzed by Rua and Nunes (2009) using wavelet coherence analysis. Market interdependencies were found to change across frequencies and along the time horizon. Strongest comovements were observed between the markets of US and Europe, and the coherence between US-Germany and UK-Germany increased in time.

Barunik et al. (2011) used wavelet coherence analysis to study the time-scale dynamics of local correlations between Central European and Western European stock markets. The interdependencies between major European markets were found to change significantly in time and across scales.

The study of correlation structure between S&P 500 and other international markets was carried out by Benhmad (2013) using wavelet analysis. The co-movements of stock market were found to be a function of scale, apart from its dependence on time dynamics. S&P 500 and European stock markets were found to exhibit strong interdependencies, which changed according to changes in time-scale. The next section gives a brief review of the methodology used in this analysis which will be followed by its use in analyzing equity prices, some empirical evidences and conclusions.

Methodology

A wavelet is a function $\psi(.)$ defined on the real line $\mathbb{R}$, such that $\int_{\mathbb{R}} \psi(t)dt = 0$ and $\int_{-\infty}^{\infty} |\psi(t)|^2 \, dt = 1$. A signal can be decomposed into its finer detail and smoother components by projecting the signal onto mother and father wavelets given by ψ and ϕ respectively. Dilation and translation operation is performed on both mother and father wavelets to form a basis for the space of squared integrable function, $L^2(\mathbb{R})$. Therefore, any function $x(t)$ in $L^2(\mathbb{R})$ can be represented as linear combinations of these basis functions. The dilated and translated versions of mother and father wavelets are denoted by $\psi_{b,s}(t)$ and $\phi_{b,s}(t)$ respectively, where

$$\psi_{b,s}(t) = \frac{1}{\sqrt{s}} \psi\left(\frac{t-b}{s}\right) \tag{1}$$

$$\phi_{b,s}(t) = \frac{1}{\sqrt{s}} \psi\left(\frac{t-b}{s}\right) \tag{2}$$

s and *b* represents the scaling (dilation) and translation parameter, respectively. Here *s = 1,…, S* controls the number of multiresolution elements. Formally, a function $x(t)$ can be represented in the wavelet space as

$$x(t) = \sum_b a_{S,b}\phi_{S,b}(t) + \sum_b d_{S,b}\psi_{S,b}(t) + \sum_b d_{S-1,b}\psi_{S-1,b}(t) + \ldots + \sum_b d_{1,b}\psi_{1,b}(t) \qquad (3)$$

where $a_{S,b}$ are coefficients describing coarser features of $x(t)$, and $d_{s,b}$ are detail coefficients that captures information from multiple resolutions or time-horizons.

Wavelet based correlation and cross-correlation

Let $X_t = (x_{1,t}, x_{2,t})$ be a "bivariate stochastic process with univariate spectra" (autospectra) $S_1(f)$ and $S_2(f)$ respectively, and let $W_{s,b} = (w_{1,s,b}, w_{2,s,b})$ be the scale *s* wavelet coefficients computed from X_t. These wavelet coefficients are obtained by applying the wavelet transform to all elements of X_t. The obtained wavelet coefficient contains both $a_{S,b}$ (coarser approximations) and $d_{s,b}$ (wavelet details). For a given scale *s*, the wavelet covariance between $x_{1,t}$ and $x_{2,t}$ is given by

$$\gamma_X(s) = \frac{1}{2\pi} Cov(w_{1,s,b}, w_{2,s,b}) \qquad (4)$$

The wavelet covariance "decomposes the covariance of a bivariate process on a scale-by-scale basis", i.e.

$$\sum_{s=1}^{\infty} \gamma_X(s) = Cov(x_{1,t}, x_{2,t}) \qquad (5)$$

By introducing an integer lag τ between $w_{1,s,b}$ and $w_{2,s,b}$, the notion of wavelet cross-covariance can be introduced, and is given by

$$\gamma_{X,\tau}(s) = \frac{1}{2\pi} Cov(w_{1,s,b}, w_{2,s,b+\tau}) \qquad (6)$$

In some situations it may be beneficial to normalize the wavelet covariance by wavelet variance, which gives us wavelet correlation

$$\rho_X(s) = \frac{\gamma_X(s)}{\sigma_1(s)\sigma_2(s)} \qquad (7)$$

where $\sigma_1^2(s)$ and $\sigma_2^2(s)$ are the wavelet variances of $x_{1,t}$ and $x_{2,t}$ (at scale *s*), respectively. Just like the usual correlation coefficient between two random variables, $|\rho_X(s)| < 1$. However, wavelet correlation gives correlation among variables from a

multiscale dimension Also, by allowing the two processes $x_{1,t}$ and $x_{2,t}$ to differ by an integer lag τ , we can define wavelet cross-correlation, which gives us the lead-lag relationship between two processes, on a scale-by scale basis. The approximate confidence bands for the estimates of wavelet correlation and cross-correlation is given in Percival and Walden (2000) and Gencay et al. (2002). Moreover, the reader is referred to Fernandez-Macho (2012) for the technique of wavelet multiple correlation (WMC) and multiple cross-correlation (WMCC).

Empirical data

The data used for this study comprises of BSE sensitive index and four other indices from the developed markets. BSE sensitive index constitutes 30 Clue Chip securities traded in Bombay stock exchange, and represents major portion of BSE in terms of market capitalization. We use BSE 30 series against Shanghai stock exchange (SSE) and four developed stock market indices, viz., FTSE 100 index of the UK, Nikkei 225 of Tokyo stock exchange, CAC40 of France and DAX index of Germany. The series used for our study is the closing price level series. The study period spans over a period of January 2000 to March 2013, thus involving around 3330 data points, which provides a fairly rich data set for our analysis.

Empirical results

The daily stock market returns are decomposed applying the MODWT with the D(4) Daubechies wavelet filter, with decomposition up to six levels of resolution.

Figure 1 shows the wavelet correlation between SSE and BSE. The wavelet correlations between SSE and BSE are all low, across all six scales, with negative correlations for the first two and a half scales which correspond to a period of 8-16 days. The correlations tend to increase as scale increases, but since the lower confidence band lie below zero across all scales, there is no significant correlation between SSE and BSE. See Table 1 for the values of wavelet correlation across all the six scales.

Figure 2 shows the wavelet cross correlation between SSE and BSE. Wavelet cross correlation is performed between SSE and BSE, with leads and lags up to 36 months. The variable that maximizes the correlation, as against the other variable, is shown in the upper-left portion of all figures. The cross correlations are all near zero, across all six scales for all lags, which signals a very weak cross correlation between SSE and BSE.

Figure 1. *Wavelet correlation between SSE and BSE*

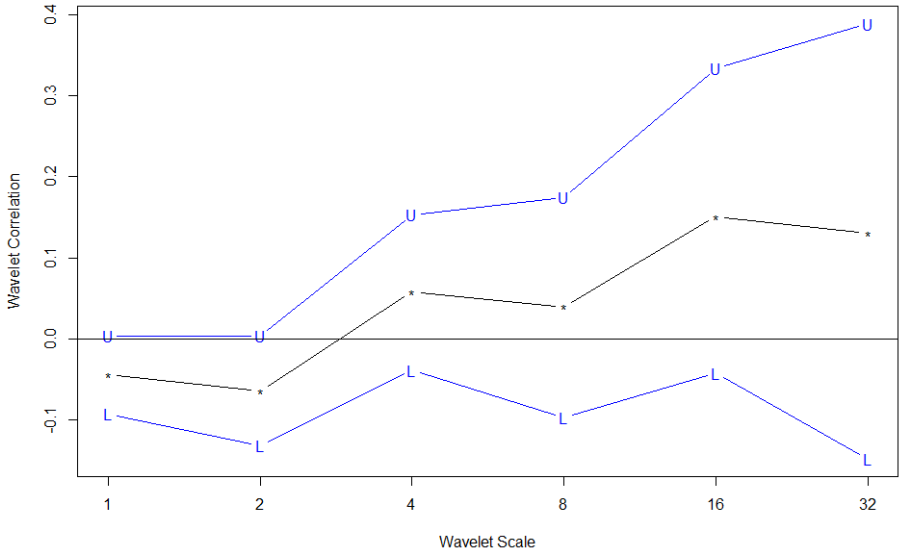
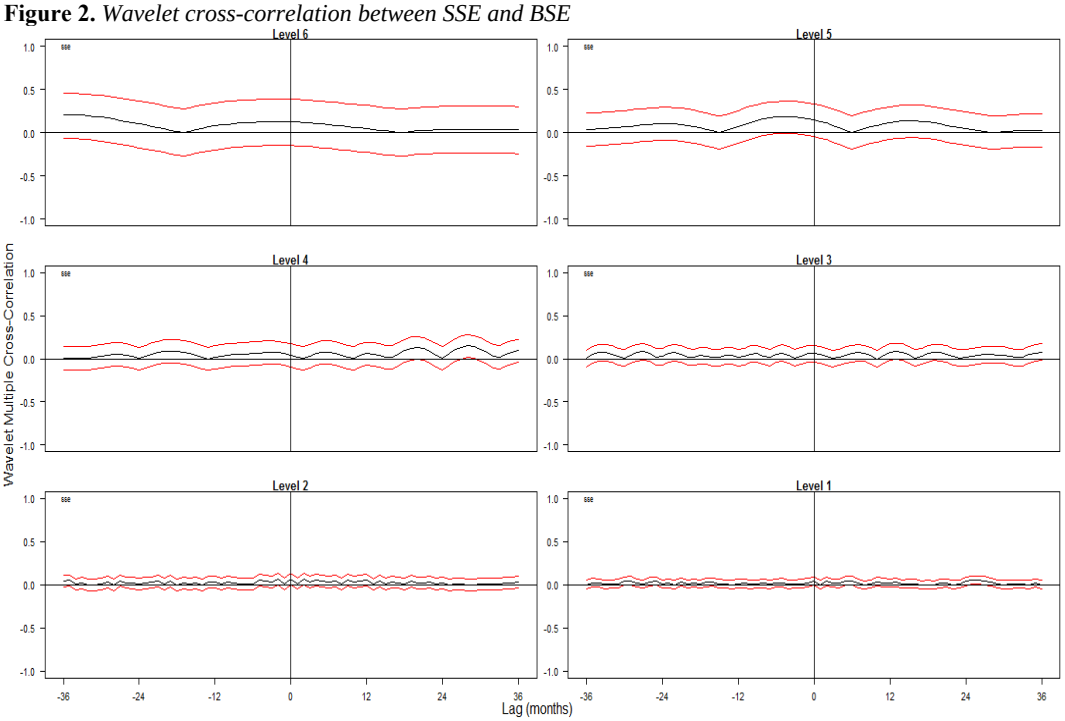


Figure 2. *Wavelet cross-correlation between SSE and BSE*



Figures 3 and 4 shows the wavelet correlation and wavelet cross-correlations between FTSE and BSE respectively. There is no significant correlation between FTSE and BSE and no significant cross correlations too as the cross correlations are all near zero, across all scales for all lags. This indicates a weak integration between FTSE and BSE. Similar results hold for wavelet cross correlations between CAC40 and BSE.

Figure 3. *Wavelet correlation between FTSE and BSE*

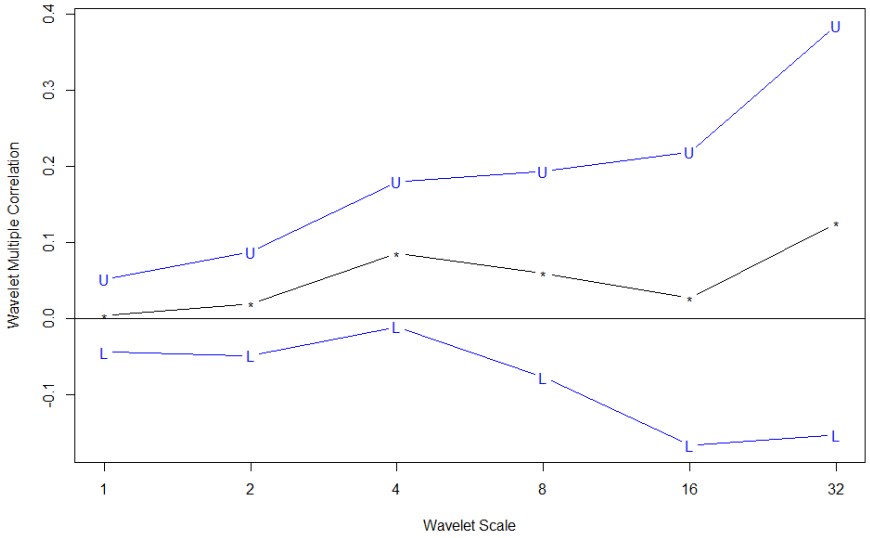


Figure 4. *Wavelet cross-correlation between FTSE and BSE*

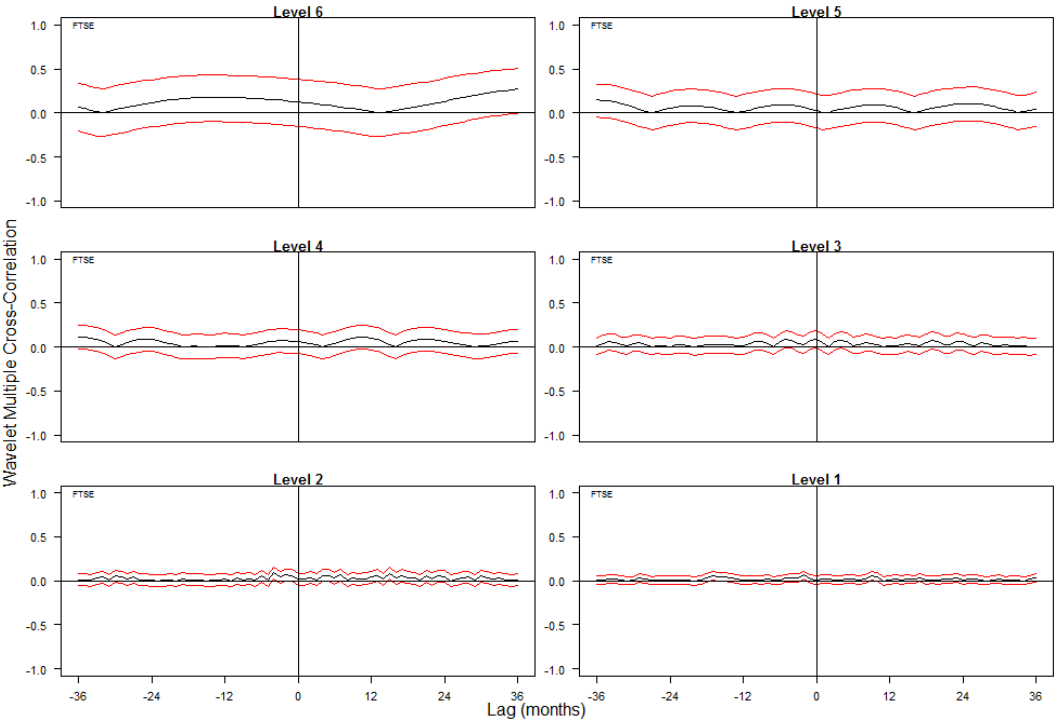


Figure 5 displays the wavelet cross correlations between NIKKEI225 series and the BSE series.

The first two levels, associated with periods of 2-4 and 4-8 days (intra-week and weekly scales), shows many lags converging towards zero and many lags different from zero but all

positive. The lags where wavelet correlations are positive, and different from zero, lie around the zero axes. However, the correlations are not statistically significant as the plot of lower confidence band lie below the zero axes. We see no significant correlations at level three, except a slight correlation at around lag -20. There is a slight correlation between the BSE series and the NIKKEI series at lag 24 at level four, but no correlation at other lags. As we move towards higher levels of resolution we see increasing correlations between BSE and NIKKEI. Some positive cross correlations around lag 24 is observed at level six which correspond to a period of 64-128 days(quarterly to biannual scales).

Figure 5. *Wavelet correlation between NIKKEI225 and BSE*

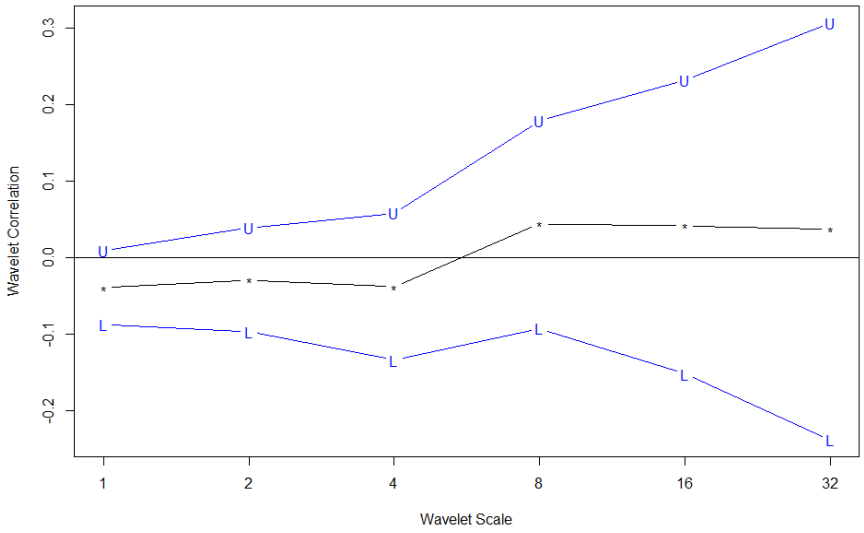


Figure 6 shows the wavelet correlation between DAX and CAC. The wavelet correlations between DAX and CAX are positive but low, across the first and second level of resolution which corresponds to intra-week and weekly scales. There is an increase in wavelet correlation at the third level which corresponds to a period of 8-16 days. At level four, which covers the monthly scale, we see a sharp drop in correlation. However, we see a significant rise in correlations at the next two levels of decomposition which roughly corresponds to a period of 64-128 days (quarterly to biannual) and 128-256 days (biannual scale). The correlations tend to increase as we look at higher levels of decomposition, except a decrease in correlations at monthly scale analysis. This shows the strong integration between these two markets, with good market integration at quarterly to annual scales.

Figure 7 shows the wavelet cross correlation between DAX and CAC. Wavelet cross correlation is performed between DAX and CAC, with leads and lags up to 36 months. The variable that maximizes the correlation, as against the other variable, is shown in the upper-left portion of all figures. Wavelet cross correlation analysis at level 1 and level 2 reveal some significant correlation at lags 10, 11 and 12. As we increase the resolution level, there seems to be a slight increase in cross correlations with correlations oscillating between zero lag up to one year in the future. Statistically significant cross correlations are observed after increasing the level of decomposition, with strong cross correlations at

level 5 and level 6, for almost all leads and lags. This suggests weak but positive correlations between DAX and CAC when the analyses are performed at smaller levels of resolution (intra –week and weekly period), but higher cross correlations when time scales are increased for analyzing the data at quarterly, biannual and annual periods. This further gives us some evidence about good market integration between DAX and CAC.

Figure 6. *Wavelet Correlation between DAX and CAC*

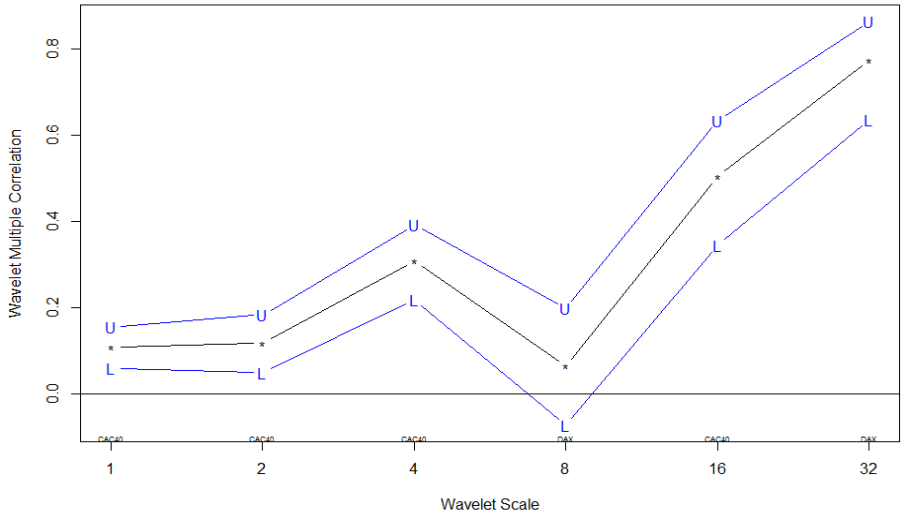
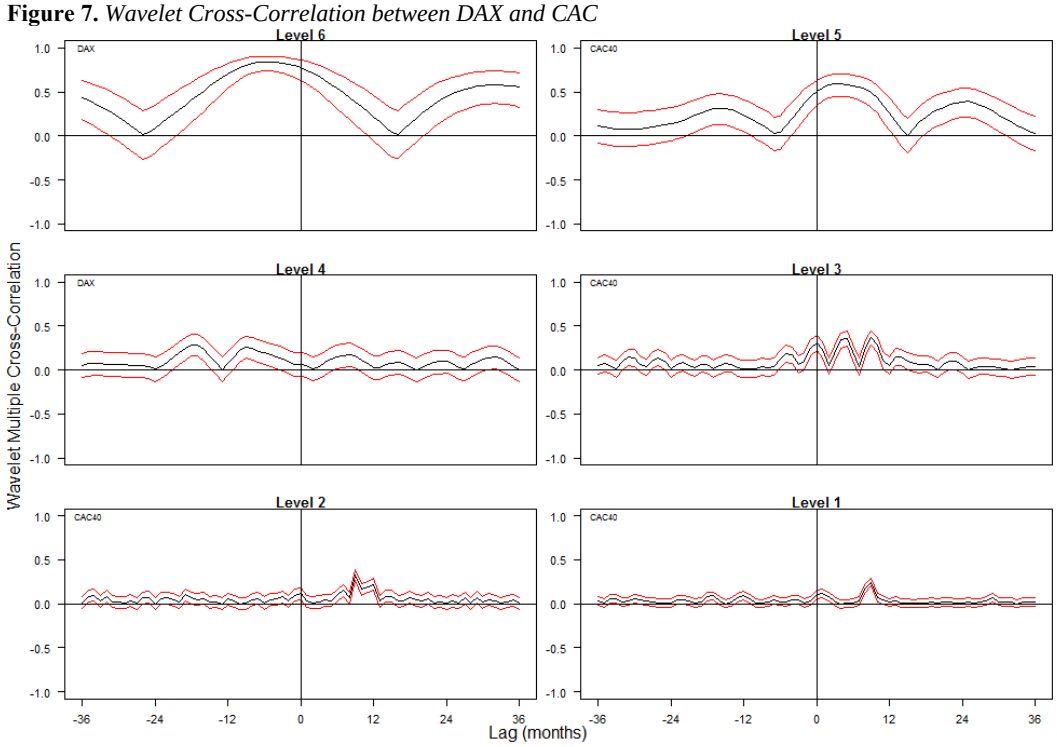


Figure 7. *Wavelet Cross-Correlation between DAX and CAC*



Conclusion

Traditional methods like spectral analysis works by projecting the time series data into a set of sines and cosines, wherein the output signal is a function of frequency only. As a result the time information is completely lost. This problem is resolved by using wavelets based decomposition where the output signal is a function of both time and scale, providing us with simultaneous information from both time and frequency domains. This approach helps us to decompose the one dimensional time series data into a time-frequency plane by projecting the time signal into a set of orthogonal wavelet basis functions.

Therefore, a Time-scale decomposition of Bombay stock exchange (BSE) stock returns and returns from other select international markets, using wavelet based multiresolution analysis, is performed. Wavelet correlation analysis is used to analyze the correlation structure between BSE and stock exchanges from China, France, Germany and Japan. Very weak correlation between BSE and Chinese stock returns (SSE) are recorded at all levels of decomposition. The correlations tend to increase as we increase the timescale of analysis, but no statistically significant correlations are recorded. Wavelet cross-correlation between BSE and SSE, at all leads and lags, are very weak as all correlations lie near zero at all levels of resolution. This indicates a weak integration between BSE and SSE stock markets. Same holds true for analyses of BSE performed with FTSE (London stock exchange) and CAC40 (French stock market index) stock returns. Some positive cross correlations around lag 24 is observed at level six which correspond to a period of 64-128 days(quarterly to biannual scales). BSE seems to be slightly correlated with NIKKEI (Tokyo stock exchange) at a resolution of level six, which corresponds to quarterly-biannual scales. On the other hand, French and Markets are highly integrated as wavelet correlation and wavelet cross correlations (at most of the leads and lags) are positive and increases significantly with the increase in the level of resolution.

This approach allows us to detect changes in stock market behavior from a time-scale perspective where the data can be analyzed at different time horizons. The dynamics of stock returns can be studied by decomposing the stock returns into several layers of time-scale resolution (i.e. Short time period analysis to long period analysis), which can provide useful insights for investors with different trading horizons in mind.

Tables showing wavelet correlations between pairs of select markets

Table 1. *Wavelet Multiple correlation between SSE and BSE*

Levels	WMC	LowerCI	UpperCI
1	0.04459197	0.003469	0.0924478
2	0.06445618	0.003527	0.131846
3	0.05794457	0.038415	0.1532365
4	0.03965149	0.096912	0.17475
5	0.15121177	0.042618	0.3340713
6	0.13002267	0.148134	0.3891159

Table 2. *Wavelet Multiple correlation between FTSE and BSE*

Levels	WMC	LowerCI	UpperCI
1	0.003968619	0.044094	0.0520126
2	0.019467548	0.048564	0.0873194
3	0.085205468	0.011031	0.1798775
4	0.059260635	0.077405	0.1937399
5	0.026907131	0.166544	0.2183638
6	0.125241818	0.152884	0.384984

Table 3. *Wavelet Multiple correlation between CAC40 and BSE*

	WMC	LowerCI	UpperCI
1	0.0135397	0.03454	0.061554
2	0.00318541	0.0648	0.071137
3	0.04259046	0.05378	0.13817
4	0.09077961	0.04583	0.224054
5	0.13911413	0.05495	0.323047
6	0.04646006	0.22935	0.315362

Table 4. *Wavelet Multiple correlation between DAX and NIKKEI*

Levels	WMC	LowerCI	UpperCI
1	0.003132742	-0.044928	0.0511789
2	0.04663081	-0.021404	0.1142362
3	0.018538062	-0.077746	0.1144796
4	0.054547953	-0.082102	0.1891852
5	0.060086397	-0.134053	0.2497841
6	0.193326789	-0.084006	0.4428622

Table 5. *Wavelet Multiple correlation between FTSE and NYSE*

Levels	WMC	LowerCI	UpperCI
1	0.002823504	-0.04524	0.050871
2	0.00777433	-0.06022	0.075702
3	0.048070075	-0.0483	0.143552
4	0.185210195	0.05044	0.313356
5	0.254215066	0.064799	0.425949
6	0.741953405	0.588139	0.843968

Table 6. *Wavelet Multiple correlation between NIKKEI225 and BSE*

Level	WMC	LowerCI	UpperCI
1	0.03916004	0.008911	0.0870501
2	0.02897762	0.039067	0.0967545
3	0.03802189	0.058337	0.1336788
4	0.04423065	0.092366	0.1791935
5	0.04195577	0.15186	0.232664
6	0.03748039	0.237853	0.3072382

Table 7. *Wavelet Multiple correlation between CAC and DAX*

Levels	WMC	LowerCI	UpperCI
1	0.10778593	0.060043	0.1550368
2	0.11706433	0.0494907	0.1835711
3	0.30788209	0.2181954	0.3924117
4	0.06419309	-0.072481	0.1985007
5	0.50388835	0.3447563	0.6348672
6	0.77502356	0.6368115	0.8649775

Table 8. *Wavelet Multiple correlation between FTSE and CAC*

Levels	WMC	LowerCI	UpperCI
1	0.023040084	-0.025042	0.0710154
2	0.008664079	-0.059338	0.0765864
3	0.094352935	-0.001809	0.188786
4	0.149253908	0.0134866	0.2796175
5	0.145565312	-0.048379	0.3289322
6	0.082871054	-0.194426	0.3479034

Table 9. *Wavelet Multiple correlation between FTSE and DAX*

Levels	WMC	LowerCI	UpperCI
1	0.02509043	-0.022991	0.0730563
2	0.06944789	0.0014875	0.1367697
3	0.12349066	0.0276736	0.2170591
4	0.04023634	-0.096332	0.1753178
5	0.01581551	-0.177313	0.2077709
6	0.34130332	0.0754285	0.5618701

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The cost to have a healthy population – The European Union's strategy

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Abstract. *In this article, the authors focus on the study of health as a fundamental element in having a population and, as a consequence, a work force capable of performing efficient activities. A comparative analysis of the current situation, from this point of view, in the European Union and the Member States, is highlighted, highlighting the shortcomings that occur. This article refers to the cost of maintaining health and the financial potential of each Member State. The focus is on the conditions in hospitals, the coverage of needs through the existing network, the facilities and, last but not least, the quality of the medical staff involved in the health field.*
From the comparative study undertaken, it follows that Romania still has a lot to do in order to reach a suitable, truly European standard. Measures are needed to determine the medical staff to accept their stay in the country. Data from the Eurostat source is used to highlight the arguments made by the authors.

Keywords: health, cost, strategy, health protection, accidents at work.

JEL Classification: H51, I10.

Introduction

The health system is organized and funded in different ways by the member countries of the European Union, but the most common system that is agreed by all Member States concerns access to quality protection that provides individual and social protection as far as possible of the entire population of a country.

This is a point in the health system of the European Union based on principles that lead to the expenses necessary to ensure it. The healthcare system also includes expenditures for the construction of hospitals, their endowment, the preparation of quality medical staff, their entire structure (doctors, assistants, auxiliary staff), as well as the provision of conditions for making available to people in need appropriate medication. In other words, maintaining health has a cost. The European Union has set a strategy by 2030, aiming at Member States to take measures to ensure a standardized but quality framework. These issues are carefully analyzed by the authors in order to understand the current state and direction of action over the medium and long term.

Literature review

Airesa, Gemez and Gibb (2010) investigated the extent to which European policies contributed to the prevention of construction accidents. Anghelache (1999-2017) performed a study of the evolution and structure of the Romanian population and its access to the health system. Beale and Hoel (2011) discussed ways to avoid aggression at work and managerial control of work. Cagnie et al. (2007) estimated the one-year prevalence of neck pain among office workers and determined the physical, psychological and individual factors that are associated with these prevalence. Giorgi, Arenas and Leon-Perez (2011) addressed issues related to harassment at work and the possibilities to prevent intimidation of employees and improve their welfare. Iavicoli et al. (2011) have developed a study to show that psychosocial risks and work-related stress are important occupational health and safety issues. Leka et al. (2011) outlines the process of developing the European framework for managing psychosocial risks. Lewchuk et al. (2008) developed a new approach to understanding the impact of less permanent forms of employment on workers' health. López-Alonso et al. (2013) studied the impact of investment in health and safety on the construction company's costs. Morillasa, Rubio-Romeroa and Fuertes (2013) have studied a number of possibilities for reducing workplace accidents and the potential for improving health and safety management in Spain. Leka et al. (2010) investigated the political context for managing work-related psychosocial risks in the European Union. Persechino et al. (2013) have developed a strategy for assessing work-related stress risks. Poterba, Venti and Wise (2010) addressed issues related to the cost of goods for poor health. Walker and Maltby (2012) addressed issues related to the need for an active social and public policy to incorporate active aging as the main paradigm for aging in the European Union. Woolfson (2007) analyzed the implications of rising labor migration for the new member states and wider EU labor standards.

Research methodology, data, results and discussions

The current level of health spending in Germany, for example, was 309 billion EUR in 2013, equivalent to 10.9% of GDP. In France, the total health expenditure was 231 million EUR and equaled 10.9% of GDP while in the Netherlands 11% of GDP was spent. Also, Sweden, with a high level of spending on health insurance, has allocated 11.9% of GDP. Other Member States of the European Union also used a very high percentage of the Gross Domestic Product to ensure the health of the population in those countries. Thus, in Switzerland, 11.2% of GDP goes to health, medication, free and compensated medicines, and treatments for diseases with a high impact on health and life.

But there are also countries in the European Union where spending on health is quite low. For example, in Poland, Lithuania and Estonia, less than 6.5% of GDP is allocated to maintaining and securing health with quality protection.

As far as Romania is concerned, we again find that we are in the last places, with only 5.2% of GDP allocated to maintaining health.

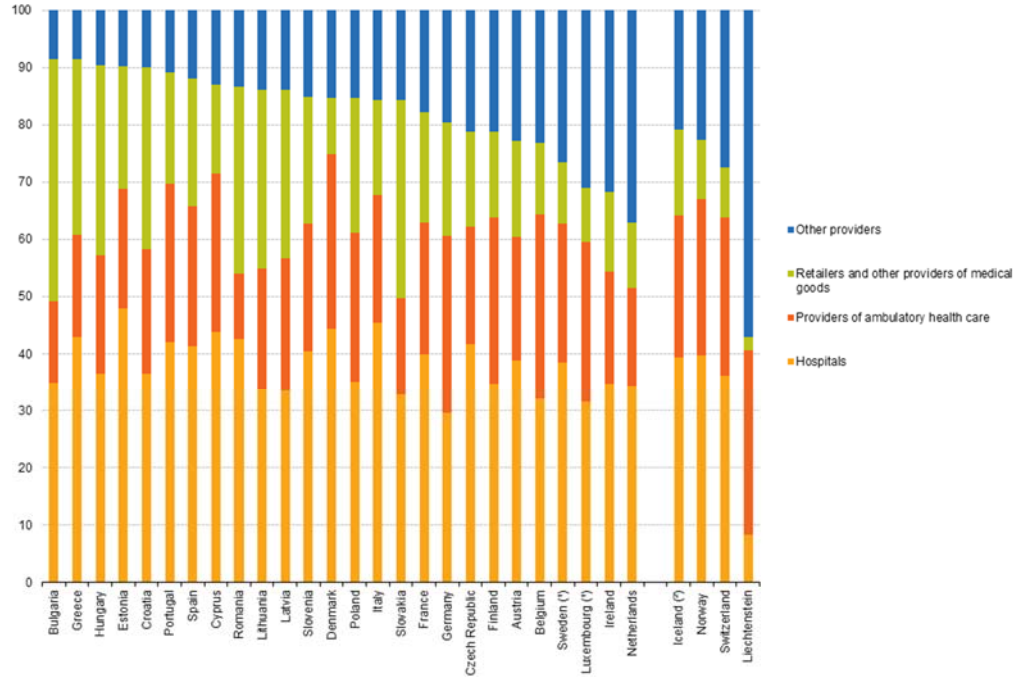
Another important element for maintaining health is the number of hospitals, the quality of these hospitals and the health services provided to the population. In general terms, it appears that in the European Union, in 2013-2014, the rate of health care spending allocated to hospitals out of the total of these expenditures averaged 29.5% for all Member States. In some countries, such as Germany, Estonia, these revenue-sharing allowances for the construction, maintenance and maintenance of hospitals were very high. Thus, 47.6% of all spending for these hospitals was allocated to Estonia. In Bulgaria, there are still problems with hospitals that do not have the highest quality, and where 31.1% of all spending is allocated to ensure optimal conditions for hospital maintenance and use.

Also, a high percentage of health care spending is allocated to provide the prospect of obtaining high-quality medicines to be used with a positive health-enhancing effect.

In other considerations, a fairly important problem of health care spending is how to produce the necessary preventive treatments, curative treatments and, moreover, to have the necessary effect, such costs high quality hospitals and quality health centers.

Another very important expense to be covered by the state is ambulatory treatment for health care. This includes vaccination, endowment and supply of medicines and vaccines, checking their quality. From the total expenditure, there is a large difference in allocation from the Member States. Thus, while Romania allocates 10.4% of outpatient treatment and health costs, in Germany and Belgium, these expenses amount to more than 30%. There are also states, such as Liechtenstein, which, although a very small state, allocates 31.7% of the total for maintaining health.

Figure 1. *Healthcare expenditure by provider, 2014 (% of current healthcare expenditure)*



Note: Malta and the United Kingdom, not available.
(*) Provisional.
(*) Definitions differ.
Source: Eurostat (online data code: hlth_sha11_hp)

Source: Eurostat.

In Figure 1 graphically presents the percentage structure of those four categories of expenditure that requires maintaining a high level of health. These are costs for hospitals, medical expenses and medication, out-patient health care, and other expenses. We find that the expenditures are diversified and in the case of Romania we can estimate that for hospitals we spend about 40% of the total health expenditures for outpatient treatment 10%, for obtaining and offering free and compensated drugs the percentage is about 30% and other expenses are about 20%.

It is noted that most EU Member States allocate important amounts for the construction, maintenance and equipment of hospitals that provide curative treatments for all citizens in this situation.

In Table 1 is the current expenditure for maintaining health, both in absolute terms and as a percentage of the Gross Domestic Product. We find that Romania allocates 7431 billion EUR for health, expressed in EUR per capita and purchasing power parity per capita, which is 767 EUR per capita which represents 5.2% of GDP. There are countries like Belgium, which allocates 40.0 billion EUR, which means 3,658 EUR per capita, totaling 10.4% of GDP. Germany allocates 308.5 billion EUR, which means 3,789 EUR per capita, thus having an extraordinary high per capita and overall. France spends 231 billion EUR at an expense of 3,267 EUR per capita, and so on, we can see that countries like Finland, Sweden and the UK are also spending extra costs to ensure the health of the people in those countries.

Table 1. *Current healthcare expenditure, 2014*

GEO/TIME	Million EUR	EUR per capita	PPS per capita	% of GDP
Belgium	40907	3658	3263	10.4
Bulgaria	3298	454	1034	7.9
Czech Republic	10895	1036	1593	6.9
Denmark	:	:	:	:
Germany	308526	3826	3739	10.9
Estonia	1136	862	1222	6.0
Ireland	:	:	:	:
Greece	15777	1439	1710	8.8
Spain	92700	1988	2110	9.0
France	231060	3515	3262	10.9
Croatia	3171	745	1177	7.3
Italy	:	:	:	:
Cyprus	1244	1443	1529	6.9
Latvia	:	:	:	:
Lithuania	2147	726	1253	6.1
Luxembourg	:	:	:	:
Hungary	7408	749	1369	7.4
Malta	:	:	:	:
Netherlands	71453	4252	3731	11.0
Austria	32729	3860	3521	10.1
Poland	25262	664	1264	6.4
Portugal	15477	1480	1844	9.1
Romania	7431	372	767	5.2
Slovenia	:	:	:	:
Slovakia	:	:	:	:
Finland	19319	3552	2854	9.5
Sweden	48375	5039	3540	11.1
United Kingdom	202721	3161	2736	9.9
Iceland	1013	3130	2789	8.8
Liechtenstein	287	7762	:	:
Norway	35130	6916	4134	8.9
Switzerland	57651	7127	4573	11.2

: not available

Source: Eurostat.

The concern of the European Union is to standardize and pursue in the same way that in all countries implementation of strategies for health promotion, treatment of diseases with rapid effects on health, to reduce the effects of death causes as little as possible. Health has its own cost, which must be achieved by using financial resources, endowments, improving the quality of medical staff, improving the quality of hospitalization conditions, and many other such desires.

In the European Union a priority objective is to allocate an average of 8-10% of each country's Gross Domestic Product to improve the conditions of population health insurance.

Table 1 summarizes the data for all Member States, including some states which, although not members of the European Union, are listed to show the very high level of spending allocated to maintaining health. In protecting the health of the population as well as in protecting it, an important chapter is the protection of work, in the context of avoiding labor accidents, serious accidents, and creating the conditions for fast, qualified and curative treatment.

In this context, European statistics show that national management, i.e. governments, the administration of each country, must pay close attention to avoiding accidents at work.

The indicator used at European Union level is given by the European accident statistics, briefly mentioned in the EAW. An occupational accident defined in this system is that in the goats during work they occur due to irregularities or phenomena that may occur spontaneously, accidents that can lead to injuries or may be fatal. Fatal or fatal accidents usually lead to death and, from this point of view, increased attention must be paid to avoiding the conditions that cause such work accidents.

In 2014, there were 3.1 million less-life-suppression crashes in the European Union, of which 3739 were fatal accidents. This shows that, although light accidents have been high, but as a result of the measures taken in the European Union, the number of accidents has been lower. Another curious issue of this situation is that in the total number of non-fatal accidents, i.e. low-risk, most have occurred in men, of course, they also have jobs at higher accident risk. The accident rate in the European Union is 2.3 accidents per 100,000 people, compared to a very high number that occurred in earlier periods.

An analysis in this respect can be based on the data in Table 2.

Table 2. *The number of fatal and high-risk or low-risk accidents produced in 2014*

GEO/TIME	Accidents at work involving at least four calendar days of absence from work			Fatal accidents at work
	Total	Men	Women	
European Union (28 countries)	3176640	2183494	992870	3739
Belgium	65587	46812	18771	52
Bulgaria	2246	1600	646	117
Czech Republic	42306	29797	12509	118
Denmark	54157	31920	22041	38
Germany	847370	631819	215552	500
Estonia	6288	4097	2191	16
Ireland	18115	12503	5583	47
Greece	3410	2551	859	28
Spain	387439	264010	123430	280
France	724662	454997	269664	589
Croatia	11669	7686	3981	26
Italy	313312	226263	87049	522
Cyprus	1613	1145	468	5
Latvia	1725	1154	571	41
Lithuania	3120	2025	1092	55
Luxembourg	7183	5701	1482	10
Hungary	19491	12674	6817	81
Malta	2632	2235	397	4
Netherlands	87964	55567	32397	45
Austria	65418	51352	14066	126
Poland	76274	50294	25980	263
Portugal	130153	93003	37150	160
Romania	3396	2629	767	272
Slovenia	12.314	9312	3002	25
Slovakia	8552	5910	2642	40
Finland	44434	30521	13913	22
Sweden	35296	19596	15700	40
United Kingdom	244948	156842	88064	239
Iceland	:	:	:	0
Norway	10108	6243	3865	61
Switzerland	86346	68492	17854	74

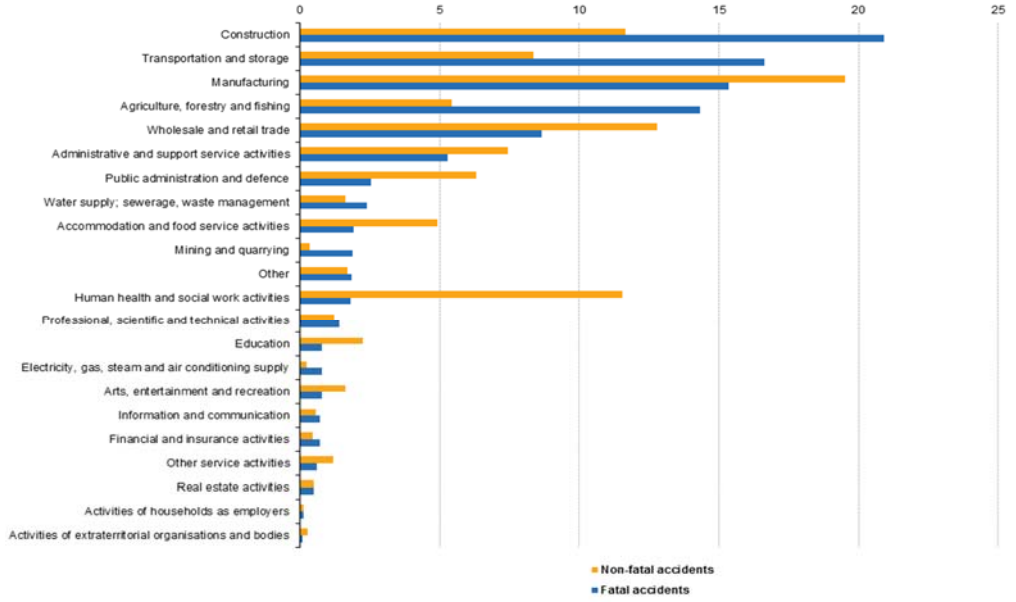
: not available

Source: Eurostat.

Romania had a total of 3,396 accidents (down compared to 2013 when there were 3,653 accidents), of which 2,629 male accidents (down 97 accidents compared to the previous year) and 767 accidents caused by female employees (with 41 accidents more than in the previous period). The fatal accidents, that is, at risk of death in Romania, totalled 272 people this year. Romania is well above the number of accidents, although we are overtaken by France - with 589 fatal accidents, Italy - 522, Germany - 500, but we must also report this situation to the size of the population in each country.

In Figure 2 summarizes the areas in which accidents occur. It is found that accidents, deadly or not, usually occur in the construction industry - with over 23% of all manufacturing accidents, manufacturing, transport, agriculture, and sales in detail. There are also less serious accidents in terms of social, administrative or other work in which there are no such high risks as those mentioned above.

Figure 2. *Fatal and non-fatal accidents at work by economic activity, EU-28, 2014 (% of fatal and non-fatal accidents)*



Note. Provisional.

Source: Eurostat.

The EU's policy is to take urgent, well-correlated measures to create conditions of protection for all employees and to avoid accidents in this way irrespective of the degree of risk to life present them.

Conclusions

From this article, we find that in the European Union a major problem lies in providing conditions for maintaining the health of the population. From this point of view, the conclusion is that more than half of the Member States have a reduced rate of spending on health expenditures in the Gross Domestic Product and therefore it is necessary to reconsider the percentage points that are granted for health.

As a particular conclusion, Romania is at the bottom of the conditions and expenditures for maintaining health, preventive, curative treatments and, last but not least, for ensuring labor protection and avoiding accidents of any degree of risk.

One final conclusion that we can present is the constant concern of the European Union to establish and standardize a tangible financial resource allocation system to improve the quality of health care, preventive, especially, and curative treatments especially in cases of which talks about very serious diagnoses of the risk of death.

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The relationship between oil and stock prices: The case of developing and developed countries

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Abstract. *This research examines the relationship between oil prices and stock market indices of developed and developing countries. All analyses in this study were performed with the monthly data of December 1992 – April 2016 period. The long-term relationship between stock market indices and oil prices was examined by Pedroni Panel Cointegration analysis. Dumitrescu-Hurlin (2012) causality test examines the direction of the relationship between oil prices and long-run markets. According to the findings, there is a long-term relationship between stock exchanges in developing countries and oil prices, and there is a two-way causality between stock prices and oil prices. However, in developed country stock markets, the causality relation is one way and it is correct to oil prices from stock prices.*

Keywords: oil price, developed stock exchange, developing stock exchange, causality relationship.

JEL Classification: C23, G11, G15, O13.

1. Introduction

Utilization of energy sources in the world ranges as oil by 37%, coal by 27%, natural gas by 24%, hydroelectric by 6%, and nuclear energy by 6% (EIA, 2014). Accordingly, oil is the most used primary energy source in the world. These energy sources are consumed in industry, housing, service and transportation activities most. When we regard that energy sources are consumed in industry sector most, it is expected that the changes in oil prices influence the profitability of the sector and therefore, this reflects on stock prices. Stock prices state the sum of today's reduced values of cash flows that are expected to be obtained in the future. The increase in oil prices in the sectors where oil is used as input causes also the increase in production costs. Increasing production costs decrease the cash flows of companies. As a result of this, stock prices of the company decrease. Also increasing oil prices cause an increase in interest rates. While increasing interest rates increase bills and bonds investments, they decrease the demand for stocks. As a result of this, stock prices decrease. However, high oil prices affect oil producing and consuming companies in the world differently. When it is considered that the number of oil consuming companies is more than the producing ones, the effect is expected to be negative (Basher and Sadorsky, 2006). The cost of energy source influences the profitability of the company and trade price of the share in exchange market. For that reason, knowing the relationship between the prices of energy sources and exchange market prices is highly important for investors. At that point, the reflections of the changes in oil prices with the oil shock in 1973 to the economy of the countries have become a focus for both theoreticians and applicants.

The effect of oil prices on share market was firstly analyzed by Jones and Kaul (1996) and Huang, Masulis and Stoll (1996). Jones and Kaul indicated that the change in oil prices had negative effects on actual share earnings in the USA, Canada, Japan and England. However, Huang, Masulis and Stoll (1996) indicated that the changes in oil prices had a high correlation with the change in US share prices. There are lots of studies analyzing the effect of oil prices on share prices on the basis of certain countries. However, the concept of national border in the world lost its validity for countries with the globalization phenomenon. All economies in the world are directly or indirectly influenced by each other or they influence each other. As a result of the analysis in current literature, the effect of the changes in oil prices on stock market prices, an important economic indicator, was not analyzed comprehensively by dealing the developed and developing countries together. Since the developed and developing countries have different economic Dynamics, their responses to the oil prices also vary. The responses of developed and developing countries to the oil prices in their stock markets are analyzed in two different groups in also this study. Therefore, the responses of countries to oil prices according to their economic development levels are evaluated separately. In accordance with these obtained data, revealing non-homogeneous responses of different countries according to their development levels to the oil prices is highly important in terms of portfolio risk management (Li et al., 2012). Oil price movements and the relationship between share prices for the developed and developing countries in the world are analyzed in also this study. For that purpose, Brent oil prices in the period from 12:1992 to 04:2016 and monthly closing prices of exchange market indices obtained from MSCI for the developed and developing countries were used as data set. Accordingly, index closing prices for forty

different share markets in the world and the long term relationship between Brent oil prices were analyzed through Pedroni Panel Cointegration test. However, the direction of causality between oil prices and share markets with long term relationship was analyzed through Dumitrescu-Hurlin (2012) panel causality test. The study consists of six parts in accordance with these targets. After the introduction part, in the second part literature studies, in the third part methodology, in the fourth part used data set and in the fifth part the findings obtained as a result of conducted analyses are presented. In the last part general evaluations about the interactions between oil prices and share market prices of countries were carried out according to the obtained findings.

2. Literature review

There are many studies analyzing the interaction between energy sources and share prices. The sampling used in current studies differs as periodically or methodically.

Henriques and Sadorsky (2008) analyzed the relationship between alternative energy share market prices, interest rates, oil prices and technology shares. Results indicate that technology share prices and oil prices influence alternative energy share prices separately. In addition, as a result of simulation it was determined that rather than oil shock prices technology share prices influence alternative share prices more.

Park and Ratti (2008) analyzed the effect of oil price shocks for 1986-2005 period on shock index earnings of the USA and 13 European countries. Results indicated that there was a positive relationship between share earnings and oil prices in Norway.

Miller and Ratti (2009) analyzed the long term relationship between world oil prices and international share prices among OECD countries for 1971-2008 period. As a result of the study it is seen that there is a long term relationship between oil and share prices of 6 OECD countries and share prices respond to the long term increase in oil prices in 1980-1988 periods negatively.

Mohantry, Nandha and Bota (2010) analyzed the relationship between share and oil prices of gas and oil companies in Middle and Eastern European countries and oil prices for 1998-2010 period. As a result of the study a significant relationship was found between the shares of gas and oil companies and oil prices.

İşcan (2010) analyzed the long term relationship between oil prices and share prices for 2001-2009 period by using daily İstanbul Stock Exchange IMKB-100 index and brent oil price data. According to the results obtained from cointegration tests conducted in this context, there is no long term relationship between these two variables.

Güler, Tunç and Orçun (2010) identified that oil prices were a significant indicator of share prices in their studies that they tested the effect of the change in oil prices for 2000-2009 period on share prices of energy sector trading in İstanbul Stock Exchange.

Arouri, Lahiani and Nguyen (2011) analyzed the fluctuation between share market and oil and earnings connections in Gulf Cooperation Council countries for 2005-2010 period. As a result of the study it was identified that political changes and shocks (crises) influence oil

supply and demand which directly increases the fluctuations in Gulf Cooperation Council markets and this leads to fluctuations in oil prices.

Arouri (2011) analyzed the response of European share market to the changes in oil prices for 1998-2010 period. According to the conducted analysis result, it is stated that the increase in oil prices influences the share prices of automobile and finance sectors negatively, but it influences the share prices of oil and gas sectors positively.

Anoruo (2011) analyzed the relationship between US share earnings and brent oil price changes through linear and non-linear models for 1974-2009 period. According to the analysis results, there is a two-way causality relationship between crude oil price changes abd share earnings.

Nguyena and Bhattib (2012) analyzed the relationship between share prices and oil price of China and Vietnam for 2000-2009 period. While the dependence between oil prices and Chinese market was opposite, a left-tail dependence was identified between Vietnam market and oil prices.

Sadorsky (2012) tried to analyze the fluctuation transitivity of technology companies and clean energy companies between oil prices and share market for 2001-2009 period. As a result of the study, a very high correlation was found between share markets of energy companies and technology companies.

Naifar and Dohaiman (2013) analyzed the effect of oil price shocks on share earning markets under regime shift and the relationship between oil prices and inflation and interest rates in pre-crises and post-crises period for 20014-2011 period for Gulf Cooperation Countries. As a result of the study, it was found that whether oil prices in oil producing countries increase or not, they have positive effects on shares of these countries. However, oil price changes do not influence the sectors for oil consuming countries.

Fattoum and Guesmi (2014) analyzed the relationship between share markets of 10 OECD countries and Brent oil prices for 1990-2012 period. According to the analysis results, it was identified that the events such as chaos, political changes, crises, etc. in the world had significant effects on shares and oil price shocks.

Reboredo and Rivera-Castro (2014) analyzed the relationship between sectoral share prices and oil prices of Europe and the USA for 2000-2011 period. According to the conducted analyses results the companies out of oil and gas companies are not influenced from the changes in oil prices in pre-crisis periods.

Reboredo, Rivera-Castro and Zebende (2014) analyzed the relationship between sectoral and overall share and oil prices of Europe and the USA for 2000-2011 period. When we look at the results, the changes in oil prices at sectoral level do not influence other sectors apart from oil and gas companies in pre-crisis period. However, positive dependence and contagion relationship between oil prices and share earnings since the beginning of crisis is perceived in the USA and Europe apparently.

Abdioğlu and Değirmenci (2014) analyzed the relationship between oil prices and share prices for 2005-2013 period on sectoral basis. As a result of the study, it was identified that there was a long term relationship between share prices and oil prices for industry, chemistry, textile and communication sectors.

Kaya and Binici (2014) analyzed the relationship between share prices and oil prices of the companies in İstanbul Stock Exchange (BIST) Chemistry, Oil, Plastic indices activating in Turkey with main production factor of oil for 2002-2013 period. As a result of the study, variables move together in long term. However, according to the test results carried out in order to determine the direction of causality between variables, it was identified that there was a one-way causality relationship from Brent oil prices and BIST-100 Chemistry, Oil and Plastic index variable.

Özdemirvanlı (2014) identified a long term relationship between oil prices and BIST-100 index as a result of his study that he analyzed the relationship between oil prices and BIST-100 index for 2003-2014 period. In addition, there is a one-way causality relationship from BIST-100 index closing prices to oil prices with Granger causality test.

Gönüllü, Otluoğlu and Şengöz (2015) concluded that oil prices had an effect on index in their studies that they analyzed the relationship between the fluctuations in crude oil prices and BIST-Oil, Chemistry and Plastic index for 2003-2012 period.

Çelik, Özdemir and Gülcan (2015) analyzed the effect of the changes in oil prices for 2000-2014 period on share earnings trading in İstanbul Stock Exchange. According to the study result, the changes in oil prices have no effect on share earnings.

Avcı (2015) analyzed the effects of oil prices on share markets for 2003-2013. As a result of the analyses, a long term relationship was found between variables. As a result of the conducted causality test, a causality was identified from oil prices to stock exchange earnings.

Özdemir and Akgül (2015) analyzed the effect of sudden changes in crude oil prices and gasoline prices in Turkey on industrial production for 2005-2014 period. It was observed that compared to industrial production the volatility of oil and gasoline prices in crisis period was more, but the volatility of industrial production in growth regime was more.

Phan, Sharma and Narayan (2015) analyzed how the changes in oil prices influenced share prices of oil producing and oil consuming countries for 1986-2010 period. According to the study results, all kinds of changes in oil prices in oil producing countries influence share prices of these countries positively. However, it is stated that the changes in oil prices do not influence sectors for oil consuming countries.

Eyüboğlu and Eyüboğlu (2016) indicate in their analysis that there is a long term relationship between natural gas and oil prices for 2005-2015 period. Accordingly, it is stated that index prices for the related sectors could have the same trend with natural gas and oil prices in long term.

Kendirli and Çankaya (2016) analyzed the causality relationship between the changes in crude oil barrel prices and İstanbul Stock Exchange 100 index (BIST-100) and İstanbul Stock Exchange Transportation (XULAS) Index for 2000-2015 period. According to the analysis result, it was identified that BIST-100 was the reason of crude oil prices and İstanbul Stock Exchange Transportation index. Also it was identified that İstanbul Stock Exchange Transportation index was the reason of crude oil prices.

3. Methodology

The long term relationship between stock exchange index for forty different economies which are grouped as developed and developing according to MSCI and Brent oil prices is analyzed in this study. 23 of the countries included in the study was grouped as developed economies, 17 of them was grouped as developing economies. First data group established with the stock exchange index of developed 23 economies was called as Panel A, but second data group established with the stock exchange index of developing 17 economies was called as Panel B. Existence of long term relationship between oil prices and Panel A and Panel B was analyzed with Pedroni Panel Cointegration analysis. Before this analysis is performed, unit root analysis should be performed for the data groups included in the study. For that purpose unit root analysis for Brent oil prices and Panel A, Panel B established from stock exchange indices included in the study was conducted through Im, Pesaran and Shin (2003) Panel Unit Root Test. However, the causality relationship between Brent oil prices and stock exchange indices with long term relationship was analyzed through Dumitrescu-Hurlin (2012) test. Therefore, direction of the relationship between stock exchange price indices and Brent oil prices of the developed and developing countries tried to be identified.

After analyzing the unit roots, whether there was a long term relationship between the series through Pedroni Panel Cointegration analysis. The following hypotheses are tested through Pedroni Panel Cointegration test (Pedroni, 2004).

H_o: There is no cointegration relationship for all cross-sections.

H_1: There is a cointegration relationship for all cross-sections.

In Pedroni Cointegration analysis seven different cointegration tests are presented in order to cover the effects within the sections and between the sections in the panel. These tests consist of 4 pooled tests in "within" dimensions and other 3 tests in "between" dimension (Asteriou and Hall, 2007).

$$\text{Panel v} - \text{Statistic} \quad Z_v = T^2 N^{3/2} \left(\sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^2 \right)^{-1}$$

$$\text{Panel } \rho - \text{Statistic} \quad Z_\rho = T\sqrt{N} \left(\sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^2 \right)^{-1} \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \left(\hat{e}_{i,t-1} \Delta \hat{e}_{i,t-1} - \hat{\lambda}_i \right)$$

$$\text{Panel } t - \text{Statistic (Non} - \text{Parametric)} \quad Z_t = \left(\hat{\sigma}_{N,T}^2 \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^2 \right)^{-1/2} \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \left(\hat{e}_{i,t-1} \Delta \hat{e}_{i,t-1} - \hat{\lambda}_i \right)$$

$$Panel\ t - \text{Statistic}$$

$$(Parametric) \qquad Z_t^* = \left(\tilde{S}_{N,T}^{*2} \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^{*2} \right)^{-1/2} \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^{*} \Delta \hat{e}_{i,t}^{*}$$

$$Grup\ p - \text{Statistic} \qquad \tilde{Z}_\rho = TN^{-1/2} \sum_{i=1}^{N} (\sum_{t=1}^{T} \hat{e}_{i,t-1}^2)^{-1} \sum_{t=1}^{T} \hat{e}_{i,t-1}\, \Delta\hat{e}_{i,t} - \hat{\lambda}_i)$$

$$Grup\ t - \text{Statistic}$$

$$(Non - Parametric) \quad \tilde{Z}_t = N^{-1/2} \sum_{i=1}^{N} (\hat{\sigma}_i^2 \sum_{t=1}^{T} \hat{e}_{i,t-1}^2)^{-1/2} \sum_{t=1}^{T} \hat{e}_{i,t-1}\, \Delta\hat{e}_{i,t} - \hat{\lambda}_i)$$

$$Grup\ t - \text{Statistic}$$

$$(Parametric\ ) \qquad \tilde{Z}_t^* = N^{-1/2} \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{S}_i^{*2}\, \hat{e}_{i,t-1}^{*2})^{-1/2} \sum_{t=1}^{T} \hat{e}_{i,t-1}^{*}\, \Delta\hat{e}_{i,t}^{*}$$

If the calculated statistics are higher than the critical values, the null hypothesis is rejected. We decide that there is a long term cointegration relationship between the variables included in the analysis.

The causality relationship between Y and X in the analyses in Dumitrescu-Hurlin (2012) panel causality test was performed by using a linear model as the following.

$$y_{i,t} = \alpha_i + \sum_{k-1}^{K} \gamma_i^{(k)} y_{i,t-k} + \sum_{k-1}^{K} \beta_i^{(k)} x_{i,t-k} + \varepsilon_{i,t}$$

Basic and alternative hypotheses tested by utilizing this model are as the following:

$H_0 = \beta_i = 0 \quad \forall i = 1, \dots, N$

$H_1 = \beta_i = 0 \quad \forall i = 1, \dots, N_1$

$\beta_i = 0 \quad \forall i = N_1, \dots, N$

Basic hypothesis here is the absence of Granger causality relationship between the analyzed variables of all units. However, alternative hypothesis is the relationship between these two variables in at least one unit.

4. Data

All analyses in this study were performed by Brent oil prices and closing prices of stock exchange indices of forty different countries belonging to 23 developed and 17 developing economies according to MSCI. However, the data set used for the analyzed stock exchange indices and oil prices contains 282 monthly periods from 12:1992 to 04:2016. Before the analyses began, natural logarithms of Brent oil prices and closing prices of stock exchange indices for forty different economies used in the study were taken. Therefore, the data set used in the study were prepared to be ready for the analyses. Accordingly, stock exchanges of the developed and developing economies included in the study are as in Table 1.

Table 1. *Developed and developing economies for stock exchange included in the research*

PANEL A			**PANEL B**	
Developed Stock Market			**Developing Stock Market**	
Australıa	Ireland	Spaın	Chına	Chıle
Austrıa	Israel	Sweden	Indıa	Colombıa
Belgıum	Italy	Swıtzerland	Indonesıa	Mexıco
Canada	Japan	Unıted Kıngdom	Korea	Peru
Denmark	Netherlands	USA	Malaysıa	Greece
Fınland	New Zealand		Phılıppınes	Poland
France	Norway		Taıwan	Turkey
Germany	Portugal		Thaıland	South Afrıca
Hong Kong	Sıngapore		Brazıl	

Stock exchange closing price data for the developed and developing countries used in the study were obtained from www.msci.com. However, the data for Brent oil prices were obtained from www.eia.doe.gov. In further parts of the study the expression of Developed Stock Market is used for the first group data set established from stock exchange price indices for the developed countries and the expression of Developing Stock Market is used for the second group data set established from stock exchange price indices for the developing countries. However, the expression of OIL is used for Brent oil prices.

5. Empirical results

Im, Pesaran and Shin (2003) unit root analysis results of stock exchange price indices for the developed and developing countries used in the study are as in Table 2.

Table 2. *Results for Im, Pesaran ve Shin (IPS) Unit Root Test*

Variables	**I(0)**	**I(1)**		
	Istatıstics	Prob.	Istatıstics	Prob.
PANEL A				
Developed stock market	- 0.73555	0.2310	-81.3036	0.0000*
oil	1.98754	0.9766	-69.9213	0.0000*
PANEL B				
Developing stock market	0.62875	0.7352	-66.6381	0.0000*
oil	1.71409	0.9567	-60.1096	0.0000*

*, **, *** indicate the significance at 1, 5, 10 levels, respectively. The relevant lag length was determined according to Schwarz information criterion. Barlett Kernel method was used in LLC test and Band with width was determined by Newey-West method.

According to Im, Pesaran and Shin (2003) panel unit root test results, panel is unit rooted and H_o hypothesis is accepted for level values. Accordingly, all panel data are not stable at I(0) and include unit root. However, when the first difference of the data is taken, H_o hypothesis is rejected. Thus, when all panel data is I(1), it is stable. In other words, at least one cross section is stable and it does not include a unit root.

After the stability of the data was analyzed by Im, Pesaran and Shin (2003) panel unit root test, the existence of a long term relationship between the developed and developing stock exchange price indices and Brent oil prices was analyzed by Pedroni Panel Cointegration Analysis. General equation established for Pedroni Panel Cointegration Analysis applied to analyze the long term relationship between stock exchange price indices and oil prices was prepared as the following:

$$\text{Stock Market}_{it} = \alpha_{it} + \beta_1 \text{OIL}_{it} + u_{it} \quad (1)$$

This equation was prepared as the following for oil prices and Panel a data group with stock exchange price indices for the developed economies used in the study.

$$\text{Developed Stock Market}_{it} = \alpha_{it}+\beta_1 OIL_{it}+u_{it} \quad (2)$$

However, this equation was revised as the following for oil prices and Panel B data group with stock exchange price indices for the developing economies. Therefore, it was aimed to increase the generalization and reliability of the findings obtained as a result of the study.

$$\text{Developing Stock Market}_{it} = \alpha_{it}+\beta_1 OIL_{it}+u_{it} \quad (3)$$

Result of Pedroni Panel Cointegration analysis applied for equation 2 and equation 3 are as in Table 3.

Table 3. *Results of Pedroni panel cointegration test for stock markets*

$STOCK\ MARKET_{it}=\alpha_{it}+\beta_1 OIL_{it}+u_{it}$									
Developed Stock Markets					**Developing Stock Markets**				
Pedroni Panel Cointegration Test					Pedroni Panel Cointegration Test				
Within-Dimension					Within-Dimension				
	Statistic	Prob.	Weighted Statistic	Prob.		Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	-2.616533	0.9956	-2.738568	0.9969	Panel v-Statistic	-0.077615	0.5309	-0.463144	0.6784
Panel rho-Statistic	-0.834223	0.2021	-0.847515	0.1984	Panel rho-Statistic	-1.637842	0.0507***	-1.774489	0.0380**
Panel PP-Statistic	-1.470640	0.0707***	-1.478082	0.0697***	Panel PP-Statistic	-1.879603	0.0301**	-1.990923	0.0232**
Panel ADF-Statistic SS	-1.345049	0.0893***	-1.391446	0.0820***	Panel ADF-Statistic	-1.809542	0.0352**	-1.892054	0.0292**
Between-Dimension					Between-Dimension				
	Statistic		Prob.			Statistic		Prob.	
Group rho-Statistic	2.7570		0.99708		Group rho-Statistic	0.369244		0.6440	
Group PP-Statistic	-0.1242		0.4506		Group PP-Statistic	-1.721803		0.0426**	
Group ADF-Statistic	0.0801		0.5319		Group ADF-Statistic	-1.543104		0.0614***	

*, **, *** indicate the significance at 1, 5, 10 levels, respectively. The relevant lag length was determined according to Schwarz information criterion.

According to two criteria of seven different criteria from the results obtained by Pedroni Panel Cointegration test applied for equation 2, there is a long term relationship between stock exchange price indices and oil prices for the developed economies Similarly, according to five criteria of seven different criteria obtained by Pedroni Panel Cointegration test applied for Equation 3, there is a long term relationship between stock exchange price indices and oil prices for the developing economies. This situation also supports that there is an interaction between stock exchange price indices and oil prices of both developed and developing economies. However, direction of this interaction should be identified. For this purpose, however, Dumitrescu-Hurlin (2012) panel causality test was applied in order to identify the direction of the interaction between oil prices and stock exchange price indices with the long term relationship. Results of Dumitrescu-Hurlin (2012) panel causality analysis applied for different lag lengths are as in Table 4.

Table 4. *Results for Dumitrescu Hurlin (2012) Panel Causality Test*

	K=1		**K=2**		**K=3**	.
	W-Stat.	**Zbar-Stat**	**W-Stat.**	**Zbar-Stat**	**W-Stat**	**Zbar-Stat**
OIL ≠> DEVELOPED STOCK MARKET	1.1566	0.5001	2.1380	0.2914	3.2215	0.3835
DEVELOPED STOCK MARKET ≠> OIL	3.2250*	7.4258*	11.8128*	23.1527*	13.2191*	19.6338*
OIL ≠> DEVELOPING STOCK MARKET	2.3171*	3.7708*	3.1730**	2.3532**	3.7011	1.1237
DEVELOPING STOCK MARKET ≠> OIL	3.0115	5.7696	9.8095*	15.8353*	10.9216*	13.0765*

*, **, *** indicate the significance at 1, 5, 10 levels, respectively.

According to Dumitrescu-Hurlin (2012) test results applied for stock exchange indices and oil prices of developed economies in Table 4, there is a one-way causality. Direction of the causality is from the stock exchange price index of the developed economies to the oil prices. According to these obtained results, stock exchange index of developed countries is a factor to be used for explaining the changes in oil prices. However, the changes in oil prices are not factors to be used for explaining the changes in stock exchange indices of developed economies. In other words, price changes in stock exchanges of developed economies provide useful information to explain the changes in oil prices.

However, according to the results obtained for stock exchange price indices and oil prices of developing economies in Table 4, causality relationship is two-way with two lag lengths. Thus, stock exchange price changes of developing economies are factors to be used for explaining the changes of oil prices. This is also valid for both stock exchange price changes of developing countries and the changes in oil prices. Thus, both stock exchange price indices of developing economies and oil prices provide useful information for explaining price changes.

6. Conclusions

There are a lot of studies in literature analyzing the long term relationship between oil prices and share price level changes. However, no comparative study analyzing the cointegration and causality relationship between share prices and oil prices in two groups as developed and developing economies in the world was found. At that point, with this study it is aimed to fill this gap in literature by the analyses conducted for 282 monthly period from 12:1992 to 04:2016. Brent oil prices and stock exchange index of forty different economies, 23 developed, 17 developing ones, were used in the study. The long term relationship between stock exchange indices and oil prices was analyzed through Pedroni Panel Cointegration test. However, direction of causality between stock exchanges having a long term relationship with oil prices was analyzed through Dumitrescu- Hurlin (2012) test.

Main results that we obtained from this study can be grouped as the following. Firstly, there is a long term relationship between stock exchange indices and oil prices of developed countries. This is also valid for developing countries and oil prices. However, according to the obtained results, the relationship between oil prices and stock exchange price indices in developing economies is stronger according to the cointegration analysis results applied for different economies. According to this result, oil prices and share prices move together. This indicates that price changes in one of them is effective in price changes in the other.

Secondly, there is a one-way causality relationship between Brent oil prices and stock exchange price indices of developed countries. Direction of this relationship is from the stock exchange price index to the oil prices. Thus, general level of share prices of developed countries influences the oil prices. However, oil prices do not influence the general level of share prices. This is against the common view that oil prices influence share prices negatively. Because oil prices do not influence share prices in developed countries. However, share prices influence oil prices.

In developing economies causality relationship is two-way. Thus, share prices provide useful information to explain the changes in oil prices. Also oil prices provide useful information to explain share prices. Accordingly, changes in oil prices in developing economies can be used as a parameter to determine the strategies of share market investors. Share investors in developing markets may develop investment strategies and make decisions by following oil prices.

Also oil in developing economies are intensely used in industry as an important raw material and energy source. No replacement or limited replacement of oil, an important input in developing economies, causes a more sensitive structure of these economies against oil prices. This causes to be influenced from the changes in prices and to influence oil prices. The interaction in these economies with intensive demand for oil is therefore high. Studies to be obtained more specific information may be carried out by grouping the economies in the world according to different economic criteria such as economic cooperation, trade volumes as well as development level in future studies. In addition, models in which the methods that structural breaks are considered are used may be utilized in future studies.

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Macroeconomic determinants of income inequality in India and Pakistan

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Abstract. *The objective of this study is to determine the macroeconomic determinants of income inequality in India and Pakistan. The study uses panel data from 1973 to 2015 and utilizes FEM model to estimate the parameter. Following general to specific methodology macroeconomic determinants of income inequality are found. The study finds the following macroeconomic variables as determinants of income inequality i.e. per capita GDP, government consumption expenditure, fertility rate, value addition by agricultural sector, per capita arable land, urban population, and globalization. Special attention must be given to reduce high fertility rate, especially in the lower class of the society.*

Keywords: income inequality, macroeconomic determinants, panel data, India, Pakistan.

JEL Classification: C23, E66, I38.

1. Introduction

Poverty and inequality are interrelated, in many countries poverty is due to the inequitable distribution of resources. The society in which there is no equality in distribution of resources then the poor becomes poorer and leads to worsening condition of that society. Development in developing countries increases inequality as the population shifts from lower income and less unequal sector to higher income sector of the economy. It is generally believed that income distribution has strong relationship with redistribution policies and effect the investment and working conditions of a country. Concentration of income in few hands effects the development of human capital and physical assets.

Two important issues that have been addressed in the literature are factor responsible for income inequality and existence of Kuznet (1955) inverted U-shaped relationship. A number of studies are conducted on cross-country to find the relationship between inequality and growth (Barro, 2000; Forbes, 2000; Azzoni, 2001; Beckfield, 2009; Bandelj and Mahutga, 2010). However, few studies have explored the relationship of income inequality with macroeconomic variables (Feenberg and Poterba, 1993; Mocan, 1999). The decomposition of income inequality into different income groups or sector of economy (e.g. agricultural or industrial sector) is another dimension of research (Cowell, 1988; Shorrocks, 1982a; 1982b; Bourguignon and Morrisson, 1998).

India and Pakistan share a long social, economic and political history before partition. Since, independence both the countries are facing similar socioeconomic challenges, while income inequality is the major challenge faced by both the countries. The gains from growth are spread unevenly in India and Pakistan, some segments of the population left behind in absolute as well as in relative terms (Chaudhuri and Ravallion, 2006). Monetary measures of income inequality in India and Pakistan shows Gini coefficient of 0.34 and 0.29 respectively. However, nonmonetary indicators of well-being show much darker picture of both the countries. Both the countries have worst human development outcomes worldwide. India and Pakistan have some of the highest infant mortality rates and under-five child mortality rates (Rama et al., 2015).

Therefore, in order to tackle income inequality, it is necessary to find the determinants that contribute towards income inequality. The objective of this study is to determine the macroeconomic determinants of income inequality in India and Pakistan. This study will shed light on different macroeconomic factors that are contributing towards income inequality positively and negatively in both the countries. The results of the study will indicate those sectors of the economy which are needed to invest in order to eradicate income inequality.

The remainder of the paper is organized in the following manner. Previous literature is discussed in Section 2. Methodology and data are described in section 3. The empirical results on the determinants of inequality are analyzed in section 4. Section 5 contains concluding remarks and policy recommendation.

2. Literature review

A large number of studies have been conducted to explain the income inequality relation with different macroeconomic variables.

Milanovic (2000) investigated the level of income inequality among 80 countries for 1980. He estimated the standard Kuznet's curve by incorporating economic policies, regional heterogeneity and level of per capita income and then augmented it by incorporating social-choice factors. He found that in rich countries income inequality decreases due to their economic factors and their ability to grow rich.

Odedokun and Round (2004) investigated the relationship between growth and inequality as well as determinants of income inequality in African countries. They found that share of labor force in agricultural sector, regional factors, level of economic development, size of government budget as well as land and human resource endowments are main determinants of income inequality. They also found the negative relation between inequality and growth.

Okatch (2013) explored the determinants of income inequality in Botswana. Firstly, the study has used Field (2003) methodology of decomposing income inequality to find the channels of income inequality at household level. The study adopted the methodology proposed by Shorrocks (1982a) to further decompose inequality by using different income sources. The results of former methodology concluded that primary education level and age have negative relation with income inequality, while secondary education level, number of children and working adults have positive relation with income inequality. The results of latter methodology indicated that wages are vital determinant of income inequality in Botswana.

Lee, Kim and Cin (2013) identified the determinants of income inequality in Korea. The time period for testing both Kuznet's inverted U-shaped and Barro's U-shaped relationship between inequality and economic growth is from 1980 to 2012. They found neither Kuznet's nor Barro's hypothesis hold in Korean economy. The most important and crucial determinant of income inequality in Korea is aging population while share of investment in GDP has negative relation with income inequality.

Skare and Stjepanovic (2014) examined the determinants of income distribution and income inequality in 200 countries. They found that many macroeconomic variables like exports, unemployment, labor force and population have strong impact on income distribution regardless of difference in their income level.

Few researchers examined the impact of selected macroeconomic variables on income inequality. However, Gini index has been used to measure the income inequality and regressed against different micro and macroeconomic variables.

Li and Zou (2002) examined the relationship between inflation, income inequality and economic growth. They conducted a panel data analysis for 46 countries and covered a time period from 1952 to 1992. The inflation causes more unequal distribution of income and support the concentration of income in the hands of rich people. The study found negative relation of inflation with economic growth.

Yue (2011) analyzed the relationship between income inequality, economic growth and inflation. He conducted the analysis on Korea for the period of 1980 to 2002. The error-correction model of the study indicates that there exist long run relationship between income inequality and economic growth. He also found that there is no relation between inequality and inflation in long run.

Thalassinos, Ugurlu and Muratoglu (2012) examined the paradox of inflation and income inequality nexus. They conducted the analysis for 13 European countries for the period 2000 to 2009. By adopting panel data techniques, they confirmed positive and significant impact of inflation on income inequality.

Rehman, Khan and Ahmed (2008) explored the determinants of income inequality in 51 countries for the period 1975 to 2002. The study confirmed the existence of inverted U-shaped relationship between income inequality and growth in these countries. They concluded that government consumption, financial development, per capita GDP and population growth rate are the main determinants of income inequality.

Sarkar (2008) worked on persistent income inequality in different income groups. He used child mortality and fertility in overlapping generation model. The study found that interaction of differential child mortality with child fertility led to a trap of income inequality in low income countries that prevents poor people to spend on education of their offspring's. He also concluded that one important factor that transmit income inequality is differential child mortality.

Khuhro et al. (2012) analyzed the impact of foreign aid on income inequality. They found that foreign aid contributes to income inequality in middle and lower income regions.

Herzer and Nunnenkamp (2012) examined the relationship between foreign aid and income inequality in 21 countries for the period 1970 to 1995. They used panel co-integration technique and used FMOLS and DOLS to check the existence of endogeneity and serial correlation in data. The study concluded that foreign aid increases income inequality among selected countries.

Meschi and Vivarelli (2007) examined the relationship between globalization and income distribution. They used a dynamic model consisting of 70 developing countries to examine the impact of trade liberalization on income inequality for the period of 1980 to 1999. The study found weak relation between trade and income inequality.

They conclude that trade with high income countries leads to high income inequality in developing countries.

Velde and Morrissey (2004) worked on FDI and wage inequality. They conduct the analysis on five East Asian countries over the period 1985 to 1998. The panel regression analysis confirmed that FDI is not reducing wage inequality. They found inequality increasing effects of FDI in Thailand because FDI increasing the wages for both skilled and unskilled workers. They suggested that countries should effectively utilize FDI especially they promote investment in human capital.

Herzer and Nunnenkamp (2011) examined the relationship between foreign direct investment and income inequality. They used a sample of 10 European countries for the time period ranging from 1980 to 2000. The study used causality and panel co-integration techniques and found that income inequality is directly affected by FDI in short run, while in long run FDI has negative relationship with income inequality.

Franco and Gerussi (2013) examined the effect of inward FDI and trade openness on income inequality. Their analysis was based on 18 transition economies for the period 1990 to 2006. They found insignificant impact of FDI on inequality. They concluded that trade openness has positive relation with inequality in short run and negative in long run.

3. Methodology and data

The study uses the following simple model in order to determine the determinants of income inequality:

$$GINI = f(PCGDP, GCON, FER, AGR, LND, KOF, UPOP, FDI, GFCF, ENR, INF) \quad (1)$$

Where, GINI is Gini index used to measure income inequality, PCGDP is per capita GDP a proxy for economic development, GCON is government consumption expenditure used as proxy for fiscal action on inequality, AGR is value addition by agricultural sector, LND is per capita arable land a proxy for natural resource endowment, FER is fertility rate, KOF index is used as a proxy to measure globalization, UPOP is urban population a proxy for urbanization, FDI is foreign direct investment, GFCF is gross fixed capital formation used as proxy for investment, INF is inflation rate, ENR is gross enrolment ratio of secondary education a proxy for human capital.

This study is utilizing the panel data because it provides better estimates than cross-sectional and time series data. Panel data estimates are more efficient as it decreases collinearity among explanatory variables by using large degree of freedom and control individual country heterogeneity and minimizing misspecifications. Two most famous techniques used in panel data estimation are Fixed Effect Model (FEM) and Random Effect model (REM). Hausman specification test is applied to check whether FEM or

REF is suitable for estimation. However, if number of cross sections is less than time period then FEM is better than REF.

3.1. Data

Panel Data is collected for India and Pakistan from 1973 to 2015 at annual frequency. Income inequality is measured by Gini index (GINI). The data for Gini index is collected from World Income Inequality Database (WIID). However, Gini index includes various missing values, to encounter this issue the data is interpolated through exponential smoothing for both the countries. Data for per capita GDP (PCGDP), government consumption expenditure (GCON), value addition by agricultural sector (AGR), per capita arable land (LND), fertility rate (FER), urban population (UPOP), foreign direct investment (FDI), gross fixed capital formation (GFCF), gross enrolment ratio of secondary education (ENR), and inflation rate (INF) are taken from World Development Indicator (WDI). The data for KOF index (KOF) is taken from KOF index of Globalization.

4. Results

The study has estimated five models through FEM by adopting general to specific methodology. Starting from Model-I, insignificant variables are excluded one by one, while Model-V is the final model. Model-V indicates the macroeconomic determinants of income inequality in India and Pakistan. The results of all the models are given in table1.

Table 1. *Determinants of income inequality*

Variable	Model - I	Model - II	Model - III	Model - IV	Model - V
C	-4.2931 (5.111)	-5.0554* (2.6419)	-2.2331 (5.3648)	-6.6103*** (0.5497)	-15.2316*** (2.5731)
PCGDP	0.0026*** (0.0007)	0.0022* (0.0013)	0.0016 (0.0023)	0.0029*** (0.0005)	0.0036*** (0.0002)
GCON	-0.2132 (0.2121)	-0.2024 (0.2330)	-0.3390** (0.1515)	-0.3531** (0.1479)	-0.5508*** (0.0266)
FER	4.2914* (2.2996)	4.3450** (2.0549)	3.8120* (2.0979)	4.6506*** (1.2021)	6.6928*** (0.0073)
AGR	-0.0178 (0.0300)	-0.0237* (0.0123)	-0.0245 (0.0284)	-0.0262 (0.0253)	-0.0366** (0.0167)
LND	4.1028 (6.7772)	2.3946 (3.0357)	3.0621*** (0.6886)	4.4224 (3.1984)	-2.2247*** (0.1866)
UPOP	1.4696 (1.7059)	1.6156 (1.9773)	1.9831 (1.7869)	1.4321 (1.1061)	1.1317** (0.5009)
KOF	0.3569*** (0.0569)	0.3710*** (0.0156)	0.3306*** (0.0684)	0.3754*** (0.0615)	0.4791*** (0.0199)
FDI	0.3395*** (0.0327)	0.3030** (0.1228)	0.0790 (0.0915)	0.0879 (0.0615)	----
GFCF	0.0019 (0.0028)	0.0026 (0.0042)	0.0027 (0.0035)	----	----
ENR	-0.0388 (0.0453)	-0.0481 (0.0638)	----	----	----
INF	-0.0283 (0.0598)	----	----	----	----
R^2	0.6741	0.6702	0.6410	0.6387	0.6979

Note: ***, ** and * indicates 1, 5 and 10% level of significance respectively Parenthesis shows standard errors.

In Model-I all variables are included, while fertility rate (FER), KOF index (KOF) and foreign direct investment (FDI) are statistically significant and having positive signs. All other variables have no impact on income inequality in India and Pakistan. Starting from bottom, the study has excluded one by one insignificant variables from the model. In Model-II, inflation (INF) has been excluded. In this model per capita GDP (PCGDP) variable become significant at 10% level of significance. There is no change on the significance level of other variables. Model-III excludes gross enrolment ratio of secondary education (ENR). Now, foreign direct investment (FDI) and per capita GDP (PCGDP) have become insignificant, while per capita arable land (LND) and government consumption (GCON) have become statistically significant at 1% level of significance. Model-IV excludes gross fixed capital formation (GFCF), and now only per capita GDP (PCGDP) and fertility rate (FER) have significant impact on income inequality. Model-V has excluded foreign direct investment (FDI) from the model. The exclusion of this variable leads to R^2 value of 0.69. All variables are statistically significant and having their respective relationship with income inequality. Thus, the final macroeconomic determinants of income inequality in India and Pakistan are per capita GDP (PCGDP), government consumption (GCON), fertility rate (FER), value addition by agricultural sector (AGR), per capita arable land (LND), globalization (KOF) and urban population (UPOP).

The final estimated model for determinants of income inequality is:

GINI = -15.2316 + 0.0036*(PCGDP) – 0.5508*(GCON) + 6.6928*(FER)

– 0.0366*(AGR) – 2.2247*(LND) + 1.1317*(UPOP) + 0.4791*(KOF).

Many studies in literature have examined the linear relationship between GDP and income inequality in order to prove Kuznet (1955) inverted U-shaped relationship. The existence of inverted U-shaped relationship among GDP and income inequality is subject to controversy. A rich literature is available that has not confirmed this inverted U-shaped relationship between GDP and income inequality (Bussmann et al., 2002; Choi, 2006; Meschi and Vivarelli, 2007; Grimalda and Meschi, 2008).

Model-V indicates positive relationship between income inequality and per capita GDP (PCGDP) which shows that as economic development increases income inequality also increases. This direct relation between PCGDP and income inequality shows that both India and Pakistan are at the initial stages of development. These results are consistent with the findings of Odedokun and Round (2004). The effects of fiscal action on income inequality are accounted by incorporating government final consumption expenditure (GCON). Both positive and negative relation between government consumption and income inequality exist in literature. The estimated coefficient of government consumption expenditure is statistically significant and showing negative relation with income inequality. It means that as the government expenditure increases income inequality will decrease.

The fertility rate (FER) has significant and positive relation with income inequality. In developing countries like India and Pakistan a high fertility rate is a common social issue. The population which is living below poverty line has higher fertility rate which makes them more vulnerable towards poverty. In order to examine the impact of agricultural growth on income inequality the study has included the growth rate of agricultural value addition (AGR). This variable shows negative and significant impact on income inequality. Lee, Kim and Cin (2013) also found negative and significant relation between agricultural growth and income inequality. In agrarian economy where agricultural sector contributes more to GDP as compared to other sector reduces unequal distribution of income due to increase in free trade agreements with many other economies and generate more employment opportunities. These channels automatically decrease income inequality in an economy.

Per capita arable land (LND) is used to check the impact of natural resource endowment on income inequality. The estimated coefficient of this variable indicates significant negative impact on income inequality. In literature there are mixed results regarding natural resources and inequality. Deininger and Squire (1998) reported a positive relationship between inequality and natural resource endowment. Bergh and Nilsson (2010) found negative relation between inequality and natural resource endowment. Income inequality decreases as the availability of land increases because increase in employment opportunities generated by equal distribution of land which in turn increases the tendency of equal distribution of income. These results are consistent with the findings of Bourguignon and Morrison (1998). Urbanization is major issue in developing economies. Results indicate positive and significant relation between income inequality and urban population (UPOP). Urban population creates unequal distribution of income among different classes of society. There are considerable differences in the income of people living below poverty line and those who are living in well-furnished urban areas.

In order to capture the effects of globalization on income inequality KOF index is utilized. This index capture economic, social and political dimensions of globalization therefore, this is a comprehensive proxy for examining the impact of globalization on income inequality. Most of the studies have used trade openness as a proxy for globalization. The coefficient of KOF indicates positive and significant impact on income inequality. This suggests that globalization has been effective in increasing income inequality. This indicates that as the economies become more open either economically, socially or politically their abilities to access each other's technologies and culture increases and this increase in turn increases income inequality. Because the rich class of a country has more opportunities to develop financially, socially and they can be politically stable as compared to poor class. This situation in a country leads to concentration of money again in few hands. Barro (2000) found that openness

positively affects income inequality in rich nations while decreases inequality in poor economies. Bergh and Nilsson (2010) also found positive relation between income inequality and globalization by using KOF index.

Foreign direct investment (FDI), gross fixed capital formation (GFCF), gross enrolment ratio of secondary education (ENR), and inflation (INF) are proved to be insignificant. FDI is showing positive and significant impact on income inequality in Model-I and Model-II but later on it becomes insignificant. This indicates that in both India and Pakistan FDI is not increasing labor demand, transfer of technology and employment opportunities which lead to unequal distribution of income in the economy. These results are consistent with the findings of Lee, Kim and Cin (2013).

Investment measured by gross fixed capital formation (GFCF) has positive but insignificant impact on inequality. This indicates that in both economies investment is not affecting income inequality. Bourguignon and Morrisson (1998) found negative relation between skilled labor force and income inequality. However, secondary school enrolment ratio (ENR) is used to incorporate human capital but result suggests negative but insignificant impact on income inequality in India and Pakistan. This may be due to the fact that the share of skilled labor in total labor force is not enough which creates inequality in income. The impact of inflation (INF) on income inequality is ambiguous in the literature. Many cross-country studies found insignificant impact of inflation on inequality. Usually, the impact of inflation is considered with wealth distribution rather than income distribution (Lee et al., 2013). Our results suggest negative but insignificant impact of inflation on income inequality in India and Pakistan.

5. Conclusion

The society in which there is no equality in distribution of resources then the poor becomes poorer and leads to worsening condition of that society. India and Pakistan are the two major players of the South Asian region and share a long social, economic and political history before partition. This study explores the macroeconomic determinants of income inequality in India and Pakistan from 1973 to 2015 at annual frequency. FEM is utilized to estimate the parameter because of larger number of periods than the cross section. Following general to specific methodology macroeconomic determinants of income inequality are found. Some variables are suggesting strong positive impact, while others are discouraging income inequality. The study finds the following macroeconomic variables as determinants of income inequality in India and Pakistan i.e. per capita GDP, government consumption expenditure, fertility rate, value addition by agricultural sector, per capita arable land, urban population, and globalization.

Results show positive relationship between income inequality and per capita GDP, which shows that as economic development increases income inequality also increases.

This direct relation between per capita GDP and income inequality shows that both India and Pakistan are at the initial stages of development. Government consumption expenditure shows negative relation with income inequality, which means that as the government expenditure increases income inequality will decrease. The fertility rate has a significant and positive relation with income inequality, while value addition by agricultural sector shows negative and significant impact on income inequality. The estimated coefficient of per capita arable land proxy for natural resource endowment indicates significant negative impact on income inequality. Urbanization indicates positive and significant relation with income inequality. KOF index captures economic, social and political dimensions of globalization. The coefficient of KOF indicates positive and significant impact on income inequality, which suggests that globalization is increasing income inequality. However, foreign direct investment, gross fixed capital formation, gross enrolment ratio of secondary education, and inflation are proved to be insignificant determinants of income inequality in India and Pakistan.

Based on the results, it can be concluded that that per capita GDP, fertility rate, urbanization, and globalization have positive impact, while government consumption expenditure, value addition by agricultural sector, and per capita arable land have negative impact on income inequality. Therefore, government of both the countries must promote the policies which reduce income inequality, especially in the agricultural sector where majority of the unskilled labour force work to increase their employment level which in turn decrease income inequality in the country. Special attention must be given to reduce high fertility rate, especially in the lower class of the society.

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Urbanisation and inequalities in China and India. Overview and comparative study

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Abstract. *The purpose of the present study is to evidences the overview of urbanisation and inequalities that arise from urbanisation in India and China.*

Design/Methodology/approach. The study uses linear regression model and graphical tools for deriving study conclusions.

Findings. The study finds that both the countries are at different level of urbanisation and both the countries are yet to achieve fully positive synchronisation advantages from urbanisation. The study further finds that both the countries yet to achieve the social and environmental sustainability completely from urbanisation. Government of both of these countries are effective and efficient in providing advanced water resources to its citizens but in terms of providing advanced hygiene to its citizens both of these countries are par below as compared to other nations and need serious attention. Population and pollution are the other major reasons that challenged sustainable development for both of these countries. Empirically study finds HDI significant at 5% level and at 10% levels ES becomes significant for urban population growth percentage.

Research Implications. The findings of the study would have high social implication for the policy makers and other decision makers in emerging nations.
Originality/Value. The study is Unique in several senses: The present study discuss about the operational efficiency of government of both the countries in providing basic facilities like water resources and sanitation. The study set up a benchmark for the other BRIC nations or other emerging nations to learn about the success and failure of urbanisation.

Keywords: urbanisation, inequalities, HDI, agglomerations, sustainable growth, environmental sustainability.

JEL Classification: R11, I24, O1, O2, O57, P25.

1. Introduction

Among the BRIC countries especially China and India are always a topic of interest for researchers, investors and policy makers. For the past few decades these two countries among the BRIC nations shows rapid development and have huge potential to develop in the future. Goldman Sachs analysts predicted that by 2050, China and India become the first and third largest economies followed by Brazil and Russia at fifth and sixth place. Due to rapid technological advancement and globalisations both of these countries seen high growth in their economies and have capability to become the future superpower (Klasen and Nestmann, 2006). As a consequence of it, large number of human shift or concentration observed in the urban areas. The process of gradual shift of people from rural to urban areas is known as the urbanisation. Urbanisation leads to swift and rapid changes in the human predominant culture. Urbanisation opens up avenues for various dangerous anthropogenic activities those results into serious impact in the geography, society, economy, urban planning and public health etc. (McKinney, 2002). Due to urban transition several challenges emerges and leads to unsustainable development and inequalities that retard the growth (Castells-Quintana and Royuela, 2015). Among BRIC countries China and India is growing at very high speed and are state of urban transition state. Hence, there raises a question that whether China and India able to achieve sustainable urbanisation or not?

Presently both of these countries have taken stock of deficiencies in urban structure, various aspects of smart city development, expanding slums and the need for ensuring liveable and sustainable human settlements, financing urban infrastructure and reforms required to enable urban renaissance in member countries. Both these countries are at different levels of urbanisation and the government of both these countries facing problems in managing urbanisation (Acolin et al., 2014). Hence, the present study will evidence the individual country experiences and approaches to emerging challenges. The study will discuss about the operational efficiency of government of both the countries in providing basic facilities like water resources and sanitation etc. Further study will investigate about the several inequalities arises due to urbanisation in these countries as the nature or intensity of the inequalities are not same in these countries. The study will set up a benchmark for the other BRIC nations or other emerging nations to learn about the success and failure of urbanisation. Hence, the government and policy maker of the emerging nations will gain advantage from the study result and enable them to well-planned and guided urbanisation to take advantages of urbanisations. Literature of review discussed immediately end of this section. The Section 2 of the paper deals with the data and methodology, followed by Section 3 that discuss about the overview of urban population. Section 4 discusses about the government operational efficiency followed by the social and environmental sustainability in Sections 5 and 6 then empirical justification covered in Section 6 and the paper concluded with discussing the policy implications and lesson to the other nations.

Literature review

Cali (2008) empirically studies on the urbanisation on the India's states and town and concludes with three aspects of Indian urbanisation. In the first part of the study it addresses the rural-urban parities and its effect on economic development and found that the results support the U shaped relationship between rural-urban disparities in socio-economic indicator with the level of economic development. The part two of the study finds that there is a negative correlation between the growth of the country and urbanisation. Finally study finds that there are convergences in growth rates among all Indian towns over the century and more agglomerations towards the biggest cities. Kanbur and Zhuang (2003) study on the urbanisation and inequalities in Asian four Asian countries namely China, India, Indonesia and Philippines. The find that urbanisation increases inequality by 15% in India whereas China mange to reduce the inequalities. Due to urbanisation income inequalities increases in both India and China by 50% and 33%, respectively. The study also answer how the urbanisation will affect in future in these countries and found that China has reach the turning point and holding urban-rural inequalities and income ratio will reduce the income inequalities at the level and is just reverse in case of India. The study uses four inequality variables due to urbanisation out of them rural-urban income parity is going to affect most both of these countries. Tripathi (2013) study tries to understand the past and current trend of urbanisation of India. The study evaluates the outcome of various government policies and programmes on urbanisation of India. The study finds that higher urbanisation leads to reduction of poverty and inequalities and in turns leads to overall economic development. Hence, government should incline its policy towards higher urbanisation. Colmer (2015) study on urbanisation in India finds that after the independence urbanisation happens at slower rate than other countries at the same level of urbanisation. Study also finds that the population in India is mostly concentrated in the big cities. The study uses six big cities and finds there is a spatial inequality in India. The study concludes that the urbanisation is bit complicated and policy makers need to be very careful while designing the policy. After 1978 China experience the highest flow of human capital from rural to urban and Zhang and Shunfeng (2003) study give empirical justification to the urban shift during 1978-99 in China. The study find that inter and intra rural-urban gaps encourage migration in China for the study period. On the other hand geographical distance discourages migration from rural to urban in the period in China. Sicular, Ximing, Gustafsson and Shi (2007) study evaluates size of the urban-rural gap, its contributions to overall inequalities and the factors for urban-rural gap in China during the period 1995 and 2002. The study find that the rural-urban gap size in China is more than global average and its contribution to the overall inequalities is also large. The major factor behind the rural-urban inequalities is education and location of the house hold is important factor for urban-rural inequalities but not to family size, landholdings etc. Chaudhuri and Ravallion (2008) study addresses the uneven growth in India and China and its effect on poverty and inequality. The study finds that there is indeed uneven growth in sectors, geography and at house level in these countries. Later study try to

understand the reason for inequalities and found few inequalities are good and few are not. Hence suggest for structure of policies to preserves these good inequalities and investment should be made to innovate. On the other hand to mitigate the bad inequalities investment should be made in infrastructure development and human capital development. Form the last few decades' structural transformation seen in case of both India and China. There is a shift from tradition agricultural economy to services and manufacturing economy. Hnatkovska and Lahiri (2015) study address on the urbanisation, structural transformation and rural – urban inequalities in India and China. The study finds significant difference between the rural-urban wage inequalities in these two countries. From the above literature review it is concluded that the urbanisation and inequalities in India and China is very different. Hence, the present study will overview the urbanisation and inequalities arises from it by doing a comparative study between India and China.

2. Data and methodology

All data that are used in the study are taken from the United Nations online database and World Bank online databases. Population density (people per sq. km of land area), Urban population (% of total population), Urban population growth (annual %), Population in urban agglomerations of more than 1 million and Population in the largest city (% of urban population) yearly data from 1960-2015 are used. Improved water source, urban (% of urban population with access), Improved sanitation facilities yearly data used from 1990-2015 are used. Urban (% of urban population with access), Human development Index, CO_2 emission per capita (tonnes) and Natural resource depletion (% of GNI) yearly data used from 1980-2015 are used. Simple regression model and various graphs are used to derive the conclusions. The regression model used is defined as follows:

$$(\text{Urban Population Growth Rate})_t = a + b\,(HDI)_t + s\,(ES)_t + e_t \quad (1)$$

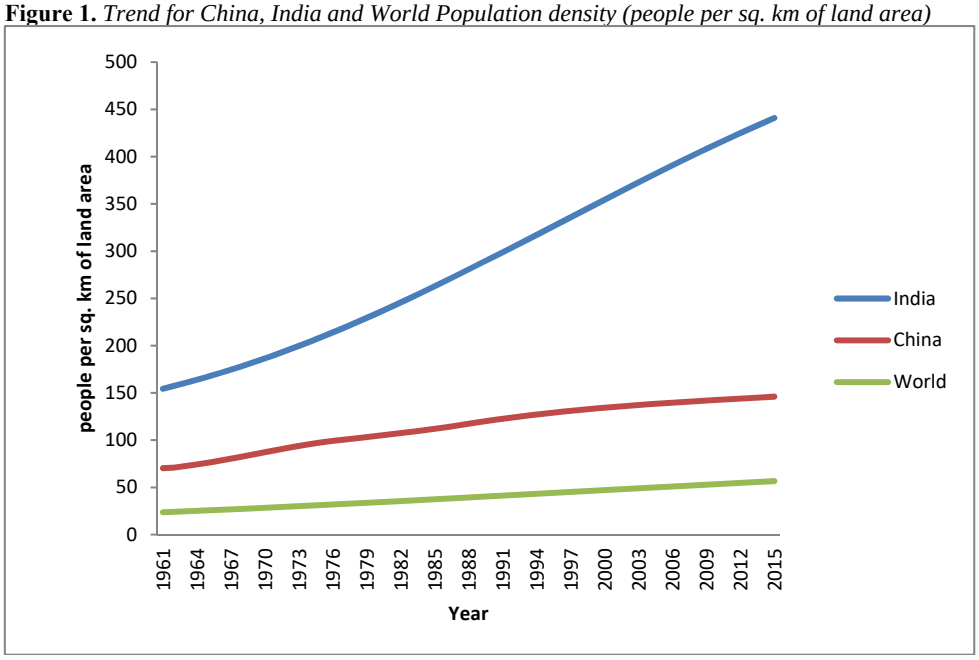
Where:
Urban Population Growth Rate is the dependent variable;
HDI is Human Development Index;
ES is Environmental Sustainable index constructed from equal weight of CO_2 emission per capita (tonnes) and Natural resource depletion (% of GNI);
e_t is error term;
a, b are constant.

3. Overview of urban populations in China and India

3.1. Population density (people per sq. km of land area)

Figure 1 below shows the trend of population density measured in terms of people per square kilometre of land for China, India and world between the periods of 1961-2015.

Figure 1. *Trend for China, India and World Population density (people per sq. km of land area)*

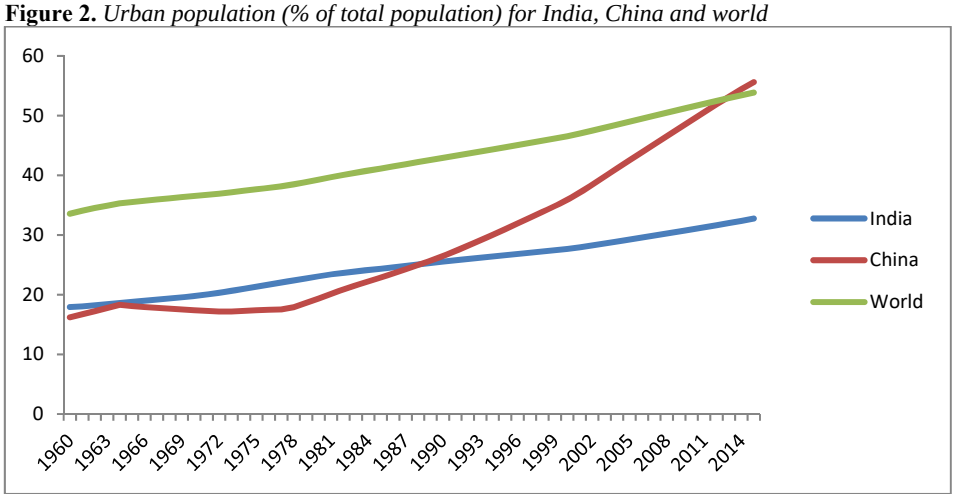


From the above picture is it clear that there is increase of population all over the world since 1961. India shows very high step slope of growth as shown in blue colour line. It is also observed that average population density of both India and China is well above the average population density of the world. It is observed that growth rate of population density is highest for India followed by China due to technological changes (Klasen and Nestmann, 2006). This uncontrolled population growth become major problem for both these countries and directly affected the economic performance of these countries (Lozeau, 2007; Lakshmana, 2013).

3.2. Urban population (% of total population)

The below Figure 2 shows the percentage of urban population as a total population for India, China and world. Urban population percentage as percentage of total population increases over the year for India, China and world as a whole and will continue (White and Subedi, 2008). Significant growth in the percentage of urban population or urban shift is observed for China since 1978 due to massive industrialisation and in the year 2013 it crosses world average of (52.94%). From the below graph it is concluded that there is high inequality persists in India in terms of urban and rural population. Only 32% of the total population of India resides in cities (Indian online pages) whereas in most of the developed countries more than 80% population resides in cities.

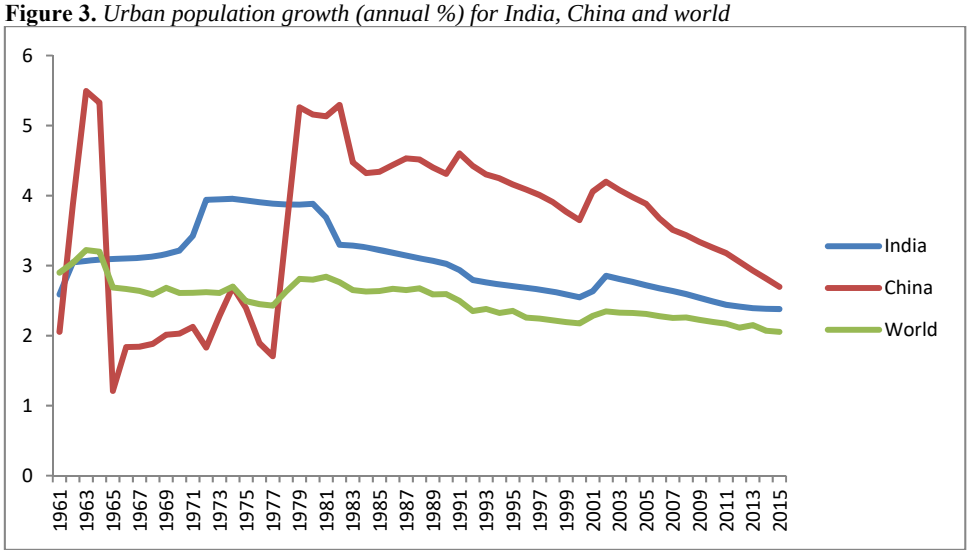
Figure 2. *Urban population (% of total population) for India, China and world*



3.3. Urban population growth (annual %)

It is important to look into the urban population growth percentage annually and also need to analyse whether the urban population is aggregated in some places and makes it very much overpopulated. It is not always possible to extract the relationship between the urbanisation and urban population growth (Peng et al., 2011) due to several constraints. Figure 3 below shows the urban population growth (annual %) for India, China and world.

Figure 3. *Urban population growth (annual %) for India, China and world*



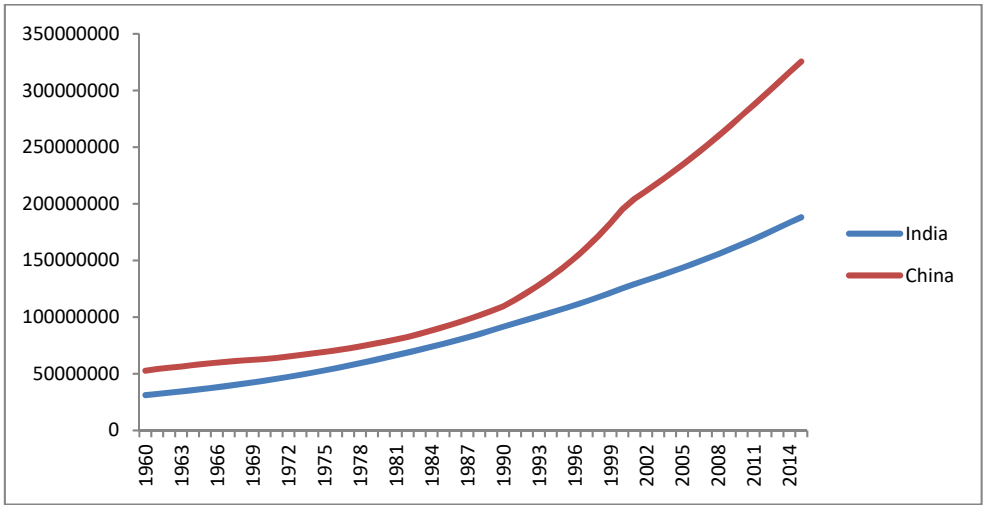
Overall there is a decrease in the urban population growth percentage observe for China, India and world. Between the year 1963 and 1980 China shows peculiar growth pattern as it was in the initial transition state. From 1990 onwards sharp decrease seen in the urban

population annual growth percentage due to several reasons like migration to other cities, environmental issues etc. Similar situation observed in case of India also due to short migration and return in migration (Chandrasekhar and Sharma, 2015).

3.4. Population in urban agglomerations of more than 1 million

Urban agglomerations (UN Report, 2014) are very important to understand because it gives an indication about the synchronisation. The positive effect of urban agglomerations is that country will get economies of scale in productions and important for the sustainable development. On the other hand negative effect of the urban agglomerations is that environment pollutions and inequalities. So, it is important to understand the effect of urban agglomerations and its effect on China and India. The Figure 4 below shows the population in urban agglomerations of more than 1 million for China and India. The figure indicates that over the period of time since 1960 the population in urban agglomerations of more than 1 million for both China and India is increasing. Higher slope observed in case of China from 2000 onwards. Gujuraj and Sudhira (2012) study find many new cities formed in India due to urban agglomerations. Due to the positive effect of urban agglomerations China is able to produce cost effect products or in other words China achieves economies of scales in production. Similarly on the other hand India in terms of services has economies of scales and can provide reliable and cheaper services. The bad effect of urban agglomerations is that harness of the natural resources and leads to several anthropogenic activities that in terms lead to severe pollutions.

Figure 4. *Population in urban agglomerations of more than 1 million (% of total population) for India and China*



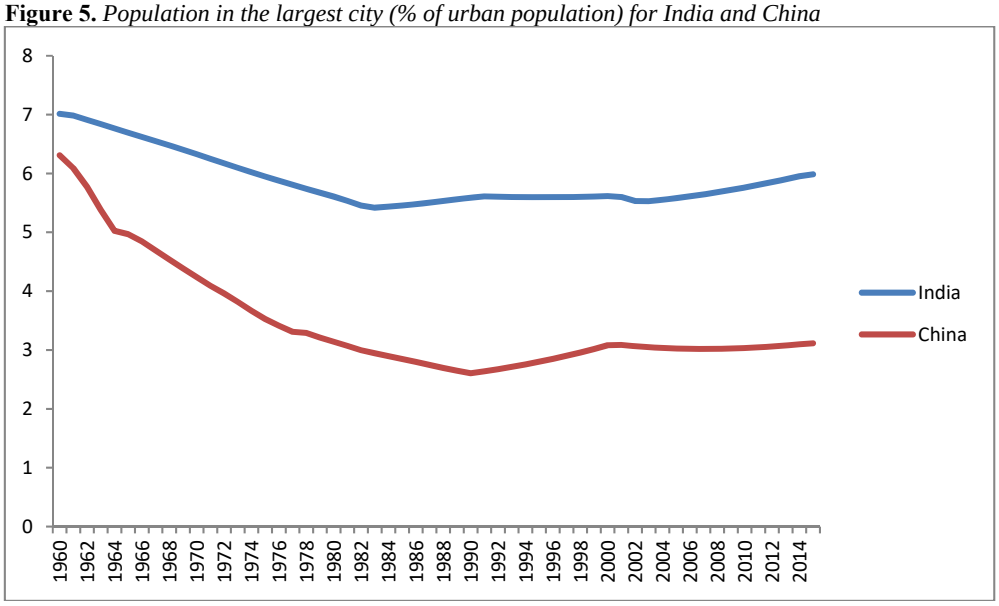
Due to urban agglomerations negative effect China is having the most polluted cities and need of sustainable development. Parallel to China, India's urban agglomerations also increase and due to which the pollution level is increasing but presently at very much lower than China. The ill effect of urban agglomerations is Beijing in China and New Delhi in

India is listed among the most polluted cities. These two cities are also having a high population density and now a segment of the population of the city is migrating to other parts. Due to which one can see inequalities presides in both this countries.

3.5. Population in the largest city (% of urban population)

It is clear from the above paragraphs that population in urban agglomerations of more than 1 million for the both the countries are increasing Y-O-Y. Next it is important to understand whether the percentage of urban populations that are actually residing in the big cities of these countries. Population in the largest city (% of urban population) for India and China are shown in the Figure 5 below. From the figure it is observed that in India more percentage of the total urban population resides at the big cities. The reason might be India is having very few numbers of big cities with all amenities and facility as needed by a human to survive. On the other hand China only very few percentage of the total urban population resides in the big cities and the living pattern of population in Chinese big cities is bit complicated (Chan, 2012). The reasons may be pollution, excessive harness of the natural resources, infertility, millionaire effect, development of sub big cities etc.

Figure 5. *Population in the largest city (% of urban population) for India and China*



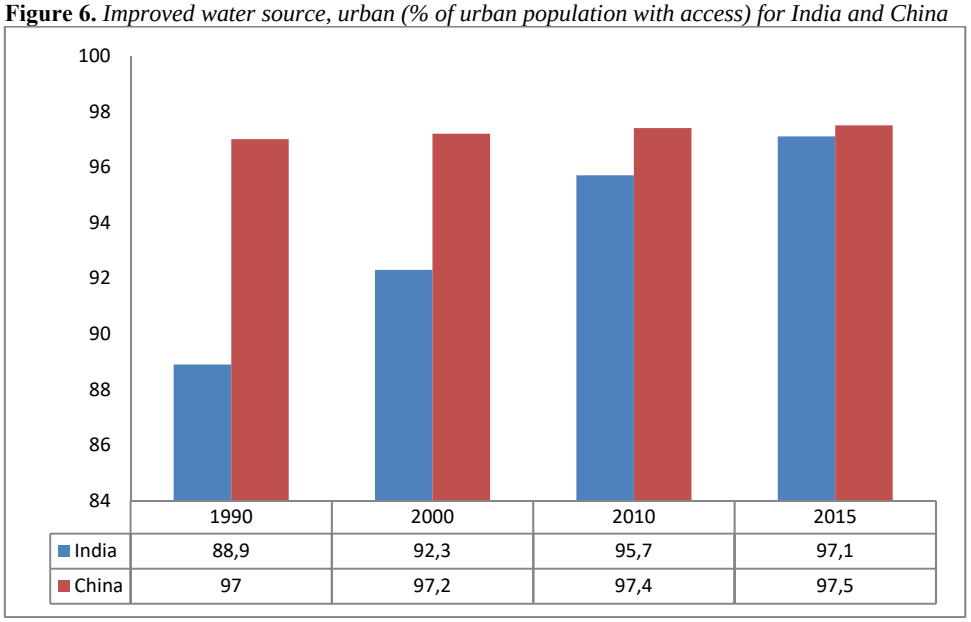
In the above paragraphs it is discussed about the overview of the urban population of both the countries and in the next paragraphs the operational efficiency of government of India and China studied in terms of providing basic amenities like water resources and sanitations is discussed.

4. Government efficiency in providing basic needs

4.1. Improved water source, urban (% of urban population with access)

With rapid urbanisation there is scanty of water and many developed countries are also facing the same problem (UN Report 2014 on 'drinking water and sanitation'(1); UN Habitat report on 'sick water'). In such a scenario it is very much important to evaluate how efficient is the government polices of both these countries in providing them and trends (International planning and urban policy draft paper(2)). The below Figure 6 explains the efficiency of the government in providing the improved water resources for China and India. The government of both the countries are very much efficient in providing the improved water resources to the urban population. Significant growth rate observed in case of India since 1990 that the era of LPG (Liberalization, Privatization and Globalization).

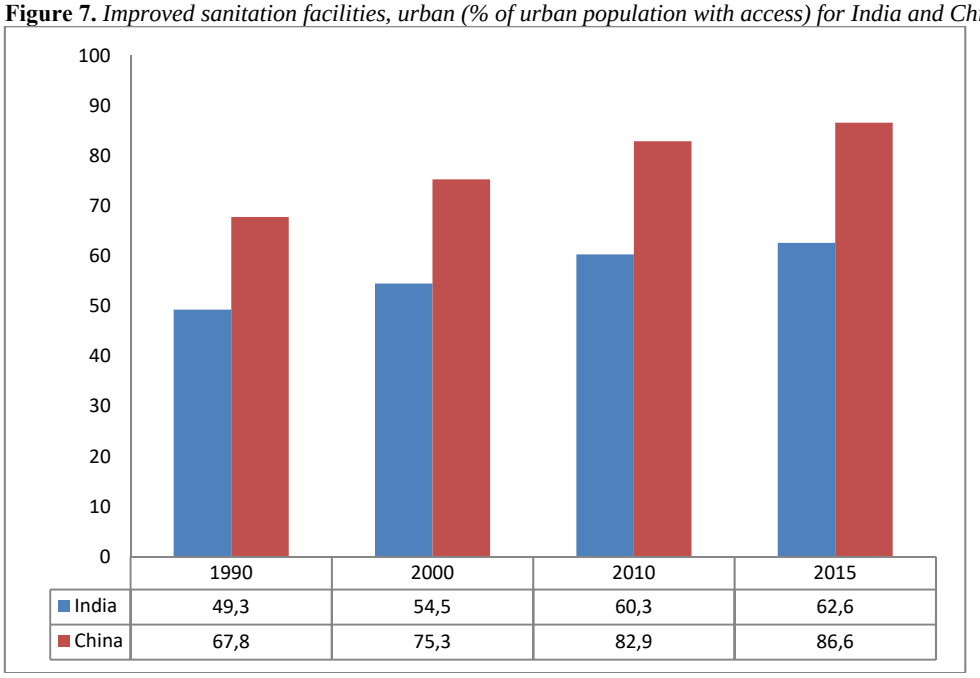
Figure 6. *Improved water source, urban (% of urban population with access) for India and China*



	1990	2000	2010	2015
India	88,9	92,3	95,7	97,1
China	97	97,2	97,4	97,5

4.2. Improved sanitation facilities, urban (% of urban population with access)

Figure 7. *Improved sanitation facilities, urban (% of urban population with access) for India and China*



	1990	2000	2010	2015
India	49,3	54,5	60,3	62,6
China	67,8	75,3	82,9	86,6

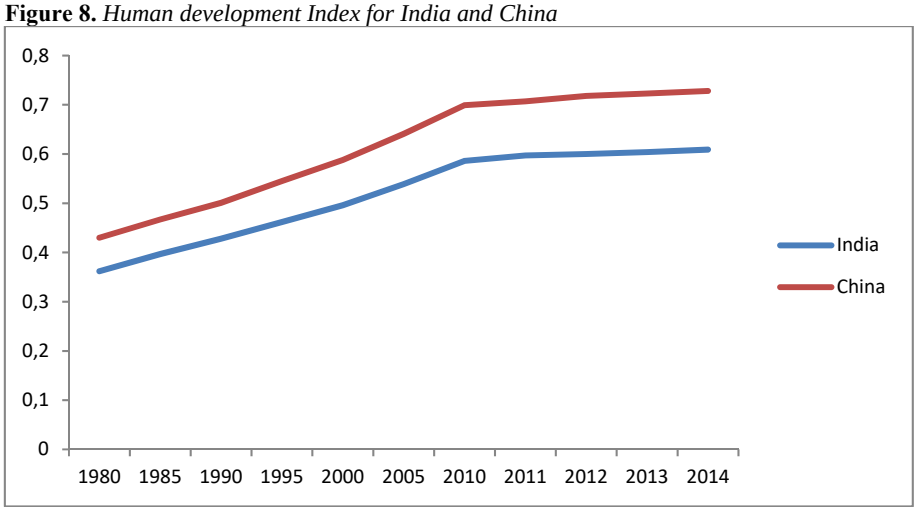
Similarly sanity conditions are also important for a country and for sustainable development improved sanitation facilities are needed as more than millions of children are died below 5 years of age due to unsafe water and basic sanitation problems (WHO and UNICEF report 2006). The Figure 7 below shows the efficiency of the government in providing the improved sanitation facilities for China and India. In terms of improved sanitation facilities to the urban population both India and China lagging behind of other emerging economies like Brazil that achieves (100%) etc. among India and China, India's performance is worst as only 62.6% of the urban population are accessed with the improved sanitation facilities and need serious attention (CEEW 2013 Report[(3)]).

From the above paragraphs it is very much clear that both the countries are at different level of urbanisation and both the countries lack proper synchronization in achieving full benefits from the urbanisations. Zeng, Deng, Dong and Hu (2016) comparative study on BIC nations raises the same question about the issue of sustainability development associated with urbanisation. That leads to no synchronisation in urbanisation several inequalities may arise and our concern with that inequalities that are bad for sustainable urbanisation those are inequalities in term of social sustainability (human development) and environmentally sustainability are discussed in the next paragraphs.

5. Urbanisation and social sustainability (human development)

Several studies by (Rathi, 2006; Shen et al., 2011; Li et al., 2009) find significant relationship between urbanisation and social sustainability. Human development index is one of the powerful indicators to measure the social sustainability. The Figure 8 below shows the Human development Index for the India and China from 1980 to 2014. From the above figure it is seen that since 2007 onwards the HDI for both countries increases and urbanisation is one such reason. HDI indicates among India and China, China able to create greater intensity of sustainable development from urbanisation than India.

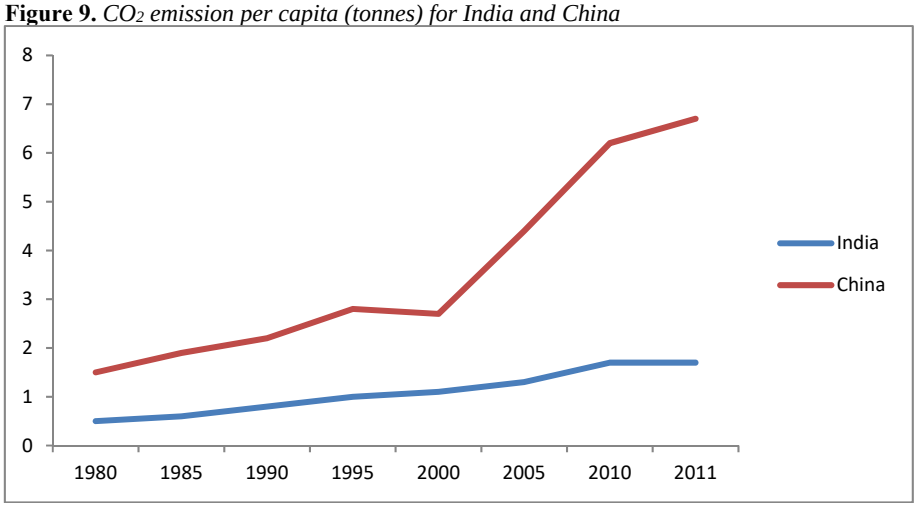
Figure 8. *Human development Index for India and China*



6. Urbanisation and Environmental sustainability

6.1. CO_2 emission per capita (tonnes)

Figure 9. *CO_2 emission per capita (tonnes) for India and China*

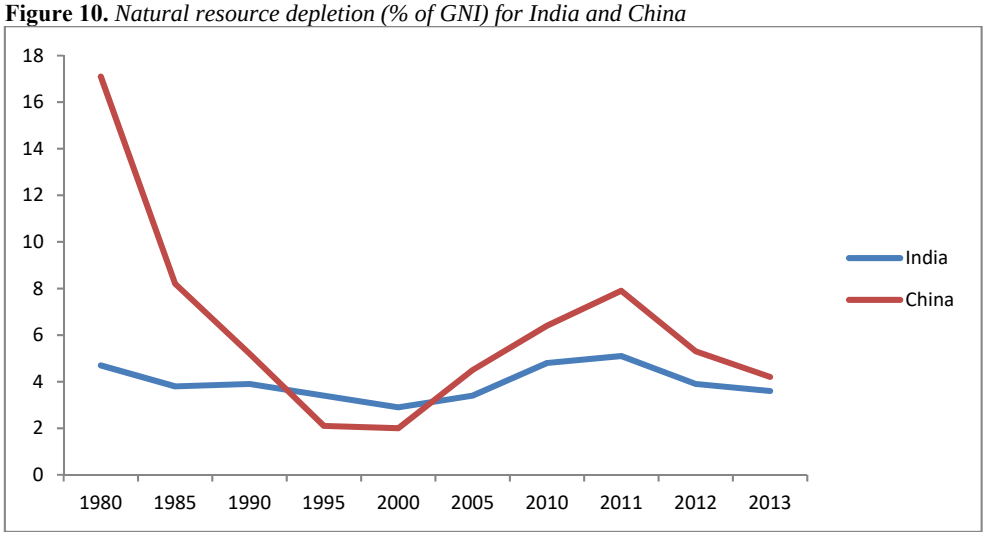


BRIC countries are drawing special attention regarding the amount of air pollution they causes due to rapid development as it affect overall environment condition (Klafke et al., 2015). There is always a direct relationship between CO_2 emission per capita (tonnes) and economic growth (Cheng and Huang, 2013), and it is also true in case of urbanisation. For sustainable development environmental sustainable development is compulsory. Due to which many developed nations are investing in the developing nations in CDM projects to earn carbon credits in terms of capital and technology transfer. Due to technological advancement and investment more and more projects are implemented but at the same time it is necessary to investigate whether the project is environmental sustainable or not? An organisation that emits more carbon emissions induces a social cost and pollutes the environment that is undesirable for the sustainable growth. Hence, a nation's aim is to reduce the CO_2 emission per capita. The Figure 9 above shows the amount of CO_2 emission per capita for India and China. After 2000 the amount of CO2 emission per capita increases rapidly in case of China. Direct usage of energy in both India and China leads to more emissions of CO2 emission per capita (Ahmad et al., 2015). Hence the sustainable energy practices and renewable energy practices by the government of these countries will promote sustainable urbanisation.

6.2 Natural resource depletion (% of GNI)

The Figure 10 below shows the amount of Natural resource depletion (% of GNI) for India and China.

Figure 10. *Natural resource depletion (% of GNI) for India and China*



Rapid urbanisation leads to depletion of natural resources and climate change all over the globe (Steer, 2013). From the above diagram it is clear up to 1990 China has highly depleted their natural resources and still the level is higher than that of India. That implies that China is using more primary source of material to produce goods and less usage for the tertiary goods. Similar in case of India due to rapid urbanisation natural resources like water resources, mineral resources depleted due to high consumption (Nagdeve, 2007).

7. Empirical results

From the above paragraphs we find that the urban population growth rate is having some relationship with certain parameters like HDI and environmental sustainability. To be prove it empirically the regression with urban population growth rate as dependent variable and HDI, environment sustainable index as independent variable for a period of 36 years from 1980 to 2016. Environmental sustainability is composed of CO_2 emission per capita (tonnes) and Natural resource depletion (% of GNI) in equal ratio. The regression results are shown as below:

$$(\text{Urban population Growth rate})_t = a + b\,(HDI)_t + s\,(ES)_t + e_t$$

Table 1. *Regression results*

	C	ES	HDI	R-squared
India	4.350	0.064**	-3.837*	0.761
China	7.390	0.002**	-6.085*	0.874

Note: * significant at 5% level; ** significant at 10% level.

From the above regression result it found that HDI is significant at 5% level and at 10% levels ES becomes significant for India and China.

8. Policy implications and lessons for other countries

It is a challenge to the government of both the countries to balance urbanisation and sustainable development or growth (Acolin et al., 2014). From the above study it is found that over population is one of the problem in both the countries that is actually creating several problems and government of both the countries have taken several measure to control it. Also need further similar kind of steps to continue. Going in depth further it is seen that percentage of urban population is very less in case of India and well below the average of world. China is able to achieve majority of the agglomeration economies of scale and in case of India it far away from it. Comparing India and China it is found that in India more percentage of the urban population prefer to resides in the big cities. So, it is challenge for the Indian government that whether to improve the existing infrastructure or to develop several other cities as a part of smart cities project etc.? (See IIHS report on cities as engines of inclusive development, 2014).

It is right to say that both the countries have achieved some extent of urbanisation but the question which is unanswered is whether it is sustainable development or not? To answer these question two parameters has been evaluated a) government operational efficiencies in providing basic amenities like water and sanitation facilities to the urban population and b) social sustainability and environmental sustainability. On first part it is observed that both the countries government policies are efficient in providing the improved water resources to the urban population. Whereas both the countries still struggling to provide the improved sanitation facilities to the urban population. Both the countries have huge number of population resides in the urban slum. In case of India it is worst. Hence, present initiative of Indian government programme like Swatch Bharat Abhiyan,

bathroom in every household will yield better result in long run. On second part in term of Human Development Index though China ranked much higher than the India but China still have to achieve a lot to become at par of developed nations. Y-O-Y the HDI of India is improving. The ill performance of HDI represents that there exists an inequalities in income, education and health in this countries. Government of both the countries should think of development of sustainable infrastructure and public participations to gain maximum from the urbanisation by synchronisation with the development of human capital. At the same time it is to be noted whether the synchronisation supports environmental sustainability or not. In terms of environmental sustainability China has harness and depleted the natural resource at high rate during the initial phase of urbanisation during 1978 but then onwards it is moving towards sustainability. On the other hand India still have not utilised its natural resources effectively and efficiently. Hence, Indian government should incline their policy for maximum utilisation of the natural resources with less usage of it. The policy should be to develop more products from tertiary goods as like developed nations. To meet the unplanned and unsustainable demand China has emitted the maximum amount of CO_2 in the environment and resulting into high social cost. On that part India's position is still better. But recently New Delhi is listed among the high polluted cities in the world raising a high alarm for the Indian government. So, the decision of Indian government to align its policy towards renewable energy is good for long run. As this project will be mostly funded by the private companies therefore policies should be designed in such a manner so that it should not impose much of restriction as it may kill innovations. Further study evaluates out of a) government operational efficiencies in providing basic amenities like water and sanitation facilities to the urban population and b) social sustainability and environmental sustainability is more related to the urban growth and the regression result found that HDI is significant at 5% level for both India and China. The government of both the country should incline their policy measures to improve the parameters or sub components of the HDI along with measures for environment sustainability. Hence, the present study has provided ample of evidences on urbanisation and its impact on India and China. The study result will help policy makers of both the countries in designing the policy for sustainable growth. To take it for further studies one can do comparative studies for BRICS nations. Also in the present study health factor index was not taken. So, the third factor can be added as the health factor index and how it is related to the urban percentage of population growth for future studies.

Notes

(1) World Progress on drinking water and sanitation 2014, United Nations report published by WHO & United Nations (2014).

(2) World urbanisation prospects 2014, United Nations report published by department of economic and social affairs-United Nations (2014).

(3) Sugam & Ghosh, Urban water and sanitisation in India, CEEW report November 2013 published by council on energy, environment and water (2013).

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Examination of the exchange rate and interest rate channels of the monetary transmission mechanism during the inflation targeting: Turkey and Mexico countries examples*

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Abstract. *In this paper, the efficiency of the exchange rate and interest rate channels were investigated of the monetary transmission mechanism (MTM) in Turkey and Mexico. Quarterly data are used for Turkey 2002I – 2013II period and for Mexico 2001I – 2013I period were analysed for both Countries using the VAR (Vector Autoregressive) and FAVAR (Factor Augmented Vector Autoregressive) econometric methods. Obtained the findings in this paper namely, VAR Model results impulse-response functions showed that partially work of the interest rate channel in Turkey and of the exchange rate channel in Mexico. FAVAR Model impulse-response functions results have pointed out that did not work for both Countries of the exchange rate and interest rate channels.*

Keywords: exchange rate, interest rate channel, monetary transmission mechanism.

JEL Classification: C50, E50, E52, E58.

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1. Introduction

Monetary policy implementations may affect the economies directly or indirectly through specific mechanisms. It is crucial to be anticipated by economic agents the possible impacts and consequences of the monetary policy of the central bank will implement knowledge of the effects on the income level and general price level of the monetary policy changes.

It is defined and categorized in different ways of the Monetary Transmission Mechanism (MTM) concept and its channels. Monetary Transmission Mechanism (MTM) concept refers to the transmission on inflation of the monetary policy decisions (Taylor, 1995). According to Ireland (2005) MTM, is defined as the effects on the real variables of the policy-induced changes in nominal money stock or short-run nominal interest rate. MTM as a general framework, it is the mechanism explaining the effects the overall on the entire national economy indicators such as total production, employment and general price level to conduct monetary policy in a country where the authorities of monetary policy changes. MTM concept, before only when defined the effects on the aggregate demand and aggregate production today the effects on the general price level it will be investigated in addition to the effects on aggregate production.

MTM has been working through some channels. MTM channels classified in different forms generally, it is classified as interest rates, exchange rates, asset prices and credit channels in the literature. Mishkin (1995) examined MTM channels under four headings as interest rates, exchange rates, asset prices and credit channels. Generally, MTM cannels are based on such as classification the MTM literature. Sznajderska (2011) added in addition to the expectations channel to the classification of the MTM channels Mishkin (1995) indicated that the bank loans (narrow credit channel), balance sheet and risk-taking channels in studies conducted in recent years.

On the other hand Boivin et al. (2010) were evaluated in two categories the MTM channels Neoclassical and non-Neoclassical that including financial market shortcoming. Neoclassical channels are considered as the MTM's core channels. Core channels are determined as short-term policy interest rate, long-term interest rates, asset prices and exchange rate. It is classified non-neoclassical channels as credit-based channels.

Bofinger (2001) examined the MTM channels in three portions as quantity theory channel, interest rate channel and expectations channel (Phillips Curve).

Besides similarities there are also differences among the classification describing MTM channels. Mishkin (1995), Boivin et al. (2010) and Sznajderska (2011) were classified more extensive MTM channels. It affects preferred monetary policy instruments and practices in a country transmission process of MTM closely affected by the financial and real variables.

After the crisis, the significant transformations has occurred about monetary policy in some emerging economies where the financial crisis deeply affected. In this context, Central Bank of the Republic of Turkey (CBRT) has included the main purpose of price

stability as well as financial stability for policy purposes on the basis of a new objective composition in monetary policy in the process after the global financial crisis. Mostly as econometric methods Vector Autoregressive (VAR) Model, Vector Error Correction (VECM) and Factor Augmented Vector Autoregressive (FAVAR) Model methods were used in studies on the efficiency of the MTM for developed and developing countries in MTM literature.

In this paper, cause as examples of countries analysis Turkey's and Mexico's preference both countries it is to show similarities in terms of the phases in the economy and due to be implemented inflation targeting regime. There have been important developments both countries in monetary policies implementation after the financial crisis induced with the failure of the stability program applied in the close past.

Before 1980, the monetary policies is applied based on Keynesian Approach in Turkey, after 1980, the monetary policies have been implemented based on Monetarist Approach. Monetarist monetary policies has been implemented but the effects of Keynesian monetary policies has been also seen in nineties years.

The stabilization programs has been implemented based on the fixed exchange rate regime and these programs failed for both countries examined in this article in nineties years.

The Central Bank of the Republic of Turkey (CBRT) has come to more active position in terms of the implementation of the monetary policies with the structural and institutional reforms after the November 2000 and February 2001 crises, CBRT provided the objective and instrument independence with the regulations made in the Central Bank Law No 1211. The inflation targeting regime has begun to be implemented implicit since 2002 and official since 2006.

An economic stabilization program was implemented called “Pacto” and based on fixed exchange rate regime basis in Mexico in 1987. Mexico faced a monetary and finance crisis with the effect of international capital flows together with the financial liberalization process and implemented monetary and exchange rate policies in 1994. After the crisis, it is accepted that a contractionary monetary policy should be implemented and that the Central Bank should be transparent in monetary policy implementations in order to reestablish the credibility of the Central Bank and to reduce inflationary effects. After the monetary and finance crisis, flexible exchange rate regime has been introduced a significant change in monetary policy in Mexico in 1995. A new monetary program was put into practice that annual inflation target is determined the change in the monetary base and flexibility in 1996. In this Country, the inflation targeting regime has been passed since 2001, an annual target of three percent was set since 2003 and short-term interest rates were set as policy interest rates. Beside the monetary policy has begun to be implemented in order to sustain the stability of the national currency as well as economic growth since 2009.

Analyzed in this study and nowadays the official inflation targeting regime implementation changes on monetary policy objectives and instruments applied will also affect the efficiency of the MTM and its channels in a positive way for both countries. After the Global Finance Crisis 2007, it is stated that of the MTM affects the operation in positive way particularly changes about the composition of the monetary policy in Turkey.

The Monetarist Approach is analyzed using VAR and FAVAR methods of the MTM in Turkey and Mexico in the first part of this study, literature of the MTM has been examined. In the second part, econometric analysis was applied using VAR and FAVAR methods in terms of Monetarist Approach of the MTM in Turkey and Mexico.

2. Literature review

Bernanke and Blinder (1992) examined the effect on real variables of monetary policy in the US economy for the period 1959-1989. The data of the paper are monthly and VAR model method is applied in the study. The variables has been determined; industrial production index, manufacturing industry capacity utilization rate, non-agricultural employment, housing construction, retail sales, personnel income, new orders for durable goods in the manufacturing industry, personal consumption expenditures, narrowly defined Money supply, the effective interest rate on funds, the average return of three-monthly treasury bill rate, and the six-monthly treasury bills, commercial paper interest rate, one yearly fixed-term treasury securities.

Bernanke and Blinder (1992) has reached the conclusion that it is effective the monetary policy measured by shocks at the federal fund rate in the US economy for the period 1959-1989. In this context, obtained the findings are summarized in three parts in the paper first; the federal funds rate has been a good indicator for the monetary policy second; nominal interest rate have been a good estimator of real variables and the federal fund rate is an explanatory variable. Third; consistent with the view that monetary policy affects the composition of bank assets. Contractionary monetary policy with effect on bank loans also affected the sales of securities on the assets of the banks in short run.

Sims (1992) has done to investigate the effects of monetary policy on France, Germany, Japan, UK and US, monthly data were used in the study during the period 1965-1990 for France and England, during the period 1961-1989 for Germany, during the period 1965-1991 for Japan, the period 1958-1991 for US. Sims (1992) investigated the responses of other variables to short-run interest rate volatility through a MTM using the VAR model method. In the study, the VAR model consist of six variables (short term interest rate, narrow defined money supply, consumer price index, industrial production index, exchange rate) and four variables (short term interest rate, narrow defined money supply, consumer price index, industrial production index) it has been estimated in two different format. According to obtained the findings in the study, the increase in short-run interest rate has reduced industrial production and level Money stock for five countries during the

periods examined. The consumer price response to for France and Japan while in other countries the response is negative and weak. Obtained the findings, the effects on prices of monetary policy is weak and relatively insignificant in Germany and UK and the effect on production of monetary shocks are weak and negative in all of the countries examined except Germany.

Bernanke and Blinder (1992), Sims (1992) are the reasons why it is taken as priority, they are the first time the VAR method has been used analyzing the effects on macroeconomic variables of monetary policy shocks.

Romer and Romer (2004) examined the effects on production and inflation of monetary shocks in US economy for the period 1969-1996. In the study VAR model method is used, the variables are determined for the econometric modelling; industrial production, consumer price index for final goods and federal fund rate. Obtained the results pointed out that monetary policy is very effective on production and prices in US economy. Accordingly, the implementation of a contractionary monetary policy has affected the production and reducing prices.

Seyrek et al. (2004) examined Monetarist Approach and New Keynesian transmission mechanism in terms of Turkey for the period 1968-1996. The series used in the study in which the externality analysis is applied; money supply, total credit volume, interest rate, price change, GDP. The findings of Seyrek et al. (2004) supported the Monetarist Approach and showed that the money supply variable is exogenous, it shows that this variable can explain other variables along with the total credit volume change. Therefore, the New Keynesian Approach has made the claim of money supply endogen in terms of Turkish economy is invalid.

Bernanke et al. (2005) proposed factor augmented vector autoregressive (FAVAR) model method by improving the vector autoregressive (VAR) model where the effects of monetary policy shocks on the economy are estimated. In this context, they have brought together the factor model and the structural VAR model in FAVAR method.

Bernanke et al. (2005) examined the effects of monetary policy shocks in the US economy with the FAVAR method developed by factor models and structural VAR model methods. In this context, monthly data were used in the study and it was examined during the period January 1959-August 2001. For the study one hundred twenty variables were identified belong to US economy, these variables were evaluated as twelve groups, these twelve groups are composed as twelve groups including real output and income employment and working hours, consumption, housing construction and sales, real stocks and orders, stock price exchange rates, interest rates, Money and loan amount quantities, price indices, other various variables. In these variables groups, assuming that the federal fund rate is the only observable factor the system is shocked by this variable. In the study, the variables are classified as slow-moving and fast-moving. An each of the variables is given the transformation codes. Obtained the findings show that the FAVAR model has method provides a consistent and logical measurement of the economic effects in US

economy during the period 1959-2001. Therefore, while there are decline for real activities and prices following the monetary policy and a decrease for monetary aggregates.

Boivin et al. (2008) examined whether the MTM was influenced by the common currency conditions with the transition to the common currency EURO in six EURO Countries; Germany, France, Italy, Spain, Netherland and Belgium. It was examined during the period 1980-2007 and quarterly data were used in study. Thirty three variables were used for each country in which the FAVAR method is applied in the study. When the variables are grouped in the study the variables are determined such as interest rate variables, real exchange rate, deflator variables, gross domestic product, consumption expenditure variables, foreign trade variables, production related variables, price indices, employment and labor force variables and monetary aggregate variables.

Boivin et al. (2008) obtained the results in their study showed that the responses to monetary policy shocks were different in EURO region countries during the period 1980-2007. When the interest rate shock is applied, the interest rate and consumption response of Italy and Spain are stronger the response of Germany. A homogeneity has emerged in terms of transmission mechanism and a decrease in the effects of monetary shocks has been revealed with the transition to EURO currency.

Butkiewicz and Ozdogan (2009) have examined the role of financial structure based reforms after 2000-2001 crisis in achieving the monetary policy objectives and the effects on MTM channels in Turkish Economy during the period 1996-2007. In the study, firstly it was examined during the period 1996-1999 before 2000-2001 crisis then during the period 2002-2007 after 2000-2001 crisis for Turkey. Obtained the findings supported the financial reforms implemented after the crisis in Turkish economy. In the context, the effects on production of monetary policy shocks was more effective after the crisis and had a weak effect on prices. Also, it was found to be stronger in after crisis period than before the crisis the effect of the exchange rate channel on economy, in Turkish economy during their period 1996-2007. It has been determined that the asset price channel is not active in both periods, the credit channel is operating very poorly and it is only effective in short-run for pre-crisis period.

Büyükakın et al. (2009) examined the exchange rate channel of the MTM in Turkish economy during the period 1990-2007. Monthly data were used VAR model method is applied in the study. The variables determined for VAR modelling of the study; real interest rate, real effective exchange rate index, net exports, gross domestic product with fixed prices, wholesale price index and interbank money market interest rate. In the econometric analysis, it was estimated the dynamic responses of real exchange rate, net export, production and prices against to monetary policy shocks. The findings showed that the monetary policy shocks have had effective on prices and have played an important role exchange rates in MTM in Turkish economy during the period 1990-2007.

Erdoğan and Beşballı (2009) examined the functioning of the MTM bank credit channel by using monthly data during the period 1996-2006 in Turkey. The variables were determined for the econometric modelling of the study such as; total deposit of banks, total credit of banks, total securities portfolio of banks industrial production index, wholesale price index, interbank money market overnight interest rate. According to the impulse-response results, it has been found that the bank lending channel is partially functioning due to financial dominance and the weight of public banks within the financial system in Turkey during the period 1996-2006.

Örnek (2009) tested the effects on real economy and prices of monetary policy shocks, the functioning of monetary transmission channels and the efficiency of these channels by using quarterly data for Turkey during the period 1980-2006. VAR model method is applied and the variables determined for econometric modelling; the real GDP, the interbank money market interest rate, the real effective exchange rate, IMKB national 100 index, the consumer price index and the deposit bank total credits in the study. The impulse-response function and variance decomposition results pointed out that the interest rate and the exchange rate channels are significant and active, the asset price and credit channels are insignificant and passive in Turkish economy during the period 1990-2006.

Boivin et al. (2010) examined the effects of monetary policy shocks on economic activity in Canadian economy for period 1969-2008. Both monthly data and quarterly data were used, VAR model and FAVAR model methods were applied in the study. For monthly data set of the study three hundred and forty eight series were used and for quarterly data set eighty seven series were used. Obtained the results of the study indicated that there is no evidence that the effects on economic activity of monetary policy shocks are significant in Canadian economy during the period 1969-2008.

Boivin et al. (2010) examined the MTM in US economy for the periods 1962-1979 and 1984-2008. The findings of the study using the monthly data and the FAVAR method were applied namely; Neoclassical Channels; interest rate, direct investment expenditures, the substitution in between periods in wealth and consumption are effective but also affect trade through the exchange rate.

Cambazoğlu and Güneş (2011) examined the effectiveness of the MTM channels in Turkish and Argentine economies for the period 2003-2010. Monthly data set were used and VAR model method was applied in the study. For this purpose, five variable VAR models have been established for both countries, the variables determined for VAR model; the interbank money market overnight interest rate, the bank deposits, the bank credits, consumer price index and industrial production index. The responses of the production and the price level against bank loans and overnight interest rates were examined in the study. Obtained the findings point out that money and credit channels are effective in both countries for the period 2003-2010.

Artar (2011) examined the effects of monetary policies implemented in Turkey after 2000 year on selected macroeconomic variables such as inflation, industrial production, IMKB-100 index, real effective exchange rate and current account deficit. VAR model method was employed for the period 2003-2008 using monthly data. According to VAR model results, the effect of interest rate shock on the real and financial variables was found to be limited in short-run while it was more effective in long-run in Turkish economy for the period 2003-2008. Therefore, CBRT's interest rate policy has a weak effect on macroeconomic variables in short-run and it has stronger influence in long-run.

Cambazoğlu and Karaalp (2012) examined the effects of the MTM on total output and prices of the exchange rate channel in Turkey for the period 2003-2013. Monthly data set were used in the study and VAR model method was applied. The variables used for VAR model estimation, short-term interest rate, real effective exchange rate, net export volume, consumer price index and industrial production index. The results of the study show that the exchange rate channel is an extremely active and effective channel in Turkish economy for the period 2003-2013. In this context, the fact that exchange rate channel caused real depreciation after monetary expansion aggregate demand affected positively and caused the inflation rate to increase.

Arabacı and Baştürk (2013) examined the efficiency of the MTM interest rate channel in terms of fiscal dominance. In the study which the VAR model method is employed monthly data are used. The variables used for VAR model estimation of the study; overnight interest rate, government borrowing interest rates, fixed capital formation, domestic consumption of residential households, gross domestic product, consumer price index. According to the findings of Arabacı and Baştürk (2013) has revealed that there are differences between before and after 2004 year the functioning of the interest rate channel in Turkey. The decline in fiscal dominance after 2004 year has emerged as a development the increases the functioning of the interest rate channel in Turkey. On the contrary, if the fiscal dominance is high before year 2004, the efficiency of the interest channel has decreased in Turkey.

Yıldırım (2013) examined the effect on the bank credit channel of the economic integration process using the annual data is twelve members countries of European Monetary Union (EU) including; Germany, Austria, Belgium, Finland, France, Netherland, Ireland, Spain, Italy, Luxembourg for the period 2003-2013. They have been determined the variables for the panel least squares method modelling; output ratio of banks, foreign assets-output ratio of banks, ratio of foreign asset-liabilities of banks and financial crisis 2008, puppet-output ratio, real per capita interest rate, monetary policy interest rate and bank deposits variables.

The results of Yıldırım (2013) show that he monetary policy implemented on the interest rate shock has shown that the shock does not have an effect on the credit volume and the credit channel is not effective.

Table 1. *Literature Summary-1*

Author	Country and Period	Method	Result
Bernanke and Blinder (1992)	US (1959-1989)	VAR	The monetary policy measured by shocks through federal fund rate is influential on real activity.
Sims (1992)	France, Germany, Japan, England, US (1958-1991)	VAR	The findings show that the effect on prices of monetary shocks is weak and relatively insignificant in Germany and England while the effect of monetary shocks on production is weak and negative in all countries except for Germany
Romer and Romer (2004)	US (1969-1996)	VAR	Monetary policy is very influential on production and price s in US economy.
Seyrek et al. (2004)	Turkey (1968-1996)	Externality Analysis	The money supply variable is an external variable in Turkey.
Bernanke et al. (2005)	US (1959-2001)	FAVAR	There has been a decrease in real activities and prices following the monetary policy and a decrease in monetary aggregates in US economy.
Boivin et al. (2008)	Germany, France, Italy, Spain, Netherland, Belgium (1980-2007)	FAVAR	A homogeneity has emerged in terms of transmission mechanism and a decrease in the effects of monetary shocks has been revealed after the transition to the EURO.
Butkiewicz and Ozdogan (2009)	Turkey (1996-2007)	VAR	The effect on economy of the exchange rate channel is strong, while the effect of credit channel is weak before and after the crisis in Turkish Economy. It has been determined that the interest channel is strong after monetary reforms.
Büyükakın et al. (2009)	Turkey (1990-2007)	VAR	It has been found that monetary policy shocks have an impact on prices and the exchange rate channel plays an important role in the MTM in Turkish economy for the period 1990-2007.
Erdoğan and Beşballı (2009)	Turkey (1996-2006)	VAR	It has been found that the bank lending channel operates partly due to financial dominance and the weight of public banks within the financial system in Turkey during the period 1996-2006.
Örnek (2009)	Turkey (1990-2006)	VAR	Interest rate and exchange rate channels are significant and active while asset price and credit channels insignificant and passive in Turkish Economy during the period 1990-2006.
Boivin et al. (2010)	Canada (1969-2008)	VAR FAVAR	Monetary policy shocks don't have an impact on economic activity in Canadian economy.
Boivin et al. (2010)	US (1962-1979) (1984-2008)	FAVAR	The MTM was found to be effective.
Cambazoğlu and Güneş (2011)	Turkey Argentina (2003-2010)	VAR	Money and credit channels are effective in Turkey and Argentina for the period 2003-2010.
Artar (2011)	Turkey (2003-2008)	VAR	CBRT's interest rate policy has a weak effect on macroeconomic variables in short-run and it has a stronger effect in long-run.
Cambazoğlu and Karaalp (2012)	Turkey (2003-2013)	VAR	The exchange rate channel is a very active and effective channel in Turkish economy during the period 2003-2013.
Arabacı ve Baştürk (2013)	Turkey (2001-2008)	VAR	An improvement in the functioning of the interest rate channel a decrease of financial dominantly in Turkey after 2004.
Yıldırım (2013)	EU Countries and Turkey (2003-2010)	Panel Least Squares	Credit channel is not effective in Turkish economy.

3. Econometric methodology

According to the monetarist approach VAR and FAVAR methods have been applied in this section the econometric analysis of the MTM in Turkey and Mexico.

3.1. Data set and variables

The data used in the study were provided by the IFS 2013 CD-ROM published by IMF. The data used are quarterly and cover in Turkey implementation the period 2002I – 2013II. The reason for preferring 2002 as the initial period for implementation is that the year is initial period of the implicit inflation targeting regime in Turkey. The variables and dataset are shown in Table 2 used for Turkey analysis.

Table 2. *The variables and data set information used for Turkey analysis*

Variable	Period	Description
IPI	2002:Q1-2013:Q2	Industrial Production Index (Seasonal Adjustment) (2005=100)
M1	2002:Q1-2013:Q2	Narrow-Defined Money Supply
M2	2002:Q1-2013:Q2	Broad-Defined Money Supply
M3	2002:Q1-2013:Q2	Broadest-Defined Money Supply
DR	2002:Q1-2013:Q2	Deposit Rate
RIR	2002:Q1-2013:Q2	Real Interest Rate
HCE	2002:Q1-2013:Q2	Household Consumption Expenditures
GCE	2002:Q1-2013:Q2	Government Consumption Expenditures
GFCF	2002:Q1-2013:Q2	Gross Fixed Capital Formation
SPI	2002:Q1-2013:Q2	Stock Price Index (2005=100)
CPI	2002:Q1-2013:Q2	Consumer Price Index (2005=100)
ER	2002:Q1-2013:Q2	Exchange Rate (SDR)
ERend	2002:Q1-2013:Q2	Exchange Rate (End of the Period)
NER	2002:Q1-2013:Q2	Nominal Exchange Rate
Imp	2002:Q1-2013:Q2	Import
Exp	2002:Q1-2013:Q2	Export (c.i.f.)
Credit	2002:Q1-2013:Q2	Banking Sector Domestic Credit Volume
Res	2002:Q1-2013:Q2	Reserve Money
SD	2002:Q1-2013:Q2	Savings and Deposits

All variables listed Table 2 used for the implementation of the FAVAR Model, firstly A VAR Model has been estimated some of the variables are selected six narrowed model variables are preferred for Turkey; RIR (Real Interest Rate), Credit (Banking Sector Domestic Credit Volume), IPI (Industrial Production Index, Seasonal Adjustment, 2005 = 100), CPI (Consumer Price Index, 2005 = 100), SPI (Stock Price Index, 2005 = 100), NER (Nominal Exchange Rate).

The data used are quarterly and do include during the period 2001I – 2013I for Mexico Analysis. The reason for the preference of 2001 as the starting year is that the inflation targeting regime has started to be implemented since 2001 in Mexico.

Table 3.*The variables and data set information used for Mexico analysis*

Variable	Period	Description
GDP	2001:Q1-2013:Q1	Gross Domestic Product (Prices in 2003)
IPI	2001:Q1-2013:Q1	Industrial Production Index (2005=100)
MIPI	2001:Q1-2013:Q1	Manufacturing Industrial Production Index
Mining	2001:Q1-2013:Q1	Mining Sector Production
COP	2001:Q1-2013:Q1	Crude Oil Production
M1	2001:Q1-2013:Q1	Narrow-Defined Money Supply
M2	2001:Q1-2013:Q1	Broad-Defined Money Supply

Variable	Period	Description
M3	2001:Q1-2013:Q1	Broadest-Defined Money Supply
M4	2001:Q1-2013:Q1	M4
M4A	2001:Q1-2013:Q1	M4A
MIR	2001:Q1-2013:Q1	Money Market Interest Rate
TBR	2001:Q1-2013:Q1	Treasury Bound Rate
DR	2001:Q1-2013:Q1	Deposit Rate
HCE	2001:Q1-2013:Q1	Household Consumption Expenditures
GCE	2001:Q1-2013:Q1	Government Consumption Expenditures
GFCF	2001:Q1-2013:Q1	Gross Fixed Capital Formation
SPI	2001:Q1-2013:Q1	Stock Price Index (2005=100)
WPI	2001:Q1-2013:Q1	Wholesale Price Index (2005=100)
CPI	2001:Q1-2013:Q1	Consumer Price Index (2005=100)
RER	2001:Q1-2013:Q1	Real Effective Exchange Rate
Exp	2001:Q1-2013:Q1	Exports of Goods and Services
Imp	2001:Q1-2013:Q1	Imports of Goods and Services

The variables and data set used for Mexican analysis are shown in Table 3. All of the series used for the implementation of the FAVAR model were selected for estimation of the VAR model by selecting some of them in Table 3.

3.2. Unit root analysis

Firstly, unit root test have been done in order to determine whether the series are stationary used in the study, after that stationary analysis of all series was performed using Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) unit root test methods logarithmic transformations were performed and all series except NFO and RFO used for Turkey application. The "Schwarz Information Criteria" is based on the implementation of the ADF Unit Root Test with delay (lag) values determined. The ADF Unit Root Test results are shown in Table 4.

Table 4. *Augmented Dickey-Fuller (ADF) unit root test results (Turkey)*

Variable	Level		First Difference		Result
	Intercept No Trend	Intercept Trend	Intercept No Trend	Intercept Trend	
IPI	-1.3961(0)	-2.6191(1)	-5.0387(0)*	-4.9834(0)*	I(1)
M1	-1.9512(0)	-1.9881(0)	-8.1867 (0)*	-8.6002(0)*	I(1)
M2	-2.0440(0)	-0.8576(0)	-6.1482(0)*	-6.5868(0)*	I(1)
M3	-2.0842(0)	-0.9027(0)	-6.1791(0)*	-6.6405(0)*	I(1)
DR	-2.7395(1)	-3.3880(0)	-5.6725(0)*	-5.9716(0)*	I(1)
RIR	-1.9689(0)	-1.6383(0)	-4.9123(0)*	-5.0012(0)*	I(1)
HCE	-2.8714(2)	-2.3890(4)	-5.1354(1)*	-5.7433(1)*	I(1)
GCE	-1.3076(2)	-2.6851(3)	-28.4556(2)*	-30.8665(2)*	I(1)
GFCF	-2.0210(5)	-2.9633(5)	-3.0281(4)**	-4.8037(2)*	I(1)
SPI	-1.5082(1)	-2.5531(1)	-4.7963(0)*	-4.7677(0)*	I(1)
CPI	-2.1413(5)	-2.3074(5)	-3.9762(3)*	-6.0252(4)*	I(1)
SDR	-2.1207(0)	-3.1275(0)	-6.2841(1)*	-5.4977(5)*	I(1)
NERend	-1.6741(0)	-2.1803(0)	-5.9882(1)*	-6.1929(1)*	I(1)
NER	-1.4754(0)	-1.9684(0)	-6.2308(0)*	-6.2102(0)*	I(1)
Exp	-2.0352(3)	-2.4855(2)	-4.3045(2)*	-4.5848(2)*	I(1)
Imp	-2.2436(0)	-2.6491(0)	-3.4710(4)**	-3.6824(4)**	I(1)
Credit	-1.8080(3)	-1.9937(3)	-5.4928(0)*	-5.8820(0)*	I(1)
Res	-0.3683(0)	-2.9800(0)**	-7.6007(0)*	-7.5152(0)*	I(1)
SD	-1.9548(0)	-0.6383(0)	-5.7631(0)*	-6.1671(0)*	I(1)

* PP indicates that the alternative hypothesis is accepted according to 1% significant level.
** PP indicates that the alternative hypothesis is accepted according to 5% significant level.
Note: Values indicate lag values in parentheses.

According to the results given in Table 4, the series are non-stationary in the study according to the levels both intercept-no trend and intercept-trend, 1% and %5 have been made stationary by taking first difference. According to the ADF unit root test results, it is found that all series are stationary in the first difference [I(1)], the series are distributed around a certain average. The lag values were determined based on the automatic selection of "Newey-West Bandwidth" which is the preferred method of spectral estimation "Default (Bartlett Kernel)" in implementation of the Phillips-Perron (PP) Unit Root Test. PP unit root test results are given in Table 5.

Table 5. *Phillips-Perron (PP) unit root test results (Turkey)*

Variable	Level		First Difference		Result
	Intercept No Trend	Intercept Trend	Intercept No Trend	Intercept Trend	
IPI	-1.4295(2)	-2.3006(1)	-4.9108(5)*	-4.8410(5)*	I(1)
M1	-2.7196(9)	-1.9307(4)	-8.1475(1)*	-8.4508(2)*	I(1)
M2	-2.0557(1)	-0.8576(0)	-6.1456(1)*	-6.5959(2)*	I(1)
M3	-2.1024(1)	-0.9027(0)	-6.2219(2)*	-6.6405(1)*	I(1)
DR	-5.0542(5)*	-3.4615(5)	-5.6728(1)*	-5.9805(1)*	I(1)
RIR	-1.9484(3)	-1.8774(2)	-4.8011(5)*	-4.8021(7)*	I(1)
HCE	-3.1141(1)**	-3.3371(1)	-5.9627(3)*	-6.6618(7)*	I(1)
GCE	-1.9049(13)	-8.6494(13)*	-28.0426(11)*	-26.9926(10)*	I(1)
GCFC	-2.9205(7)	-3.2309(3)	-6.3231(4)*	-6.3709(5)*	I(1)
SPI	-1.0112(1)	-1.9495(1)	-4.6582(5)*	-4.5598(6)*	I(1)
CPI	-3.8896(6)*	-8.6839(25)*	-	-	I(0)
SDR	-2.2188(3)	-3.3981(3)	-7.7654(3)*	-8.0363(4)*	I(1)
NERend	-1.7005(2)	-2.2103(2)	-6.8516(2)*	-7.5627(5)*	I(1)
NER	-1.5824(5)	-1.9684(0)	-6.2193(3)*	-6.2252(4)*	I(1)
Exp	-3.1393(11)**	-2.1264(6)	-7.4709(3)*	-7.9050(5)*	I(1)
Imp	-2.9558(13)**	-2.5595(7)	-6.0432(16)*	-6.9233(21)	I(1)
Credit	-1.1562(3)	-1.1377(3)	-5.5914(3)*	-5.8836(1)*	I(1)
Res	-0.1735(9)	-3.1518(2)	-8.6253(7)*	-8.5000(7)*	I(1)
SD	-1.9548(0)	-0.6383(0)	-5.7564(1)*	-6.1733(2)*	I(1)

* PP indicates that the alternative hypothesis is accepted according to 1% significant level.
** PP indicates that the alternative hypothesis is accepted according to 5% significant level.
Note: Values indicate lag values in parentheses.

According to the PP Unit Root Test results all series have reached the first degree [I(1)] result which are given in Table 5 both of which are intercept-no trend and intercept-trend at 1% and 5% significance levels. Thus, the series were distributed around a certain average in long-run. According to the results shown in Table 5, it has been determined that only the CPI series are stationary with respect to the level values [I(0)] and ADF unit root test results differently. In this case, ADF unit root test results are taken as basis.

It was examined whether all the series were stationary firstly, unit root tests were performed except for the series MIR, TBR and DR series are used in the study and belong to Mexico with logarithmic transformations. ADF and PP Unit Root Test methods were used for unit root analysis of the series. Schwarz Information Criteria was used to determine the lag values in implementation of ADF Unit Root Test. ADF Unit Root Test results are shown in Table 6.

Table 6. *Augmented Dickey-Fuller (ADF) unit root test results (Mexico)*

Variable	Level		First Difference		Result
	Intercept No Trend	Intercept Trend	Intercept No Trend	Intercept Trend	
GDP	-3.4293(3)**	-1.8149(3)	-6.4534(1)*	-5.8178(2)*	I(1)
IPI	-1.2418(1)	-2.6853(1)	-3.9936(0)*	-3.9316(0)**	I(1)
MIPI	-1.5074(0)	-2.6082(0)	-7.2150(0)*	-7.1502(0)*	I(1)
Mining	-1.3149(0)	-2.1974(0)	-7.7664(0)*	-7.7705(0)*	I(1)
COP	-0.5534(1)	-2.1712(0)	-8.9880(0)*	-6.5914(1)*	I(1)
M1	-0.1097(4)	-2.4863(4)	-3.8170(3)*	-3.7207(3)**	I(1)
M2	-1.3665(0)	-2.7295(0)	-6.5180(1)*	-6.7457(1)*	I(1)
M3	-0.3668(2)	-3.4848(0)*	-7.3321(1)*	-7.2715(1)*	I(1)
M4	0.5778 (2)	-3.4633(0)	-7.3790(1)*	-7.3560(1)*	I(1)
M4A	-0.0700(2)	-3.5506(0)**	-7.8152(1)*	-7.7237(1)*	I(1)
MIR	-1.4696(6)	-4.0564(1)**	-4.8283(0)*	-4.6320(0)*	I(1)
TBR	-2.5336(1)	-3.5101(1)	-5.8034(0)*	-5.5433(0)*	I(1)
DR	-1.9283(1)	-3.6266(1)**	-4.8472(0)*	-4.4124(0)*	I(1)
HCE	-2.3224(4)	-2.0475(4)	-3.1532(3)*	-3.7458(3)*	I(1)
GCE	-1.4853(1)	-1.7961(3)	-4.3127(3)*	-4.7223(3)*	I(1)
GFCF	-2.7140(4)	-1.9286(4)	-3.7267(2)*	-4.0083(2)**	I(1)
SPI	-1.9665(0)	-3.4251(1)	-7.9755(0)*	-8.0011(0)*	I(1)
WPI	-1.9225(3)	-1.2109(3)	-4.1413(1)*	-4.8887(1)*	I(1)
CPI	-2.0172(3)	-1.3188(3)	-3.8561(1)*	-4.8914(1)*	I(1)
RER	-2.7667(0)	-2.7206(0)	-9.6365(0)*	-9.5946(0)*	I(1)
Exp	-2.5941(0)	-1.0604(0)	-9.2811(0)*	-9.8829(0)*	I(1)
Imp	-2.6064(4)	-1.5093(4)	-6.5100(2)*	-7.9470(2)*	I(1)

* PP indicates that the alternative hypothesis is accepted according to 1% significant level.
** PP indicates that the alternative hypothesis is accepted according to 5% significant level.
Note: Values indicate lag values in parentheses.

According to the ADF Unit Root Test results in Table 6, all the series are stationary according to first difference and that when the first differences are taken of the series, they do not contain the unit root 1% and 5% significance levels and intercept-no trend and intercept-trend in both formats.

The Default (Bartlett-Kernel) Spectral estimation method is preferred when the lag values are determined "Newey-West Bandwidth" automatic selection is based on while applying the Phillips-Perron (PP) Unit Root Test. PP Unit Root Test results are given in Table 7.

Table 7. *Phillips-Perron (PP) unit root test results (Mexico)*

Variable	Level		First Difference		Result
	Intercept No Trend	Intercept Trend	Intercept No Trend	Intercept Trend	
GDP	-0.5880(12)	-1.4034(6)	-7.4277(5)*	-10.2766(12)*	I(1)
IPI	-0.5787(2)	-2.1693(3)	-3.8868(4)*	-3.8192(4)**	I(1)
MIPI	-1.4763(5)	-2.6520(3)	-7.3558(8)*	-7.2959(8)*	I(1)
Mining	-1.1138(5)	-2.0280(5)	-7.8575(8)*	-8.0916(11)*	I(1)
COP	-0.7488(1)	-2.0189(3)	-9.0598(2)*	-10.1483(3)*	I(1)
M1	-1.4764(11)	-7.2567(13)*	-18.5693(13)*	-19.1852(13)*	I(1)
M2	-3.1102(12)**	-2.6533(8)	-8.1937(12)*	-11.5272(12)*	I(1)
M3	0.2278(12)	-3.5119(4)**	-8.8592(12)*	-8.7648(12)*	I(1)
M4	0.6230 (12)	-3.4842(4)	-9.2513(12)*	-9.2767(12)*	I(1)
M4A	-0.1933(12)	-3.4884(2)	-8.9994(12)*	-8.8493(12)*	I(1)
MIR	-4.7604(3)*	-4.9838(3)*	-	-	I(0)
TBR	-4.7843(4)*	-5.1158(4)*	-	-	I(0)
DR	-4.6691(4)*	-5.1531(4)*	-	-	I(0)
HCE	-1.3138(12)	-2.7782(7)	-8.5631(12)*	-10.1389(12)*	I(1)

Variable	Level		First Difference		Result
	Intercept No Trend	Intercept Trend	Intercept No Trend	Intercept Trend	
GCE	-1.9037(12)	-7.6032(5)*	-19.8671(12)*	-21.1138(12)*	I(1)
GFCF	-1.2422(6)	-1.2078(3)	-8.8574(0)*	-8.9273(3)*	I(1)
SPI	-0.8689(1)	-1.2868(0)	-4.3665(7)*	-4.2983(7)*	I(1)
WPI	-0.9839(3)	-1.9274(2)	-3.9907(5)*	-4.1044(8)*	I(1)
CPI	0.6884 (12)	-3.4231(6)	-8.1558(12)*	-8.2072(12)*	I(1)
RER	-1.9769(0)	-2.9337(2)	-6.9890(4)*	-7.0037(4)*	I(1)
Exp	-0.5781(12)	-3.6729(12)	-10.3807(9)*	-10.3685(10)*	I(1)
Imp	-0.6763(12)	-4.5257(3)*	-13.8321(12)*	-13.9076(12)*	I(1)

* PP indicates that the alternative hypothesis is accepted according to 1% significant level.
** PP indicates that the alternative hypothesis is accepted according to 5% significant level.
Note: Values indicate lag values in parentheses.

According to the results in Table 7, MIR, TBR and DR series were stationary concluded with the level values, all the series belonging to all other variables are stationary with the first difference values.

When the unit root tests results are evaluated according to both methods, there was a difference between ADF and PP results in terms of MIR, TBR and DR series. In such a case the ADF Unit Root Test results are taken as basis.

3.3. VAR and FAVAR Model Impulse – Response Functions Analysis

VAR model method is an econometric method widely used to analyze the effects of monetary policy. The impulse-response functions obtained from the VAR model results examine the response of the other variables in the model against shock, based on a certain confidence interval if shocks are given from one of the model variables.

Sims (1992) developed the VAR Model in his study of the response of macroeconomic variables to monetary policy shocks in the German and US economies. Some variables were considered exogenous were considered exogenous and examined during the period 1958-1976 for Germany and during the period 1949-1975 for US.

The described variables are characterized as endogenous variables in an equality system, the variables in the descriptive position are also referred to as exogenous variables or predetermined variables (Kutlar, 2000, p. 190).

According to the VAR model method some variables are considered as external variables and this method is based on the least squares estimation method. VAR model estimates using the least squares method commonly used in econometric analyzes give better results than complex simultaneous equations systems. The VAR model method is the best way to show the effects of monetary policy shocks on the economy, assuming that the constraints are at a minimum level (Ornek, 2009, pp. 109-110).

The VAR model is shown in the following equation (1). According to this;

$$X_t = A_1 \chi_{t-1} + \ldots\ldots + A_P X_{t-p} + u_t \qquad (1)$$

Equation (1), A_i (i = 1,..., P), (K × K) dimension coefficient matrix and the error term process $u_t = (u_{1t},..., u_{Kt})'$ K dimension, the means is zero, $E(u_t u_t') = \Sigma u$ it is "White Noise" process with covariance matrix. In short, *ut~iid (0, Σu)* 'dir (Lütkepohl, 2007).

All information about the economy is not included in the analysis in the standard VAR and structural VAR analyzes. Bernanke et al. (2005), assuming that the additional information Kx1 unobserved factors summarize represent the vector F_t;

$$\begin{bmatrix} F_t \\ Y_t \end{bmatrix} = \Phi(L) \begin{bmatrix} F_{t-1} \\ Y_{t-1} \end{bmatrix} + v_t \quad (2)$$

Equation (2), is a transition equation is polynomial with a reasonable lag value of the limited d row Φ(L) represents the preliminary limitations in the structural VAR model. v_t is the error term and its average and covariance matrix is zero. In equation (2), (F_t, Y_t) is a VAR system, if there are Φ(L) conditions for Y_t for F_{t-1} to be zero reduced to standard in Y_t otherwise equation (2) is preferred for FAVAR analysis. And it is assessed on the marginal contribution of additional information on the F_t. Can't be estimated directly because the FAVAR method described in Equation (2) is unobservable.

For a moment, assume that we have some amount to informational time series N×1 dimension X_t vector. N, the number of informational time series is large (In particular, N is greater than T; T is the number of periods) and is greater than the number of factors (K + M < N). We assume that X_t is related to unobservable factors (F_t) and observable factors (Y_t) in the informational time series. According to this;

$$X_t' = \Lambda^f F_t' + \Lambda^y Y_t' + e_t' \quad (3)$$

Equation (3) is the observation equation and Λ', is the N × K – dimensional factor loading matrix. Λ^y is the size of N × M and e_t is the vector of N × 1 dimensional error terms and is assumed to be weakly related or unrelated, depending on whether the averages are estimated by zero and basic components and likelihood estimates. Equation (3) implies that X_t, in which F_t is able to interpret the same lags of the original factors, depends only on the current and non-delayed values of the unconstrained factors in practice.

Bernanke et al. (2005) two approaches were taken, namely equation (2) and equation (3). Firstly, $C_t = (F'_t, Y'_t)'$ which specified in equation (3), is the "Two-Stage Principal Component Approach" which determines a non-parametric path of the area where the main components emerge. The second approach is "One-Stage Bayesian Probability Approach". In the first stage, the main components of C_t, the main components of X_t were first estimated by using K+M in the "Two-Step Main Component Approach". When the number of N major components is used the number of correct factors is small, the main components are continuous in both F_t and Y_t. F_t was obtained as part of the area covered by C_t, not covered by Y_t. In the second stage, the factor augmented vector autoregressive (FAVAR) model was estimated by standard methods according to (2) equation with F_t of F_t. In the study, it is assumed that joint estimators are based on likelihood-based Gibbs sampling techniques. Gibbs sampling approach provides empirical estimation of the factors and their marginal intensities of the parameters through the repeated sampling procedure.

Determination of factors;

The factors are all obtained by the main components (1) through the observation equation in two-stage estimation. In this case, the limiting factors of $F'F/T = I$ may be preferred for limited loading at $\Lambda f'\Lambda f/N = I$. Two approach also provide the same principal component $F\Lambda f'$ and the same factor field (space).

Bernanke et al. (2005), the likelihood method was applied to Gibbs sample at the first stage (joint estimation stage) the factors were determined both in the observation equation and the transition equation. In this case, the factors (F_t) must be determined in order to be able to determine the conversion to $F^*_t = AF_t - BY_t$ format, A is K × K and not singular, B is K × M. Limitation is preferred VAR dynamics (2) described in the equation and must be implemented the limits of equation (3). F_t' can be obtained in equation (3) as in equation (4) below;

$$X_t = \Lambda^f A^{-1} F_t^* + (\Lambda^y + \Lambda^f A^{-1} B) Y_t + e_t \quad (4)$$

The factors should be defined and loaded.

$$(\Lambda^f A^{-1} = \Lambda^f \text{ and } \Lambda^y + \Lambda^f A^{-1} B = \Lambda^y) \quad (5)$$

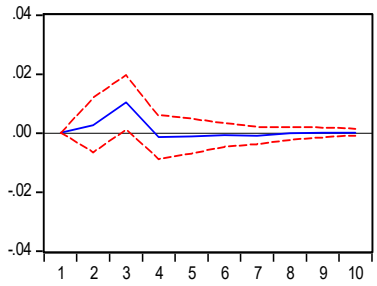
Both methods are different in many ways. It is a distinct advantage that two-stage approach is simple. In contrast, the transition equation is not used for estimation the factors in this approach.

In equations (4) and (5), the estimation system is used not only for dynamic responses of the basic variables in Y_t, but also for revealing dynamic responses in the series included in X_t in FAVAR method. In this framework, they can be controlled not only by three or four variables but by the behavior of many variables.

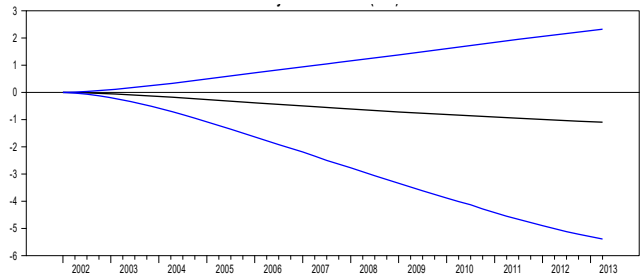
The impulse-response results are shown in Figure 1 in terms of the exchange rate channel. Accordingly, the responses of IPI and CPI variables was different for a unit standard deviation of 95 percent confidence interval applied to the exchange rate variance in response to external shocks. According to Figure 1, (A) panel, the response of the IPI variable resulted in an insignificant against the shock in NER variable, in panel (C) of Figure 1, the response of the CPI variable is positive and significant against shock in NER variable, while the effect is gradually decreasing from this period when it is maximum in the second period.

Figure 1. *Exchange Rate Channel VAR and FAVAR Model Impulse-Response Function Results (Turkey)*

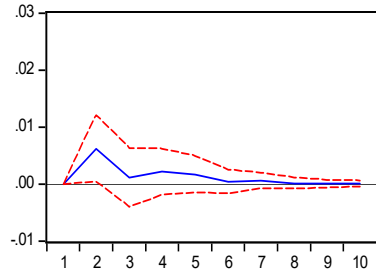
(A)
The response of IPI variable to NER variable shock



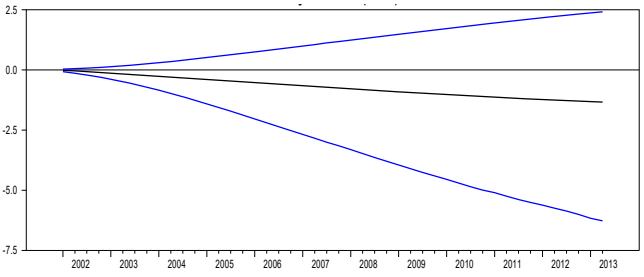
(B)
The response of IPI variable to NER variable shock



(C)
The response of CPI variable to NER variable shock



(D)
The response of CPI variable to NER variable shock

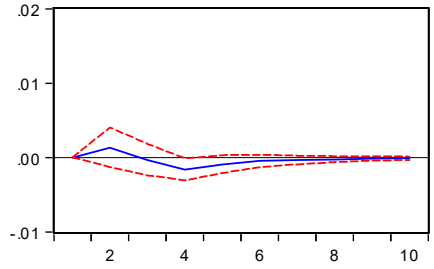


In Figure 1, (C) and (D) panels, the impulse-response function showed the results using the VAR model method of the MTM interest rate and bank credit channels partially effective in Turkey. The results obtained using the FAVAR method show that the MTM exchange rate channel does not work in Turkey.

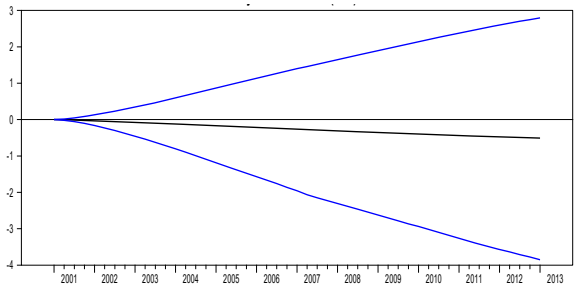
VAR and FAVAR model impulse-response function results figures are shown in Figure 2 in terms of the exchange rate channel. In Figure 2, Panel (A), the response of the IPI variable was realized as insignificant when a standard deviation external shocks is applied to RER for a 95 percent confidence interval. In Figure 2 panel (C), the response of the CPI variable was negative and significant the maximum in the second period. The effect gradually faded after the second period.

Figure 2. *Exchange Rate Channel VAR and FAVAR Model Impulse-Response Function Results (Mexico)*

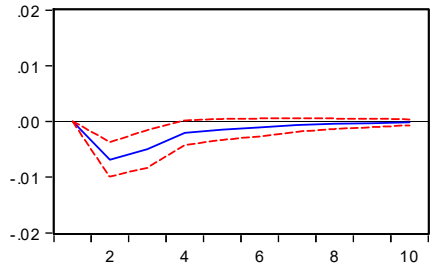
(A)
The response of IPI variable to RER variable shock



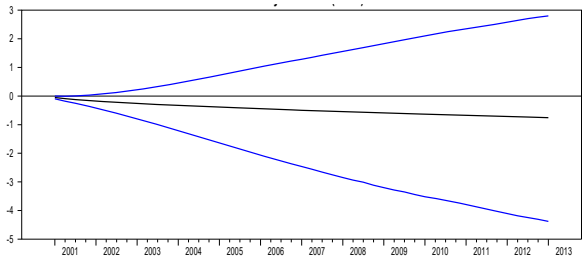
(B)
The response of IPI variable to RER variable shock



(C)
The response of CPI variable to RER variable shock



(D)
The response of CPI variable to RER variable shock



According to the VAR model impulse-response function results figure shown in Figure 2 the MTM exchange rate channel that is partially active in Mexico.

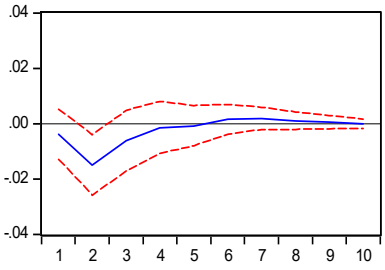
According to FAVAR model, the monetary policy shock through TBR variable to the system the impulse response function results are shown in Figure 2, panels (B) and (D). The IPI and CPI variables did not give a significant response to the monetary policy shock applied through the TBR variable.

Impulse-response function figures obtained according to VAR model has shown of the MTM exchange rate channel is active in Mexico.

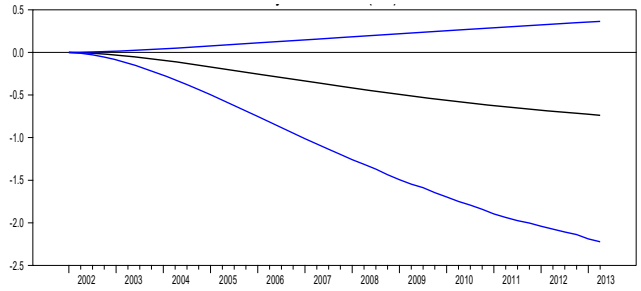
VAR model impulse-response function results are shown in Figure 3 in terms of interest rate channel. It is seen the response of the IPI variable to the RIR variable shock in Figure 3, panel (A). When a unit standard deviation external shock is applied for RIR variable for a 95 percent confidence interval, the response of the IPI variable to this shock is negative and significant, this response is at maximum level in the second period, the response diminished after this period and extinguished from the fifth period.

Figure 3. *Interest Rate Channel VAR and FAVAR Model Impulse-Response Function Results (Turkey)*

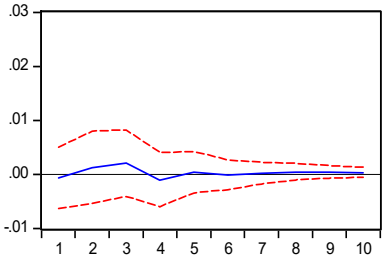
(A)
The response of IPI variable to RIR variable shock



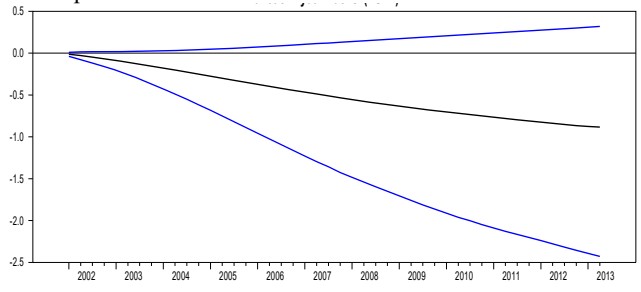
(B)
The response of IPI variable to DR variable shock



(C)
The response of CPI variable to RIR variable shock



(D)
The response of CPI variable to DR variable shock



In Figure 3 panel (C), the response of CPI is seen to RIR variable shock. When a unit standard deviation an external shock is applied to RIR variable the response of CPI to shock is statistically insignificant.

In FAVAR model application, the monetary policy is applied to the system through DIR variable, FAVAR model impulse-response function results are given in Figure 3, (B) and (D) panels. An external shock was applied to DIR variable and the response of the IPI and CPI variables to shock was statistically insignificant.

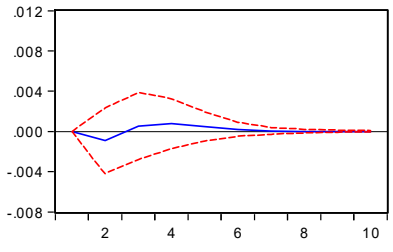
The FAVAR model results are based on 95 percent confidence interval in terms of price index, the response of CPI variable to the monetary policy shock is statistically insignificant.

These econometric results have shown that the MTM interest rate channel is partly active in Turkey.

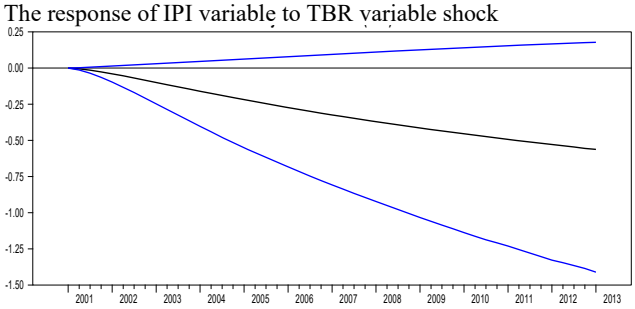
The VAR model impulse-response function results are shown Figure 4 in terms of interest rate channel for Mexico. In this context, the response of IPI and CPI variables resulted as insignificant when applying a standard deviation external shock to TBR variable for 95 percent confidence interval in Figure 4, panels (A) and (C).

Figure 4. *Interest Rate Channel VAR and FAVAR Model Impulse-Response Function Results (Mexico)*

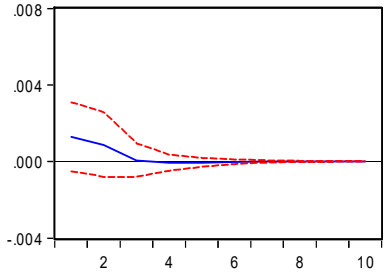
(A)
The response of IPI variable to TBR variable shock



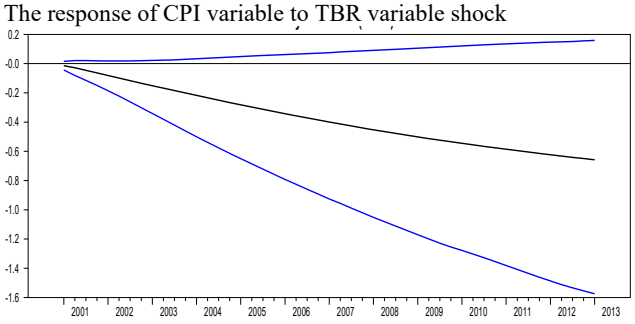
(B)
The response of IPI variable to TBR variable shock



(C)
The response of CPI variable to TBR variable shock



(D)
The response of CPI variable to TBR variable shock



According to the FAVAR model impulse-response function results the response of the IPI and CPI variables to an external shock for TBR variable is insignificant in Figure 4, panels (B) and (D).

Obtained the econometric results above has shown that the MTM interest rate channel is not actively working in Mexico.

4. Conclusion

MTM channels it differs from country to country in terms of functioning and effectiveness with economic explanations in different forms. Because, factors such as applied monetary policies, the structure and depth of the financial system, openness level of the country's economy affect the functioning of the MTM.

The objective and means of classical monetary policy have been re-discussed after the global financial crisis. Naturally, there have been new developments in the objectives and instruments of monetary policy and a more active role in execution of monetary policies to central banks. Today, approaches are taken as the basis and stand out for the purposes of central banks as well as price stability and financial system stability. Monetary policy objectives and instruments designed for purposes price stability and financial system stability affects the process positively MTM. In an economy where financial stability is

realized together with price stability, the effectiveness of MTM will increase and will be more effective of monetary policies on economy especially on production and prices.

In this study, two countries including Turkey and Mexico were included in the analysis. Two countries mentioned above, the effects of MTM have been examined in terms of Monetarist approach. The reason for examination of two countries in analysis, there are similarities in terms of applied monetary policies and economic and financial conditions between both countries economies recently. Along with nineties, financial crises have arisen in financial structure where disruptions have played a significant role in both countries. After financial crises, structural and institutional reforms have been carried out and comprehensive changes have been made in monetary policies objectives and instruments in such countries. Inflation targeting regime is being implemented for both countries in recent years.

Turkey has had to struggle with high inflation with the eighties. As mentioned above, Monetarist monetary policies were implemented in Turkey during the period 1980-1989, money markets and financial system were integrated together with structural-institutional arrangements for the period 1986-1989. The required reserves ratios were used as an important instrument of monetary policy, from this period, open market operations became the policy instrument in execution of monetary policies. The use of monetary policy instruments has pointed to active use of monetary policies. The disruptions in financial structure came to fore with the influence of external factors during the 1990-2000 period.

The February 2001Crisis was experienced following the implemented of the stabilization program based on the failed fixed exchange rate regime in Turkey for year 2000. After the crisis, the new "Central Bank Law" was adopted and instrument independence was provided to the CBRT within the scope of the transition program to a strong economy. The monetary base has been targeted as the monetary size and has started to be applied with the implicit inflation targeting regime since 2002, the inflation targeting regime has been passed since 2006.

After the global financial crisis, there has been an important transformation in terms of monetary policy. In this context, the CBRT is based on a new policy that establishes a new and different policy composition and determines financial stability as well as price stability has created a new and different policy component since April of 2010. Accordingly, the CBRT has implemented two new monetary policy instruments, namely the interest rate corridor and the reserve option mechanism (ROM) during the execution of monetary policies. These monetary policy instruments have enabled the CBRT to carry out an active monetary policy.

With all this central banks have become more active in the conduct of monetary policies, monetary policy implementations are carried out in a structure focused on the financial structure. After the crisis, MTM works more effectively in Turkey. In this context, active monetary policies will be implemented by the CBRT in the forthcoming period and the continuation of the new policy component will affect the functioning of the MTM.

The Mexican economy has stepped up its search for sustainable economic growth and price stability in the eighties. A stabilization program named "Pacto" based on the fixed exchange rate regime was put into effect in 1987. In the nineties, a major financial crisis was experienced which could not adapt to the changes in international financial conditions and the implementations of the stabilization program based on the fixed exchange rate regime was unsuccessful in Mexico during year 1994. Inflation targeting regime started to be implemented since year 2000 following the stabilization programs aimed the removing the effects of the crisis.

Banco de Mexico has adopted it as its along with its economic growth target, it has accepted the preservation of the purchasing power of the national currency as an invariable priority in monetary policy implementations since year 2009.

Monetary policies has a new role to central banks and financial stability has also been seen as an indispensable objective as well as price stability after the Global Financial Crisis. In addition, the search for new monetary policy instruments has been discussed. The effects of monetary policies on the economy, especially on production and prices will develop positively in an economy in which financial stability is achieved along with price stability.

In this paper which examines the channels of MTM from the econometric side the effectiveness of Monetarist Approach in Turkey and Mexico, VAR and FAVAR methods have been employed in the analysis of the two countries implementing the inflation targeting.

Because the VAR model method allows econometric analysis with a limited number of variables, this method has been expanded and FAVAR method has been developed which allows econometric analysis with a large number of variables.

Six variable VAR model for Turkey and five variable VAR model for Mexico were estimated and impulse-response function figures were interpreted. FAVAR models have been estimated for both countries FAVAR method is applied nineteen variables for Turkey and twenty two variables for Mexico.

In this paper, according to the results the impulse-response function obtained by moving from the VAR model them MTM works partly in both countries, FAVAR model impulse response function results pointed out that of the MTM does not work in Turkey and Mexico.

Generally, significant findings were obtained on the functioning of the MTM in studies on the functioning of the MTM for developed and developing countries. Bernanke and Blinder (1992), Sims (1992), Romer and Romer (2004) obtained important evidences that the functioning of the MTM for developed and developing countries using the VAR model method.

Butkiewicz and Ozdogan (2009), Büyükakın (2009), Erdoğan and Beşballı (2009), Örnek (2009), Cambazoğlu and Güneş (2011), Artar (2011), Cambazoğlu and Karaalp (2012), Arabacı and Baştürk (2013), Yıldırım (2013) found that the MTM is working in Turkey

in the studies that examined the efficiency and functioning of the MTM using the VAR model method for Turkey.

When the studies are examined, the functioning and effectiveness of the MTM applied the FAVAR method for developed and developing countries Bernanke et al. (2005), Boivin et al. (2008), Boivin et al. (2010) obtained the results that the MTM partly works.

Obtained the findings in the study, while the VAR model results indicates that the channels of MTM partially work for Turkey and Mexico.

The findings using the VAR model supported in the study the findings of Cambazoğlu and Karaalp (2012), Büyükakın et al. (2009), Örnek (2009), Cambazoğlu and Güneş (2013), obtained the findings by the FAVAR method don't support the findings of such studies.

The contribution of this study to the MTM literature has been examined together with Turkey and Mexico and the VAR and FAVAR model methods have been used for the first time in both countries.

According to findings of this study, the central banks of both countries must continue to play an active role for monetary policies implementations. In addition to the central banks has adopted as well as the purpose of price stabilization as well as the aim of financial stability and putting the new monetary policy instruments in line with these objectives, it will be important in terms of the functioning of the MTM continuation of the inflation targeting regime.

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Macroeconomic determinants of public debt growth: A case study for Tunisia

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Abstract. *This article offers an econometric investigation of the macroeconomic determinants of public debt in Tunisia using VECM model for the period 1986-2015. The results of the full sample analysis reveal that inflation and investment reduce the value of public debt. However, real interest rate, budget deficit and trade openness increase public debt. The study shows also the budget deficit is the most important determinant of public debt in Tunisia.*

Keywords: Public debt, budget deficit, fiscal policy, Tunisia.

JEL Classification: E62, H62, H63.

Introduction

The rapid rise of public debt has drawn the attention of policy-makers and economists to the negative effects of excessive public debt (Omrane et al, 2015). As a result of the 2007-2008 financial crisis, an economic downturn caused severe public finance problems. In the Euro zone, the debt ratio increased from 66.2% of GDP in 2007 to 90.7% of GDP in 2015. The sharp increase in public debt is not restricted only to the euro countries, but it has been marked also in other regions and over the same period. For example, in the United Kingdom, public debt ratios increased from over 40% of GDP in 2007 to 89.2 % of GDP at the end of 2015. In the United States, the public debt ratio rose from 60% of GDP to about 104% of GDP at the end of 2015. Even in Japan, the debt ratio which was already high in 2007, 183% of GDP, rose to 229% of GDP. It is clear that this sharp increase in the debt ratio observed in recent times is directly linked to the support programs granted at the period of the crisis and, on the other hand, to the fall in revenues due to recession. It should be pointed out, therefore, that the growth of fiscal deficits forms the major determinant of the increase in the ratio of public debt. Even though the economic situation had finally been brought under control in 2010, the upward trend in the debt ratio of most of the mostly advanced countries continued. For this reason, a lot of studies have conducted a series of analyses to identify the factors that affect public debt size in the economy, which are divided into three major variables including economic variables, political institutional variables, and structural ones.

For Tunisia, the outbreak of the international debt crisis in the early 1980s and the drying up of international funding did not prevent the debt/GDP ratio from increasing and reaching a peak of 57.39 % of the GDP in 1986. This crisis required the intervention of the International Monetary Fund and the implementation of the Structural Adjustment Program in 1986 (Omrane, 2012). Public debt fell from 55.67% of GDP in 1987 to 40.66% of GDP in 2010. In the aftermath of the revolution, an expansionary fiscal policy, based on stimulus through raised government spending combined with a decline of the economic activity, explains the increase of the public debt to 44.49 percent of GDP in 2011 (Omrane and Gabsi, 2017). By the end of 2012, favorable growth dynamics kept the debt-to-GDP ratio constant at 44.47 percent, a relatively comfortable level which is lower than those in similar countries of the region, and achieved despite a wider fiscal deficit (IMF, 2014). The fiscal year 2015 was marked by a worsening security climate, besides persisting social pressure, the impact of which was however, offset by oil prices easing on the international market. Therefore, the budget deficit posted 4.8% of GDP against 5% a year earlier, while the rate of public indebtedness pursued its' upwards trend, rising by three percentage points to 53.9% (BCT, 2015). Thus, the objective of this paper is to deliver the most crucial factors of that support the increased level of public debt in Tunisia and to examine the importance of budget deficit reduction.

The article is organized as follows. Section two briefly reviews the theoretical and empirical literature on the determinant of public debt. The third section details the data. The fourth section describes the empirical strategy and reports the results. The final section offers some concluding remarks and provides policy recommendations.

2. Literature review

Governments may accumulate public debt to support public and profitable investment, for example in physical infrastructures and human resources, by public spending in education and healthcare. Also, in advanced economies, the existence of developed social safety nets partially financed by public deficits that respond, for example, to the increase of the unemployment rate has a vital role as economic automatic stabilizers. Public debt can grow in these circumstances to avoid distorting taxes fluctuations (Barro, 1979). Public debt allows governments to smooth and redistribute tax burdens over time and across generations (Cukierman and Meltzer, 1989). The existing literature on public debt determinant shows that the factors that can affect public debt are macroeconomic, political, institutional and structural variables. Several economic factors can influence the trajectory of public debt such as interest rate, economic growth, inflation, debt stock, budget deficit, public spending, credibility of monetary policy and openness (Drazen, 2000; Imbeau and Pétry, 2004; Swaray, 2005). The level of political instability and political polarization in a country can also affect the size of public debt. Indeed, Edwards and Tabellini (1991) are the supporters of the influence of political instability on the size of budget deficit. In their opinion, the more politically unstable a country is, the larger will be its budget deficit. Political instability increases the frequency of government changes and lowers the likelihood of reelection of a current policymaker. Institutional stability, i.e. absence of government's corruption and quality of the bureaucracy, has also a great impact on the public debt level (Lavigne, 2011). According to Cooray et al. (2016), a higher level of corruption leads to the accumulation of larger public debt. The growth of public debt was also stimulated by structural factors. In fact, population ageing puts strong upward pressure on public expenditure and public debt through two channels: age-related health care and public pension expenditure (Creel et al., 2012). In their research, Veiga and Veiga (2014) indicates that the structure of expenditures and revenues affects the debt level, and higher unemployment rates generate higher debt. The empirical studies estimating the main determinant of public debt remain scarce and limited. In this context, Pirtea et al. (2013) analyze the factors that influence the debt to GDP ratio in Romania. They found that the primary fiscal balance, the real interest rate, the real GDP growth rate, and exchange rate are significant factors. The same results are found by Dumitrescu (2014). Swamy (2015) used Panel Granger causality method and found that real GDP growth, foreign direct investment, government expenditure, inflation and population growth have a negative effect on debt. However, Gross fixed capital formation, final consumption expenditure, and trade openness have a positive effect on debt. Using panel regression, Sinha et al. (2011) confirmed that the main indicators that impact the size of sovereign debt are economic growth, interest rates, inflation, level of current account balance and the level of FDI. The studies of Gargouri and Ksantini (2016) focus-on the identification of the Europeans public debt determinants using the correlated panels corrected errors model. The results show a positive impact of bank nonperforming loans, military expenditures and imports and a negative influence of GDP growth and bank liquid reserves on public debt. The empirical study of Galinski (2015) shows that in Poland, the debt limit growth was significantly determined by the variables concerning the financial situation both in the public finance sector and in the local governments as well as a cost of capital. Recently, Globan and

Matosec (2016) analyse public debt determinants in EU new member states. The results showed that by achieving a more balanced government budget, the growth rate of public debt should decrease. Furthermore, the GDP growth rate appeared to be highly significant, which is expected and consistent with economic theory, higher economic growth should certainly diminish the pressure on internal and external borrowing. In addition, long-term interest rates on government bonds proved to be significant and positively impacting the public debt growth rate, as well as primary budget balance and election year interaction term indicating that, in accordance with the political-budget cycles theory, greater public expenditure in pre-election quarters generates a public debt increase.

3. Data and methodology

Our dataset comprises annual macroeconomic data for Tunisia, over the period 1986-2015. Our empirical analysis is based on the following model:

$$\text{Debt}_t^j = \hat{\beta} X_t^j + \mu_j + \vartheta_t + \varepsilon_{jt} \quad \text{Equation (1)}$$

X_t^j is a vector of regressors including lagged GDP, Gross fixed capital formation (gfcf), openness (tgdp), inflation (infl), budget deficit (DB), real interest rate (rir). The dependent variable in the analysis below is the public debt-to-GDP growth rate. It also includes the constant. μ_j is country-specific fixed effects, ϑ_t is time-fixed effects, ε_{jt} is the unobservable error term. The final equation estimated in the model is given as:

$$Debt_t^j = GDPgrowth_{t-1}^j + gfcf_t^j + tgdp_t^j + INFL_t^j + DB_t^j + rir_t^j +$$

$$+\mu_j + \vartheta_t + \varepsilon_{jt} \quad \text{Equation (2)}$$

We provide in Table 1 the description of variables and data sources.

Table 1. *Description of variables and data sources*

Variables	Description	Source
Debt	Public debt in percentage of GDP	Ministry of finance of Tunisia
Gdpgr	GDP growth	(WDI)
Gfcf	Gross fixed capital formation in percentage of GDP	(WDI)
Infl	Inflation is measured by consumer price index	(WDI)
Rir	Real interest rate	National Institute Of Statistics of Tunisia
Tgdp	Openness/ Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product	(WDI)
DB	Budget deficit in percentage of GDP	Ministry of finance of Tunisia

4. Results and interpretation

Stationarity of all variables has been tested and variables which initially proved to be non-stationary were transformed by taking first differences. The Augmented Dickey-Fuller (ADF) test and Phillips-Perron test are applied to test the stationarity of variables. The results of the unit root test are presented in Table 2.

Table 2. *Unit root test (ADF and PP)*

Augmented Dickey-Fuller				PP		
Variables	t-statistic	Critical value	Integration order	t-statistic	Critical value	Integration order
Debt	-12.24053	-3.699871	I(1)	-5.138662	-3.689194	I(1)
Gdpgr	-5.857143	-3.679322	I(0)	-5.828742	-3.679322	I(0)
Gfcf	-5.385843	-2.685718	I(1)	-4.293228	-3.689194	I(1)
Infl	-9.070850	-3.689194	I(1)	-9.739121	-3.689194	I(1)
Rir	-5.359216	-2.685718	I(1)	-8.687911	-3.689194	I(1)
Tgdp	-5.909413	-3.699871	I(1)	-6.332247	-3.699871	I(1)
Db	-6.906401	-3.689194	I(1)	-12.35988	-3.689194	I(1)

The results show that the GDP growth is stationary in level but all other variables are stationary in first difference, so this concludes that there is a possibility of a long-term association between these variables integrated of the same order. To discover the long-term association between variables under study, Johansen's Cointegration test is applied.

The first step is to select appropriate lag length for co-integration by using VAR (Vector Auto Regressive) test based on SIC and AIC (Akaike Info Criterion). The VAR estimation test recommended two lag to be the optimum lag length for this model (Table 3).

Table 3. *Determination of Lag Length*

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-364.3275	NA	12392.95	26.45196	26.73744	26.53923
1	-265.9601	147.5511	153.6753	21.99715	23.99546	22.60805
2	-193.5616	77.56987*	16.97420*	19.39725*	23.10840*	20.53179*

* indicates lag order selected by the criterion

Next process is to conduct Johansen co-integration test. The results of unrestricted cointegration rank test (trace test and Eigenvalue) are presented in Table 4. From Table 4, we can conclude that the null hypothesis of no cointegration among the variables is rejected in both tests. Both Trace test and Maximum eigenvalue test indicate two cointegrating equation at 5% level of significance. This means that all variables Debt, Gfcf, Rir, Infl, Tgdp and DB are cointegrated or have relationship in the long-run.

Table 4. *Johansen Cointegration Test*

Trace statistics		Max-Eigen Statistics			
Nul hypothesis	P-Value	Trace statistic	5% critical value	Max-Eigen Statistics	5% critical value
r = 0	0.919587	166.0302	95.7536	70.576	40.077
r < ou =1	0.834433	95.45386	69.8188	50.354	33.876
r < ou =2*	0.534045	45.09912	47.856	21.382	27.584

*denotes rejection of null hypothesis at 5% level. Trace Test and Max-eigenvalue Test indicates 2 cointegrating equation at 5%level.

Since the existence of cointegration is found among the variables of interest, the study proceeds to estimate the long-run relationship between public debt and its determinants. Restricted VAR (Vector Autoregressive) is run to estimate the long-run relationship model of public debt in Tunisia. This model is also known as VECM (Vector Error Correction model).

The VECM is specified as follows:

$$Debt = \alpha_0 + \alpha_1 tce_{-1} + \sum_{i=1}^{k} \beta_i \Delta Db_{t-1} + \sum_{i=1}^{k} \gamma_i \Delta gfcf_{t-1} +$$

$$+ \sum_{i=1}^{k} \delta_i \Delta rir_{t-1} + \sum_{i=1}^{k} \varepsilon_i \Delta infl_{t-1} + \sum_{i=1}^{k} \theta_i \Delta tgdp_{t-1}$$

Where:
k represents lag length, I = 1, …, K, tce_{-1} is the error-correction term, which is the cointegrating vectors and α_1 is the adjustment coefficient indicating the weight of adjusted disequilibrium in the past. To get a long-run relationship among the variables, the coefficient of all variables should be statistically significant (For our study we eliminated the variable of GDP growth because it is not significant).

The estimated results of the VECM are illustrated in Table 5. It is observed that budget deficit has a positive and significant impact on public debt at 1% level of significance respectively. Large deficits caused the debt rise. The same result is found by Sulley (2010), Forslund et al. (2011) and Matiti (2013). In addition, budget deficit coefficient is the highest which shows that budget deficit is the most important determinant of Tunisian public debt. The association of real interest rate with debt is found to be positive and statistically significant. The same result is reached by Gabsi (2004), who showed that the increase of Tunisian public debt cost can be explained by the rise in the real interest rate. Trade openness has a statistically significant positive association with debt, in line with our theoretical propositions. We conclude that more open countries suffer less from balance sheets effects associated with external borrowing (Calvo et al., 2003), and open countries may be more successful in attracting foreign investors into the domestic market. Inflation has a statistically significant negative effect on debt. This result is in conformity with Aizenman and Marion (2009), who also found that inflation reduces the value of debt. Gross fixed capital formation has a negative and significant impact on public debt. Indeed, public investment can boost growth and reduce public debt (Mourougane et al., 2016).

Table 5. *Vector Error correction estimate*

	Coefficient	Std. Error	t-Statistic	Prob.
TCE(-1)	-0.506974	0.156502	-3.239414	0.0071
Db(-1)	3.100732	0.641632	4.832571	0.0004
dGfcf(-1)	-2.125722	0.531377	-4.000404	0.0018
drir(-1)	2.880628	0.772896	3.727056	0.0029
dinfl(-2)	-1.079161	0.518837	-2.079963	0.0596
dtgdp(-1)	0.347343	0.083733	4.148234	0.0014
R-squared	0.884635	Mean dependent var		-0.140741
Adjusted R-squared	0.750042	S.D. dependent var		2.512317
S.E. of regression	1.256054	Akaike info criterion		3.594008
Sum squared resid	18.93206	Schwarz criterion		4.313917
Log likelihood	-33.51911	Hannan-Quinn criter.		3.808075
F-statistic	6.572667	Durbin-Watson stat		1.551424
Prob(F-statistic)	0.001171			

Conclusion

The main objective of this study is to examine the principal determinant of public debt in Tunisia using a VECM approach during the 1986-2015 period. The results of the full sample analysis reveal that inflation and investment reduce public debt, whereas real interest rate, budget deficit and trade openness are the main factors that contributed to the increase in the public debt in Tunisia. The above results suggest that the only way to stop the process of debt accumulation is to reduce the primary deficit by continued fiscal adjustment.

The economic situation in Tunisia today is the best proof of our results. In other words, a lack of accumulated resources for debt financing is explained by the increase in external borrowing from international organizations especially after the revolution. The decline in investment, the high level of unemployment and the rise in the inflation rate remain threatening.

Thus, Tunisia must consider the improvement of the productive apparatus for a sustained growth rate of more than 5%, the adjustment of the interest rate to a lower average, the orientation towards a participatory tax system and the rationalization of budgetary choices.

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Dynamic regime switching behaviour between cash and futures market: A case of interest rates in India

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Abstract. *This study examines the Markov dynamic regime switching behaviour between cash and futures market in respect to interest rate in India. The study uses daily data of volumes, weighted average price, weighted average yield for cash market and total values, open interest, settlement price from 21st January 2014 to 30th October 2014. We a contract i.e. 883GS2023 of NSE has been used for our analysis. All data are sourced from Clearing Corporation of India Ltd. (CCIL) and National Stock Exchange (NSE). We have run regime switching regression to capture the switching behaviour in bull as well as bear state of cash to future and future to cash in six different equations. This model also captures the estimated probability and estimated duration to continue in bull and bear state and does not require to test stationarity or conversion of data into any normalised form. We find switching behaviour in both cash is regime switching the future as well as future is regime switching the cash market and the estimated probability differs from 70% to 97% in different cases. The estimated duration to continue in an existing state has also been captured in 6 different equations.*

Keywords: Govt. Securities, Interest Rate Futures (IRF), Markov Dynamic Regime Switching Model.

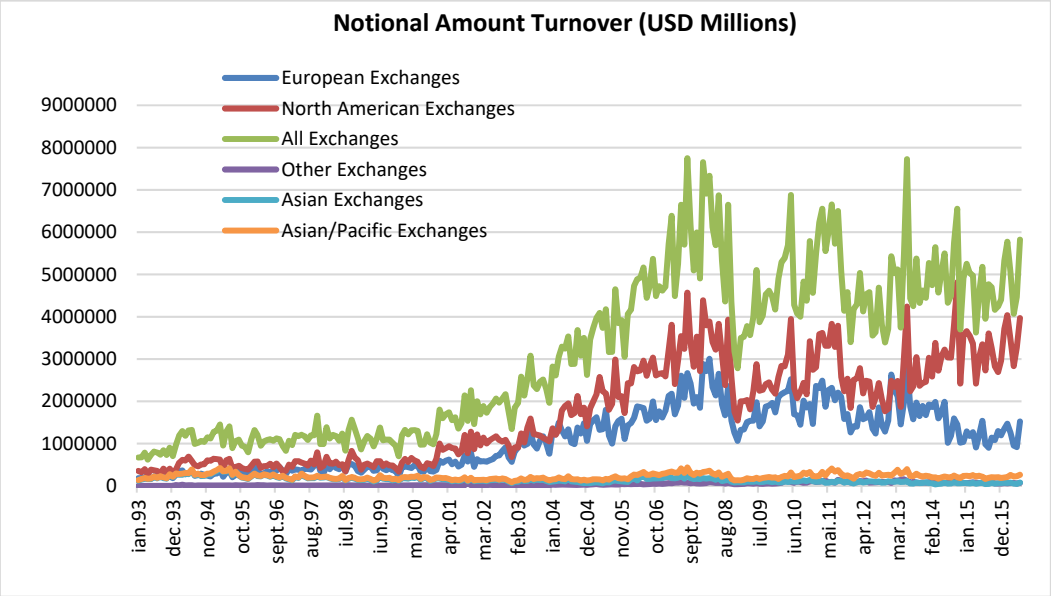
JEL Classification: C58, G12, G13.

Introduction

Investors use interest rate derivative to hedge against interest rate risk. Among all derivative instruments, Interest Rate Futures (IRF) are the most popular derivative products available in the market across globe (see Figure 1 and Figure 2). Chicago Mercantile Exchange (CME) is the first exchange introduced IRF in the year 1981. This product is popular in developed markets compared to developing markets. In India, IRF has failed when it was introduced in 2003 as well as in 2009. Again it was introduced in the year 2014 for the third time (MSEI formerly MCX-SX introduced on 20th January 2014, NSE on 21st January 2014 and BSE on 28th January 2014), and this time the trading volume in the NSE was observed high among all the three exchanges (Panda and Thiripalraju, 2015). In India the underlying for the interest rate futures contract are the treasury securities. As per the regulatory provisions the interest rate future contracts on exchange platform are allowed on the liquid treasury securities in the maturity range of 5 years, 10 years and 15 years and also on 91 days treasury securities.

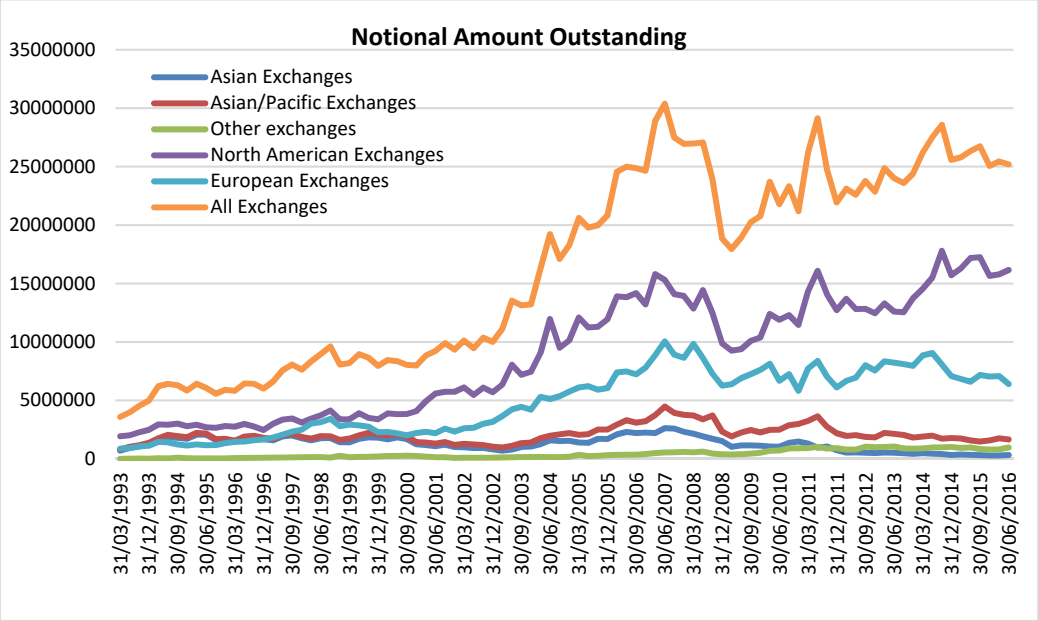
A perennial issue among investors, policy makers and market participants is whether future market leads cash market or cash market leads futures market? Although several empirical studies exists to understand the behaviour of equity/commodity/index/ currency cash and futures market, but there is no focus or less focus in the literature on the interest rate futures in Indian context. Empirical studies found that the futures market leads cash market (Oellermann and Farris, 1985; Oellermann et al., 1989; Chaihetphon and Pavabutr, 2010; Kumar and Arora, 2011 and Arora and Kumar, 2013). In case of equity cash and futures market empirical results found that the futures market leads cash market (Chan, 1992; Raju and Karande, 2003; Gupta and Singh, 2007 and Gupta and Singh, 2009). This study is an attempt to understand the regime switching behaviour of interest rate cash and futures market in India. Panda and Thiripalraju (2015) evaluated the rise and fall of interest rate futures (IRF) in Indian derivative market presenting three different cases like 2003, 2009 and 2014. The study used trend analysis of 2014 IRFs for three different exchanges like BSE, NSE and MCX-SX results found that NSE IRFs volume was higher than BSE and MCX_SX in the Indian derivative market. Sahoo and Panda (2016) found interest rate cash market price leads the futures market but the future settlement price has impact on the yield of the underlying security by considering the most liquid contract of NSE.

Figure 1. *Notional Amount Turnover (USD Millions) of Interest Rate Derivative Contracts from Jan, 1993 to Sep, 2015*



Source: Bank for International Settlement (BIS).

Figure 2. *Notional Amount Outstanding (OI) (USD Millions) of Interest Rate Derivative contracts of All Exchanges from March, 1993 to Sep, 2015*



Source: Bank for International Settlement (BIS).

Most of the studies are based on interest rate futures relating to developed markets. Possibly usage concentration of interest rate derivative is more in developed countries in comparison to developing countries.

Review

In a study, Poon et al. (1998) found that the suspension of trading in Shanghai Treasury bond futures had a positive impact on the market liquidity of both A and B shares traded on both Shanghai and Shenzhen Stock Exchanges. Brewer et al. (2000) found a positive relationship between usage of interest rate derivatives by banks and the growth in bank lending's. Kuttner (2000) found a strong relationship between surprise policy actions and market interest rates, but response to anticipated policy actions is small. Choi and Finnerty (2006) depicted a strong correlation among the interest rates of T-Bonds and the fund rate. Zhou (2007) found Fed affecting the interest rates market through a policy of changing in the funds rate target by a fixed amount for the foreseeable future. Hyde (2007) found the sensitivity of stock returns at the industry level to interest rate risk was observed mainly in Germany and France. Purnanandam (2007) finds banks which use derivatives for interest rate risk management are more comfortable during the events of external shocks. Debasish (2009) finds no significant volatility Spill-over from futures to spot market on NSE Nifty. Park and Choi (2011) finds interest rate sensitivity of US property/liability insurer stock returns to be time varying and is closely related to the underwriting cycle or performance of the insurance industry. In Indian case there exist two studies to the best of our knowledge. Those are, Panda and Thiripalraju (2015) evaluate the rise and fall of interest rate futures (IRF) in Indian derivative market pertaining three different cases like 2003, 2009 and 2014 and find NSE IRFs volume is higher in the Indian derivative market. Sahoo and Panda (2016) examine the price discovery process in the interest rate cash and futures market for India. The study employ correlation, regression and AR (1) GARCH (1, 1) spillover model to capture the spillover effect between cash and futures market. The study finds, in most of the cases cash market leads the futures market.

Based on the above literature, we find most of the research on interest rate derivatives have been done in developed markets. But in case of emerging markets like India the study on IRF are very few and none of them have attempted to capture switching behaviour of cash and futures market. The objective of this study is to measure the regime switching behaviour between interest rate cash and futures market by using Markov Regime Switching model.

Data and model

Data. For our analysis we have considered the most liquid treasury security in the 10 year maturity horizon i.e. 883 GS 2023 (GS = Government Securities). We sourced all futures market data from National Stock Exchange (NSE) and all cash market data from Clearing Corporation of India Ltd. (CCIL). The period of our study covers from *21st January 2014 to 30th October 2014* with total of 182 daily observations (trading days). We considered three variables from the futures market such as daily settlement price, value/volume of contracts traded and open interest and three variables from the cash market such as weighted average price, total volume and weighted average yield for our analysis.

Model. Regime switching models match the tendency of financial markets which often changes its behaviour and the new behaviour associated with financial variables that persists for longer period after this change. The reasons behind popularity of regime

switching model in financial modelling are as follows. First, the idea of regime is natural and intuitive. Second, these models parsimoniously capture stylized behaviour of many financial return series including Fat tails, persistently occurring periods of turbulence followed by periods of low volatility (ARCH Effects), skewness and time-varying correlations. Finally, regime switching models are capable to capture non-linear stylized dynamics of asset returns in a framework based on linear specifications, or conditionally normal or log normal distributions within as regime (Ang and Diego, 2011).

The regime switching models in interest rate have been used by several researchers since 1988. Hamilton (1988), Sola and Driffill (1994), Gray (1996).

Markov switching dynamic regression model

The Markov Switching model or regime switching model was proposed by Hamilton (1989) in his work on business cycle recession and expansions and the regime naturally captured economic activity cycles around a long term trend. This model characterizes the time series behaviour in different regimes of the selected variables involving multiple equations. This model captures more complex dynamics of the variables allowing them to switch between these regimes. The model control the switching behaviour by an unobservable state variable that follows first order Markov chain process and it explains the correlated data which exhibits dissimilar dynamic patterns during various time periods.

State 1: $y_t = \mu_1 + \varepsilon_t$ (1)

State 2: $y_t = \mu_2 + \varepsilon_t$ (2)

Where, μ_1, μ_2 are the intercepts of state1 and state 2 equations respectively and $\varepsilon_t$is the white noise term with varianceσ^2. If the s_t is the timing of switches then the equations is expressed as follows:

$$y_t = s_t\mu_1 + (1 - s_t)\mu_2 + \varepsilon_t \quad (3)$$

Where, s_t is 1 if the process state is one other wise 2. It is difficult to infer the process state by knowing the intercept. This model allows the parameters to change over the states. Markov-switching dynamic regression model with state dependent intercept is expressed as follows:

$$y_t = \mu_{st} + \varepsilon_t \quad (4)$$

If s_t =1, then $\mu_{st} = \mu_1$, if s_t =2, then $\mu_{st} = \mu_2$, where μ_{st} is an intercept parameter. The transition probabilities are of greate interest and it can be expressed as $p_{s, s+1}$ in Markov Switching regression. In two states process, P_{11} denotes the probability of remaining in state 1 in the next period, given that the state is 1 at current period. If the value is close to 1 then it is expected to stay in state 1 for a long time or process is said to be persistent.

Markov-Switching Dynamic Regression with exogenous variables is expressed as follows:

$$y_t = \mu_{st} + X_t\alpha + Z_t\beta_{st} + \varepsilon_s \quad (5)$$

Where, μ_{st} is a time dependent intercept, y_t is a dependent variable, X_t is a vector of exogenous variables with state invariant parameter α, Z_t is a vector of exogenous variable

with state dependent variable β_{st}. Here $X_t and\ Z_t$ can include lag of dependent variable y_t. The error term ε_s is independent and identically distributed with mean zero and error varianceσ^2.

Transition probability from one state to other can be expressed in K x K matrix

$$P=\begin{bmatrix} p_{11} & \cdots & p_{1k} \\ \vdots & \ddots & \vdots \\ p_{1k} & \cdots & p_{kk} \end{bmatrix}$$

The probability of the state s_t is equal to j, where j = {1,…, k-1}, is dependent on the most recent realized value of s_{t-1} and can be expressed as

$$\Pr (s_t = j \mid s_{t-1} = i) = p_{ij}$$

P is non-negative and sum of each column equal to 1.

$$p_{ij} = \frac{\exp(-q_{ij})}{1 + \exp(-q_{i1}) + \cdots + \exp(-q_{ij})}$$

$$p_{ik} = \frac{1}{1 + \exp(-q_{i1}) + \cdots + \exp(-q_{ij})}$$

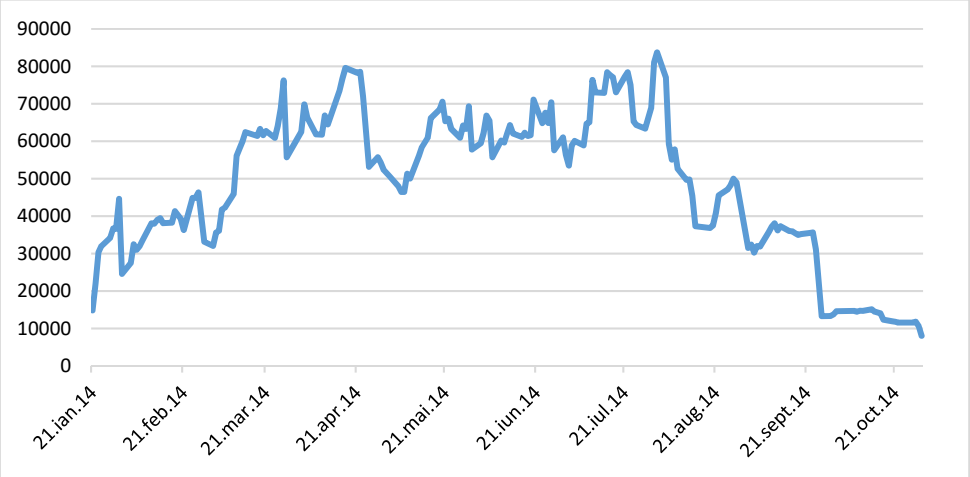
Where j ϵ (1,…, k-1) and transmitted parameter q can be computed as

$$q_{ij} = -\left(\frac{p_{ij}}{p_{ik}}\right)$$

Empirical result

The regime switching behaviour from cash to futures and futures to cash markets are given below.

Figure 3. *Open interest*



From Figure 3 of open interest, we find January and June periods were characterized by periods of high prices while other periods displaying moderate to low prices. Thus, two regime dynamic regression models seem to be reasonable. The Markov dynamic regression model also supported two regimes for the selected data.

The estimates of the two states dynamic regression model results are presented in the following table.

Table 1. *Markov switching dynamic regression model: dependent variable-open interest*

	State1			State2		
Variable	Coefficient	SE	P value	Coefficient	SE	P value
Total volume	5.512324	.3765475	0.000	-2.949145	.5336494	0.000
Wtdavg price	1773.28	5680.941	0.755	66578.06	1426.745	0.000
Mean	133274	586473.8	0.820	6536314	143350.5	0.000
Sigma	37149.71	1440.332				
P11	.9712535	.0066312				
P12	.0287465	.0066312				
P21	.0394168	.0072161				
P22	.9605832	.0072161				
State1 expected duration	90.3317					
State2 expected duration	80.1928					

Maximization algorithm has been used to estimate the Markov Regime Switching Dynamic model. The results in Table 1 reported the information about the regimes transition probabilities and its persistence.

The state 1 is associated with lower mean 133274 compared to state 2's mean value, which is 6536314 .State 1 is low volatile state with low mean and state 2 is high volatile state with high mean. So, state 1 represent a bull market situation and state 2 can be considered as bear market situation. The two states dynamic regression model exhibit dissimilar dynamics across unobserved regimes using state dependent variables. The estimated coefficients in both the regimes are statistically significant and positive.

The result also suggests that total traded volume is significant and positive in state 1 that is bull market conditions. But total traded volume and weighted average prices are significant and positive during state2, that is bear market conditions. The regime switching probability matrix shows that the estimated probability that open interest in state 1 is 97% for the next period and assuming that the process is in state 1 in the current period. P12 is the estimated probability that the open interest rate shift to state 2 from the current state 1. The estimated probability value is 3%. P22 is the estimated probability of open interest rate to continue in state 2 in the next period and the estimated value is 0.96, and P21 indicates that the probability of shifting from state 2 to state 1 is 4%, assuming that the process is in state 1. The results infer that the state 1 and state 2 are highly persistent with 96% and 97% probabilities respectively.

Results also estimated the expected duration for these two states. The state 1, less volatile state is expected to continue for 90 days and state 2 which is high volatile state is expected to continue for 80 days.

The below Figure 4 presents the predicted values for the two states i.e. state 1 and state 2. These predicated values are one step ahead probabilities and weighted average values of

the state specific predictions. The state one predicated values are lower than the state 2 predicted values with low mean values. Which confirms that the state 1 is low volatile price market situation.

Figure 4. *Comparison between the state1 and state 2 one-step a head predicted values*

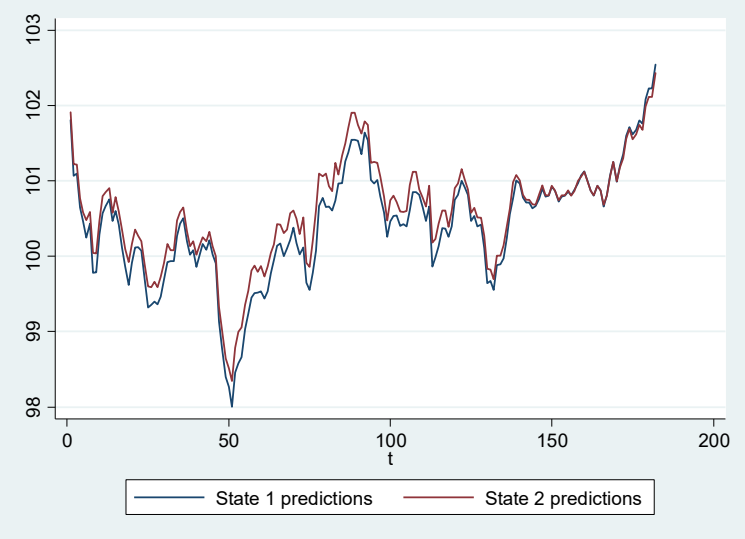


Figure 4 represents the model fitness by comparing fitted values of open interest rates.

Figure 5. *Model fitness by comparing fitted values of open interest rates, residuals and actual values of open interest rates*

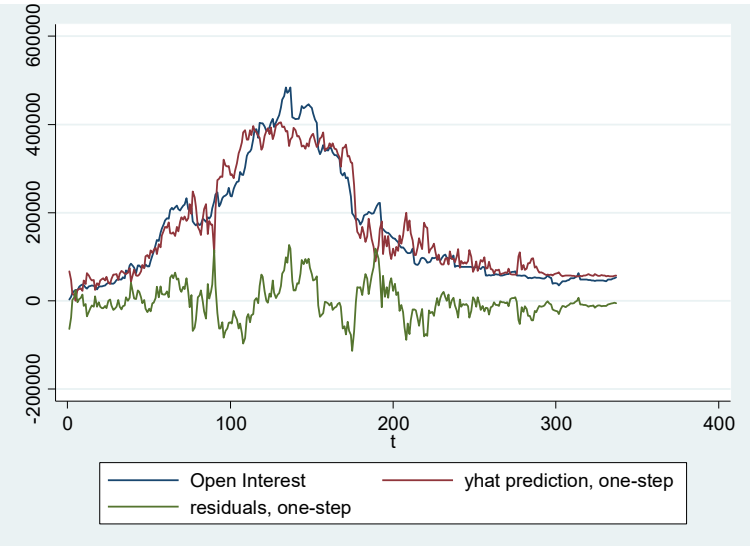


Figure 6. *Total volume (Rs. Cr.)*

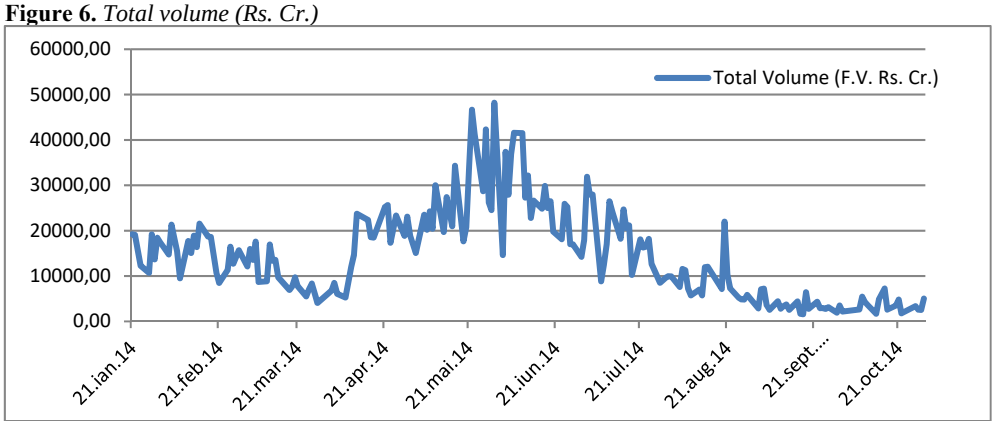


Table 2 presents regime switching behaviour of total volume. There are two states – state 1 and state 2. State 1 is associated with negative mean -225535.7 as compared to mean value of state 2 (-5590119). State 1 is high volatile state with high mean and state 2 is low volatile state with low mean. State 1 is regarded as bear market and state 2 can be regarded as bull market. Total contracts, open interest and near month settlement prices are positive and significant in both the states.

Table 2. *Markov Switching dynamic regression model: Dependent Variable-Total Volume*

	State1			State2		
Variable	Coefficient	Standard error	P value	Coefficient	Standard error	P value
Total contracts	.0999006	.015428	0.000	.1808527	.0343266	0.000
Open interest	.1230078	.0340118	0.000	.1070402	.0605322	0.077
Near month daily settlement price	2235.634	951.7714	0.019	5658.031	749.1802	0.000
Mean	-225535.7	96733.08	0.020	-559011.9	74809.32	0.000
Sigma	4484.549	240.461				
P11	.9729385	.0159087				
P12	.0270615	.0159087				
P21	.0436271	.0226944				
P22	.9563729	.0226944				
State1 expected duration	36.95292					
State2 expected duration	22.92155					

The regime switching probability matrix indicates the estimated probability that total value in state 1 is 97% for the next period and assuming that the process is in state 1 in current period. P12 is the estimated probability that total value total value sift to state 2 from the current state 1 is 3%. The estimated probability that the total value to continue in state 2 in the next period is 96%. P21 depicts that the probability of shifting from state 2 to state 1 is 4% assuming that the process is in state 1. The result indicate the state 1 and state 2 are highly persistent with 97% and 96% probability respectively. The result also estimated that the expected duration for these two states. The state 1 which is more volatile is expected to continue for 27 days and state 2 which is less volatile is expected to continue for 5 days.

The below Figure 8 presents the predicted values for the two states i.e. state 1 and state 2. These predicated values are one step ahead probabilities and weighted average values of the state specific predictions. The state 1 predicated values are higher than the state 2 predicted values with high mean. Which confirms that the state 1 is more volatile price market situation.

Figure 7. *Total volume and predicted values*

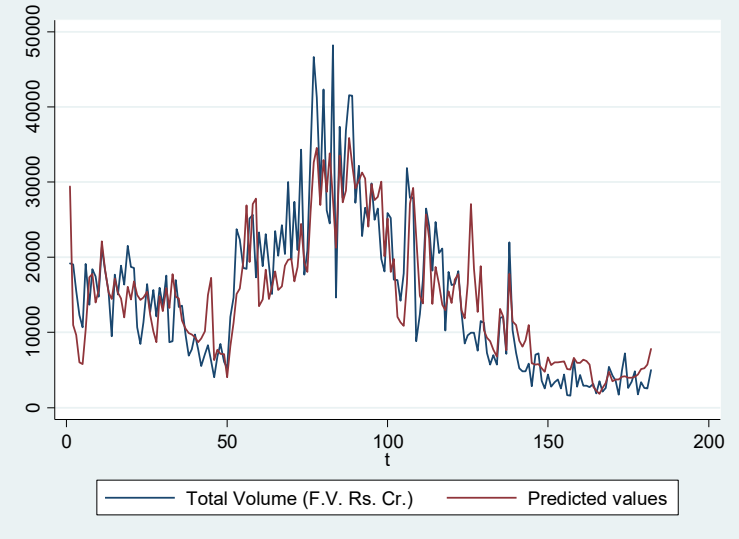


Figure 8. *Comparison between the state1 and state 2 one-step a head predicted values*

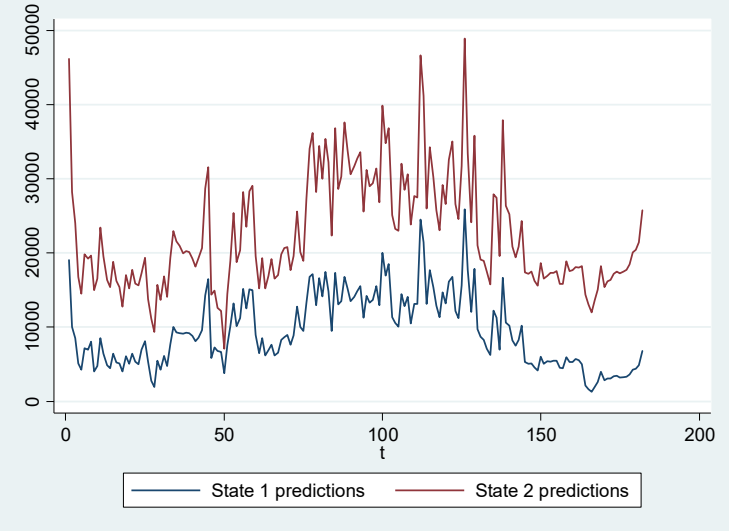


Figure 9. *Model fitness by comparing fitted values of total volume, residuals and actual values of total volume*

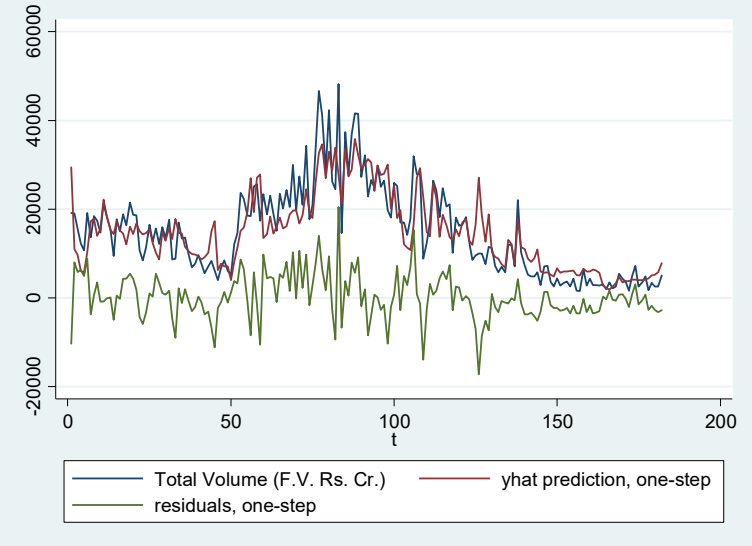
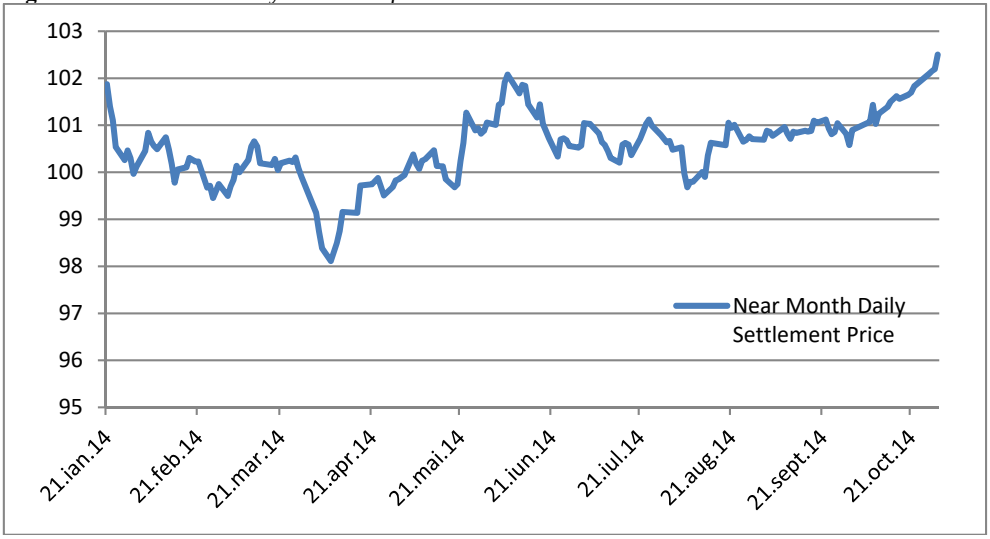


Figure 10. *Near month daily settlement price*



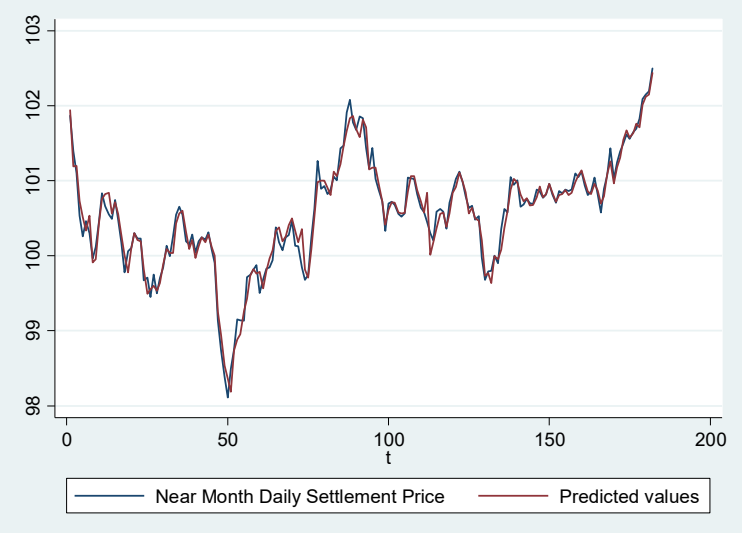
January to February and June to August is characterized by periods of high near month settlement prices and other periods are characterized by moderate to low near month settlement prices. This depicts that the application of two regime switching regression model is good. The Markov dynamic regression model also supported two regimes of the selected data. The estimates for two states dynamic regression model results are presented in Table 3.

Table 3. *Markov Switching dynamic regression model: Dependent Variable - Near Month Settlement Price*

	State1			State2		
Variable	Coefficient	Standard error	P value	Coefficient	Standard error	P value
Total volume	-.0000101	2.25e-06	0.000	1.60	9.47	0.092
Wtdavg price	1.080243	.0218325	0.000	.9814821	.0153321	0.000
Mean	-8.116148	2.198124	0.000	1.814773	1.539941	0.239
Sigma	.1006614	.0063092				
P11	.6880125	.1074249				
P12	.3119875	.1074249				
P21	.1231902	.0498823				
P22	.8768098	.0498823				
State1 expected duration	3.205257					
State2 expected duration	8.117526					

The results of information about the regimes transition probabilities and its persistence has been presented in Table 3. There are two states – state 1 and state 2. State 1 is associated with negative mean of -8.116 as compared to mean value of state 2 of 1.815. State 1 is low volatile state with low mean and state 2 is high volatile state with high mean. State 1 is regarded as bull market and state two can be regarded as bear market. The two states dynamic regression model exhibit dissimilar dynamics across unobserved regimes using state dependent variables. The estimated coefficient in both the variables are statistically significant. Result depicts total volume is negative and significant in bull market that is State 1 but weighted average price is significant and positive in this state. Total volume and weighted average price are positive and significant in bear market that is in state 2.

Figure 11. *Comparison of near month settlement price and its predicted value*



The regime switching probability matrix indicates the estimated probability that total value is in state 1 is 69% for the next period and assuming that the process is in state 1 in current period. P12 is the estimated probability that total value total value sift to state 2 from the current state 1 is 31%. The estimated probability that the total value to continue in state 2 in the next period is 88%. P21 depicts that the probability of shifting from state 2 to state 1 is

12% assuming that the process is in state 1. The result indicate the state 1 and state 2 are highly persistent with 69% and 88% probability respectively. The result also estimated that the expected duration for these two states. The state 1 which is less volatile is expected to continue for 3 days and state 2 which is more volatile is expected to continue for 8 days.

The below Figure 12 presents the predicted values for the two states i.e. state 1 and state 2. These predicated values are one step ahead probabilities and weighted average values of the state specific predictions. The state 1 predicated values are lower than the state 2 predicted values with low mean. Which confirms that the state 1 is less volatile price market situation.

Figure 12. *Comparison between the state1 and state 2 one-step a head predicted values*

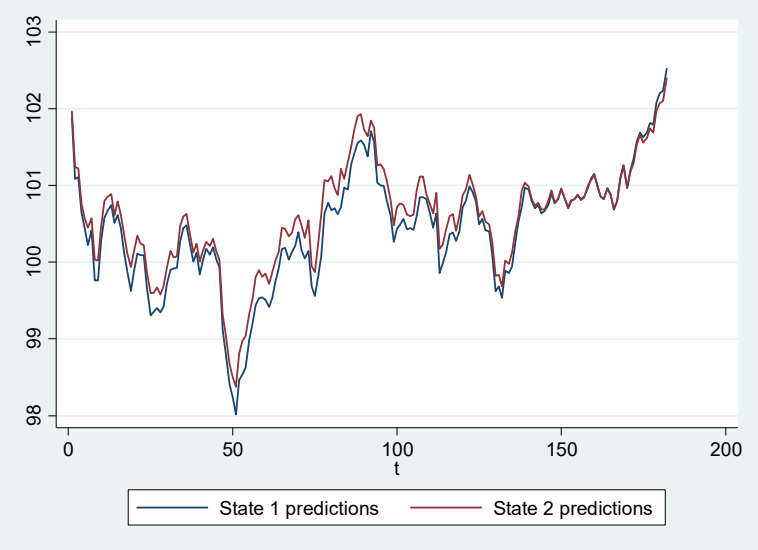


Figure 13. *Model fitness by comparing fitted values of total volume, residuals and actual values of near month settlement price*

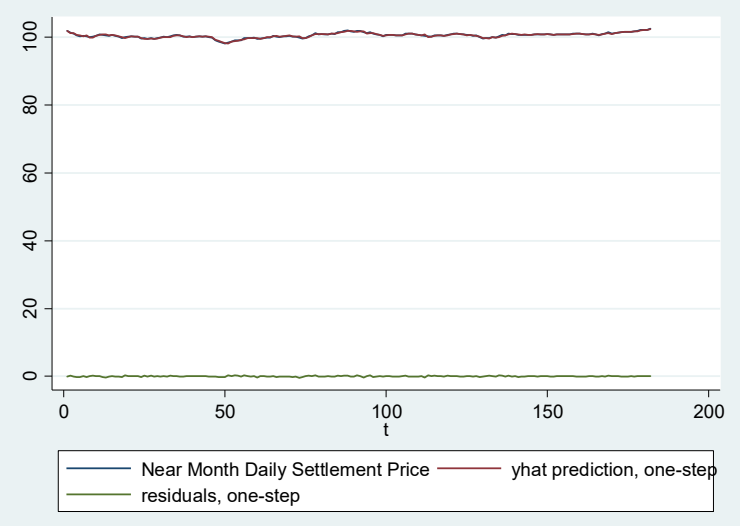
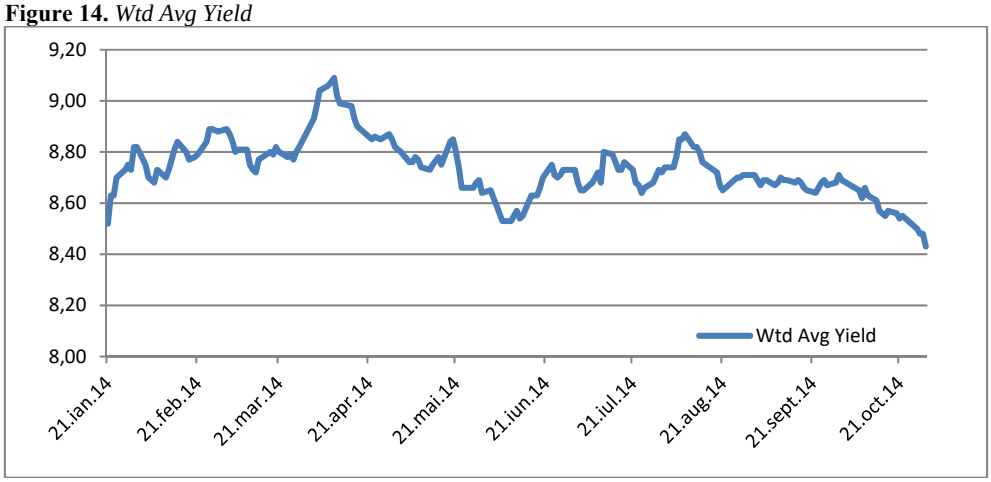


Figure 14. *Wtd Avg Yield*



January to May is characterized by periods of high near month settlement prices and other periods are characterized by moderate to low near month settlement prices. This depicts that the application of two regime switching regression model is good. The Markov dynamic regression model also supported two regimes of the selected data.

Table 4. *Markov switching dynamic regression model: dependent variable - Wtd Avg Yield*

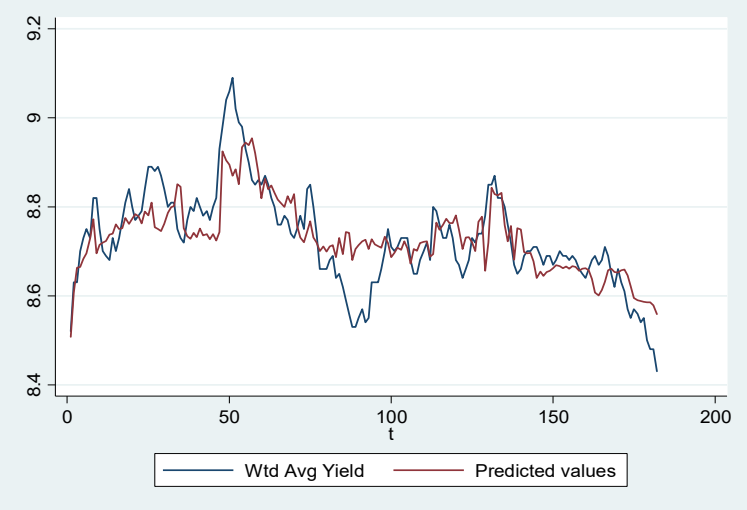
	State1			State2		
Variable	Coefficient	Standard error	P value	Coefficient	Standard error	P value
Open interest	3.15	5.68e-07	0.000	5.49	.561	0.000
Total value	-.0000337	.0000135	0.013	-.0000452	.0000166	0.006
Mean	8.544127	.026838	0.000	8.596584	.0244119	0.000
Sigma	.0655273	.0036401				
P11	.9664406	.0176092				
P12	.0335594	.0176092				
P21	.0527145	.0278579				
P22	.9472855	.0278579				
State1 expected duration	29.79795					
State2 expected duration	18.97011					

The results of information about the regimes transition probabilities and its persistence has been presented in Table 4. There are two states – state 1 and state 2. State 1 is associated with positive mean of 8.54 as compared to mean value of state 2 of 8.60. The mean value of these two states are slightly different. State 1 is low volatile state with low mean and state 2 is high volatile state with high mean. State 1 is regarded as bull market and state two can be regarded as bear market. The two states dynamic regression model exhibit dissimilar dynamics across unobserved regimes using state dependent variables. Result depicts total value is negative and significant in bull market as well as in bear market that is State 1 and state 2, but open interest is significant and positive in these two states.

The regime switching probability matrix indicates the estimated probability that weighted average yield is in state 1 is 97% for the next period and assuming that the process is in state 1 in current period. P12 is the estimated probability that total value total value sift to state 2 from the current state 1 is 3%. The estimated probability that the total value to

continue in state 2 in the next period is 95%. P21 depicts that the probability of shifting from state 2 to state 1 is 5% assuming that the process is in state 1. The result indicate the state 1 and state 2 are highly persistent with 97% and 95% probability respectively. The result also estimated that the expected duration for these two states. The state 1 which is less volatile is expected to continue for 30 days and state 2 which is more volatile is expected to continue for 19 days.

Figure 15. *Weighted average yield and predicted values*



The below Figure 16 presents the predicted values for the two states i.e. state 1 and state 2. These predicated values are one step ahead probabilities and weighted average values of the state specific predictions. The state 1 predicated values are lower than the state 2 predicted values with low mean. Which confirms that the state 1 is less volatile weighted average yield market situation.

Figure 16. *Comparison between the state1 and state 2 one-step a head predicted values*

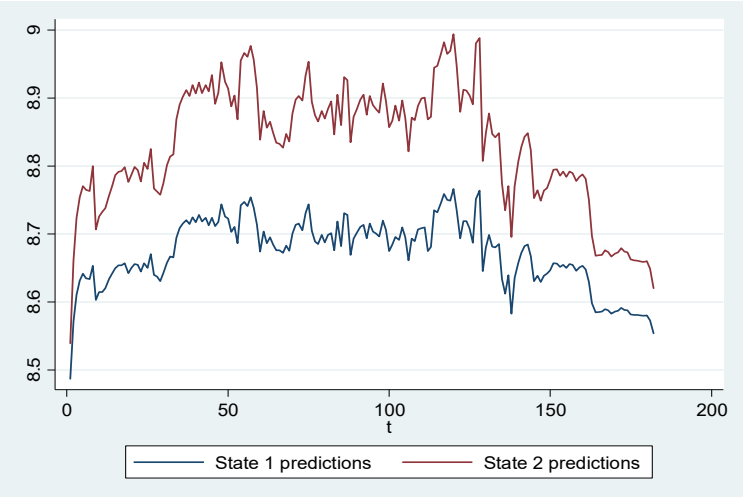


Figure 17. *Model fitness by comparing fitted values of weighted average yield, residuals and actual values of weighted average yield*

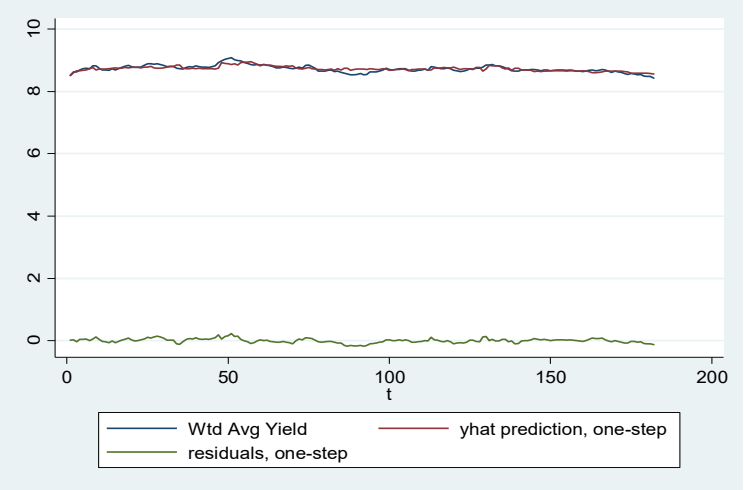
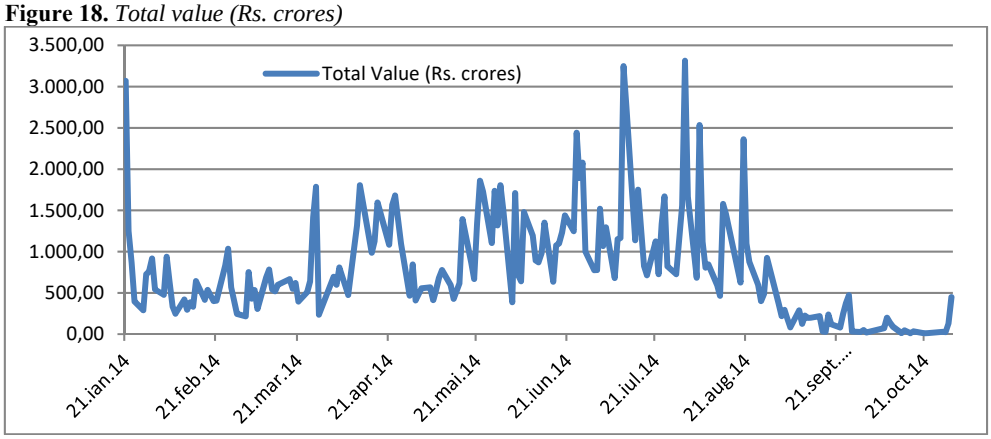


Figure 18. *Total value (Rs. crores)*



The period from March to August are characterized by high values while rest of the periods are display moderate to low prices. For this reason two regime dynamic regression model is suitable. The estimated results of two dimensions regime switching models are presented in Table 5.

Table 5. *Markov switching dynamic regression model: dependent variable - total value*

	State1			State2		
Variable	Coefficient	Standard error	P value	Coefficient	Standard error	P value
Total volume	.0346815	.0027543	0.000	.0730763	.0178753	0.000
Wtdavg price	-111.1784	45.07733	0.013	391.9498	185.2423	0.034
Mean	11342.86	4541.815	0.014	-38667.74	18379.46	0.035
Sigma	353.091	20.2935				
P11	.9626766	.0171197				
P12	.0373234	.0171197				
P21	.1989945	.118086				
P22	.8010055	.118086				
State1 expected duration	26.79286					
State2 expected duration	5.025264					

The results of information about the regimes transition probabilities and its persistence has been presented in Table 5. There are two states – state 1 and state 2. State 1 is associated with high positive mean 11342.86 as compared to mean value of state 2 (-38667.74). State 1 is high volatile state with high mean and state 2 is low volatile state with low mean. State 1 is regarded as bear market and state two can be regarded as bull market. The two states dynamic regression model exhibit dissimilar dynamics across unobserved regimes using state dependent variables. The estimated coefficient in both the variables are statistically significant. Result depicts total volume is positive and significant in bear market that is State 1 but weighted average price is significant and negative in this state. Total volume and weighted average price are positive and significant in bull market that is in state 2.

The regime switching probability matrix indicates the estimated probability that total value is in state 1 is 96% for the next period and assuming that the process is in state 1 in current period. P12 is the estimated probability that total value total value sift to state 2 from the current state 1 is 4%. The estimated probability that the total value to continue in state 2 in the next period is 80%. P21 depicts that the probability of shifting from state 2 to state 1 is 20% assuming that the process is in state 1. The result indicate the state 1 and state 2 are highly persistent with 96% and 80% probability respectively. The result also estimated that the expected duration for these two states. The state 1 which is more volatile is expected to continue for 27 days and state 2 which is less volatile is expected to continue for 5 days.

Figure 19. *Total values and its predicted values*

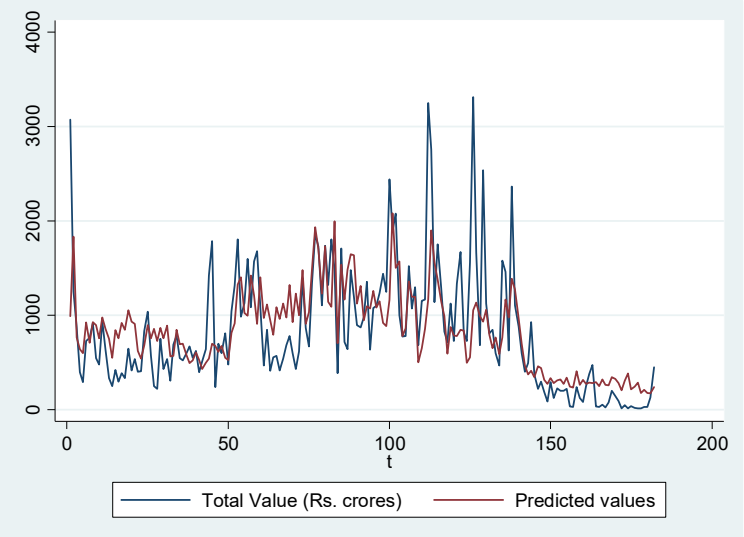


Figure 19 presents the predicted values for the two states i.e. state 1 and state 2. These predicated values are one step ahead probabilities and weighted average values of the state specific predictions. The state 1 predicated values are higher than the state 2 predicted values with high mean. Which confirms that the state 1 is more volatile price market situation. The model fits very well.

Figure 20. *Comparison between the state1 and state 2 one-step a head predicted values*

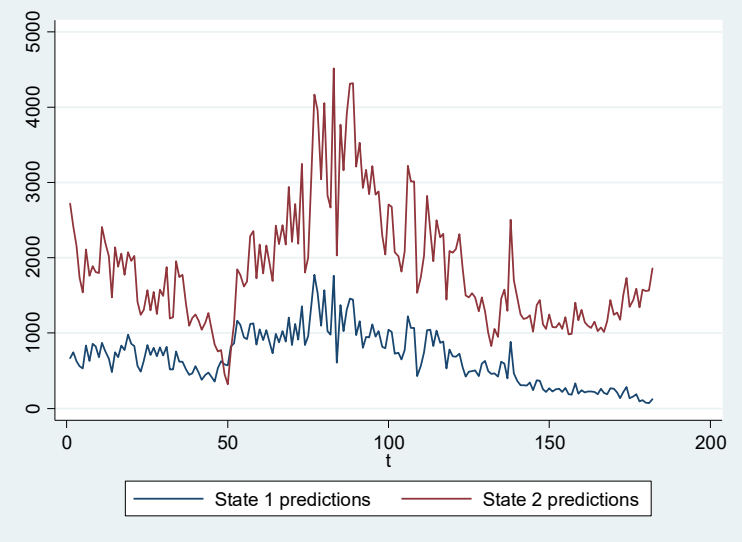


Figure 21. *Model fitness by comparing fitted values of total value, residuals and actual values total value*

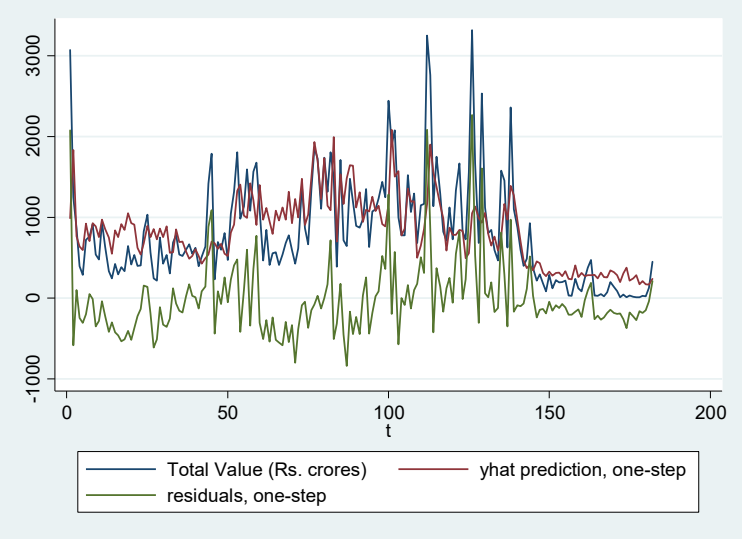
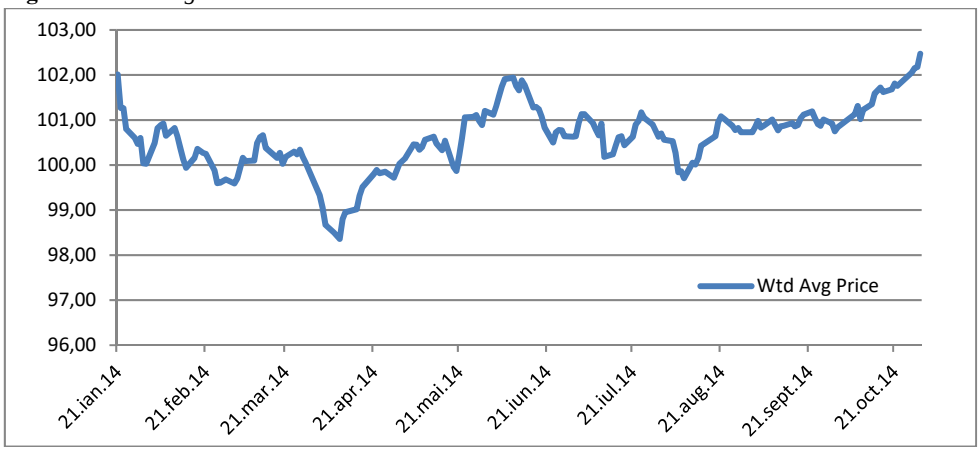


Figure 22. *Wtd Avg Price*



From Figure 22, it is very clear that the series is exhibiting high volatility for few periods and for some periods it is showing low volatility. This depicts that the application of two regime switching regression model is good. The Markov dynamic regression model also supported two regimes of the selected data.

Table 6. *Markov Switching Dynamic Regression Model: Dependent Variable- Weighted Average Price*

	State1			State2		
Variable	Coefficient	SE	P value	Coefficient	Standard error	P value
openinterest	-.0000348	.77e-06	0.000	-.000019	3.94e-06	0.000
totalvalue	.0002918	.0001095	0.008	.0002175	.0000844	0.010
Mean	101.4514	.1660495	0.000	101.736	.1973601	0.000
Sigma	.4192832	.0237948				
P11	.9460557	.0290047				
P12	.0539443	.0290047				
P21	.0325782	.0181579				
P22	.9674218	.0181579				
State1 expected duration	18.53764					
State2 expected duration	30.69537					

The results of information about the regimes transition probabilities and its persistence has been presented in Table 6. There are two states – state 1 and state 2. State 1 is associated with positive mean of 101.5 as compared to mean value of state 2 of 101.8. The mean value of these two states are slightly different. State 1 is low volatile state with low mean and state 2 is high volatile state with high mean. State 1 is regarded as bull market and state two can be regarded as bear market. The two states dynamic regression model exhibit dissimilar dynamics across unobserved regimes using state dependent variables. Result depicts open interest is negative and significant in bull market as well as in bear market that is State 1 and state 2 but the coefficients are very low. Total value is significant and positive in these two states.

The regime switching probability matrix indicates the estimated probability that weighted average price is in state 1 is 95% for the next period and assuming that the process is in state 1 in current period. P12 is the estimated probability that weighted average price sift to state 2 from the current state 1 is 5%. The estimated probability that the weighted average price to continue in state 2 in the next period is 97%. P21 depicts that the

probability of shifting from state 2 to state 1 is 5% assuming that the process is in state 1. The result indicate the state 1 and state 2 are highly persistent with 97% and 95% probability respectively. The result also estimated that the expected duration for these two states. The state 1 which is less volatile is expected to continue for 30 days and state 2 which is more volatile is expected to continue for 19 days.

Figure 23. *Weighted Average Price and its Predicted Values*

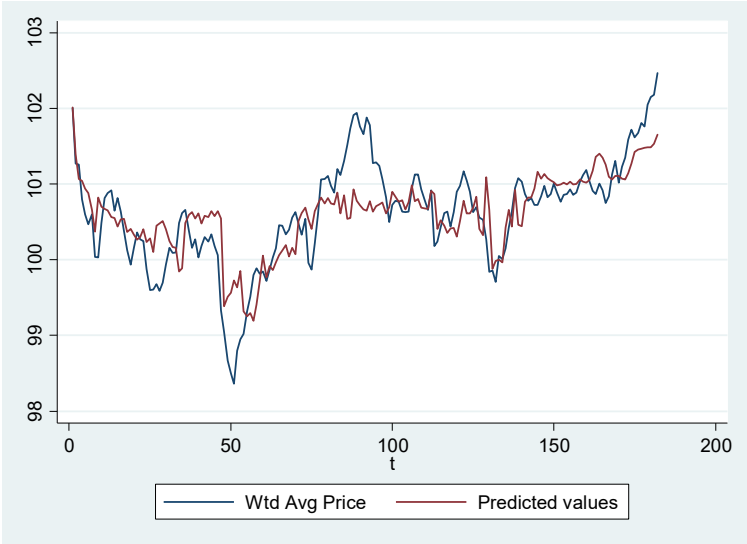


Figure 24. *Comparison between the state1 and state 2 one-step a head predicted values*

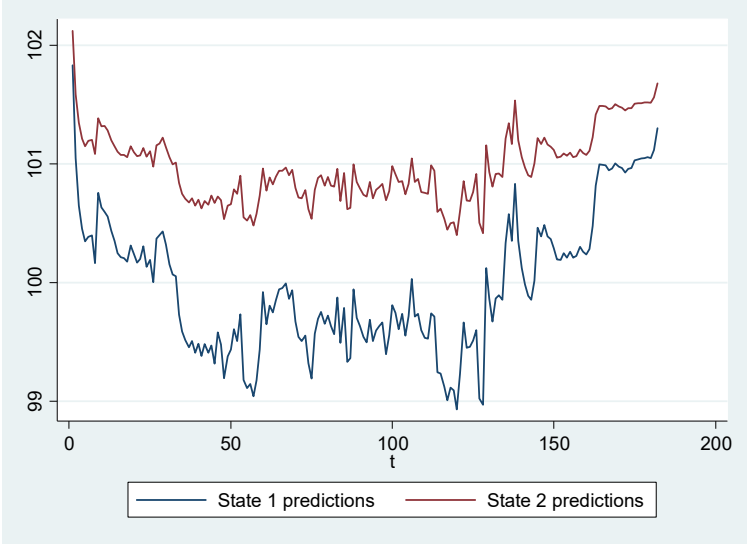
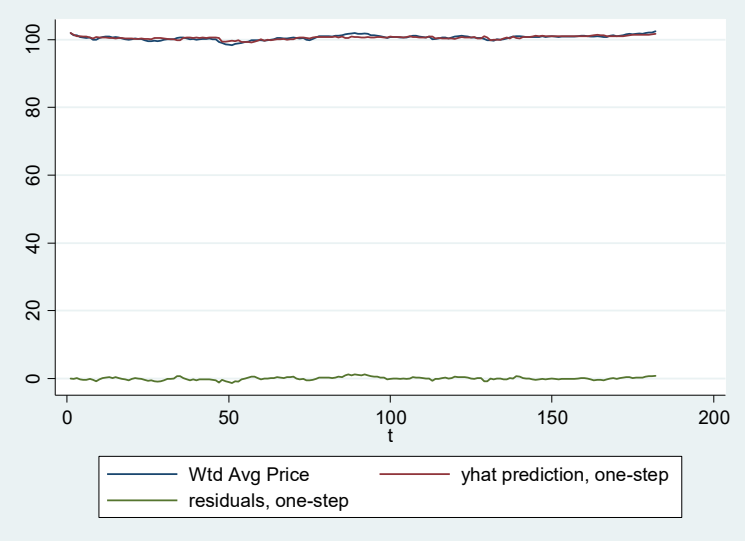


Figure 25. *Model fitness by comparing fitted values of Weighted Average Price, residuals and Actual values of Weighted Average Price*



Conclusion

Study relating to interest rate futures and cash market in India are a few. In this study we use daily data for interest rate cash market like- volumes, weighted average price, weighted average yield and for futures market - total values, open interest, settlement price from 21st January 2014 to 30th October 2014. We consider the most liquid and having longer period contract i. e. 840GS2024 of NSE for our analysis. All data are sourced from Clearing Corporation of India Ltd. (CCIL) and National Stock Exchange (NSE). We run regime switching regression to capture the switching behavior in bull as well as bear state of cash to future and future to cash in six different equations. This model also captures the estimated probability and estimated duration to continue in bull and bear state and does not require to test stationarity or to convert data into any normalise form. We find both cash is regime switching the future and future is regime switching the cash market and the estimated probability differs from 70% to 97% in different cases. The estimated duration to continue in an existing state has been captured in 6 different equations. This result will help investors of interest rate cash and futures in India.

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