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# The European Union's strategy for increasing the living conditions of the population in the member states

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**Abstract.** *In this article, the authors propose to analyze the European Union's Strategy for Improving Living Conditions on a total, as well as in each country part of the Community. The European Commission considers the need to ensure respect for fundamental human rights, aiming to implement a program to ensure economic well-being and social cohesion. This article will devote a space of social inclusion that can be expressed by monetary or non-monetary indicators that highlight the danger of poverty risk that is different from one country to another. A number of countries have made significant progress in improving living conditions, with others experiencing even more negative aspects. To highlight these elements, the authors analyzed income levels and their distribution across Member States, ranking hierarchically on the basis of these indicators a number of countries where immediate action is needed to ensure a level playing field. The study highlights the inequality of revenue distribution, suggesting the need for important measures, especially in those countries where there are lagging behind. Concretely, an analysis is made of the existence of adequate incomes as a fundamental requirement for housing in all EU countries. And here are hierarchies that highlight the situation of each state. In the final part, the authors focus on the social protection that needs to be ensured by each country. On this background, an analysis of Romania's situation was carried out resulting in vigorous measures being taken under the heading of Living Conditions of the Population.*

**Keywords:** social exclusion, at-risk-of-poverty rate, social protection, housing cost, criminality.

**JEL Classification:** H55, I38, R21.

## Introduction

The European Strategy for 2020 foresees the need for sustained economic growth so as to ensure better living conditions for the entire population of the European Union. The European Union's Platform against Poverty is one that covers a number of issues that focus primarily on economic, social and territorial growth, as an element of European and national cohesion. The European Commission considers the need to ensure respect for fundamental rights of the population by trying to ensure economic well-being and social cohesion so that the whole community of the community lives in dignified conditions and takes an active part in social life. On the other hand, it is intended to mobilize the entire population to live in better living conditions, to ensure the conditions for a job and, in this way, the access of all people to the benefits that society offers. Against this background, it is intended to ensure that the fundamental objectives of the European Union's strategy are met in 2020 so as to alleviate, if not disappear, the different situations and circumstances that affect the population of a number of countries.

One of the directions that is intended to act and accomplish is that, ultimately, 20 million people will no longer be socially excluded. Economic integration and job creation have been agreed since 2008 and have been specified in 2010 as the framework within which action must be taken to ensure that the European Strategy for 2020 removes social concerns, secures social inclusion and ensures a cohabitation in reasonable social conditions.

## Literature review

Alkire and Santos (2014) analyzes the scope, robustness and reliability of the Multidimensional Poverty Index as a measure of acute poverty. Anghelache, Anghel and Panait (2017) studied the main economic and financial developments of the EU Member States, insisting on the period after 2007, when Romania became a member of the European Union. Atkinson and Brandolini (2010) consider it necessary to re-examine the concept of well-being used to measure income inequality and the relationship between poverty and poverty. Anghelache (2016) undertook a comprehensive study on the economic situation in Romania, analyzed and interpreted the evolution of the main macroeconomic indicators from 1997 to the present, paying particular attention to socio-economic development as well as to the analysis of living standards. Shortall (2008) considers that EU rural development programs misapply social participation processes and categorizes some groups of people as socially excluded, although they are not, simply because the groups concerned do not participate in those programs. Anghelache (2008) draws up a treaty on the theoretical and practical notions of the statistical apparatus used in economic and financial analyzes. Pęciak and Tusińska (2015) show the common position of the EU Member States on social protection and analyze a series of statistical documents on the fight against poverty, doubting the effectiveness of EU policy on poverty and social exclusion. Anghelache et al. (2006) perform a synthesis of the specific indicators applied for measuring the level of poverty, which are used in the macroeconomic analysis and international comparisons. Saraceno (2015) believes that the

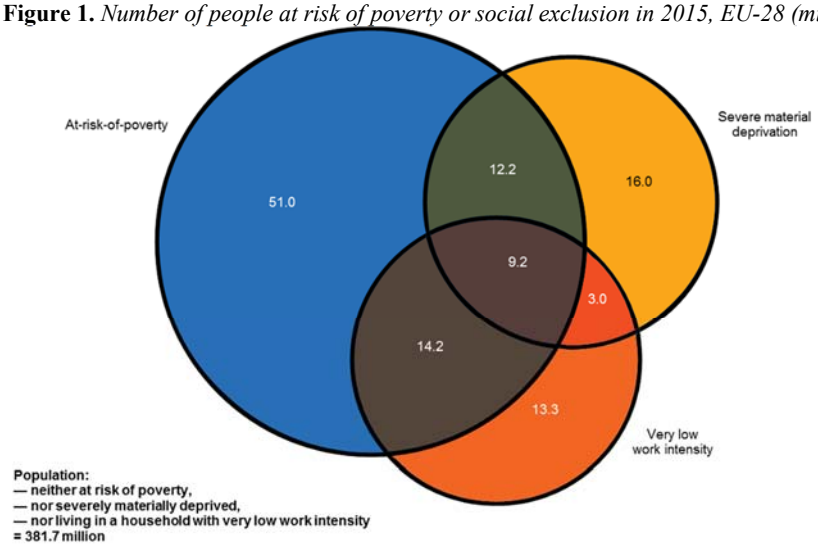
objective of reducing poverty and social exclusion found in the 2020 European Strategy seems to be more distant than its foundation, due to the long-standing financial crisis and the austerity measures taken to deal with this crisis. Marlier and Atkinson (2010) analyze a set of indicators for measuring poverty and social exclusion applicable at multinational level. Anghelache and Anghel (2016) make a relevant synthesis of the concepts, theories and calculus relations specific to the statistical and mathematical instrumentation, applicable in complex analyzes of socio-economic phenomena. Nolan and Whelan (2010) investigate the contribution of non-monetary indicators to improving the identification of those experiencing poverty and the prospect offered by the application of material deprivation indicators in comparative country analyzes. Saraceno and Keck (2010) studies models to identify intergenerational obligations regarding financial support and care for certain categories of people - children, the elderly, as well as sharing social responsibility between family and state intergenerations. Hall and Jones (2007) have made a model showing that by the middle of the century the optimal share of health spending will exceed 30%, showing that health concerns are rising as revenue increases. Hervey (2008) analyzes whether the European Union's health governance through the "Open Method of Coordination" is advancing a neoliberal agenda for the modernization of health care. Hermann (2017) notes that rising poverty and inequality are seen in crisis countries, and believes that switching from the open method of coordination to economic governance could increase the pressure on other countries to introduce similar reforms, further weakening the European social model. Faist (2009) tries to identify and clarify the theoretical notions on the transnational social issue and analyzes the implications of social rights policy and social standards. Kvist (2015) demonstrates that transnational models indicate a positive relationship between social investment policies and returns. Besley and Persson (2010) performs an analytical structure in which state capacity is modeled as government-oriented investment for the future, closely linked to growth and growth patterns. Bar and Leukhina (2010) studied aspects of economic and demographic transformations and their links, taking into account the historical changes in youth mortality and sector-specific productivity. Jorgenson and Timmer (2011) highlight the important role of the service sector in the economic activity of the European Union, insisting on the substantial heterogeneity of this. Akbulut (2011) develops an economic model that can explain the simultaneous growth of women's employment and the growth of the service sector. Gibler and Tyvimaa (2014) assessed the context of the housing market in Finland from the perspective of consumer segmentation-related potential. Norris and Shiels (2007) analyze variations in the quality and accessibility of housing in the European Union and propose a typology of international variations in living conditions. Wonka et al. (2010) focus on the size and scope of the EU interest group population. Gruszczyńska and Heiskanen (2012) develop a 10-year analysis in Western Europe, Central and Eastern Europe, where there have been significant socio-political changes related to some crimes committed such as homicide, assault, rape, etc., but some less frequent offenses in police statistics such as corruption or money laundering are also addressed.

## Research methodology, data, results and discussions

- **Social inclusion**

There are several concepts about poverty and social exclusion that can not be measured only statistically. As a result of monetary and non- monetary indicators we find that the risk of poverty is quite severe in a number of countries that tackle the social aspects trails. A number of indicators are relevant to social inclusion analysis. Measuring progress in terms of strategy implementation by 2020 makes it possible to highlight situations that reflect different situations and circumstances in which Member States of the European Union population live. In 2014 there were 122 million people in the European Union, about 24.5% of the entire population, living in delicate material or socially excluded. Comparing the situation in the year 2013 we find that the number of persons at risk of poverty or social exclusion has decreased by 564 000, equivalent to a 0.1%, which means very little. The results for the European Union of 28 states, we also consider the UK after Brexit, calculated as a national average, result in a series of differentiations. In Bulgaria, in 2012, very close to half of the population is considered to be at risk of poverty or social exclusion, i.e. 49.3%. In 2014, 40.3% in Romania, while in Greece 36% of the population is in this situation. More than one third of the population is at risk of poverty or social exclusion in 10 other EU Member States. These are Lithuania, Hungary, Croatia, Spain, Italy, Portugal, Ireland, Cyprus, Latvia and Estonia. Some of the EU Member States with the lowest proportion of the population at risk of poverty or social exclusion in 2014 were the Czech Republic with 14.8%, the Netherlands 16.5%, Sweden 16.9%, Finland 7.3%, Iceland 11.2%, Norway 13.5% and Switzerland 16.4%. Data comparing in 2014 with those recorded in 2013, however, show a slight improvement in the situation, but this is not significant in the long run. In the years 2015 and 2016, light steps have been taken, but it remains a delicate situation to be taken into account by the European Commission.

**Figure 1.** *Number of people at risk of poverty or social exclusion in 2015, EU-28 (million)*




Note: the sum of the data for the seven groups at-risk-of-poverty or social exclusion differs slightly from the total (published elsewhere) due to rounding.
*Source:* Eurostat (online data code: ilc_pees01)

**Source:** Eurostat.

**Table 1.** *People at risk of poverty or social exclusion. Evolution in 2010-2015*

| | Number of persons (thousand) | | | | Proportion of the total population (%) | | | |
|---|---|---|---|---|---|---|---|---|
| | **2010** | **2012** | **2014** | **2015** | **2010** | **2012** | **2014** | **2015** |
| EU-28 | 117678 | 123614 | 121897 | 118820 | 23.7 | 24.7 | 24.4 | 23.7 |
| EA-19 (Euro Area) | 72723 | 77373 | 77825 | 76665 | 22.0 | 23.3 | 23.5 | 23.1 |
| Belgium | 2235 | 2356 | 2339 | 2336 | 20.8 | 21.6 | 21.2 | 21.1 |
| Bulgaria | 3719 | 3621 | 2909 | 2982 | 49.2 | 49.3 | 40.1 | 41.3 |
| Czech Republic | 1495 | 1580 | 1532 | 1444 | 14.4 | 15.4 | 14.8 | 14.0 |
| Denmark | 1007 | 965 | 1006 | 999 | 18.3 | 17.5 | 17.9 | 17.7 |
| Germany | 15962 | 15909 | 16508 | 16083 | 19.7 | 19.6 | 20.6 | 20.0 |
| Estonia | 289 | 311 | 338 | 315 | 21.7 | 23.4 | 26.0 | 24.2 |
| Ireland | 1220 | 1392 | 1267 | 1204 | 27.3 | 30.3 | 27.5 | 25.9 |
| Greece | 3031 | 3795 | 3885 | 3829 | 27.7 | 34.6 | 36.0 | 35.7 |
| Spain | 12029 | 12628 | 13402 | 13175 | 26.1 | 27.2 | 29.2 | 28.6 |
| France | 11712 | 11760 | 11540 | 11048 | 19.2 | 19.1 | 18.5 | 17.7 |
| Croatia | 1322 | 1384 | 1243 | 1216 | 31.1 | 32.6 | 29.3 | 29.1 |
| Italy | 14891 | 17975 | 17146 | 17469 | 25.0 | 29.9 | 28.3 | 28.7 |
| Cyprus | 202 | 234 | 234 | 244 | 24.6 | 27.1 | 27.4 | 28.9 |
| Latvia | 798 | 731 | 645 | 606 | 38.2 | 36.2 | 32.7 | 30.9 |
| Lithuania | 1068 | 975 | 804 | 857 | 34.0 | 32.5 | 27.3 | 29.3 |
| Luxembourg | 83 | 95 | 96 | 95 | 17.1 | 18.4 | 19.0 | 18.5 |
| Hungary | 2948 | 3272 | 3097 | 2735 | 29.9 | 33.5 | 31.8 | 28.2 |
| Malta | 86 | 94 | 99 | 94 | 21.2 | 23.1 | 23.8 | 22.4 |
| Netherlands | 2483 | 2492 | 2751 | 2744 | 15.1 | 15.0 | 16.5 | 16.4 |
| Austria | 1566 | 1542 | 1609 | 1551 | 18.9 | 18.5 | 19.2 | 18.3 |
| Poland | 10409 | 101128 | 9337 | 8761 | 27.8 | 26.7 | 24.7 | 23.4 |
| Portugal | 2693 | 2667 | 2863 | 2765 | 25.3 | 25.3 | 27.5 | 26.6 |
| Romania | 8425 | 8673 | 8043 | 7435 | 41.5 | 43.2 | 40.3 | 37.4 |
| Slovenia | 366 | 392 | 410 | 385 | 18.3 | 19.6 | 20.4 | 19.2 |
| Slovakia | 1118 | 1109 | 960 | 963 | 20.6 | 20.5 | 18.4 | 18.4 |
| Finland | 890 | 916 | 927 | 904 | 16.9 | 17.2 | 17.3 | 16.8 |
| Sweden | 1419 | 1519 | 1636 | 1555 | 15.0 | 15.6 | 16.9 | 16.0 |
| United Kingdom | 14211 | 15099 | 15271 | 15028 | 23.2 | 24.1 | 24.1 | 23.5 |

**Source:** Eurostat; data processed by the authors.

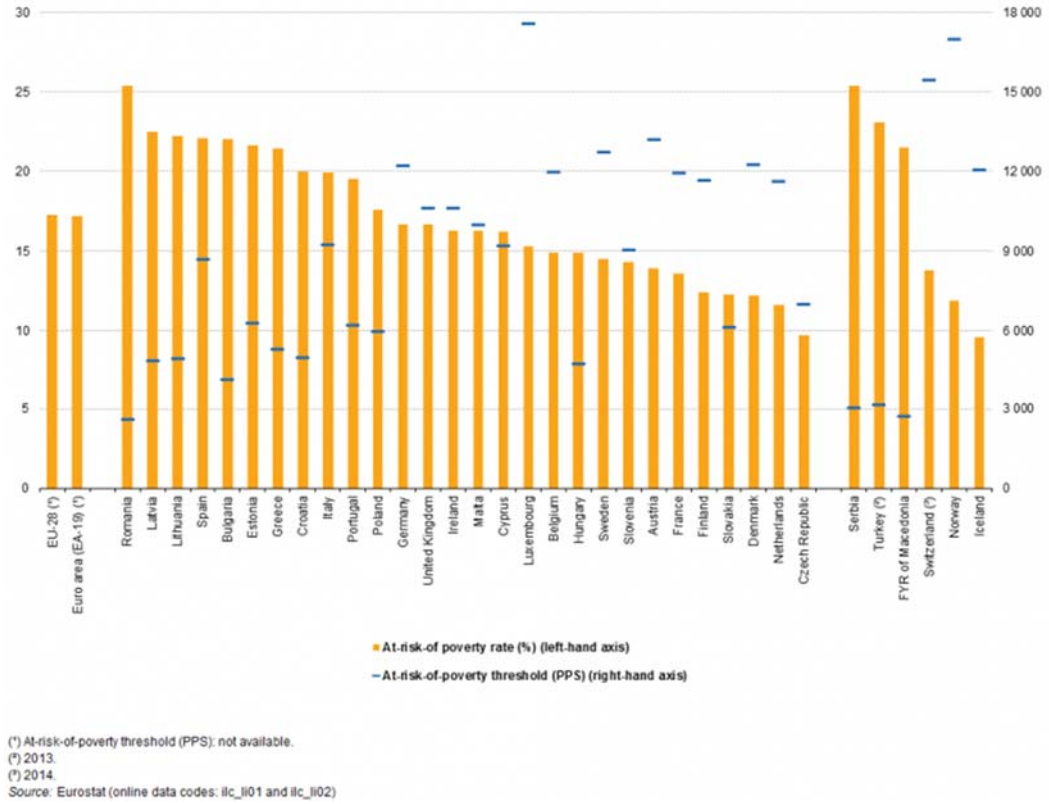
There are presented the average data recorded in the European Union 28 states as in the first 18 states. It is noted that in some countries such as Belgium, the Czech Republic, Denmark, even Germany or France the share of the population stagnated or increased somewhat. Romania, from 2010 to 2015, saw a decrease in the percentage of the population at risk of poverty or social exclusion from 41.5% in 2010 to 40.3% in 2014 and 37.4% in 2015. Countries with a special economic potential, for example the United Kingdom, saw an increase in the proportion of the population at risk of poverty from 22.7% in 2011 to 24.1% in 2014 and almost the same level in 2015 (23.5%). Other countries, such as Malta or the Netherlands, have experienced an impact on the percentage of people at risk of poverty and social exclusion.

- **Income distribution**

Another aspect of the prospect of poverty and social exclusion is the European Union's revenue and the way it is distributed. Between 2011 and 2015, there were no spectacular leaps. It is also somewhat difficult because resources are scarce and the ability of Member States to create additional revenue and increase the primary incomes of the population are limited. Romania, also this time, is in a more delicate situation in which the proportion of

the low-income population is much higher than in the other Member States. A number of social categories are vulnerable and at risk of poverty. First, the unemployed are the most vulnerable group, of which 47.2% are people who were unemployed at risk of poverty in 2014. In 2015 and 2016, this situation improved very little.

**Figure 2.** *At risk of poverty rate and threshold, during 2015*



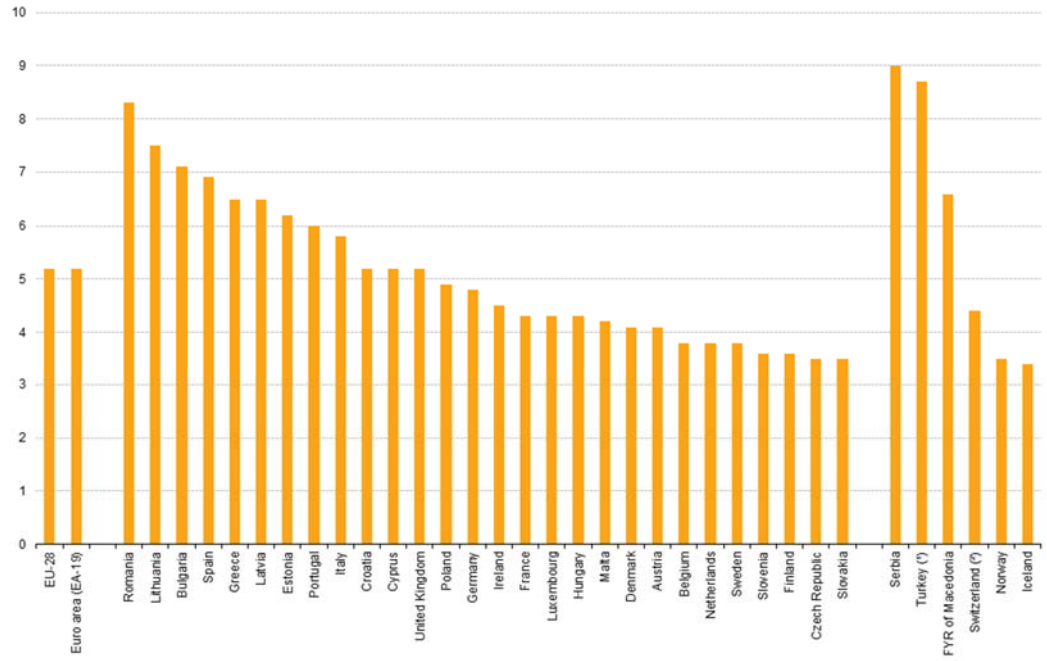

(*) At-risk-of-poverty threshold (PPS): not available.
(*) 2013.
(*) 2014.
*Source:* Eurostat (online data codes: ilc_li01 and ilc_li02)

**Source:** Eurostat.

This graph presents the situation of the population in each country of the EU member states at the risk of poverty and the percentages as well as the absolute number. Because in the figure we have the percentages of the population at risk, and on the right side the absolute value of the population at risk, it shows that a number of countries are still facing particularly serious problems. Unfortunately, Romania is at the forefront of the poverty risk rate of 25.3%. Data on economic inequality becomes particularly important in expressing relative poverty because the distribution of economic resources has a precise focus and can not cover the prospect of poverty. There are a number of inequalities in the distribution of population incomes, data specific to each EU member country, shows that on average 20% of the population receives 5.2 times more income while the share of the population with insufficient or limited income is sufficient Of the sea. Concerning the median of personal incomes compared to the risk of poverty in the 28 Member States, we find that 24.6% are below the level recorded in 2014 and 60% of the

members of the society live on low income. The relative median in Romania in relation to the poverty risk is the highest 31.2% and this is quite alarming if we compare it with the lowest recorded by Finland 13.9%.

**Figure 3.** *Inequality of revenue distribution, 2015*



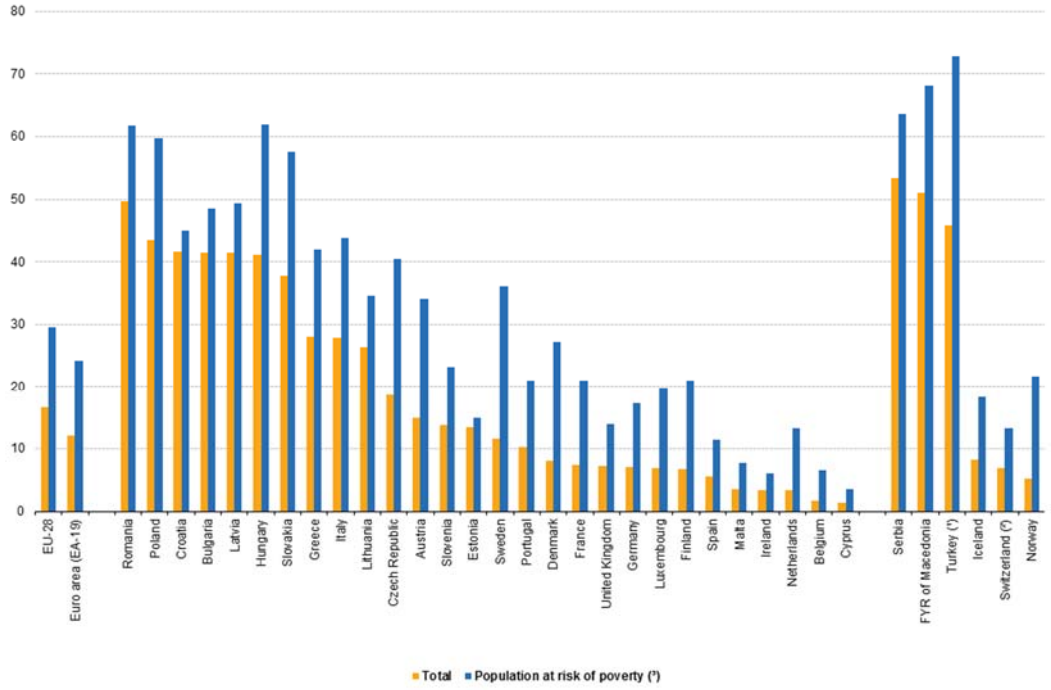

(1) 2013.
(2) 2014.
*Source:* Eurostat (online data code: ilc_di11)

**Source:** Eurostat.

- **Housing**

The existence of adequate revenues is a fundamental requirement that the European Union must vigorously pursue. In 2014, 4 out of 10 people in all EU countries lived in apartments 25.6%, lived in semi-detached houses, and 3.7% lived in proper homes. An element that expresses the dimension of the quality of housing is the size of the space that a dwelling offers for an average family. 17.1% of the population of the 28 countries live in highly agglomerated housing. In 2015, 2015 and 2016, 11.4% of the population of the EU Member States lived in homes where they invested or spent about 40% of the income they earned. It is an element that shows that, on the one hand, the income situation, the living conditions and, on the other hand, the high costs they imply. Countries such as Malta and Cyprus have very good living conditions, while most of the eastern and even central European countries, which later joined the European Union, are in a delicate situation, spending more than 40% of their income on housing.

**Figure 4.** *Overcrowding rate, 2015 (% of specified population)*




(1) 2013.
(2) 2014.
(3) Population below 60 % of median equivalised income.
*Source:* Eurostat (online data code: ilc_lvho05a)

**Source:** Eurostat.

This table shows a ranking of countries with the most delicate living conditions. Note that the overall living conditions and the population at risk of poverty are compared. Of course, in all Member States the share of the population at risk of poverty is higher, and Romania is also the first to be followed by Hungary, Poland, Bulgaria, Croatia, Latvia, Slovakia, Lithuania and even Greece.

**Table 2.** *Housing cost overburden rate by tenure status in 2015*

| | Total population | Owner occupied with mortgage or loan | Owner occupied, no outstanding mortgage or housing loan | Tenant – rent at market price | Tenant – rent at reduced price or free |
|---|---|---|---|---|---|
| EU-28 | 11.3 | 6.7 | 6.8 | 27.0 | 12.4 |
| EA-19 (Euro area) | 11.2 | 7.2 | 5.6 | 25.5 | 11.4 |
| Belgium | 9.4 | 2.4 | 1.8 | 33.7 | 14.2 |
| Bulgaria | 14.8 | 10.4 | 14.1 | 30.8 | 16.6 |
| Czech Republic | 10.4 | 6.0 | 6.0 | 31.0 | 10.7 |
| Denmark | 15.1 | 5.3 | 4.3 | 31.9 | : |
| Germany | 15.6 | 10.7 | 9.2 | 22.8 | 16.1 |
| Estonia | 6.8 | 4.3 | 4.5 | 42.3 | 11.0 |
| Ireland | 4.6 | 2.7 | 1.5 | 18.0 | 3.7 |
| Greece | 40.9 | 31.5 | 37.9 | 54.4 | 49.8 |
| Spain | 10.3 | 8.7 | 2.7 | 43.3 | 9.9 |
| France | 5.7 | 1.9 | 1.7 | 14.9 | 9.7 |

| | Total population | Owner occupied with mortgage or loan | Owner occupied, no outstanding mortgage or housing loan | Tenant – rent at market price | Tenant – rent at reduced price or free |
|---|---|---|---|---|---|
| Croatia | 7.2 | 3.4 | 6.3 | 36.4 | 11.6 |
| Italy | 8.6 | 4.8 | 2.8 | 32.7 | 9.9 |
| Cyprus | 3.9 | 4.7 | 0.4 | 19.7 | 1.1 |
| Latvia | 8.1 | 15.5 | 6.2 | 13.6 | 9.4 |
| Lithuania | 9.1 | 7.7 | 8.3 | 30.3 | 13.4 |
| Luxembourg | 6.0 | 1.4 | 0.7 | 23.2 | 4.0 |
| Hungary | 8.5 | 11.9 | 5.4 | 32.4 | 12.7 |
| Malta | 1.1 | 1.0 | 0.5 | 14.2 | 1.5 |
| Netherlands | 14.9 | 11.3 | 2.2 | 25.0 | 13.0 |
| Austria | 6.4 | 1.4 | 1.6 | 15.3 | 6.8 |
| Poland | 8.7 | 12.6 | 7.1 | 26.3 | 10.9 |
| Portugal | 9.1 | 6.6 | 3.2 | 35.4 | 7.6 |
| Romania | 15.9 | 21.7 | 15.5 | 45.7 | : |
| Slovenia | 6.1 | 11.5 | 3.2 | 25.9 | 8.2 |
| Slovakia | 9.1 | 30.9 | 6.0 | 8.4 | 9.1 |
| Finland | 4.9 | 1.6 | 2.0 | 16.7 | 10.6 |
| Sweden | 7.5 | 2.5 | 5.5 | 18.3 | 53.9 |
| United Kingdom | 12.5 | 5.0 | 3.9 | 37.3 | 15.4 |

**Source:** Eurostat; data processed by the authors.

In this table is presented a ranking of the member countries of the European Union taking into account a number of essential elements namely: total population, owner-occupied dwelling, share of dwellings with good living conditions. This table expresses in a ranking of countries in somewhat alphabetical order the situation from this point of view of the cost of housing.

- **Social protection**

The issues presented to date reveal the difficulties encountered by the population of most of the Member States of the European Union that have joined in Stages 2 and 3 and the rest of which are a number of countries.

It is taken into account that in the conditions of low incomes that bring a significant percentage of the population in the risk area, the limited income, the living conditions, it is a problem for the Member States to pay attention to social protection. Since 2007, when Romania joined the European Union until 2016, social protection has increased by 3.8%. In 2012, there was a negative evolution in the sense that the losses increased by 3.3% on average compared to the GDP growth of 1.9% on average, resulting in a slight improvement of the social protection.

Among the Member States with reduced social protection we meet the countries that have accessed the European Union in good conditions for social protection, we meet France, Denmark, which provides about 33% of social protection, quite consistent. Expenditure incurred by Member States in ensuring the living conditions of the third generation population, especially pensioners, shows that attention is paid to them, but the costs are sufficiently low.

Table 3 shows the evolution of social protection spending over the period 2004-2014, which in most Member States has grown, if not significant, at least important. As far as Romania is concerned, it is estimated that in 2004 expenditures represented almost 13%, increased to 14.1% in 2008, 16.9% in 2009, 17.3% in 2010, after which it decreased in the next four years to 16.4% in 2011, 15.4% in 2012, 14.9% in 2013, 14.8% in 2014.

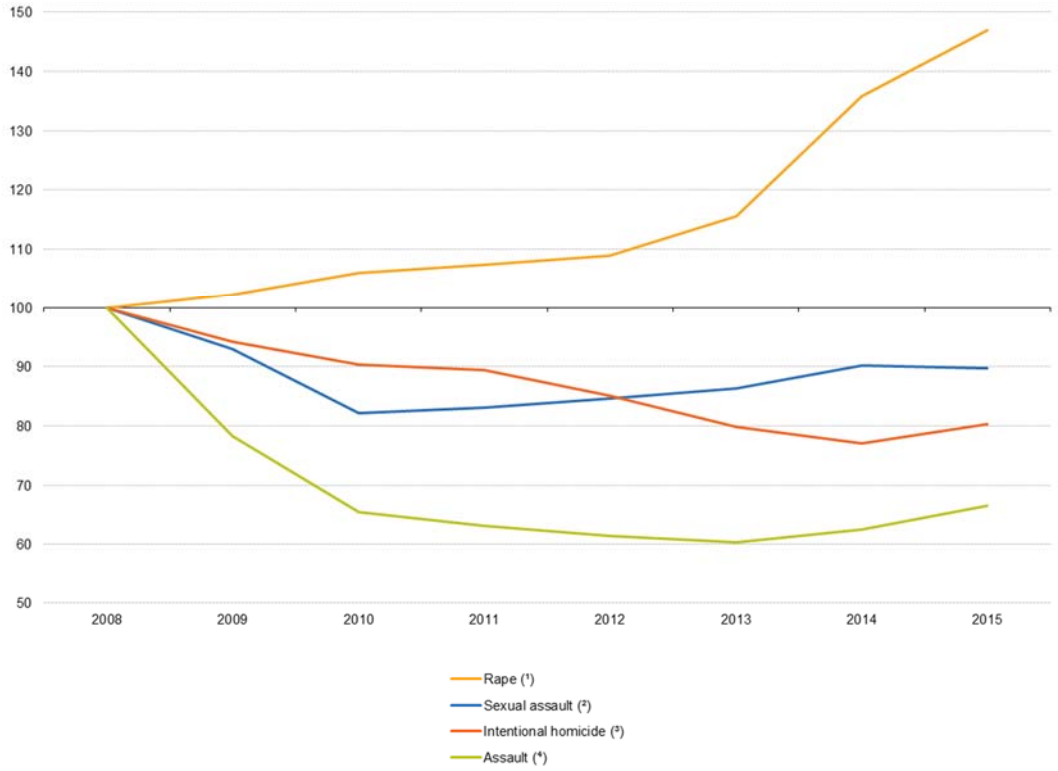
**Table 3.** *Expenditure on social protection, 2004-2014 (% of GDP)*

| | 2004 | 2006 | 2008 | 2010 | 2012 | 2014 |
|---|---|---|---|---|---|---|
| EU-28 | : | : | 25.9 | 28.6 | 28.7 | 28.7 |
| EA-19 (Euro area) | 26.5 | 26.2 | 26.5 | 29.2 | 29.3 | 29.7 |
| Belgium | 26.9 | 26.6 | 27.7 | 29.4 | 29.6 | 30.3 |
| Bulgaria | : | 13.8 | 14.7 | 17.0 | 16.6 | 18.5 |
| Czech Republic | 17.8 | 17.6 | 17.9 | 20.1 | 20.4 | 19.7 |
| Denmark | 29.9 | 28.4 | 28.9 | 32.4 | 32.0 | 32.9 |
| Germany | 29.0 | 27.8 | 27.1 | 29.8 | 28.7 | 29.1 |
| Estonia | 13.0 | 12.0 | 14.7 | 17.6 | 15.0 | 15.1 |
| Ireland | 16.5 | 16.7 | 19.9 | 24.0 | 23.2 | 20.6 |
| Greece | 18.9 | 20.6 | 22.8 | 26.2 | 28.2 | 26.0 |
| Spain | 19.9 | 20.0 | 21.4 | 24.6 | 25.5 | 25.4 |
| France | 30.5 | 30.4 | 30.4 | 32.9 | 33.5 | 34.3 |
| Croatia | : | : | 18.6 | 20.8 | 21.1 | 21.6 |
| Italy | 25.0 | 25.6 | 26.7 | 28.9 | 29.3 | 29.9 |
| Cyprus | 16.4 | 16.7 | 17.6 | 19.9 | 22.3 | 23.0 |
| Latvia | 12.6 | 11.9 | 12.1 | 18.3 | 14.4 | 14.5 |
| Lithuania | 13.4 | 13.3 | 15.9 | 18.9 | 16.3 | 14.7 |
| Luxembourg | 22.1 | 20.8 | 21.2 | 22.7 | 22.8 | 22.7 |
| Hungary | 20.4 | 22.0 | 22.4 | 22.6 | 21.4 | 19.9 |
| Malta | 17.8 | 17.8 | 18.1 | 19.3 | 19.1 | 18.2 |
| Netherlands | 23.2 | 26.5 | 26.4 | 29.7 | 31.0 | 30.9 |
| Austria | 28.5 | 27.7 | 27.8 | 29.8 | 29.3 | 30.0 |
| Poland | 20.3 | 19.7 | 19.3 | 19.7 | 18.9 | 19.1 |
| Portugal | 23.4 | 23.7 | 23.4 | 25.8 | 26.4 | 26.9 |
| Romania | 12.8 | 12.8 | 14.1 | 17.3 | 15.4 | 14.8 |
| Slovenia | 22.8 | 22.3 | 21.0 | 24.4 | 24.9 | 24.1 |
| Slovakia | 16.9 | 16.0 | 15.7 | 18.2 | 18.0 | 18.5 |
| Finland | 25.6 | 25.4 | 25.1 | 29.3 | 30.1 | 31.9 |
| Sweden | 29.8 | 28.6 | 27.7 | 28.6 | 29.3 | 29.6 |
| United Kingdom | 24.6 | 25.3 | 25.9 | 29.1 | 29.2 | 27.4 |

**Source:** Eurostat; data processed by the authors.

It is noted that countries with a balanced economy, with a population not as big as Romania, have increased their social protection spending. For example, in the UK, they were 24.6% in 2004, reaching 29.1% in 2010, and then kept at this constant level in the coming years. Germany maintained a constant rate of 29.0% in 2004, 30.5% in 2009, 29.0% in 2013, and 29.1% in 2014. We can give other examples, but it follows that the European Union Regarding the increase of the social protection expenditures. The most vulnerable are the younger generations who are usually unemployed, a large number of them, the third-age population and, last but not least, the unemployed themselves who, on the basis of somewhat approximate conversions, do not find a job.

**Figure 5.** *Police-recorded rape, sexual assault, intentional homicide and assault*

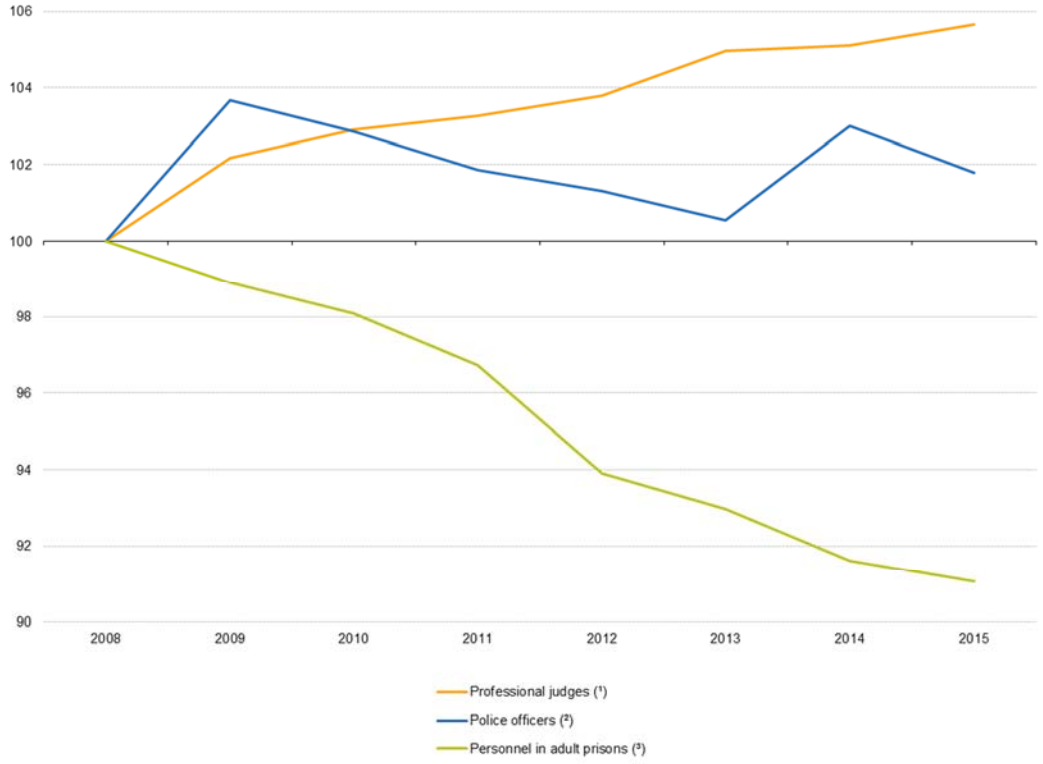



(¹) Italy and UK Scotland not available for all years.
(²) Latvia, Luxembourg, Poland, Slovakia and UK England and Wales not available for all years.
(³) The Netherlands, UK England and Wales and UK Scotland not available for all years.
(⁴) Poland and UK Scotland not available for all years.

**Source:** Eurostat.

We should also refer to criminality in the Member States. Regarding this, it is noted that despite the efforts made, the level of criminality remains high. There have been many abuses, acts of violence, especially against those who are called upon to ensure public order. Among the main aspects of crime, we encounter abductions, abuses, homicide or assault on peaceful people. Of course, as these anti-social violence acts become more frequent, the problem is raised by the staff in the crime protection system, but this has only occurred in the field of justice, and the police staff and penitentiary staff have although criminality has been steadily rising.

**Figure 6.** *Personnel in the criminal justice system, EU-28, 2008-2015*




(1) Belgium, Bulgaria, Germany, Ireland, Italy, Luxembourg, Malta, the Netherlands, UK England and Wales and UK Northern Ireland not available for all years.
(2) Germany, Italy, Ireland and Latvia not available for all years.
(3) Belgium, Germany, Estonia, Greece, France, Latvia, Luxembourg, the Netherlands and Sweden not available for all years.
**Source:** Eurostat.

## Conclusions

From this authors' study on the living conditions of the population of the EU member states, theoretical and practical conclusions are drawn. Theoretically, it starts from the European Union's Strategy, which stipulates that in 2020 it will be ensured that the fundamental objectives of the European Union's policy are fulfilled so as to alleviate and even eliminate the various situations and circumstances that affect the population of some countries. In particular, the authors analyzed the situation of social inclusion, the income situation and the distribution of these incomes, revealed the inequality of the distribution of these incomes, and ultimately made an insight into the social protection situation in the EU Member States. Concretely, it was concluded that there is a large discrepancy between the EU member countries, with a number of countries with outstanding results in this area of living conditions, with other countries still lagging behind where the gap between high incomes and Small is special. Another conclusion is that in the remaining member states from the point of view of ensuring the fundamental conditions of life, additional measures are taken to reduce the gaps separating them from the states with a particular situation. From a practical point of view, on the basis of the data provided by

Eurostat, the authors made classifications on each indicator to accurately suggest the state of each Member State. In this context, the need to implement the European Strategy has been permanently addressed so that by 2020 economic growth will ensure the improvement of living conditions for the entire population of the European Union. Another conclusion is that the study is somewhat limited, but it can be extended by using statistical and econometric models and methods that highlight the existing concrete situation and indicators, as well as the prospect of anticipating a future evolution ensure the approximation of living standards between the Member States of the European Union.

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# Does institutional environment affect the economic development? Evidence from selected CEE countries

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**Abstract.** *Economic theory identifies different variables, affecting economic development. Many economists and analysts focused their research from the determinants in the neoclassical economic growth model to the three rooted variables of economic development: institutions, geography and openness to trade. Aim of this paper is to investigate linkage between institutional environment and economic development in the selected Central and Eastern European countries (CEE). In order to explore relationship of the "deep determinants" of economic development to institutional environment several methodological approaches have been used. Empirical research was accomplished via SPSS 21 statistical software package. The results indicate the significance of institutional environment for future economic development.*

**Keywords:** data, economic development, institutional environment, CEE countries.

**JEL Classification:** C80, C88, O10, O30.

## 1. Introduction

Theoretical economy highlights diversified variables of economic development. Policymakers and economists converted their consideration from the economic determinants of neoclassical growth model to the three rooted variables of economic development, specifically: institutions, geography and openness to trade. The principal debate is about the significance of mentioned variables, exactly between institutional environment and geography (Acemoglu et al., 2005; Presbitero, 2006). Promoters of institutional quality discuss that institutional surrounding, evaluated through property rights index, corruption perception index, business freedom index and alternative institutional determinants, are crucial factors for economic development.

In the actual economic literature, there is a major compliance that low quality of institutions expressed through high corruption, absence of rule of law, bureaucratic environment constraints, and low level of business, political or civil freedom, obstruct economic development. Popular economists emphasize that the effect of geography and institutional environment on GDP per capita or other similar income is correlated to economic growth and development (Acemoglu et al., 2001; Easterly and Levine, 2003; Rodrik et al., 2004). By Bloch and Tang (2004) trade openness is important source of economic growth or development. This approach they presented through various empirical research. Borrmann, Busse and Neuhaus (2006), Bolaky, Freund (2004) investigated that countries having quality of institutions profit from trade openness than the countries that possess low quality of institutions. According to Gagliardi (2008) institutions build supportive landscape for economic development. What is uncertain is can institutional environment measures help reveal deviations in income per capita among selected high income countries and Central Eastern European (CEE) countries.

Research goal is to examine the correlation between institutional measures and economic development. This paper is classified into four section. The first part considerates theoretical background of three rooted variables of economic development. The second part reveals methodological approaches connected to the measures of institutional environment. The third part of the paper is dealing with empirical data and applied methodology. The fourth part represents analysis and research conducted via statistical software package SPSS 21.

## 2. Economic development and determinants of institutional environment: Theoretical approach

Directly prevalent rhetoric related to institutional environment and economic development experiences two theoretical issues. The first presumtion is that institutions have important influence on economic development, rejecting the possibility of institutional change. The second, although we concentrate attention on relation "institutional environment – economic development", the section of the linkage is ideological in a fixed, overly simplified way. According to Acemoglu et al. (2005), and

North (2005), institutions are the final factors of economic development. Relationship can be observed from economic development to institutions. Economic development alterates institutions in many ways. Raised economic growth can influence greater demand for high-quality institutions (such as, political institutions with higher transparency and accountability) and its environment. Expansion of countries' wealth makes institutions inexpensive. Economic development generates advanced transformations, including new institutions.

Does institutions with higher business freedom affect economic growth and development? If we admit that free market is the most suitable for economic development, there is no objective method to regulate what exactly free market means (Chang, 2002a, 2002b). Many economic theory discus that "liberalized" institutions assure property rights most secure, contribute strong business freedom and economic development (Acemoglu et al., 2001, 2005; La Porta et al., 2008). Nonetheless, the investigating connection between economic development and institutions is very difficult. Today's predominant dialogues to institutional environment and economic development do not recognize that the correlation among mentioned variables changes during the time and distincts in different countries or societies. Stiglitz (2007) emphasizes that excessive protection of Institutional Property Rights may have negative influence on economic development. However, powerful protection of institutional property rights may stimulate companies to invest in knowledge and innovation, especially in software, chemical or pharmaceutical industries. Still, Institutional Property Rights protection is absolutely crucial for acceleration of economic growth and development in many countries.

There is a wide-spreaded concurrence in the economic literature that institutions play a more significant role than other variables of economic development e.g. geography and openness to trade. Bosker and Garretsen (2008) and Rodrik et al. (2004) revealed that geography has only indirect impact on GDP per capita. A country's GDP per capita, as a measure of economic growth and development, depends on the pair determinants: country institutions and the quality of institutional environment in its neighboring countries. The major interpretation suggests that trade is the principal determinant of whether the economic development of countries accelerates or not. According to Dollar and Kraay (2003) suggestion, institutional environment and trade, both, play crucial role to economic growth and development in the long-term. Various empirical investigations provide an observation that the relative significance of geography and trade rely upon on the quality of institutions. Borrmann et al. (2006) indicated that, at certain levels of trade openness, some countries have advantages from trade more than other countries. The empirical results reveal that countries with low-quality institutions have not been able to take the advantage of trade. Besley and Ghatak (2010) emphasize two sections regarding the linkage between property rights and economic development: the instruments through which property rights influence economic performance and the variables of property rights. In the first part, they reveal certain economic costs of low level of property rights. Besley-Ghatak model and conclusions consist the instruments proposed by De Soto (2000) connecting property rights' growth with usage of assets as indirect and economic effectiveness.

Still, the investigation of the influence of the property rights model is not linear or simple assignment: Domingo (2013) investigates the correlation between property rights and social and political approval, finding contradictory proof, primary because it should take into consideration measures of the political and social factors in which property leadership are entrenched; and Locke (2013) revealed contradictory proof in the connection of land rights and growth (through investment, credit and effectiveness), perceiving a 'cluster of institutions' that affect economic growth and development. Paldam and Gundlach (2007) solved this difficulty by utilizing two variables of institutional quality: democracy and corruption. They emphasized strong support on the cooperation of institutions, income and economic development.

## 3. Methodology and empirical data

Beneficial to examine relationship of the "deep determinants" of economic development to institutional environment several methodological accesses and indices have been argued:

- The Institutional Property Rights Index (IPRI), developed by Property Rights Alliance and Institute for Liberty and Democracy methodology.
- The Business Freedom Index (BFI), refined by Heritage Foundation methodology.
- The Corruption Perceptions Index (CPI), established by Transparency International methodology.
- The Enabling Trade Index (ETI), founded by Global Alliance for Trade Facilitation methodology.

The Institutional Property Rights Index's – IPRI 2016 scores and rankings are developed on data acquired from authorized sources by established international institutions. The empirical data is supplied in various styles and dissimilar scale. As a consequence, most of the data is rearranged in order to exactly correlate between countries and inside the Institutions Property Rights Index's particular determinants and total score. The general ranking of indices from 0 to 10, where 10 is the highest value for a property rights order and 0 is the lowest value for a property rights system in a specific country.

The same declarative logic is conducted to the three variables and the ten factors. While the average system conducted considers comparable relevance of individual variables for the ending IPRI value, certain measures may be conducted to measure relevance of the various determinants on institutional property rights of a country. The IPRI for 2016 uses data from period 2010-2016. The 10 Items are composed from various sources, which signify that they should distinct admission terms for the updated data accessible. The enforced reasoning in the examination need to incorporate the current available data package for the institutional property rights index. Besides measuring the score of the Institutional Property Rights Index - IPRI and its determinants, countries were classified according to calculated grades. Countries with the similar frequencies, may be positioned in the similar ranking-class. To avoid this situation IPRI scores uses decimals, and this way the final scores were differentiated, and rank place also.

The Business Freedom Index - BFI is total determinant of the effectiveness of government regulation of business performance. The measurable score is borrowed from a set of variables that include: difficulty of beginning, performing, and concluding a business activity. The business freedom grade for each country is a number between 0 and 100. Number 100 is equal to the freest business surrounding. The grade is composited on 10 determinants, each one is evaluated in the same way, applicating the data from the Doing Business Survey. Every primary variable is transformed to a scale of 0 to 100, after which the average of the transformed measure is estimated. The results perform the country's business freedom grade. Every variable factor is transformed to a grade from 0 to 100 applicating the following formula:

$\text{Factor Score}_i = 50\ \text{factor}_{\text{average}} / \text{factor}_i$ ,

which is established on the ratio of the country data for every factor connected to the world factor average score, multiplied by 50. For example, on average worldwide, it needs 18 actions to gain fundamental permission.

The Corruption Perceptions Index – CPI collected empirical data from a number of various sources that support approach of economists and other experts of the level of corruption in the public area of the country. The following activities are followed to estimate the Corruption Perception Index:

- Selection of appropriate data sources: Every data source that is used to compose the Corruption Perceptions Index should accomplish the next standard to qualify as a relevant source:
  - Evaluates perceptions of corruption in the public sector of the country.
  - Evaluation should be conducted on a respectable and credible methodology, which grades and ranks countries on the similar scale.
  - Implemented by an adequate institution and expected to be repeated regularly.
  - Acceptable variation of grades to differentiate among countries.
- Standardisation of different data sources to a scale of 0-100 where 0 represents the highest level of anticipated corruption and 100 presents the lowest level of anticipated corruption.
- Calculation the average value: For a country to be incorporated in the Corruption Perception Index, a minimum of three sources should be relevant for individual country. A country's CPI score is estimated as the average of all standardised grades for certain country. Grades are not decimal numbers.
- CPI for country (j) can be calculated as the mean of standardized corruption scores for specific country:

$$CPI^{j} = \frac{1}{N_j} \sum_{i=1}^{Nj} S_i^j$$

$$S_i^j = \left[ V_t^j - \mu_t^{sub} \right] * \frac{\sigma_{t-1}^{sub}}{\sigma_t^{sub}} + \mu_{t-1}^{sub},$$

where:

$V_t^j$ – the value of an individual corruption rating for specific country in year t;

$\mu_t^{sub}$ – mean of subgroup for particular corruption rating in year t;

$\sigma_{t-1}^{sub}$ – standard deviation of subgroup from CPI in year t-1;

$\sigma_t^{sub}$ – standard deviation of subgroup from CPI in year t;

$\mu_{t-1}^{sub}$ – mean from subgroup from CPI year t.

- Announcement a variable of ambivalence: The Corruption Perception Index is guided by a standard error and interval of confidentiality with the grade, which consists of the variation in grades of the data available for the particular country.

The Enabling Trade Index – ETI evaluates the rang to which countries get in place institutions, policies, infrastructures and services promoting the free movement of goods across borders and to terminals. The ETI, as a complex indicator, is calculated of an aggregation of particular indicators measuring various trade-enabling determinants. These determinants are classified into seven pillars:

- Domestic market access,
- Foreign market access,
- Efficiency and transparency of border administration,
- Availability and quality of transport infrastructure,
- Availability and quality of transport services,
- Availability and use of ICTs and
- Operating environment.

Every indicator (pillar) is collected of 57 indicators and subindicators. Indicators and subindicators are strained from different sources (e.g. the Global Express Association, the International Trade Centre and the United Nations Conference on Trade and Development the World Bank, and the World Trade Organization). In extension, few indicators are drawn from the Executive Opinion Survey (the World Economic Forum).

## 4. Results and discussion

Examination of determinants of economic development and institutional environment was conducted by utilization of assorted methodologies and entrenched linkage among selected high income countries and Central Eastern European countries (CEE), regarding distinctive surveys and variables. Identification of relationship between selected variables was performed by supplementary data and correlation coefficients by Spearman. In research results presented in Table 1, which investigates categorization of high income and CEE countries by appliance of Property Rights Alliance and Institute for Liberty and Democracy, the best categorized countries are selected high income countries (Finland, New Zealand, Luxembourg and Norway).

**Table 1.** *Categorization of selected high income and CEE countries by conducting assorted methodologies and variables of institutional environment and economic development for 2016-2017*

| | Rank GDP per capita PPP 2016 | Rank Institutional Property Rights Index IPRI -2016 (128) | Rank Business Freedom Index BFI -2017 (180) | Rank Corruption Perception Index CPI-2016 (176) | Rank Enabling Trade Index ETI-2016 (136) |
|---|---|---|---|---|---|
| **Selected high income countries** | | | | | |
| Finland | 8 | 1 | 11 | 2 | 5 |
| New Zealand | 10 | 2 | 2 | 1 | 10 |
| Luxembourg | 1 | 3 | 6 | 9 | 3 |
| Norway | 3 | 4 | 12 | 5 | 9 |
| Switzerland | 4 | 5 | 3 | 4 | 6 |
| Singapore | 2 | 6 | 1 | 6 | 1 |
| Sweden | 6 | 7 | 9 | 3 | 4 |
| Japan | 9 | 8 | 15 | 10 | 8 |
| Netherlands | 5 | 9 | 7 | 7 | 2 |
| Canada | 7 | 10 | 5 | 8 | 11 |
| **CEE countries** | | | | | |
| Estonia | 14 | 11 | 4 | 11 | 7 |
| Czech Republic | 11 | 12 | 13 | 16 | 12 |
| Slovakia | 13 | 13 | 18 | 17 | 16 |
| Lithuania | 15 | 14 | 8 | 14 | 13 |
| Poland | 16 | 15 | 16 | 12 | 14 |
| Latvia | 18 | 16 | 10 | 15 | 18 |
| Hungary | 17 | 17 | 17 | 18 | 17 |
| Slovenia | 12 | 18 | 19 | 13 | 15 |
| Romania | 19 | 19 | 14 | 19 | 19 |
| Moldova | 20 | 20 | 20 | 20 | 20 |

**Source:** Estimation is conducted on data published by the Central Intelligence Agency and World Bank country data base, Property Rights Alliance, Institute for Liberty and Democracy, Heritage Foundation, Transparency International and Global Alliance for Trade Facilitation for 2016-2017.

By Property Rights Index Romania and Moldova are the lowest categorized CEE countries. Singapore is the freest high income country by Business Freedom Index. The best categorized CEE country by BFI is Estonia and Moldova the worst classified country. By examining variable of economic growth and development – GDP per capita (Puchasing Power Parity), the highest categorized country is Luxembourg and Singapore, and the lowest ranked countries Romania and Moldova. The highest categorized countries by the lowest level of corruption in public sector are New Zealand and Finland. Corruption level is the highest in Moldova. The most "free trade" countries are Singapore, Netherlands and Luxembourg. The best classified CEE country is Estonia (7th place) by Enabling Trade Index, while Moldova is the worst classified. Appended research should demonstrate the relationship of the attributes for comprehending institutional environment and economic development. The linkage of categorized variables of economic development and institutional environment (Gross Domestic Product per capita -Purchasing Power Parity, Property Rights Index, Business Freedom Index, Corruption Perception Index, Trade Enabling Index) is displayed in Table 2. The determination of relationship among selected variables was managed by SPSS 21.0 statistical software package.

**Table 2.** *Correlation matrix for variables of institutional environment and economic development in the selected high income countries and CEE countries*

| | GDP pc | PRI | BFI | CPI | ETI |
|---|---|---|---|---|---|
| **GDP pc** | 1.000 | .839** | .586** | .779** | .880** |
| **PRI** | .839** | 1.000 | .656** | .898** | .827** |
| **BFI** | .586** | .656** | 1.000 | .674** | .692** |
| **CPI** | .779** | .898** | .674** | 1.000 | .803** |
| **ETI** | .880** | .827** | .692** | .803** | 1.000 |

**Correlation is significant at the 0.01 level (2-tailed).
**Source**: author own calculations.

Research results indicate the linkage between "deep" determinants of economic development and institutional environment, presented by a set of relevant and reliable indices. Positive relationship between the Gross Domestic Product per capita and PRI, ETI and CPI indices, followed by correlation coefficients 0.839, 0.880 and 0.779, indicates that achieving faster economic development depends on higher property rights, better trade conditions and low level of corruption in selected countries. Strong positive interrelationship is noticeable between PRI indices and CPI and ETI indices accompained by correlation coefficients 0.898 and 0.827, respectively. The degree of stability of institutional environment and acceleration of economic development between selected CEE and high income countries examined by differentiate methodologies, suggest that Global Alliance for Trade Facilitation methodological method highly correlates with the economic development, illuminated by very high correlation between GDP per capita as reliable determinant of economic development and Enabling Trade Index (ETI).

## 5. Conclusions

The established examination on selected variables distribute recommendations for convenient institutional environment and future acceleration of economic growth and development. Various proposals may be emphasized from the conducted research in selected high income and CEE countries:

- It is determinated significant strong positive correlation between GDP per capita and following indices: Property Rights Index (0.839), Enabling Trade Index (0.880) and Corruption Perception Index (0.779).
- Positive linkage is present among IPRI indices, CPI and ETI indices followed by correlation coefficients 0.898 and 0.827, respectively.

Economic theory perceives three deep determinants of economic growth and development: institutions, geography and trade openness. In accordance with access of institutional development, high-quality institutions decrease ambivalence, diminish macroeconomic evaporation, assure institutional property rights, which are elements of economic growth and development acceleration. Trade openness can raise Gross Domestic Product per capita along with competitiveness advantages or via technology transfer, competitive interplay impact with foreign enterprises. The aim of the investigation points on the linkage between GDP per capita (Puchasing Power Poverty), as a relevant measure of economic development, and the variables of institutions and its environment. The results of research declare that differences among observed high

income and CEE countries may be correlated with the originators of institutional property rights, corruption perception or trade openness. Apparently, the lessons of the selected high income countries are helpful for selected CEE countries in reconsolidation of the recent countries into European Union. The usage of the appropriate procedures and economic policy should raise along with developing environment for quality institutions, business sophistication, enabling trade and faster economic development of the selected CEE countries. The IPRI, CPI and ETI indices are useful instruments to foster partnership among institutions, business society and international associations. Nevertheless, access of methodology of the Enabling Trade Index established by the Global Alliance for Trade Facilitation encourages interesting new perception into the determinants of economic development in CEE countries.

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# Causality between economic policy uncertainty and exchange rate in China with considering quantile differences

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**Abstract.** *Under an existing theoretical framework regarding the relationship between investment decision and the size of economic policy uncertainty (EPU), this paper tests the causality between EPU and exchange rate (ER). Theoretically, the impact of EPU on ER should be treated asymmetrically since investors need higher risk premiums to offset the consequences of growing EPU. The causality is investigated by using the quantile Granger causality test. This test shows that causality is more significant in the tail quantile interval. Since EPU of China is extremely high since 2016, and ER also experienced huge fluctuations during this period, our result provides an empirical basis for international investors to protect themselves against the risks associated with EPU in the exchange market.*

**Keywords:** economic policy uncertainty; exchange rate; quantile causality.

**JEL Classification:** C32; G10.

## 1. Introduction

Economic policy has played an important role in stabilizing the economy and promoting global economic recovery especially since the financial crisis of 2008. However, given the increasing complexity of macroeconomic and market related processes, the uncertainty of economic policies has been high (Krol, 2014). Uncertainty in economic policy will affect economic stability from both microeconomic and macroeconomic perspective; variations in "uncertainty" could cause changes in "confidence", a term which often implies both mean and variance effects (Baker et al., 2011). Uncertainty gives firms an incentive to delay investment and hiring when investment projects are expensive to cancel or workers are costly to hire and fire (Bernanke, 1983). Uncertainty also affects precautionary spending processes by rising pressure on the cost of finance (e.g., Gilchrist et al., 2010 and Pastor and Veronesi, 2011), and increases managerial risk aversion (Panousi and Papanikolaou, 2012). As the largest and most liquid financial market in the world, the foreign exchange market may be influenced by this uncertainty (Balcilar et al., 2016). Changes in exchange rate (*ER*) are counterproductive to the economy, influencing economic policy design and increasing economic policy uncertainty (*EPU*).

China has reformed its *ER* regime in 2005, switching from a fixed to a managed floating *ER* system. This caused *ER* of the Renminbi (*RMB*) to show increased sensitivity to a number of factors, thus leading to greater volatility. As the complexity of the exchange rate influencing factors grows, it is increasingly harder to explain these fluctuations by using the classical *ER*-theory. However, the importance of this issue in international economics remains undisputed (Beckmann and Czudaj, 2016). Greater *ER* deviation not only influences the domestic economy through the increase in volatility of business profits and inflation uncertainty, but also changes the relative structure of production costs and raises the transaction risk associated with international trade (see Braun and Larrain, 2005; Grier and Grier, 2006; Aghion et al., 2006; Baum and Caglayan, 2006). Short-term changes in the *ER* of the *RMB* are largely influenced by economic policies (Zhu and Yan, 2015), this is of great interest to policy makers regarding the pass-through mechanism and how exchange movements affect domestic policy uncertainty (Balcilar et al., 2015).

There are detailed studies aimed at analyzing the impact of the *EPU* on macroeconomic variables: Balcilar et al. (2014) find the *EPU* has an important role in inflation forecasting; Karnizova and Li (2014) use probit recession forecasting models to assess the ability of *EPU* indexes developed by Baker et al. (2013) and suggests that the policy uncertainty indexes are statistically and economically significant in forecasting recessions at the horizons beyond five quarters; and Balcilar et al. (2016) analyze the performance of the monthly *EPU* index in predicting recessionary regimes of the US gross domestic product *(GDP)* and highlight the importance of using high-frequency values of the *EPU* when forecasting recessionary regimes for the US economy.

However, the relationship between *EPU* and *ER* is rarely addressed. Benigno et al. (2012) use the vector autoregressive (*VAR*) model to analyze the influence of domestic uncertainty on dollar-based *ER* and find an increase in monetary policy uncertainty will lead to an *ER* appreciation in the medium run. Colombo (2013) investigates the effects of the US *EPU* shock on nominal Euro-Dollar *ER* and finds the contribution of the US uncertainty shock

on the European aggregates to be quantitatively larger than the one exerted by a Euro area-specific uncertainty shock. Krol (2014) investigates the impact of general economic and *EPU* on *ER* volatility for ten industrial and emerging economies since 1990. The results suggest that domestic and US economic policy uncertainty directly increase *ER* volatility for some of the currencies examined. For China, Sim (2015) applies the structural vector autoregressive model (*SVAR*) to the economies of Taiwan and Hong Kong to investigate the impacts of the Chinese uncertainty on *ER* over the past decade. The results indicate that uncertainty shock have a significant impact on *ER*. Zhu and Yan (2015) focus on the dynamic spillover relationship between *ER* and *EPU*. The result indicates that *EPU* of China, the US, Euro area and Japan all have significant spillover effect on *ER* of the *RMB*.

*ER* expectations reflect all available information in case of market efficiency. However, the role of macroeconomic policy uncertainty for *ER* has not been empirically considered (Beckmann and Czudaj, 2016). The central idea in this paper is that *ER* is determined by expectations of economic fundamentals and policies. If this is true, a high level of *EPU* will lead to more revisions in expectations of the fundamental factors that determine the value of *ER*, resulting in greater *ER* fluctuation (Krol, 2014). In return, *ER* fluctuations will affect the domestic production and trade, which affect the macroeconomic and increase *EPU*. Against this background, this study contributes to the literature by analyzing the impact of China policy uncertainty on *ER.*

Taking into account quantile interval differences, this paper uses the quantile causality test to investigate the relationship between *EPU* and *ER*. In fact, over the past decade, China and the world economy have undergone a series of structural changes. For example, the 2008 financial crisis leading to a significant increasing in EPU of China. In response to the financial crisis, China restored a fixed exchange rate system during the economic crisis in order to stimulate the economy. After 2011, the debt crisis in Europe also had worldwide consequences, one of which being a significant increase in *EPU* for China. During this period, the Chinese stock and housing markets as well as the *RMB* exchange rate have experienced severe fluctuations, which caused widespread concern. After 2015, following structural changes, the *EPU* of China increased rapidly, even higher than during the financial crisis. The exchange rate showed a devaluation trend for the first time, and fluctuations were intense. Since during these periods *EPU* and *ER* have undergone great changes, in order to explore the association more essentially, we use the quantile test. Results indicate that *EPU* and *ER* in the tail (lowest or highest) quantile interval within the interaction are more significant. In contrast to the trend of *EPU* and *ER*, we find that these significant effects of the quantile range are more distributed in the financial crisis mentioned earlier, the European debt crisis and after 2015. Such conclusion is consistent with the theoretical analysis of this paper. A higher *EPU* is more likely to cause changes in the *ER*. In this case, investors need to target higher risk premiums, which in turn may hinder them from investing into the exchange market, thus triggering variations of the exchange rate. Since 2015, the EPU of the Chinese economy increased unprecedentedly, with RMB exchange rate devaluation. Based on this, this paper provides an empirical basis for investors to deal with *ER* risk when *EPU* is high.

The remainder of the paper is organized as follows: Section 2 presents the economic model of this paper; Section 3 explains the methodology; Section 4 describes the corresponding data and empirical results; Section 5 concludes.

## 2. Theoretical analysis

We refer to the model from Rodrik (1991) to investigate the investment decision under the condition of policy uncertainty. Supposing *ER* is $r - t_0$ before the implementation of the policy, where $r$ denotes the marginal return of capital, $t_0$ denotes the impact of policy distortions on investment returns, $t_0$ will reduce to $t$ ($t < t_0$) after the implementation of the policy. Assuming that the policy is implemented to get the optimal allocation of capital, and $r - t_0 < r^*$, where $r^*$ denotes the risk-free interest rate, *EPU* can be measured as $\pi$, which is the probability of policy exit. Risk neutral investors have to make decision on $r^*$ and $r - t$. Supposing the discount factor is $\rho$, the value of this decision ($V_0$) is as follows:

$$V_0 = r^*/\rho \tag{1}$$

Supposing $V_1$ denotes the maximum value of a unit of capital after policy implementation, the value of $V_1$ depends on $\pi$ and the cost of policy exit. Further supposing $V_1^R$ denotes the maximum value of capital held when policy exit, $V_1 - V_1^R$ denotes the accumulated capital loss in the case of policy exit. $V_1$ consists of $r - t$ and the expected capital loss: $\pi(V_1 - V_1^R)$. As a result, $V_1$ can be written as:

$$V_1 = \{(r - t) - \pi[V_1 - V_1^R]\}/\rho \tag{2}$$

Equation (2) can be transformed into:

$$V_1 = (\rho + \pi)^{-1}[(r - t) + \pi V_1^R] \tag{3}$$

Supposing $t$ will restore to $t_0$ in the case of policy exit, if $r - t_0 < r^* - \rho\theta$, where $\theta$ denotes costs of capital exiting from the exchange market, which means the *ER* returns before policy implementation is less than the net profit when capital withdrawal from the exchange market, then the capital will invest in the exchange market. Investors' decision making in the presence of *EPU* depends on the value of $t_0$.

$$\begin{cases} V_1^R = \left(\frac{r^*}{\rho}\right) - \theta, & when\ t_0 > (r - r^*) + \rho\theta \\ V_1^R = \frac{r - t_0}{\rho}, & when\ t_0 \le (r - r^*) + \rho\theta \end{cases} \tag{4}$$

Therefore, $V_1$ can be written as follows:

$$V_1 = (\rho + \pi)^{-1}\left[(r - t) + \pi \max\left\{\frac{r - t_0}{\rho}, \left(\frac{r^*}{\rho}\right) - \theta\right\}\right] \tag{5}$$

The boundary condition for capital investing in the exchange market is as follows:

$$V_1 \ge V_0 + \varepsilon \tag{6}$$

where $\varepsilon$ denotes the entry cost of unit capital, the capital will enter the exchange market only when the net income of the reset capital is positive. When $t_0 > (r - r^*) + \rho\theta$, based

on Equation (1), Equation (5) and Equation (6), the boundary condition for capital investing in the exchange market is as follows:

$$(r-t)-r^* \geq \varepsilon\rho + \pi(\varepsilon+\theta) \quad (7)$$

Based on Equation (7), $t$ must be small enough to make up for the cost of capital reconfiguration ($\varepsilon\rho$) and the cost of policy exit ($\pi(\varepsilon+\theta)$), or the capital will not be invested in the exchange market. Specifically, if *EPU* is at a high level, which means the cost of policy exit ($\pi(\varepsilon+\theta)$) is higher, then the inhibitory effect of *EPU* on investment will be stronger. Rodrik (1991) suggests that if $\pi$, $\varepsilon$ and $\theta$ are big enough, investors are hard to make up for these costs even when $t=0$. Equation (7) suggests that, the essence of *EPU* is taxing on investors. In this case, higher risk premiums are needed to hedge the negative impact of *EPU* on investment.

When $t_0 \leq (r-r^*)+\rho\theta$, the boundary condition for capital investing in the exchange market is as follows:

$$t \leq (r-r^*) - \varepsilon\rho - [\pi/(\rho+\pi)]t_0 \quad (8)$$

Equation (8) suggests that, when the discount factor $\rho$ is much smaller than the probability of policy exit $\pi$, $\pi/(\rho+\pi)$ is close to 1. Investors need a risk premium greater than $r^*$ to offset the risk of *EPU*.

Investors need a risk premium to make up for costs from *EPU*. Especially, when *EPU* is at a higher level, the risk premiums will increase accordingly, resulting in greater inhibition of investment (Gulen and Ion, 2016). As a result, when costs from *EPU* are high, willingness to invest is hard to achieve even when the negative impact of policy distortions $t$ is small enough. French and Sichel (1993) prove that investment is closely related to the size of uncertainty, external negative shocks being usually associated with higher uncertainty. The negative effect occupies the main position when the uncertainty is high. Therefore, the impact of *EPU* on *ER* depends on the size of uncertainty.

## 3. Quantile Granger causality test

To provide a complete understanding of the internal causality between $EPU_t$ and $SR_t$, Chuang et al. (2009) consider the following Granger non-causality test in quantiles:

$$Q_{y_t}(\tau|(\mathcal{Y},\mathcal{X})_{t-1}) = Q_{y_t}(\tau|\mathcal{Y}_{t-1}), \forall\tau\in[a,b] \quad (9)$$

where $Q_{y_t}(\tau|\mathcal{F})$ denotes the $\tau$-th quantile of $F_{y_t}(\cdot\,|\mathcal{F})$. If Equation (11) holds, then $x_t$ does not Granger cause $y_t$ over the quantile interval $[a,b]$. We can conduct the Granger non-causality test in quantiles by using the quantile regression method in Koenker and Bassett (1978). The conditional quantile function of $y_t$ can be written as follows:

$$Q_{y_t}(\tau|\boldsymbol{z}_{t-1}) = \omega(\tau) + \sum_{i=1}^{p}\alpha_i(\tau)y_{t-i} + \sum_{j=1}^{p}\beta_j(\tau)x_{t-j} = \boldsymbol{z}_{t-1}'\theta(\tau) \quad (10)$$

where

$\boldsymbol{z}_{t-1} = \left[1, \boldsymbol{y}_{t-1,p}', \boldsymbol{x}_{t-1,p}'\right]$,

$\boldsymbol{y}_{t-1,p} = \left[y_{t-1}, y_{t-2}, \ldots, y_{t-p}\right]'$,
$\boldsymbol{x}_{t-1,p} = \left[x_{t-1}, x_{t-2}, \ldots, x_{t-p}\right]'$ and
$\theta(\tau) = \left[\omega(\tau), \alpha_1(\tau), \ldots, \alpha_p(\tau), \beta_1(\tau), \ldots, \beta_p(\tau)\right]'$. In Equation (4), we can estimate $\hat{\theta}(\tau)$ by minimizing asymmetrically weighted absolute deviations, that is, the check function. Under some regularity conditions, $\hat{\theta}(\tau)$ is consistent and asymptotically normal:

$$\sqrt{T}\left(\hat{\theta}_T(\tau) - \theta(\tau)\right) \rightsquigarrow [\tau(1-\tau)]^{\frac{1}{2}} \Omega(\tau)^{\frac{1}{2}} \mathcal{N}(0, I_k) \tag{11}$$

where
$\Omega(\tau) = D(\tau)^{-1} M_{zz} D(\tau)^{-1}$,
$M_{zz} = lim_{T\to\infty} \sum_{t=1}^{T} \boldsymbol{z}_{t-1} \boldsymbol{z}'_{t-1}$,
$D(\tau) = lim_{T\to\infty} \sum_{t=1}^{T} f_{t-1}(F_{t-1}^{-1}(\tau)) \boldsymbol{z}_{t-1} \boldsymbol{z}'_{t-1}$ and
$\rightsquigarrow$ denotes convergence in distribution. Here $F_{t-1}$ and $f_{t-1}$ denote the distribution and density functions of $y_t$ conditional on $\mathcal{Z}_{t-1}$, which is the information set generated by $\boldsymbol{z}_{t-1}$, $\boldsymbol{z}_{t-2}$, …, respectively.

The null hypothesis for the Granger causality test in quantile is:

$H_0: \beta(\tau) = 0, \forall \tau \in [a, b]$
where $\beta(\tau) = \left[\beta_1(\tau), \beta_2(\tau), \ldots, \beta_p(\tau)\right]'$. For a given $\tau$, the Wald statistic of $\beta_i(\tau) = 0$, for all $i = 1,2, \ldots, p$, is as follows:

$$\mathcal{W}_T(\tau) = T \frac{\hat{\beta}_t(\tau)' \left(\boldsymbol{\Psi} \hat{\Omega}(\tau) \boldsymbol{\Psi}'\right)^{-1} \hat{\beta}_T(\tau)}{\tau(1-\tau)} \tag{12}$$

where $\hat{\Omega}(\tau)$ denotes a consistent estimator of $\Omega(\tau)$ and $\boldsymbol{\Psi}$ denotes $q \times k$ election matrix such that $\boldsymbol{\Psi}\theta(\tau) = \beta(\tau)$. However, the above Wald test cannot be used to test $H_0$ because it is valid only for fixed $\tau$, not $\forall \tau \in [a, b]$. Koenker and Machado (1999) suggest a sup-Wald test to test $H_0$. Using a vector of $p$ independent Brownian bridges, $\boldsymbol{B}_p(\tau) = [\tau(1-\tau)]^{\frac{1}{2}} \mathcal{N}\left(0, I_p\right)$, we can write:

$$\sqrt{T}\left(\hat{\theta}_T(\tau) - \theta(\tau)\right) \rightsquigarrow [\boldsymbol{\Psi} \Omega(\tau) \boldsymbol{\Psi}']^{1/2} \boldsymbol{B}_p(\tau) \tag{13}$$

Under suitable conditions, Equation (13) holds uniformly on the closed interval $\mathcal{T} \subset [a, b]$. Therefore, under the null hypothesis, we can express the Wald statistic as follows:

$$\mathcal{W}_T(\tau) \Rightarrow \left\| \frac{\boldsymbol{B}_p(\tau)}{\sqrt{\tau(1-\tau)}} \right\|^2, \text{for } \tau \in \mathcal{T}$$

where the weak limit is the sum of square of $p$ independent Bessel processes and $\Rightarrow$ stands for weak convergence. However, note that when $a$ and $b$ are very close to 0 and 1, respectively, $\mathcal{W}_T(\tau)$, $\tau \in \mathcal{T}$ may not be well defined asymptotically because $\frac{\boldsymbol{B}_p(\tau)}{\sqrt{\tau(1-\tau)}}$ diverges (Andrews, 1993). From the above result, we have the following equation:

$$sup_{\tau\in\mathcal{T}}\,\mathcal{W}_T\,(\tau) \rightsquigarrow \left\|\frac{\boldsymbol{B}_p(\tau)}{\sqrt{\tau(1-\tau)}}\right\|^2 \tag{14}$$

When we conduct the above test, we choose $n$ points, say, $a=\tau_1<\cdots<\tau_n=b$, and calculate the sup-Wald test by $sup\,\mathcal{W}_T = sup_{i=1,2,\ldots,n}\mathcal{W}_T(\tau_i)$.

By considering various $[a,b]$ we can capture the quantile range from which causal relationship arises. For the critical values of the sup-Wald test we simulate the standard Brownian motion by using a Gaussian random walk with 10,000 independent identically distributed $N(0,1)$ iterations.

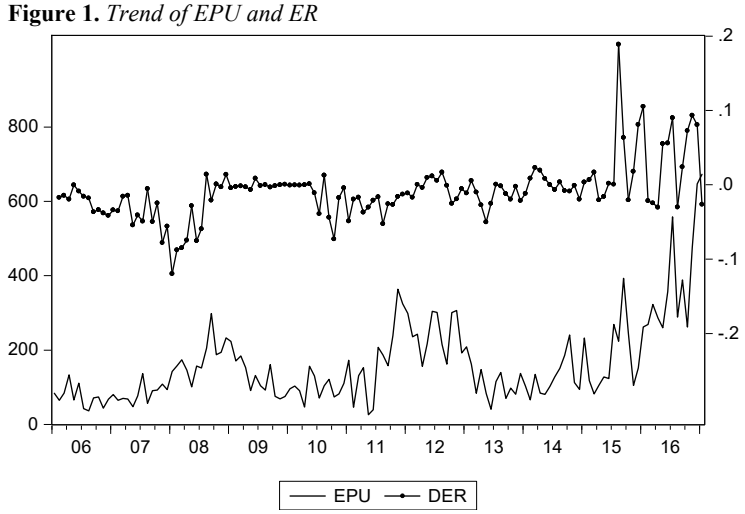
## 4. Data and empirical results

Considering that before 2005 China implemented a fixed exchange rate regime, we use the monthly data covering the period from 2006:M1 to 2017:M1. Data of *ER* is the US dollar against the Renminbi (*RMB*), which can be obtained from the National Bureau of Statistics of the People's Republic of China. Baker et al. (2013) measured *EPU* for major countries and regions in the world, and the data can be obtained from the Economic Policy Uncertainty database. It includes uncertainties regarding tax, spending, monetary and regulatory policy by the government that is calculated from 3 components: the frequency that economic policies appear in the newspaper, the number of expired code, and the extent of forecaster disagreement over future inflation and government purchases. All data are transformed by taking natural logarithms to correct for potential heteroskedasticity. Some unit root tests (the *ADF* test, the *PP* test and the *KPSS* test) are applied to test the stationarity of the data. *EPU* of China is a stationary process in the level, and data of *ER* is integrated of order one *I(1)*. As a result, data of *ER* is taken first order difference processing to ensure the data stability.

Figure 1 shows the trend of *EPU* and *ER*. It can be intuitively seen that *EPU* and *ER* experience abnormal fluctuations in three periods (the financial crisis during 2007-2010, the European debt crisis during 2011-2013, and Chinese economic structure reforming since 2015). Among them, during 2007-2008, *EPU* of China rises significantly affected by the financial crisis. Meanwhile, *ER* also shows a huge fluctuation before 2008:M4. In 2007, the rapid economic growth of China causes surge in exports, massive inflows of short-term international capital and domestic inflation. As a result, the Chinese government implements the *RMB* appreciation strategy. Nevertheless, the Chinese economy suffers a huge shock (such as the rapid decline of external demand and exports, and the slowdown of economic growth) since 2008:M4 caused by the financial crisis. In response to the financial crisis, the Chinese government makes a substantial adjustment from the macro policy to stimulate the economic growth, such as the 4 trillion government investment, the lower interest rates and deposit reserve ratio and the recovery of the fixed exchange rate regime. In 2010, China shortly after the end of the financial crisis, the housing price enters into a new round of rising cycle, further generating domestic inflation. As a result, the government implements the managed floating exchange rate regime, and the *RMB* begins a continuous process of appreciation. During 2011-2013, *EPU* of China rises caused by the

European debt crisis. Since 2015, the Chinese economy experiences a series of turmoil (such as the downturn of the economy, the stock market crash and the continued devaluation of the *RMB*). In this time period, *EPU* of China is significantly higher. It is worth noting that, the *RMB* shows a substantial depreciation for the first time in the past decade. In order to promote the economic structural reform and maintain the stability of the *RMB*, the government implements a series of policies and further causing the rise of the *EPU*.

**Figure 1.** *Trend of EPU and ER*




We utilize the quantile Granger causality test to examine the relationship between *ER* and *EPU*. Table 1 and Table 2 show the result of the quantile causality test. We consider 5 quantile intervals ([0.05, 0.2], [0.2, 0.4], [0.4, 0.6], [0.6, 0.8], [0.8, 0.95]) to test the correlation between *EPU* and *ER*, and find some more regular results. The optimal lag length in each quantile interval is selected by the Akaike Information Criterion (*AIC*).

**Table 1.** *Causality in Quantiles: EPU does not Granger cause ER*

| Quantile interval | *EPU ⇏ ER* | Lag Length | Critical values | | |
|---|---|---|---|---|---|
| | | | 1% | 5% | 10% |
| [0.05, 0.2] | 4.14 | 1 | 9.86 | 6.77 | 5.32 |
| [0.2, 0.4] | 0.48 | 1 | 8.53 | 6.50 | 5.18 |
| [0.4, 0.6] | 1.78 | 1 | 8.91 | 6.31 | 5.15 |
| [0.6, 0.8] | 4.29 | 1 | 10.15 | 6.40 | 4.87 |
| [0.8, 0.95] | 12.16** | 1 | 9.87 | 7.10 | 5.68 |

**Note:** ** denotes the rejection of the null of no Granger causality at 5% level of significance.

**Table 2.** *Causality in Quantiles: ER does not Granger cause EPU*

| Quantile interval | *ER ⇏ EPU* | Lag Length | Critical values | | |
|---|---|---|---|---|---|
| | | | 1% | 5% | 10% |
| [0.05, 0.2] | 22.51*** | 1 | 9.86 | 6.77 | 5.32 |
| [0.2, 0.4] | 6.43* | 1 | 8.53 | 6.50 | 5.18 |
| [0.4, 0.6] | 4.84 | 1 | 8.91 | 6.31 | 5.15 |
| [0.6, 0.8] | 10.14** | 1 | 10.15 | 6.40 | 4.87 |
| [0.8, 0.95] | 14.56** | 1 | 9.87 | 7.10 | 5.68 |

**Note:** *, ** and *** denotes the rejection of the null of no Granger causality at 10%, 5% and 1% level of significance, respectively.

First, Table 1 shows the causality from *EPU* to *ER*, suggesting *EPU* causes *ER* only in the quantile interval of [0.8, 0.95] at 5% significance level. We find *EPU* is more likely to cause *ER* in the tail quantile interval (extremely high). From Figure 1 we can see that, *EPU* is extremely high during the period of 2008-2009 and 2015-2016. Intuitively, Table 2 shows that the causality from *ER* to *EPU* is significant in several quantile intervals. Table 2 shows that, *ER* significantly causes *EPU* of China in most quantile intervals except [0.4, 0.6]. It can be seen that, *EPU* of China is mostly influenced by *ER* when it is higher (or lower). *ER* is relatively low in 2007-2008 and 2010-2012, and it is relatively high in 2015-2016. Above all, the quantile test can reveal the causality between *EPU* and *ER* more essentially without considering exogenous variables. Results of the quantile causality test provide the internal relationship between *EPU* and *ER*, which is more robust than the full-sample causality test. The regularity of the relationship between *EPU* and *ER* is of great significance for government's policy making and investors' prospective risk aversion in the exchange market.

## 5. Conclusions

This paper elaborates the relationship between *EPU* and *ER* theoretically from the perspective of investment decision, and uses the quantile causality test to empirically investigate the causality between them. The quantile Granger causality test can investigate the causality from the perspective of sample distribution. Results suggests the causality of *EPU* and *ER* mostly exists in the tail quantile interval. From the empirical result a conclusion can be draw that when the value of EPU is extremely high, the causal relationship exits from EPU to ER in China. At the same time, when ER is too high (or too low), EPU is easily be affective by ER. In conclusion, the relationship between EPU and ER is more likely exist in extreme situations. In view of the interrelation between *EPU* and *ER*, this paper provides evidence for international investors' decision making in the exchange market. Macroeconomic volatility often leads to increased *EPU*, while higher *EPU* will raise investor risk premiums. *EPU* of China is relatively high since 2015, therefore, investors should guard against the exchange rate risk caused by policy changes.

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# An agency theory approach on Romanian listed companies' capital structure

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**Abstract.** *Capital structure is one of the most studied thematics in corporate finance because of its strong dependencies with companies' performance. Literature provides various theories trying to explain capital structure and financing decisions. Agency theory treats the subject from a principal-agent approach. Diverging interests of these two decisional factors can explain the financing decisions taken by companies where other capital structure's theories fail. Testing agency theory implications against a sample of Romanian listed companies will show whether this theoretical concept provides empirical results in an emerging market with developing capital market.*

**Keywords:** agency theory, optimal capital structure, stakeholder type, equity, leverage.

**JEL Classification:** G32.

## Introduction

When considering agency theory, also known as Principal-Agent Model, one should bear in mind two essential elements. The *principal* and the *agent* are the two components of an agency relationship. The first one engages the second to perform a service on their behalf by delegating the authority to make decisions in the company (Grigore and Ștefan-Duicu, 2013). The principal is the one who writes off capital funds, bearing the risk of default and creating the incentives (Lambert, 2001).

Debates around agency theory are centered on the idea that there is a conflict between the managers and the shareholders (Jensen and Meckling, 1976). Each one is interested in maximizing their utility function. Achieving this objective opposes different strategies in structuring company's capital and financing policies. While the stakeholders bear the risk alone, managers tend to borrow beyond the optimal level in order to increase the company's size, which gives them more decisional power. Stakeholders can prevent such actions by implying some specific methods or instruments to control managerial activity.

## Literature review

Agency theory was first introduced by Jensen and Meckling (1976) in their working paper about managerial behavior, agency costs and ownership structure. Even if this theory is very old in capital structure's literature, many works still refer at it today trying to explain its implications on company financial decisions.

Fama (1980) states that the extent to which a company invest in risky projects is probably determined by the type of the shareholder. A company may be controlled by a family (or an individual) or by a non-family owner/shareholder (companies, banks, financial institutions and others). Recent papers found that there are differences in behavior of listed family-controlled companies, these ones having a *safer* approach when engaging expenses or indebtedness. Because of the fact that the wealth of the controlling families is tied to the company assets, small and medium family-owned companies may show a higher risk aversion (Demsetz and Lehn, 1985). Moreover, implying a strategy based on consistent levels of growth may be limited (Kotey, 2005) to the extent these strategies do not jeopardize their survival (Gomez-Meija et al., 2007).

As a primary conclusion, it is widely expected from the family-owned companies to take decisions for reducing risk and not be able to make strategical changes in company activity such as product diversification, innovation or challenging new markets. Resistance to change is often explained by the primary objective of survival. Family owners may become isolated and not be able to respond appropriately to changes in the economic environment they activate (Boeker and Goodstein, 1991).

Big companies owned by other large companies or by financial institutions are more inclined to follow a profit maximizing strategy because they have a more capable managerial team. Most studies considers non-family companies to be more able to seize

market opportunities and at a greater extent. On the other side, for companies with mangers-not-shareholders, monitoring of the managers' expenditures on perquisites and other personal consumption relies on the vigilance of the non-managing shareholders and/or third parties, such as the company's creditor (Ang et al., 2000).

In family-controlled company, the agent and the principal are the same person. The advantage of this situation is that there can be no more the case of diverging interest or opinions. At the end of the day, their utility functions will follow the same direction. The differences found by recent studies in the behavior of family-owned companies and the others types of companies represent evidences that agency theory has practical support.

## Methodology and data

This section explains how the research has been conducted in this paper. A combination of descriptive and quantitative approach was used in order to answer the facts questioned in the first part. This was accomplished by collecting data from a sample of 595 Romanian listed companies. Bucharest Stock Exchange currently holds for 83 listed companies at primary category. The rest of the companies are gathered from the secondary categories operating alongside Bucharest Stock Exchange. RASDAQ market operated independently until it merged by absorption in 2005 with Bucharest Stock Exchange.

This was done on a 9-year period between 2007-2015. A longer period of time would have been preferred but for unavailability reasons the period was limited to a 9-year period. Financial figures used in this working paper were extracted from the companies' annual reports on stock exchange and other financial data sites. The annual reports were used as a primary source because it lowers the chance of errors generated by transferring the data.

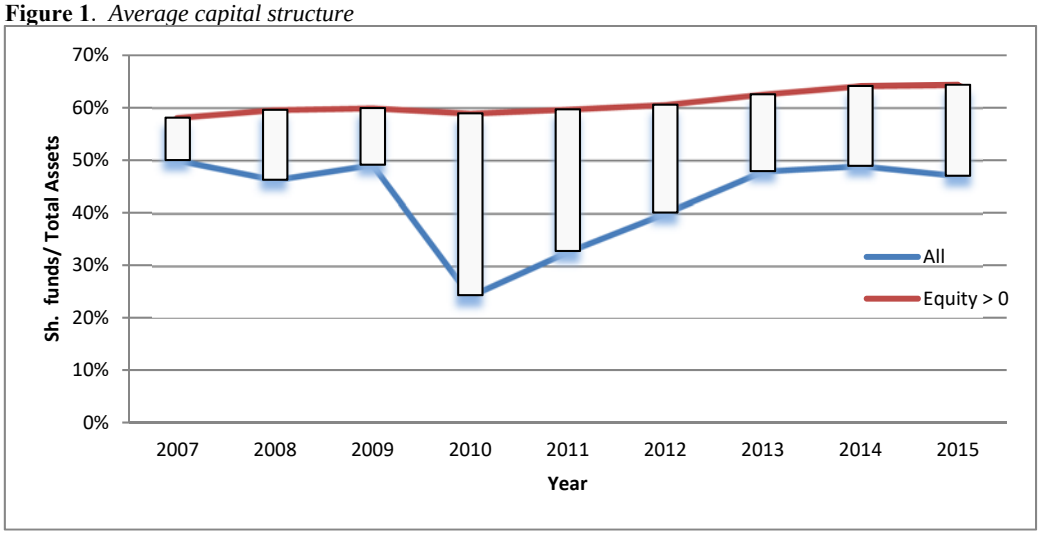
At first, a general analysis to the companies in the sample was assigned. After transferring the data in Excel a number of companies were eliminated. Banks, financial companies, mutual funds/nominee/trusts, foundations, research institutes and other types of financial companies were cut down. In total, 81 companies were eliminated, making the final sample to contain 514 firms. This included Romanian listed companies between 2007-2015, even if some of them may have been delisted in this period of time.

An important issue was the heterogeneity of the sample. The main idea was to keep as many companies in order to generate a general overview on the economic environment during this period. However, many companies did not have reportings for the whole period. Maintaining only companies with all observations available would have kept a small number of companies in the sample and would have biased the results. The decision was to analyse the whole sample and create subsamples of companies where necessary.

## Main findings

In order to analyse the tendencies of capital structure for the selected sample it was first rendered the average value for the whole period (Figure 1). At first, capital structured has been proxied by the ratio between shareholder funds and total assets. For empirical analysis, this ratio will be used in order to evaluate capital structure of companies. Average value has been calculated for each company in each year, and then for the whole period. For companies with incomplete financial reports, the ratio has been rendered for available years only. Then, a simple average for the whole sample and period has been calculated as seen in Figure 1.

**Figure 1**. *Average capital structure*



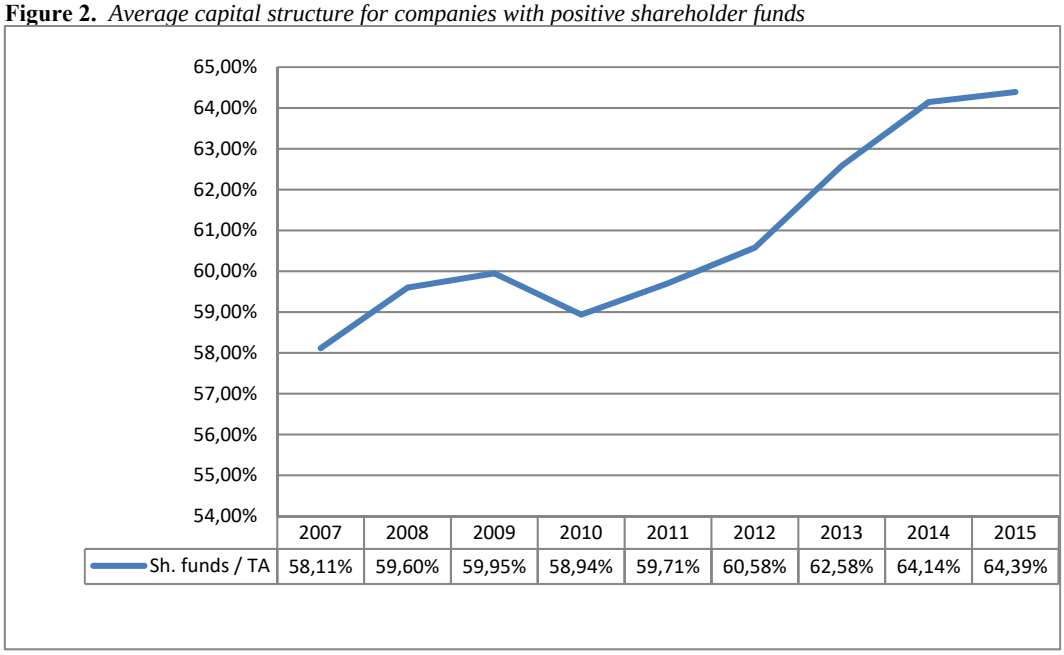

**Source:** own calculations.

Heterogeneity of the sample proved to be something needed to be addressed. *Outliers* generated by companies with financial difficulties or undergoing bankruptcy procedures drastically affect the average value for this indicator. This is shown by the blue line which is the average ratio calculated for all the companies, including ones with at least one negative value. The red line considers only companies with positive values for shareholder funds, eliminating 74 companies out of 514. This resampling is made on the assumption that companies with positive shareholder funds constitute the healthy component. Negative shareholder funds values usually occurs at high values distorting the average indicator.

Nevertheless, comparing the two indicators may give some piece of information. The gap between the two colored lines includes the effect of negative shareholder funds situations, proxing the extent to which companies faced unfriendly economic environment. According to Figure 1, 2010 displays the largest gap between the two values, indicating the start of financial crisis in Romanian economy. Afterwards, the gap gradually narrows down reaching pre-2010 values in 2013. The narrowing trend inverses again starting year

2015. For further research purposes, it would be useful to determine if more recent data would confirm the inverting dynamics.

**Figure 2.** *Average capital structure for companies with positive shareholder funds*




| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|
| Sh. funds / TA | 58,11% | 59,60% | 59,95% | 58,94% | 59,71% | 60,58% | 62,58% | 64,14% | 64,39% |

**Source:** own calculation.

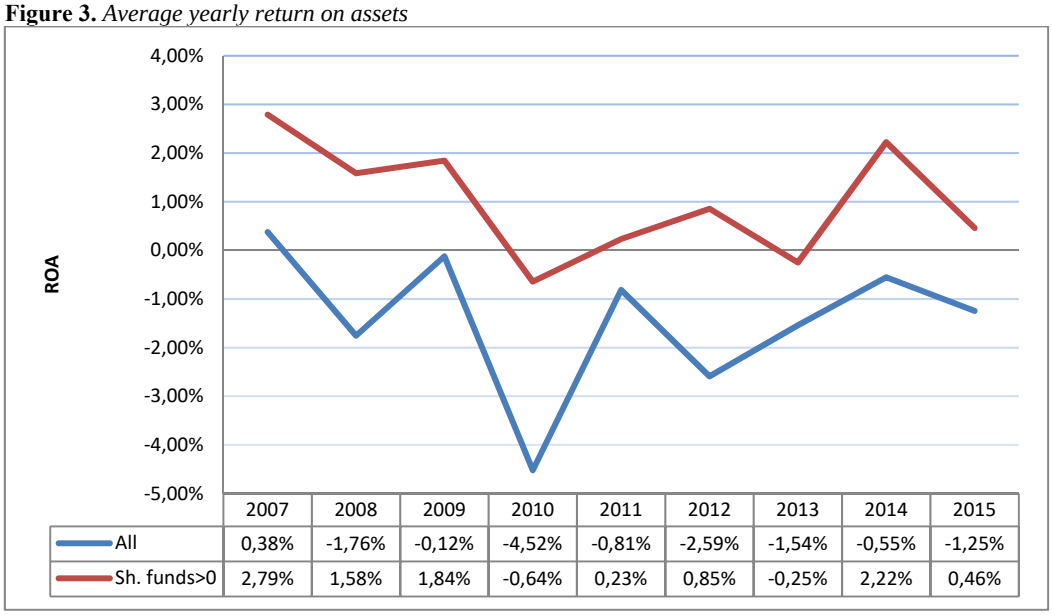
Regarded independently, companies with positive shareholder funds trend around 60 percent for the capital structure proxy ratio (Figure 2). Comparing the starting value (58 percent for 2007) with the final one (64 percent in 2015) it can be stated that companies improved their indebtedness situation. Another conclusion which can be drawn is that companies in this sample did not face important economic hardship during years of financial turmoil. Companies with positive shareholder funds maintained an positive trend during period, even if it registered lower value during the peak of the crisis in 2010. They not only managed to avoid high variations in their capital structure but also improved this indicator over the observed period.

Considering the fact that out of 514 companies, 74 were found with at least one negative value for shareholder funds, which would make around 15 percent of the sample. By the amplitude by which the blue line gaps the red one it can be concluded that the financial shock was mostly absorbed by that 15 percent of companies.

In Figure 3 is shown an average financial indicator for the samples of companies presented above. Return on assets is calculated in yearly average values for the same subsamples in order to inspect if this profitability indicator trends in a similar way with capital structure indicator. Negative values smaller than 100 percent were deleted in order to keep the sample consistent.

Țaga and Stănică (2016) found that, in case of Romanian companies, there is a negative relationship between profitability and debt ratio. Serghiescu and Văidean (2014) also found negative dependencies between the two variables, stating that profitability is the variable with the highest impact on the capital structure choices.

**Figure 3.** *Average yearly return on assets*




| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|
| All | 0,38% | -1,76% | -0,12% | -4,52% | -0,81% | -2,59% | -1,54% | -0,55% | -1,25% |
| Sh. funds>0 | 2,79% | 1,58% | 1,84% | -0,64% | 0,23% | 0,85% | -0,25% | 2,22% | 0,46% |

**Source:** own calculations.

Results showed that average return on assets has its lowest value during 2010 for both samples. This coincides with the lowest levels for the shareholder funds reported to total assets presented earlier. First year, 2007, displays the highest value for the ROA indicator. Second highest peak for profitability is registered in 2014 (2.22 percent) but does not exceed past record value of 2.76 percent.

This shows that even if companies succeeded in regaining their shareholder funds-debt ratio after the financial crisis, profitability indicator remains inferior to pre-crisis's values. For companies with positive shareholder's funds (red line) negative values were registered in 2010 as expected, but also in 2013. At whole sample level, average value for return on assets failed in reaching positive values as in 2007.

Table 1 includes data about industry classification and ownership type for the sample of companies. It also includes information about the companies in the sample classified depending on the industry where it operates. Percentages for each class shows that *manufacturing* companies makes up for around 46 percent of the sample. Other important percentages are read for *wholesale and retail trade* (12 percent), *construction* (11 percent), *agriculture*, *transportation* and *HoReCa*[(1)] (each one around 7 percent). Such imbalanced numbers are specific to developing economies with relatively small service sector.

In Table 1 companies are considered and analysed by the type of ownership. As seen in the table, almost 60 percent of the companies included in the sample are owned by families or individuals. Financial companies or banks own 10 percent of the companies, while other companies have a share of 11 percent of the total sample.

The rest it is owned by employees, managers, directors or others type of institutions which includes foundations, research institutes, mutual and pension funds or unspecified/ undisclosed owners. This distribution implies a high concentration of companies owned by families or individuals, which is seen across all domains of activity except for electricity and health.

**Table 1**. *Industry classification and ownership type*

| Industry classification/ Ownership type | Percent (%) | Financial companies/ banks | Families or individuals | Industrial companies | Employees/ Managers/Directors | Others |
|---|---|---|---|---|---|---|
| **Mining and quarrying** | 2.14 | 1 | 8 | 2 | | |
| **Electricity, gas, steam and air conditioning supply** | 0.97 | | 1 | 4 | | |
| **Manufacturing** | **45.72** | 20 | 138 | 27 | 21 | 29 |
| **Agriculture, forestry and fishing** | 7.59 | 5 | 24 | 3 | 5 | 2 |
| **Transportation and storage** | 7.00 | 1 | 24 | 4 | 4 | 3 |
| **Construction** | 11.48 | 5 | 35 | 7 | 6 | 6 |
| **Wholesale and retail trade, repair of motor vehicles and motorcycles** | 12.06 | 11 | 35 | 3 | 5 | 8 |
| **Water supply, sewerage, waste management and remediation activities** | 0.19 | | 1 | | | |
| **Accommodation and food service activities** | 7.20 | 10 | 20 | 3 | | 4 |
| **Information and communication** | 0.97 | | 4 | 1 | | |
| **Professional, scientific and technical activities** | 2.72 | | 10 | 1 | 1 | 2 |
| **Human health and social work activities** | 0.19 | | | 1 | | |
| **Administrative and support service activities** | 0.97 | | 4 | 1 | | |
| **Others service activities** | 0.39 | | 1 | | | 1 |
| **Others** | 0.39 | | | 1 | 1 | |
| **Total** | 514 companies | 53 | **305** | 58 | 43 | 55 |
| Percent | | **10.31** | **59.34** | **11.28** | **8.37** | **10.70** |

**Source:** own calculations.

Table 2 includes some financial indicators for the companies in the samples classified according to the ownership type. There were calculated average yearly values for return on assets and shareholder funds to total assets ratio for 2007-2015 period. Not all companies have recorded values in all years. As earlier, where incomplete data

occurred, average was computed for available values. There were eliminations where extreme outliers occurred because of atypical economic situations. Even if those values were deleted, high variance marked the data series. For this reason, alongside average indicator, median was also calculated. Capital structure indicator was included only for positive shareholder funds.

**Table 2.** *Financial indicators by ownership type*

| Descriptive analysis for ownership type | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Variable** | **Indicator** | **Financial companies and banks** | **Family and individuals** | **Industrial companies** | **Employees/ Managers/ Directors** | **Other** | *Average* |
| ROA | Average | -0.51% | 0.63% | -3.95% | -1.20% | -0.46% | -1.10% |
| | Median | 0.69% | 1.04% | 0.99% | 1.38% | 0.78% | |
| Capital structure* | Average | 72.76% | 62.97% | 60.69% | 56.93% | 63.47% | 62% |
| | Median | 85.03% | 66.69% | 59.50% | 57.91% | 66.91% | |
| ***Capital structure was calculated only for positive values of shareholder funds by the same (Shareholder funds / Total Assets), **All data is considered at yearly values.** | | | | | | | |

**Source:** own calculations.

The averages values are heavily marked by high negative values for a number of companies registering high loses. In these cases, median indicator could be more representative in drawing conclusions.

Family and individual owned companies look more performant than the other categories. Average ROE is the only positive and highest for family-owned companies. Median values does not confirm this ranking, employers/managers/directors companies being more efficient. Negative values for median indicator indicates that a larger number of companies were non-performant.

If this is coupled with positive values for average indicator means that high performant companies compensate for the higher number of non-performant companies. Looking at ROA indicator, all categories of companies have positive median values, meaning more profitable entities in yearly average. Combining median and average values, family and individual owned companies tops the performance indicator. Anyway, unless further refinements on the sample is done for variance reduction, these data should be looked at prudently.

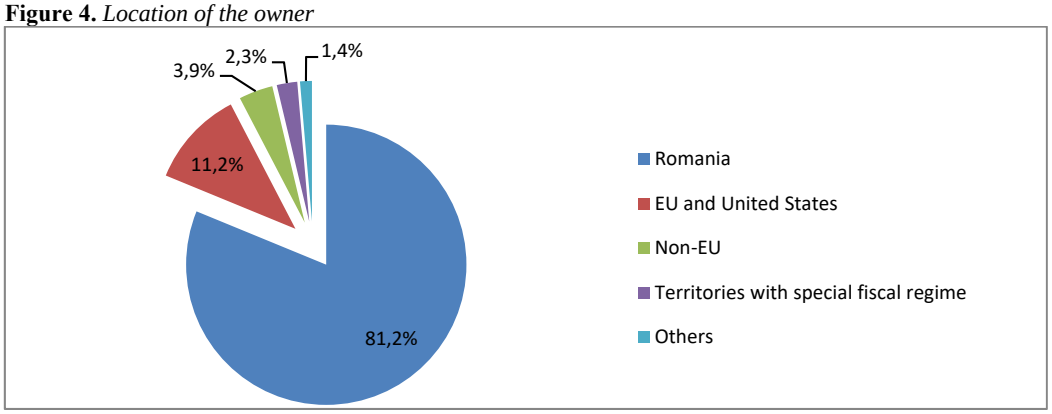
Capital structure may give more accurate information considering only companies with positive shareholder funds were selected. Family companies were expected to be the least leveraged, with a higher portion of total assets financed through shareholder funds. Surprisingly, the least indebted companies are those with financial and bank ownership, with a 0.72 shareholder funds to assets ratio. This contradicts the theory that credit facilities and group membership's advantages generates higher leverage levels.

Companies with industrial companies' ownership rank third, with a 0.61 ratio on average. Family and individual owned companies, which make for around 60 percent of the sample, have a shareholder funds – assets ratio equal to the average of the whole sample, 0.62, which is contrary to expectations of a lower leverage's level for this type of companies.

Companies owned by employees, managers or directors have the highest level of indebtedness, financing only 57 percent of its assets through shareholder funds.

Lastly, companies in the sample have been classified according to the country of the owner. As expected, majority of the companies are owned by Romanian owners, whatever the type of ownership.

**Figure 4.** *Location of the owner*




**Source:** own calculations.

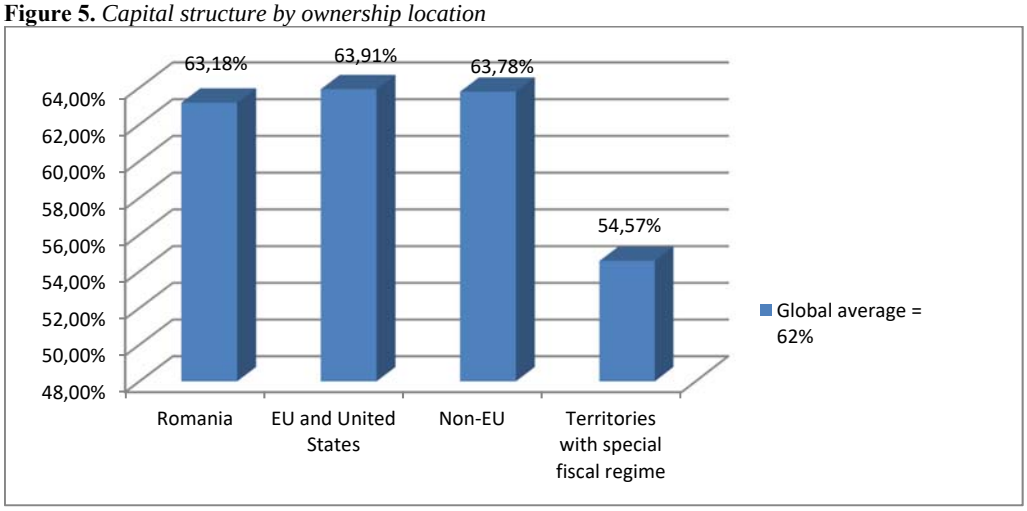
Capital structure ratio was then analysed according to the origin of the owner. There were set forth four categories of territories or countries: Romania, European Union and United States of America, Non-EU countries and territories/countries with special fiscal regimes.

This separation was done on the basis that each category may have different economic behavior or financing policy. The huge imbalance in favor of domestic ownership was expected by the high percent of companies owned by families or individuals. In any case, this could be a signal of a developing stock exchange with insufficient strength.

Companies with foreign owners are usually backed by larger companies or holdings. This could determine their financing decisions by raising their equity and lowering their financial and commercial debt's necessary. On the other side, intragroup credit facilities could raise debt levels.

Figure 5 displays the average capital structure for each category of companies separated by above mentioned criteria. Average capital structure is determined as presented in earlier analysis. Companies with owners in Romania, European Union, United States of America or non-EU countries are about equal in equity-debt ratios. These companies finance their assets by shareholder funds in 63 percent.

**Figure 5.** *Capital structure by ownership location*




**Source:** own calculation.

However, companies with owners from territories or countries with special fiscal regimes have a much lower equity share in total capital. Their financing preference shows an almost equal percent between shareholder funds and debt. This is the most important finding when analysing capital structuring according to the origin of the ownership. Higher levels of indebtedness for these companies may be explained by lower rentability rates for fiscal reasons.

Similar behavior for the first three categories shows that ownership location is not an important factor in explaining capital structure. However, companies with owners located in territories with special fiscal regimes displayed different behavior. Further studies may determine if there is a lower performance for this type of companies.

## Conclusions

This study performed an analysis over a sample of Romanian listed companies trying to determine if there are any agency theory implications. Analysis resumed descriptive analysis of data collected and put together from different sources.

The aspects covered in this paper are limited in addressing agency theory to some particular issues. Ownership type and location approaches were addressed. There were also reviewed aspects related to performance of companies, negative shareholder funds issue, and variations in capital structure determined by financial crisis.

The most important limitation of the paper stems from sample selection. The main objective was to include as many companies as possible in order to determine an overall perspective. However, many small companies in economic turmoil, especially during years financial distress, were included in the sample. Considering such a wide range of companies may have reduced the statistical significance of the results. Separating in sub-samples according to size criteria may represent the reason of further studies.

Industry classification was applied but the study did not conduct analysis of capital structuring for each domain of activity. This may have offered interesting results on how different industries responded to financial shocks.

However, this paper have shown that a majority of companies included are manufacturing companies and are family owned. Companies owned by families or individuals were more profitable in than their counterparts. This was shown both in average and median calculations, contradicting recent studies where family owned companies were seen as less efficient. Capital structuring for companies owned by families or individuals should have underperformed in indebtedness ratio. Expectations were that this companies should borrow less, but results showed their equity-assets ratio was near average and around 0.60. Companies owned by financially companies displayed a surprisingly low rate of indebtedness.

As far location of ownership is concerned, only companies with owners located in territories with special fiscal regimes trended differently. Their level of debt is higher than for the rest of the sample.

Finally, there have been recorded changes in capital structure behavior during the period observed. Speaking of the 440 companies with positive shareholder funds value, the ratio between shareholder funds and total assets raised from 0.58 to 0.64. This positive trend was interrupted in 2009, but recovered previous values starting with 2011. The shock of financial crisis was not so important, according to low variation in capital structure average. For companies less performant which included negative shareholder funds values during observed period, the shock was higher. The gap between these two categories showed that less performant companies were predominantly affected by financial turmoil.

## Note

(1) HoReCa stands for accommodation and food service activities.

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# What impact has free trade area on economies of ASEAN-5 countries?(1)

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**Abstract.** *The main object of this study is to evaluate the impact of free trade liberalization on ASEAN-5 countries, consisting of Indonesia, Malaysia, The Philippines, Singapore and Thailand. Since ASEAN free trade area agreement was declared on 28 January 1992, the cooperation among the members has increased rapidly and has fostered them to achieve higher levels of economy. Therefore, variables such as foreign direct investment and trade should be implied to find out the determinants of the increase of output per capita of these countries. Panel data regression analysis has been employed in order to analyze the data. The variable of foreign direct investment has a positive effect on increasing output per capita of ASEAN-5 economies. We have also found the evidence for which the variable of trade and dummy free trade area don't have significant effect on output per capita before the policy was totally applied (zero tariffs). However, after the policy of zero tariffs was applied, these variables proved to give significant positive effects on output per capita.*

**Keywords:** free trade area, ASEAN, foreign direct investment, economic integration, panel data analysis.

**JEL Classification:** C33, F14, F15, F21.

## 1. Introduction

Integrating economy for development in general can define as "removing all trade barriers (include tariff and quota), integrating more than one economies by following common policies in economy, technology, social-cultural and political dimensions against non-member countries (Paksoy, 2000: p. 9)". By the advantages of economic integration, member countries should be able to gain a level of development in order to increase their productivities and capacities, sustain the competitive ability with other regional and prevent conflict of trade among members in a region. However, the main purpose of economic integration is to achieve high level of economy and prosperity by liberalizing trade among member countries of region, to ensure member of countries to be regionalized and also to effort member of countries to be involved in economic and political events in the world (Şanlı, 2003: p. 15).

Economic integration theory itself has been known as one of basic macroeconomic theory to estimate the effect of economic integration accelerating economic growth. Many scholars also agreed that economic integration should be put into consideration as an important policy in macroeconomics. According to Chou (1967), the theory of economic integration revealed that analyzing its effect towards economic growth could be possible to evaluate the achievements of an economic integration to robust level of economic development using static effect and dynamic effect as criteria. In term of technological and economic structure as constant assumption, by eliminating tariffs, static effect of economic integration provides rapid increases in international trade volume and welfare changes. While static effects are one-off time effect, dynamic effects of economic integration are sustained ones, which leads to changes in economic structures of member countries, include production capacities and resource efficiency (Seyidoğlu, 2015: p. 243).

A number of former studies predominantly has inspired by Viner (1950)'s finding which divided the effect of economic integration towards trade creation and trade diversion. According to Salvatore (2013), custom union (one of prominent level to explain economic integration) may create and divert trade among countries. After establishing custom union and eliminating trade barriers (tariff and quota), member countries prefer to cooperate with each other and against non-member countries, which will be difficult for them to trade due to tariff and quota policy. However, custom union also can divert trade among countries since all trade barriers (tariff and quota) have removed and member countries will gain more trade advantage with members than trade with non-member countries.

There are some success stories in the world that can explain the effect of economic integration to accelerate economic development of member countries. One of simple successful economic integration story is European Union's PIGS countries (Portugal, Ireland, Greece and Spain) which decided to join European Union in the late 1970's. After they became the member of European Union, these countries enjoyed high and rapid economy growth for some decades and foster them to jump into the group of high income countries in late 1980's (Licandro, 2004). This evidence showed that economic integration has important role to develop the economy of members. On the other hand,

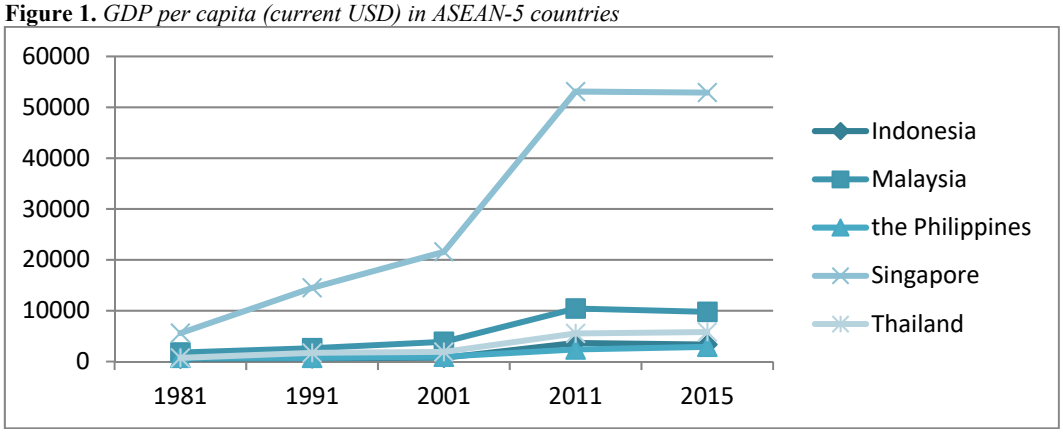
other regional integration such as North Free Trade Area (NAFTA), Central America Free Trade Agreement (CAFTA), Economic Community of West African States (ECOWAS), Southern Common Market (MERCOSUR), Andean Community of Nations (CAN), Central American Common Market (CACM) and Association of South East Asia Nations (ASEAN) are not experienced the success of European Union and tend to modest compare to European Union (Viotti and Kauppi, 2014: p. 411).

This study is expected to give evidence and evaluate the effect of regional economic integration, moreover with regional economic integration in Asian countries such as ASEAN. Since Asian countries grow rapidly in recent decades, the momentum to form regional economic cooperation among countries in Asia has risen, followed by the success of the European Single Market which started in 1992 and NAFTA in 1994. However, Sharma and Chua (2000) also agreed that economies of South East Asia should be moving forward to be more integrated in the future to obtain more advantages from current rapid economic growth.

While signing of ASEAN Free Trade Area in 1992, leaders from six countries of ASEAN member consist of Brunei Darussalam, Indonesia, Malaysia, The Philippines, Singapore and Thailand declared to decrease export and import tariff among the countries. The leaders made an agreement to push tariff into zero until 2010. After the agreement, other member countries such as Cambodia, Myanmar, People's Democratic Republic of Laos and Vietnam also decided to join the agreement and agreed to decrease their tariff into zero until 2015.

Recently some countries in South East Asia have been able to obtain the advantages after the agreement of ASEAN Free Trade Area was signed includes ASEAN-5 countries. The resilient growth of 5 countries in South East Asia (Indonesia, Malaysia, The Philippines, Singapore and Thailand) in recent years has been succeeded to increase their standard of living and tackling poverty problems by the increasing of their GDP per capita after AFTA agreement signed in 1992 as illustrated by Figure 1. Among these countries, only Singapore and Malaysia can achieve such rapid growth in their income per capita.

**Figure 1.** *GDP per capita (current USD) in ASEAN-5 countries*




**Source**: World Bank Data (2017).

Besides, Table 1 illustrated that some countries in South East Asia are also receiving high capital inflow by the rapid growth of Foreign Direct Investment inflow after AFTA agreement started in 1992. Singapore has received more FDI than other ASEAN-5 countries followed by Indonesia, Malaysia, Thailand and The Philippines. This achievement finally was able to gain more capital inflow and increase foreign' investment expenditures in ASEAN-5 economies.

**Table 1.** *FDI net inflow (BOP, current USD) in ASEAN-5 countries*

| Country | 1981 | 1991 | 2001 | 2011 | 2015 |
|---|---|---|---|---|---|
| Indonesia | 133 | 1,482 | -2,977 | 20,564 | 20,054 |
| Malaysia | 1,264 | 3,998 | 553 | 15,119 | 10,962 |
| The Philippines | 172 | 544 | 760 | 2,007 | 5,835 |
| Singapore | 1,659 | 4,887 | 17,006 | 48,329 | 65,262 |
| Thailand | 290 | 2,013 | 5,067 | 2,473 | 9,003 |

**Source**: World Bank Data (2017).

ASEAN itself has plans for further integration with other regional cooperation in East Asia and Pacific. In 1989, as the growing interdependence of Asia-Pacific economies, ASEAN member countries agreed to join regional economic cooperation called APEC (Asia Pacific Economic Cooperation). Amelung (1992) believed that ASEAN will gain more benefits from larger cooperation intra-regional such as Asia Pacific cooperation or APEC. Capannelli et al. (2009) also found that ASEAN integration and 16 integrating Asian economies (include Australia, China, India, Japan, New Zealand and South Korea) in term of trade, direct investment, financial flows and other form of economic and social changes increased rapidly and same like what European Union approach. Moreover, ASEAN has taken a forward step to become more integrated since the ASEAN common market has been realized at the end of 2015. This step makes ASEAN now become one of the biggest single markets in the world where all factors of production can be easily moved among country's members and the further goal of ASEAN integration is become a single entity as outlined in the ASEAN Vision 2020 and integrating 3 pillars of ASEAN, politics, economy and social.

There are some studies which focus on the effect of economic integration towards Asian countries and other developing countries. Most of the studies revealed different perception about Asian economic integration. Hamilton and Winters (1992) note that ASEAN has a strong bias towards ASEAN intra-regional trade. The ASEAN economies do not have significant trend towards their members. However, it has a significant effect to other ASEAN member like APEC. Shams (2003) also gave an evidence of regional integration in developing countries such as MERCOSUR, which in general the members do not enjoy the effect of economic integration due to scarcity of larger and more developed countries in the neighborhood and the risk of trade diversion among member countries.

Since ASEAN member countries dominated by developing countries (Singapore and Brunei are the only developed countries), thus they need to wider their regional economic cooperation, especially with other regional neighbors in East Asia and Pacific like APEC (Sharma and Chua, 2000). Countries like Japan and South Korea, whose are rich of capitals and savings can flow their capitals and savings to other ASEAN member

countries like Indonesia and Thailand. In the other hand, rich resource countries like Indonesia and Thailand can channel their resource to poor resource countries like South Korea and Japan.

With these backgrounds, this study tried to purpose our objectives, evaluating the effect of ASEAN economic integration on the stage of Free Trade Area, which divided by two parts of policy analysis, before zero tariff applied and after zero tariff applied. This study is briefed into five sections. Section 1 is introduction of research, which is explaining the research background and questioning the research problems. In section 2, we construct the theories from some references to explain our expected hypothesis of relation dependent variables to independent variables. After the theories constructed, in section 3 it is important to interpret the research methodology and build the model of our analysis by expected hypothesis. Thus, in sections 4 and 5, the result of analysis and concludes of study will be described.

## 2. Empirical literature

Economic integration can promote the freedom of movement in terms of trade and factors of production among the member countries and give equal opportunity for social classes, regions and member countries. Balassa (1961, quoted by Hosny, 2013) illustrates economic integration as "the abolition of discrimination within area". However, integration of economy according to Narendra and Goel (2014) limit the definition of economic integration as synonymous of globalization and limit it with regional economic integration. Thus, regional economic integration in particular is an agreement among member countries to reduce and ultimately remove tariff and non-tariff barriers to the free flow of goods, services and also factors of production. In addition, Ünsal (2005) explained that there are five forms of economic integration. They are Preferential Trade Agreements, Free Trade Area, Custom Union, Common Market and Economic and Monetary Union. Preferential Trade Agreements usually describe as affording to decrease tariff among participant countries than other member countries (Panagariya, 1998). However, if the participants pushing tariff to decrease or even pushing it into zero level, it can be defined as economic integration in the level of Free Trade Area. The most common model to describe the level of economic integration is Custom Union which is among participants should have a common trade policy. Common market is more developed than custom union since it allows factor production to be distributed among participant countries freely. Finally the most advance models of economic integration itself is economic union where participant countries have one common policy of monetary and economic (Ünsal, 2005).

There are some empirical literatures that constructed some model of economic integration in analyzing its effect towards growth of economy, especially in the level of free trade area. *Vamvakidis (1997)* whom analyse the impact of international trade on economic growth of 138 countries as its observation found that free trade and growth of economy having significantly positive correlation with time period started from 1980 through 1970.

On the other hand, *Barro and Sala-I-Martin (1995)* stated that trade protection using tariff policy in trade is possible to give negative impact on economic growth.

It is also important to review some worthy empirical works on European Union integration. According to Cecchini Report (1988), the static effect of regional growth is invariably around 2.5-6.5% towards the income of European Economic Community. Baldwin and Seghezza (1996) believed that there is a positive effect of free trade in European Union towards economic growth for medium term.

Herekson et al. (1997) resulted that member countries in European Community (EC) and European Free Trade Area (EFTA) have significantly increases on their growth rates in long term. The growth effect is estimated in approximately 0.6-0.8%. Badinger (2001)'s study found that the European Union economic integration had a positive impact towards economic growth and with observation between 1950-2000, if European economies was not integrate, the average growth rate per decade would be 0.4 percentage points lower for some EU countries. Another study by Cuaresma et al. (2008) found that European Union membership have positive and asymmetric influences on economic growth in the long term (which is relatively higher for poorer countries). Economic integration also positively influenced growth in the long run, in the study of economic integration in the European Union by Pehlivan (2013).

In case of ASEAN integration, a study by Plummer et al. (2014) found that by the applying of ASEAN Economic Community and Regional Economic Comprehensive Partnership all ASEAN economies will gain benefits on their income growth, rising about 8% and 18% in respectively. Nguyen and Ezaki (2005) resulted that Vietnam as a member of ASEAN enjoyed rapidly growth on its market and positive improves welfare and income-distribution after participated in the China-ASEAN free trade area and signed a bilateral package with United States. The empirical result of Ismail et al. (2009) revealed that AFTA has impact on increasing of FDI from European Union more than other USA and Japan and also found that USA and Japan have significant investitions on ASEAN-5 more than other members. Moreover, Ardiyanti (2015) also estimated a positive effect of AFTA on the member's countries trade performance in term of export.

Some empirical studies also found the opposite effect of economic integration on the growth of economy. De Melo et al. (1992) believed that there is no significant effect relationship between economic integration and long term growth in observation of 101 countries, include OECD and developing countries. Similarly, Vanhoudt (1999) also revealed no evidence of economic integration's positive effect towards growth of European Union membership or non-membership in 23 OECD's countries observation.

## 3. Data and methodology

This study investigates the effect of free trade area agreement among ASEAN countries since 1992 who signed by six countries (including Brunei Darussalam). However, this study will only concern on ASEAN 5 dominant economies such as Indonesia, Malaysia, The Philippines, Singapore and Thailand. We use a dummy variable to analysis the effect

of the AFTA agreement. (Herenkson et al., 1997) and Sachs and Warner (1995) are used dummy variable in their analysis to find some indicators that have possibility for effecting growth of economy. For the period of 1981 through 1992, the value is 1 and the period of 1992 through 2015 the value is 0. Other variables that are used in this analysis can describe as follows:

**Table 2.** *Variables descriptions*

| Variables | Symbol | Sources |
|---|---|---|
| GDP per capita is defined as total gross domestic product of country divided by population of country in a year (in current US Dollar). This includes total gross value added of all goods and service by producers in the economy plus any product taxes and minus any subsidies. | $GDP_{it}$ | World Bank Data (2017) |
| Foreign direct investment is confine as cross-border's capital inflow of country that reported by the economy. Calculated by total of equity capital, reinvestment of earnings and other capital. This includes a resident in one economy that having control and has a significant degree of influence on the management of an enterprise that is resident in another economy. Data used are in current U.S. dollars. | $FDI_{it}$ | World Bank Data (2017) |
| Trade is measured by total of merchandise goods exports and imports divided by the value of GDP (as share of GDP) and calculated in current U.S. dollars. | $TRD_{it}$ | World Bank Data (2017) |

The analytical framework will be estimated by panel data regression analysis in two different parts due to the Common Effective Preferential Tariff (CEPT) aims zero tariff policy for all products for ASEAN-6[(2)] in 2010 (Kraichitti, n.d.). First, we applied sample period of observation before zero tariff policy applied from 1981 through 2010 in ASEAN. The second, our sample period of observation is ASEAN free trade area after applying zero tariff policy (from 1981 through 2015). Moreover, by Hausman Test analysis, the two models of Fixed Effect Model and Random Effect Model are possible to be selected. Rayp and Standaert (2017) also suggest other variables such as Foreign Direct Investment and Trade can be used to measure integration in term of economy. Therefore, we also applied these variables in our panel data model as follows:

$$D.\log.GDP_{it} = ß_0 + ß_1\, D.\log.FDI_{it} - ß_2\, D.\log.TRD_{it} + ß_3\, DummyFTA_{it} + e_{it} \qquad (1)$$

$D.\log.GDP_{it}$ is Gross Domestic Product per capita of a country *i* in a period of *t;* $D.\log.FDI_{it}$ is Foreign Direct Investment, net inflows (BoP current US Dollar) of a country *i* in a period of *t;* $D.\log.TRD_{it}$ is trade (in term of total merchandise trade) variable of a country *i* in a period of *t;* $DummyFTA_{it}$ is dummy free trade area variable of a country *i* in a period of *t;* $\beta_o$ is constant; $\beta n$ is regression coefficient; $e_{it}$ is disturber coefficient. As explained on literature review and the theories, it can be expected hypothesis of the effect of variables as follows:

**Table 3.** *Expectation effect of independent variables towards dependent variables ($GDP_{it}$)*

| Independent variables | Hypothesis on both of policies |
|---|---|
| Foreign Direct Investment ($FDI_{it}$) | (+) significant |
| Trade ($TRD_{it}$) | (+) significant |
| Dummy of Free Trade Area ($FTA_{itt}$) | (+) significant |

## 4. Findings

### 4.1. Unit root test

Before we analyse variables with panel data regression, it is important to check the stationary of data that are used. The unit root test of Im, Pesharan and Shin W-stat (IPS)

result in Table 4 show that the probability of GDP variables, FDI variables and Trade variables are significant at 5 percent. It can be concluded that our data is stationary in first difference. Therefore, these data is possible to use for further panel data regression.

**Table 4.** *The unit root test result of all variables*

| Method | Probability | | |
|---|---|---|---|
| | GDP variables | FDI variables | Trade variables |
| Im, Pesaran and Shin W-stat | 0.0000**<br>I(1) | 0.0000**<br>I(1) | 0.0000**<br>I(1) |

**Note:** **Statistically significant at 5 percent (*p-value* less than 0.05) and *Statistically significant at 10 percent (*p-value* less than 0.1).

## 4.2. Regression results

As we mentioned above, some variables of our analysis might be possible to determine and evaluate the effect of free trade area in ASEAN-5 countries in two scenarios, before zero policy applied and after zero policy applied. Since the Hausman tests results probabilities with value 0.93 and 0.97 in respectively and it is bigger than a probability value of 10%. Therefore, it can be assumed that both of two policy scenario, *Random Effect Model* is the best model to interpret them. From the results of analysis in Table 5, both of F-statistic probabilities have significances less than 5%. Thus, it can be concluded that the independent variables ($FDI_{it}$, $TRD_{it}$, $DummyFTA_{it}$) have a simultaneous influence on both dependent variables (GDP per capita). The R-square of analysis for after zero tariffs applied is fit to interpret the analysis result than the R-square of before zero tariff applied.

The variable of $D.log.FDI_{it}$ or Foreign Direct Investment has a positive effect and significant towards GDP per capita both of before zero tariff applied and after zero tariff applied. It can be concluded that before zero tariff policy, FDI only affected output per capita of a country with value 0.031111.

**Table 5.** *Panel regression analysis result of GDP per capita with random effect model*

| | Before zero tariff applied | | After zero tariff applied | |
|---|---|---|---|---|
| Variables | Coefficient | Prob. | Coefficient | Prob. |
| Constants | 0.070263 | 0.0000 | -0.064858 | 0.0520 |
| $D.log.FDI_{it}$ | 0.031111 | 0.0049** | 0.177152 | 0.0000** |
| $D.log.TRD_{it}$ | -0.132435 | 0.1883 | 0.840112 | 0.0000** |
| $DummyFTA_{it}$ | -0.011995 | 0.5189 | 0.105479 | 0.0133** |
| Hausman Test | Prob.chi square : 0.9340 | | Prob.chi square : 0.9871 | |
| R-square | 0.047800 | | 0.639489 | |
| Prob(F statistic) | 0.025328 | | 0.000000 | |

**Note:** **Statistically significant at 5 percent (*p-value* less than 0.05) and *Statistically significant at 10 percent (*p-value* less than 0.1).

However, after zero tariff policy has applied, in certain period FDI effecting more output per capita (with value 0.177152) and more significant (with p-value 0.0000). This result is incline with Di Mauro (2000) finding who suggests country's member should be able to receive more and more FDI by the impact of economic integration (impact in commercial changes and monetary integration), then increasing investment and output. Besides, FDI also creates two main channels of economic integration of non-members in member countries. This two main channel could be as trade creation among members or trade diversion (Ünsal, 2005). Moreover, Sharma and Chua (2000) suggest ASEAN needs

to create cooperation with to other regional like East Asia. Thus, countries like Japan and South Korea can channel their abundant of savings and capital through FDI investment into ASEAN countries.

The result analysis of variable D.log.$TRD_{it}$ or Trade is different in both of two our policy of analytical framework. Trade variable does not have a significant effect towards GDP per capita of the countries. However, after zero policy applied on AFTA, trade influencing positively towards GDP per capita of a country in certain period as 0.840112. Increasing trade in general should be increasing together in output of a country. Frankel and Romer (1999) claiming that there is increasing in GDP per capita by 2.4% accompanied with increasing trade by 1%. However, since most ASEAN member countries top 10 major trade partners are non ASEAN's members and only 24 percent trade within ASEAN members, trade might not possible to give an effect towards GDP per capita of the members and create possibility of trade diversion among the members (Table 6).

**Table 6.** *Top ASEAN trade partner countries/region in 2015*

| Trade partner country/Region | % Share to total ASEAN trade | | |
|---|---|---|---|
| | Exports | Imports | Total Trade |
| ASEAN | 25.8 | 21.9 | 23.9 |
| China (People's Republic of) | 11.3 | 19.4 | 15.2 |
| Japan | 9.6 | 11.4 | 10.5 |
| EU 28 | 10.8 | 9.2 | 10.0 |
| United states | 10.9 | 7.6 | 9.3 |
| Korea, Republic of | 3.9 | 7.0 | 5.4 |
| Taiwan | 2.8 | 5.6 | 4.1 |
| Hong Kong | 6.5 | 1.1 | 4.0 |
| India | 3.3 | 1.8 | 2.6 |
| Germany | 2.2 | 2.6 | 2.4 |

**Source**: ASEAN (2017).

The result of variable $DFTA_{it}$ or Dummy of Free Trade Area is also different with our expecting hypothesis. AFTA does not have significant influence on GDP per capita in period sample of before zero tariff policy applied. However, AFTA has a significant effect towards GDP per capita after zero tariff policy applied to value 0.105479. Therefore, it is important to note that zero tariff policy in AFTA has effort ASEAN-5 countries to be more integrated and foster them to obtain more advantages from ASEAN Free Trade Area in the future.

Herenkson et al. (1997) have pointed that traditional economic integration does not have a permanent effect on economic growth. On the contrary, some scholars claimed that regional integration could give a long-run effect on growth of economy. Asian integration trade has tended to increase rapidly until the mid of 1980 as their share of world trade increase and traded more intensively with other non-Asian economies. Sharma and Chua (2000) revealed that the recent developments of free trade area in ASEAN only give less effect of economic impact since ASEAN only have 25 percent trade share with ASEAN member countries themselves. This evidence can create such trade diversion among the members. Capannelli et al. (2009) explained that trade of economies in MERCOSUR also increases after they become more integrated with other regional economies and Shams (2003) also believed that MERCOSUR economic integration generally does not have a

significant effect towards economic integration due to scarcity of larger and more developed countries in the neighborhood and the risk of trade diversion among member countries.

## 5. Conclusion

The result analysis of this study found some important notes to evaluating the progress of integration in ASEAN, especially after AFTA was signed in 1992. All variables of our analysis resulted positive and significant effects on output per capita of ASEAN-5 countries after AFTA applied fully zero tariff policy among the members. However, only the variable of Foreign Direct Investment has a positive effect and significantly influences output per capita of ASEAN-5 countries before AFTA applied zero tariff policy. The variable of trade and dummy free trade area do not have significant influence on the output per capita.

The AFTA's zero tariff policy itself has ensure ASEAN countries (especially ASEAN-5 countries) to be more integrated and by beginning ASEAN Community in 2015, it can be a moment for ASEAN countries to obtain more advantages by applying a more developed level of economic integration in the future. Some scholars by Hamilton and Winters, (1992); Sharma and Chua, (2000); Frankel, 1993; Petri, (1993) also agreed that ASEAN needs to wider its cooperation towards other regions such as East Asia and Pacific (especially with other developed countries in ASEAN-6). ASEAN members, which are in general rich of resources can improve their trade performance by channeling their resources to developed countries in East Asia developed countries which in general rich of capitals and savings, otherwise East Asia developed countries also can invest in ASEAN member countries. Therefore, ASEAN-5 countries can sustain their rapid growth of economy and achieve high level of economy by integrating their economies with other regions.

## Notes

(1) This paper had been presented in International Economics, Finance and Econometrics Symposium (EFEOS) in 17-18 May 2017 and awarded as the second best paper in economics field.

(2) ASEAN-6 consists of Brunei, Indonesia, Malaysia, The Philippines, Thailand and Singapore.

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# Is more government debt or currency depreciation expansionary? The case of Poland

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**Abstract.** *This paper finds that Poland's aggregate output is positively associated with the government debt-to-GDP ratio, the real effective exchange rate during 2002.Q4-2007.Q3, the real stock price and the real oil price and negatively impacted by the real effective exchange rate during 2007.Q4-2016.Q4, the real interest rate and the expected inflation rate. Hence, the current level of the debt-to-GDP ratio is sustainable, and real depreciation may be contractionary or expansionary depending upon the time period under consideration.*

**Keywords:** government debt, real appreciation or depreciation, stock prices, oil prices.

**JEL Classification:** E62, F31.

## 1. Introduction

After the global financial crisis, Poland has shown faster economic recovery than most of other EU countries. In 2015, its 3.9% growth rate of real GDP ranked 6th among 28 EU countries. The price level was stable as evidenced by a negative inflation rate of 0.7%. The value of the zloty had declined as the exchange rate of the zloty versus the U.S. dollar changed from an average of 3.1551 in 2014 and 3.7701 in 2015 to 3.9487 on October 28, 2016. Whether the depreciation of the zloty would be beneficial to the economy remains to be seen. The 2.6% budget deficit as a percent of GDP was the lowest since 2008 and close to the EU's average of 2.4%. The 51.1% of general government gross debt as a percent of GDP was much lower than the average of 85.0% for 28 EU countries. The government bond yield of 2.70% was higher than EU's average of 1.45%, suggesting that it cost more for Poland to finance its deficits. Improvement in fiscal consolidation has led to early exit out of EU's Excessive Deficit Procedure program. The banking sector was profitable, liquid, and sufficiently capitalized. The unemployment rate of 7.5% was lower than the EU average of 9.4% but higher than 5.4% in the U.S. The lending rate of 8.4% for household consumption loans was higher than many other EU countries and expected to reduce demand for loans and household spending.

This paper focuses on the impacts of more government debt and real appreciation or depreciation on aggregate output in Poland and has several different aspects. First, a simultaneous-equation model consisting of aggregate demand and short-run aggregate supply is applied in formulating the theoretical model. Second, in short-run aggregate supply, supply shocks such as the real oil price will be considered. Third, other relevant variables such as the real interest rate, the real stock price and the expected inflation rate will be incorporated in the model.

## 2. The model

Extending Agenor (1990), Moreno (1999), Romer (2000, 2010) and other studies, we can specify that aggregate demand is a function of the inflation rate, government spending, government tax revenue, the real interest rate, the real stock price and the real effective exchange rate and that in the short-run aggregate supply function, the inflation rate is determined by the expected inflation rate, real GDP supplied, the real oil price and the real effective exchange rate. We can express aggregate demand and short-run aggregate supply as:

$$Y^d = f(\pi, G, T, R, S, \varepsilon) \tag{1}$$

$$\pi = g(\pi^e, Y^s, E, \varepsilon) \tag{2}$$

where:
$Y^d$ – aggregate demand;
$\pi$ – the inflation rate;

G – government spending;
T – government tax revenue;
R – the real interest rate;
ε – the real effective exchange rate (an increase means real appreciation);
$\pi^e$ – the expected inflation rate;
$Y^s$ – short-run aggregate supply, and
E – the real oil price.

In equilibrium, $Y^d = Y^s$. Solving for the two endogenous variables Y and π simultaneously, we find equilibrium real GDP $\overline{Y}$ as:

$$\overline{Y} = h(G - T, \varepsilon, R, S, E, \pi^e) \quad (3)$$

In empirical work, we substitute government debt D for the government deficit G – T as the former is the sum of the latter:

$$\overline{Y} = h(D, \varepsilon, R, S, E, \pi^e) \quad (4)$$

? ? – + ? –

We expect that equilibrium real GDP has a positive relationship with the real stock price, a negative relationship with the real interest rate and the expected inflation rate, and an unclear relationship with the government debt, the real effective exchange rate and the real oil price.

Whether more government debt as a percent of GDP may affect equilibrium real GDP depends on whether the debt/GDP ratio is relatively small or large. If the debt/GDP ratio is relatively small, an increase in the government debt to stimulate the economy and improve infrastructures may not affect the interest rate and private spending. However, when the debt/GDP ratio is relatively high and unsustainable, a further increase in the debt/GDP ratio may raise the interest rate, crowd out private spending completely, cause the zloty to appreciate, and reduce net exports. Recent studies for Poland and other related countries generally show that more government debt or deficit as a percent of GDP tends to raise interest rates in different degrees or under certain conditions and tends to reduce aggregate output (Baldacci and Kumar, 2010; López, Riquelme and Muñoz, 2011; Hauner and Kumar, 2011; Gruber and Kami, 2012; Claeys, Moreno and Suriñach, 2012; Ağca and Celasun, 2012; Aisen and Hauner, 2013). Cebula and Cuellar (2010), Cebula (2014a; 2014b) and Cebula, Angjellari-Dajci, and Foley (2014) find that more government deficit raises real interest rates in the U.S. On the other hand, the Ricardian Equivalence hypothesis (Barro, 1974, 1989) suggests that debt or deficit-financed government spending has a neutral effect on output in the long run.

Real depreciation tends to increase net exports and shift aggregate demand upward, but it increases import prices and domestic inflation and shift short-run aggregate supply leftward (Cheikh and Rault, 2016). Therefore, whether the net impact would be positive, negative

or neutral is an empirical question. Findings of previous studies including Poland and other related countries are inconclusive. Depreciation of the zloty is found to be expansionary in the short run (Bahmani-Oskooee and Kutan, 2008), contractionary in the long run (Miteza, 2006; Kalyoncu et al., 2008), expansionary in the long-run (Nusair, 2014), and neutral in the long run (Bahmani-Oskooee and Kutan, 2008).

For oil importing countries, a higher real oil price tends to shift short-run aggregate supply to the left and reduce real GDP. However, if a higher real oil price is driven by a strong aggregate demand, it would shift aggregate demand to the right. Hence, the net impact is unclear (Hamilton, 1996; Kilian, 2014a, 2014b).

## 3. Empirical results

The data were collected from the *International Financial Statistics* published by the International Monetary Fund and the *Eurostat* published by the European Commission. Real GDP is measured in million zlotys. The government debt as a percent of GDP is selected to represent fiscal policy. The real effective exchange rate is a trade-weighted index, and an increase means real appreciation of the zloty versus a basket of major currencies of its trading partners. The government bond yield minus the inflation rate is used to represent the real interest rate. The nominal equity price is adjusted by the CPI to derive the real stock price. To derive the real oil price, the average crude oil price per barrel is adjusted by the CPI and measured in the zloty. The expected inflation rate is estimated as the average inflation rate of the past four quarters. The sample ranges from 2002.Q4 to 2016.Q4. The data for the government debt-to-GDP ratio are not available before 2002.Q4.

According to the DF-GLS test, each of the variables has a unit root in level and is stationary in first difference. The test on the regression residuals shows that the test statistic of -5.7681 is greater than the critical value of -2.6077 in absolute values at the 1% level. Therefore, these time series variables are cointegrated.

The scatter diagram in Figure 1 seems to show that the government debt-to-GDP ratio had a positive impact on real GDP. The scatter diagram in Figure 2 seems to indicate that the real effective exchange rate affected real GDP positively in the early stage and negatively in the latter stage. Hence, a binary variable with a value of 0 during 2002.Q4-2007.Q3 and 1 during 2007.Q4-2016.Q4 is generated to test whether the slope of the real effective exchange rate and the intercept may have changed.

Table 1 reports estimated parameters and relevant statistics. As shown, approximately 97.74% of the change in equilibrium real GDP can be explained by the eight exogenous variables. Equilibrium real GDP is positively affected by the debt-to-GDP ratio, the real effective exchange rate during 2002.Q4-2007.Q3, the real stock price and the real oil price and negatively influenced by the real effective exchange rate during 2007.Q4-2016.Q4, the real interest rate and the expected inflation rate. If government debt as a percent of GDP

rises 1%, equilibrium real GDP would rise by 0.0647%. A 1% real appreciation of the zloty would lead to a 0.4786% increase in equilibrium real GDP during 2002.Q4-2007.Q3 and a 0.5851% decline in equilibrium real GDP during 2007.Q4-2016.Q4. The mean absolute percent error of 1.6148% suggests that the forecast error is relatively small.

**Figure 1.** *Scatter Diagram between Real GDP and the Government Debt-to-GDP Ratio (DEBTY) in Poland*

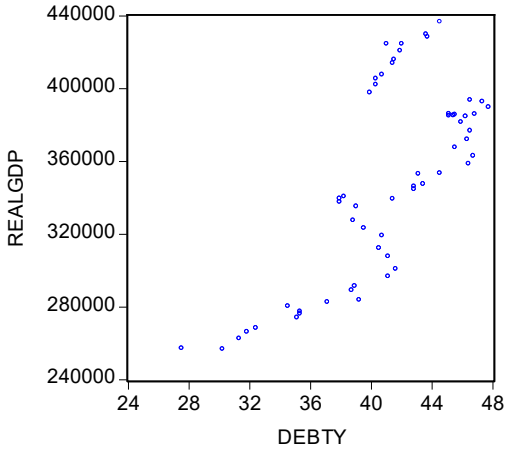


**Figure 2.** *Scatter Diagram between Real GDP and the Real Effective Exchange Rate (REERFRBB) in Poland*

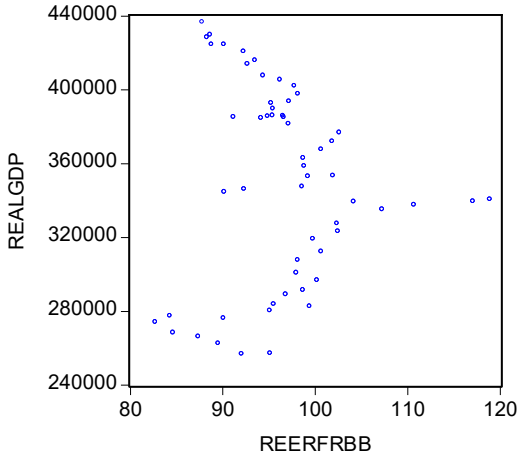

**Table 1.** *Estimated Regression of Log(Real GDP) in Poland*

| Variable | Coefficient | z-Statistic |
|---|---|---|
| C | 9.696444 | 155.0437 |
| Log(government debt/GDP ratio) | 0.064739 | 3.174142 |
| Log(real effective exchange rate) | 0.478636 | 22.71971 |
| Log(real effective exchange rate) x binary variable | -1.063694 | -24.16641 |
| Binary variable | 5.093651 | 25.14061 |
| Real interest rate | -0.016011 | -5.691551 |
| Log(real stock price) | 0.064172 | 8.383433 |
| Log(real oil price) | 0.057232 | 5.351225 |
| Expected inflation rate | -0.030329 | -11.86533 |
| R-squared | 0.977410 | |
| Adjusted R-squared | 0.973645 | |
| Akaike information criterion | -4.939817 | |
| Schwarz criterion | -4.545544 | |
| Mean absolute percent error | 1.614767% | |
| Methodology | GARCH | |
| Sample period | 2002.Q4 – 2016.Q4 | |
| Number of observations | 57 | |

**Note:** All the coefficients are significant at the 1% level.

## 4. Summary and conclusions

This paper has examined whether more government debt or real depreciation/appreciation would affect aggregate output in Poland. Empirical results show that more government debt as a percent of GDP raises real GDP and that real appreciation of the zloty increased real GDP during 2002.Q4-2007.Q3 and reduced real GDP during 2007.Q4-2016.Q4. These results suggest that expansionary fiscal policy seems to be effective and that real appreciation was effective during 2002.Q4-2007.Q3 whereas real depreciation was effective during 2007.Q4-2016.Q4. Other results indicate that a lower real interest rate, a higher real stock price, a higher real oil price or a lower expected inflation rate would increase real GDP.

Although real GDP and the government debt-to-GDP ratio have a positive relationship, in interpretation of the results, caution should to be exercised. In Figure 1, the correlation between real GDP and the debt-to-GDP ratio seemed to be negative in some of the periods, suggesting that a higher debt-to-GDP ratio would reduce real GDP. In Figure 2, real GDP and the real effective exchange rate seemed to move in different directions in some of the periods. Hence, once more new data are available, a periodic assessment of their relationships is needed.

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# Long-memory, self-similarity and scaling of the long-term government bond yields: Evidence from Turkey and the USA

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**Abstract.** *This study investigates the long-memory and self-similarity characteristics of the long-term government bond yields in Turkey and the USA. The Geweke-Porter-Hudak (GPH) log-periodogram regression method has been utilized to measure the long-term persistency in the bond yield returns and volatilities for the period between 28.02.2010 and 28.04.2017. The empirical results show that while bond yield returns have random walk behaviors their volatility dynamics can be represented by a long-memory process. The paper also puts forward that bond yield returns have scale invariant distributional features and fitted with a Levy-stable distribution.*

**Keywords:** long-memory, bond markets, self-similarity, Levy-stable distribution.

**JEL Classification:** C14, G01, G10.

## 1. Introduction

The concept of long-range dependence of time series was introduced by Hurst (1951) and has been an intensely discussed topic in the empirical finance literature. Later, Mandelbrot (1964) adapted the phenomenon of long-range dependence to the financial time series. The seminal paper of Granger and Joyeux (1980) introduced the use of fractional processes in economics and econometrics. The motivation behind the economic literature on fractionally integrated processes stems from empirical evidence that many economic and financial time-series are not characterized as neither $I(0)$ nor $I(1)$ process. There have been numerous studies dealing with analysing the interest rate dynamics by using fractionally integrated models in the literature. The results from the studies are mixed, while some of them revealed existence of long-range dependence in the interest rate series some of them found no evidence of such properties.

Along with the long-range dependence, the scaling property of financial assets was firstly investigated by Mandelbrot (1964). In this pioneering study, he found out that addition to non-Gaussian distributional properties of cotton prices, distributions at different time scales have consistent functional form. Inspired by Mandelbrot, there have been several authors studied the scaling characteristics of financial returns across different asset classes and markets. One of the first study in this field was conducted by Müller et al. (1990) in which they examined the scaling law in intra-day FX prices and found evidence of scaling behaviour in absolute returns. Evertsz (1995a, 1995b) documented distributional self-similarity in USD/DM exchange rate and 30 German stocks. Mantegna and Stanley (1995) empirically suggest that the probability distribution of S&P500 can be identified by a non-normal scaling law. Scaling characteristics of Norwegian stock market have been studied by Skjeltorp (2000). Dacorogna et al. (2001) prove that empirical scaling law of USD/JP and USD/GBP is described by a power law. Gençay et al. (2001a) and Xu and Gençay (2003) also show that return and volatility characteristics of exchange rates follow scaling laws at different time horizons. The other papers that document the scaling law in financial asset prices are; Galluccio et al. (1997), Guillaume et al. (1997), Gopikrishnan et al. (1999), Wang and Hui(2001), Di Matteo et al. (2003, 2005), Sarkar and Barat (2006).

There are handful of studies about the long-memory and scaling dynamics of interest rates in the literature but only a few of them investigated such properties for Turkish rates. Therefore, it is beneficial to delve into this area and shed some light on the long-memory and scaling properties of the interest rates in the Turkish bond market. In this study, we conducted an intensive study on the long-memory, self-similarity and scaling characteristics of the Turkish interest rates vis-a-vis the USA interest rates. The rest of the paper is organized as follows. The notions of long-range dependence and self-similarity are introduced in section 2. Section 3 provides the empirical framework for the detection of the Long-range dependence and self-similairity. Data and empirical results are analysed and discussed in sections 4, and section 5 draws conclusion.

## 2. Literature review

Backus and Zin (1993) were the first authors who studied the long-term dynamics of the interest rates. They found evidence on long-term dependence in the 3-month zero coupon rates for the US bonds. Also McCarthy et al. (2004) came up with similar findings for US interest rates by using wavelets. Lai (1997), Gil-Alana (2002) and Gil-Alana (2004) also presented existence of Long-range dependence for the US interest rates. However, Caporale and Gil-Alana (2008) showed that the degree of persistence of the US interest rates is very sensitive to the model specification.

Karanasos et al. (2006) investigated the long-range dependence of the monthly US ex-ante and ex-post real interest rates by implementing FARIMA-FIAPARCH model. They state that US real interest rate has Long-range dependence characteristics in both first and second conditional moments. Their findings are in line with the results of Tsay (2000) where he has showed that ex-post interest rates of the US market has Long-range dependence.

Cajueiro and Tabak (2006) presented empirical evidence on the Long-memory properties of US 1, 3, 5 and 10 year maturity bond rates for the period from 1962 to 2005. They split the whole period into five sub-periods according to monetary policy and FED tenure. They argue that interest rate dynamics of the US bonds showed strong Long-memory before the Volcker administration and that after 1982 this characteristic has faded away suggesting a structural break in the dynamics of US interest rates.

Apart from studies on the US market, there have been several papers on investigating the Long-memory characteristics of interest rates world markets. Barkoulas and Baum (1997) have found the Long-memory effects on Euroyen deposit rates and Eureyen term premium for the Japan. Tabak and Cajueiro (2005) also found long-term dependency for the Japanese interest rates. Their study has some interesting features that the Bank of Japan's zero-interest rate policy to boost the economy has caused anti-persistent behaviour for the Japanese short-rate.

Fractional dynamics of the long-term interest rates of the five developed economies (US, Canada, Germany, UK, and Japan) have been examined by Barkoulas et al. (1996). They empirically found out that all interest rate series are integrated of order one I(1) and do not show persistent behaviour. However, their study reveals an important property such that 'even though each interest rate series is best characterized as a unit-root process, they possess a common fractional component'. In other words, interest rate series of five developed markets are fractionally co-integrated.

Iglesias and Phillips (2005) examined the one-month five Euro-market (Denmark, Germany, Netherlands, Portugal, and Spain) and Switzerland interest rates with the FARIMA model. Their study exposes that the one-month interest rate dynamics of the Euro-market countries are best characterized as fractionally integrated processes, whereas interest rates of Swiss market do not show Long-memory behavior and found to be $I(1)$ unit-root process.

In their study, Venetis et al. (2006) investigated the Long-memory behaviour of the ex-post monthly interest rates for the 14 European countries and US. They suggest that the evidence of Long-memory existence in the interest rates might be spurious due to structural breaks and cyclical components. They argue that the European and the USA interest rates are fractionally integrated processes between the 1978 and 1999. Also, Couchman et al. (2006) conducted a similar research by studying the Long-memory behaviour of real interest rates for 16 countries and state that majority of them have fractionally integrated parameter $d$ lie between 0 and 1.

Fractionally integrated dynamics of the developing economies have been also addressed by several authors in the literature too. The study on the Long-memory dynamics of the East Asian countries (Singapore, Thailand, Malaysia, South Korea, Philippines) and Mexico have been proposed in the studies of Gil-Alana (2003) and Candelon and Gil-Alana (2006). According to the results of the papers, while Thai and Singaporean interest rates display mean-reverting characteristics $d \in (0,1)$, the results for the other countries are inconclusive.

Silva and Leme (2011) considered fractionally integrated models for the dynamics of Brazilian inflation rate and real interest rate. Their empirical findings point out a fractionally integrated process with some Long-memory for the Brazilian real interest rate.

A recent study on the Long-memory characteristics of Turkish real interest rates has been carried on by Yurttaguler and Kutlu (2013). They put account GPH estimation method to inspect the fractional differencing parameter for the Turkish monthly interest rates for the period of February 2003 - March 2012. They obtained the fractional differencing parameter as $d = 0.708$.

## 3. Methodology

### 3.1. Detection of the long-memory

A covariance stochastic process $X = (X_t, t = 0,1,2,\dots)$ with mean $\mu$ and variance $\sigma^2$, and autocorrelation function $\rho(k), k \geq 0$ is said to have Long-memory if we assume that $X$ has an autocorrelation function of the form;

$$\boldsymbol{\rho(k) \sim k^{-\beta} L(k), k \to \infty} \quad (1)$$

where $0 < \beta < 1$ and $L$ is slowly varying at infinity. Reversely $X$ has short-memory, if its autocorrelation function has geometric decay rate;

$$\boldsymbol{K > 0, c \in ]0,1[, \mid \rho(k) \mid \leq K c^k} \quad (2)$$

The general behavior of the autocorrelation function cannot solely determine the long-range dependence. Instead, it only specifies the asymptotic behavior when $k \to \infty$. Therefore, we need more robust statistical tests to detect the long-memory in a time series. For this purpose, we resort to the GPH method developed by Geweke-Porter-Hudak.

The spectral density of the fractionally integrated process $X_t$ is expressed as;

$$\boldsymbol{f(\omega) = \left[4sin^2\left(\frac{\omega}{2}\right)\right]^{-d} f_u(\omega)} \quad (3)$$

where $\omega$ is the Fourier frequency, and $f_u(\omega)$ is the spectral density corresponding to $u_t$. The difference parameter $d$ can be estimated by;

$$\ln f(\omega_j) = \beta - d\ln\left[4sin^2\left(\frac{\omega_j}{2}\right)\right] + e_j \text{ for } j = 1,2,\ldots,n_f(T) \quad (4)$$

Geweke and Porter-Hudak showed that using a periodogram estimate of $f(\omega_j)$, the least squares estimate $\hat{d}$ using the regression in Eq.4 is normally distributed in large samples if $n_f(T) = T^{\alpha}$ with $0 < \alpha < 1$ $\hat{d} \sim N\left(d, \frac{\pi^2}{6\sum_{j=1}^{n_f}(U_j-\overline{U})^2}\right)$ where $U_j = \left[4sin^2\left(\frac{\omega}{2}\right)\right]$ and $\overline{U}$ is the sample mean of $U_j$. Under the null hypothesis of no long memory ($d = 0$), the t-statistic is $t_{d=0} = \hat{d}.\left(d, \frac{\pi^2}{6\sum_{j=1}^{n_f}(U_j-\overline{U})^2}\right)^{-0.5}$

### 3.2. Detection of the self-similarity and scaling behaviors

For examining the scale invariance of the distribution of interest rate returns, we follow the methodology proposed by Evertsz (1995a) which is given as:

Let $P_t$ denotes the logarithm of the interest rate series, then the logarithmic changes (returns) of the interest rates are given by

$$X_t = P_{t+i} - P_t \quad (5)$$

By modifying Eq.5 in order to reflect the scale invariance of the rates of return, we will analyze whether the distribution of the absolute returns is scale invariant. The Eq.6 reflects a more relevant financial sense.

$$\frac{P_{t+\Delta t} - P_{\Delta t}}{\Delta t} \sim \left(\frac{\Delta t}{\Delta t(\Delta t)^{'}}\right)^{\frac{1}{\alpha}-1} \frac{P(t + (\Delta t)^{'}) - P_t}{(\Delta t)^{'}} \quad (6)$$

Let $F_{\Delta t}(x)dx$ denotes the probability density of interest rate returns in Eq.6 over time periods of size $\Delta t$, that is $F(X, \Delta t)$ is the probability density of the left hand side of the equation. Eq.6 hints for the densities, such as

$$\left(\frac{1}{\alpha} - 1\right)\log(\Delta t) + \log F(X, \Delta t) = \log Q\left((\Delta t)^{1-\frac{1}{\alpha}}X\right) \quad (7)$$

As Evertsz (1995a) suggests that, in the case of self-similarity, densities of $F(X, \Delta t)$ collapse onto the -basic distribution- $Q$ by plotting, $\left(\frac{1}{\alpha}\right)\log(\Delta t) + \log F(X, \Delta t)$ vs. $(\Delta t)^{1-\frac{1}{\alpha}}X_t$

Therefore, -fractal dimension of the probability space- $\alpha$ and -basic distribution- $Q$ fully specify the distribution of interest rate returns on all time intervals $\Delta t$.

As Mandelbrot (2010) points out there is a number of different methods to determine $\alpha$. However, these methods generally examine the tails of the distributions, which becomes difficult for larger values of $\Delta t$ where number of observations decrease making the results unreliable. Thus, we employ the methodology proposed by Mantegna and Stanley (1995) to calculate the $\alpha$. This method is straightforward but it requires an intensive amount of data manipulation. Let us define the logarithm of interest rates $P_t$ and logarithmic changes $X_{\Delta t}$ over a set of non-overlapping time windows divided by a time interval $\Delta t$ as:

$$X_{\Delta t} \equiv P_{t+\Delta t} - P_t \tag{8}$$

When we determine the probability distributions of logarithmic changes $F(X, \Delta t)$ on all time scales with traditional methods, investigating the tail behavior of the distribution yields distorted results due to reduced number of observations at larger time scales $\Delta t$. In order to address this issue, Mantegna and Stanley (1995) introduced an alternative approach by examining the scaling behavior of the -probability of return to origin- $F(X_{\Delta t} = 0)$, as a function of $\Delta t$. By plotting $F(X_{\Delta t} = 0)$ against $\Delta t$ in a log-log scale, and fitting a least-square regression, the slope coefficient ($\lambda$) determines normal or non-normal scaling behavior as the slope of a normal scaling property is equal to $\lambda = -0.5$. The Hurst exponent $H$ can also be determined from the log-log plot of $F(X_{\Delta t} = 0)$ against $\Delta t$ through following relation, $H = -\alpha$.

Since, Hurst exponent is equal to $H = 1/\alpha$, we can calculate $\alpha$ as $\alpha = \frac{1}{-\lambda}$. If the slope coefficient is $\lambda = -0.5$, the -fractal dimension of the probability space- $\alpha = 2$, the distribution is Gaussian with finite variance. In contrary, if $\lambda \in (-0.5, -1)$, $\alpha > 2$, the variance of the distribution becomes infinite, and distribution is more leptokurtic.

## 4. Empirical results

### 4.1. Initial data analysis

The data set we employ for this chapter consists of the daily rates of Turkish Republic Central Bank's and US Federal Reserve Bank's 10-year maturity treasury bonds for the period between 28/01/2010 and 28/04/2017. The data were retrieved from http://tr.investing.com. For statistical tests, we use the logarithmic changes of the interest rate series which is calculated as in Eq.5. Descriptive statistics of the logarithmic changes in the interest rate series are reported in Table 1. The series under examination are stationary as Augmented Dickey-Fuller (ADF) test results suggest the rejecting the null hypothesis of a unit-root at 1% significance levels. The skewness and kurtosis statistics for the series indicate a slightly asymmetric and heavy-tailed distribution rather than the normal distribution. Jarque-Bera test statistics also confirm the deviation from normal law by rejecting the null hypothesis which states normality assumption. Ljung-Box statistics up to 35 lags indicate a presence of serial correlation for the returns series at 5% significance level.

**Table 1.** *Descriptive statistics of the interest rate returns*

| | Mean | St. Dev | Skewness | Ex. Kurtosis | ADF[12] | Jarque-Bera | Ljung-Box[35} |
|---|---|---|---|---|---|---|---|
| Turkey | -0.005% | 1.297% | 0.622 | 6.982 | -10.737 | 3976.680* | 38.250** |
| USA | -0.026% | 2.301% | 0.116 | 1.034 | -12.336 | 85.598* | 44.096** |

## 4.2. Long-memory

In order to check the degree of long-memory persistency, we applied GPH method for the estimation of the long-memory parameter $d$. Before we move into empirical estimates, we run a simulation study to check the robustness of the method; since the results of the GPH method are sensitive to the bandwidth parameter which measures the number of periodogram points. We simulated 100 sample paths with 10000 observation points, with different $d$ values ranging from $0.1$ to $0.4$. Then, we run GPH estimation process on every simulated paths with using different bandwidth parameters $\alpha = 0.5$, $\alpha = 0.6$, and $\alpha = 0.7$.

We present the mean, standard deviation and bias of the $d$ parameters of the simulated series. The results of the simulation study are depicted in Table 2. According to our simulation study, average values for the long-memory parameter $d$ of the simulated series are similar to the nominal values as indicated with the statistically insignificant bias values. Therefore, GPH method is a reliable statistical tool in measuring the long-range dependence.

Table 3 reports the estimated long-memory parameters for the empirical series. The estimation procedure is carried out with using bandwidth values 0.5, 0.6 and 0.7. The long-memory property of the absolute returns of the Turkish interest rates is proven by the GPH test statistic with a statistically significant $d$ parameter. GPH test results also predicate the existence of long-memory in the squared return series of the Turkish interest rates at 1% significance level. The return series of the Turkish bond yields, however, do not show any long-term dependence indicated with statistically insignificant values for the d parameter. The estimation results for the US data have similar implications with the Turkish data. While the interest rate returns show random walk behaviors, the $d$ estimates for the absolute and squared returns are representatives of the strong long-range dependence.

**Table 2.** *Estimation results for d parameter using 100 independent paths of simulated time series*

| | | | Nominal d | | |
|---|---|---|---|---|---|
| | | d=0.1 | d=0.2 | d=0.3 | d=0.4 |
| $\boldsymbol{\alpha = 0.5}$ | Mean | 0.1047 | 0.2089 | 0.2998 | 0.4119 |
| | Bias | 0.0047 | 0.0089 | -0.0002 | 0.0119 |
| | p-value | [0.498] | [0.169] | [0.974] | [0.029]** |
| $\boldsymbol{\alpha = 0.6}$ | Mean | -0.0971 | 0.2036 | 0.3012 | 0.4053 |
| | Bias | 0.0029 | 0.0036 | 0.0012 | 0.0053 |
| | p-value | [0.502] | [0.356] | [0.735] | [0.391] |
| $\boldsymbol{\alpha = 0.7}$ | Mean | 0.1004 | 0.2025 | 0.3013 | 0.405 |
| | Bias | 0.0004 | 0.0025 | 0.0013 | 0.005 |
| | p-value | [0.874] | [0.296] | [0.340] | [0.272] |

**Notes:** ** denotes the rejection of null hypothesis (H0: Bias=0) at 5% significance level.

**Table 3.** *Estimated values for the long-memory parameter d at return, absolute return and squared return levels*

| | $\alpha = 0.5$ | $\alpha = 0.6$ | $\alpha = 0.7$ |
|---|---|---|---|
| Panel A: Turkey | | | |
| $Xt$ | -0.052 | 0.077 | -0.018 |
| | (0.116) | (0.074) | (0.047) |
| $\|Xt\|$ | 0.418* | 0.324* | 0.273* |
| | (0.103) | (0.059) | (0.044) |
| $Xt^2$ | 0.364* | 0.474* | 0.365* |
| | (0.059) | (0.053) | (0.045) |
| Panel B: USA | | | |
| $Xt$ | 0.081 | 0.034 | -0.061 |
| | (0.115) | (0.081) | (0.048) |
| $\|Xt\|$ | 0.442* | 0.325* | 0.257* |
| | (0.095) | (0.063) | (0.046) |
| $Xt^2$ | 0.393* | 0.331* | 0.249* |
| | (0.090) | (0.067) | (0.046) |

**Notes:** Corresponding standard errors for the parameter estimates are given in brackets. * denotes the rejection of null hypothesis (H0: d = 0) at 1% level.

### 4.3. Self-similarity and scaling

We used "probability of zero return" approach (Mantegna and Stanley, 1995) by defining $F(X_{\Delta t} = 0)$ as a function of time intervals $\Delta t$. Figure 1 illustrates the plots of $F(X_{\Delta t} = 0)$ versus $\Delta t$ in a log-log scale. It is evident from the figure that datasets are well fitted by a linear line with slopes $\lambda_{TR} = -0.442$ and $\lambda_{US} = -0.507$ for Turkish and US data respectively. Thus, the scaling power law is observed for $\Delta t$ for 1-day to 1-month in Turkish and US interest rates. If we make an assumption about the Lèvy-stable distribution(1) of the interest rate returns with scaling index $\alpha$ and scaling parameter $\gamma$, we can derive the "'probability of zero return'" from the density function of Lèvy-stable process as:

$$F(X_{\Delta t} = 0) = \frac{\Gamma(1/\alpha)}{\pi\alpha(\gamma\Delta t)^{1/\alpha}} \tag{9}$$

where $\Gamma$ is the gamma function. We obtain the scaling index values for Turkish and US data as $\alpha_{TR} = 1.58$ and $\alpha_{US} = 1.77$ by using the slope values $\lambda_{TR}$ and $\lambda_{US}$ . The estimated values of $\alpha_{TR}$ and $\alpha_{US}$ indicate that the processes deviate from a Gaussian random walk. The fractal dimension parameters $\alpha < 2$ suggest that interest rate returns have a leptokurtic distribution.

**Figure 1.** *"Probability of return to origin" $F(X_{\Delta t} = 0)$ vs time increments. $\Delta t$ in a logarithmic plane*

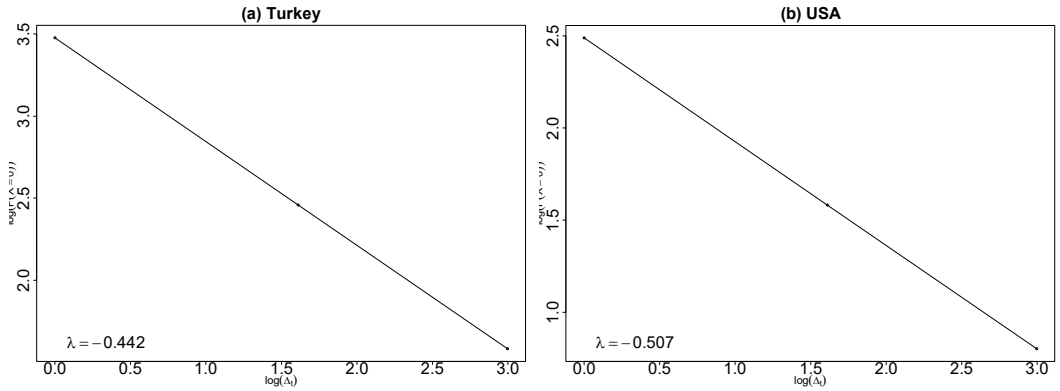
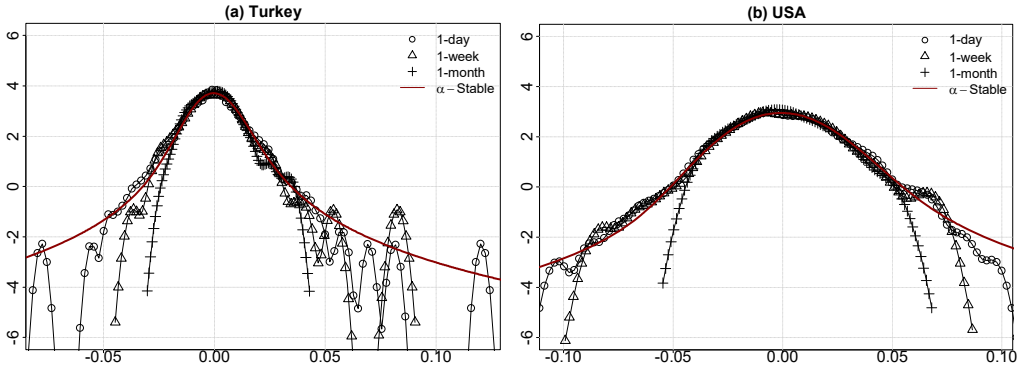



Figure 2 reflects the $\alpha$-scaled densities of the bond yield returns at different time intervals ($\Delta t$ = 1, 5, 20) (ranging from 1 day to 1 month) in a logarithmic plane. While all data collapse on the $\Delta t = 1$ day distribution for the Turkish returns, there are some deviations from the basic distribution for the US returns at larger time scales. One can infer from the figure that Turkish and the USA long-term government bond yields show self-similarity characteristics and bond yield returns at different time intervals (daily, weekly and monthly) are best represented with a Lèvy stable distribution.

**Figure 2.** *Log-density functions of interest rate returns at daily, weekly and monthly scales fitted with Levy-stable distribution*




## 5. Conclusion

The findings of this have significant economic implications. The long-memory in the first conditional moment of the interest rates helps researchers and practitioners to have more accurate forecasts on the term-structure. Furthermore, the strong persistent behavior found in interest rate volatility could be crucial for risk management and pricing of interest rate derivatives. For a future development, it would be worthwhile to consider long-memory in mean and volatility of interest rates in deriving pricing formulas for the interest rate derivatives. Focusing on the microstructure of the bond markets with taking into account liquidity and term premia can also be an important route for further research.

Another important finding of this study is that, returns of the Turkish and the USA bond markets are scale invariant meaning that distributional characteristics of the interest rate returns do not change at different time scales. The distributional scaling analysis results also suggest that interest rate returns are characterized by a Lèvy stable distribution on all scales. These findings have implications for the assessment of the risks of big losses or gains as a function of time, and thus for the derivative pricing.

In order to provide a new framework to improve new and better economic and financial models, the natural follow up of this study would be the investigation of multifractal characteristics of the interest rates which would take the analysis of dynamic scaling behavior one step further.

## Note

(1) Lèvy-stable distribution which is represented by

$$F_\alpha(X,\Delta t) \equiv \frac{1}{\pi}\int_0^\infty \exp\{-\gamma \Delta t u^\alpha\}\cos(uX)du$$

with $0 < \alpha \leq 2$ denoting the characteristic exponent or -fractal dimension of the probability space- $X$ is the log-returns, $\gamma$ is the scale factor, and $\Delta t$ denotes the time lag. By using the following transformation, Lèvy-stable distribution can be rescaled as

$$F_S \equiv \frac{X_{\Delta t}}{(\Delta t)^{1/\alpha}} \text{ and } F_\alpha(X_S,1) \equiv \frac{F_\alpha(X,\Delta t)}{(\Delta t)^{-1/\alpha}}$$

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# Hard currency inflows and sterilization policy in Algeria: An ARDL approach

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**Abstract.** *This paper aims to explore to what degree the Algerian Bank sterilized hard currency inflows using monthly data covering the period January 2002-December 2016, by estimating a sterilization coefficient in both long and short run terms using and ARDL approach, and also by applying a TYDL Granger causality to investigate the relationship among concerned variables. Our results showed that there are four co-integration vectors among the variables, and the evidence suggested that the sterilization coefficient is equal to -0.99, i.e. near to the minus one (-1) which indicates the full sterilization (Algerian Bank roughly sterilizes 99% of the frequent hard currency inflows in both short-run and long-run terms). Indeed, the results also indicated that there are three unidirectional causalities running from Algerian bank's net domestic and foreign assets to the money multiplier and from the latter to the interest rate.*

**Keywords:** hard currency inflows, sterilization policy, sterilization coefficient, ARDL.

**JEL Classification:** C22, E52, E5.

## 1. Introduction

Unquestionably, capital inflows have both benefits and costs. As benefits, they trigger investment and economic growth in the host countries, allow inter-temporal smoothing in consumption, and thus improve welfare across countries. At the same time, as costs, they may lead to a rapid monetary expansion, an excessive rise in domestic demand, inflationary pressures, and a real exchange rate appreciation.

Among the main economic events which have been experienced in the emerging economies during and after 1990s is the notable increase in capital inflows compared to the previous years, this phenomenon eventually led to substantial increase in the central bank's foreign assets. However, the same result has seen in the oil exporting countries since the beginning of 21st century. It should be noted that the former increase resulted from the globalization of capital flows, but the latter came as an aftermath of the oil prices scaling up. Actually, both cases have made it difficult to keep monetary indicators in check.

The aforementioned negative effects have induced policy makers to adopt a variety of measures to reduce the economy's vulnerability, namely exchange rate intervention, fiscal policy, capital controls, and monetary sterilization policy. The latter has been and continues to be the most popular as Lee (1996); Calvo et al. (1993) have confirmed given the experiences of some developing countries in the 1990s, which proved the viability of sterilization as a key element of the central bank's monetary policy in circumstances of intensified inflow of foreign capital. The same result was found in Cardarelli et al.(2010)study since they have characterized policies over an entire episode, they were unable to capture the initial bout of aggressive sterilization, but they confirmed that it was usually the first line of defense against surges of capital inflows.

There is some consensus in the literature regarding the sterilization definition, which is broadly described as the monetary operation through which a rise in net foreign assets is offset by a decrease in net domestic assets, thereby keeping the monetary base constant (Cardarelli et al., 2010; Takagi, 2001). As for the explicit trend toward policy adopting is due to its ability to achieve both exchange rate stability and domestic monetary objectives, therefore solving the conflict between internal and external equilibrium (Obstfeld, 1983), even though Stanley Fischer has classified it as a "half-instrument" if it coincides with the intervention in the foreign exchange market, because the authorities can purchase reserves without limit and sterilize the resulting liquidity, whereas they cannot automatically sell reserves without limit (Obstfeld 2014). In other words, it works for capital inflows, but under tight restrictions for outflows. Actually, this does not contradict with what is stated in Aizenman (2009) study when he has concluded that "the hoarding international reserves and sterilizing the potential inflationary impact have complemented each other during recent years".

Unlike most previous studies that examined the sterilization function in response to capital flow (FDI or speculative flows), this paper looks for estimate and evaluate the

same function, but in response to different type of inflow, what is so-called "hard currency inflows" taking Algerian case as one of the oil exporting countries and using ARDL approach, in addition to investigating the TYDL causational relationship over the period January 2002-December 2016.

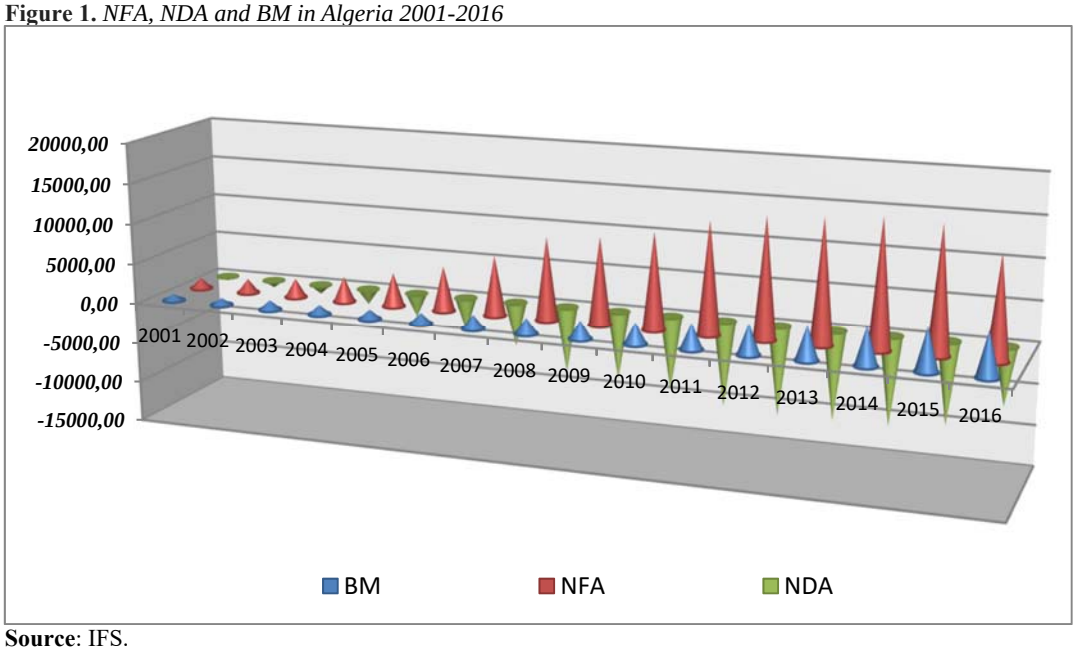
## 2. Hard currency inflows and sterilization policy of Algerian bank

Since the early 2000s, Algerian economy has received unprecedented oil revenues inflows resulted from oil price boom. Despite their importance as a key trigger for needed development, but they have led to very complicated problems on the money market namely, inflationary pressures was rapidly building up, an undesirable increase of monetary aggregates, and the Algerian bank (AB) has lost its role as a last resort (refinancing operations) since 2001.

However, the above-mentioned problems mainly resulted after a frequent "hard currency monetization", this process occurs when the oil exporter companies (Sonatrach and its foreign partners) waive all returns (dollar denominated) to the AB in exchange for an equivalent amount denominated in local currency. Thus, a structural excess liquidity has emerged as a new phenomenon in need of mopping up.

As a reaction aimed to neutralize the money base and its consequences if the monetary multiplier is taken into account, the AB has been adapting the sterilization policy, through which it has started to decrease its net domestic assets so as to offset the enormous increase in its net foreign assets(1), as shown in the following Figure 1.

**Figure 1.** *NFA, NDA and BM in Algeria 2001-2016*




**Source**: IFS.

The behavior of net foreign and net domestic assets tends to be fully inversely symmetrical as shown in the above Figure 1, this aspect expresses the effective practice of sterilization monetary, which eventually aims to achieve its major goal, i.e. neutralizing the money base. Therefore, the net domestic assets have been reduced by more than 08 times during the period 2002-2014 in order to offset the enormous increase in net foreign assets (increased about 11 times). As a result, the monetary base grew only 04 times for the same period, after that, both assets took an opposite trend when oil prices started to fall down.

It is also important to keep in mind that 2009 was the only breakpoint of the persistent decrease (increase) in $^{BM}/_{NFA}$($^{BM}/_{NDA}$), where it recorded in the same year 23.4% (-30.5%) after reaching 48.9% (-96%) in 2001, then it took a completely inverse trend registering 43% (-75.6%) at the end of period. In other words, the AB has kept the money base growing at moderate rate although the tremendous increase in foreign assets depending on substitution feature between monetary counterparts as a core sense of sterilization policy.

## 3. Literature review

Argy and Kouri (1974), Herring and Marston (1977) and Obstfeld (1983)are the pioneers who put what is called so far “the monetary reaction function”, in which the sterilization coefficient was embedded to explain the response of the central bank’s net domestic assets (NDA) as a monetary policy instrument according to the already change in its net foreign assets (NFA).

The standard form of the monetary reaction function is as follows:

$$\Delta NDA_t = \propto_0 + \beta \Delta NFA_t + \delta Z + u_t$$

where β and δ are respectively the sterilization coefficient and a set of explanatory variables which represent the objectives of the central bank.

Although variations in the choice of explanatory variables over time, recent studies have continued to employ the aforementioned equation depending on various econometric methodologies (e.g. OLS, VAR, 2SLS...).

Using four-variable vector auto-regression model over the period 1981M1–1994M12, Moreno (1996) investigates the response degree of monetary authorities in Korea and Taiwan. The main conclusion of this study is that in both countries, the sterilization is an important element of the response to shocks to foreign assets. The latter were largely offset by shocks to domestic credit, and were generally associated with a little net change in reserve money, particularly in the case of Taiwan. In addition, Korea has had a tendency to sterilize shocks to foreign assets more fully than has Taiwan, achieving a smaller change in an exchange rate with a far smaller change in the money supply.

Focusing on the decade preceding the outbreak of the currency crisis in July 1997 (using quarterly data from 1987 q1 to 1997 q2), Takagi (2001) estimates the degree of sterilization whilst setting aside the question of how sterilization has actually been carried out, since the countries in the sample (Thailand, Indonesia, Korea, Malaysia and the Philippines) have used various sterilization methods. Therefore, he divides its paper into two main steps. The first examines the co-integration and Granger causality tests, whereas the second estimates a structural equation, which indicates the sterilization coefficient depending on ordinary least squares method (OLS). Overall, the causality tests and the regression analysis gave the somewhat perplexing results indicating that, while sterilization was apparently effective in fully limiting the growth of monetary aggregates arising from an increase in foreign assets, it was not causing the level of interest rates to rise.

Christensen (2004) analyzes the relationship between large-scale capital inflows and sterilization efforts in the Czech Republic during 1993–96 using a vector auto-regression (VAR) model, which consists of domestic and foreign interest rates, domestic credit and foreign reserves. The findings support the sterilization success in maintaining monetary independence, but later there was a vicious circle created by high-interest rates, which led to more capital inflows needed for additional sterilization. In the end, the policy proved unsustainable and too costly, and the authorities therefore widened the exchange rate band. Also, Christensen found the problem and he called it a "sterilization game" between the monetary authorities and the commercial banks, when the latter borrowed extensively abroad and invested in domestic bonds, and they were induced by both a credible fixed exchange rate system and high-yielding sterilization bonds.

Aizenman and Glick (2009) estimate the marginal propensity to sterilize foreign asset accumulation associated with net balance of payments inflows. For that matter, the authors select countries in Asia and Latin America and use OLS over sample periods that end 2007 q2, but have varying start points in the 1980s or 1990s. Their findings reveal the extent of sterilization of foreign reserve inflows has risen in recent years to varying degrees in Asia as well as in Latin America. As for some countries, the sterilization of foreign direct investment (FDI) inflows is typically less than for current account surpluses and non-FDI flows, suggesting that misgivings about monetary instability depend on the composition of balance of payments inflows.

Cardarelli et al. (2010) develop a sterilization index for 52 countries (8 advanced and 44 developing countries) over the period 1991-2007. Pooled regressions of central banks' $\Delta NDA$ on $\Delta NFA$ are carried out for each year using monthly observations and without including other explanatory variables. Taking another step further, the authors use $\Delta M2$ instead of $\Delta NDA$ to estimate a broader sterilization index that reflects the central bank's effort to prevent the increase in monetary base from causing an expansion of money supply. This has generally occurred through an increase in the reserve requirements for the banking sector, which eventually reduces the money multiplier. Their results indicate that with the onset of the two waves of large capital inflows (during the early 1990s and

early 2000s) there are high values of the sterilization index, i.e. an aggressive sterilization effort when capital begins to pour in. The index subsequently tapers off around 2006, perhaps indicating that as intervention continued, the authorities became increasingly conscious of its cost.

Using monthly data from January 1994 to February 2011 and applying 2SLS regression models, Mansour (2012) explore the effectiveness of hoarding international reserves and sterilization in dollarized and indebted countries such as Turkey and Lebanon. Overall, she finds that both countries theatrically enjoyed from the application of the sterilization policy, but in return, are suffering from economic constraints such deficit in Balance of Payment, high external debt and important dollarization rate, which in theory should decrease the efficiency of the sterilization monetary policy. Also, additional inflows have occurred and need to be sterilized again, which creates a vicious circle of rising capital inflows and the need for additional sterilization has led to less effective policy.

Despite the differences among the estimation methods, there has been a consensus regarding the sterilization coefficient ($\beta$ as mentioned above). In principle, if the central bank is able to completely offset the increase in NFA by decreasing NDA, then $\beta$ should take the value of –1, while $\beta = 0$ implies no sterilization. A value of the sterilization coefficient between these levels, $-1 < \beta < 0$, indicates partial sterilization.

## 4. Data and methodology

### 4.1. The ARDL model

ARDL approach for co-integration relationship was developed by Pesaran and Shin (1995, 1998) and Pesaran, Shin and Smith (1996,2001) as an unification of Auto-Regressive models and Distributed Lag models, the main advantage of the ARDL model is the possibility to test the long-run relationship irrespective of the order of integration in both large and small samples while Engel-Granger (1987), Johansen (1988), Johansen-Juseluis (1990) and Gregory-Hansen (1996) methods require all variables be of equal degree of integration and also need large samples (>30), this model (ARDL) also removes problems of endogeneity, omitted variables and autocorrelation (Pesaran et al., 2001), the ARDL bounds test to co-integration can be applied whether the variables are I(0) or I(1) or a combination of the I(0) and I(1) series but no I(2) or higher degree of integration.

The ARDL model has several desirable statistical features:

1. The co-integrating relationship can be estimated normally using OLS after selecting the number of lags using Akaike or Schwarz criterion.
2. Testing simultaneously for the long run and short run relationships.
3. The ARDL approach procedure is valid irrespective for both of the variables are I(0) or I(1) but not the I(2) variables.
4. The ARDL model provides unbiased coefficients of explanatory along with t-statistic.
5. The ARDL model corrects the omitted lagged variables bias.
6. The ARDL model is very efficient with small sample sizes.

The purpose of this paper is to examine the degree of sterilization by deriving a domestic credit policy reaction function from two equations which summaries the monetary approach to the balance of payment:

$$M_t^d = AY_t^{\beta 1} Q_1^{\beta 2} \exp(\beta_3 i_t + \beta_4 i_t^* + \mu_t) \quad (1)$$

$$M_t^s = K(D+R)_t \quad (2)$$

When $M^d$ is the money demand as a function of real income (Y), real exchange rate (Q), domestic rate (i) and foreign interest rate ($i^*$), and A is the scale factor when $\beta_1$, $\beta_2$, $\beta_3$ and $\beta_4$ are the parameters of estimation.

$M^s$ is the money supply composed of money multiplier (K) of domestic (D) and foreign components (R) of monetary base, and we can obtain the following equation:

$$Ln\ D_t = lnM_t^d - ln\ K - lnR_t \quad (3)$$

And by using logarithms in equation (1) and substituting in equation (3) we get:

$$LnD_t = lnA + \beta_1 lnY_t + \beta_2 lnQ_1 + \beta_3 i_t + \beta_4 i^* + lnK + lnR_t + \mu_t \quad (4)$$

$$d_t = \beta_0 + \beta_1 y_1 + \beta_2 q_t + \beta_3 i_t + \beta_4 i_t^* + \beta_5 m_t + \beta_6 r_t + \mu_t \quad (5)$$

The coefficient $\beta_6$ in equation (5) is the sterilization coefficient, and it measures the thrust of monetary policy to sterilize the impact of international reserve flows on monetary base, this coefficient limited between zero (no sterilization) and -1 (full sterilization), and when is $-1 < \beta_6 < 0$ the sterilization is conducted incompletely by the Algerian bank.

Our ARDL framework is as follows:

$$\Delta (NDA)_t = \alpha 0 + \sum_{i=1}^{n} \alpha 1i\, \Delta (NDA)_{t-j} + \sum_{i=1}^{n} \alpha 2i\, \Delta (INT)_{t-j} + \sum_{i=1}^{n} \alpha 3i\, \Delta (MM)_{t-j} +$$
$$+ \sum_{i=1}^{n} \alpha 4i\, \Delta (NFA)_{t-j} + \sum_{i=1}^{n} \alpha 5i\, \Delta (REER)_{t-j} + \beta_1 NDA_{t-1} + \beta_2 INT_{t-1} + \beta_3 MM_{t-1} +$$
$$+ \beta_4 NFA_{t-1} + \beta_5 REER_{t-1} + e_t \quad (6)$$

When:
NDA: is central bank's net domestic asset.
NFA: is central bank's net foreign asset.
MM: is the money multiplier.
INT: is the interest rate.
REER: is the real effective exchange rate.

Depending on monthly data from January 2002 to December 2016 collected from IMF-IFS database, and taking Algeria as a case study, we try to investigate the AB's sterilization reaction function.

### 4.2. The TYDL Granger causality

The most common way to test the direction of causality is Granger (1969), Sims (1972) and Gwekes (1983), Granger causality is conventionally conducted by estimating VAR models, but this model suffers of the non stationary problem, and the problem here is how to confirm the co-integrating relationship and how to estimate the VAR model when the

system is integrated, the drawback of Granger causality (1969) test is the specification bias and spurious regression, in 1987 Engel and Granger declared that if X and Y two non-stationary and co-integrated variables the standard Granger causality is invalid procedure.

Toda and Yamamoto (1995) and Dolado and Lutkepohl (1996) developed a new procedure of Granger causality based on an augmented VAR modeling by introducing a modified Wald tests (MWald) statistic, and it can be applied with all the integration series types I(0), I(1) and I(2) for both non co-integrated or co-integrated variables, the TYDL (Toda, Yamamoto, Dolado and Lutkepohl) procedure composes from four steps, the first step is to find the maximum order of integration between the variables $d_{max}$ where is the higher order of integration, the second step is to determine the optimal lag order (K) of VAR model in levels as usually choosed by Akaike information criterion (AIC), Schawrz information criterion (SIC), Hannan-Quin information criterion (HQ), the final prediction error (FPE) and the sequential modified LR test statistic (LR), Finally, the TYDL procedure uses the MWald test statistic to test the causal relationships between the variables.

## 5. Empirical results

### 5.1. Unit root test

Before we proceed for ARDL testing, we must test for unit root of the variables to determine their order of integration (I(0), I(1) or I(2)), we must run the unit root tests to ensure that none of the series is integrated in I(2), in our study we have used Augmented Dickey-Fuller test (ADF), Philips-Perron test (PP) and the test developed by Ng-Perron (2001), the result are presented in Table 1, and this results indicate that 3 variables (NDA, NFA and INT) are stationary in the level when the two other variables (REER and MM) are integrated order one and none of the variables are I(2) series.

**Table 1.** *Unit test roots results*

| Variables | ADF | PP | Ng-P | |
|---|---|---|---|---|
| | | | (MZa) (k) | (MZt) (k) |
| NDA | -10.33*** | -10.34*** | -80.95*** | -6.35*** |
| NFA | -10.17*** | -10.15*** | -80.86*** | -6.35*** |
| MM | -2.58 | -3.90** | -7.78 | -1.87 |
| D(MM) | -22.26*** | -27.52*** | -68.40*** | -5.84*** |
| REER | -4.84*** | -4.60*** | -4.18 | -1.42 |
| D(REER) | / | / | -79.18*** | -6.28*** |
| INT | -5.45*** | -5.78*** | -27.25*** | -3.86*** |

**Note:** *** denotes significant at 10%,5% and 1% level. (k) denotes lag length (2) Selection of lag length in NP test is based on Spectral GLS-detrended AR based on SIC.

### 5.2. Co-integration results

The first step in the ARDL model is bounds test for co-integration by looking a long-run relationship between the variables by carrying out partial F-test, this test is sensitive to the number of lags used for each first differenced variable (Bahmani-Oskooee and

Brooks, 199), the results of the bounds test procedure for co-integration analysis between the NDA and its determinants are presented in the table below:

**Table 2.** *Bounds test results*

| K | 90% level | | 95% level | | 99% level | |
|---|---|---|---|---|---|---|
| 4 | I(0)<br>2.45 | I(1)<br>3.52 | I(0)<br>2.86 | I(1)<br>4.01 | I(0)<br>3.74 | I(1)<br>5.06 |
| Calculated F-statistic | | | | | 19.05*** | |

**Note:** ***denotes statistical significance at the 1%, 5% and 10%.K is the number of regressors.

From Table 2 above, the F-statistic of null hypothesis of lagged variables of the coefficients are zero is rejected at the three significance levels (1%, 5% and 10%), further, since the F-calculated (F = 19.05) exceeds the upper bound (I(1)) of the critical values band, the null hypothesis of no co-integration between NDA and its determinants is rejected in 5% significance level, this result indicates that there is a co-integration relationship among the variables in Algeria monetary policy, this implies that there exist a long-run relationship among net domestic assets, real effective exchange rate, interest rate, money multiplier and net foreign assets.

### 5.3. Long-run ARDL model of NDA in Algeria

Since the NDA and its determinants are co-integrated, we estimate the long-run parameters of the ARDL model based on the Akaike Information Criterion (AIC), the results presented in the table below:

**Table 3.** *Long-run ARDL estimation results*

| Selected Model: ARDL(1, 1, 0, 4, 0) | | | | |
|---|---|---|---|---|
| Variable | Coefficient | Std. Error | t-Statistic | Prob.* |
| NDA(-1) | 0.003963 | 0.006274 | 0.631704 | 0.5286 |
| MM | 2.352890 | 0.057356 | 41.02245 | 0.0000 |
| MM(-1) | -2.380774 | 0.059131 | -40.26253 | 0.0000 |
| NFA | -0.994357 | 0.006272 | -158.5283 | 0.0000 |
| REER | 0.007657 | 0.153639 | 0.049839 | 0.9603 |
| REER(-1) | 0.049162 | 0.223261 | 0.220200 | 0.8260 |
| REER(-2) | 0.012763 | 0.227738 | 0.056042 | 0.9554 |
| REER(-3) | -0.074716 | 0.231779 | -0.322361 | 0.7476 |
| REER(-4) | -0.036221 | 0.148096 | -0.244575 | 0.8071 |
| INT | 0.005667 | 0.006124 | 0.925462 | 0.3562 |
| C | 0.078051 | 0.164372 | 0.474841 | 0.6356 |
| R-squared | 0.995195 | Mean dependent var | | -0.06198 |
| Adjusted R-squared | 0.994871 | S.D. dependent var | | 0.207641 |
| S.E. of regression | 0.014871 | Akaike info criterion | | -5.51209 |
| Sum squared resid | 0.032731 | Schwarz criterion | | -5.29977 |
| Log likelihood | 449.2113 | Hannan-Quinn criterion | | -5.42587 |
| F-statistic | 3065.446 | Durbin-Watson stat | | 2.079876 |
| Prob(F-statistic) | 0.000000 | | | |

The above table presents the results obtained by regressing independent variables on NDA to get long-run sterilization coefficient for the period of the study, the results indicates that the degree to which the AB sterilizes the foreign exchange reserves is equal to -0.99 (significant at 1%), this implies that the AB sterilizes 99% of hard currency inflows during the period of study (near to the minus one i.e. full sterilization). The results also indicate that the MM coefficient is significance at 1% level.

### 5.4. Short-run ARDL model of NDA in Algeria

According to Granger (1987), if a co-integration relationship exists between the variables, then a dynamic error correction model also exists, and the general form of it can be written as:

$$\Delta \text{NDA}_t = \alpha 0 + \sum_{i=1}^{n} \alpha 1i \, \Delta \text{NDA}_{t-1} + \sum_{i=1}^{n} \alpha 2i \, \Delta \text{INT}_{t-1} + \sum_{i=1}^{n} \alpha 3i \, \Delta \text{MM}_{t-1} +$$

$$+ \sum_{i=1}^{n} \alpha 4i \, \Delta \text{NFA}_{t-1} + \sum_{i=1}^{n} \alpha 5i \, \Delta \text{REER}_{t-1} + \lambda \text{ECT}_{t-1} + \mu_t \quad (7)$$

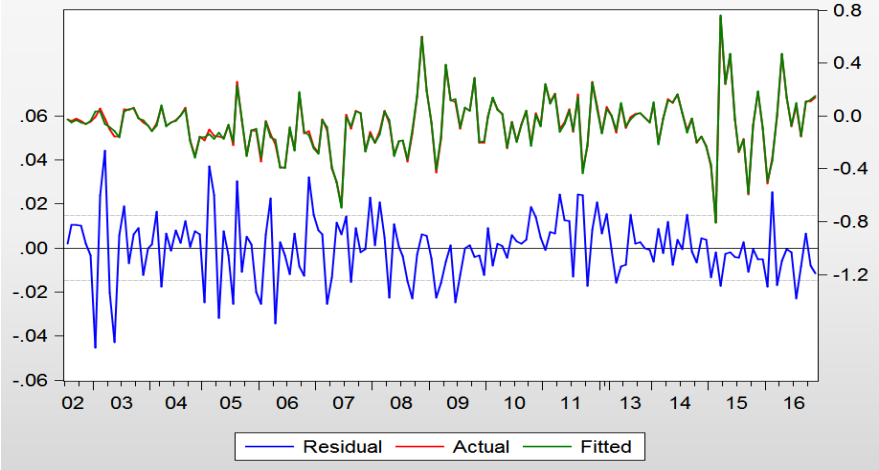
The table below shows the static behavior of the variable over the data period to introduce the short run estimation to the model and to estimate the short run adjustment coefficient (error correction term), the results from the estimated error coefficient model are presented in Table 4, except the MM coefficient is significantly different from zero at the 5% level of significance, the error correction term possessed expected sign and statistically significant, the error correction term is equal -0.996 which implies that about 99% adjustment towards long-run equilibrium take place in one month, the coefficient of NFA (sterilization coefficient) is statistically significant and equals to -0.994, which suggest that the AB sterilizes 99% of hard currency inflows in the short-run .

**Table 4.** *Short-run ARDL estimation results*

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D(INT) | 0.00566 | 0.006124 | 0.925462 | 0.3562 |
| D(MM) | 2.35289 | 0.057356 | 41.02245 | 0.0000 |
| D(NFA) | -0.99435 | 0.006272 | -158.5283 | 0.0000 |
| D(REER) | 0.00765 | 0.153639 | 0.049839 | 0.9603 |
| D(REER(-1)) | -0.01276 | 0.227738 | -0.056042 | 0.9554 |
| D(REER(-2)) | 0.07471 | 0.231779 | 0.322361 | 0.7476 |
| D(REER(-3)) | 0.03622 | 0.148096 | 0.244575 | 0.8071 |
| CointEq(-1) | -0.99603 | 0.006274 | -158.7668 | 0.0000 |
| Long Run Coefficients | | | | |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
| INT | 0.00569 | 0.006145 | 0.925997 | 0.3560 |
| MM | -0.02799 | 0.033804 | -0.828175 | 0.4089 |
| NFA | -0.99831 | 0.007835 | -127.4156 | 0.0000 |
| REER | -0.04151 | 0.079589 | -0.521673 | 0.6027 |
| C | 0.07836 | 0.165045 | 0.474787 | 0.6356 |

Moreover, when the estimated values are fitted against the actual values, it perform very well in terms of tracking the cyclical nature of the movements in Algeria, the results represented in the Figure 2.

**Figure 2.** *Plot of actual and fitted values*




## 5.5. TYDL Granger causality

The second step in testing for causality (after the determine of higher order of integration $d_{max}$ which equals to 1) is to investigate the optimum lag length (K) chosen by AIC, LR, FPE, SC and HQ, where we must be caution when we select the lag length, because if the chosen lag length is less than true lag, the omission of relevant lags can cause bias, and if it is more than true lag, cause the estimate to be inefficient (Caporal and Pittis, 1999), the Table 5 chows that the optimum lag length is 1 (k = 1) out of maximum of 10 lags length as selected by AIC, FPE, SC and HQ.

**Table 5.** *Lag length criterion*

| Lag | LR | FPE | AIC | SC | HQ |
|---|---|---|---|---|---|
| 1 | NA | 6.18e-15* | -18.5277* | -17.9790* | -18.3048* |
| 2 | 18.84413 | 7.76e-15 | -18.30183 | -17.20443 | -17.85591 |
| 3 | 44.04099 | 7.80e-15 | -18.29982 | -16.65371 | -17.63093 |
| 4 | 29.65216 | 8.81e-15 | -18.18527 | -15.99047 | -17.29343 |
| 5 | 17.30137 | 1.11e-14 | -17.96682 | -15.22331 | -16.85201 |
| 6 | 38.0736* | 1.13e-14 | -17.96210 | -14.66989 | -16.62433 |
| 7 | 23.25561 | 1.34e-14 | -17.82267 | -13.98176 | -16.26194 |
| 8 | 26.08830 | 1.52e-14 | -17.72768 | -13.33806 | -15.94398 |
| 9 | 20.50057 | 1.84e-14 | -17.58437 | -12.64606 | -15.57772 |
| 10 | 29.25516 | 1.99e-14 | -17.56387 | -12.07685 | -15.33425 |

* indicates lag order selected by the criterion.
LR: sequential modified LR test statistic (each test at 5% level).
FPE: Final prediction error.
AIC: Akaike information criterion.
SC: Schwarz information criterion.
HQ: Hannan-Quinn information criterion.

It's clear from Table 6 that there are just three causalities. The first from MM to INT. The second and the third are respectively from NDA to MM and NFA to MM, and there is no evidence of any causal relationship between the other variables in Algeria during the period of study (January 2002- December 2016).

**Table 6.** *TYDL Granger causality results*

| Dependent variable: INT | | | |
|---|---|---|---|
| Excluded | Chi-sq | df | Prob. |
| MM | 14.25064 | 1 | 0.0002 |
| NDA | 0.486708 | 1 | 0.4854 |
| NFA | 0.245439 | 1 | 0.6203 |
| REER | 2.168847 | 1 | 0.1408 |
| Dependent variable: MM | | | |
| INT | 0.002769 | 1 | 0.9580 |
| NDA | 43.86719 | 1 | 0.0000 |
| NFA | 47.49640 | 1 | 0.0000 |
| REER | 0.056682 | 1 | 0.8118 |
| Dependent variable: NDA | | | |
| INT | 0.370071 | 1 | 0.5430 |
| MM | 1.282599 | 1 | 0.2574 |
| NFA | 2.365417 | 1 | 0.1241 |
| REER | 1.109135 | 1 | 0.2923 |
| Dependent variable: NFA | | | |
| INT | 0.337987 | 1 | 0.5610 |
| MM | 2.568563 | 1 | 0.1090 |
| NDA | 0.371836 | 1 | 0.5420 |
| REER | 1.257297 | 1 | 0.2622 |
| Dependent variable: REER | | | |
| INT | 1.216469 | 1 | 0.2701 |
| MM | 1.784828 | 1 | 0.1816 |
| NDA | 0.150393 | 1 | 0.6982 |
| NFA | 0.000351 | 1 | 0.9850 |

## 6. Conclusion

This paper aimed to develop and estimate the reversed symmetry of AB's assets as a reaction function in order to analyze the monetary implications of the sterilization policy in Algeria using monthly data covering the period January 2002-December 2016, by employing an ARDL multivariate co-integration and TYDL Granger causality to estimate the degree of sterilization that the Algerian central bank has used in controlling hard currency flows.

As we showed in the paper, the degree to which a change in net foreign assets affects net domestic assets is estimate by the coefficient $\alpha_4$ in ARDL model (both short and long run). The evidence suggests that the Algerian central bank sterilizes roughly 99% (coefficient near to the minus one (-0.99) which indicates full sterilization) of hard currency inflows in both short-run and long-run terms during the period of the study. Therefore, the AB has been able to completely isolate the money base from frequent hard currency inflows.

## Note

(1) It important to keep in mind that during the period of study, the most dominant component of AB's net foreign assets is the official reserves ranging from 97 to 98%, the remainder is mainly shared by both SDRs and monetary gold.

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# Evaluating Indian economy's vulnerability to currency crisis

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**Abstract.** *This paper examines India's exposure to currency crisis for the period 1986 to 2015 using KLR (Kaminsky, Lizondo and Reinhart) methodology. Focus of the study is on evaluating currency crises and building an Early Warning System (EWS) to anticipate future crises. Using KLR methodology we explain the phenomenon of currency crises over three stages – identification of the crises periods, selection of the variables causing the crisis based on previous literature and economic structure, and estimating indicators' ability to forecast the crisis. The following are identified as crisis periods: 1991, 2008-2009 and 2012. Among these crises, 1991 crisis was attributed to fiscal mismanagement, global financial crisis caused the 2008 currency slump whereas 2012 crisis occurred due to domestic macroeconomic imbalances. A surprising finding is that there were no common indicators issuing signals in these three spells of crises.*

**Keywords:** currency crisis; three generations of currency crises models; signal extraction: early warning system; noise-to-signal ratio.

**JEL Classification:** F31, F47, G01.

## 1. Introduction

In the recent past, the world economy has seen many crises and gone through major transformations post World War II such as Bretton Woods collapse in 1971, shifting to flexible exchange rate system, globalization, stagflation in 1970s, Latin American currency crises in 1980s, European currency crisis in 1992, Asian currency crisis in 1997 and global financial crisis in 2007-2008 (Glick and Hutchison, 2013). Indian economy has also witnessed major changes in its macroeconomic structure during this period, especially after 1991 currency crisis, though it was relatively stable till 2007-2008 global financial crisis but the economy has seen financial and exchange rate instabilities afterwards. This study focuses on evaluating currency crisis and Early Warning System (EWS) in anticipating the future crises.

A general description of currency crisis, in the absence of a widely accepted definition, is as follows: currency crisis is a situation where there is a rapid depreciation of country's currency or a sudden depletion of foreign reserves or combination of both and/or a sharp increase in domestic interest rates as a result of *speculative attack*(1) on the currency or exodus of investments in fear of devaluation (Edison, 2003; Glick and Hutchison, 2013). There are three generations of models to analyze the phenomenon of currency crisis. In the context of first wave of Latin American Currency Crises, Krugman (1979) developed a theory, which later on came be to referred to as "first-generation model" (Stijn and Kose, 2013), and it was further refined by Flood and Garber (1984). The source of crisis is the mismatch between domestic macroeconomic policies and exchange rate policy. The principal reasons for speculative attack on the currency are fear of 'monetization of debt' through *seigniorage revenue*(2) and investors' anticipation of financial collapse.

The second generation models were developed by Obstfeld (1996) and Eichengreen et al. (1996) among others in the wake of UK's devaluation in Exchange Rate Mechanism (ERM) crisis in 1992. This was a classic example of *self-fulfilling prophecy*(3). The crisis would be aggravated by contagion and herd behavior if the economies are competitors in international markets (currency war) or if the countries share common macroeconomic policies (Asian Crises 1997) or inter-dependent on each other or share common culture (Tequila Crisis in Latin America). The third-generation models were brought out by Krugman (1998 and 1999), Corsetti et al. (1999), Chang and Velasco (1998) and Aghion et al. (2000 and 2001) in the event of East Asian Currency Crisis of 1997 upon the failure of first two generations of models in explaining it. This crisis was ascribed to *moral hazard*(4) problems, asset bubbles, loss of confidence, *international illiquidity*(5) and credit crunch as most important causes. Apart from the above mentioned reasons, unsound macroeconomic policies, self-fulfilling and contagion elements added fuel to the existing ailing economies.

We argue that the above mentioned three generations of models do not fully explain the 1991 currency crisis in India and also the currency slumps of 2008-2009 and 2012. Reasons for these above phenomena could be the time of their developments. The first generation models were developed to explain the first wave of Latin American currency crises, and second and third generations of models were developed much later in the wake of other crises. The 1991 currency crisis does not fit in the first generation of models as there was no monetization of debt (Cerra and Saxena, 2002) and 2008-2009 and 2012

currency slumps cannot be explained by any of the three generations of models since their features – monetization of debt, self-fulfilling expectations, moral hazard problems and contagion effects – were largely absent.

The reasons for 1991 currency crisis are as follows: the collapse of USSR (with whom India had Rupee Trade System) (Sachdeva, 2011), withdrawal of NRI deposits and reduction in NRI remittances, overvaluation of rupee, high current account deficit (CAD), political confidence (Cerra and Saxena, 2002), buying oil in panic at $30 a barrel, which was $10 above the market price due to Gulf war and decrease in domestic oil production due to supply side problems (Weinraub, 1991). However, India has shifted from fixed exchange rate system to managed floating exchange rate system in 1993 (Dua and Rajeev, 2010). But surprisingly, during *global financial crisis* (Reinhart and Rogoff, 2008; Richard, 2011) and again in 2012 due to domestic macroeconomic factors, India had to face currency slumps. The reasons for this slump in 2012 can be attributed to following factors: a series of allegations of corruption scandals, tapering news and recovery signs in USA (Aizenman et al., 2016, p. 319), high CAD, low output (IIP), rise in gold imports, and decline in exports.

It would be interesting to examine an economy with significant differences in economic structure – pre and post reforms (Ahluwalia, 2002) – but facing similar problems in a different fashion. The purpose of our study is to re-look into the 1991 currency crisis and study the economy's *vulnerability*(6) to currency crisis in the recent past. We would also look into the possibilities of forecasting the crisis if an EWS had been available. To best of our knowledge, this is the first India specific ex-post study to employ an EWS to forecast the currency crisis.

Rest of the paper is organized as follows: Section 2 provides review of literature, Section 3 discusses data and variables, Section 4 presents methodology, Section 5 describes the estimation of results and Section 6 concludes the study.

## 2. Empirical literature on currency crisis

Since the first wave of Latin American Currency Crisis in 1970s, there have been several studies on currency crisis – both multi and single country studies. Initial studies were mainly of theoretical models, and after the outbreak of ERM crisis in 1992, empirical research been happening on currency crisis to a great extent. Selected empirical works are discussed below.

In an ex-post study, Kaminsky et al. (KLR) (1998) developed an EWS to forecast the currency crisis using signal extraction method for the period 1970-95 from a sample of 20 countries, and upon the successful prediction of crisis, Kaminsky and Reinhart (1999) extended the same methodology to study the twin crises – currency and banking crises. The study found that there was no link between these two crises in 1970s but there was a close association between them post liberalization of the financial markets in 1980s. Berg and Pattillo (1999) and Edison (2003) replicated the study of KLR (1998) for the same period using the same data set with minor changes, and obtained results that were almost similar but not same.

In 28 countries for the period 1970-98, Edison (2003) examined the currency crisis and the same methodology as an EWS was successfully applied to Mexico. However, Berg and Pattillo (1999) employed Probit model using the same sample as KLR and found that Probit methodology performs slightly better than the signal extraction method. In an ex-post study, Bussiere and Fratzscher (2006) used multinomial logit model contrary to traditional binary logit models to overcome *post crisis bias* with a sample of 20 emerging economies for the period 1993-2001. While investigating the role of monetary policy in a sample of 32 emerging economies for the period 1960-2001, Erler et al. (2015) say that central bank should refrain from intervention, whereas Nakatani (2016) in the analysis of role of monetary policy in twin crises states that policy interest rates should be reduced and interest rate on reserves should be increased contrary to conventional policy measures.

Following the currency crisis of 2002 in Argentina, Alvarez-Plata and Schrooten (2004) studied it using KLR method for the period Jan. 1992 – Dec. 2001 and found that this approach has not issued signals prior enough to take any policy action to prevent the crisis and the issued warnings were too late, and in addition to this, it issued more wrong signals. To examine the self-fulfilling nature of Argentina's currency crisis, Boinet et al. (2005) used Markov Switching Model for the period 1992Q1 – 2001Q4, and reasoned that economic agents' expectations about the devaluation and economy's unsuitability precipitated the currency crisis in already ailing economy and led to devaluation of currency and collapse of fixed exchange rate system.

Peng and Bajona (2008) successfully conducted an ex-post study using the same methodology in case of China for the period 1991-2004. Since the China's macroeconomic fundamentals were weak enough to experience a currency crisis, it was recommended that there should be modern banking system with supervision and reforms were needed in state-owned enterprises as they've accumulated huge non-performing loans, and before further reforms in capital market and exchange rate system, the financial sector should be revamped. In recent times, Megersa and Cassimon (2015) successfully used KLR method in case of Ethiopian currency crisis for the period Jan. 1970 – Dec. 2008. The crises in Ethiopia were attributed to domestic economic and political factors in addition to border conflicts with its neighbouring nations. The 2008 currency crisis in Ethiopia was ascribed to global economic crisis.

In the analysis of history of currency crises in Turkey, Ali Ari (2012) used Logit model for the period 1990-2008. Crises in Turkey were attributed to various combinations of macroeconomic imbalances, banking sector weaknesses and external shocks. In another study, Ari and Cergibozan (2016) studied twin crisis in Turkey for the period 1990-2013. Their results showed that currency crisis was due to large budget deficits, excess money supply, overvaluation of lira, rise in short term external deficits, external shocks and banking sector weakness. The study found that banking crisis was due to excess money supply and bank short positions, and it was also found that banking crisis leads to currency crisis and vice versa. In a study of India's devastating currency crisis in 1991, Cerra and Saxena (2002) used Error Correction Model for the period 1979-1997. It was found that there was no monetization of debt before or during the crisis and it was also found that current account deficits played a significant role in this crisis and that the exogenous shocks led to loss of investor confidence.

## 3. Data and selection of variables

In this study, we use the monthly data spanning from January 1985 to December 2015 covering 372 months so as to make sure that this period covers important events both in economic and political spectra. We use monthly data instead of quarterly or annual data since it captures the sudden changes in the economy and nature of the crisis. The data we use starts from 1986 since we take 12 month change(s) in the variable(s) except for Real Exchange Rate (deviation from trend), Excess M1 balances (Excess M1 Balances is defined as real M1 balances less *estimated demand for money*(7)) and the variables which are already in percentage terms. Whenever the monthly data is not available for any variable, we interpolated using cubic spline method. The choice of the variables is based on the previous literature and the availability of data, which are assumed to represent the three generations of currency crisis models and beyond. The list of the variables is as follows:

**Financial sector**: M3 Multiplier, Bank Credit, Real Interest Rate, Stock Prices (proxy BSE Stock Index), Lending-Deposit Ratio, Excess M1 Balances, M3/Reserves and Deposits.

**External sector**: Exports, Terms of Trade, Real Exchange Rate, Imports, Reserves, Current Account Deficit, Gold Prices and Crude Oil Prices.

**Real sector**: Output (Index of Industrial Production (IIP) is taken as a proxy).

**Fiscal sector**: Fiscal Deficit (as percentage of GDP).

A detailed list of variables can be found in the Appendix I.

## 4. Methodology

The purpose of this study is thus to explore India's exposure to currency crisis, and to identify the indicators. In our ex-post study, we use Indicators Approach to assess the currency crisis and use EWS (which all variables are able to issue signals) to see the possibilities of forecasting it, which could be helpful in (policy) decision making in order to mitigate the severity of or prevent the currency crisis. This is a three stage methodology and they are as follows: First, we estimate the crisis index and then identify the crisis months. Two, based on the previous literature and macroeconomic structure of the economy, we select the variables. Third, using Kaminsky, Lizondo and Reinhart (KLR 1998) (EWS) approach, we estimate each indicator's ability to forecast the crisis.

The first step is to construct crisis index, which is popularly known as *Exchange Market Pressure Index* (EMPI). There are two methods available to construct EMPI: KLR method and Eichengreen et al. method [$I = \frac{\%\Delta E}{\sigma \mathrm{E}} + \frac{\Delta i}{\sigma \mathrm{i}} - \frac{\%\Delta R}{\sigma \mathrm{R}}$]. However, we choose the former method as the later includes interest rates also, which is not determined in the market in India. In addition to it, excluding interest rate from Eichengreen et al. method gives the same results as KLR method.

### 4.1. Construction of *EMPI* (I) using KLR Method

$$I = \frac{\Delta E}{E} - \frac{\sigma E}{\sigma R}\frac{\Delta R}{R}$$

Crisis = 1 if $I > \mu_I + \mathrm{m}\sigma_I$

= 0 otherwise ( $I \leq \mu_I + \mathrm{m}\sigma_I$)

The index is measured as "the weighted average of percentage change in the bilateral nominal exchange rate and percentage change in foreign reserves, with weights such that the two components of the index have equal sample volatility" (Kaminsky et al., 1998 and 1999). In the *EMPI* equation, $\frac{\Delta E}{E}$, $\frac{\Delta R}{R}$ and $\frac{\sigma E}{\sigma R}$ are percentage changes in exchange rates and foreign reserves, and ratio of standard deviations of percentage changes in exchange rate and reserves respectively. The percentage change in the respective variables is of twelve months so as to ensure that units are stationary and free from seasonal effects.

In crisis determination, '1' has been assigned if the EMPI exceeds its mean (μ ) by '*m*' standard deviations (σ) of the index (I) i.e., threshold value, and '0' has been assigned if the index is less than or equal to the threshold value. Here, we choose '*m*' as 1.5 but KLR (1998 and 1999) have taken '*m*' as 3 while Eichengreen et al. (1996) have chosen 1.5 for '*m*' and Edison (2003) has selected 2.5 as the '*m*' value. However, there is no theory but arbitrary selection behind the selection of this value(s). The reason we've chosen the value so as to include any kind of financial pressure or currency stress.

### 4.2. Signals approach

In this approach, an indicator is said to have issued a signal within the window of 24 months prior to crisis (KLR have chosen this somewhat arbitrarily). Above mentioned signal is issued whenever the indicator crosses the threshold. Here, the threshold depends on the percentile of the distribution of the observations of the indicator. The percentile usually ranges between 0.10 and 0.30 (where a decrease in the variable causes crisis) depending on the value that minimizes the noise-to-signal ratio (which will be discussed soon) and opposite will be the case if the increase in the variable (indictor) is causing currency crisis. In that case percentiles for threshold levels or critical regions will be, for instance, ranging from 0.75 to 0.95. Edison (2003) defines the threshold (*t*) as the mean of the indicator plus 1.5 of its standard deviations with its equational form as follows: $t = \mu_i \pm 1.5\sigma_i$. The sign indicates the nature of the indicator i.e., depending on whether the increase or the decrease causes the crisis. As an alternative, we choose the method proposed by Edison (2003). (Kaminsky et al., 1998 and 1999; Edison, 2003).

### 4.3 Calculation of noise-to-signal ratio and probabilities

The following 2X2 matrix is useful to study the effectiveness of each variable separately:

**Table 1.** *Performance of each indicator*

| | Crisis (in the following 24 months) | No crisis (in the following 24 months) |
|---|---|---|
| Signal was issued | A | B (Type II Error) |
| Signal was not issued | C (Type I Error) | D |

**Source:** Kaminsky et al. (1998 and 1999).

In the above matrix, cell A indicates the number of months followed by a crisis within the crisis window of 24 months when a variable issues a signal (good signals), cell B designates the number of months when there is no crisis but variable issues a bad signal, cell C shows the number of months that the indicator failed to issue a signal when there is a crisis and cell D is the number of months in which the indicator refrained from issuing a (wrong) signal. The signals that cell C consist are of Type I Error as they will have severe repercussions on the economy, while cell B consists of Type II Error as their impact on economy and policy making is less severe.

Signals will be 100% perfect when the indicator issues only good ones and doesn't miss any when there is a crisis within the window of 24 months i.e., A > 0 and C = 0, and when the indicator refrain from issuing the signal when there is no crisis and doesn't issue any wrong signals (*noise*) i.e., D > 0 and B = 0. In these cases, the 'noise-to-signal ratio' is '0' and in contrast to these cases 'noise-to-signal ratio' will be infinity when A = 0 and C > 0, and D = 0 and B > 0. The percentage of good signals can be expressed as $\frac{A}{A+C}$ and it is also known as conditional probability of crisis, and the percentage of bad signals can be expressed as $\frac{B}{B+D}$. The noise-to-signal is the ratio of percentage of bad signals to parentage of good signals and it can be expressed as $\frac{\frac{B}{B+D}}{\frac{A}{A+C}}$. The unconditional probability of currency crisis is as follows: $\frac{A+C}{A+B+C+D}$. Probabilities of Type I Error and Type II Error are as follows: $\frac{C}{A+C}$ and $\frac{B}{B+D}$ (Kaminsky et al., 1998 and 1999; Edison, 2003 among others).

## 5. Results and discussion

This section deals with results obtained from the above methodology. Figure 1 shows the EMPI from January 1986 to December 2015. The horizontal line is the threshold value and whenever the EMPI exceeds the horizontal line, it is considered as currency crisis; however not all of them would turn out to be severe financial crises since the government might intervene and take policy measures to prevent the crisis from its severest form. The following months are identified as crisis episodes and they can be classified into three periods: I. May 1989, April – November 1991 and January 1992, II. November 2008 – April 2009 and III. June – July 2012. The first episode is consistent with devaluation of rupee on July 1 and July 3, 1991. However, the second and third episodes did not see the devaluation of rupee as it would have its own negative effects on the economy in the context of India's interdependence on global economy post-reforms.

**Figure 1.** *Exchange Market Pressure Index*

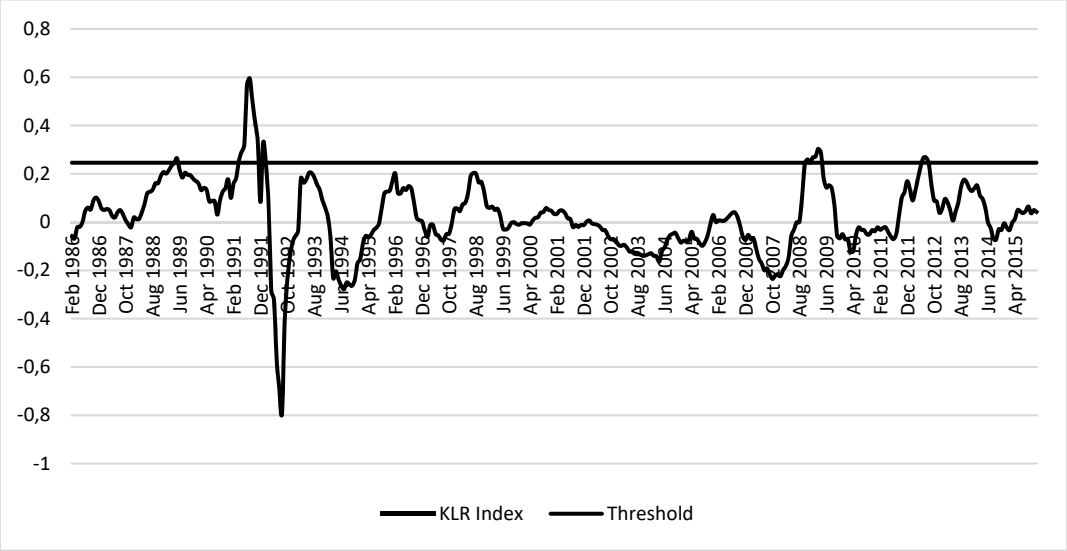



Figure 2 to Figure 19 display the movements of variables, which are assumed to have caused and precipitated currency crisis in India. These variables are expected to represent the three generations of crisis models and beyond. The variables used in this model are for the period January 1986 to December 2015 except for the variable Fiscal Deficit as it is available only from 1988. In these following figures, horizontal lines represent the threshold values of the respective variables. When the indicator exceeds the threshold line, it is considered as a warning, however these warnings include both good and bad signals. As an alternative, we employed Edison's method as an EWS to arrive at the results which do not indicate any warnings or are largely absent from issuing the warnings about the impending crisis.

Movements in variables:

**Figure 2.** *Bank Deposits*

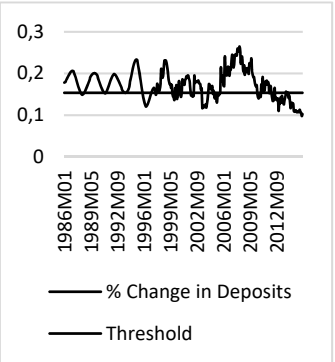



**Figure 3.** *Bank Credit*

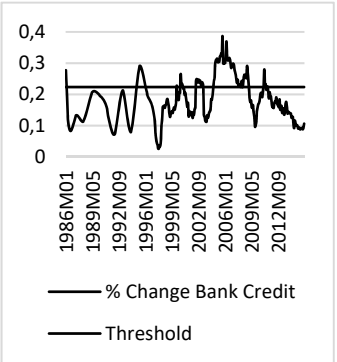



**Figure 4.** *Stock Index*

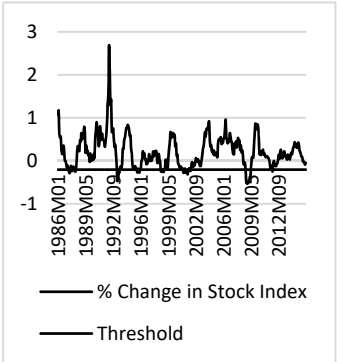


**Figure 5.** *Oil Prices*

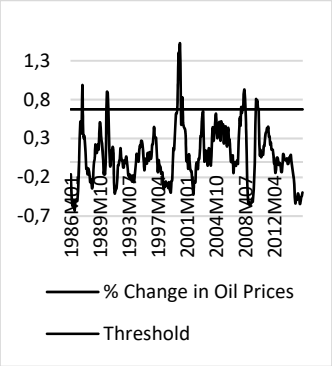



**Figure 6.** *CA as % of GDP*

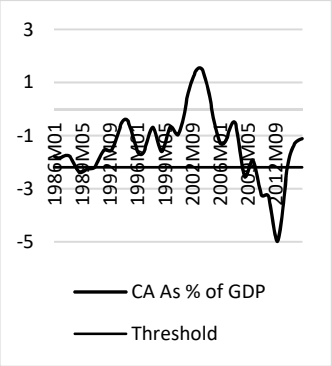



**Figure 7.** *Excess M1 Balances*

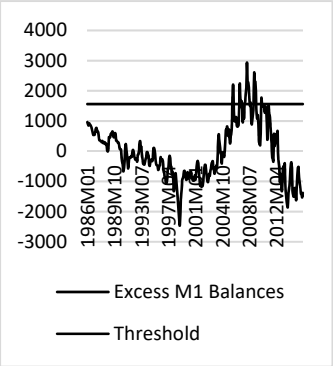



**Figure 8.** *Exports*

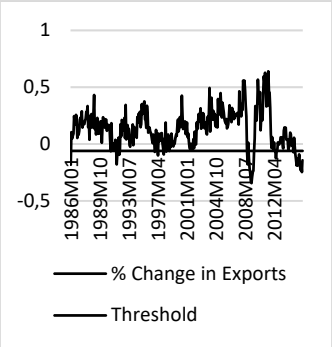



**Figure 9.** *FD as % of GDP*

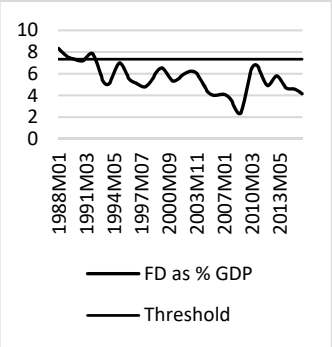



**Figure 10.** *Gold Prices*

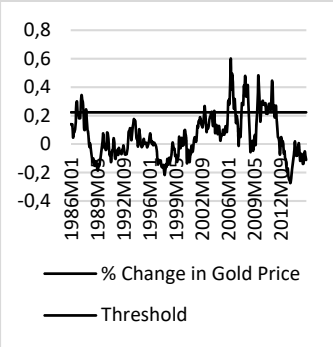



**Figure 11.** *Imports*

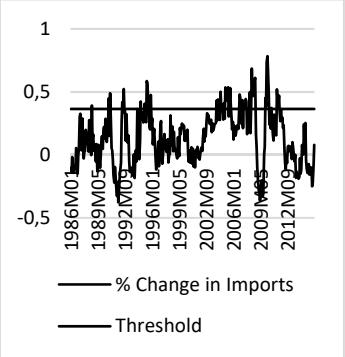



**Figure 12.** *Lending-Deposit Ratio*

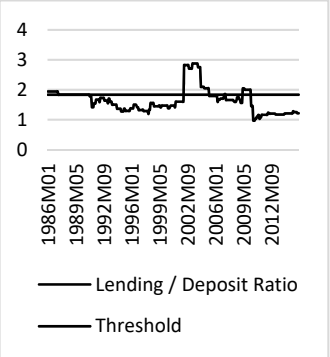



**Figure 13.** *M3 Multiplier*

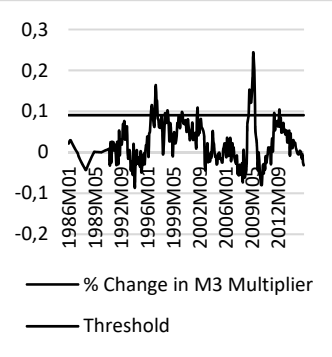


**Figure 14.** *M3/Reserves*

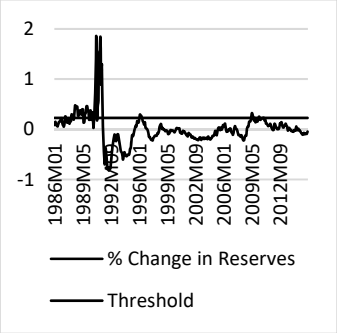



**Figure 15.** *Output*

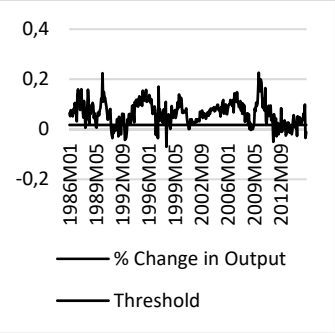



**Figure 16.** *Real Interest Rate*

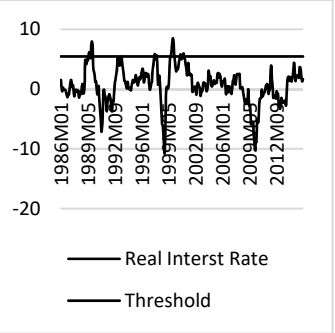



**Figure 17.** *Real Exchange rate*

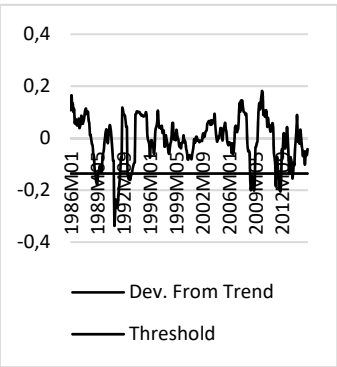



**Figure 18.** *Reserves*

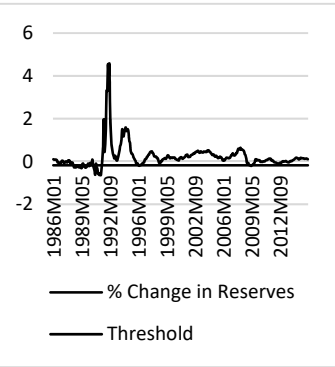
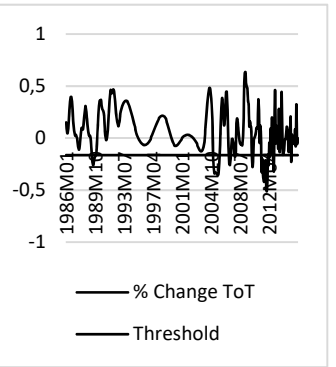



**Figure 19.** *Terms of Trade*




The following Table 2(A) illustrates threshold values for 18 indicators as well as location of critical region along with their noise-to-signal ratios. For a currency crisis, for instance, a large decline in reserves signals a crisis, so the "<" sign symbolizes that the rejection region is positioned at the bottom tail of the distribution whereas the ">" sign denotes that the critical region is located at the top tail of the distribution and based on the expected sign of the variable, grid search operation has been conducted. It can be said that lower the value of noise-to-signal ratio better the indicator. The noise-to-signal ratio can be used as a condition to decide which variables are more reliable in considering their warnings to act on to prevent or to take policy measures to mitigate the effects. When the value of noise-to-signal ratio for any variable is more than unity/one, it can be said that the indicator issues warnings at random times i.e., that indicator has no inherent predictive power. The best performed indicators based on the noise-to-signal ratios are as follows: lending-deposit ratio, excess M1 balances, terms of trade, real exchange rate, imports, reserves, current account balance, gold prices, crude oil prices, output, fiscal deficit, bank credit, real interest rate and stock index. Whereas the worst performing variables are: M3 multiplier, deposits and exports.

**Table 2(A).** *Threshold values and noise-to-signal ratios*

| Indicator | Threshold percentile | Noise to signal ratio |
|---|---|---|
| Financial sector | | |
| M3 Multiplier | >93 | 1.393 |
| Bank Credit | >75 | 0.926 |
| Real Interest Rate | >95 | 0.880 |
| Lending-Deposit Ratio | >81 | 0.612 |
| Excess M1 Balances | >94 | 0.138 |
| M3/Reserves | >86 | 0.097 |
| Deposits | <30 | 2.355 |
| Stock Prices (Stock Index) | <10 | 0.691 |
| External sector | | |
| Terms of Trade | <11 | 0.275 |
| Exports | <10 | 1.000 |
| Real Exchange Rate | <10 | 0.247 |
| Imports | >85 | 0.550 |
| Reserves | <10 | 0.026 |
| Current Account Balance | <23 | 0.179 |
| Gold Prices | >84 | 0.344 |
| Crude Oil Prices | >94 | 0.484 |
| Real sector | | |
| Output (IIP index) | <16 | 0.563 |
| Fiscal sector | | |
| Fiscal Deficit | >89 | 0.023 |

**Source:** Authors' calculations.

Another way to interpret the results is by comparing conditional and unconditional probabilities of the crisis (from Table 2(B)). This information is useful in checking the effectiveness of the individual variable in forecasting the crisis and if the indicator is effective then the conditional probability will be higher than unconditional probability of crisis. From these estimates, it can be said that when conditional probability is lower than unconditional probability, this is almost similar to that of noise-to-signal ratio being greater than one.

However, when we look at performance of each indicator, the following indicators perform relatively better in terms of conditional probability: reserves, current account balance, fiscal deficit, lending-deposit ratio and M3/reserves. The unconditional probability (0.306) is same for all the indicators as 'its calculation includes good and missed signals in proportion to all months' and 'the number of months in the crisis horizon are same for all variables'. From column 5 and 6, it can be said that the indicators are not issuing wrong signals but they are refraining from issuing signals when there is an impending crisis in next 24 months. The prevalence of Type I Error in the variables point out that crisis occurrence in Indian context is due to combination of various macroeconomic inconsistencies.

**Table 2(B)** *Performance of individual indicators*

| Indicator | Conditional probability of crisis | Unconditional probability of crisis | Probability of Type I error | Probability of Type II error |
|---|---|---|---|---|
| Financial sector | | | | |
| M3 Multiplier | 0.055 | 0.306 | 0.945 | 0.076 |
| Bank Credit | 0.264 | 0.306 | 0.736 | 0.244 |
| Real Interest Rate | 0.055 | 0.306 | 0.945 | 0.048 |
| Lending-Deposit Ratio | 0.418 | 0.306 | 0.582 | 0.256 |
| Excess M1 Balances | 0.145 | 0.306 | 0.855 | 0.020 |

| Indicator | Conditional probability of crisis | Unconditional probability of crisis | Probability of Type I error | Probability of Type II error |
|---|---|---|---|---|
| M3/Reserves | 0.360 | 0.306 | 0.627 | 0.036 |
| Deposits | 0.155 | 0.306 | 0.845 | 0.364 |
| Stock Index (BSE) | 0.127 | 0.306 | 0.873 | 0.088 |
| External sector | | | | |
| Terms of Trade | 0.218 | 0.306 | 0.782 | 0.060 |
| Exports | 0.100 | 0.306 | 0.900 | 0.100 |
| Real Exchange Rate | 0.209 | 0.306 | 0.791 | 0.052 |
| Imports | 0.218 | 0.306 | 0.782 | 0.120 |
| Reserves | 0.309 | 0.306 | 0.691 | 0.008 |
| Current Account Balance | 0.536 | 0.306 | 0.463 | 0.096 |
| Gold Prices | 0.291 | 0.306 | 0.709 | 0.100 |
| Crude Oil Prices | 0.091 | 0.306 | 0.909 | 0.044 |
| Real sector | | | | |
| Output (IIP index) | 0.227 | 0.306 | 0.773 | 0.128 |
| Fiscal sector | | | | |
| Fiscal Deficit | 0.340 | 0.286 | 0.660 | 0.008 |

**Source:** Authors' calculations.

In 1991 currency crisis, fiscal deficit, reserves, current account balance and M3/Reserves were consistently issuing signals throughout the crisis horizon and lending-deposit ratio issued signals prior to crisis but refrained from issuing signals during the crisis period. Decisive variables like Real Exchange Rate issued signals only during the crisis but not fully. Whereas other important variable like Excess M1 Balances was largely absent from issuing any signals along with other variables. These results show that there was a fiscal mismanagement apart from external shocks.

In 2008-2009, real exchange rate, stock index, reserves, M3 multiplier, exports, output and current account balance were issuing signals only during the crisis period but did not issue signals prior to the crisis whereas Bank Credit issued signals prior to crisis but stopped half the way during the crisis. However, Excess M1 Balances was the only variable consistently issuing signals throughout the crisis horizon. It shows that, in the absence of early warnings, the currency stress in 2008-2009 happened all of a sudden and this could be due to global economic crisis of 2007-2008. In 2012, current account balance was the only variable that issued warnings throughout the period whereas other variables – reserves, real exchange rate, output, M3 multiplier, gold prices, exports, terms of trade and bank deposits – also issued prior warnings but not at a very consistent level. Given the high probability throughout the crisis horizon and early warnings from the important macroeconomic variables, this currency slump can be attributed to macroeconomic inconsistencies.

The periods identified with more number of signals are as follows: from 1988 to 1991 and from early 2007 to 2012, however, these periods do not cover all the months. It is noticeable that the first period mentioned above was followed by devaluation in 1991 but the later periods were not followed by any devaluation. However, central bank had to intervene in foreign exchange market and the then Prime Minister Manmohan Singh had to announce in the parliament that the economy was not heading to 1991 like crisis[(8)], and there were a series of statements and indications from various quarters of the government before this event[(9)]. The crisis tremors were felt (politically) only in 2013 but it started building up from 2012, and the 2008-2009 currency slump was due to global economic factors rather than domestic macroeconomic factors.

During 2008-2009, rupee depreciated around 25% w.r.t. its previous year's value and reserves depleted around 15-20%, and in 2012 rupee depreciated around 25% and reserves depleted around 10%. However, these currency crises periods did not turn out to be a full-blown currency crisis like 1991 due to both government and central bank intervention apart from its relative openness and managed floating exchange rate system. However, there were no common indicators that issued warnings prior to the crisis in these three spells of currency crises. The results, we obtained in this study, suggest that India has been vulnerable to currency crisis both pre and post reforms periods.

We end this section by comparing all the crises periods. The 1991 currency crisis ended with large scale financial reforms, devaluation of the rupee and abandonment of fixed exchange rate system (in 1993), and in 2008-2009 currency stress did not lead to any devaluation of the currency whereas the 2012 currency slump ended with the intervention of fiscal and monetary authorities. Is the Indian economy immune to currency crisis in later periods (post reforms)? The answer is 'No' as it is clear from our results. The reasons, why others crises did not turn out to be severe financial crisis like 1991, are relatively better position of reserves and managed floating exchange rate system apart from intervention by fiscal and monetary authorities.

## 6. Conclusion

The present study is aimed at explaining India's vulnerability to currency crisis in last three decades. In this ex-post study, we used KLR indicators approach to examine the probabilities of currency crisis for the period of 30 years spanning from January 1986 to December 2015 covering major events both globally and domestically. The probabilities obtained in this paper, based on the information provided by individual indicators, support the signals extraction approach. This method identified and forecasted currency crises of 1991, 2008-2009 and 2012, and it shows that developing an EWS helps in forecasting the currency crisis in India. However, only 1991 crisis was followed by devaluation among these economic instabilities. While the 1991 crisis was a result of fiscal mismanagement, 2012 can be largely attributed to domestic macroeconomic imbalances and the 2008-2009 financial stress can be ascribed to global financial crisis of that time.

Findings of the study say that crises in the Indian context are due to amalgamation of different macroeconomic inconsistencies i.e., there is no single indicator that gives the complete picture of the crisis. The economy seems more stable post reforms but as our results suggest, it is still vulnerable to currency crisis as the economy witnessed the short spells of currency crises in recent times. Given the economy's vulnerability to both domestic and global macroeconomic factors, fiscal and monetary authorities may take note of any unusual behavior in the macroeconomic variables in order to take precautionary measures to mitigate or prevent crisis and its aftermath effects.

However, major limitation to this methodology is that marginal effects are not known as it is a non-parametric method apart from issuing wrong signals and not being able to identify the exact timing of the crisis. A new theoretical model can be built to understand

the relationship among exchange rate regimes, macroeconomic structure and the economy's vulnerability to currency crisis. The present work can be extended further by including variables such as political factors, institutional or governance related variables and contagion effects etc. Other methods like Logit/Probit Regression, Artificial Neural Networks (ANN) and Markov Switching Model can also be used to explain the phenomenon.

## Notes

(1) A speculative attack in foreign exchange market is massive selling of country's currency assets by both domestic and foreign investors. Currency/Paper Money not only functions as a widely accepted record for payments and repayments but also works as a modern day asset/wealth.

(2) In monetary economics, revenue earned by creation of money (Neumann, 1992).

(3) It refers to a situation where currency crisis is not caused by weak economic fundamentals or improper government policies, instead they're the consequence of pessimistic expectations of investors about the economy.

(4) "Moral hazard problem may arise when individuals engage in risk sharing under conditions such that their privately taken actions affect the probability distribution of the outcome" (Hölmstrom, 1979).

(5) A situation in which the financial system's potential short term obligations exceed the liquidation of its assets (Chang and Velasco, 1998).

(6) In this context, economy's inability to cope with macroeconomic shocks – both domestic and external – and deterioration of economic fundamentals, and as a result economy eventually leads to a crisis.

(7) Estimated demand for money is a function of real GDP, inflation rate and linear time trend.

(8) PM's Statement on the Current Economic Situation in the Country, PIB, Govt. of India, August 30, 2013; "India's Economy: A Five Star Problem" by The Economist, August 30, 2013; "A Speculative Attack on the Rupee" by C.P. Chandrasekhar, The Hindu, August 27, 2013 and "Rupee Gains on RBI Intervention, Global Clues" by Dinesh Unnikrishnan, Live Mint, August 30, 2013.

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## Appendix I

**List of variables**

| Variable/Indicator | Purpose of the inclusion | Data source |
|---|---|---|
| M3/Reserves | Captures to what extent the liabilities of the banking system are backed by international reserves | Handbook of Statistics on Indian Economy and IMF IFS Database |
| Excess Real M1 Balances | Loose monetary policy | Handbook of Statistics on Indian Economy and IMF IFS Database |
| Fiscal Deficit as % of GDP | Loose fiscal policy | Bloomberg Database |
| Deviation of Real Exchange Rate from Trend | Overvaluation of the currency | IMF IFS Database (Recalculate) |
| M3 Multiplier (M3/M0) | Rapid growth of money supply | Handbook of Statistics on Indian Economy and IMF IFS Database |
| Domestic Credit | Credit expansion | Handbook of Statistics on Indian Economy |
| Deposits | Loss of deposits as crisis unfolds | Handbook of Statistics on Indian Economy |
| Oil Prices | High oil prices associated with recessions | IMF IFS Database |
| Real Interest Rate | Its increase indicates credit crunch / Higher interest rate indicates higher risk premium and default expectations | Handbook of Statistics on Indian Economy |
| Lending Deposit Ratio | Decline in loan quality | IMF IFS Database |
| Terms of Trade | A decrease in TOT indicates the crisis | World Bank Data Indicators |
| Gold Prices | Effects reserves through exchange rate | World Gold Council |
| Output | A rapid decline in output indicates the recession | IMF IFS Database |
| Stock Index | Burst of asset prices | BSE Index |
| Reserves | Rapid depletion of reserves is a strong indication of a crisis | IMF IFS Database |
| Current Account Balance<br>Exports<br>Imports | Current Account Deficit strongly effects reserves through exchange rate whereas rapid increase in imports and decrease in exports are strong indicators of a crisis | Bloomberg Database<br>IMF IFS Database<br>IMF IFS Database |

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# Impact of fiscal responsibility legislations on state finances in India

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**Abstract.** *The study aims to evaluate the impact of Fiscal Responsibility Legislations (FRLs) on state finances in India, considering the panel data for 28 states for the period 2000-01 to 2009-10. Fixed-effect and GLS for the random-effect model techniques are used to get regression coefficients. It is observed that the Fiscal Responsibility Legislations (FRLs) positively, affect the revenue receipts. The FRLs are effective in reducing the gross fiscal deficit and revenue deficit. The policy of FRBM is important to enhance states own revenues, check increasing expenditure and limit deficits under feasible targets. Furthermore, there is a need to develop institutional set up for effective monitoring of the fiscal performance of the state and review of Fiscal Responsibility and Budget Management targets.*

**Keywords:** State finance, fiscal policy, revenue, deficit, panel data model.

**JEL Classification:** E62, H62, C63.

## Introduction

In the process of economic growth, state level fiscal management plays a vital role. Economic growth and government finances are interlinked with each other. In federal countries financial relationship among different layers of the government are defined in terms of functions and financial transfers to correct vertical and horizontal imbalance with a specified design of the inter-governmental transfers. However, there are various exogenous factors which influence a particular tier of the government in comparison to the other and it depends on the nature and process of the factors.

The state governments are responsible for the various activities like social services and infrastructural development in the states. The states are also responsible for maintaining the law and order. Thus a deteriorating state finances decrease the capability of the investment in lots of human development activities. The pressure has increased due to rise in population, the expenditure on various human development programmes and investment in the physical infrastructure of the state government. The states which were economically better off and had a responsible fiscal behavior in the past also depicted deteriorating finances. The expenditure increased but the revenue generation did not increase at the same pace. Hence, borrowing was the only way; it raised the debt of state governments in the latter part of 1990s. By 1998-1999 almost all states were facing the deteriorating state government finances.

There are various factors which influence the state fiscal management, such as, revenue, expenditure, deficit and change in macroeconomic policy. To control and manage the state government finances various policies have been undertaken, among them the Fiscal Responsibility and Budget Management (FRBM) legislation is one. Then the FRBM Act 2003 came into existence and thereon it was further amended. As ten years have been passed since implementation of FRBM. It is necessary to assess the impact of the FRBM on the expenditure, deficit and revenue indicators. It helps to understand the effectiveness of the FRBM Act.

In this context, the main objective of this study is to evaluate the impact of the fiscal responsibility legislations on state finances in India. This paper is organized as follows: Section 2 reviews the literature pertaining to study. The data, variables and estimation techniques are discussed in Section 3. Section 4 provides the empirical results and discussions. Finally, Section 5 provides conclusive remarks.

## 2. Review of literature

There are some important studies, which analyze the issues of state finances. Kurian (1999), Rao, Shand and Kalirajan (1999), Ahluwalia (2000) attempted to study different issues pertaining to state finances and they have observed that there are differences in terms of performance among different states.

In the context of fiscal responsibility and budget management act some selected studies are reviewed here. Rakshit (2001) tried to assess whether the fiscal responsibility and Budget Management Act likely to help or to hinder its basic objectives like, inter-generational equity, macroeconomic stabilization and growth. He analyzed the Fiscal Responsibility Act. (FRA) in different angles and found five different issues relating to it. Kopits (2001) assessed the utility of fiscal rules with the experience of other countries. He has discussed certain issues, which should be taken into consideration before the implementation of the FRA rules. Karnik (2002) evaluated the commitments of the FRBMA in the light of international experience of the New Zealand FRA of 1994. His discussion was based upon the FRBM bill introduced in the parliament in 2000. Sarma (2003) attempted to asses fiscal reform in Andhra Pradesh in order to find the measures and to form the strategies for fiscal correction. He concludes with the view that the macro-management of state's is not possible unless, there will not be adequate fiscal correction take place.

Majumdar and Rajaraman (2005) attempted to examine the aspects of recommendations of the Twelfth Finance commission and observed state should enact FRBM in order to qualify for the interest rate reduction on debt obtained from the Centre. Chelliah (2005) discussed causes of financial crisis mainly in states and suggested that the Fiscal Responsibility cannot be planned by the Centre; rather, the rules and regulations must be made so that it must be obeyed by states.

Zahir, Kaul and Ravishankar (2008) highlighted various fiscal correction measures used by the Centre and state government during 2000 to 2006. According to Reserve Bank of India assessment the fiscal deficits of all states reduced from 4.7 percent to 3.2 percent in 2005-2006. Panda and Murthy (2008) analyzed the patterns and determinant of Andhra Pradesh's revenues and selective state taxes and they had observed that the factors such as pressure of financing increased revenue expenditure and maintaining own revenues of the last year determines, increase in own revenues and taxes of state. EPWRF (2009) provided various reasons for the withdrawal of FRBM Act in their article. The FRBM Act is ineffective to achieve the goal of fiscal consolidation. This rule also restricted the fiscal deficit but expenditure acceleration is needed to face the economic crisis situation.

Panda (2009a) examined empirically, the incentive effects of federal transfers, on states own revenue and found that the per capita resource transfers from the Centre were significant and negatively associated with states own revenue, own tax revenue and own nontax revenue in per capita terms. Panda (2009b) analyzed the political economy of determining own tax revenue and selective state taxes of Andhra Pradesh, India. He found that in Andhra Pradesh economic and need based factors were determines own tax revenue and selective state taxes rather, than political factors. Mala Lalvani (2009) in a study argued that there is enough evidence for suggesting that the fiscal correction was wrong headed after the period of the FRBM Act. They suggested that there is an opportunity to make some second generation rules with experience from the period of

FRBM Act. EPWRF (2009) discussed about the fiscal consolidation. It is clear from the 2012-13 budgets that the fiscal consolidation of India is postponed as the budget did not come to the FRBM Act. Therefore, there is an indication that the fiscal deficit will be at a higher rate in the future. Rakshit (2010) discussed the nature and merits of the thirteenth finance commission. The thirteenth finance commission framed to reduce the effect of global crisis. Under the Fiscal Responsibility and Budget Management Act (FRBMA) the commission emphasized on allowing for macro stabilization and under fiscal stabilization programme, it raises both public and private investment. Panda and Nirmala (2013) attempted to examine the inducement effects of sub-national fiscal transfers on the expenditure in India. The results of fly paper effect in Indian context is validated, that the central transfers provides stimulatory effects as well as the disincentive effects on the states spending.

From the above discussion of literature, it is observed that there is deterioration of state finances and disincentives on states mobilizing larger own resources. As an option some of the studies suggested for implementation of FRBM. However, there is no exclusive empirical study that examines the impact of FRBM act on state finances after its implementation.

## 3. Data, variables and estimation techniques

### 3.1. Data and variables

The study is based on annual secondary data considering the period 2000-01 to 2009-10. The data are collected from various secondary sources for 28 states. The data for Andhra Pradesh has taken as undivided state because Andhra Pradesh was not divided by the time period under consideration. Our data are obtained from Centre for Monitoring Indian Economy (CMIE) and various issues of Reserve Bank of India State Finances-A Study of Budgets. Data related to urban population is obtained from Office of Registrar General and Census Commissioner of India.

State total expenditure, revenue expenditure, revenue receipts, fiscal deficit and revenue deficit are taken as the ratio of gross state domestic product and used as dependent variables to know the impact of the FRBM on these variables. We have used explanatory variables such as log of urban population, log of per capita gross state domestic product and FRBM dummy. The same explanatory variables are used for all regression models.

In order to analyse the impact of shifting from non-FRBM to FRBM on state finances, we have taken FRBM as a dummy independent variable. The control variable used for GSDP growth and urban population growth are remaining same for all the regression models. In the side of dependent variable we have taken from the category of spending ratio of educational expenditure, developmental expenditure and total expenditure to GSDP. From the category of receipts we have only taken the ratio of revenue receipts to GSDP and excluded capital receipts and total receipts. The reason behind this, is the

capital receipts have included some borrowing components so deficit may be compensated by the borrowing and the real effect cannot be properly known. Likewise, we also skipped the total receipts for the obvious reason that it includes the capital receipts component.

The standard practice to report for summary statistics is to present mean value, standard deviation, minimum and maximum is adopted. Table 1 represents variables used in the study with their abbreviation and summary statistics.

**Table 1.** *Summary statistics*

| Variable | Abbreviation | Obs. | Mean | S.D | Min | Max |
|---|---|---|---|---|---|---|
| Ratio of Total Expenditure to GSDP | TESDPR | 280 | 0.33166 | 0.2752866 | 0 | 1.680715 |
| Ratio of Revenue Expenditure to GSDP | RESDPR | 280 | 0.2610804 | 0.2108128 | 0 | 1.475512 |
| Ratio Of Revenue Receipts to GSDP | RRSDPR | 279 | 0.2696882 | 0.2409117 | 0.0433997 | 1.630624 |
| Ratio Of Fiscal Deficit to GSDP | FDSDPR | 280 | 0.0463332 | 0.385315 | -0.0327076 | 0.2970408 |
| Ratio Of Revenue Deficit to GSDP | RDSDPR | 279 | -0.0076781 | 0.0521959 | -0.2223205 | 0.1337919 |
| Log of Urban Population | LURBPOP | 280 | 6.373919 | 0.7786315 | 4.11444 | 7.70602 |
| Log of per capita GSDP | LPCGSDP | 280 | 4.424779 | 0.2846955 | 3.362696 | 5.300354 |
| Fiscal Responsibility and Budget Management | FRBM | 280 | 0.4607143 | 0.4993467 | 0 | 1 |

**Source:** Calculated by the author (Basic data from various issues of RBI, Census and CMIE).

### 3.2. Model specification and estimation techniques

The most important things of analysis are to select the variables and also to use the method for analyzing the objectives. In our study panel data models are found to do better than the formal one dimensional model of either time series or cross-section of data. In panel data models the significant increase in degrees of freedom helps to gain the dependability of estimates. Further, the quality of the parameter estimates might be better as pooled sample permits to study the individual groups and also the individual states in the model. Keeping in mind these things, we have applied two way fixed effect models to analyze the impact of FRBM on state governments' finances. Overall fixed effect and GLS for the random effect techniques are used to get coefficients. To make a choice between these two coefficients of fixed and random effect models the Hausman test statistic has been used. The coefficients which are favored by Hausman test are only be reported.

Alternatively, we have regressed ratio of total expenditure, revenue expenditure, revenue receipts, revenue deficit and fiscal deficit to GSDP. Growth rate of Gross State Domestic Product (GSDP) is widely used as a substitute of variable as an indicator of states resource capacities. Similarly, the growth of urban population is used as a variable to represent the increase in the urban population also increases the expenditure on state's economy. The urban population growth can be taken as the more appropriate proxy to measure the need of the state as it gives weightage to both population in urban area and its growth.

In order to verify the multi-collinearity, cross correlation among the explanatory variables are computed and the results are reported in Table 2. The table shows no high correlation among the explanatory variables.

**Table 2.** *Correlation among explanatory variable*

| Variables | LURBPOP | LPCGSDP | FRBM |
|---|---|---|---|
| LURBPOP | 1.00 | | |
| LPCGSDP | 0.075 | 1.00 | |
| FRBM | 0.3908 | 0.4124 | 1.00 |

In our study, we are using the fixed effect model and random effect model and to test which model is better Hausman test shall be done. The model used in the following form:

$$TESDPR = \beta_0 + \beta_1 LURBPOP + \beta_2 LPCGSDP + D_i(FRBM) + \lambda i + \mu_t + \varepsilon_{it} \quad (1)$$

$$RESDPR = \beta_0 + \beta_1 LURBPOP + \beta_2 LPCGSDP + D_i(FRBM) + \lambda i + \mu_t + \varepsilon_{it} \quad (2)$$

$$RRSDPR = \beta_0 + \beta_1 LURBPOP + \beta_2 LPCGSDP + D_i\,(FRBM) + \lambda i + \mu_t + \varepsilon_{it} \quad (3)$$

$$FDSDPR = \beta_0 + \beta_1 LURBPOP + \beta_2 LPCGSDP + D_i(FRBM) + \lambda i + \mu_t + \varepsilon_{it} \quad (4)$$

$$RDSDPR = \beta_0 + \beta_1 LURBPOP + \beta_2 LPCGSDP + D_i(FRBM) + \lambda i + \mu_t + \varepsilon_{it} \quad (5)$$

TESDPR = Ratio of Total Expenditure to Gross State Domestic Product
RESDPR= Ratio of Revenue Expenditure to Gross State Domestic Product
RRSDPR = Ratio of Revenue Receipt to Gross State Domestic Product
RDSDPR = Ratio of Revenue Deficit to Gross State Domestic Product.
FDSDPR = Ratio of Fiscal Deficit to Gross State Domestic Product.
LPCGSDP = Log of Gross State Domestic Product.
LURBPOP = Log of Urban Population
FRBM = Fiscal responsibility and budget management Act has been taken as a dummy variable. FRBM = 1, if there is fiscal variables corresponds to the time period after 2005, zero, otherwise. i =1,…, 28; t = time (1, 2, 3,…, 10); t = current year; i = state; ε = random error terms; λi = state specific effect; μt = time specific effect; Di = coefficient of dummy variable ; β0 = intercept coefficient; and βi = coefficients of explanatory variables.

The independent variable in the model may have both temporary and spatial differences. State specific dummies are included to control for time invariant and state specific unobservable explanatory variables like institutions and other factors. The unexplained variations in the regression are controlled by the error term $\varepsilon_{it}$ and it also assumed to be normally distributed homoscedastic and independent across observations.

The GSDP data at current prices from 2000-2001 to 2009-2010 series are obtained from the CMIE. The *per capita* GSDP and urban population are transformed to logarithmic form. Further, these data are obtained by interpolation of census data for 2001 and 2011.The dependent variable are in per cent terms and independent variables such as LPCGSDP and LURBPOP are transformed as log.

## 4. Empirical results and discussion

The results based on the empirical model are outlined in the previous sections are presented in Table 3 and Table 4. The results of impact of the FRBM on states total expenditure, revenue expenditure and revenue receipts are reported in Table 3. The consequence of the Hausman test shows that the difference in coefficients between the random effect and fixed effect models is not systematic, and furnish the evidence in support of the random-effect coefficients for equation (1) and (4). Hausman test supports the fixed-effect model for equations (2), (3) and (5).

From the regression result shown in Table 3, it is seen that the variable of interest that is FRBM is insignificant for ratio of total expenditure to GSDP (TESDPR) at five percent level of significance. But *per capita* GSDP is significant for the total expenditure and it affects negatively. The negative sign of coefficients signifies that the *per capita* GSDP negatively affects the whole expenditure of states. This implies that the government has to try to reduce non-productive expenditure side. FRBM dummy has an impact on revenue receipts of the state government finances. The other control variables such as *per capita* GSDP growth and urban population growth are statistically significant for revenue expenditure and revenue receipts. The Urban population affects positively to the revenue expenditure and revenue receipts whereas, *per capita* GSDP affects negatively to total expenditure, revenue expenditure and revenue receipts. The sign of the coefficient of the variable of interest that is FRBM dummy has not obtained in desired lines for total expenditure and revenue expenditure. This may be due to the fact that governments did not strictly adhere to deficit targets by reducing expenditure for the whole period under study. Further, after few years of FRBM, due to the impact of Global Financial Crisis, public sector investment increases which makes expenditure to rise. FRBMA has a positive impact on the state revenue generation.

**Table 3.** *Panel regression results*

| **Dependent variable→** | **TESDPR** | **RESDPR** | **RRSDPR** |
|---|---|---|---|
| Explanatory variable ↓ | Random-Effect Model | Fixed-Effect Model | Fixed-Effect Model |
| LURBPOP | -0.0235<br>(0.0318) | 0.0894*<br>(0.0388) | 0.1511*<br>(0.4165) |
| LPCGSDP | -0. 1511*<br>(0.0667) | -0.3133*<br>(0.0747) | -0. 3895*<br>(0.7948) |
| FRBM | -0.0242<br>(0.0187) | 0.2027<br>(0.0152) | 0.0590*<br>(0.0162) |
| Constant | 1.1393*<br>(0.2421) | 1.0680*<br>(0.2033) | 1.0028*<br>(0.2166) |
| Hausman test<br>(p-value) | 2.01<br>(0.5700) | 96.30<br>(0.000) | 10.41<br>(0.0154) |
| Wald chi2 | 15.82* | - | - |
| $R^2$ Overall | 0.2955 | 0.0163 | 0.0614 |
| F test | - | 8.74* | 9.81* |

**Note:** Standard errors are given in parentheses and * indicates statistical significance at 5 percent level.

The results of impact of the FRBM on states fiscal deficit and revenue deficit are depicted in Table 4. The results of Hausman test shows that the difference in coefficients between the random effect and fixed effect models is not systematic, and furnish the evidence in support of the random-effect coefficients for the fiscal deficit equation and vice versa for the revenue deficit equation.

From the regression result furnished in Table 4, it is observed that the variable of interest that is FRBM is significant for the ratio of gross fiscal deficit to GSDP (FDSDPR) and ratio of revenue deficit to GSDP at five percent level of significance. FRBM influences negatively to both the deficit of the state finances. Implementation of FRBM legislations accounts gross fiscal deficit to decline by 0.022 percent and 0.036 percent to revenue deficit. Therefore, FRBM legislations are effective in reducing both fiscal deficit and revenue deficit.

The other control variable like *per capita* GSDP is significant in case of revenue deficit and shows a positive relationship. Urban population emerged as significant for both the deficits and a negative impact has been observed.

**Table 4.** *Panel regression results*

| **Dependent variable→** | **FDSDPR** | **RDSDPR** |
|---|---|---|
| **Explanatory variable ↓** | **Random-Effect Model** | **Fixed-Effect Model** |
| LURBPOP | -0.0120*<br>(0.0048) | -0.0731*<br>(0.0175) |
| LPCGSDP | -0.0175<br>(0.0122) | 0.0849*<br>(0.0335) |
| FRBM | -0.0222*<br>(0.0051) | -0.0369*<br>(0.0068) |
| Constant | 0.2106<br>(0.0578) | 0.0998<br>(0.0913) |
| Hausman test<br>(P- value) | 5.52<br>(0.1372) | 54.53<br>(0.000) |
| Wald chi2 | 89.10* | - |
| $R^2$ Overall | 0.2432 | 0.0289 |
| F test | - | 48.63* |

**Note:** Standard errors are given in parentheses and * indicates statistical significance at 5 percent level.

## 6. Conclusion

The study investigates the impact of the FRBMA on state finances in India. From the empirical analysis it is observed that the Fiscal Responsibility Legislations (FRLs) affects positively to the revenue receipts. From the deficit side it is observed that the FRLs are effective in reducing gross fiscal deficit and revenue deficit. As public sector investments largely increased to neutralize the impact of Global Financial crises after 2009, the impact of FRBM on expenditure is not observed for the whole period under study. We recommend for the continuation of FRLs state finances for controlling the unproductive expenditure.

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# Does fiscal policy spur economic growth? Empirical evidence from Algeria

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**Abstract.** *The present paper aims to investigate the impact of fiscal policy on economic growth in Algeria over the period 1970-2015, by using Johansen cointegration test and vector error correction model (VECM). The main results reveal that both indirect taxes and productive current expenditures have a significant long-term positive impact on real GDP, while direct taxes, capital and unproductive recurrent expenditures negatively and significantly affect economic growth in the long run. Based on these findings, it could be concluded that sustainable economic growth requires serious policy measures aimed at diversifying the Algerian economy.*

**Keywords:** fiscal policy, economic growth, Algeria, Johansen cointegration test, vector error correction model (VECM).

**JEL Classification:** C22, E62, O40, O55.

## 1. Introduction

Fiscal policy includes deliberate government actions in the area of spending money and levying taxes in order to affect the macroeconomic variables in the desired direction (Khan et al., 2012: pp. 53-82). It has dominated recent public policy negotiations in different economies, especially regarding economic and fiscal issues like high unemployment, insufficient national savings, excessive budget deficits, and increasing public debt burdens (Odhiambo et al., 2013: pp. 306-323). In this context, fiscal policy is a very important tool for achieving macroeconomic stability and attaining sustained economic growth.

According to the neoclassical growth model, fiscal policy can affect only the level of output, not its long-run rate of growth. In other words, the impact of fiscal policy on economic growth is temporary as the economy moves from one steady-state equilibrium to another. Endogenous growth models, by contrast, assert that economic growth depends on endogenously determined factors like physical and human capital accumulation, technical progress, and government economic policy. Thus, these models tend to convert the temporary growth effects of fiscal policy into permanent effects through providing mechanisms by which fiscal policy variables can influence both the level of output and the steady-state growth rate (Easterly and Rebelo, 1993: pp. 417-458; Kneller et al., 1999: pp. 171-190).

Algeria is one of the developing countries that are well endowed with natural resources, further the great dependence of the Algerian economy on oil exports as a major source of hard currency earnings, made economic growth more vulnerable to fluctuations in global oil prices. The deep roots of today's emergency situation in Algeria can be revealed with a glance back at this country’s governance and institutional tissue. Notwithstanding some economic progress has been achieved, blind reliance on oil remains the economic mainstay of Algeria, and what makes matters worse is that the private sector itself is heavily dependent on public expenditure (IMF, 2015). Obviously, non-oil GDP growth seems, at first sight, much more closely tied to the oil price growth, as the hike in oil prices boosts non-oil GDP growth by rising government spending. Emphasis on collecting non-oil revenues really frustrates the flexibility of the Algerian economy and decreases its ability to respond to adverse shocks. Furthermore, non-oil GDP growth rate in Algeria is now even more concentrated in service industries that depend to a large extent on demand expansion resulted from oil sales, and on the other hand non-oil sectors are poorly equipped to deal with plummeting oil prices (IMF, 2014a). Therefore, there exists a dire need to diversify the economic base, underpin public financial management reforms and ensure that capital spending is productive.

In light of daunting challenges that lie ahead in Algeria, this paper thus aims to unearth very interesting and research-worthy aspects of this intractable situation by testing the impact of fiscal policy variables on economic growth in Algeria over the period 1970-2015. For this purpose, the paper is divided into five sections. After introducing the topic in section 1, section 2 presents the theoretical and empirical background of the relationship between fiscal policy and economic growth, section 3 discusses fiscal policy and economic growth in Algeria, section 4 introduces the data, explains the methodology, and analyzes the empirical results and finally section 5 concludes the paper and draws some policy implications.

## 2. Theoretical and empirical review on fiscal policy and economic growth

An analysis of the relationship between fiscal policy and long-run growth requires identifying the various channels through which tax policy, expenditure policy, and overall budgetary policy could affect growth through their impact on Musgrave's three economic branches, namely: allocation, distribution, and stabilization (Tanzi and Zee, 1997: pp. 179-209).

One of the most important links between tax policy and growth is based on the idea that all taxes are non-neutral except lump-sum levies, which are broadly ineffective as a practical tool. With non-neutral taxes, the allocative decisions of private economic agents will be completely different from those that would be taken in the absence of these taxes (Auerbach, 1985: pp. 61-127; Tanzi and Zee, 1997: pp. 179-209). In general, the existence of such tax-induced distortion leads to inefficiency in the entire economy.

Additionally, it should be noted that the rate of change in the level of taxation represents the appropriate variable that can be used to obtain the actual effects of taxes on long-run growth. Engen and Skinner (1992) pointed out that there is a negative and statistically significant association between taxation and output growth. Similarly, Easterly and Rebelo (1993) used thirteen tax measures in order to determine the significance of various tax rate variables in explaining growth differences across countries, they found that a marginal income tax rate computed by employing a time-series regression of income tax revenue on GDP is the only tax rate variable that is statistically significant. However, Mendoza et al. (1997) showed clearly that reductions in income taxes increase the private investment rate, while consumption tax cuts have a strong negative effect on investment.

On the other hand, the effectiveness of fiscal policy in promoting economic growth depends on whether or not public spending crowds out private spending on investment and consumption. For example, if the government increases its spending without any corresponding increase in public revenue, it results in a deficit budget (Akpan and Abang, 2013: pp. 36-52). Accordingly, if the deficit is financed by issuing domestic debt, it can have an adverse impact on economic growth as a result of rising domestic interest rates, thereby crowding out private sector spending (Kandil, 2006: pp. 463-486). Furthermore, if the increase in spending is financed through money creation, it may lead to higher inflation which, in turn, causes nominal interest rates to go up, thus reducing private expenditure (Wahab, 2011: pp. 574-590). This has the effect of curbing economic activities in the short run and hampering capital accumulation in the long run, thereby leading eventually to a sharp decline in economic growth rates.

The nature of the relationship between public spending and long-run growth should be determined taking into account the rate of change in the level of public spending as a fundamental variable in the model. Indeed, in the context of analyzing the effects of government spending composition, many studies have indicated that public investment spending contributes to increased private capital accumulation, which in turn leads to higher rates of economic growth, while public consumption expenditure has the potential to hinder growth (Grier and Tullock, 1989: pp. 259-276; Barro, 1991: pp. 407-443; Easterly and Rebelo, 1993: pp. 417-458; Hansson and Henrekson, 1994: pp. 381-401; Tanninen, 1999: pp. 1109-1117; Bose et al., 2007: pp. 533-556). As well as, Kneller et al. (1999)

revealed that high levels of productive expenditures significantly foster economic growth for a panel of Organization for Economic Cooperation and Development (OECD) countries, whereas unproductive expenditures have a neutral impact on growth.

According to the neoclassical growth model (Solow, 1956: pp. 65-94; Swan, 1956: pp. 334-361), the steady-state growth rate is determined by two exogenous factors namely, the rate of population growth and the pace of technological advance. Since these factors are independent of the decisions of economic agents, fiscal policy can affect only the level of output, not its long-run rate of growth. In other words, the impact of fiscal policy on economic growth is temporary as the economy moves from one steady-state equilibrium to another (Kneller et al., 1999: pp. 171-190; Erős, 2010: pp. 11-17; Ahmad and Wajid, 2013: pp. 196-215). Endogenous growth models, by contrast, assert that economic growth depends on endogenously determined factors like physical and human capital accumulation, technical progress, and government economic policy (Romer, 1986: pp. 1002-1037, 1990: pp. S71-S102; Lucas, 1988: pp. 3-42; Barro, 1990: pp. S103-S125; Rebelo, 1991: pp. 500-521; Aghion and Howitt, 1992: pp. 323-351; Barro and Sala-i-Martin, 1992: pp. 645-661, 1995). Thus, these models tend to convert the temporary growth effects of fiscal policy into permanent effects through providing mechanisms by which fiscal policy variables can influence both the level of output and the steady-state growth rate (Easterly and Rebelo, 1993: pp. 417-458; Kneller et al., 1999: pp. 171-190). Accordingly, Gemmell (2001) pointed out that the long-run growth effects of fiscal policy can be achieved in several ways, such as production externalities, productivity growth, productivity differences between the public and private sectors, fiscal effects on factor accumulation, crowding-out and redistribution. Also, Dar and Amir Khalkhali (2002) argued that fiscal policy instruments, which mainly include taxation, public expenditure, and aggregate budgetary balance have wide-ranging effects on long-term growth performance through their impact on the efficiency of resource use, the rate of factor accumulation and the pace of technological progress.

In addition, the public-policy endogenous growth models distinguish four main components of the government budget: 1) distortionary taxes (i.e. taxes on income, profits, payroll, and property as well as social security contributions), which dampen incentives to invest in physical/ human capital, thereby slowing down economic growth; 2) non-distortionary taxes (i.e. taxes on domestic goods and services), which do not affect saving and investment incentives, and hence long-run growth rates; 3) Productive expenditures that enter the private production process as intermediate inputs and increase the marginal productivity of capital and labour, thus raising the steady-state growth rate of the economy (e.g. spending on general public services, defense, education, health, housing, transport and communication); and 4) unproductive expenditures that provide direct benefits to households, but do not enter into the private production function, therefore leaving the growth rate unchanged (such as social security and welfare, recreation, and economic services) (Barro, 1990: pp. S103-S125; Barro and Sala-i-Martin, 1992: pp. 645-661, 1995; Devarajan et al., 1996: pp. 313-344; Kneller et al., 1999: pp. 171-190; Angelopoulos et al., 2007: pp. 885-902; Ferreiro et al., 2008: pp. 84-108).

Based on the above classification of fiscal instruments, Kneller et al. (1999) showed that shifting the tax structure from direct taxation to less distortionary indirect taxes is very effective in boosting economic growth, while switching the composition of government spending from productive to unproductive expenditures has a profoundly growth-retarding effect. Further, he argued that productive spending financed by non-distortionary taxation is positively associated with economic growth. However, this relationship is supposed to be ambiguous when distortionary tax finance is employed. On the other hand, financing non-productive expenditures through distortionary taxes exerts a strong negative influence on growth, but when a non-distorting tax system is used to finance these expenditures, the predicted impact on growth rates tend to be neutral.

The impact of fiscal policy variables on economic growth has received a great deal of attention from economists especially in last decades, and the table below summarizes the empirical studies that have investigated this topic.

**Table 1.** *Empirical evidence on the impact of fiscal policy on economic growth*

| ***Authors*** | ***Sample*** | ***Empirical approach*** | ***Results*** |
|---|---|---|---|
| ***Barro (1991)*** | 98 countries 1960-1985 | Panel data analysis | Growth is inversely related to the share of government consumption in GDP, but insignificantly related to the share of public investment. |
| ***Easterly and Rebelo (1993)*** | 100 countries 1970-1988 | Panel data analysis | Public investment in transport and communication has a significant positive impact on growth; general government investment is positively correlated with both growth and private investment; and public enterprise investment is negatively associated with private investment. |
| ***Devarajan et al. (1996)*** | 43 developing countries 1970-1990 | Panel data analysis | The share of current expenditures in total expenditures is positively and significantly associated with per capita real GDP growth, while the capital component of public expenditure is negatively and significantly related to per capita growth. |
| ***Kneller et al. (1999)*** | 22 OECD countries 1970-1995 | Panel data analysis | Distortionary taxes have a significant negative impact on economic growth, while productive expenditures positively affect growth. Non-distortionary taxes and unproductive expenditures, on the other hand, have no significant effect on growth. |
| ***Kweka and Morrissey (2000)*** | Tanzania 1965-1996 | Engle-Granger cointegration test and error correction model (ECM) | Productive expenditure is negatively related to economic growth, while consumption expenditure is positively associated with growth. In contrast, the correlation between real GDP growth and government expenditure on human capital seems to be statistically insignificant. |
| ***M'Amanja and Morrissey (2005)*** | Kenya 1964-2002 | The Autoregressive Distributed Lag (ARDL), Granger causality tests | Productive expenditure has a strong adverse impact on growth, whilst unproductive expenditure and non-distortionary taxes have neutral effects on growth. Further, public investment plays an important role in promoting long-run growth. |
| ***Ghosh and Gregoriou (2006)*** | 15 developing countries 1972-1999 | The OLS (fixed effects) model, the GMM single equation framework and the GMM system | Current (capital) expenditure has positive (negative) and significant effects on the growth rate. |
| ***Bose et al. (2007)*** | 30 developing countries 1970-1990 | Panel data analysis | The share of government capital expenditure in GDP is positively and significantly correlated with economic growth, while the growth effect of current expenditure is insignificant. |
| ***Enache (2009)*** | Romania 1992-2013 | The ordinary least squares (OLS) technique | Distortionary public revenues are negatively and significantly associated with economic growth, while productive public expenditures are not significantly related to growth. Moreover, the budgetary balance has a significant positive impact on real GDP growth. |

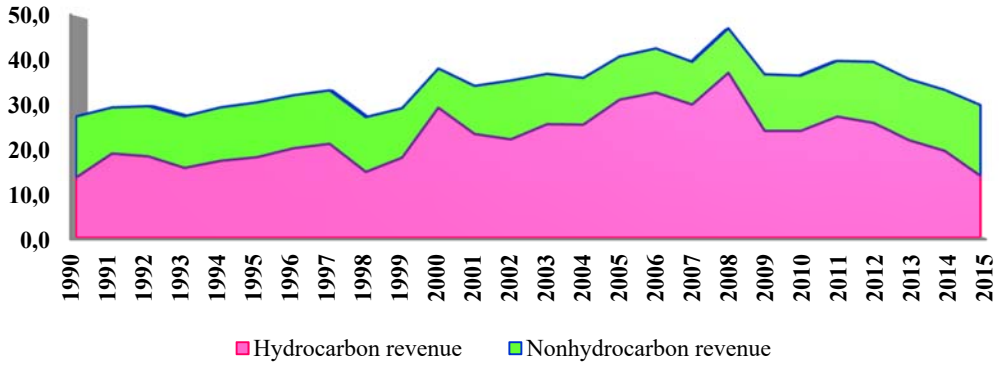
| *Authors* | *Sample* | *Empirical approach* | *Results* |
|---|---|---|---|
| ***Adefeso et al. (2010)*** | Nigeria 1970-2005 | Johansen cointegration test and Error Correction Model (ECM) | Non-productive expenditures financed by non-distortionary taxes have a neutral impact on economic growth, whereas productive expenditures have a positive growth effect. |
| ***Joharji and Starr (2010)*** | Saudi Arabia 1969-2005 | Johansen cointegration test and the VECM approach | Public spending has a significant positive effect on long-run growth. Moreover, current expenditure is more growth enhancing than capital expenditure. |
| ***Babalola and Aminu (2011)*** | Nigeria 1977-2009 | Engle-Granger cointegration test, Error Correction Model | There is a positive and statistically significant long-run relationship between productive expenditures and economic growth. Further, distortionary revenue exerts a positive influence on growth. |
| ***Scarlett (2011)*** | Jamaica 1990-2010 | The ARDL model and Granger causality tests | Indirect taxes exhibit a positive impact on long-run growth, while direct taxes are negatively linked with per capita GDP. |
| ***Olasunkanmi and Babatunde (2012)*** | Nigeria 1981-2010 | Johansen cointegration test and ordinary least squares (OLS) technique | Distortionary taxes, non-distortionary taxes, productive expenditures and fiscal deficit contribute to Nigeria's economic growth. |
| ***Hamdi and Sbia (2013)*** | Bahrain 1960-2010 | Johansen cointegration test and vector error correction model (VECM) | Oil revenues and total government expenditures are positively and significantly associated with economic growth. Further, there is a unidirectional causal relationship running from oil revenues to GDP. |
| ***Ahmad and Wajid (2013)*** | Pakistan 1979-2009 | The Autoregressive Distributed Lag (ARDL) model | Non- productive expenditures and non-distortionary taxes have neutral impact on economic growth in both the long run and the short run. Productive expenditures are positively and significantly associated with economic growth. While, distortionary taxes have a negative and significant impact on growth. |
| ***Madni (2013)*** | Pakistan 1979-2012 | The ARDL approach | Unproductive government spending is negatively associated with economic growth, whereas productive government spending has no significant effect. Also, private investment is positively and significantly related to growth. On the other side, direct and indirect taxes have no significant impact on the pace of economic growth in Pakistan. |
| ***Takumah (2014)*** | Ghana 1986-2010 | Granger causality test, Johansen cointegration test and the VECM approach | There is a unidirectional causality running from tax revenue to economic growth. Further, tax revenue has a statistically significant positive effect on economic growth in both the short and long run. |
| ***Maşca et al. (2015)*** | 27 EU countries 1995-2011 | The least squares method for panel data, fixed and random effects models. | Unproductive expenditures hinder economic growth while productive expenditures enhance it. Further, total taxes and public debt negatively influence the growth rate. |
| ***Arin et al. (2015)*** | 28 OECD countries 1990-2009 | Bayesian Model Averaging (BMA) | Productive public spending and budget surplus have a strong positive effect on economic growth, while, top corporate tax rates and other revenues have a robust negative impact on growth. Further, top income tax rates, government consumption, other expenditures, and distortionary taxes have no significant effect on economic growth. |

**Source:** Constructed by authors.

## 3. Fiscal policy and economic growth in Algeria

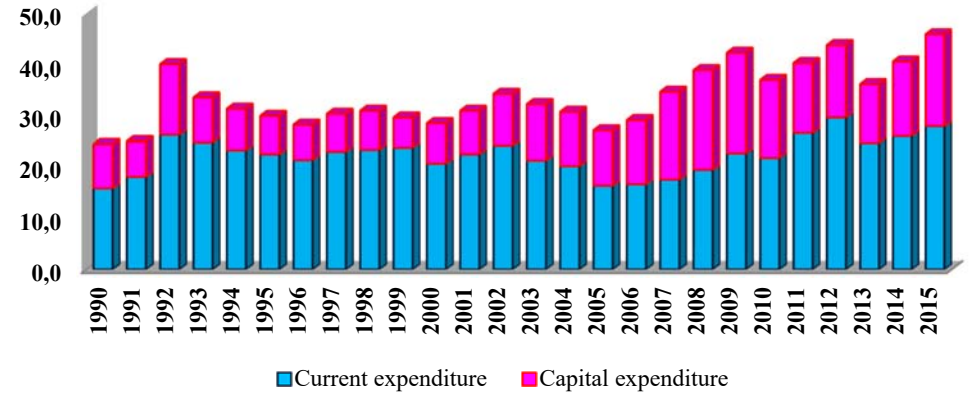
### 3.1. Fiscal policy and challenges facing Algeria

**Figure 1.** *Hydrocarbon and nonhydrocarbon revenues (% of GDP) in Algeria, 1990-2015*




**Source:** The National Statistical Office of Algeria (ONS), Statistical Retrospective 1962-2011 and the Ministry of Finance: General Directorate of Taxes.

**Figure 2.** *Capital and current expenditures (% of GDP) in Algeria, 1990-2015*

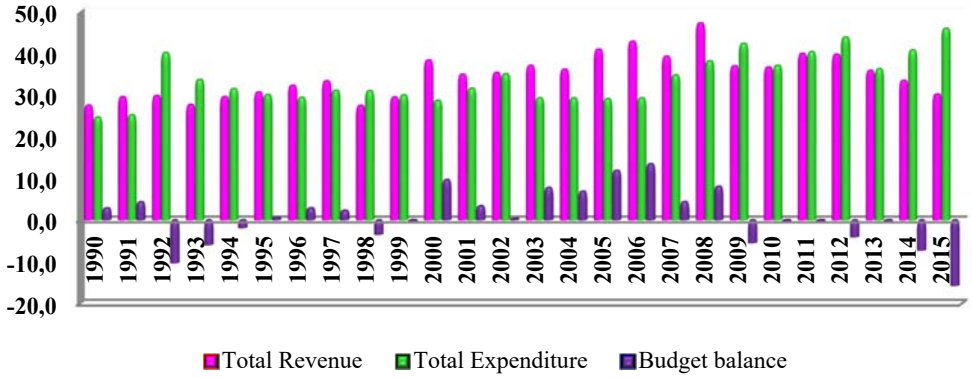



**Source:** The National Statistical Office of Algeria (ONS), Statistical Retrospective 1962-2011 and the Ministry of Finance: General Directorate of Budget.

According to the Bank of Algeria's 2014 annual report, the hydrocarbon sector remains Algeria's primary growth engine, and, of course, the government spending itself is always waiting for a handout from the oil sector, reflecting the fact that the Algerian economy is still being held hostage to hydrocarbon revenues. This is the harvest of the slothful dependence on oil rents in generating non-shameful growth rates since independence, and this period was long enough for structural distortions to be roosted in the whole economy. The fiscal policy adopted since 2001 led to a significant increase in public expenditure from 47 percent of non-oil GDP in 2001 to 52 percent in 2004. On the other hand, the nonhydrocarbon primary budget deficit increased to about 32 percent of NHGDP in 2004, compared with 29.5 percent in 2003, largely affected by the reduction of import taxes and

the decline in non-tax revenue (IMF, 2005). In 2009, Algeria posted its first overall fiscal deficit of about 8 percent of GDP, mainly due to a sharp fall in hydrocarbon revenues, however, non-oil revenues grew by 20 percent, driven by the further modernization of the revenue administration and higher income tax collections. On the other hand, current expenditure increased by 15 percent in 2009 as a result of additional maintenance costs of new infrastructure and employment support programs, while capital expenditure remained stable in real terms (IMF, 2010). After that, the budget deficit declined to 1.5 percent of GDP in 2013 from 5 percent in 2012, thanks to the consolidation measures adopted by the government in its 2013 budget (IMF, 2014b). However, in 2015, the overall budget deficit rose to about 16.4 percent of GDP as a result of lower oil revenues and increased public expenditure (both current and capital) (IMF, 2016).

**Figure 3.** *Overall budget balance (% of GDP) in Algeria, 1990-2015*



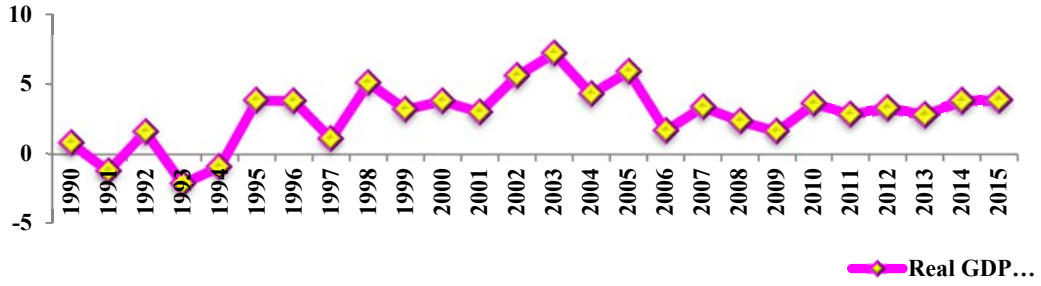

**Source:** The National Statistical Office of Algeria (ONS), Statistical Retrospective 1962-2011 and the Ministry of Finance: General Directorate of Budget.

Indeed, falling oil prices urge the Algerian government to acclimate to the new situation by abruptly adjusting its expenditure and revenue policies in order to stay the course during tough times. Past omission and lowering the gaze on such situation, stemming from mazes of geostrategic conflicts and hidden financial interests, unearth numerous bets and force the government to undergo austerity and tighten the public spending belt. Efforts should be made to freeze spending on lower priority projects and maintain it in high-priority areas that closely concern those who have limited purchasing power. The Revenue Regulation Fund (RRF) has been almost depleted due to the slump in oil prices; the option of external borrowing will be a solution of last resort, as this looks rather like dancing with one leg suffering from osteoporosis, particularly given high international interest rates. The government should embark on a feasible and publicly palatable privatization scheme, speed up the reform of the state-dominated banking sector, and curb tax evasion. A new World Bank report stresses the longstanding need for economic diversification and urgency of non-oil sector recovery to lift economic growth (World Bank, 2016), because the longer the consumerism and near-total dependence on black gold persist, the greater will be the bitterness of economic adjustment.

### 3.2. Economic growth in Algeria

Algeria had a strong economic growth during the past decade due to high hydrocarbon revenues and prudent macroeconomic policies broadly adopted since 1990 in the context of increasing oil revenues, and this led to the acceleration of economic growth and the creation of a solid financial position with large external reserves (IMF, 2012). Real GDP growth declined from 2.4 percent in 2000 to 2.1 percent in 2001, largely reflected lower hydrocarbon output owing to reduced OPEC oil quotas, while growth in the non-oil sector increased to 4.5 percent (IMF, 2003). However, in 2003, overall GDP growth rose significantly to about 7 percent because of higher oil production and accelerating activity in services, construction, and industry, as well as the positive effects of the government's Economic Recovery Program that helped push up the growth in the nonhydrocarbon sector (IMF, 2005, 2006). Then, it declined to about 2 percent in 2009 due to lower global demand for hydrocarbons and the significant fall in crude oil prices under the impact of the global financial crisis. On the other hand, nonhydrocarbon GDP growth reached 9 percent in 2009, reflecting strong performance in the sectors supported by the Public Investment Program (PIP) (IMF, 2010). In 2013, real GDP grew by 2.8 percent, held back by the continued decline in hydrocarbon output and the slowdown in public spending. Non-oil GDP growth, however, remained relatively steady at around 7.1 percent, driven by continued strong growth in the agricultural and services sectors (IMF, 2014 b), after that overall GDP growth increased slightly in 2015 to reach 3.9 percent, compared with 3.8 percent in 2014, mainly boosted by high oil production (IMF, 2016).

**Figure 4.** *Gross domestic product, constant prices (percent change) in Algeria, 1990-2015*




**Source:** IMF, World Economic Outlook (WEO) database, the data are available online at: http://www.imf.org/ (accessed 24/01/2017).

## 4. Data and empirical results

### 4.1. Data description and sources

In the present study, we employ annual data covering the period 1970-2015 to investigate the relationship between fiscal policy and economic growth. The dataset includes the following variables:

***GDP:*** Gross Domestic Product (constant 1980 prices, LCU) is used as a proxy for economic growth, from the World Bank's World Development Indicators (WDI) database.

***DT:*** Direct Taxes (constant 1980 prices, LCU), which refer to those taxes that are levied on the income and profits of individuals and corporations. These taxes are used as a proxy for distortionary taxes and are obtained from the Algerian National Statistical Office and the Ministry of Finance: General Directorate of Taxes.
***IDT:*** Indirect Taxes (constant 1980 prices, LCU), which basically include those taxes and duties that are levied on goods and services. These taxes are used as a proxy for non-distortionary taxes and are obtained from the Algerian National Statistical Office and the Ministry of Finance: General Directorate of Taxes.
***PCE:*** Productive Current Expenditures (constant 1980 prices, LCU), which include current expenditures on education, health, transport and communication, housing, and general public services. Data on these expenditures are obtained from the Ministry of Finance: General Directorate of Budget.
***UCE:*** Unproductive Current Expenditures (constant 1980 prices, LCU), which represent total recurrent expenditures less productive current expenditures, and they mainly include interest payments, subsidies, public administration, and defense expenditure. The data source is the Ministry of Finance: General Directorate of Budget.
***GCE:*** Government Capital Expenditures (constant 1980 prices, LCU) are used as a proxy for public investment and are obtained from the Ministry of Finance: General Directorate of Budget.
***PINV:*** Private Investment (constant 1980 prices, LCU), which represents gross fixed capital formation of the private sector, and it is obtained from the World Bank's World Development Indicators (WDI) database.
***LF:*** denotes total labor force, from the World Bank's World Development Indicators (WDI) database.

### 4.2. Model specification and estimation methods

This study examines the impact of fiscal policy variables on economic growth in Algeria over the period 1970-2015 using the following model:

$$\mathrm{LNGDP_t} = \beta_0 + \beta_1 \mathrm{LNDT_t} + \beta_2 \mathrm{LNIDT_t} + \beta_3 \mathrm{LNPCE_t} + \beta_4 \mathrm{LNUCE_t} + \beta_5 \mathrm{LNGCE_t} +$$

$$+\beta_6 \mathrm{LNPINV_t} + \beta_7 \mathrm{LNLF_t} + \varepsilon_t$$

where LNGDP represents the natural log of gross domestic product, LNDT and LNIDT are natural logs of direct taxation and indirect taxation, LNPCE and LNUCE are natural logs of productive current expenditures and unproductive current expenditures, respectively, LNGCE stands for the natural log of government capital expenditures, LNPINV is the natural log of private investment, LNLF denotes the natural log of labor force, and $\varepsilon_t$ is a white noise error term with zero mean, constant variance and no autocorrelation.

The purpose of taking the natural logarithm is to normalise the data and linearise the relationship between variables.

We use the Johansen and Juselius cointegration test (1990) (which is based on two likelihood ratio test statistics, namely the trace and the maximum eigenvalue statistics) in order to investigate the existence of long-run relationships among the variables included in the model, then we employ a Vector Error Correction Model (VECM) to identify the long-

run and short-run dynamic relationships that exist between the various time series. Finally, we apply both impulse response functions and variance decomposition to examine the dynamic interactions among the variables in the system, through employing Eviews 8.0 software package.

## 4.3. Analysis of empirical results

### 4.3.1. Phillips Perron unit root test

**Table 2.** *Phillips Perron unit root test*

| | Level | | | First Difference | | |
|---|---|---|---|---|---|---|
| | Intercept | Trend & Intercept | None | Intercept | Trend & Intercept | None |
| LNGDP | -1.515816<br>(-2.928142) | -2.090876<br>(-3.513075) | 5.235178<br>(-1.948313) | -8.473323*<br>(-2.929734) | -8.873289*<br>(-3.515523) | -5.792176*<br>(-1.948495) |
| LNDT | 0.043084<br>(-2.928142) | -1.116246<br>(-3.513075) | 2.822549<br>(-1.948313) | -5.187905*<br>(-2.929734) | -5.171102*<br>(-3.515523) | -4.403179*<br>(-1.948495) |
| LNIDT | -1.201664<br>(-2.928142) | -1.891038<br>(-3.513075) | 2.610601<br>(-1.948313) | -6.419397*<br>(-2.929734) | -6.380145*<br>(-3.515523) | -5.559596*<br>(-1.948495) |
| LNPCE | 0.105088<br>(-2.928142) | -1.516636<br>(-3.513075) | 4.620532<br>(-1.948313) | -5.259727*<br>(-2.929734) | -5.175001*<br>(-3.515523) | -4.067398*<br>(-1.948495) |
| LNUCE | -1.131889<br>(-2.928142) | -2.959026<br>(-3.513075) | 3.753304<br>(-1.948313) | -7.051644<br>(-2.929734) | -7.167617*<br>(-3.515523) | -5.934486*<br>(-1.948495) |
| LNGCE | -1.120178<br>(-2.928142) | -2.238164<br>(-3.513075) | 2.486153<br>(-1.948313) | -5.553407*<br>(-2.929734) | -5.468213*<br>(-3.515523) | -5.029046*<br>(-1.948495) |
| LNPINV | -0.725474<br>(-2.928142) | -1.914202<br>(-3.513075) | 2.156391<br>(-1.948313) | -4.823106*<br>(-2.929734) | -4.742100*<br>(-3.515523) | -4.569316*<br>(-1.948495) |
| LNLF | -1.247546<br>(-2.928142) | -1.175574<br>(-3.513075) | 4.455234<br>(-1.948313) | -6.295140*<br>(-2.929734) | -6.436177*<br>(-3.515523) | -4.764745*<br>(-1.948495) |

** indicates statistically significant at 5% level of significance. (Test critical values at 5% level of significance).*
**Source:** Author's computation using Eviews 8.0.

According to the table above, the Phillips Perron value is greater than the critical t-value at the 5% significance level for the following variables: LNGDP, LNDT, LNIDT, LNPCE, LNUCE, LNGCE, LNPINV and LNLF. Thus, null hypothesis of a unit root is accepted and these variables are not stationary at their levels. Then again, after first differencing the previously mentioned variables, the null hypothesis of a unit root in the PP test can be rejected at the 5% level, so these variables are integrated of the order one I(1). Hence, we can now proceed with the Johansen-Juselius cointergation test.

### 4.3.2. Johansen cointegration test

#### 4.3.2.1. Lag-Length Selection

Before using Johansen's cointegration approach to investigate the existence of a long-run relationship between fiscal policy variables and economic growth, we determine the optimal lag length by employing VAR lag order selection criteria. The results indicate that one (1) lag is the suitable lag length for our model (Appendix 1).

#### 4.3.2.2. Trace and maximum eigenvalue tests

**Table 3.** *Results of the Johansen cointegration test*

| Null Hypothesis | Eigenvalue | Trace Statistic $\lambda_{trace}$ | 0.05 Critical Value | Prob. | Max-Eigen Statistic $\lambda_{max}$ | 0.05 Critical Value | Prob. |
|---|---|---|---|---|---|---|---|
| $r = 0$ | 0.729873 | 200.2811* | 159.5297 | 0.0000 | 57.59005* | 52.36261 | 0.0134 |
| $r \leq 1$ | 0.640361 | 142.6911* | 125.6154 | 0.0030 | 44.99685 | 46.23142 | 0.0674 |
| $r \leq 2$ | 0.530256 | 97.69423* | 95.75366 | 0.0365 | 33.24493 | 40.07757 | 0.2397 |
| $r \leq 3$ | 0.461611 | 64.44930 | 69.81889 | 0.1245 | 27.24368 | 33.87687 | 0.2505 |
| $r \leq 4$ | 0.375437 | 37.20561 | 47.85613 | 0.3379 | 20.71091 | 27.58434 | 0.2941 |
| $r \leq 5$ | 0.219365 | 16.49470 | 29.79707 | 0.6770 | 10.89652 | 21.13162 | 0.6576 |
| $r \leq 6$ | 0.100519 | 5.598182 | 15.49471 | 0.7424 | 4.661230 | 14.26460 | 0.7838 |
| $r \leq 7$ | 0.021069 | 0.936951 | 3.841466 | 0.3331 | 0.936951 | 3.841466 | 0.3331 |

**Source:** Author's computation using Eviews 8.0.

As can be seen from Table 3, the Trace test and the Maximum Eigenvalue test yield different results regarding the number of cointegrating vectors. The Trace test successively rejects the null hypothesis of zero, at most one, and at most two cointegrating vectors because the Trace statistic is greater than the critical value at the 5% significance level, while the null hypothesis of at most three cointegrating vectors cannot be rejected. Hence, the Trace test confirms the presence of three cointegrating equations between the following variables: LNGDP, LNDT, LNIDT, LNPCE, LNUCE, LNGCE, LNPINV and LNLF. The Maximum Eigenvalue test, on the other hand, accepts the null hypothesis of one cointegrating equation because the Maximum Eigenvalue statistic is less than the critical value at the 5% significance level. Thus, there exists a long-run relationship between the variables under study.

Despite these conflicting results, we rely on the Maximum Eigenvalue test results because Johansen and Juselius (1990) have argued that the Maximum Eigenvalue statistic might perform better than the Trace statistic (Herzberg, 2015). Enders (2010) has also stated that the Maximum Eigenvalue test has the sharper alternative hypothesis and it is usually preferred to identify the number of cointegrating vectors (Hertrich, 2013).

#### 4.3.2.3. Cointegrating equation

$$\text{LNGDP} = -0.112326\ \text{LNDT} + 0.594369\ \text{LNIDT} + 0.180019\ \text{LNPCE} - 0.144427\ \text{LNUCE}$$
$$(0.05249) \qquad (0.08929) \qquad (0.06875) \qquad (0.05318)$$
$$-0.054599\ \text{LNGCE} - 0.029065\ \text{LNPINV} + 0.402464\ \text{LNLF} + \text{e}_\text{t}$$
$$(0.03150) \qquad (0.03449) \qquad (0.04507)$$

$(\cdot) =$ Standard errors.

The cointegrating equation shows that long-run economic growth is significantly adversely affected by direct taxes, since these taxes reduce incentives to invest in physical and human capital, and thus hinder economic growth. Likewise, indirect taxes have a significant long-term positive impact on real GDP, indicating that such taxes do not discourage investment in physical and human capital, because they are considered as non-distortionary with

respect to economic activity and growth; hence, this type of tax revenue may represent a better method of financing public investment. Productive current expenditures display a significant positive effect on long-run economic growth, and this is consistent with theory, that highlights the crucial role of productive public spending in raising the marginal product of private capital, thereby promoting economic growth. By contrast, there is a statistically significant negative association between real GDP and unproductive current expenditures, this can be explained by the fact that these expenditures are often ineffective, since they mainly include spending on general public administration, defense and internal security; hence, they do not lead to any increase in the marginal product of private capital. On the other hand, government capital expenditures exert a significant negative effect on economic growth at the 10% level of significance, reflecting that most public investment projects have not achieved the desired results, especially with regard to future growth plans. This result is consistent with those obtained by Devarajan et al. (1996) and Ghosh and Gregoriou (2006), who find that the capital component of public expenditure is negatively associated with economic growth. Also in contrast to the theoretical prediction, the estimated coefficient of private investment has a negative sign but is not statistically significant even at the 10% level. This suggests that the overall level of private investment in Algeria is still relatively low and is not sufficient to generate long-term growth. Finally, labor force has a positive and highly significant impact on real GDP, highlighting the fact that more skilled and trained labor produces more output.

### 4.3.3. Vector error correction model

The VECM equation (where D(LNGDP) is a dependent variable) has been estimated using the least squares method in order to obtain the p-value for each coefficient.

**Table 4.** *OLS Estimation Results for the Vector Error Correction Model*

| Dependent Variable: D(LNGDP)<br>Method: Least Squares<br>Sample (adjusted): 1972 2015<br>Included observations: 44 after adjustments | | | | |
|---|---|---|---|---|
| D(LNGDP) = C(1)*( LNGDP(-1) + 0.112326497002*LNDT(-1) - 0.594368829775*LNIDT(-1) - 0.180019372846*LNPCE(-1) + 0.144426838665*LNUCE(-1) + 0.0545989662006*LNGCE(-1) + 0.0290651963356*LNPINV(-1) - 0.402464181428*LNLF(-1) - 9.7474792248 ) + C(2)*D(LNGDP(-1)) + C(3)*D(LNDT(-1)) + C(4) *D(LNIDT(-1)) + C(5)*D(LNPCE(-1)) + C(6)*D(LNUCE(-1)) + C(7) *D(LNGCE(-1)) + C(8)*D(LNPINV(-1)) + C(9)*D(LNLF(-1)) + C(10) | | | | |
| | Coefficient | Std. Error | t-Statistic | Prob. |
| C(1) | -0.456687 | 0.058560 | -7.798601 | 0.0000 |
| C(2) | -0.267407 | 0.076482 | -3.496336 | 0.0013 |
| C(3) | 0.043401 | 0.026234 | 1.654384 | 0.1073 |
| C(4) | -0.102825 | 0.056168 | -1.830668 | 0.0759 |
| C(5) | -0.065500 | 0.033688 | -1.944338 | 0.0602 |
| C(6) | 0.025128 | 0.021172 | 1.186862 | 0.2435 |
| C(7) | 0.064532 | 0.020846 | 3.095712 | 0.0039 |
| C(8) | 0.042555 | 0.027393 | 1.553472 | 0.1296 |
| C(9) | -0.145501 | 0.066389 | -2.191632 | 0.0354 |
| C(10) | 0.050954 | 0.005447 | 9.355008 | 0.0000 |
| ***R-squared*** | 0.780944 | | | |
| ***F-statistic*** | 13.46790 | | | |
| ***Prob(F-statistic)*** | 0.000000 | | | |

**Source:** Author's computation using Eviews 8.0.

The VECM equation (where D(LNGDP) is a dependent variable) is as follows:

D(LNGDP) = **- 0.456687296457***( LNGDP(-1) + 0.112326497002*LNDT(-1) - 0.594368829775*LNIDT(-1) - 0.180019372846*LNPCE(-1) + 0.144426838665*LNUCE(-1) + 0.0545989662006*LNGCE(-1) + 0.0290651963356*LNPINV(-1) - 0.402464181428*LNLF(-1) - 9.7474792248 ) - 0.267406934413*D(LNGDP(-1)) + 0.0434007321932*D(LNDT(-1)) - 0.102824830442*D(LNIDT(-1)) - 0.0654999725001*D(LNPCE(-1)) + 0.0251282563605*D(LNUCE(-1)) + 0.0645324914557*D(LNGCE(-1)) + 0.0425545664311*D(LNPINV(-1)) - 0.145501034483*D(LNLF(-1)) + 0.0509543738934

#### 4.3.3.1. The long run causality

According to Table 4, the coefficient of the error correction term C(1) is negative and highly significant at 1% level of significance, and this emphasizes the existence of a long-run relationship between the dependent variable (LNGDP) and the independent variables (LNDT, LNIDT, LNPCE, LNUCE, LNGCE, LNPINV and LNLF).

#### 4.3.3.2. The short run causality

Government capital expenditures exhibit a positive and statistically significant influence on economic growth in the short run. Likewise, direct taxes, unproductive current expenditures and private investments have a positive but insignificant impact on real GDP. In contrast, labor force, indirect taxes and productive current expenditures display a significant negative short-term effect on economic growth.

- **The short run causality of direct taxes**

The p-value of the Wald test chi-square statistic (0.0980) exceeds 0.05. Thus, the null hypothesis (which indicates that LNDT does not cause LNGDP in the short term) has been accepted (Appendix 2).

- **The short run causality of indirect taxes**

The Wald test chi-square statistic is statistically insignificant at the 5% significance level. Hence, the alternative hypothesis has been rejected and indirect taxes do not cause economic growth in Algeria (Appendix 2).

- **The short run causality of productive current expenditures**

The p-value of the Wald test chi-square statistic (0.0519) is greater than 0.05. Therefore, the null hypothesis (which indicates that LNPCE does not cause LNGDP in the short term) cannot be rejected (Appendix 2).

- **The short run causality of unproductive current expenditures**

The Wald test chi-square statistic is not significant at the 5% level of significance. Thus, the null hypothesis has been accepted, which means that unproductive current expenditures do not cause real GDP in the short term (Appendix 2).

- **The short run causality of government capital expenditures**

The p-value of the Wald test chi-square statistic (0.0020) is less than 0.05. Hence, the alternative hypothesis has been accepted, in other words there is a short-run unidirectional causality running from LNGCE to LNGDP (Appendix 2).

- **The short run causality of private investment**

The p-value of the Wald test chi-square statistic (0.1203) exceeds 0.05. Thus, the null hypothesis (which indicates that LNPINV does not cause LNGDP in the short run) has been accepted (Appendix 2).

- **The short run causality of labor force**

The p-value of the Wald test chi-square statistic (0.0284) is smaller than 0.05. Therefore, the null hypothesis has been rejected and labor force causes economic growth in the short term (Appendix 2).

#### 4.3.4. Diagnostic tests of Vector Error Correction Model (VECM)

**Table 5.** *Diagnostic tests of Vector Error Correction Model (VECM)*

| *Test* | *Obs*R-squared* | *Prob. Chi-Square* | *Probability* |
|---|---|---|---|
| *Heteroskedasticity Test: Breusch-Pagan-Godfrey* | 23.09768 | 0.1111 | |
| *Heteroskedasticity Test: ARCH* | 0.218294 | 0.6403 | |
| *Breusch-Godfrey Serial Correlation LM Test* | 0.280784 | 0.5962 | |
| *Jarque Bera Normality Test* | | | 0.9436 |

**Source:** Author's computation using Eviews 8.0.

The table above summarizes the main results of the diagnostic tests. Breusch-Pagan-Godfrey test confirms the assumption of homoscedasticity, since the Prob. $Chi^2 = 0.1111$ that accompanies the amount ($Obs*R^2$) exceeds 0.05. Moreover, ARCH test asserts the absence of ARCH effect (Prob. $Chi^2 = 0.6403 > 0.05$). Furthermore, The Breusch-Godfrey Serial Correlation LM test reveals that there is no serial correlation, because the Prob. $Chi^2 = 0.5962$ is greater than 0.05. Also, The Jarque Bera normality test accepts the null hypothesis which indicates that the residuals are normally distributed, since the Prob. (Jarque-Bera) = 0.9436 exceeds 0.05. All these diagnostic tests indicate that the Vector Error Correction Model is well specified.

#### 4.3.5. Impulse response of LNGDP to one standard deviation innovations (Appendix 3)

- **The Response of LNGDP to One Standard Deviation LNDT shock**

A positive LNDT shock causes a rise of 0.0025 units in LNGDP in the second year, then it decreases and becomes negative with a value of -0.00098 units in the next fifth year, after that it continues declining to reach its lowest value of -0.0026 in the next tenth period.

- **The Response of LNGDP to One Standard Deviation LNIDT shock**

By giving one standard deviation LNIDT shock, LNGDP rises to 0.0143 units in the second year, then it continues to increase in the positive direction, reaching its highest value of 0.0377 units in the next tenth year.

- **The Response of LNGDP to One Standard Deviation LNPCE shock**

By giving one positive LNPCE shock, LNGDP becomes negative for one-time during the ten years with a value of -0.00043 units in the second year, then it rises slowly to its maximum positive value (0.0212 units) in the next tenth period.

- **The Response of LNGDP to One Standard Deviation LNUCE shock**

A positive LNUCE shock has an immediate negative impact on LNGDP which reaches -0.0034 units in the second year, then it continues to decrease smoothly, reaching its lowest value of -0.0157 units in the next tenth period.

- **The Response of LNGDP to One Standard Deviation LNGCE shock**

A positive LNGCE shock leads to rise LNGDP by 0.0051 units in the second year, and it witnesses a slight fall to 0.0047 units in the third year but it increases again to reach its highest value of 0.0069 units in the next tenth year.

- **The Response of LNGDP to One Standard Deviation LNPINV shock**

LNGDP rises to 0.0024 units in the second year as a result of giving one standard deviation LNPINV shock, then it enters to the negative field with a value of -0.00072 units in the next third year and it decreases continuously to reach its lowest value of -0.0012 units in the next fifth period, after that it increases slightly again to -0.00018 units in the next tenth year.

- **The Response of LNGDP to One Standard Deviation LNLF shock**

By giving one positive LNLF shock, LNGDP rises to 0.0018 units in the second year, then it continues to increase in the positive direction, reaching its highest value of 0.0128 units in the next tenth year.

#### 4.3.6. Variance decomposition analysis (Appendix 4)

The forecast error variance in LNGDP reaches 0.0212 units in the first period, then it sees a slight increase to 0.1263 units in the tenth period and this is due to the combination of the following independent variables LNDT, LNIDT, LNPCE, LNUCE, LNGCE, LNPINV and LNLF.

In the short term (the second year), 67.97% of the forecast error variance of LNGDP is explained by its own innovations, followed by LNDT (0.78%), LNIDT (25.36%), LNPCE (0.02%), LNUCE (1.50%), LNGCE (3.24%), LNPINV (0.73%) and LNLF (0.40%).

In the medium term (the fifth period), 27.42% of the variability in LNGDP is explained by its own shocks, while 0.17% is due to LNDT's shocks, 47.64% of LNIDT's shocks, 9.81% of LNPCE's shocks, 8.92% of LNUCE's shocks, 2.68% of LNGCE's shocks, 0.20% of LNPINV's shocks and 3.15% to LNLF's shocks.

In the long term (the tenth period), 15.26% of innovations in LNGDP is caused by its own past values, followed by LNDT (0.20%), LNIDT (52.81%), LNPCE (14.73%), LNUCE (9.51%), LNGCE (2.14%), LNPINV (0.06%) and LNLF (5.29%).

These results indicate that indirect taxes explain the largest proportion of the forecast error variance of LNGDP, while productive current expenditures represent the second key determinant of LNGDP, whereas unproductive current expenditures, labor force, government capital expenditures, direct taxes and private investment play a minor role in interpreting the forecast error variance of LNGDP.

## 5. Conclusion

The present paper examines the impact of fiscal policy on economic growth in Algeria over the period 1970-2015, by using Johansen cointegration test and vector error correction model (VECM). The main findings indicate that there is a long run equilibrium relationship between economic growth and fiscal policy variables and the VECM confirms the existence of this relationship. It is also revealed that both indirect taxes and productive current expenditures have a significant long-term positive impact on real GDP, while direct taxes, capital and unproductive recurrent expenditures negatively and significantly affect economic growth in the long run.

In the light of the results obtained from this study, it could be concluded that the government should hedge against the mounting risks and challenges by underpinning public financial management reforms, strengthening supervisory and transparency practices, improving tax administration, and fighting tax evasion. There is also a pressing need to seek more sources of non-oil revenue by embarking on a feasible and publicly palatable privatization scheme, speeding up the reform of the state-dominated banking sector, lessening the bureaucratic burden that weighs heavily on private entrepreneurship, and developing a dynamic business environment. On the other hand, the limited financial resources available to Algeria should be wisely used in order to stay the course by restraining discretionary spending, keeping a watchful eye on public sector wages, phasing out energy subsidies, containing social transfers and better targeting them toward categories that lack the purchasing power. Furthermore, it is worthwhile to note that sustainable economic growth requires serious policy measures aimed at diversifying the Algerian economy.

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**Appendix 1**. *VAR lag order selection criteria*

VAR Lag Order Selection Criteria
Endogenous variables: LNGDP LNDT LNIDT LNPCE LNUCE LNGCE LNPINV LNLF
Exogenous variables: C
Sample: 1970 2015
Included observations: 45

| Lag | LogL | LR | FPE | AIC | SC | HQ |
|---|---|---|---|---|---|---|
| 0 | 82.78844 | NA | 4.97e-12 | -3.323931 | -3.002746 | -3.204196 |
| 1 | 388.8814 | 489.7488* | 1.10e-16* | -14.08362* | -11.19296* | -13.00601* |

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

**Appendix 2**. *The short run causality*

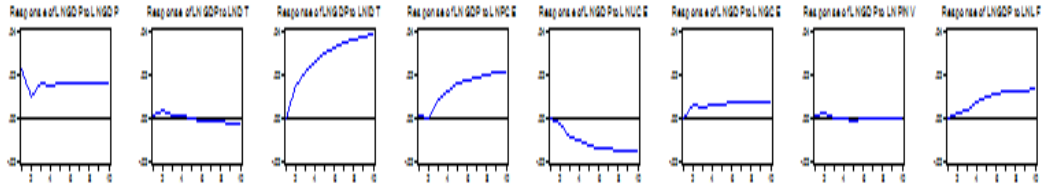
VEC Granger Causality/Block Exogeneity Wald Tests
Sample: 1970 2015
Included observations: 44

Dependent variable: D(LNGDP)

| Excluded | Chi-sq | df | Prob. |
|---|---|---|---|
| D(LNDT) | 2.736988 | 1 | 0.0980 |
| D(LNIDT) | 3.351346 | 1 | 0.0672 |
| D(LNPCE) | 3.780450 | 1 | 0.0519 |
| D(LNUCE) | 1.408643 | 1 | 0.2353 |
| D(LNGCE) | 9.583434 | 1 | 0.0020 |
| D(LNPINV) | 2.413275 | 1 | 0.1203 |
| D(LNLF) | 4.803253 | 1 | 0.0284 |
| All | 21.82634 | 7 | 0.0027 |

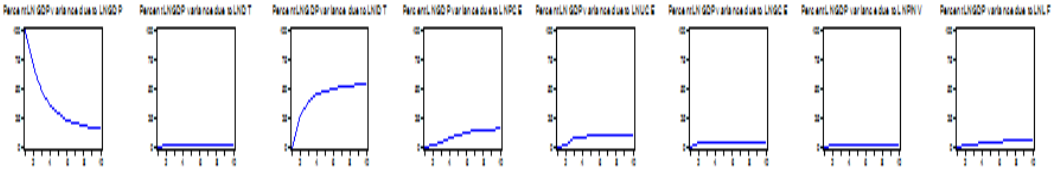
**Appendix 3**. *Impulse response of LNGDP to one standard deviation innovations*

| Response of LNGDP: | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Period | LNGDP | LNDT | LNIDT | LNPCE | LNUCE | LNGCE | LNPINV | LNLF |
| 1 | 0.021259 | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 |
| 2 | 0.009806 | 0.002504 | 0.014301 | -0.000437 | -0.003474 | 0.005109 | 0.002419 | 0.001804 |
| 3 | 0.015552 | 0.000705 | 0.020663 | 0.008184 | -0.009859 | 0.004733 | -0.000729 | 0.003692 |
| 4 | 0.014244 | 0.000298 | 0.025358 | 0.011933 | -0.011134 | 0.005941 | -0.000947 | 0.006676 |
| 5 | 0.015582 | -0.000985 | 0.029537 | 0.015251 | -0.012993 | 0.006089 | -0.001264 | 0.008976 |
| 6 | 0.015236 | -0.001502 | 0.032123 | 0.017164 | -0.013750 | 0.006339 | -0.000826 | 0.010399 |
| 7 | 0.015551 | -0.002002 | 0.034350 | 0.018683 | -0.014565 | 0.006496 | -0.000639 | 0.011402 |
| 8 | 0.015489 | -0.002264 | 0.035808 | 0.019763 | -0.015064 | 0.006669 | -0.000397 | 0.012020 |
| 9 | 0.015602 | -0.002501 | 0.036973 | 0.020613 | -0.015496 | 0.006804 | -0.000285 | 0.012479 |
| 10 | 0.015615 | -0.002659 | 0.037781 | 0.021239 | -0.015788 | 0.006913 | -0.000183 | 0.012802 |



**Appendix 4**. *Variance decomposition analysis*

| Variance Decomposition of LNGDP: | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Period | S.E. | LNGDP | LNDT | LNIDT | LNPCE | LNUCE | LNGCE | LNPINV | LNLF |
| 1 | 0.021259 | 100.0000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 |
| 2 | 0.028397 | 67.97165 | 0.777621 | 25.36417 | 0.023691 | 1.496434 | 3.237066 | 0.725968 | 0.403402 |
| 3 | 0.040944 | 47.12154 | 0.403648 | 37.66947 | 4.006610 | 6.517696 | 2.893197 | 0.380921 | 1.006917 |
| 4 | 0.053568 | 34.59954 | 0.238919 | 44.41478 | 7.303051 | 8.128095 | 2.920410 | 0.253773 | 2.141426 |
| 5 | 0.067130 | 27.41962 | 0.173648 | 47.64225 | 9.811506 | 8.921966 | 2.682379 | 0.197036 | 3.151595 |
| 6 | 0.080034 | 22.91491 | 0.157386 | 49.62738 | 11.50210 | 9.228737 | 2.514571 | 0.149268 | 3.905644 |
| 7 | 0.092547 | 19.96072 | 0.164477 | 50.89048 | 12.67723 | 9.378760 | 2.373252 | 0.116405 | 4.438678 |
| 8 | 0.104397 | 17.88769 | 0.176280 | 51.75758 | 13.54612 | 9.452518 | 2.273130 | 0.092925 | 4.813760 |
| 9 | 0.115683 | 16.38676 | 0.190305 | 52.36598 | 14.20707 | 9.492389 | 2.197176 | 0.076287 | 5.084027 |
| 10 | 0.126384 | 15.25576 | 0.203693 | 52.81019 | 14.72715 | 9.513492 | 2.140046 | 0.064124 | 5.285542 |



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# Financial conditions index (FCI), inflation and growth: Some evidence

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**Abstract.** *This paper first estimate financial conditions index (FCI) for India and then examines the empirical performance of the financial conditions index (FCI) to predict inflation and GDP growth. For optimal coverage of all major set of indicators, those which are determining the Indian economies, financial conditions, so we have broken financial conditions index into four sub-indices including major key indicator. The sub –indices of FCI include (i) short term rate of interest (CMR), (ii) exchange rate, (iii) housing price index (iv) FDI total inflow, each with equal weights. Based on granger causality and correlation test with quarterly data, the finding of this paper is the financial condition index is able to predict inflation bitterly.*

**Keywords:** monetary conditions index, financial conditions index, housing price index.

**JEL Classification:** B22, E44, E31, F43.

## 1. Introduction

The main aim of monetary authority is to maintain monetary stability in economy with less inflation and more economic growth. For more monetary stability and proper functioning of the financial economy, sound financial conditions in an economy play an important role. Individual indicators like the exchange rate, short term interest rate, asset pricing and so on are the most important part of monetary policy. The lack of stability of these variables has affected economic growth and inflation of a country.

Monetary conditions index (MCI) is a weighted average of changes in monetary as well as financial variables in which the weights are intended to reflect the effect of these-variable on macro-economic variable such as inflation and economic growth. Freedman (1994) first proposed the construction of a monetary conditions index (MCI) and arguing that MCI being a weighted sum of the short-term interest rate and the exchange rate, is preferable to the interest rate and exchange rate alone as an operating target for a small open economy. In empirically we can say, an MCI is nothing but a simple weighted average of changes in an interest rate and an exchange rate relative to their, values in a base period. The estimated relative effects of interest rate and exchange rate on aggregate demand over some period is reflected by the weights given to those variables. Till now MCIs are, however, continue to be calculated by central banks and international organizations as an indicator for the stance of monetary policy. Currently MCIs are not only used as indicators of monetary conditions but also as operational short-run targets for monetary policy.

A financial conditions index is a simple device that combines moments in different financial variables such as short term interest rate, exchange rate, total FDI inflow and housing price. FCI is an extension of the monetary conditions index (MCI), including of total FDI inflows and housing price with later for covering of major set of indicator, which are related to the financial condition so that it becomes easy-to-understand information variable to financial markets. The study of financial conditions index (FCI) is of particular interest to the monetary authority since this can serve as information variables or even transmission variables, in the conduct of monetary policy. The relationships between the financial conditions index and other macro variables such as inflation and GDP growth can also be used to forecast changes in these latter variables. In this light, central banks are interested in choosing FCI that would act as useful indicators. For conduct of monetary policy and FCI can serve as a short-term operating target.

This paper first estimate financial conditions index (FCI) and then examines the empirical performance of the financial conditions index (FCI) to predict inflation and GDP growth. For optimal coverage of all major set of indicators, those which are determining the Indian economies, financial conditions, so I have broken financial conditions index into four sub-indices including major key indicator. The sub –indices of FCI include (i) short term rate of interest (CMR), (ii) exchange rate, (iii) housing price index (iv) FDI total inflow, each with equal weights.

## Extension of MCI to FCI

Individual indicators like the exchange rate, short-term interest rate, asset pricing and so on are the most important part of monetary policy. These variables are volatile over time to time and its volatility also depends on policy rules. The lack of stability of these variables has affected economic growth and inflation of a country. Due to inflation and economic growth are uncertain as measure by conditional variance has increased, it makes harder for forecasting inflation and growth. So, to identifying the appropriate indicators which could help for anticipating inflation and growth is important. From the prediction of inflation and economic growth central bank can take proper policy rules for it with a series of tools to anticipate future price pressured and change in economic activity. Individual indicators also have some limitations, one individual indicator is not sufficient for predicting the macro variable of the country as many other variables are also affecting it at the same time. So more than one individual variables are necessary for predicting the goal variable because these variables are simultaneously affecting to these goal variables. As inflation and economic growth influence of many macro-economic variables like short-term rate of interest, exchange rate, FDI and so on, so we need to take all these variables into account for prediction of inflation and economic growth.

The MCI is a composite index which measures changes in monetary as well as financial variables. In a pioneering study, Freedman (1994) constructed a MCI by combining both exchange rate and short term interest rate instead of taking single indicators. The estimated relative effects of interest rate and exchange rate on aggregate demand over some period are reflected by the weights given to those variables. Till now MCIs are, however, continue to be calculated by central banks and international organizations as an indicator of the stance of monetary policy. Currently, MCIs are not only used as indicators of monetary conditions but also as an operational short-run target for monetary policy.

So in simply MCI is a weighted average of short-term rate of interest (to capturing the interest rate-channel effect of monetary policy) and real exchange rate (to capturing the exchange rate channel effect of monetary policy).

So it's usually defined as:

$$MCIt = w1(rt - r0) + w2(et - e0) \quad (1)$$

Where “MCIt” is the monetary conditions index for time period t (current time period), “r” is the short-term rate of interest, e is the natural logarithm of the exchange rate. In short-term comparison, an MCI can be constructed in real or nominal term because the difference is negligible. Whether we should give equal weight to all the variations or different weights to variables that depend on the importance of that variable to monetary policy. For assigning unequal weight, those weights are estimated by using the following strategies:

a. Simulations on a structural macro-econometric model.
b. Estimation of reduced–form aggregate demand equation.
c. Estimation of structural vector auto-regression (VAR) system.

The financial conditions index is nothing, just an extension of the monetary conditions index. It is a simple device that combines moments in different financial variables such as

short-term interest rate, exchange rate, total FDI inflow and housing price. It is an extension of the monetary conditions index (MCI), including of total FDI inflows and housing price with later for covering of a major set of indicator, which is related to the financial condition so that it becomes easy-to-understand information variable to financial markets. It is more efficient for prediction of inflation of economic growth than other individual variables and monetary conditions index, as it takes more relevant variables into accounts for prediction.

The financial conditions index can be express by

FCI = f (interest rate, exchange rate, HPI, FDI). (2)

### Component of FCI

This work tries to construct the financial conditions index (FCI) and then after a predictive power of the FCI is checked by using econometric tools. The following components are selected for the Indian context.

**i. Interest rate**

The interest rate channel is a most important tool of monetary policy, price level, output and employment are affected by a policy-induced changes in short-term rates of interest by a central bank. Expectation hypothesis describe, the rise in the short-term interest rate leads to rising in the long term interest rate, it is postulated by interest rate channel. This change affects the real interest rate directly and indirectly to the cost of capital because assumption taken for short-run is the sticky price. The interest rate mechanism is given emphasis on the real interest rate rather than the nominal interest rate, which is one most important feature of it. Interest rate-channel defines by a coming diagram of monetary expansion:

$M\uparrow \Rightarrow ir\downarrow \Rightarrow I\uparrow \Rightarrow Y\uparrow$

Where M↑ represents the increase in money supply (expansionary monetary policy) leads to a decrease in short-term real interest rate, which lowers the cost of capital so rise in investment, and finally increase in aggregate demand and employment.

**ii. Exchange rate**

In an open economy and the coming of the flexible exchange rate, more attention has been given to monetary-transmission operating through exchange rate effect on net export. It also involves the effects of interest rate because the fall in the exchange rate for a currency occurs always with fall in domestic real interest rate, which leads to lower the value of that domestic currency. So domestic good becomes cheaper than foreign goods, by that causing an increase in net exports. The increase in net exports leads to increase aggregate output.

Exchange rate-channel defines by a coming diagram of monetary expansion:

$M\uparrow \Rightarrow ir\downarrow \Rightarrow E\uparrow \Rightarrow NX\uparrow \Rightarrow Y\uparrow$

**iii. Housing price in India**

Recent housing price fluctuation makes an important place of it in monetary policy. Transmission mechanisms of monetary policy beyond the standard interest rate and exchange rate-channel many other channels also affect it, we can give focus on housing

price due its recent fluctuation. Fluctuation in this housing price is likely to play an important role in how monetary policy has conducted.

A volatility in housing price directly or indirectly affects the households by affecting the value of wealth and hence its influence in the spending and borrowing decision of households. Stock and property prices recent volatility has renewed the interest towards the role of the asset for monetary policy. Forward moments in housing prices have raised the concerns about the appropriate stance of monetary policy with a different direction moment in financial markets. Housing prices are monitored monthly by the Reserve bank of India (RBI) in India. It is observed from the study of RBI for the last three years that in India annual average housing price increase is 20 per. So India has experienced significant housing market volatility in recent time like other countries.

### Housing price index

To measure the moment of single –family housing prices, the housing price index is used. It is a weighted, repeated–sales index to measure average changes in repeat sales or refinancing of some property. Rent paid for rented, self-owned house and rented free houses are taken in assembling the housing index.

The Housing price index is estimated by the reserve bank of India and it's based on the monthly consumer price index (CPI) for industrial workers. This index is a simple measure of housing price in India. The RBI compelling HPI individually for nine major cities as well as for the all-India level, these cities are Mumbai, Delhi, Chennai, Kolkata, Bengaluru, Lucknow, Ahmedabad, Jaipur and Kanpur. It used Laspeyres index based on transaction price and Q4:2008-09 taken as based year for it. Data's for HPI are available in quarterly basis in official side of RBI.

**iv. Total FDI inflow into India**

Foreign direct investment (FDI) refers to the inflow of foreign capital in terms of direct investment equity flows in the reporting country. It is just the sum of earnings, equity capital and other capital. To the prospect of skilled work force and good economic growth large amount of Foreign direct investment are attracted in opening economies than in highly regulated closed economies.

Financial and capital account liberalization in India facilitates to increasing capital flow into it. The post-globalization period has involved economic liberalization, it's opening-up economies to international trade and financial inflows. Total FDI inflows into India fluctuates time-to-time, which also impact to monetary policy. FDI inflow is more crucial to the economic growth enhancement (Hansan and Rand, 2006) because it brings technology, capital, and know how into the developing countries like India. And it also increases the stock of knowledge in the host countries by transferring knowledge through giving training to labor, transfer of skills, etc. It promotes more advanced technology into the host country, so it thought to open the export market and improve BOP in the host country. So India has also experienced a significant increase in total FDI inflow into it in recent time like other developing countries.

### Research gap

There are several studies found in the context of both advanced and emerging economies. However, there are very few studies done in the context of India to calculate FCI. The past studies have not accounted some of the important variables, such as FDI, housing price index, etc., in the construction of FCI. So there is a scope of the study to focus on expanding MCI to FCI by adding total FDI inflow and housing prices.

### Objective of the study

For checking the short term financial conditions, financial conditions index (FCI) has served as a crucial indicator in Indian economy. The financial conditions Index is very helpful for forecasting the turning points in financial conditions. It helps in facilitating policy decision for a country by providing effective monitoring of current condition. Our study mainly focuses on three objectives:

1. Constructing a Financial conditions index (FCI) for India.
2. Testing the predictive ability of Financial conditions Index (FCI) for inflation.
3. Testing the predictive ability of Financial conditions Index (FCI) for GDP growth.

## 2. Model

Here we have described the methods of several time series tests and statistical tools. A detailed description is given about the procedure of testing the time series models. The methodology of unit root tests like Augmented dickey-fuller (ADF, 1984), Phillips-Perron (1988) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS, 1992) and Granger causality are described thoroughly.

**Human Development Index method (HDI)**

This method is a very useful method to make a composite index with more than one variable. HDI method first makes index for all individual variable by using formulas

$$\text{x index}=\frac{x-\min(x)}{\max(x)-\min(x)} \qquad (3)$$

Where x is the actual value of x variable, min(x) is the minimum value and max(x) is the maximum value the variable x can attain.

Then by giving equal weight to all those variables, the new composite index is constructed. As recommended by literature review and the theoretical support, we have taken four variables for construction of financial conditions index particularly, call money rate, which acting as a proxy for the rate of interest, exchange rate, housing price index (HPI) and foreign direct investment. Wholesale price index (WPI), which is acting as a proxy for inflation and GDP for factor price at constant cost are taken as goal variables. The reason behind using the housing price index and foreign direct investment in construction of FCI for their importance in the monetary transmission channel. For checking the order of integration of FCI, inflation, and GDP growth, we have used unit root test such as ADF, PP and KPSS. All these test results show that all the variables are of an order I-(1), so we

have taken first difference for all variable to make them stationary. The correlation test and causality test results suggest that there has a long run relation among FCI and inflation.

**Testing of stationary and Unit-root**

The Unit root test is otherwise known as the test of stationary. Getting a significant co-efficient and high value of $R^2$ (which is greater than the DW statistics) by regressing one variable upon another does not imply a meaningful relation exist among these two variable, there may be chance of spurious regression (that high value of $R^2$ due to high and similar trend of these two variables). This unit root test was first introduced to economics by Granger and Newbold (1974). So for a meaningful relationship between two variable, both variable must be stationary. Stationary time series is one which is white noise (constant mean, constant variance and constant covariance of each variable given lag). Based on the fact that a non-stationary time series is defined by unit root, there is some method for testing of stationary such as Dickey and fuller (1979) augmented Dickey-fuller (1984), Phillips Perron (1988) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS,1992).

**i. Augmented Dickey-Fuller (ADF)**. The ADF test is superior to Dickey-Fuller (DF) because it takes the large and complicated set of time series models and it also can be applied where the error term is not white noise. It is used in a test, is a negative number. If it is more negative that means a high chance to reject the null hypothesis that there is unit-root at some confidence level.

The ADF can be written as:

$$\Delta M_t = \theta M_{t-1} + \alpha_1 \Delta M_{t-1} + \alpha_2 \Delta M_{t-2} + \alpha_3 \Delta M_{t-3} + \ldots + \alpha_s \Delta M_{t-s} + e_t \quad (4)$$

Where $\Delta M_t = M_t - M_{t-1}$, "$e_t$" is the pure white noise error term (stochastic term) whose mean is equal to zero variance is constant and no auto-correlation with its lag, $\theta$ is a constant, $\alpha$ is the coefficient on a time trend and "s" is the lag order. To increase in coefficient standard error and reducing autocorrelation, lag "s" is chosen. Optimal lag "s" is chosen using both Akaike (AIC) and Schwartz' Information criterion (SBIC).

**ii. Phillips-Perron (PP) Unit Root test**

Phillips-Perron (PP) Unit Root tests is an alternative method for testing unit root, when a time series is an integrated of order 1. It is the non-augmented Dicky-fuller (DF) by estimates. Phillips and Perrorn suggest this test in 1988. Phillips-Perron (PP) Unit Root tests is based on the dickey-fuller test, where the null hypothesis $\theta = 0$ in $\Delta M_t = \theta M_{t-1} + \alpha_1 \Delta M_{t-1} + \alpha_2 \Delta M_{t-2} + \alpha_3 \Delta M_{t-3} + ... + \alpha_s \Delta M_{t-s} + e_t$, and $\Delta$ is the first difference operator. It has just made the correction over the Augmented Dickey-Fuller (ADF), by making a non-parametric correlation to the t-statistics.

The Phillips-Perron (PP) test is based on following statistics:

$$M_t = \alpha_1 M_{t-1} + \alpha_2 (t - T/2) + v_t \quad (5)$$

Where T is the number of observations, v is the stochastic error term with $E_{wt} = 0$. In Phillips-Perron (PP) unit root test is better to ADF because on PP test there is no assumption like error terms are serially uncorrelated.

**iii. Kwiatkowski-Phillips-Schmidt-Shin (KPSS) Test**

The KPSS test is an alternative method to both ADF and PP test for checking unit root. Unlike ADF and PP test where null hypothesis are taken as non-stationary, KPSS test stationarity in null hypothesis. Both with and with-out trend are reported in chapter-IV for capturing trend stationarity of the variables.

**Correlation test**

The correlation coefficient measures the robustness of the relationship between two variables. The range of correlation coefficient is -1 to +1. So, correlation can be negative or positive, positive correlation Coefficient shows the relationship between two variables is positive means when one variable increase same time another variable also increasing, here we can take an example of income and consumption for simple understanding. Similarly, negative correlation coefficient reflects a negative relation between two variable, here we can take an example of price change of a commodity and demand of that commodity. If the correlation coefficient is zero for two variable, then that implies, there is no relation between those variables. If the value of correlation coefficient is closer to zero that implies there is a very weak relationship between two variables and if value closer to one (neglecting the negative sign) that showing a strong relation between two variable.

**Granger-Causality test**

This test helps to decide whether one-time series is useful in forecasting another or not. But the argument of Civil Granger was that causality could be tested for by measuring the predictable capacity of a time series using the prior value of another time series. So simply it is a statistical concept and is based on the prediction. According to this test, if time series X is Granger-Causes another time series Y that implies past value of X should contain information about Y so that helps predict Y above and beyond the information contained in the prior value of "Y" alone.

To determine the direction of causality between the FCI, inflation and growth this test is done. This test was conducted with a view to knowing, which type of cause and effect relationship present between FCI, inflation, and real GDP growth. Wholesale price Index (WPI) is used as an indicator for inflation, while changes in economic are taken as the rate of growth of GDP. According to Mahdavi and Sohrabian (1989), the following two equations can be specified for inflation and FCI

$$(FCI)t = \alpha + \Sigma\, \beta i(INF)t\text{-}1 + \Sigma Tj(FCI)t\text{-}j + \mu t \qquad (6)$$

$$(INF)t = \theta + \Sigma\, \varphi i\, (FCI)t\text{-}1 + \Sigma\, \psi j\, (INF)t\text{-}1 + \eta t \qquad (7)$$

Where FCI is a Financial conditions index, the INF is inflation, i =1,…, m and j = 1,…, n for equation (6) where as for equation (7) i = 1,…, p and j = 1,…, q.

Four different hypotheses about the relations about the relationship between Inflation and Financial conditions Index (FCI) can be made based on OLS Coefficient (estimated) for equation (6) and (7).

A. Unidirectional Granger-causality from FCI and inflation
B. Unidirectional Granger-causality from inflation and FCI
C. Bidirectional or feedback causality.
D. Independence between GDP and SP.

So by getting one of these results it seems possible to detect the causality relation between Financial conditions Index (FCI) and economic growth of a country.

## 3. Review of literature

An attempt is made to review the major national and international literature examining the construction and performance of the monetary conditions index and financial conditions index. There are few works done on the prediction of output growth and inflation using financial conditions index (FCI), monetary conditions index (MCI), and other economic indicators. This literature review reviews the use of single individual indicators such as the short-term rate of interest, real exchange rate and asset price.

A detailed survey is done regarding the procedure of testing the time series models and other statistical tools. We finally concluded composite index like MCI and FCI are better to predict macro variable like inflation and growth than single individual indicator like short-term interest rate, exchange rate, etc. But FCI gives more accurate results than MCI as it includes some more important financial variables.

**Monetary conditions index (MCI)**
Giving a broad view on MCI, Costa (2000) discussed the interpretation of the monetary conditions index (MCI). She argues that MCI can be used as an indicator of stance of monetary policy. The MCI is calculated as a weighted average of short-term rate of interest and effective exchange rate. Weights are assigned, according to the relative importance of these variables in this economy. A reduction (increase) of the MCI corresponds to looser (tighter) monetary conditions. The MCI value lies between zero to hundred, the exact value MCI depends on the monetary conditions of that country.

R. Kannan et al. (2006) constructed a MCI for India by taking both interest rates-channel and exchange rate-channel simultaneously into account. . They took 1996Q2-2007Q1 data taken into account in this model. The result reveals that the monetary policy is influenced significantly by interest rate rather than exchange rate. Further, they show that MCI works as an effective tool to assess the stance of monetary policy has been more effective to put to gather than individual indicator in order to provide a better assessment of the stance of monetary policy and reveals its role as a leading indicator of economic activity and inflation. They're finding out “potential of MCI is a variable indicator of monetary policy in India supplementing the existing set of multiple indicators of monetary authority”.

Samantaraya (2009) also develops MCI for India. Due to Sevier limitation of an interest rate as an individual proxy of monetary policy, he extended FCI as an alternative proxy for it. Constructed MCI has taken three indices into account for its construction, where interest rates, exchange rate, monetary and banking aggregates and prices are taken as indicators for MCI. Here a broad information set of variables is taken for reflection of monetary policy

appropriately. Construction of MCI was used for assessing the monetary policy impact on the macro variable inflation rate of growth and so on. A monthly MCI for the post-reform period (April 1996 – June 2008) is constructed in India by him. Here approach used for construction MCI is similar to that used by UNDP for the construction of some development indices such as HDI, GDI and so on. His findings were an MCI better indicator than traditional individual monetary policy indicator to capture the monetary policy stance for post-reform in India.

Xiong (2012) constructed the monetary conditions index for china over 1987Q1 – 2010Q2. Empirical results show that the MCIs has been useful in predicting future output growth and inflation over the short term and medium term in china. This article concludes with, derived MCI is informative than individual monetary variables for predicting inflation and output growth.

Gichuki and Moyi (2013**)** calculated MCI and tested its implications for monetary in Kenya. Here quarterly time series data for the time period 2000-2011 was taken for construction of MCI. Empirical results show the existence of co-integration between GDP, the real exchange rate, the claims on private sector and the short-term interest rate. It was finally concluded that MCI is a good indicator of inflation. Further, they argued that the interest rate and exchange rate movements can be controlled with the help of MCI.

**Financial Conditions Index (FCI)**

Bank of Finland (2001) did a comparison between FCI and MCI using a group of countries from Western Europe. “Find a clear role for house prices, but a poorly determined relationship for stock prices”. These financial prices reflect wealth, by entry inter into key consumption and investment relationships and also the market expectation of future price and output development. FCI is better than other economic indicator data because it continuously updated as financial market trade. They have taken the different weight for the different indicator because all the indicators in FCI do not impact monetary policy to the same extent. “The results from using pooled data for most of the European Economic Area to explore the role of asset prices in explaining the output gap and inflation are promising. House prices, in particular, are helpful in providing information in addition to that contained in interest rates and the exchange rate”.

To propose a new index, Lack (2002) extended FCI to MCI including asset price and housing price. The result suggests that housing prices are capturing the wealth channel of monetary policy. It used CPI level effect as a proxy for inflation. For the calculating weight of FCI three strategies are used as most variables enter the model in nominal terms and FCI is mainly used for short-term comparison, shocks to nominal variables are simulated. He took annual data about 1974-2002 for housing price and showing the relation among MCIs, FCI and CPI inflation.

Gauthier et al. (2003) review on existing indices and prose several FCIs for Canada were done. Construction of several financial conditions indexes for Canada is done by using factor analysis and other tests. Each intended approach is to address one or more criticisms applied to MCIs and existing FCIs. They used different data for different model accordingly to need of that model, like monthly data for IS-curve based model, for better performance

of the model. Various FCIS estimation is done on the basis of their weights, dynamic correlation with output and inflation, their out-of-sample forecast and their in-sample fit in explaining output. They give emphasis to property and equity prices transmission mechanism through a wealth effect and a credit channel. Finally, they find FCI out performs the MCI in many criteria.

Montagnoli and Napolitano (2005) emphasized the interlink among asset price, inflation, and conduct of monetary policy. The main aim of monetary policy of central banks is to keep low inflation and more growth, and not possible to directly control inflation. So many instruments are used, like interest rate and the exchange rate for predicting inflation and growth. Interest rate and exchange rate are not sufficient indicators for predicting inflation and growth. FCI are constructed by taking asset's price into account as a good indicator for inflation and growth. For the construction of Financial Condition Indexes for four countries Kalman Filter algorithm is used. The main aim is to solve two problems the parameter inconstancy problem and the non-exogeneity of regressors. For the construction of FCI, the yearly data of most of the countries the sample for 1985-2005 are chosen. The results of the study suggest that the FCI Financial Condition Index is positively and statistically related to the setting of interest rate Federal Reserve, Bank of England and Bank of Canada. So, it is suggested that FCI could be an important tool to guide the course of monetary policy.

Beaton et al. (2009) did an expensive study on the relation among of financial conditions on US GDP growth. By using two growth base financial conditions indexes (FCI) they estimated the past and current shock to the financial variables on GDP growth. Structural vector error correction model is used for the construction of one of the FCI and for others they have taken large-scale macro-economic model. Tightening financial conditions have significantly dampened growth in the current year. They argue that final shock can have a larger impact in terms of higher real cost of interest rate.

Hatzius et al. (2010) proposed a new FCI measure by making comparison with single indicators. In that new FCI which built by them, three key innovations are made in terms of indicators, techniques. They have tried to find out the importance of FCI in prediction. They have mainly taken the quarterly data for construction of a model. They conclude that "in forecasting tests, the new FCI outperformed a variety of alternative measures in recent years".

Ørbeck and Torvanger (2011) attempt to predict Norway GDP by using the financial conditional index. They take quarterly data of quarter 2 1980 to quarter 4 2005 for prediction of period of quarter 2 2006 to quarter 4 2014. Since 2007, the crises it contributed a downturn in the economy. The latest crisis demonstrated that how important financial conditions are for real economic growth and showed up that the predictive power from past indicators has been limited, so they are used FCI for prediction. For testing, forecasting power, they examine some alternative forecast as a benchmark. They used PC approach and VAR model for calculation of weight. The result was the best FCI model based on RMSE is our static model, but chosen on MAPE the best model is the FCI with lag one. They emphasized on RMSE criterion due to the assumption underlying OLS estimate.

Chow (2012) studies the importance of FCI in guiding the monetary policy in Singapore. Real Interest rates, real exchange rates, real credit expansion and asset price (real stock prices and real house prices) are taken as a key component of FCI. Quarterly data of every component on it are taken of Q1: 1978 to Q1: 2011 for the construction of financial conditions index for Singapore. The causality test indicates that the FCI is helpful in predicting inflation from sample.

Wang et al. (2012) constructed financial conditions index (FCI) by using a regression model based on Support Vector Machine. The main aim to link between the financial indicator and future inflation. Here the more advanced machine learning method comparison to traditional econometric model is used to find accurate forecasts of future inflation in the small data base. AS money supply play an important place in monetary policy so they included in it. So short-term interest rates, money supply (M2), real estate prices, stock prices and real effective exchange rate are used as an indicator in FCI. A monthly data from July 2010 to December 2010 for all indicators are taken for construction of FCI. "The experiment result shows that FCI (SVRs) performs better than VAR impulse response analysis. As a result, our model based on support vector regression in the construction of the FCI is appropriate".

IMF (2012) constructed the FCI for South Africa. Principal component analysis and Kalman filter approach are used for extracting the index. They calculate a common for the period of 1999q1 and 2001q4 by including the financial indicator, which is exogenous to South Africa and the global financial condition and indicated that related to South Africa. They divide variable as the global and domestic factor. The comparison is done among pre-crisis, financial crisis and post-crisis period. The predictive power of the FCI is tested by using out-of-sample forecast and an in-sampler exercise. Finally, the results indicate that "both the PCA and Kalman filtered FCI performed better as a leading indicator of real activity relative to the SARB's leading indicator, and to an autoregressive model of GDP growth".

ADB (2013) constructed the financial conditions index for five Asian economies, using a principal analysis (PCA) methodology. Financial market and the real economy are closely linked by affecting one to another. FCIs are constructed for five Asian economies and also regional FCI for the individual economy are constructed. Principal component analysis (PCA) methodology is used for calculation of weights. FCI measure financial shocks so it a better predictor of future economic activity. For the construction of FCI quarterly data for 1970-2011 are taken into account. Finally a comparison among New index and single financial indicators for testing predictive power. The results suggest that "new FCI can be quite helpful in gauging of the future state of the economy, although forecasting accuracy appears to be higher for countries with a complete range of financial data". Finally, it is found that countries having a larger dataset available have enjoyed higher predictive power in FCI. Domestic and Krznar (2013) constructed the Financial Conditions Index (FCI) for Croatia, together with two subcomponents domestic and foreign. In a small and open economy, real and financial developments dependent on domestic factors, also heavily depend on global economic and financial conditions. So this paper analyzes interrelation between domestic and external financial conditions and economic activity. Vector auto-

regression (VAR) is used by them for an estimation of interdependence between financing conditions and real economic activity in Croatia. The result of VAR shows, FCI is capable for a forecast of domestic GDP and external financial conditions. Variance decomposition was also estimated by them with these same variables, and the result was almost same as VAR model.

Shankar (2014) emphasizes more on information asymmetry in financial markets, especially at times of crises. To overcome the information asymmetry FCI is constructed. For calculation, he used monthly data between January 2004 and August 2013. According to him, classification of financial markets are money market, bond market, foreign exchange market and equity market, and each market plays a significant role in monetary transmission. He used principal component analysis (PCA) for calculation of weights of FCI. The final conclusion was as compared to any other index, FCI should be updated sufficiently often enough so that it is able to capture the changes in market structure bitterly.

Zheng and Yu (2014) constructed the financial conditions index (FCI) by taking interest rate, exchange rate, stock price and house price selected as the variables and the percent change rate of the variable as an indicator. Therefore, it is very important to construct China's FCI for investigating China's economic and financial situation more precisely. They select the percent change rate of the variable as indicators to construct the FCI, which not only effectively describes the indicators, but also avoid errors arising from of gap measuring. Principal Component Analysis and Dynamic Factor methods are both introduced to build FCI. FCIs constructed by the two methods are compared, and the robustness of the FCI are tested. Five variables, money supply, interest rates, exchange rates, stock index and house price index, are selected to construct FCI. All of these indicators are taken monthly data of January 1998 – June 2013. FCI can better reflect the situation of China's financial operation, and can better predict the economic trends. Therefore, FCI can serve as an important reference index, whose performance is superior to a single financial variable.

Angelopoulou et al. (2014) attempted to calculate FCI in the euro Areas. The sample period covers 2003 to 2011. While calculating FCIs they have separated index by including FCI with monetary policy variables and FCI with non-monetary policy variables. The empirical findings support in favour of new FCI. The index outperform over individual indicator to predict the macro outcomes.

Charleroy and Stemmer (2014) formulated FCI for a large sample of emerging economies. They tested FCI's forecasting applicability for business cycles. They used vector auto-regressive model for the construction of FCI. The study uses data, which ranges from January 2001 and March 2013. They find that FCI has significant power in predicting the growth than any other indicators.

CII and IBA (2015) did a survey of prime banks and other intermediaries to construct financial Conditions Index. For constructing financial conditions index CII-IBA used purchasing managers index. FCI broken into four subs induces including four indicators under each. Equal weight taken for each indices are: cost of fund index, fund liquidity index, external financial linkage index, economic activity index.

## 5. Estimation of financial conditions index for India

Financial conditions index (FCI) is used as a tool, which is widely used to identify the state of financial conditions in a country. It takes a set of information from different variables in a single indicator and then it allows for analyzing the general behavior of financial conditions in a brief manner. Here the construction and evaluation part of a financial conditions index (FCI) for India is done. For capturing the financial stress and to know about the main factors behind fluctuation of financial conditions, we constructed the financial conditions index (FCI) for India.

In order to estimate the financial conditions index (FCI), need to classify the elements that affecting the financial conditions. Traditionally determinants like the short-term rate of interest and real exchange rate with an addition to housing price and total FDI inflow are incorporated into the financial conditions index (FCI). The Financial conditions index is explained in below table.

**Table 1.** *Recommended financial conditions index (FCI)*

| Mnemonic | Component |
|---|---|
| FCI | Short term rate of interest +exchange rate +total FDI inflow +housing price index |

Otherwise, FCI function also can express as:

FCI = f (interest rate, exchange rate, HPI, FDI).

The financial conditions index (FCI) equation by giving the same weight to all the determinant can be written as:

$$FCI = 1/4CMR + 1/4ER + 1/4HPI + 1/4FDI \quad (8)$$

Where CMR is the call money rate, which taken proxy for the short term rate of interest, ER is the exchange rate, HPI is housing price index, FDI is foreign direct investment. Here we have taken the same methodology, which the UNDP has taken for calculating the Human development index (HDI).

## 6. FCI, Inflation and GDP Growth

As we already discussed, the FCI is nothing but just an extension of the monetary conditions index with the inclusion of some more important financial variables. Those variables are not included in monetary conditions index (MCI) but affect the monetary policy. So we construct an FCI for India. In this study, we include housing price and total FDI inflow with MCI variables in the construction of FCI. It is believed that FCI can perform better to predict inflation and growth. Equal weight is given to all the variables of FCI in this study. It is important to check the trend of all variable and FCI for checking its fluctuations and its importance for monetary policy. So before going for econometric analysis, we need to present the trend of FCI components such as interest rate, exchange rate, housing price and total FDI inflow. The trend of all the variables with diagrams is discussed below.

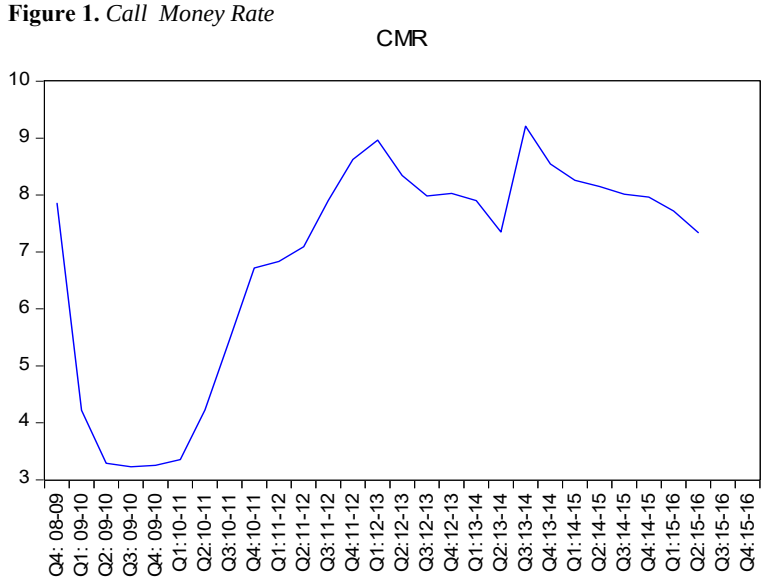
**Short-term interest rate (call money rate)**

Short term interest rates are generally the rate at which borrowing for a short-term are effected between financial institutions. The Short-term interest rate is measured as a percentage and these are generally the average of daily rates. Short term interest rates are based on the three-month money market rates, typically the money market rate and treasury bill rate. Here we used to call money rate as the proxy for the short term interest rate. Call money rate (CMR) is the rate at which commercial banks and financial institutions lend to and borrow from the money market during the short period.

**i. Trend in call money rate**

The trend of the call money rate is shown in the graph-1 where the X-axis present the time horizon and Y-axis presents the call money rate. Being a measure of liquidity availability and thus reflects the short-term costs of available funds, it has shown a greater volatility and fluctuated widely due to supply and demand sides of the Indian money market. Starting from about 8% during the last quarter of 2008-2009 CMR has fallen drastically to below 4% during the quarter 2 of 2009-2010 owing to the effects of the global meltdown. Further, it remained stable till the quarter 1 of the following year and then showed a steady increase till the Q1 of 2012-2013 owing to macroeconomic stability. The rate again followed the declining trend till Q2 of 2012-2013 making an average of around 4% during the year and then with a steep increase in Q1 to Q3 of 2013-2014 and relative falling trend during the recent period; the rate is averaged to around 7.20%.

**Figure 1.** *Call Money Rate*

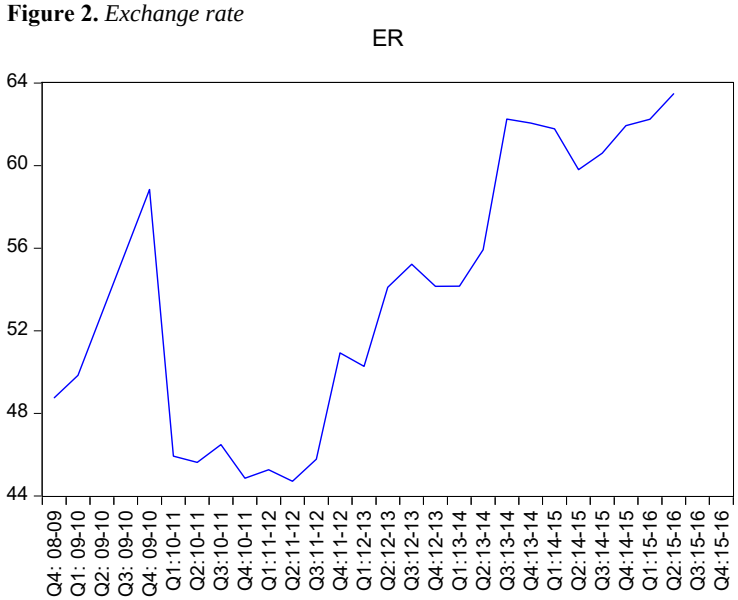



**Exchange rate**

In simple, the exchange rate can be defined as the price of domestic currency in the terms of any other countries currency. So there are basically two components of the exchange rate, one is domestic currency and foreign currency.

**i.** we cannot present exchange rate of more than two currencies in a two-dimensional plane, we take the exchange rate between the rupee and the US dollar. It is observed that the dollar is the foremost reserve currency in the world. Like the currencies of major countries, the Indian rupee too witnessed the effects of global financial crisis as is evident from the Figure 2. The rate increases from around 49 US dollar during the last quarter of crisis to around 60 US dollar till the last quarter of following year. The rate declined steeply to a level of around 45 during the first quarter of 2010-2011 and then remained more or less stable during the second quarter of 2011-2012 due to various policy regulations of the Reserve Bank. The rate again followed an upward depreciating trajectory of domestic currency with few down movements at certain instances, reaching to the peak level of 68.80 during September 2013 due to the global uncertainties, fall in oil prices, fall in FIIs, Indian trade deficit, etc. The rate continued its depreciating mode even during the recent period and has remained more or less around 66.59 during 2015-2016.

**Figure 2.** *Exchange rate*



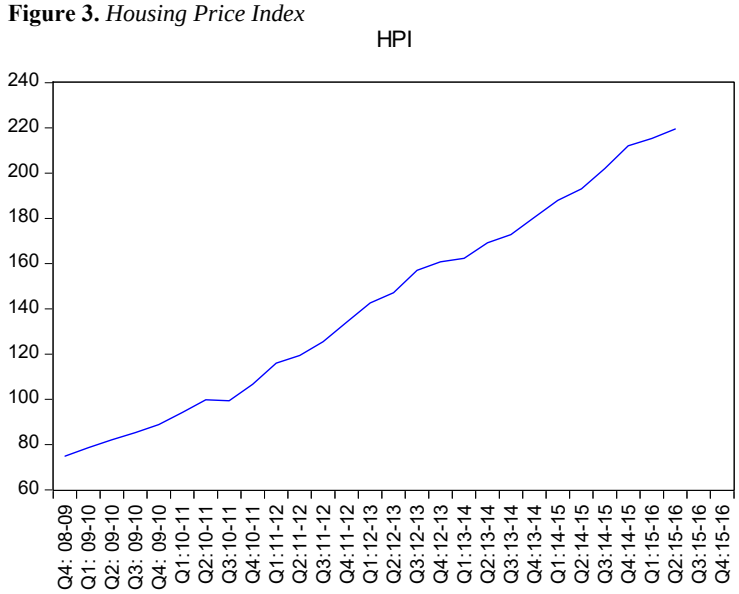

## Housing price index

The housing price index (HPI) of a country measures changes in the price of residential housing. For estimating change in the mortgage defaults, prepayments and housing affordability housing price index price index provide a tool.

## Trends in housing price index

Housing price index in India has shown an increasing trend over the years reached its peak in 2012-2013 and then stabilized during the recent period. The housing price inflation, as measured by RPPI, has swollen from a relatively moderate level of 4% during quarter 1 of 2011-2012 to a galloping figure of 28% during quarter 3 of 2012-2013 but the trend has reversed thereafter and has again reached to the level of 4% during the recent period (RBI, 2015).

**Figure 3.** *Housing Price Index*



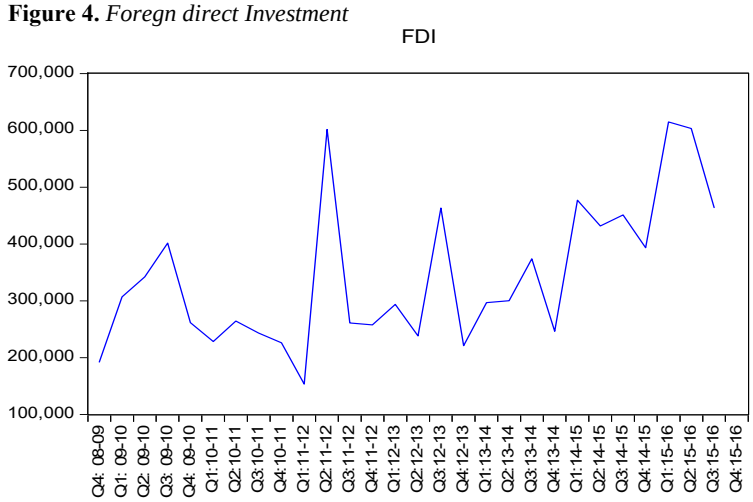

**Foreign direct investment (FDI)**

A foreign direct investment (FDI) is a direct investment equity flows into the reporting country from the company or entity of other countries. The trend of the FDI is explained in below.

**i. Trend in total FDI inflow into India**

India being a developing country has usually remained dependent on foreign inflows and has adopted various policies and strategies to manage them. Taking the synoptic view of Figure 4, it is evident that FDI on an average has shown an upward movement during the period under consideration with various ups and downs. Starting from the depressed conditions of 2008-09 the economy receives the increased foreign inflows after macroeconomic stabilisation, but there after it showed a decline till the first quarter of 2011-2012 and marked the highest value during the second quarter of same year owing to increased openness to the external world and serving as the investment destination of the world. But despite the various efforts on the part of the government, FDI declined during 2012-2013 although showed some signs of recovery during 2013-2014 and then followed an upward trajectory during 2014-2015 due to the launching of "make in India" program during September 2014. The favorable policy regime and the sound business environment has helped India to witness an increased foreign flows in the following year as well.

**Figure 4.** *Foregn direct Investment*



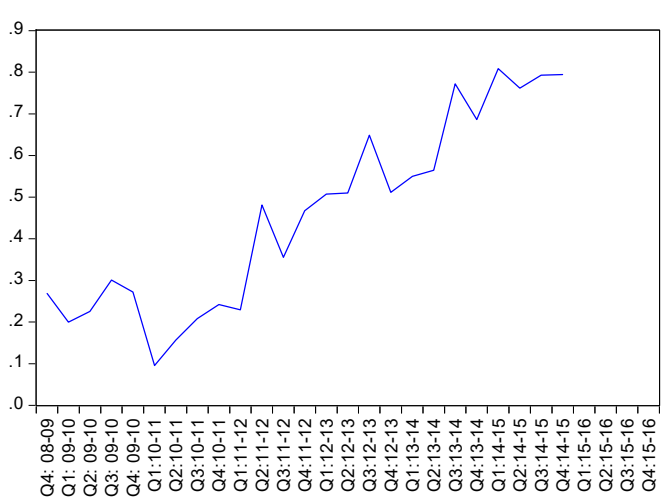

## Financial conditions index (FCI)

Financial Conditions Index (FCI) is an indicator variable, which has four components such as the short-term rate of interest, exchange rate, FDI, HPI. As any regression analysis needs stationarity check of all the variables to avoid spurious regression, similarly checking of the trend is necessary for knowing prior information about the variables.

### i. Trend in Financial conditions index (FCI)

The trend of the FCI is shown in the Figure 5. Taking the synoptic view of Figure 5, it is evident that FCI on an average has shown an upward movement. FCI has declined during 2008-09 although showed some signs of recovery during Q1-Q3 of 2009-10. But then again followed a downturn till Q1 of 2010-2011. FCI showed an increasing during 2012-13 although showed some signs of depression during 2013-14 but then after sudden recovery started and finally it stabilized during the recent periods.

**Figure 5.** *Financial Conditions Index*



## 7. Empirical analysis

In this section, we analyze the predictive capacity of financial conditions index (FCI) to forecast inflation and growth using some econometric tools. The results of all those econometric models are given below in one by one.

**Unit-Root test result**

For this study, we choose Augmented Dickey-fuller (ADF, 1984), Phillips-Perron (PP, 1988) test and Kwiatkowski-Phillips-Schmidt-Shin(KPSS, 1992)

**i. Result of the Augmented Dickey-fuller (ADF) test**

The Augmented Dickey-fuller (ADF, 1984) unit root test result of the study is presented in levels and first difference. The result of the Augmented Dickey-fuller (ADF) test enables us to determine the unit root or non-stationary time series variable among the variables for obtaining more robust results. The result of the Augmented Dickey-fuller (ADF) is presented in Table 2. The ADF test result indicates that all the variables have a unit root as the ADF test statistics value is less than the critical ADF value. So this implies that all the variable which is shown in the table are non-stationary time series in level. As all the variables have unit-root, we take the first difference of the respective variables and again tested unit-root by using the Augmented Dickey-fuller (ADF, 1984) test for resulting time series. First difference result shows, the ADF test statistics value is greater than the 95 percentage critical value. So we reject the null hypothesis that particular variable has a unit root and accept the stationary of that particular variable. So it is clear that after taking the first difference all the variable becomes stationary, now if we use any statistical tool, like regress one variable upon other then result shows the actual relation, not the spurious one due trend variable. By taking stationary time series, we just avoiding the trend effect of that time series.

**Table 2.** *Unit Root test result- Dickey-fuller (ADF)*

| ADF test Test @ Level | | | | | ADF test Test @1st dif. | | |
|---|---|---|---|---|---|---|---|
| Variable | ADF Test statistic (level) | Probability | 95%critical ADF Value | Remark | ADF Test statistic (1st dif.) | Probability | Remark |
| IFN | 0.49662 | 0.9825 | -3.004861 | I(1) | -8.07627 | 0.0000 | I(0) |
| EG | -1.57012 | 0.4796 | -3.01236 | I(1) | -17.8069 | 0.0000 | I(0) |
| FCI | -0.14597 | 0.9327 | -2.998064 | I(1) | -7.98626 | 0.0000 | I(0) |

**Note:** IFN-inflation, EG-economic growth, FCI –financial conditions index.

**ii. Result of the Phillips-Perron (PP) test**

Like the Augmented Dickey-fuller (ADF, 1984) unit root tests, Phillips-Perron (PP, 1988) test are also presented in level and first difference. Level and first difference are taken to enable us to determine the unit-root among the time series and more robust results. Here the null hypothesis is similar to the Augmented Dickey-fuller (ADF) unit root tests, that null hypothesis is the variable has a unit-root, so for stationary time series, we need to reject the hypothesis so that we can conclude that there is no unit-root or variable is a stationary one. The result of Phillips-Perron (PP) test present in Table 3. The Phillips-Perron (PP) test result indicate that one variable that is Financial conditions Index (FCI) have test statistics value is less than the 95 percent critical value. This result implies that time series of the FCI is non-stationary or have a unit-root in its level. For avoiding this, we take the first

difference of FCI variables and again perform the unit-root test on each variable. The first difference unit-root result shows all the variables are now stationary. It is seen that in absolute term, Phillips-Perron (PP) test statistics for each variable is greater than the 95 percentage critical values. So all variables are becoming stationary after taking the first difference.

**Table 3.** *Unit Root test result – Phillips-Perron (PP)*

| **PP test Test @ Level** | | | | | **PP test Test @1st dif.** | | |
|---|---|---|---|---|---|---|---|
| Variable | PP Test statistic (level) | Probability | 95%critical PP Value | Remark | PP Test statistic (1st dif.) | Probability | Remark |
| IFN | -4.74637 | 0.0009 | -2.986225 | I (0) | -20.2689 | 0.0001 | I (0) |
| EG | - 6.60171 | 0.0000 | -2.991878 | I (0) | -7.52393 | 0.0000 | I (0) |
| FCI | -0.71617 | 0.8242 | -2.991878 | I (1) | -0.71617 | 0.0000 | I (0) |

**Note:** IFN – inflation, EG – economic growth, FCI – financial conditions index.

### iii. Result of the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test

The result of Kwiatkowski-Phillips-Schmidt-Shin (KPSS, 1992) unit-root test of the study present both in level and first difference like Augmented Dickey-Fuller (ADF, 1984) and Phillips-Perron (PP, 1988). Here the null hypothesis is that an observable time series is stationary, not like the Augmented Dickey-Fuller (ADF, 1984) and Phillips-Perron (PP, 1988) test where null hypothesis are taken as non-stationary. So explanation for it is little bit different than Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP), as Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test is a statistic for testing the null hypothesis that the specific variable is a stationary one. The Kwiatkowski-Phillips-Schmidt-Shin (KPSS) unit-root test result enable us to determine the stationary time series among the variables for obtaining more robust results. The result of the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) unit-root test at level is presented in Table 4. The result indicates that all the variable test statistics value is more than the 95 percent critical value except the growth. So this level test result implies we need to reject our null hypothesis for FCI and inflation that is the specific variables is stationary and accept non-Stationarity or unit-root for these variables at level. So for avoiding this we have taken first difference of it and again perform the unit-root test for these first difference variables. The first difference unit-root result shows all the variables are now stationary. It is seen that in absolute term, Phillips-Perron (PP) test statistics for each variable is greater than the 95 percentage critical values. So, all the variables are becoming stationary after taking the first difference.

**Table 4.** *Unit Root test result – Kwiatkowski-Phillips-Schmidt-Shin (KPSS)*

| **KPSS test Test @ Level** | | | | | **KPSS test Test @1st dif.** | | |
|---|---|---|---|---|---|---|---|
| Variable | KPSS Test statistic (level) | Probability | 95%critical KPSS Value | Remark | KPSS Test statistic (1st dif.) | Probability | Remark |
| IFN | 0.55111 | 0.0007 | 0.46300 | I(1) | 0.42577 | 0.8699 | I(0) |
| EG | 0.14677 | 0.1316 | 0.46300 | I(0) | 0.18667 | 0.9363 | I(0) |
| FCI | 0.67757 | 0.0000 | 0.46300 | I(1) | 0.14363 | 0.3049 | I(0) |

**Note:** IFN – inflation, EG – economic growth, FCI – financial conditions index.

## Correlation test result

To testing the predictive power of Financial conditions Index (FCI) correlation test is used. By checking correlation among lag of FCI and the goal variables we can reflect the predictive capacity of FCI. The empirical result of correlation test is present in Table 5.

The result of correlation test indicates that FCI can predict inflation, but not the GDP Growth. The correlation between FCI and inflation is -0.59. This shows a negative relation among FCI and inflation. It means, if financial condition increases, the inflation go down.

If we take the correlation coefficient of lagged FCI and inflation, it shows an increasing trend means lag 12 of FCI (-0.50) can predict current inflation better than the FCI lag of 1 (-0.37). So FCI is a good predictor of inflation. The correlation coefficient between FCI and GDP Growth is only 0.12 which is much less, although it shows a positive relation. So, the correlation coefficient is so weak that, we cannot accept FCI as a predictive indicator of GDP Growth. The correlation coefficient of lags of the FCI and GDP Growth are also inefficient. So we cannot predict appropriately GDP growth with help FCI.

**Table 5.** *Correlation result*

| Variables | FCI | INF | GG | FCIL1 | FCIL2 | FCIL4 | FCIL6 | FCIL8 | FCIL12 |
|---|---|---|---|---|---|---|---|---|---|
| FCI | 1 | -0.59 | 0.12 | | | | | | |
| INF | -0.59 | 1 | | -0.37 | -0.45 | -0.47 | -0.45 | -0.47 | -0.50 |
| GG | 0.12 | | 1 | 0.07 | -0.02 | 0.14 | -0.01 | 0.12 | 0.13 |
| FCIL1 | | -0.37 | 0.07 | 1 | | | | | |
| FCIL2 | | -0.45 | -0.02 | | 1 | | | | |
| FCIL4 | | -0.47 | 0.14 | | | 1 | | | |
| FCIL6 | | -0.45 | -0.01 | | | | 1 | | |
| FCIL8 | | -0.47 | 0.12 | | | | | 1 | |
| FCIL12 | | -0.50 | 0.13 | | | | | | 1 |

**Note:** FCI – financial conditions index, INF – Inflation, GG – GDP Growth, FCIL – Financial conditions index lag.

## Granger causality test

This section presents the empirical result of Granger-Causality test for testing whether Financial conditions Index (FCI) "Granger cause" inflation and GDP growth or not, if yes then what is the exact direction of it, Bidirectional or Unidirectional.

The result of Granger-Causality test for testing whether financial conditions Index (FCI) "Granger cause" inflation and GDP growth and its direction are present in Table 6. According to Granger causality test, there were unidirectional causality between The Financial conditions Index (FCI) and inflation, meaning is that change in former Granger causes the latter but change in the latter not Granger cause former. In first null hypothesis, it is observed that the probability value (0.55) is too high, so it is not possible for rejecting that null hypothesis. So we need to accept that inflation does not Granger cause FCI. In similar basis third and fourth null hypothesis are rejected, conclusions derived from it is that there is no causality between FCI and GDP growth. But second null hypothesis probability value is less than 0.05 (5% critical value) so it is rejected and we need to accept that there is a unidirectional relation between FCI and inflation. We also can explain the result of causality test with the help of F-statistics value. The result shows that only the F-statistics for the second null hypothesis, that is FCI does not Granger cause inflation, is statistically significant (F-statistics value is greater than the 95 percent critical value).

So this null hypothesis was rejected and need to accept that FCI granger causes inflation. Other F-statistics values are showing statistically insignificant, as F-statistics values are less than the 95 percent critical value for all three null hypothesis. So we cannot reject these null hypothesizes. Thus, the conclusion derives is that inflation does not Granger Cause Financial conditions Index FCI, and there is no causality among Financial conditions Index (FCI) and GDP Growth.

**Table 6.** *Causality test result*

| Null hypothesis | F- statistics | Prob. | Granger cause | Direction |
|---|---|---|---|---|
| INFLATION does not Granger Cause FCI | 0.62427 | 0.5469 | No | None |
| FCI does not Granger Cause INFLATION | 4.29498 | 0.0299 | Yes | Uniderectional (FCI → INFLATION) |
| GDP growth does not Granger Cause FCI | 1.99465 | 0.1650 | No | None |
| FCI does not Granger cause GDP growth | 0.91631 | 0.4179 | No | None |

**Note:** GDP – Gross domestic product, FCI – financial conditions index, Prob. – probability.

### Financial conditions Index (FCI), Inflation and GDP Growth

Before discussing the conclusion of the study we need to explain the objective of our study with regard to our test results. The most important objective of our study is to test the predictive capacity of the financial Conditions Index (FCI) for inflation and GDP growth. This is nothing but the testing of whether the FCI is a good indicator or not.

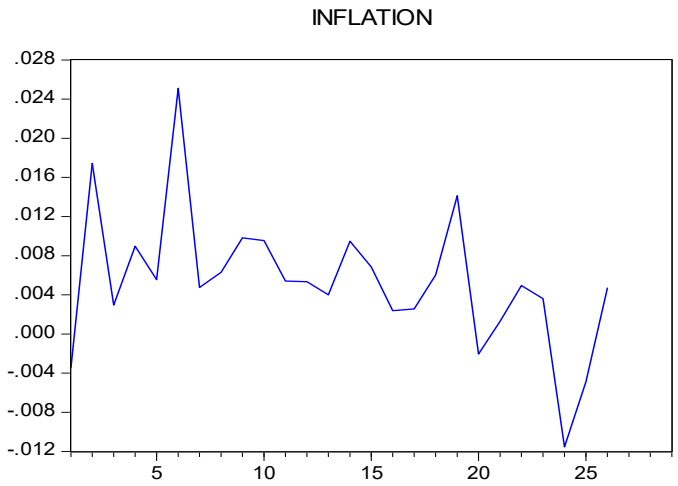
Based on the causality and correlation test result, we argue that higher the FCI, the lower the inflation in a country and FCI do not content much information about the GDP growth. So we cannot say the exact relation among them. For clear understanding, we need to explain the test result. First, we present the predictive power of the FCI for inflation and the relation between them and then the predictive power of the FCI for GDP Growth and their relations.

Inflation means an increase in the general price level. It is affected by many variables simultaneously. Till a certain point inflation contribute positively to the economic growth and after that inverse relation will occur in a country. So in many developing countries main aim is to maintain less inflation with more economic growth for monetary stability. For that properly prediction of inflation is needed. Fluctuation in inflation can be explained better from the Figure 6. It shows that India has most often suffered from the problem of inflation either because of monetary factors or by supply shocks. As is evident from the graph below, WPI has shown various ups and downs during the period considered. Starting with a lower value during the last quarter of 2008-2009, it jumped steeply in the following quarter owing to meltdown effects. As the economy stabilized to some extent WPI also showed the signs of decline with some gyrations in between the year of 2009-2010. With the increased food prices, rise in prices of primary articles and fuel costs, etc. during 2010-2011, WPI has again witnessed the upward movements and then showed some decline during the following years due to moderation in international commodity prices, lowering crude oil prices and continuous tightening of monetary policy by the reserve bank.

If we take the causality test result, its showing there is a unidirectional relation among FCI and inflation and that direction is FCI cause inflation. It means any change in the FCI cause changes in inflation but the reverse is not occurring. The Correlation test result reflects that there is a strong correlation between FCI and inflation. And it also shows that using FCI as

an indicator it is possible to predict one period, two periods, four periods, six periods, eight periods and twelve periods ahead of inflation as checked from correlation coefficient of lag FCI and inflation. If we take the correlation coefficient of lagged FCI and inflation, it shows an increasing trend means lag 12 of FCI (-0.50) can predict current inflation better than the FCI lag of 1(-0.37). So FCI is a better indicator of inflation as it includes a broader range of important variables.

**Figure 6.** *Inflation*




Similarly, we have tested the relationship between FCI and GDP growth. The result indicates that the FCI cannot predict GDP growth correctly. For detail clarification, we need to discuss further. The causality test result reflects that there is no causality between FCI and GDP growth. The coefficient of correlation between current FCI and current GDP growth is weak. This implies that the current FCI is not a good indicator of the current GDP growth. Similarly, the correlation coefficient of lags of the FCI and GDP Growth are also low. So we cannot predict GDP growth appropriately with the help of FCI.

## 8. Conclusion

In this study, our basis objective is to check whether a financial conditions index is useful to guide monetary policy in the context of India. For that, we constructed an financial conditions index for India that comprises not only the usual financial variables like, exchange rates, interest rates expansions but also included asset prices such as house prices and FDI. The selection of those variables is based on their role played in monetary mechanism. A weighted sum approach for construction of the index is adopted, where by an equal weight assigned to each component. Correlation and granger causality used for testing the ability for predicting the financial variables. The findings based on the simple granger causality test as well as correlation test, results indicate that FCI does granger cause inflation and there is a unidirectional causality between FCI and inflation but there is no meaningful relation between FCI and GDP growth. So, we can predict inflation with the help of FCI but it is not a case for GDP growth.

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# On the effects of total productivity growth of economic freedom and total resource rents: The case of both natural resource rich and OECD countries

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**Abstract.** *The focus of the paper is to analyse the relation between institutions on cross-country economic development in Natural Resource Rich countries and OECD countries. The paper emphasizes the effects of economic freedom that interacts with total resource rents on total factor productivity, covering 30 Natural Resource Rich, 34 OECD countries in dynamic panel data for the period of 2000-2013. Findings suggest that as economic freedom increases along with resource rents, total factor productivity increases for natural resource rich countries. The results are mixed for OECD countries.*

**Keywords:** natural resources, economic freedom, total productivity growth, generalized method of moments (GMM), instrumental variables (IV) estimation.

**JEL Classification:** P28, D02, D24, C23, C26.

## 1. Introduction

Economic growth is a popular concept in economic development literature. Economic growth theories are divided into two main groups, exogenous and endogenous. Exogenous model specifies a neo-classical production factor influencing the level of output such as physical capital, labor, and an exogenous technology. According to the endogenous growth theory; physical capital growth is not enough to find out per capita output growth and human capital by itself, therefore, international trade and technology are added to the model. Endogenous growth theory also suggest that, unlike the neoclassical growth theory, technological development has occurred in the economic system and also affected by economic decisions. Recent studies indicate that technological development has emerged as a reaction to economic signals such as price and profit in the economy.

In today's world of intense competition, efficiencies created by the impact of technological development constitute the basis for sustainable growth. As a key variable to measure production systems performance, productivity effects investigate the feasibility of producing more at lower cost. In other words, the productivity effect is expressing relationship between the inputs used in production and outputs.

Productivity is divided mainly into two parts; Partial Productivity and Total Factor Productivity (TFP). Partial productivity is calculated as a ratio of gross or net output to single factor input. Also, the total factor productivity is the ratio of total outputs to the inputs used in the production process. Higher total factor productivity means producing more and higher income with the same amount of capital.

Information technology, research and design (R&D) and investment in innovation, which particularly affect competitive advantages, are very important in terms of Total Factor Productivity. This condition is regarded as an increase in productivity to achieve more output with existing factors of production, and therefore seize the benefits of economies of scale. Productivity growth effect can not be explained by the amount of production inputs but can be explained as increase in the level of knowledge in technology and economies of scale.

Industrial Revolution has led to a great increase in production volume by means of mechanization. In this period, concept of competition and efficiency gained importance and businesses have turned to work more efficiently, which led to increased production. Developments in this area attract researchers to investigate the sources of productivity growth. Oyeranti (1994) and Bosworth and Collins (2003) observe that information and rapid developments in communications technology, research and design activities, development in human capital, foreign direct investment (FDI) and the free trade are the key factors in productivity increase. For example, in Romer (1986, 1990 and 1994) studies, he claimed that technological development in the research and design is the main force of growth. Technology can be transferred to the developing countries by the trade of goods. "Developed countries uses natural resources and human capital to invent new technology, while developing countries invest in human capital and their political and economic institutions to promote the diffusion and absorption of foreign technology" (Limam and Stephen, 2004).

Level of innovation together with acquiring and absorption of technology determine differences in growth rate of the countries. Romer also believes that liberalization of foreign trade and creating economic integration with rich countries in terms of human capital will affect economic growth positively.

Productivity is a simple ratio. However, productivity measurement is a great deal of conflict among the literature. Antle and Capalbo (l988) observe two main approaches to measure total factor productivity: The Growth Accounting Approach (index number) and The Econometric Approach.

Laspeyres exact index, geometric exact index, and Tornqvist-Theil index that approximates the Divisia Index (Oyeranti, 1994) are examples of above mentioned indexes. In this study Tornqvist-Theil index is going to be used.

Mentioned in the literature, there is also a problem in measuring institutions quality quantitatively. Table 1 shows five main sources measuring the effectiveness of the institution in economic era.

**Table1.** *Economic freedom data sources*

| Data | Time Span Frequency | Aspects Covered | No. Of Economies Studied |
|---|---|---|---|
| Fraser Institute – Economic Freedom Index | Start from 1970- Annual since 2000 | (1) Size of government;<br>(2) Legal structure and security of property rights;<br>(3) Access to sound money;<br>(4) Freedom to trade internationally and<br>(5) Regulation of credit, labour and business. | 157 |
| Heritage Foundation – Index of Economic Freedom | Start from 1994- Annual | (1) Trade policy<br>(2) Fiscal burden of government<br>(3) Government intervention in the economy<br>(4) Monetary policy<br>(5) Capital flows and foreign investment<br>(6) Banking and financ<br>(7) Wages and prices<br>(8) Property rights<br>(9) Regulation<br>(10) Informal market activity | 186 |
| ICRG – International Country Risk | Monthly Since 1980 | (1) Economic risk<br>(2) Political risk<br>(3) Financial Risk | 140 |
| World Bank (WB) Governance Indicators | Start from 1996- Annual since 2002 | (1) Voice and accountability<br>(2) Political stability and absence of violence<br>(3) Government effectiveness<br>(4) Regulatory quality<br>(5) Rule of law<br>(6) Control of corruption | 215 |
| WB Ease of Doing Business Report | Start from 2004- Annual | (1) Starting a business<br>(2) Dealing with construction permits<br>(3) Employing workers<br>(4)Registering property<br>(5) Getting credit<br>(6) Protecting investors<br>(7)Paying taxes<br>(8)Trading across border<br>(9) Enforcing contracts<br>(10) Closing a business | 189 |

**Source**:Lam,Kwok Ying.,2010.Institutions and Economic Development.*Phd Thesis.pp.15 (Updated by authors)*

We use Fraser Institute's economic freedom index (EFI) consisting of five subindices: government size, access to sound money, legal system and property rights, freedom to international trade and regulation of business, labor and credit markets (Appendix C).

Acemoglu (2009) states that traditional growth regressions face the problem of endogeneity, measurement errors and omitted variables. Panel data solves omitted variables problem by considering country-specific and time-specific effects.

Generalized Method of Moments (GMM) estimation method helps overcome the problems of endogeneity problem. Serial correlations based on the GMM residuals are tested by Aurellona-Bond and over-identifying restrictions are tested by Sargan tests.

Main differences of this study, from other studies, are: first, most growth studies only deal with variables and effect of these variables on the total productivity growth. While this study focuses not only on variables, but their interaction effect on total productivity growth are also studied: second, using new econometric methods and different dimensions of economic freedom in not only Natural Resource Rich but also OECD countries are studied.

## 2. Review of literature

The investigation of relation between natural resource abundance and economic development is always key concept in economic literature. Among 1950-1980 many economist argue on the positive effect of resource abundance on economic growth in natural resource rich countries. But, world encountered big oil shock and this led to retardation on growth in oil exporting countries in the 70's.

In the 80's, The Dutch Disease concept was noticed. Labor and capital moved from non-resource sectors, especially manufacturing sector to the oil sector, and at the same time vast amount of foreign currency entrance in economy led to appreciation of the domestic currency in mainly Iran, Russia, Trinidad and Tobago and Venezuela. Totally, they cause the decline in growth in manufacturing sector. And late 80's, recourse curse theory is stated by Sach and Warners, and Richard Auty. Generally, theory says that natural resource abundance increase the probability of negative economic growth in natural resource rich countries.

In the 90's, the quality and efficiency of institutions in resource rich countries had changed government behaviour. Researches in this period show that weak institutions negatively affect growth and development and vice versa.

Resource revenue-growth theories can be divided mainly two parts. One part investigate resource curse hypothesis, the other part investigates Institutionalism (Kaznacheev, 2013).

### 2.1. Natural resource revenue and total productivity growth

Resource Curse Hypothesis states that Natural resources are a hindrance to an economic growth in Natural Resource Rich countries. Sachs and Warner's study (1995) is the first

significant and systematic one regarding economic problems concerning natural resources. They observe that economies with a high ratio of natural resource exports to GDP have slower growth from 1970 to 1990 than the world average. Sala-i- Martin (1997) confirmed the Sachs and Warner's results. Sala-i-Martin observe significant 22 variables on economic growth such as natural resources having negative effect. There is concurrence about the existence of a "resource curse" among studies in the 90's. Richard Auty (1993) studies natural assets, which lead the economy to a point where the benefits become curse. Auty (2000) also studied 70 developing countries and found that in resource rich countries corporate institutional weakness was spotted and due to limited diversification in manufactured goods led to constrained economic growth in these countries.

Researchers claimed "volatility curse" hypothesis in 2000's. The main topic in these studies was not only the resource dependence problem, but also the volatility of commodity prices in the global market. Atkinson and Hamilton (2003) observe significant and negative relationship between natural resources and economic growth for 91 countries in his model.

Arezki and Ploeg (2007) observe significant negative effects of natural resources on income per capita and indirect effect of natural resources on institutions. Also, they conclude that the natural resource curse severely influences economic performance of countries which have low degree of trade openness.

After 2007, some papers questioning the existence of resource curse. For example, Lederman and Maloney (2008) show that the negative impact of resources disappeared on growth putting fixed effects on their model. Brunnschweiler and Bulte (2008) declare a new concept as recourse dependence and observes that resource abundance has positive effects on growth and institutional quality unlike resource dependence. Butkiewicz and Yanikkaya (2010) argue that the panel data set comprised of developed and developing countries show that in emerging countries curse hypothesis is confirmed but similar results in developed countries can not be seen. Weishu Leonga and Kamiar Mohaddesaby (2011) find that volatility of resource rents negatively affect economic growth as resource rents increase real output per capita. They also show that higher institutional quality may eliminate some of the negative volatility effects of resource rents. Davis (2011) concludes that natural resources cause slower growth rates in mineral resources dependent countries and result in crowding-out effect. Cavalcanti, Mohaddes and Raissi (2015) show a direct positive relationship between resource abundance and growth. Also, they observe negative relationship between resource volatility and growth by using annual data for 1970-2007 and five-year non-overlapping observations.

### 2.2. Institutions and total productivity growth

A number of authors look for another channel about natural resource's impact on development, unlike macroeconomic explanation such as the "Dutch disease" and price volatility. They developed an alternative approach on institutional insufficiency, which is the key factor in growth decline in resource-abundant economies.

The institutionalist approach, dating back to Hayek (1945 and 1960), is based on the idea that resources and resource efficiency are determined by the institutional structure and policies implemented by these institutions. Even though there is debate over the actual character of the institutional structure, this structure can be stated in liberal perspective, as working of market economy, protection of property rights, removing obstacles to competition, minimal government intervention guaranteed economic freedoms. Therefore, this idea of seeing economic freedoms as the key to growth enters into the field of institutional approach.

Gwartney et al. (2004) states that the institutionalist approach emphasizes policy towards improving legal, economic and political institutions. Also, eligible institutional structure will encourage market actors investing in physical and human capital and will enable innovation to improve the production method. Chong and Calderon (2000) analyze causality between institutional measures and growth and show the existence of reverse causality. They observe that the poorer the country and the longer the wait, the higher the influence of institutional quality on economic growth. Also economic growth leads to institutional quality. Glaeser et al. (2004) claim that human capital is only the basic source of growth rather than institutional quality. Acemoglu, Johnson and Robinson (2005) state that good legal structure and secure property rights are important and necessary conditions for a successful economy. They lead to decrease irregularity in the allocation of resources, motivate savings, investment in human and physical capital and trade. Moreover, they provide motivation for individuals in entrepreneurial activities and foreign technologies. Halvor Mehlum, Karl Moene and Ragnar Torvik (2006) state that natural resource abundant countries form not only growth losers, but also growth winners and the quality of institutions create the difference.

### 2.3. Economic freedom and productivity growth

Economic freedoms in general terms can be described as a mechanism; which stimulates the dynamics of economic growth and development, leading the economy to come to the natural balance without any external intervention and letting the individuals in the society to take and implement economic decisions freely. An institutional structure guarantees economic freedoms; in other words, a liberal market economy creates an environment that is both augmenting growth and accelerating development.

Besides the idea of presenting economic freedoms to individuals as a right, some characteristics for a country to be economically free are the size of the public sector, the use of economic structures and markets, monetary policy and price stability, freedom to use alternative currencies, the existence of legal order and private property security, freedom in foreign trade, freedom of exchange in capital markets and freedom of enterprise.

Henry (2003), states that, the positive effects of economic freedoms on the physical capital occurs through capital accumulation by means of saving and investing this capital accumulation increases the amount of output per worker. As a result, economy reaches the final stage with sustainable rapid economic growth. Barro (2001), states that, at a given output level; a high human capital stock, equipped with factors such as education,

health, capital and knowledge, stimulates the rapid economic growth process with the help of two channels. In the first channel, higher human capital accumulation has an ability to absorb more qualified technological developments and this channel is related to the rate of schooling. The second channel is that an advanced human capital has the ability use the physical capital stock optimally in the country.

Economic freedoms, which are emphasized to be an important factor in ensuring macroeconomic stability also bring about a stable economy, such as the low and predictable inflation rates, the creation of interest rates to meet the needs of the country, the realization of exchange rates at competitive levels and the balance of payments. In parallel with this economic structuring, saving volume increases, long-term capital accumulation increases, and national prosperity is preserved, future investments increase, capital accumulation increases and efficiency in resource allocation is ensured. Depending on the combination of the stated factors, the growth process is accelerating and gaining a sustainable momentum.

"Economic Freedom" is not quantitative. It is a qualitative subjectivity and imprecision in measuring the notion. Among many indices, the most widely used one is the Economic Freedom of the World (EFW Index) published by the Fraser Institute Canada. Main sub-indices of Economic Freedom are:

- Rule of law and property rights (LEG).
- Size of government and taxation (GVZ).
- Soundness of money (SMN).
- Trade regulation and tariffs (FRT).
- Regulation of business, labour and capital markets (REG).

The assurance of the legally acquired property of individuals is one of the essential elements of both civil society and economic freedoms. Countries with secured property rights are subject to high valuation the measure of economic freedom.

There are many empirical studies finding positive and important relationships between economic freedom and the protection of property rights and the legal structure, such as Heckelman (2000), Halvor Mehlum, Karl Moene and Ragnar Torvik (2006), Barro (1991), Torstensson (1994), Knack and Keefer (1995).

Heckelman (2000) observes positive relationship between economic freedom and property rights. Halvor Mehlum, Karl Moene and Ragnar Torvik (2006) analyze relationship and find that entrepreneurs look for unproductive rent-seeking and grabber-friendly activities due to weak protection of property rights in resource rich economies.

The size of government is main the concept of classical liberal scholars. The government intervenes in the economy through government consumption, public investments and marginal taxation. That is a good measure of economic freedom (Bjørnskov and Foss, 2006, p. 12).

The fact that an economy is economically free does not mean that there is no government intervention in that economy. In a liberal society, there is absolutely a minimal state

intervention that protects individual freedoms. In terms of economic freedoms the size of the government is important.

Strong money access function means that all people reach the strong (stable) currency. Unexpected price changes and monetary instability can lead to welfare decline and deterioration. Economic freedom is necessary in a stable monetary order. There is positive relationship (Ayal and Karras, 1998) and negative relationship (Gwartney et al., 1998) between economic growth and first three criteria (rule of law and property rights, size of government and taxation, soundness of money) in the EFW index targeting to measure price stability. However, no strong correlation was observed by Levine and Renelt (1992) and Sala-i-Martin (1997).

Gwartney and Lawson (2004) state that by unsound monetary policies create uncertain markets distorting relative prices in which it is difficult to plan wisely and be eager to innovate for entrepreneurs. That leads to lower productivity and lower economic growth.

For a country's economy to be economically free, it is expected that it will not only be free in national trade but also free in international trade. Reducing trade barriers and liberalizing trade, leads countries to mutually earn and effectively distribute their own resources more efficiently. Moreover, as free trade will interact with foreign investors, it will increase the international competitiveness of firms by creating widespread foreign technologies and increasing the productivity of local companies.

Cagetti and DeNardi (2006) state that the fewer restrictions on capital movements across borders lead the easier the access to international capital markets that increases the supply of venture capital, which may lead huge increase in innovation.

It is possible to say that, the less the regulations on the credit market, the labor market and the enterprises, the higher the economic freedom in country. The competitive nature of the credit market will result in effective borrowing by reducing the cost of information and money transfer between borrowers and lenders.

Iimi (2006) observe that rent-seeking behavior and corruption can be reduced by efficient business, labor and credit regulations mitigating the effects of the resource curse.

"Secure property rights, a high quality of regulations and the judicial system, sound money, openness to international trade and investment have positive effect on TFP. Also a high level of regulation and high taxes may or may not be noxious to TFP" (Bjørnskov and Foss, 2010).

## 3. Empirical framework

The dynamic panel regression model:

$$Tfp_{i,t} = \beta_0 + \beta_1(Efi_{i,t-1}) + \beta_2 Totr_{i,t-1} + \beta_3 Efi_{i,t-1} * Totr_i + \beta_4 Tfp_{i,t-1} + \pi_i + \rho_i + \varepsilon_{i,t} \quad (1)$$

In Equation (1) The subscript '$i$' shows a country, subscript '$t$' shows time, $Efi_{i,t}$ shows economic freedom (EFI), $Tfp_{i,t}$ indicates total factor productivity (TFP) growth

(Appendix B), $\text{Totr}_{i,t}$ indicates ratio of the natural resource rents to GDP, $\pi_i$ is country-specific fixed effects, $\rho_i$ is a time dummy and $\varepsilon_{i,t}$ is the random error term.

In equation we use the one year lagged value of TFP, EFI and TOTR to estimate current TFP growth, because the effects of resource rents and economic freedom on productivity growth doesn't occur at the same period or vice versa.

The regression model in Eqn. (1) is estimated using data over the period 2000-2013 for a panel of 30 sample natural resource rich countries based on the country classification by United Nations and using data over the period 2000–2013 for a panel of 34 sample OECD countries based on the country classification by OECD Websites. The countries used in the analyses are listed in Appendix A.

## 4. Methodology and data

### 4.1. Methodology

The data will be analyzed by using dynamic panel regression model putting on Stata.

$$Y_{i,t} = \alpha Y_{i,t-1} + \beta X_{i,t} + \pi_i + \varepsilon_{i,t} \qquad (2)$$

In this model, $X_{i,t}$ are correlated with the unobserved individual fixed country effect ($\pi_i$) but uncorrelated with the past, present and future of error terms ($\varepsilon_{i,t}$ ) i.e. exegoneous, $Y_{i,t-1}$ are correlated both country effect and past values of error terms i.e. endegenous (Arellano, 2003, p. 129).

To get an econometric model first crosssectional dependence is analysed in panel data. Mainly used methods are; Pesaran (2004) $CD_{LM}$ (if T<N), Breusch-Pagan (1980) $CD_{LM1}$ test (If T > N), Pesaran (2004), $CD_{LM2}$ (If T = N almost) and Pesaran, Ullah ve Yamagata (2008) $CD_{LMADJ}$. Cross-Sectional dependency is tested by using Pesaran (2004) $\text{CD}_{\text{LM}}$ method.

It tests whether a shock (increase in labor, growth, investment, research and development) subjected to a country in panel data influences other countries' or not. We find cross-sectional dependence in both the series and in the equation. In this case, the shock subject to one of the countries also affects the other countries. With this in mind, it can be said that countries must be aware of interacted countries by determining their policies. As the cross-sectional dependency was determined between countries, we use methods considering cross- sectional dependency while testing unit root.

If there is cross-sectional dependence than second generation unit root test must be applied. Mainly used second generation unit root tests in literature are; the multivariate augmented Dickey-Fuller (MADF), SURADF (Seemingly Unrelated Regression Augmented Dickey-Fuller), Bai ve Ng (2004), Cross-Sectionally Augmented Dickey-Fuller-CADF (Pesaran, 2006) and PANKPSS (Carrion-i-Silvestre, 2005).

Since cross-section dependency was identified among the countries in this study, the stationary of the series was tested with CADF second-generation unit root tests.

Stationary of the series are achieved by taking difference of the some explanatory variables.

To get rid of endogeneity in dynamic panel model, Anderson and Hsiao (1981, p. 604) proposed to use variables with different lag levels as an instrument variables. In his model, he chooses new instrument variables ($Z$), which are uncorrelated with the error terms ($Cov(Z, \varepsilon) = 0$) (i.e. exogenous) but correlated with the regressors.

Arellano and Bond include all possible instrument variables in the Generalized Moments Method (GMM). The deficiency of this difference equation is, it does not include country specific effects. Arellano and Bover (1995) first developed system GMM estimation method, which considers the difference and level equations together and considered to be more effective (Roodman, 2006, p. 1).

The Sargan/Hansen tests the validity of the instrument variables. Null hypothesis is that all instruments are exogenous. Elitza Mileva (2007) states that the higher the p-value, the better Sargan statistic.

Arellano and Bond (1991) developed an autocorrelation tests. The null hypothesis is that there isn't second order autocorrelation for the residuals of the first difference model. In the first difference model, autocorrelation at first degree – AR(1) – is not important, and even expected because regression uses the lag value of the dependent variable. However, in order to achieve effective results, autocorrelation should not occur at the second level – AR(2).

### 4.2. Data

Total Productivity Growth (TFP) data are taken from TED Total Economy Database. It is the extensive database with annual data covering GDP, population, employment, hours, labor quality, capital services, labor productivity, and total factor productivity for approximately 123 countries in the world. The data covers the period from 2000-2013 and 128 countries in the world, including 5 top developed economies. We have 476 observations from OECD, 420 observations for Natural Resource Rich countries.

The ratio of oil rents to GDP (OILR), The ratio of Natural Gas rents to GDP (NATGR) and Total Resource rents (TOTR) (oil, natural gas and mineral rents) to GDP ratios are taken from the 2013 World Development Indicators online database.

The Fraser Institute Freedom Index (EFI) are taken from the Fraser Institute Database. Index values ranges between 0-10. "0" value shows "less economic freedom" and the value of "10" shows "more economic freedom" for a specific country.

Natural Rich Countries list are taken from "Conflict Prevention in Resource-Rich Economies" report of United Nations and OECD Countries List are taken from OECD website.

The pairwise correlation matrix for our data is stated in Table 2.

**Table 2.** *Correlation matrix for natural resource rich countries and OECD countries*

| | TFP | EFI | GVZ | LEG | SMN | FRT | REG | OILR | NATGR | TOTR |
|---|---|---|---|---|---|---|---|---|---|---|
| TFP | 1,00 | | | | | | | | | |
| | (1,00) | | | | | | | | | |
| EFI | -0,09 | 1,00 | | | | | | | | |
| | (0,05) | (1,00) | | | | | | | | |
| GVZ | -0,02 | 0,25 | 1,00 | | | | | | | |
| | (0,05) | (0,06) | (1,00) | | | | | | | |
| LEG | -0,05 | 0,77 | -0,22 | 1,00 | | | | | | |
| | (0,06) | (0,76) | (-0,32) | (1,00) | | | | | | |
| SMN | -0,11 | 0,81 | 0,14 | 0,53 | 1,00 | | | | | |
| | (-0,09) | (0,68) | (-0,32) | (0,40) | (1,00) | | | | | |
| FRT | -0,06 | 0,79 | 0,10 | 0,53 | 0,57 | 1,00 | | | | |
| | (0,07) | (0,52) | (-0,33) | (0,43) | (0,42) | (1,00) | | | | |
| REG | -0,09 | 0,80 | 0,06 | 0,63 | 0,48 | 0,58 | 1,00 | | | |
| | (0,06) | (0,78) | (-0,08) | (0,57) | (0,50) | (0,21) | (1,00) | | | |
| OILR | 0,18 | -0,13 | -0,23 | 0,07 | -0,22 | -0,19 | 0,08 | 1,00 | | |
| | (-0,13) | (-0,04) | (0,00) | (0,07) | (-0,10) | (-0,22) | (0,04) | (1,00) | | |
| NATGR | 0,17 | 0,00 | -0,02 | -0,05 | 0,00 | 0,07 | 0,06 | 0,27 | 1,00 | |
| | (-0,11) | (0,12) | (-0,04) | (0,24) | (-0,03) | (-0,05) | (0,15) | ( 0,83) | (1,00 ) | |
| TOTR | 0,22 | -0,09 | -0,15 | 0,03 | -0,18 | -0,13 | 0,09 | 0,91 | 0,59 | 1,00 |
| | (-0,12) | (0,13) | (0,21) | (0,08) | (-0,05) | (-0,09) | (0,12) | ( 0,70) | (0,66 ) | (1,00) |

**Note:** The numbers in parentheses are values for OECD countries.
**Source:** Author's computation using Stata.

In natural resource rich countries, Total productivity growth is positively correlated with the total resource rents and other resources, OILR and NATGR. Economic Freedom and its five sub-indices are negatively correlated with productivity growth. This pairwise correlation matrix indicates that country's level of development is not only related to the measures of natural resources, but also related to the freedom of an economy.

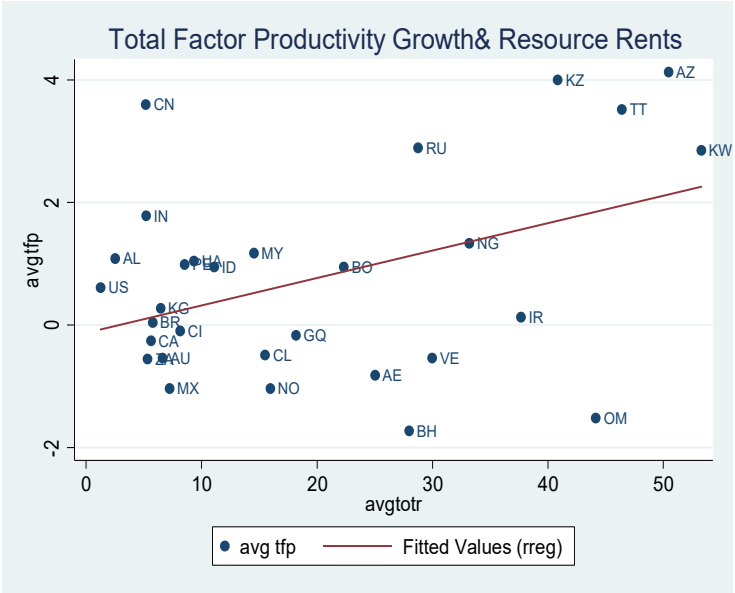
On the other hand, TOTR is negatively correlated with the EFI and its major five subindices (except LEG and REG). But the level of correlation is not too high and this is a good evidence of the less multicollinearity problem in this study.

In OECD Countries, where five of them (Australia, Chile, Mexico, Norway, United States) are common in Natural Resource Rich Countries, productivity growth is negatively correlated with the OILR and NATGR which are alternative measures of resource rents. In pairwise correlation matrix, Resource rents – GDP ratio (TOTR) positively correlated with the EFI as well as its major five subindices (except SMN and FRT).

## 5. Empirical results

Figure 1 shows the average value of total factor productivity growth and the average value of the Resource Rents in natural resource rich countries. The plot shows that Total Resource Rents are positively related to TFP growth.

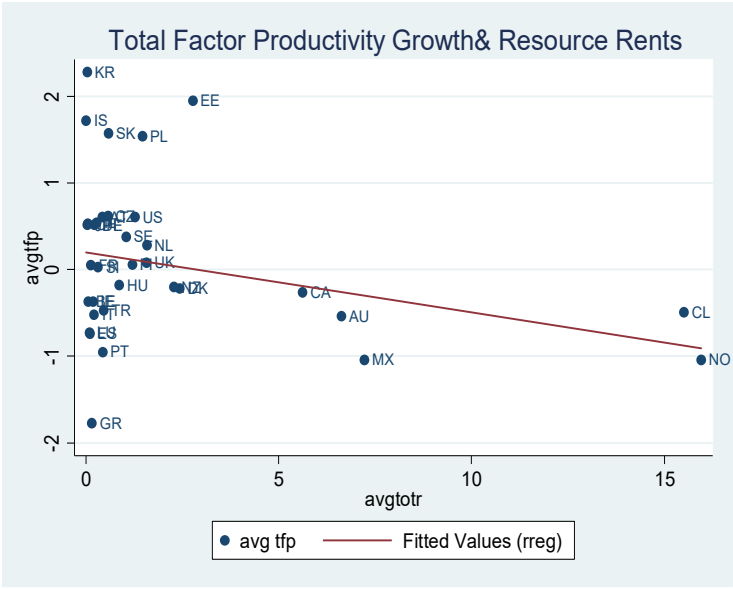
**Figure 1.** *Average resource rents versus average total factor productivity growth (2000-2013) in natural resource rich countries*




**Source:** Data processed by the authors

Figure 2 shows the average total factor productivity growth and the Resource Rents in OECD countries. The plot shows that Total Resource Rents are negatively related to TFP growth. Most of the countries have negligible amount of resource rents, so their effect can not be seen on TFP growth.

**Figure 2.** *Average resource rents versus average TFP growth (2000-2013) in OECD countries*




**Source:** Data processed by the authors

According to general literature review in Equation 1; we expect $\beta_2$ value as negative which shows resource curse, $\beta_1$ value as positive which shows good institutions have positive effects on economic growth, and $\beta_3$ interaction value as positive which shows the negative effect of the resource rents on TFP growth decreases when the quality of economic instutions increase. We expect also absolute value of $\beta_3$ larger than $\beta_2$.

Table 3 presents the Economic Freedom, Total Resource Rents and TFP Growth and interaction effect of economic freedom and Total Resource Rents on TFP Growth in Natural Resource Rich Countries.

**Table 3.** *Economic freedom, total resource rents and TFP growth: 2000-2013 in natural resource rich countries*(1)

| Index Sample | EFI | GVZ | LEG | SMN | FRT | REG |
|---|---|---|---|---|---|---|
| | N.R. (1) | N.R.(2) | N.R.(3) | N.R.(4) | N.R.(5) | N.R.(6) |
| $Totr_{i,t-1}$ | -0.05 | -0.48 | -0.05 | -0.05 | -0.04 | -0.04 |
| | *(-18.50)* | *(-12.59)* | *(-22.47)* | *(-13.59)* | *(-8.45)* | *(-11.41* |
| $Tfp_{i,t-1}$ | 0.15 | 0.21 | *0.16* | *0.21* | *0.23* | *0.25* |
| | *(16.71)* | *(54.99)* | *(18.28)* | *(20.49)* | *(39.80)* | *(19.96)* |
| $d(Efi_{i,t-1})$ | 1.74 | 0.35 | 0.31 | **0.04** | 1.90 | -0.26 |
| | *(5.95)* | *(3.81)* | *(4.22)* | *(0.23)* | *(14.35)* | *(-2.53)* |
| $dEfi_{i,t-1} * Totr_{i,t-1}$ | 0.12 | 0.02 | **0.00** | 0.03 | 0.07 | 0.01 |
| | *(12.07)* | *(22.89)* | *(0.42)* | *(14.82)* | *(23.25)* | *(2.23)* |

**Note:** t-stats are given in parentheses.
**Source:** Author's computation using Stata.

Table 4 presents the Economic Freedom, Total Resource Rents and TFP Growth and interaction effect of economic freedom and Total Resource Rents on TFP Growth in OECD Countries.

**Table 4.** *Economic freedom, total resource rents and TFP growth: 2000-2013 in OECD countries*

| Index Sample | EFI | GVZ | LEG | SMN | FRT | REG |
|---|---|---|---|---|---|---|
| | OECD (1) | OECD(2) | OECD(3) | OECD(4) | OECD(5) | OECD(6) |
| $dTotr_i$ | 0.30 | 0.22 | 0.36 | 0.37 | 0.40 | 0.36 |
| | *(6.00)* | *(7.42)* | *(8.18)* | *(6.80)* | *(7.66)* | *(9.79)* |
| $d(Tfp_{i,t-1})$ | *0.39* | *0.35* | *0.43* | *0.40* | *0.40* | *0.42* |
| | *(47.62)* | *(33.34)* | *(64.20)* | *(44.12)* | *(39.85)* | *(74.66)* |
| $d(Efi_i)$ | 4.24 | 2.60 | 0.27 | -0.57 | -0.82 | 1.16 |
| | *(16.77)* | *(22.00)* | *(3.57)* | *(-2.53)* | *(-6.50)* | *(25.59)* |
| $dEfi_{i,t} * Totr_{i,t}$ | -0.20 | -0.10 | -0.03 | **0.19** | 0.04 | 0.85 |
| | *(-8.16)* | *(-4.94)* | *(-4.98)* | *(0.47)* | *(2.09)* | *(2.73)* |

**Note:** t-statistics are in parentheses.
**Source:** Author's computation using Stata.

The coefficients of total resource rents appear to be significantly positive in the OECD countries but negative in Natural Resource Rich (NRR) Countries. The negative effects of TOTR on TFP growth are consistent with the resource curse hypothesis.

Economies with abundant natural resources have tendency to grow slower than resource-poor counterparts (Auty, 2001; Frankel, 2010; Sachs and Warner, 2001). We expect the sign of the coefficients of economic freedom to be positive and our results show there is positive relation between economic freedom and total factor productivity growth in NRR and OECD countries. The coefficients are statistically significant also. We find also that coefficients of the interaction variables are positive and statistically significant. It means

that for NRR countries the more economic freedom the higher productivity growth. But the results for OECD countries showed different pattern as opposed to NRR samples.

In NRR countries, columns (2-6) of Table 3 reports the growth effects of the resource rents – GDP ratio, five major components of the EFI, and the interaction between these two groups on TFP growth. The results shows that except sound of money and regulations all subindices of Economic Freedom show positive and significant effect on total productivity growth. The interaction effect of sub-indices with total resource revenue have positive effects on TFP as well. Our results also similar to (Farhadi et al., 2015) where the size of government and access to sound money don't show significant interaction effects with the TOTR.

Columns (2-6) of Table 4 reports growth effects of the resource rents – GDP ratio, five major components of the EFI, and the interaction between these two groups on TFP growth of OECD economies. All subindices are statistically significant except interaction effects of Sound of Money with Resource Rents. The results shows that higher natural resource rents increase productivity growth in countries with greater freedom in legal system/property rights and government size. However, the access to sound money and international trade shows negative effect on productivity growth although there is positive interaction effect of these subindices on TFP growth.

## 6. Conclusion

In this study, the link between total factor productivity growth and natural resource rents and economic freedom in 30 Natural Resource Rich and 34 OECD member countries are analzyed by using Two System GMM method. Cross-Sectional dependency is tested by using Pesaran (2004) $CD_{LM}$ method and found to have cross-sectional dependence in both series and in the equation. Panel unit root test; Pesaran (2015) was conducted with CADF tests and the series were found to be non-stationary. This indicates that the effect of shocks, subjected to the economies of the respective countries, is a long run phenomena. Due to dynamic characteristic of model, autocorrelation and endogeneity problem arised. Exogenous instrument variables are used to get rid of this problem. The main findings of this study are similar with the resource curse literature and quality of institutions determines the curse or blessing in Natural Resource Rich countries. Although OECD countries are more market oriented than Natural Resource Rich countries, positive impact of natural resource rents on economic growth decreases as economic freedom increases. In Natural Resource Rich countries, subindices of the Economic Freedom are positive impacts on the growth except regulations but the interaction of regulations with resource rents turns this negative effect to positive. In OECD countries, subindices of the Economic Freedom are positive impacts on the growth except sound of money and international trade, but the interaction of them with resource rents turns this negative effect to positive.

## Note

(1) The dependent variable is total factor productivity $Tfp_i$ growth in every one year interval from 2000 to 2013. $Totr_{i,t-1}$ indicates 1-year lagged value of ratio of total resource rents (oil, gas and mineral rents) to GDP. $Efi_{i,t-1}$ indicates Lagged economic freedom index. Two-step system GMM estimation results are used for estimating coefficients. All regressions satisfy AR(1) test for first-order serial correlation and no second-order serial correlation AR(2). The numbers in second row of each explanatory variables are z-statistics. Number in bold shows that results are not statistically significant at %1, %5 and %10 confidence level.

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## Appendix A

| **NATURAL RESOURCE RICH COUNTRIES (NRR)** | | |
|---|---|---|
| Albania (AL) | Ecuador (GQ) | Norway (NO) |
| Australia (AU) | India (IN) | Oman (OM) |
| Azerbaijan (AZ) | Indonesia (ID) | Peru (PE) |
| Bahrain (BH) | Iran, Islamic Rep. (IR) | Russian Federation (RU) |
| Bolivia (BO) | Kazakhstan (KZ) | South Africa (ZA) |
| Brazil (BR) | Kuwait (KW) | Trinidad and Tobago (TT) |
| Canada (CA) | Kyrgyz Republic (KG) | Ukraine (UA) |
| Chile (CL) | Malaysia (MY) | United Arab Emirates (AE) |
| China (CN) | Mexico (MX) | United States (US) |
| Côte d'Ivoire (CI) | Nigeria (NG) | Venezuela, RB (VE) |

| **OECD COUNTRIES** | | | |
|---|---|---|---|
| Australia (AU) | Germany (DE) | Mexico (MX) | Switzerland (CH) |
| Austria (AT) | Greece (GR) | Netherlands (NL) | Turkey (TR) |
| Belgium (BE) | Hungary (HU) | New Zealand (NZ) | United Kingdom (UK) |
| Canada (CA) | Iceland (IS) | Norway (NO) | United States (US) |
| Chile (CL) | Ireland (IE) | Poland (PL) | |
| Czech Republic (CZ) | Israel (IL) | Portugal (PT) | |
| Denmark (DK) | Italy (IT) | Slovak Republic (SK) | |
| Estonia (EE) | Japan (JP) | Slovenia (SI) | |
| Finland (FI) | Korea, Rep. (KR) | Spain (ES) | |
| France (FR) | Luxembourg (LU) | Sweden (SE) | |

**Appendix B**

## Total factor productivity

Robert Solow (1956) is the first in literature explaining total productivity by the Cobb-Douglas (1928)'s production function in which there is single good with two factors.

$$Y = A(t)\, F[K(t), L(t)] \tag{2}$$

$Y$ = Total production,
$L$ = Labor input,
$K$ =Capital input,
$A$ = Total factor productivity

First, we take differences of the equation (2). So production function turns to growth base.

$$\frac{\dot{Y}_t}{Y} = \frac{\dot{A}_t}{A} + \frac{F_K}{F[K(t),L(t)]}\dot{K}_t + \frac{F_L}{F[K(t),L(t)]}\dot{L}_t \tag{3}$$

In this equation, $F_K$ is marginal product of capital, $F_L$ is the marginal product of labor.

We know from Eq. (2) that

$$\frac{Y}{A_t} = F[K(t), L(t)]$$

And putting this in equation (3)

$$\frac{\dot{Y}_t}{Y} = \frac{\dot{A}_t}{A} + \frac{A_t F_K K_t}{Y_t}\frac{\dot{K}_t}{K} + \frac{A_t F_L L_t}{Y_t}\frac{\dot{L}_t}{L} \tag{4}$$

In a competitive market, we pay marginal product to factor of product

$$\frac{dY}{dK} = A\frac{dF}{dK} = AF_K \text{ and } \frac{dY}{dL} = A\frac{dF}{dL} = AF_L$$

As a result

$$\frac{\dot{Y}_t}{Y} = \frac{\dot{A}_t}{A} + r\frac{K_t}{Y_t}\frac{\dot{K}_t}{K} + w\frac{L_t}{Y_t}\frac{\dot{L}_t}{L} \tag{5}$$

Where r is a price of capital and w is a price of labor

$s_{k=} r\frac{K_t}{Y_t}$ where $s_k$ is the weight of physical capital in production

$s_{l=} w\frac{K_t}{Y_t}$ where $s_l$ is the weight of labor in production

$$s_k + s_l = 1$$

$$\frac{\dot{Y}_t}{Y} = \frac{\dot{A}_t}{A} + s_k\frac{\dot{K}_t}{K} + s_l\frac{\dot{L}_t}{L} \tag{6}$$

Equation (6) shows that, the source of change in economic growth mainly depends on changes in technological development, capital accumulation and changes in labor of inputs. According to this production function, production is an increasing function of these inputs, and output increases through technological development (change in A) at a given capital and labor level.

## Appendix C

Government size index (GVZ) ranges from 0–10. Countries with a larger proportion of government expenditures, with larger transfer sectors, when government investment exceed 50% of total investment, with the higher marginal tax rates gets 0 rates.

Legal System and Property Rights index (LEG) ranges from 0–10. Countries with no judicial independence, inefficient legal framework for private businesses, no protection of property rights, high militaries involvement in politics and no integrity of legal system gets 0 rates.

Access to sound money index (SMN) ranges from 0–10. Countries, where the money supply growth rate greatly exceeds real output growth rate, where the annual standard deviation of the inflation rate is approximately 25%, where annual inflation rate is over 50% and where foreign currency bank accounts were restricted both domestically and abroad gets 0 rates.

Freedom to trade internationally index (FRT) ranges from 0–10. Countries with more than %15 taxes on international trade, mean tariff rates is nearly %50, the standard deviation of tariff rates increases toward 25%, longer import or export procedures, the percentage difference between official exchange rates and black-market rates is over 50%, highly restrictive regulations for international capital flow, highly capital control gets 0 rates.

Regulation index (REG) ranges from 0–10. It includes credit market, Labor market and Business regulations. Countries where 10% or less of private deposits held in privately owned banks, where greater government borrowing occurs, where lending and deposit rates are fixed by the government, where fixed-term working contracts are used for any kinds of task, where hiring and firing of workers is hindered by regulation, where wages are set by a centralized bargaining process, where conscription period is over 18 months, to start a new business takes longer times or more costly, long time and high monetary cost to obtain licence to construct warehouse gets 0 rates.