GOVERNANCE, OIL PRICE, AND ECONOMIC GROWTH: THE CASE OF ECUADOR

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ABSTRACT

Ecuador is a developing country that faces an economic and financial crisis every time the price of oil falls. Therefore, determining the variables that have an impact on economic growth is of a high importance. Prior studies show that governance and inequality influence economic growth. By using a vector autoregressive model, the main goal of this research is to analyze the effect of the price of oil and governance on economic growth. The findings show governance has a positive effect on GDP but it is not of a huge magnitude. On the other hand, in the case of oil exporting countries, a positive shock in the oil price leads a negative and significant effect on GDP.

Keywords: Ecuador, oil price, governance indicators, GDP

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LIST OF ABBREVIATIONS

APEC:	Asia-Pacific Economic Cooperation
BCE:	Banco Central del Ecuador (Central Bank of Ecuador)
ECLAC:	Economic Commission for Latin America and the Caribbean
FEVD:	Forecast Error Variance Decompositions
GDP:	Gross Domestic Product
IEA:	International Energy Agency
IRF:	Impulse Response Function
LGBTI:	Lesbian, Gay, Bisexual, Transgender, and Intersexed
OECD:	Organization for Economic Co-operation and Development
OPEC:	Organization of the Petroleum Exporting Countries
UN:	United Nations

1. INTRODUCTION

According to the UN classification, all South American countries are developing economies. A developing country is one where people have a lower standard of living and industries are not developed or are less developed than in other countries. Most developing countries depend on natural resources. This is the case for the South American region, where countries can be divided according to their exported baskets. For instance, Venezuela, Colombia, Bolivia and Ecuador are fuel fossil exporters. Chile and Peru are mining exporters. Uruguay, Brazil, Paraguay, and Argentina are agricultural exporters. This stands for the main product exported by the countries and represents the product of which these countries are dependent on.

Although South American countries differ as for exported products, these countries are similar in many other ways; for instance, politics, culture, language, religion and other social aspects. Nonetheless, each of these countries has developed its economy in a different way during the last decades. For example, Chile in recent years has shown significant economic growth, rendering it one of the most developed countries in South America. Chile depends on copper as Ecuador does on oil. Still, the growth of Chile is significantly higher than that of Ecuador. It is interesting, therefore, to compare the two countries.

The main characteristic of being a developing country is a relatively low standard of living. This translates into low incomes, poor health and education systems, high inflation, low consumption, and so on. Therefore, the main goal for the governments in these countries is to establish a system that in the long run allows their countries to raise their standard of living.

The Ecuadorian economy has been directly dependent on oil exports since the seventies. The so-called oil boom led to a significant economic growth for the country. Most of the highways, hospitals, schools and universities were built in that period. However, natural resources do not last forever, and even worse, world oil prices are not always favorable for oil exporting countries.

Given that Ecuador is an oil dependent country, this research aims to find ways for the Ecuadorian government to make this dependence less heavy. For this reason, an analysis of the governance was applied, as previous studies have shown that good governance contributes to durable economic growth.

Hence, this paper aims to show the relationship between real GDP on the one hand, and governance indicators and the oil price on the other. I formulate my research questions as follows:

1. What is the impact of governance on economic growth?
2. What is the impact of the price of oil on economic growth?

The thesis proceeds as follows: Section 2 includes a description of the social economic and political situation of Ecuador. Section 3 includes a comparison of some economic indicators between Ecuador and Chile. Section 4 shows prior studies that focus on governance and oil price. Sections 5 describes the empirical analysis and 6 describes the empirical results. Policy recommendations are explained in section 7. Lastly, the conclusions based on the results are explained in section 8.

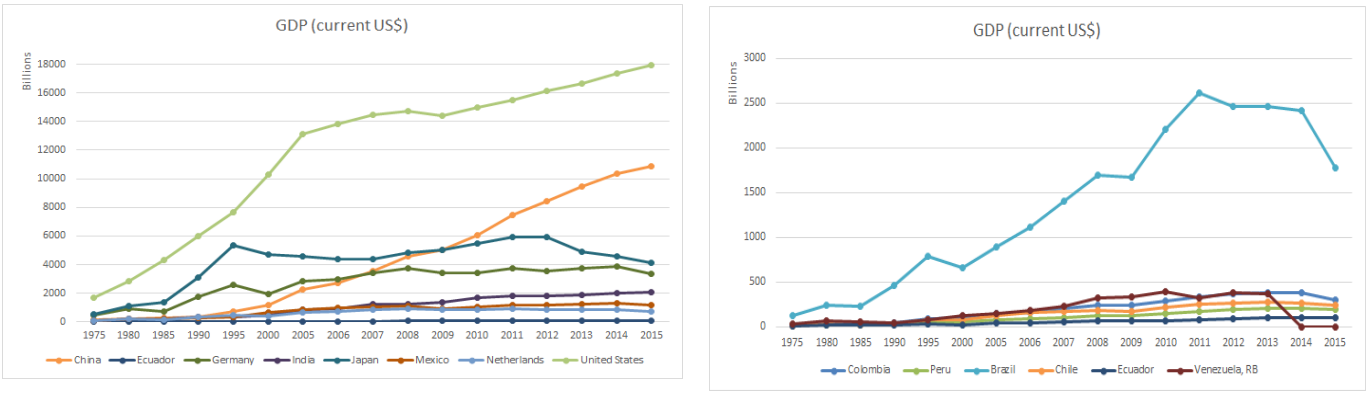
2. OVERVIEW OF ECUADOR

Ecuador's population estimate for 2015 is 15 million people. It's a democratic republic bordered by Colombia and Peru. The official language is Spanish, which is spoken by most the population. The ecology and bio diversification are the most representative and known aspects of Ecuador.

As regards the economy, GDP in 2015 was $100.8 billion. In the last decades, Ecuadorian GDP increased constantly, maintaining the pattern of other South American countries. Nonetheless, other countries that have the same socio, economic and political characteristics, have experienced a better growth. Figure 1 shows that Ecuador is at the bottom and very far away from economies such as China, Germany, and Japan. Moreover, compared to the other five South American countries, Ecuador is the one with the lower GDP[1].

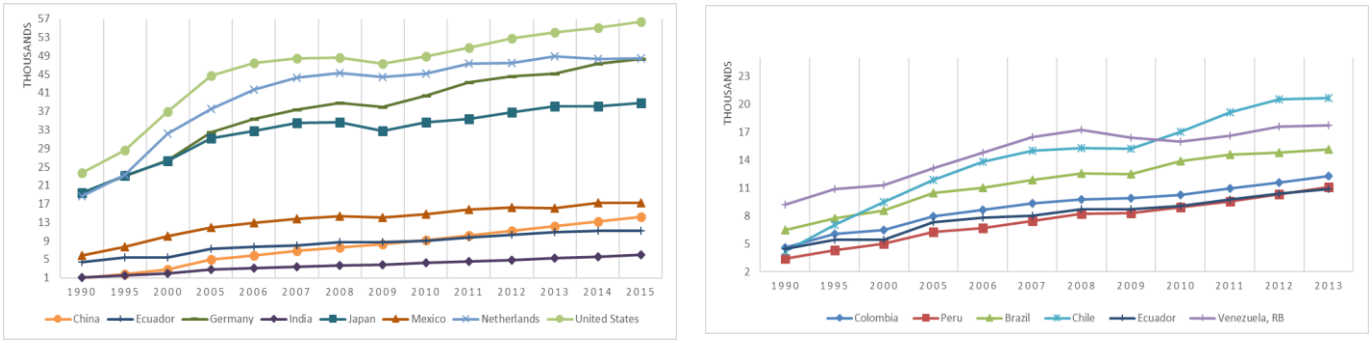
Figure 2 shows GNI per capita of various countries from 1960 to 2014. In the case of Ecuador, GNI per capita was around $6000, which according to the UN, is considered upper middle income. Exports were around $23.4 billion, of which more than half can be attributed to oil. The dependency on oil is also evident from public sector revenues, 30% of which come from oil sales.

Figure 1: GDP (current USD) by country



Source: The World Bank. World Development Indicators.

Figure 2: GNI per capita, Atlas method (current US$) by country



Source: The World Bank. World Development Indicators.

Like other countries in the region, Ecuador experienced an oil boom in between 1972 and 1981. During the early years of oil exports, GDP per capita increased at an average rate of 4.05% per year, while the productivity of the economy increased at a rate of 2.7% annually. This growth was possible due to the high international price of oil.

[1] There was not available data for 2014 -2015 for Venezuela

By 1982, the "oil boom" had ended and the country began a new period under the "Washington Consensus". The economic policies of this consensus established the liberalization of exchange rates and interest rates, dismantling of tariff protection, opening of markets, elimination of subsidies and deregulation of the financial system and the labor market (Larrea, 2006). However, the results were not the expected ones. Due to the high level of debt and the slump in international oil prices, for nearly two decades the Ecuadorian economy was stagnant. Average per capita GDP grew at a negative rate of -0.14% per year, while the productivity of the economy declined on average by -0.04% annually.

Furthermore, social inequality, exclusion and poverty deepened during the economic stagnation and trade liberalization. In 1994, 57% of the urban population had low productivity jobs (ECLAC, 2001). In 1995, 56% of the population was below the poverty line, reaching 76% in rural areas, higher than the Latin American average. In addition, the illiteracy concerned 10.5% of the population and the average schooling of adult population reached 7 years (UNDP, 2001). In 1998, chronic malnutrition among children under 5 years of age reached 26%. (Larrea, Freire and Lutter, 2001). Also, the Gini coefficient (0.57) which measures the distribution of income, placed Ecuador in the third most unfavorable position in the region, after Brazil and Paraguay (JID, 2000).

In the late 90s, the outlook worsened. The climatic phenomenon of El Niño in 1998, falling oil prices and the international financial crisis, triggered a deep economic, social and political crisis. In 1999, Ecuador suffered from an economic and financial-banking crisis, which ended in the closure of 30 private banks, driven by a failure of an effective regulatory and control environment in the financial system and a credit boom, which showed the vulnerability of the system. This crisis contracted the economy, increased the unemployment level (from 8% to 17% in the main cities) and urban poverty reached 65% (an increment of 29 points compared to 1998). The annual inflation rate was around 40%. Consequently, migration increased enormously with an unprecedented number of Ecuadorians leaving the country. The countries chosen by the migrants were mostly Spain, Italy and the USA.

Table 1: Annual GDP growth rate and consumer price (in percentage)

	GDP	CPI
1950 -1969 (before the oil boom)	**4.41**	**3.23**
1950 – 1960	5.10	2.30
1960 – 1969	3.71	4.15
1970 - 1981 (after the oil boom)	**6.84**	**12.34**
1982-1999 (crisis)	**2.23**	**38.93**
1982 – 1992	2.46	42.00
1993 – 1999	1.87	34.10
1992 -1998 (without 1999)	2.85	34.40
1999	-4.74	52.24
2000 - 2003 (dollarization)	**2.98**	**38.55**
2004-2006	5.97	2.73
2007-2015 (period of current president)	**3.85**	**4.36**
2007-2013	4.39	4.53
2014-2015	1.98	3.77

Source: Data from 1950 to 1960 taken from Gastambide A, El Camino hacia la Dolarización. FLACSO 2010.
Data from 1960 to 2015 taken from The World Bank. World Development Indicators.

As a result of the crisis, in January 2000, the government eliminated the national currency “Sucre” and adopted the US dollar as legal tender. Dollarization was given as a response to an uncontrollable depreciation of the Sucre (Ecuadorian currency) and the inflationary spiral caused by the depreciation of the Sucre. In that time, prices rose from one day to another and suppliers demanded dollars instead of Sucres. Ecuador dollarized with an exchange rate of $ 1: 25,000 Sucres, a questioned conversion, as it especially favored certain economic and political power groups.

Dollarization stabilized the economy, aided by the increase in remittances from people who migrated after the crisis. However, although the dollarization stabilized the economy, it also introduced a set of long-term problems in terms of the government’s loss of control over monetary and exchange rate policy. Under dollarization, the government cannot print money to finance its fiscal deficits. As a result, the Ecuadorian government had to seek new sources of income to cover its expenses, such as new taxes, loans or reduction of the expenditure. Thus, by giving up control of its money supply, dollarization encourages fiscal discipline, but also restricted the fiscal response to stabilize the economy in difficult times.

Formerly, it was thought that having vast natural resources guaranteed the welfare and economic growth. Given that Ecuador had an abundance of oil underground, many governments thought that economic sustainability would be guaranteed, and any effort was made to find new sources to improve the economy. Ecuador exports two types of crude oil: i) “Crudo Oriente” medium oil with 23° API gravity and ii) “Crudo Napo” a heavy oil between 18° and 21° API gravity. Both are of lower quality than the international benchmark West Texas Intermediate (WTI), which Ecuador uses as a reference for the sale of crude oil. Due to the high price of oil, Ecuador experienced economic growth in the years after the global crisis of 2008 and before the price decreased.

Regarding politics, a democratically elected President, who serves a four-year term, governs Ecuador. At the time of writing, Ecuador’s’ president is Rafael Correa. The current constitution was written by the Ecuadorian Constituent Assembly elected in 2007, and was approved in 2008. Ecuador has more than 10 political parties. The suffrage is universal and compulsory between 18-65 years old and eligible for people from 16 - 18 years old and over 65 years old. The current government belongs to the left party and has been in power for almost 10 years. The Ecuadorian State has five branches of government: The Executive Branch, the Legislative Branch, the Judicial Branch, the Electoral Branch, and Transparency and Social Control Branch. The executive branch includes 25 ministries. Ministers, provincial governors and councilors are directly appointed by the Executive Branch.

3. COMPARISON ECUADOR AND CHILE

In this section, a comparison of some economic indicators between Ecuador and Chile is shown. As previously mentioned, and contrary to Ecuador, Chile has been economically well performing in recent years. Thus, this comparison between Ecuador and Chile aims to analyze the economic policies Chile implemented that led to its current prosperity.

3.1. Exports and Imports

Exports of both countries can be categorized into three groups: mining, agriculture and fishing, and manufacturing industry. The mining sector accounts for more than 50% of both countries exports. Agriculture and fishing sector is the second most important sector in Ecuador, with products such as bananas, coffee, cacao and shrimp. Manufacturing industry has the less weight in Ecuadorian’s

exports. In the case of Chile, both agriculture and manufacturing industries have almost the same weight, being grape one of the main products exported.

In regards to imports (Figures 5 and 6), goods for consumption are the main imported item for Ecuador, whereas Chile mainly imports intermediate products. Clearly, the difference between both countries is that Ecuador imports final products whereas Chile imports items to transform these into final products, which can later be used in the domestic economy or exported.

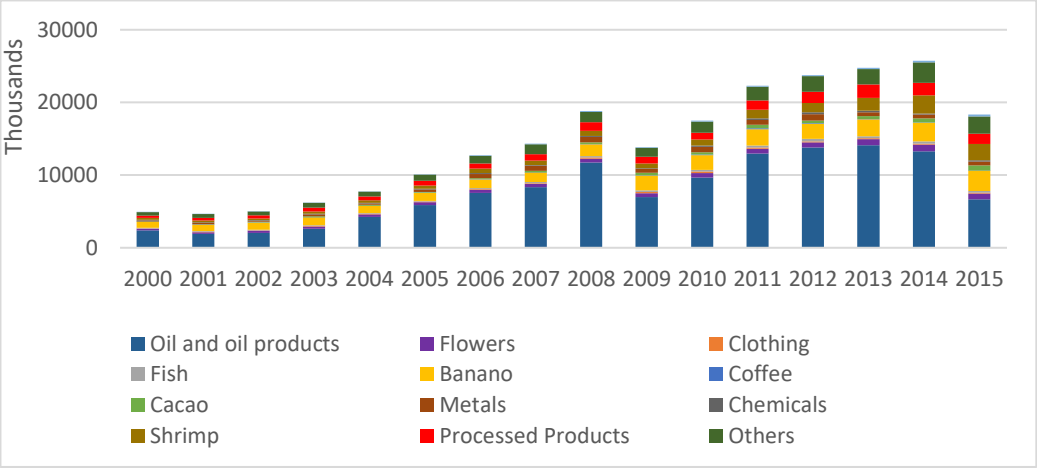
As mentioned Ecuador's economy had primary products as an important component of its exports. Oil is the most important with around 50% of the total exports. The worrisome effect of this dependency is the well-known "Dutch Disease". This economic concept appeared in the 1970s after the negative effects of gas-export experienced by the Netherlands. The jump increases in oil prices translated into larger price fugue. This increased wages in the oil and gas sector in the Netherlands. This wage increased quickly spilled over to other sectors, making these other reduces in competitive in world markets. It is difficult to determine that an economy is being affected by the Dutch disease. However, in the point of view of the author of this research, Ecuador has shown some of the conditions and effects of the Dutch disease. To mention some of them, issues in the balance of payments, increase in external debt, and undesirable mobilization of factors.

The theory suggests that the dependence on one product discourages the production of other tradable products, leaving poor development in the industrial sector. A huge problem for Ecuador is the low amount of manufacturing of products. In the last decades, Ecuador has not shown progress of its manufacturing industry, which is noticeable in the level of imports of processed products.

The external debt's increment responds to the fact that governments need more recourses to extract the natural resource. To avoid a diminishment in social investment such as education, health or others due to investment in machinery and technology for oil or gas extraction, governments increase the external debt. Another issue from the Dutch disease is the mobilization of factors, especially the human capital. Given that wages increase in the oil sector, work force move to that sector leaving a labour fissure in the other sectors.

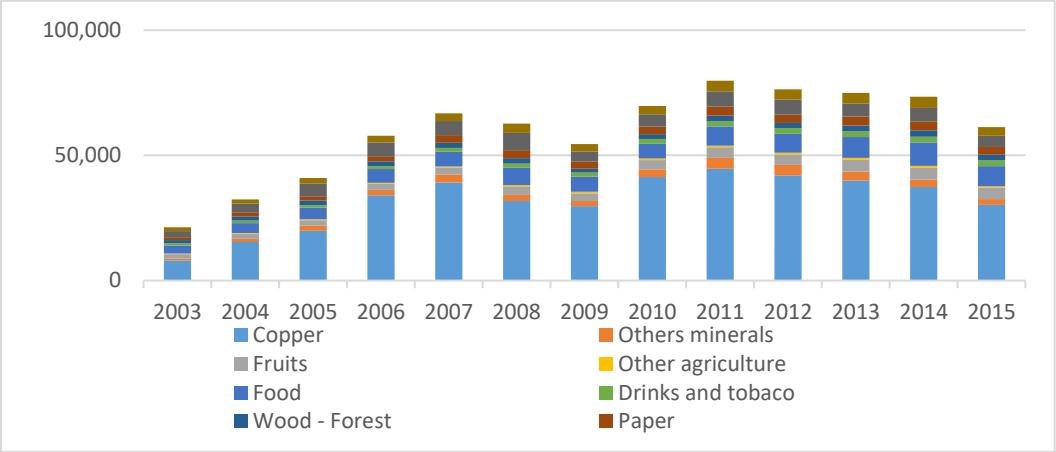
Dependence on primary goods makes an economy more vulnerable than a manufacturing economy. This is due to the greater volatility of the prices of primary goods than processed products in international markets. This lack of competition reduces the possibility of economic growth in the long term.

Figure 3: Ecuador exports by product



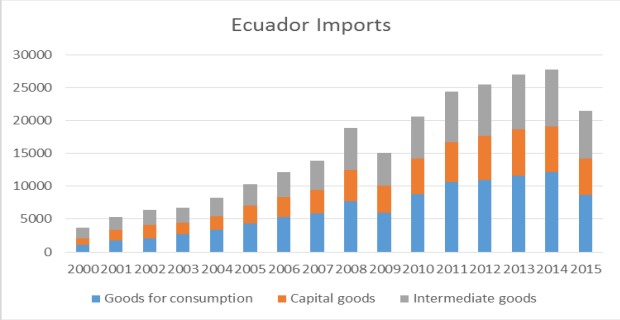
Source: BCE. Información Económica. Sistema de Información Macroeconómica.

Figure 4: Chile exports by product



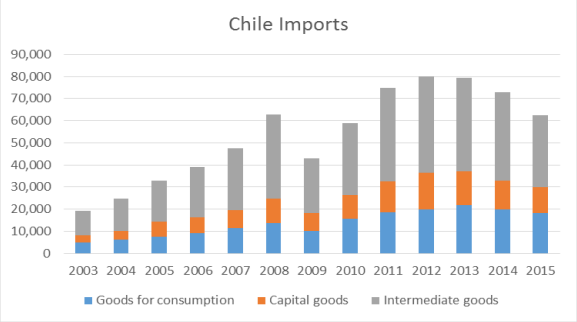
Source: Central Bank of Chile. Base de datos. Retrieved from https://www.bcentral.cl

Figure 6: Ecuador imports



Source: BCE

Figure 5: Chile imports



Source: Central Bank of Chile

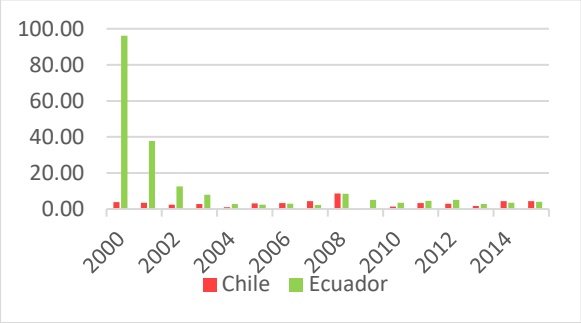
3.2. Domestic Expenditure, Inflation and Employment

Other important economic indicators include inflation and employment. As mentioned earlier, Ecuador does not have a national currency. This helps to explain the dramatic change in inflation illustrated in Figure 7. In 2000, Ecuador's inflation was 96%. However, with the use of the dollar, inflation nowadays is around 3 or 4%. Comparatively, Chile's inflation shows volatile patterns in the first years of this analysis, and like Ecuador it looks stable with values around 3 and 5% in the latest years.

While GDP per capita has been much higher in Chile than in Ecuador in recent years, it is surprising that the level of unemployment is higher in Chile than in Ecuador. The reason behind the high unemployment rate in Chile is due to a larger reduction in both economic activity and confidence levels compared to Ecuador since the beginning of the crisis. Further, as highlighted by the OECD (2016), the lack of flexibility of Chile's labor market has contributed to its level of unemployment. The hiring and firing costs in Chile are high by international standards. Moreover, the emergence of entrepreneurship in Ecuador in the past years has helped to contain the unemployment levels, which have fallen since 2014 (Figure 8). In 2013, the ILO estimated unemployment for Latin America at 5.3%. Therefore, the unemployment levels of both countries cannot be considered exceptionally high.

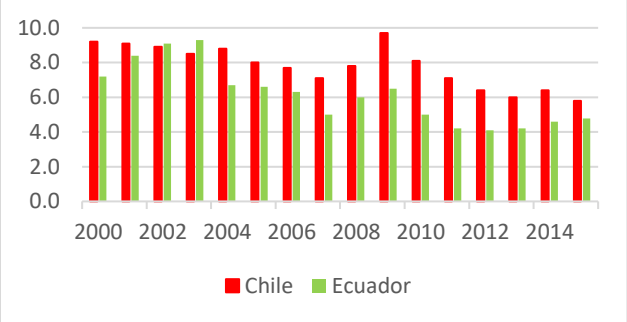
The way in which an economy develops also effects household consumption. Since 2009, after the world financial crisis, household consumption has increased in both countries. During 2010 to 2015, with the sole exception of 2014, Chile showed a higher household consumption than Ecuador. This anomaly of 2014 could be explained, once again, by the price of oil. 2014 was the last year with high oil prices, while in 2015 the price of oil plummeted.

Figure 7: Inflation - Ecuador and Chile



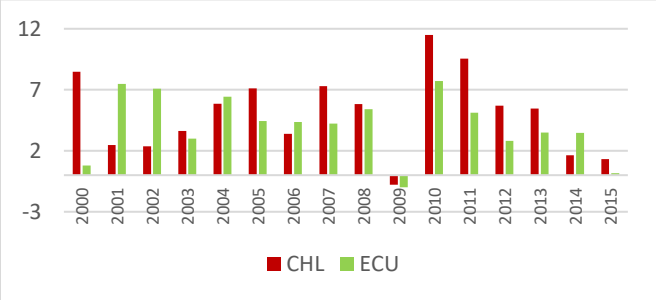
Source: The World Bank. World Development Indicators

Figure 8: Unemployment - Ecuador and Chile



Source: The World Bank. World Development Indicators

Figure 9: Household final consumption expenditure (annual % growth) – Comparison between Ecuador and Chile



Source: The World Bank. World Development Indicators.

3.3. Political Stability

Table 2 shows the number of presidents of Ecuador since 1972. In 44 years, Ecuador has had 15 presidents. The current one, Rafael Correa has been in power for 9 years. Before the oil boom, Ecuador experienced a difficult political situation, which ended with the ousted coup of president Jose Maria Velasco Ibarra. Guillermo Rodriguez, a military general, assumed power, who later on was considered by many as a dictator. After seven years of military governance, democracy returned to Ecuador and lasted for 17 years. From 1996 to 2005, Ecuador had 6 presidents, the most unstable political period for the country. Although for the last 9 years Ecuador has had the same president, its political stability has been affected by the economic policies implemented by the government.

Table 2: Presidents of Ecuador since 1972

Presidents of Ecuador since 1972			
Period	**President**	**Form of election**	**Form of leaving**
February 1972 - January 1976	Guillermo Rodriguez Lara	Militar Ousted Coup	Change of militar leader
January 1976 - August 1979	Supreme governing council	Triummvirate - Militar Government	Back to the Democracy
August 1979 - May 1981	Jaime Roldós	Democratic election	Accidental death
May 1981 - August 1984	Osvaldo Hurtado	Designation by Congress - Sucession (VP)	End of mandate
August 1984 - August 1988	Leon Febres Cordero	Democratic election	End of mandate
August 1988 - August 1992	Rodrigo Borja	Democratic election	End of mandate
August 1992 - August 1996	Sixto Duran Ballen	Democratic election	End of mandate
August 1996 - February 1997	Abdala Bucaram	Democratic election	Ousted by Congress
February 1997 - August 1998	Fabian Alarcon	Congress designation	End of mandate
August 1998 - January 2000	Jamil Mahuad	Democratic election	Ousted coup
January 2000 - August 2002	Gustavo Noboa	Designation by Congress - Sucession (VP)	End of mandate
August 2002 - April 2005	Lucio Gutierrez	Democratic election	Ousted by Congress
April 2005 - August 2007	Gustavo Palacio	Designation by Congress - Sucession (VP)	End of mandate
August 2007 - April 2009	Rafael Correa	Democratic election	Anticipated election
April 2009 - August 2013	Rafael Correa	Anticipated election after the change in the Constitution	Re-election
August 2013 - present	Rafael Correa	Democratic election	

Ecuador's political management has been criticized by various international institutions. For instance, the Bureau of Democracy, Human Rights and Labor of the U.S. Department of State in the annual report of 2015, mentioned that Ecuador suffers from lack of independence in the judicial sector, restrictions on freedom of speech, press and corruption, as well as political interference that resulted in impunity. In the case of Chile, the principal human right concerned harsh prison condition and the excessive force by security forces. The same report mentioned for both, Ecuador and Chile issues related to violence and discrimination against women, children, and LGBTI persons.

From the texts, we can infer that the U.S Department of State remarks were more severe to Ecuador than to Chile. These factors have affected the political image of Ecuador, and this has had economic repercussions. Foreign investments decreased in the last years, with many companies moving out of Ecuador to neighboring countries like Peru and Colombia.

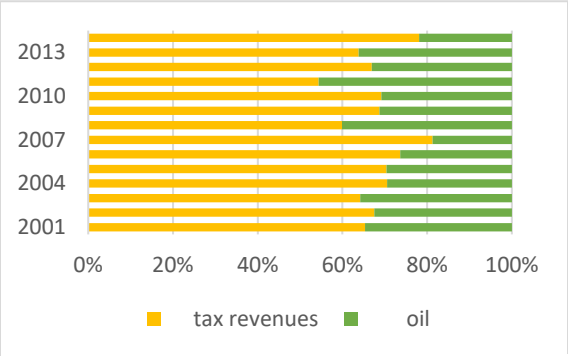
3.4. Government Revenues

Figures 10 to 13 show the government revenues of both countries. Even when both countries reveal that most of their revenue comes from taxes, there is a difference in the percentage of revenues from oil to Ecuador and copper to Chile. Figure 10 shows that the sale of oil, on average, represents 30% of total revenue in Ecuador. However, in 2014, the percentage dropped to 20% due to the low price of oil. This visibly creates a huge gap in the Ecuador's government revenues. Figure 11 shows Ecuador's income relative to GDP. Oil sales, on average, represent about 6% in relation to GDP.

In comparison, Chile's copper sales, on average, denote about 10 percent of the total revenue of the Chilean government (Figure 12) and about 2% relative to GDP (Figure 13).

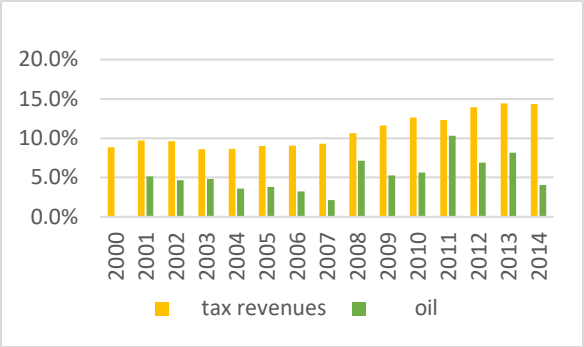
The Ecuadorian government's budget suffers from many fluctuations when the oil price is not favorable. At the time of writing, the oil price is low, thus Ecuador faces the prospect of the cost of producing oil to be higher than its final price. This also signifies a loss of approximately 30% of the revenue, and consequently many government projects have stopped due to lack of funding.

Figure 11: Ecuador's revenue



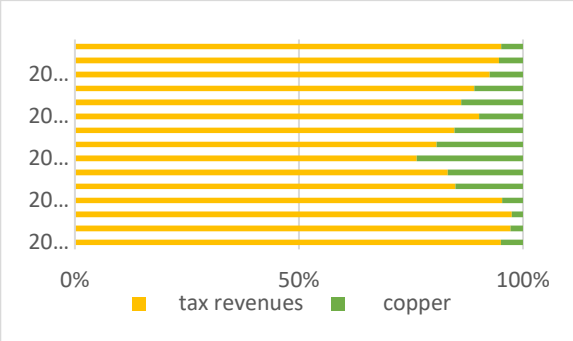
Source: ECLAC, BCE

Figure 10: Ecuador's revenue (%GDP)



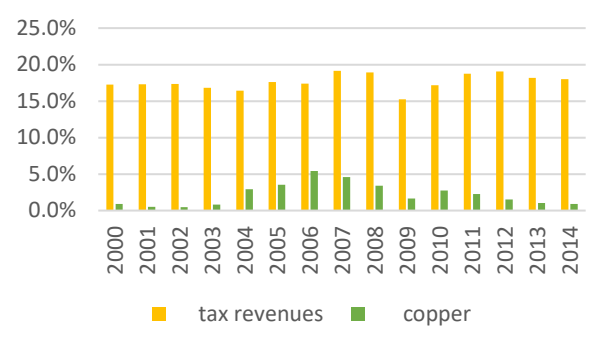
Source: ECLAC, BCE

Figure 13: Chile's revenue (% GDP)



Source: ECLAC, Central Bank of Chile

Figure 12: Chile's revenue



Source: ECLAC, Central Bank of Chile

4. THEORETICAL FRAMEWORK

4.1. Measuring Governance

Kauffmann, Kraay, Zoido- Lobatón (1999) showed the relationship between governance indicators and development outcomes, using six aggregate indicators constructed for this analysis. According to the authors, the aggregate indicators provide better measures of governance than the individual indicators. For instance, in the creation of the indicators, the authors used a database of over 300 governance indicators collected from different sources. The data came from a poll of experts and cross-country surveys of residents. These indicators are i) voice and accountability, ii) political instability and violence, iii) government and effectiveness, iv) regulatory burden, v) rule of law, and vi) graft.

Following Hall and Jones (1999), the authors regressed the log-level of per-capita income on each of the aggregate indicators. The results of the estimations show a causal relationship between good governance and development outcomes. For instance, a high per capita income, decreases the infant mortality, and increases literacy. Better governance, with a one-standard-deviation increase, leads to an improvement in literacy that ranges between 15 to 25 percentage points and a 2.5-fold and 4-fold (for some of the indicators) increase in income per capita, and a comparable reduction in infant mortality

4.2. Does Governance Matter?

Quibria (2006) analyses the 'governance-deficit' and 'governance-surplus' of the Asian countries, using some governance quantitative indicators, such as voice and accountability, government effectiveness, political stability and absence of violence, regulatory quality, rule of law, and control of corruption.

To establish a governance deficit or surplus, the author estimated a regression using governance levels of countries against per capita income levels. To make the countries comparable, he first set the average international level of governance and then he compared the values of each country to the international average. For the international average line, he used the KKZ governance index, which is the weighted sum of all six individual governance indicators, mentioned above. For the construction of the index, each indicator is assigned equal weight. If an economy's score is above the international reference line, the economy has a surplus of governance. If it is below the international line, the economy has a governance deficit.

Firstly, the author estimated a regression between the governance indicator against real GDP per capita. The result of this regression was an upward-sloping line, which indicates that the higher the level of income, the better the quality of governance.

Then, the author estimated a second regression using the GDP growth against GDP per capita and the governance index. The result of his analysis is that countries with governance deficits have, on average, consistently outperformed countries with governance surpluses. The author mentioned some explanations for this paradox. First, the relationship between governance and economic performance is not strong, arguing that the conventional measures of governance do not capture the nuances of government-growth interactions. This means that governance has only a second order effect on economic performance. The second is that not all the indicators of governance are equally vital for economic growth. For instance, in countries like China or Vietnam, government effectiveness and regulatory quality are apparently more important than voice and accountability, or corruption control.

Finally, Rodrick (2003) and Dixit (2004), argue that changes in institutions aimed at improving governance should be focused on the existing structure, and not aimed at imitating a western-style governance. (This as a consideration for the policy-makers of developing countries)

4.3. The Links between Economic Growth and Income Inequality

The impact found by previous empirical papers related to the effect of inequality and economic growth are mixed. Persson and Tabellini (1991) or Alesina and Rodrik (1994), found evidence of a negative relationship between those variables. In contrast, Li and Zou (1998) and Forbes (2000) find that greater inequality is associated with faster economic growth. Barro (2000 and 2008) argues that inequality has a positive effect on GDP growth in advanced economies, but has a negative impact in developing ones.

Given that governance influences economic growth, Zhuang, De Dios, and Lagman-Martin (2010) aimed to establish where Asian countries stand in comparison to the rest of the world and whether growth performance also influences inequality or only poverty. Papers from Barro (1991), Mauro (1995), Knack and Keefer, Kauffmann and Kraay (2008) were mentioned, which established a strong relationship between the governance indicators and the growth of an economy.

Regarding the results, Asia reported a low score in political stability and voice and accountability. However, government effectiveness and rule of law were high. Following Quibria´s approach (2006), Zhuang et al. (Zhuang et al. 2010) estimate the surplus and deficit in each of the six world governance

indicators for each developing Asian economy in both 1998 and 2008. The results show a positive relationship between governance and real GDP per capita for all six indicators in 1998 and 2008. During 1998–2008, the indicators decreased, except control of corruption which increased and regulatory quality which kept unchanged.

Emerging Asian economies with better performance on government effectiveness, regulatory quality, and rule of law grew faster during 1998-2008 than countries with a deficit governance. These results support the relationship between better governance and economic growth. However, this link cannot distinguish in the cases of voice and accountability, political stability, and control of corruption.

Furthermore, considering Fukuyama (2008), improving government effectiveness, regulatory quality and rule of law, and control of corruption, can be used as development policies for many Asian countries.

4.4. Oil shocks and economic growth

Many types of research have been conducted to analyze the impact of oil prices on economic growth. Many of these studies showed mixed results. Miguel, Manzano and Martín Moreno (2003) analyzed the impact of the oil price on economic activity in the case of Spain. By using a VAR model, they showed a negative impact of the oil price on economic growth.

On the other hand, Cunado and Pérez de Gracia (2003) found no long-term cointegration relationship between oil prices and economic activity, except for the United Kingdom and Ireland. Therefore, they suggest that the impact of oil shocks on economic activity is limited to a short term. Limin et al. (2010) investigate the relationship between oil prices and China's macroeconomics. They that the world price of oil affects significantly China's economic growth and inflation.

Ftiti, Guesmi and Teulon (2014) analyzed the four main OPEC countries (UAE, Kuwait, Saudi Arabia and Venezuela). They found the exporting countries are more sensitive to oil shocks than the importing countries. Additionally, they have shown that oil prices in periods of global turmoil or during economic cycle fluctuations have a significant impact on the relationship between oil and real economic activity.

Rodríguez and Sánchez (2004) analyzed the oil price shocks in the real economic activity of the main industrialized countries. Using a multivariate VAR analysis, they found an increase in the price of oil has a negative effect on economic activity in all cases, except in Japan, in the case of oil importing countries. However, the effect differs between oil-exporting countries; for example, the high oil price negatively affects the UK and positively Norway.

5. EMPIRICAL ANALYSIS

5.1. VAR Model

The vector autoregressive models (VAR models), developed by Sims in the 1980s, emerge as an alternative to the traditional models of simultaneous equations. The structured models grounded in economic theory require divide variables between endogenous and exogenous before doing the estimation. Precisely, the difficulty or arbitrariness in deciding which variable will be taken as dependent and which as explanatory is solved with the implementation of the autoregressive vectors (Maddala, 1996). According to Sims (1980), if there is simultaneity among a number of variables, then all these variables should be treated in the same way. In other words, these should be no distinction between endogenous and exogenous variables. Therefore, all the variables are

treated as endogenous. One of the main contributions of the VAR models in the analysis of the time series that allows analyzing the dynamic impact of a shock in one of the variables of the system over the others. This analysis is performed through the estimation of impulse-response functions and decomposition of variance.

The VAR model in its primary or structural form is represented as follows:

$$Y_t = m + \theta_1 Y_{t-1} + \theta_2 Y_{t-2} + \cdots + \theta_p Y_{t-p} + \chi_t + \varepsilon_t \quad (1)$$

Where:

Y_t= *nx1* vector of endogenous variables

m= *nx1* vector of constant terms

θ_i= *nxn* matrix of autoregressive coefficients, with $i = 1,2 \ldots, p$

p = number of lags included in the model

χ_t= exogenous coefficient matrices

ε_t= *nx1* vector of white noise uncorrelated error terms. This is constant variance $\mathrm{E}({\varepsilon^2}_t) = {\sigma^2}_t$ and zero mean $\mathrm{E}(\varepsilon_t) = 0$

Before estimating the parameters of the model Y_t meaningfully, it is necessary to limit the length of the lag in the polynomials. If l is the lag length, the number of coefficients to be estimated is $p(pl + m)$.

The current innovations ε_t are unexpected but become part of the data set in the next period. This suggests that the anticipated effect of a variable is part of the coefficients of lagged polynomials while the unexpected contemporaneous events are part of the residuals. Henceforth, a direct interpretation of the estimated individual coefficients from the VAR system is difficult, failing this, a joint F-test on these lagged polynomials is useful in giving information about the effect of the coefficients of the right-hand side equation. Sims (1980) proposed the use of impulse response functions (IRFs) and forecast error variance decompositions (FEVD), to study the impact of unanticipated or unexpected policy shocks on the macro variables in an understandable way.

The analysis begins with the unit root test to determine the stationary and the order of integration of the time series. In case the variables are found to be I(0), VAR model is preferred. But if the variables turn out to be I(1), VAR should be estimated in differences, since there may be a linear combination of the variables, which is stationary. After determining the order of integration of each of the variables, and if they are integrated in the same order, use the Johansen cointegration test to determine if there is a long-term relationship or the balance between real GDP and the others variables in the model. If cointegration is found, it should be incorporated into the model, since its omission results in a misspecification error. As Elder (2004) mentioned *"a principal feature of cointegrated variables is that their time paths are influenced by the extent of any deviation from long-run equilibrium. After all, if the system is to return to the long-run equilibrium, the movements of at least some of the variables must respond to the magnitude of the disequilibrium"*. In other words, system's short-term dynamics is determined, among others, by its steady state, and hence the latter should be incorporated into the model exogenously.

Continue with the analysis, the Granger causality test will be conducted. In case the variables are cointegrated, the VECM model is applied to determine the causality relationships between the variables. On the other hand, if there is no cointegration between the variables, the VAR model is applied. Finally, the IRF analysis and the FEVD analysis will be used to explain the variation of real GDP in short and long term forecast horizons.

5.2. Specification of the model

The following procedure and test were applied to estimate the VAR model:

5.2.1 Determining the order of integration

The unit root test determines whether a time series is stationary or not. The presence of a unit root implies that a transitory shock in the unobservable data vector (εt) will have permanent effects, in other words, if variables are non-stationary they will have an infinite memory of transitory shocks. The specification of the test equation allows incorporating into the equation a constant term $\Delta Y_t = m_0 + \delta Y_{t-1} + \varepsilon_t$ a deterministic tendency and a constant $\Delta Y_t = m_o + m_1 t + \delta Y_{t-1} + \varepsilon_t$ or none of them $\Delta Y_t = \delta Y_{t-1} + \varepsilon_t$. In this way, the graphical analysis of each variable was used, so by observing its evolution over time, I determined whether it was necessary to include a constant, a trend term or none in the unit root test.

There are four approaches when the intercept is applied (Levi, Lin & Chu t; Im, Pesaran and Shin W-stat, ADF- Fisher Chi-square and PP-Fisher Chi-square) and five approaches (Breitung t-stat additional to the ones mentioned already) when the trend is used. For deciding whether a variable has a unit root or not, I considered all the approaches.

$$H_0: \delta = 0 \quad \Rightarrow \quad no\ unit\ root \quad H_1: \delta = 1 \quad \Rightarrow \quad unit\ root$$

Therefore, if most the approaches indicate a unit root, then the variable is not stationary.

5.2.2 Determining the number of lags

Lag length decision or so-called information criteria is one of the most important tests to do before estimating a VAR model. Any additional variable increases the fit of the regression according to standard regression theory. Therefore, VAR (p +1) will fit better than VAR (p). Even though increasing lag will improve the fit of the model, it will cause pxd additional parameters. In consequence, information criteria must be estimated as these criteria provide a trade-off between goodness of fit and the number of parameters estimated.

For deciding the number of lags, it is common to use the Akaike information criterion (AIC), but for this research, the Schwarz information criterion (SC) will be also analyzed.

The chosen lag length is one which minimizes the following:

$$AIC(n) = Iog\Sigma_n + (2d^2n)/T$$

$$SC(n) = Iog\Sigma_n + ((\ln T)/T)nd^2$$

Where *d* is the number of variables in the model, *T* the sample size and an Σ_n estimate of residuals variance-covariance matrix Σ_u obtained with a VAR (n).

Both criterions will be analyzed and the one which provides the better estimators in terms of no autocorrelation and no heteroscedasticity will be used.

5.2.3 Testing for autocorrelation

The graphic autocorrelation test was performed by analyzing the correlogram with a 5% confidence interval. A model with fewer autocorrelation values outside of the confidence intervals is desirable.

Additionally, the VAR Residual Serial Correlation Lagrange Multiplier Test was performed, where $H_0 := no\ serial\ correlation\ at\ lag\ order\ h$ and $H_1 := autocorrelation\ at\ lag\ order\ h.$
$LM = T * R^2(number\ of\ observations * R\ square)$. The null hypothesis is rejected if the probability of LM is lower than the significance level.

5.2.4 Testing for heteroskedasticity

The White Heteroskedasticity test was performed to detect the existence of heteroscedasticity, this is the lack of a constant variance.

$H_0 := homoscedasticity$ and $H_1 := heteroscedasticity$
$F\ and\ Chi - sq = T *\ R^2\ (number\ of\ observations * R\ square)$

The null hypothesis is rejected if Chi-square values are lower than the significance level.

5.2.5 Johansen Cointegration Test

The Johansen Cointegration test is used to determine the presence of any cointegration or long-run relationship among the variables. However, the Johansen Cointegration test can be applied only in non-stationary variables and integrated in the same order.

The Johansen test considers two approaches to determine the number of cointegration equations (r), the Trace Test and the Maximum Eigenvalue Test.

$H_0: r = 0\ \Rightarrow\ no\ cointegration\ equations \quad H_1: r = 1\ \Rightarrow\ There\ is\ a\ cointegration\ equation$
The null hypothesis is rejected if (r) is larger than the significance level.

5.2.6 Granger Causality Test

The Granger causality test for multivariate autoregressive analysis, Block exogeneity/ Wald test determines whether an endogenous variable can be treated as exogenous. It also helps to determine the useful of some variables to improve the prognosis of others. In principle, the concept is as follows, If X causes Y, the changes of X happened first and then followed by changes of Y.
The null hypothesis is that a variable does not granger cause another variable, and the alternative hypothesis that a variable cause another variable. For instance, $H_0: lngdp\ does\ not\ Granger - cause\ gov\_ind$. The null hypothesis is rejected if the p-value is lower than the significance level.

5.3. Data description

The data were taken from the World Bank indicators, except by the oil price which data were taken from the Federal Reserve Bank of St. Louis. All the series were transformed into natural logarithms,

except Governance indicator because it is an index. Such transformations are important since they reduce the volatility of the variables and facilitate the interpretation of the results.

The model for the non-oil exporting countries includes 17 countries and 14 for the oil exporting countries. (Appendix 10.1). The annual data used in the analysis cover the period 2002-2015 and consist of cross-sectional (K=17 for non-oil countries and K=14 for oil countries) and time series data (T=14). The model estimated is based on an unbalanced panel observations due to occasional missing values; thus, leading to less than 238 and 196 observations for non-oil exporting and oil exporting countries, respectively.

The variables used are the following:

- lngdp represents the natural logarithm of real GDP
- Gov_ind stands for the governance index, which was made as the average sum of all six individual indicators (described below).
- lngov_exp_r denotes natural logarithm of general government final consumption expenditure. This includes all government current expenditures on goods and services.
- lntrade is the natural logarithm of real trade openness. Trade openness is measured by the sum of imports and exports.
- lnoil_price corresponds to the natural logarithm of West Texas Intermediate (WTI) oil price.
- D1 is a dummy variable that captures the shock of the economic and financial crisis of 2008. The dummy receives "1" if real GDP went down after the crisis and "0" if real GDP was not affected.

Governance Indicator:

Coefficient estimates of governance indicators included in the regression are highly sensitive to the inclusion of more than one variable due to collinearity problems. It is common practice to assess this problem by generating a governance index. The governance index is the weighted sum of all six individual indicators (voice and accountability, government effectiveness, political stability and absence of violence, regulatory quality, rule of law, and control of corruption)[2], with each indicator being assigned equal weight.

- Voice and Accountability, measured by the extent to which a country's citizens can participate in selecting their government, as well as freedom of expression, association, and the press.
- Political Stability and Absence of Violence, measured by the likelihood that the government will be destabilized by unconstitutional or violent means, including terrorism.
- Government Effectiveness, measured by the quality of public services, the capacity of the civil service and its independence from political pressures, and the quality of policy formulation
- Regulatory Quality, measured by the ability of the government to provide sound policies and regulations that enable and promote private sector development
- Rule of Law, measured by the extent to which agents have confidence in and abide by the rules of society, including the quality of property rights, the police, and the courts, as well as the risk of crime
- Control of Corruption, measured by the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as elite "capture" of the state

Five equations are estimated in each VAR model; however, this research focuses on the equation relate to lngdp, recalling the main variables are real GDP, real oil prices and governance indicator:

$$lngdp = c + \beta lngdp_{t-1} + \beta gov\_ind_{t-1} + \beta lngov\_\exp_{t-1} + \beta lntrade_{t-1} + \beta lnoil\_price_{t-1} + \beta d1 + \varepsilon_t \qquad (2)$$

[2] Description from governance indicators taken from Zhuang J., De Dios E., Lagman-Martin A. (2010) - page 8.

6. EMPIRICAL RESULTS

6.1. Non-oil exporting countries

From the unit root test results show in Appendix 10.2, lnoil_price is stationary at levels, which means it is integrated of order 0, I(0). The other variables lngdp, lntrade, lngov_exp and gov_ind are not stationary at levels, which means those variables have a unit root. Nonetheless, these variables became stationary after the first difference. This means they are integrated of order 1, I(1). The lag order of the VAR model was determined by the AIC criterion, which was minimized for order 5. This suggests that, for this model, the VAR model should be of order 5 (Appendix 10.3). Then, the autocorrelation of the residuals was analyzed (Appendix 10.4). First I checked the correlogram for autocorrelation with a 5% confidence interval. The model with 5 lags has 1 autocorrelation value outside of the confidence intervals. Therefore, the model has sufficiently dealt with the problem of autocorrelation. Additionally, I run the Lagrange-multiplier (LM) test, which shows no problems of autocorrelation in most of the lags analyzed. Appendix 10.5 shows that Chi-sq equals 0.21, which is larger than the significance level; therefore, the null hypothesis is not rejected and the residuals are homoscedastic. The Johansen Cointegration Test shows no cointegration between the variables, not in the Trace test nor Maximum Eigenvalue. Appendix 10.7 displays the Granger causality test, in the case of lngdp, the block of lagged values of all the variables helps to improve the forecast of lngdp generated by the model (that is, the lags of the all the variables together Granger cause to the present values of lngdp), reason why this last variable cannot be considered as exogenous. This result supports the endogeneity requirement of the variable lngdp and suggests that the inclusion of all the other variables in the VAR is advantageous.

The VAR model is showed in Appendix 10.8. The final equation (3) for lngdp is:

$$
\begin{aligned}
D(LNGDP) = {} & 0.667253941667 * \mathrm{D(LNGDP(-1))} - 0.191744376932 * \mathrm{D(LNGDP(-2))} + 0.146438562286 \\
& * \mathrm{D(LNGDP(-3))} + 0.22424638651 * \mathrm{D(LNGDP(-4))} + 0.0120948272176 * \mathrm{D(LNGDP(-5))} \\
& + 0.0260303027432 * \mathrm{D(GOV\_IND(-1))} + 0.0449615899378 * \mathrm{D(GOV\_IND(-2))} \\
& - 0.0434740515952 * \mathrm{D(GOV\_IND(-3))} - 0.046868949809 * \mathrm{D(GOV\_IND(-4))} \\
& - 0.020188727023 * \mathrm{D(GOV\_IND(-5))} - 0.022066043218 * \mathrm{D(LNGOV\_EXP(-1))} \\
& - 0.0678542201059 * \mathrm{D(LNGOV\_EXP(-2))} + 0.0105779871956 * \mathrm{D(LNGOV\_EXP(-3))} \\
& + 0.0355847810622 * \mathrm{D(LNGOV\_EXP(-4))} + 0.0427366097198 * \mathrm{D(LNGOV\_EXP(-5))} \\
& - 0.106794319754 * \mathrm{LNOIL\_PRICE(-1)} + 0.0597496080061 * \mathrm{LNOIL\_PRICE(-2)} \\
& - 0.0139663087895 * \mathrm{LNOIL\_PRICE(-3)} + 0.00808373378637 * \mathrm{LNOIL\_PRICE(-4)} \\
& + 0.0259375945794 * \mathrm{LNOIL\_PRICE(-5)} + 0.0206524176212 * \mathrm{D(LNTRADE(-1))} \\
& + 0.0213213369516 * \mathrm{D(LNTRADE(-2))} + 0.0247268757798 * \mathrm{D(LNTRADE(-3))} \\
& + 0.00226708663884 * \mathrm{D(LNTRADE(-4))} - 0.0113891983582 * \mathrm{D(LNTRADE(-5))} \\
& + 0.128943702942 - 0.0175490670159 * \mathrm{D1}
\end{aligned}
$$

As mentioned before, it is difficult to analyze the coefficients from a VAR model; therefore, the impulse response function and error forecast decomposition variance help to understand the effects of the key variables in the real economic activity.

6.1.1 Impulse Response Function

As mentioned before Impulse response functions shows the dynamic effects of a shock in one variable on the other variables that are included in the same model. For this analysis, the Cholesky-dof adjusted method was used.

First, the impulse response shows lngdp reacts positively at the time to its own shock, even when the trend ups and downs along the ten-year forecast horizon.

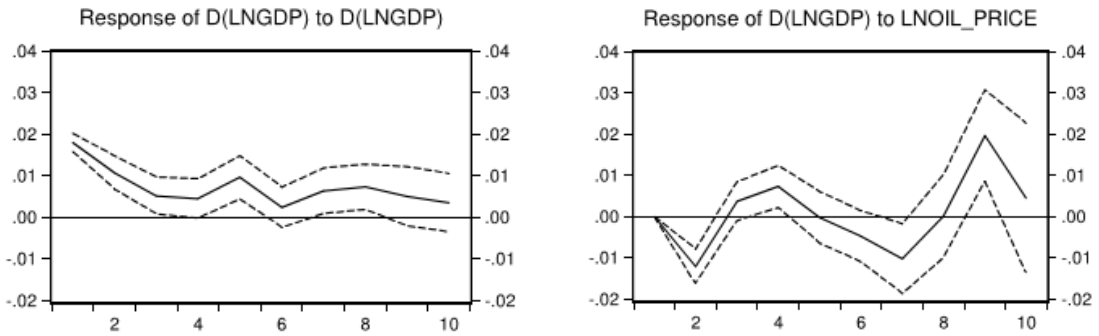
In general, economic activity in oil-importing countries would benefit from low oil prices, as the decline in the prices would increase the real income of households and businesses in the same way as a tax deduction. Baffes et al. (2015) estimate that a 10 percent decrease in the price of oil may increase the economic growth of importing countries by approximately 0.1-0.5 points percentage, depending on the share of imports of fossil fuels in GDP. In this research, the first two periods (years), lngdp reacts negatively to the shock in the oil price with an uptrend until the fourth period, to decrease again until the seventh period for finally up and down again. In technical words, one standard deviation shock to oil price leads to 0.01 units decrease in the logarithm of GDP after 2 years, which corresponds to 1% drop in the GDP when translated into the original level. In the following years, there is a rise period during two years with an increase of less than 1%, and then again there is a decrease period for around four years, the following years there is an up about 2% and down again in the last period.

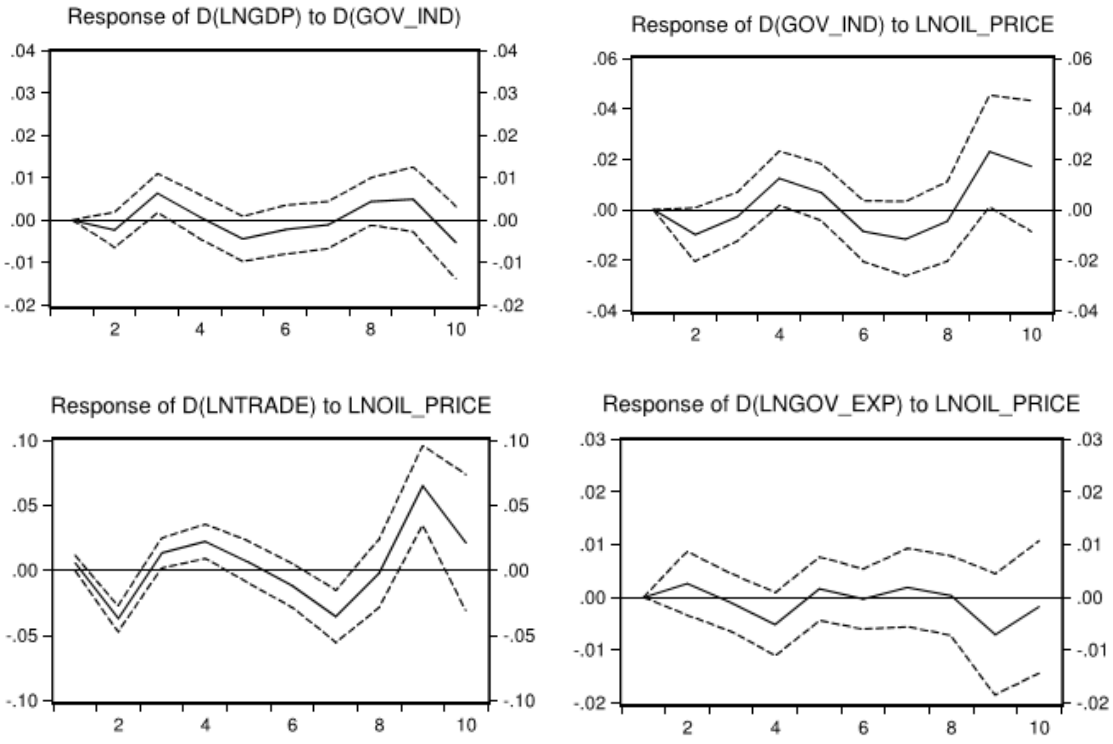
The vulnerability of an oil importing country to a positive shock in the oil price can be measured through the loss of income. This is produced by the higher price of the oil and gas imports, whose prices are correlated, resulting in a worsening of its current account balance. The higher the percentage of a country's net oil imports relative to the GDP, the higher is the loss of purchasing power of the country and consequently, the loss of economic activity and net income.

A shock in the governance indicator is not significantly different from zero, meaning it does not have a large impact in lngdp. Nonetheless, in the third year, the increase in GDP is about 1%.

Additionally, the impact of oil price in government expenditure and trade openness is analyzed. First, government expenditure does not show a huge change, the only periods to consider are the fourth and the ninth years, when the trend downs significantly compared to the other years. Trade goes down the first years, a standard deviation shock to oil price leads to 0.05 units decrease in the trade until the second year. From the third to fifth year, there is a short adjustable period, when the shock leads to less than 5% rise in trade. Then it goes down and up in the last periods.

Figure 14: IFR – Non-oil exporting countries





6.1.2 Forecast Error Variance Decomposition

The variance decomposition explains how much of the uncertainty of the prediction of the dependent variable is explained by the uncertainty surrounding the other variables in the same model during the forecast time.

The FEVD of the variables in the model are shown in the table below. At the 10-year forecast horizon, its own shocks contribute about 41% of the forecast error variance. Governance indicator and oil price explain 8.3% and 43% respectively of the forecast error variance of GDP. Furthermore, the contribution of all variables in explaining real GDP forecast error variance has increased during the 10-year forecast period.

Table 3: Variance Decomposition – Non-oil exporting countries

Variance Decomposition of D(LNGDP):

Perio...	S.E.	D(LNGDP)	D(GOV_IND...	D(LNGOV_...	LNOIL_PRI...	D(LNTRAD...
1	0.018001	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.024371	74.27511	0.865851	0.410104	24.36384	0.085091
3	0.026219	68.13823	6.725756	1.858152	23.07521	0.202650
4	0.027790	63.34641	6.075310	2.375706	27.51780	0.684770
5	0.029866	65.24669	7.433578	2.083521	23.83093	1.405277
6	0.030457	63.38683	7.680918	2.230767	25.34865	1.352831
7	0.033593	55.70899	6.420857	2.215824	30.00018	5.654148
8	0.034741	56.54893	7.605279	2.350116	28.05238	5.443300
9	0.040781	42.56095	6.976864	2.571207	43.55240	4.338581
10	0.041613	41.61290	8.299271	2.476762	43.01897	4.592096

6.2. Oil exporting countries

Similarly, as it was done before, this section analyzes the same key variables for the oil exporting countries. The variable lnoil_price is stationary at levels, which means it is integrated of order 0, I(0). The other variables lngdp, lntrade, lngov_exp and gov_ind are not stationary at levels, which means those variables have a unit root. Nonetheless, these variables became stationary after the first difference. This means they are integrated of order 1, I(1) The results are showed in Appendix 10.09. The lag order of the VAR model was determined by the AIC criterion, which was minimized for order 2. This suggests that, for this model, the VAR model should be of order 2 (Appendix 10.10). Among the sensibility analysis, the autocorrelation of the residuals was analyzed. Again, I first checked the correlogram for autocorrelation with a 5% confidence interval. The model with 2 lags has 2 autocorrelation values outside of the confidence intervals. Therefore, the model has sufficiently dealt with the problem of autocorrelation (Appendix 10.11). Secondly, I analyzed the Lagrange-multiplier (LM) test, which showed no problems of autocorrelation in most of the lags. Then, considering both tests, I conclude the model does not have autocorrelation problems. Appendix 10.12 shows that Chi-sq equals 0.32, which is larger than the significance level; therefore, the null hypothesis is not rejected and the residuals are homoscedastic. Appendix 10.13 shows the Johansen Cointegration Test for the oil exporting countries model, which establishes no cointegration between the variables, not in the Trace test nor Maximum Eigenvalue. Appendix 10.4 displays the Granger causality test, the same as in the model for the non-oil exporting countries the block of lagged values of all the variables helps to improve the forecast of lngdp.

The VAR model is showed in Appendix 10.15. The equation (4) for lngdp is:

$$\begin{aligned}\mathrm{D(LNGDP)} = {} & 0.281677772384 * \mathrm{D(LNGDP(-1))} + 0.0476708387767 * \mathrm{D(LNGDP(-2))} - 0.00209491767798 \\ & * \mathrm{D(GOV\_IND(-1))} + 0.0407606475794 * \mathrm{D(GOV\_IND(-2))} + 0.00349017754587 \\ & * \mathrm{D(LNGOV\_EXP(-1))} + 0.092745108378 * \mathrm{D(LNGOV\_EXP(-2))} - 0.0586597923049 \\ & * \mathrm{LNOIL\_PRICE(-1)} + 0.0239050658394 * \mathrm{LNOIL\_PRICE(-2)} + 0.0540812775339 \\ & * \mathrm{D(LNTRADE(-1))} - 0.0424205320994 * \mathrm{D(LNTRADE(-2))} + 0.17328542162 \\ & - 0.0644125441677 * \mathrm{D1}\end{aligned}$$

6.2.1 Impulse Response Function

The oil price shock usually benefits the oil exporters; this following the Law of Supply, which establishes that the higher the price, the higher the quantity supplied. Producers supply more at a higher price because a higher price increases revenue. Nonetheless, in this research, lngdp reacts negatively to the shock in the oil price, the first years the decrease is notorious. In this way, one standard deviation shock to oil price leads to about 0.015 units decrease in the logarithm of GDP after 2 years, which corresponds to 1.5% drop in the GDP when translated into the original level.

Based on the fact that total revenue Y equals $p\ x\ q$, one can expect a higher revenue when the price increases. For some oil export countries, especially those that belongs to the OPEC, the oil exports represent the total revenue. Having this in consideration, I will mention a possible explanation for a negative GDP when the price increases. First, the price elasticity of demand is defined to be the percentage change in quantity demanded, q divided by the percentage change in price, p. The formula for the demand elasticity ϵ is:

$$\epsilon = \frac{p}{q}\frac{\partial q}{\partial p} \qquad (5)$$

The law of demand implies that $\frac{\partial q}{\partial p} < 0$ and so ϵ will be a negative number. Considering the demand equation $q = q(p)$, we can derivate the revenue function, the derivative of a function tells us how the function will change. If Y'>0 revenue increases at that price point, and if Y'<0 revenue decreases at that price level.

$$Y'(p) = q(p) + p\frac{\partial q}{\partial p}$$

$$Y'(p) = q(p)\left[1 + \frac{p}{q(p)}\frac{\partial q}{\partial p}\right] \qquad (6)$$

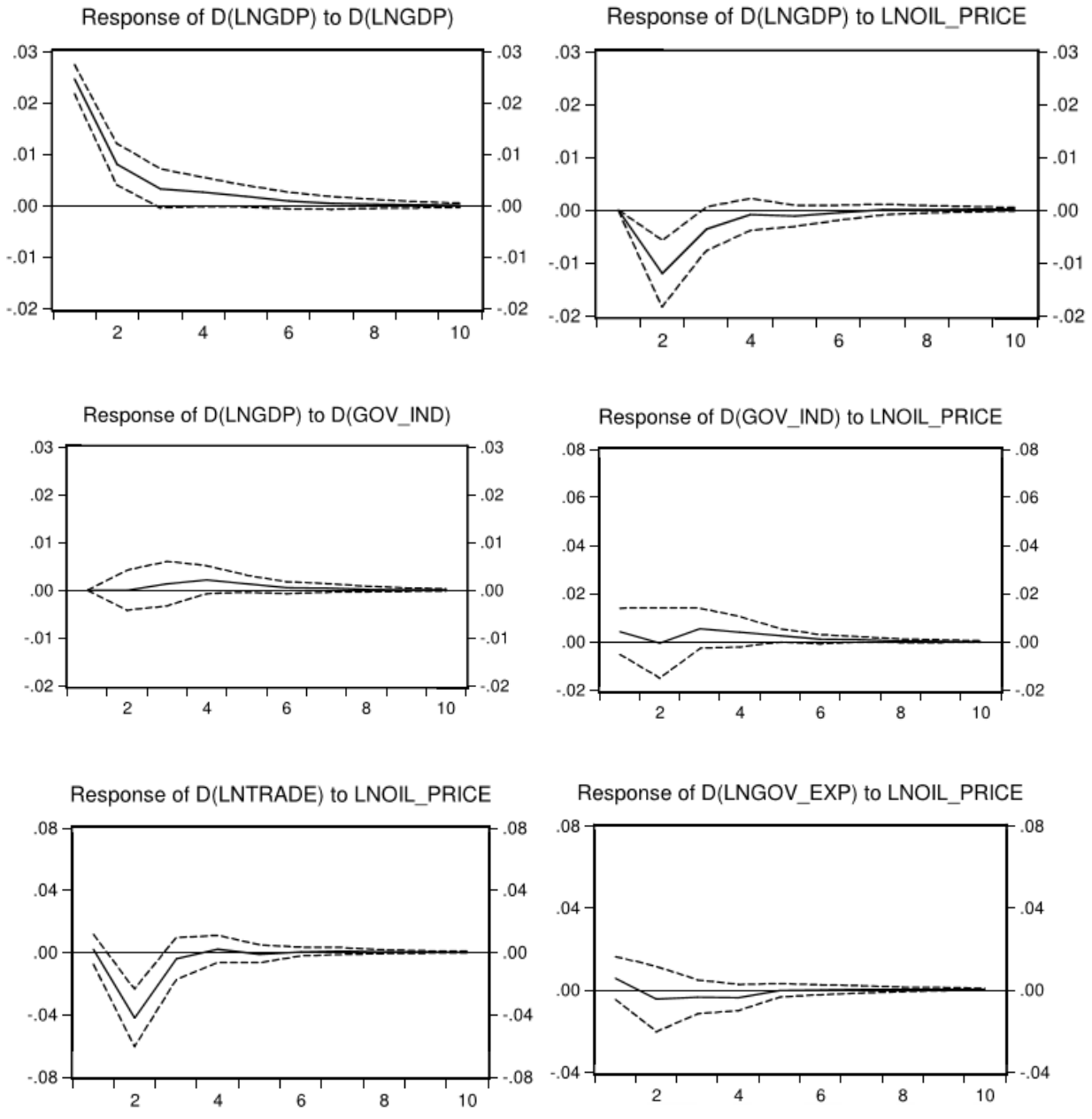
$q(p)$ is always positive, so the sign of the derivative depends on the result in the brackets. Whether the quantity is positive or negative is determined by the size of the second term, which is precisely the demand elasticity. The negative sign of the demand elasticity explains how demand responds to price changes: as price increases, quantity demanded decreases, and as price decreases, quantity demanded increases.

Based on the equation 6, we can imply that the condition for having a negative $Y'(p)$ is $\left[\frac{p}{q(p)}\frac{\partial q}{\partial p}\right] < -1$. This means that the percentage change in quantity demanded is greater than the percentage change in price. Hence, when the price increases, the total revenue falls, then we can say that the price elasticity of demand for that good is elastic.

Now we have to recall that demand for oil is inelastic in the short-term but elastic in the long term. As mentioned before the data used for this research is annual, this is long term, so the condition of an elastic good is fulfilled. This explains the negative respond of GDP to a positive shock in the oil price.

A shock in the governance indicator is positive but not significantly different from zero, meaning it does not have a large impact in lngdp. Similarly, to the importing countries, the governance indicator was not significantly different from zero. Then the conclusion is that governance indicator does not have an important effect on lngdp. Similarly, the impact of oil price on governance indicator and government expenditure are not significantly different from zero.

Regards to the trade, the impact is negative, which also relates to the lngdp. A lower trade for the exporting countries after a positive shock in oil price can be explained by the decrease in oil sales. Moreover, the effect on the balance of trade depends on the level of fuel imports of these countries. If the exporting oil countries are fuel importing, then the balance of trade can be negative or even worse affect the economic activity. The reduction in economic activity increases the costs of production of the national products. This makes that other non-oil products exports of oil exporting countries become expensive compared to oil importing countries. Daicz et al. (2016) mentioned that the transfer of income from oil-exporting to oil importers could have a negative impact on world output. It is expected that the reduction of the income of the exporting economies translates into a reduction of both domestic consumption and demand in the world market. Therefore, the slowdown in the economic activity.



6.2.2 Forecast Error Variance Decomposition

The variance decomposition explains how much of the uncertainty of the prediction of the dependent variable is explained by the uncertainty surrounding the other variables in the same model during the forecast time.

The FEVD of the variables in the model are given in the table below. At the 10-year forecast horizon, its own shocks contribute about 75% of the forecast error variance. Governance indicator and oil price explain 0.9% and 17% respectively of the forecast error variance of GDP. Furthermore, the

contribution of all variables in explaining real GDP forecast error variance has increased during the 10-year forecast period.

Table 4: Decomposition Variance Oil Exporting countries

Variance Decomposition of D(LNGDP):

Perio...	S.E.	D(LNGDP)	D(GOV_IND...	D(LNGOV_...	LNOIL_PRI...	D(LNTRAD...
1	0.024689	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.028788	81.28600	0.095705	0.033243	17.34567	1.239381
3	0.029653	77.85814	0.225407	2.879371	17.85290	1.184177
4	0.030017	76.73126	0.714326	3.604359	17.53617	1.413887
5	0.030234	75.98296	0.867876	3.962332	17.45089	1.735937
6	0.030304	75.71839	0.885843	4.111379	17.40111	1.883274
7	0.030330	75.60912	0.902973	4.176243	17.37071	1.940952
8	0.030338	75.57830	0.906291	4.190143	17.36244	1.962827
9	0.030341	75.56851	0.906893	4.194841	17.36121	1.968546
10	0.030341	75.56575	0.906937	4.195892	17.36188	1.969540

7. POLICY RECOMMENDATION

The main aim of this research is to give an economic policy recommendation for Ecuador. As it was indicated at the beginning, the key variables are the oil price and the governance indicator. The results of the oil exporting countries will be used in this section.

7.1. Oil price

The variable capturing the price of oil reveals a sizable significant impact on real GDP. The negative response of GDP to the high oil price, encourage the hypothesis of leaving the oil dependency. Moreover, the oil price is not a variable under Ecuadorian government's control. Even though Ecuador does not influence the price of oil, there are some aspects that should change, for instance, reducing the cost of extracting crude oil. Nonetheless, the main idea of this paper given the result from the impulse response is to provide recommendations to alleviate Ecuador's oil dependency. Therefore, some of the weaknesses of oil dependency and the possibilities to alleviate that dependency are mentioned below:

Some weaknesses of having an oil-dependent economy:

- The oil market is an imperfect market, given that OPEC controls the oil price and, only a few members (countries) have more than 40% of the market. The other members, like Ecuador, compete for the rest of the market, leaving Ecuador in a disadvantageous situation as its oil is of a lower quality.
- This dependency is also seen in the oil consumption. Given that Ecuador does not have an industry to satisfy all the national demand, the government imports more than 50% of the gasoline and other hydrocarbons. In 2014, the government spent approximately 3.900 million dollars subsidizing gasoline (approximately 10% of the total revenue).
- The Amazon, with its large variety of animals and plants, is being destroyed daily by the production of oil. Moreover, although a considerable percentage of Ecuador's revenues come from this zone, it is one of the poorest in Ecuador.
- The dependency on oil has increased the national debt. Around the 30% of Ecuador's revenue comes from the oil sales, the other revenue's resource is taxation. Due to the low price of oil,

Ecuador's government compensate the reduction in revenues by increasing taxes, but especially by increasing the national debt.

- Oil is also an important source of foreign exchange for the Ecuadorian economy. According to the Executive Director of Central Bank of Ecuador, the cost of buying dollars in 2016, was around 10 million dollars per year. One option to reduce this cost is by obtaining more dollars through the oil sale.

Currently, many economies are looking for an ending to the dependency on oil. For example, Mexico has applied strategies centered on opening the economy to diminish the dependency on oil. The strategy incorporates different industries such as the manufacturing sector. This strategy goes together with the trade openness. The model shows the negative effect of an oil price shock in the trade of oil exporting countries. Like Mexico, which realizes the importance of spreading the exporting basket, Chile during Pinochet's government, implemented policies to open its markets and boost exports.

The clear recommendation for Ecuador is to diminish its dependency on oil. Listed below are some of the ideas to alleviate this problem. These proposals include changes on the production and consumption of oil, and protection of the environment:

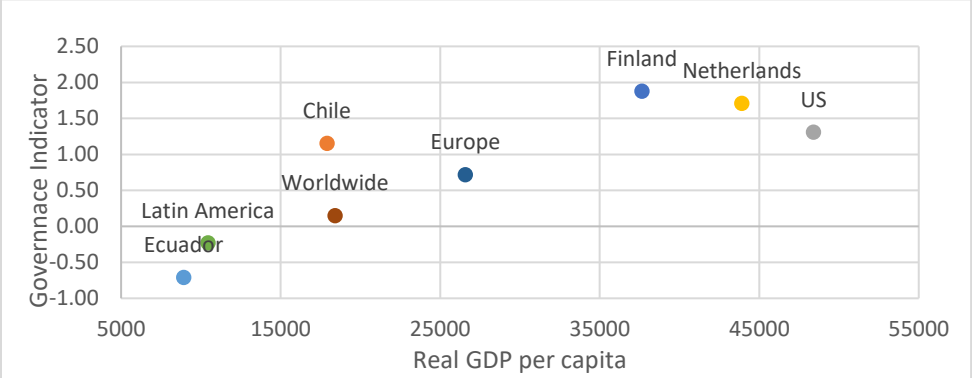
- Look inward and exploit other resources, human, agriculture, tourism etc. that are abundant in Ecuador. Chile, for example, improved the conditions of its financial system. This policy increased access to credits and allowed entrepreneurs and small companies to expand.
- Consolidate international commercial agreements, which ensure the reduction of taxes. One of the reasons for Ecuadorian products not being attractive abroad is their cost. Since Ecuador is not a highly developed country, production costs remain high. Therefore, maintaining international agreements ensures costs are not increased and ensures competitiveness in other markets.
- The promotion of strategies to improve the efficiency of production and the quality of the products to make them attractive in new international markets.
- Promote the internal competition between cities in areas of development and quality.
- Establish a plan to eliminate the subsidies on gasoline and hydrocarbons. The most important fuel used is diesel, so the government needs to promote the use of alternative fuels, or alternative ways of transportation (diesel is mainly used for transportation). This change will not only help to stop the dependence on oil, but it will also help fuel smuggling, an economic problem that has increased in the last years, as neighboring countries do not subsidize fuel.
- Adjusting emissions standards for all vehicles.
- Creating liveable places where walking and biking are real, promoting oil-free choices.
- Exploring fuel options and substitutes for oil such as advanced biofuels, hydrogen fuel cells and natural gas.
- Establish limits to the extraction of oil, limiting the damage in natural reserves.
- Efficiently use the government budget on social projects that contribute to improving the standard of living in Ecuador.
- Provide exporters and importers with a stable legal framework.
- Increase exports by diversifying the basket of products.
- Invest in promoting Ecuadorian products to be known by other countries in the world.
- Ensure good financial procedures by making micro-credit accessible to entrepreneurs.
- Analyze policies to reduce the interest rates of borrowing money, especially money whose destination is for production and commercial business
- Finally, to face the reduced revenues from the low oil price, the government must reduce government spending instead of increasing external debt.

7.2. Governance indicator

The governance indicator is the average of six sub-indicators (voice and accountability, government effectiveness, political stability, and absence of violence, regulatory quality, rule of law, and control of corruption). The results from the model show the governance indicator explain 0.9% of the forecast error variance of GDP and shows a positive effect in the IFR even when the value was not higher than 1%. Then, it can be argued that the improvement of the governance indicator does not show a real effect on the economic activity. However, as it mentioned before the implication of a bad governance is reflected in the foreign investment. Therefore, this indicator is important for economies like Ecuador.

On the other hand, if the governance indicator is compared directly to the GDP, it seems as having a positive effect. Figure 17 shows that Ecuador's governance is worse than the average of Latin America, Worldwide and developed countries such as Finland, the Netherlands, and the US. The higher the indicator, the better is the governance of the country.

Figure 15: Ecuador compared to other countries and regions - Governance Indicator



Thus, even when the variable does not show a significant effect on GDP, the policy recommendation is to improve the governance in Ecuador. Some of the policies adopted by Ecuador in the last years related to the governance indicators are mentioned below:

In 2007, the Ecuadorian government created the National Anticorruption Secretariat. In 2008, the name was changed to National Transparency of Management Secretariat. In 2016, the institution was eliminated. This institution implemented anti-corruption policies and systems to identify who commits acts of corruption in the public administration. In 2007, the corruption index was -0.87 and in 2014 it was -0.82.

To face the problems related to government effectiveness, in 2013 the government created the National Secretariat of Public Administration. This institution oversees improving the efficiency of public institutions. In 2013 the index for government effectiveness was -0.48 and in 2014 it worsened to -0.49.

The political stability is the indicator that has changed the most. In 2000 the political stability was -0.68 and it has improved to -0.0096 in 2014. One possible explanation for this improvement is the permanence of approximately 10 years of the same President in the government.

In 2008, the government created the Council of Citizen Participation and Social Control. The main goal of this institution is to promote the empowerment of citizens and the inclusion and the active intervention of all, to achieve true participatory democracy. In 2008, the voice and accountability indicator was -0.28 and it improved to -0.26 in 2014.

The regulatory quality includes: the commonness of rules and requirements that impose a burden on business, ease of starting and closing a new business, property, labor market policies, wage and price controls, and the height of tariffs barriers among others. The value for Ecuador went from -0.51 in 2000 to -1.02 in 2014. This change could correspond to the last policies taken by the government to increase taxes on imports and the announcement of a new tax on property and inheritance.

In the case of the rule of law indicator, the situation is similar with values that went from -0.69 in 2000 to -1.05 in 2014. The worsening of this aspect can be related to the changes of most laws in the last decade.

Despite the creation of the new institutions, the overall governance has not significantly changed. Listed below are some of the negative aspects of the measures implemented by the government and the reasons for not getting better governance results.

- The new institutions increase the government current expenditure. Given the low price of the oil, the government had to increase the debt, especially to pay public employee salaries.
- Citizens do not know about the existence of these institutions, especially the Council of Citizen Participation and Social Control. In 2015 less than 15.000 people participated in any procedure of this institution, and approximately 65% of these formalities were requesting public information.
- Despite the improvement in political stability in the last years, being in the power for longer periods can lead to abuse of power and tyranny (Welsch, 2007).

Good governance affects economic growth in many ways. National consumption, investment, and government expenditure are affected in the long run, as are imports, exports, and foreign investment. For instance, good governance is an indicator of protection for foreign countries and companies. Investors feel secure investing when there is political stability, and laws allowing them to engage in a competitive market. Therefore, having good governance attracts investment, which can increase competitiveness and boost GDP.

Considering the weaknesses in the governance of the Ecuadorian Government, the following policies are recommended:

- Autonomous institutions to ensure the control and accountability of public institutions.
- Establish transparent procedures for starting private businesses and entrepreneurships.
- Promote laws and policies to guarantee a transparent legal system and provide economic security.
- Introduce simple language to make laws and procedures understandable to the wider public.
- Adopt an appropriate policy, legal, and regulatory framework to improve the development of the private business sector.
- Promote anti-corruption laws and protection to those who report any act of corruption.
- Promote an e-government by investing in technology.
- Analyze the possibility of decentralization of functions from the government to the municipalities.
- Introduce mechanisms to increase the participation of both society and companies in the formulation of regulations.
- Support the creation of organizations to defend the freedom of expression.
- Analyze and re-formulate any law or tax that affects competitiveness and foreign investment.

8. CONCLUSIONS

This study examines the effects of governance and the oil price on economic growth of Ecuador. By using a VAR model for oil exporting countries including Ecuador, and a VAR model for oil importing countries, this study aimed to understand the relationship between economic growth and the key variables mentioned.

The analysis started with an overview of some economic and social aspect of Ecuador and the comparison of some of them with Chile. This comparison helps to understand than even a commodity dependent country could have better outcomes if the policies adopted are the right ones. This does not mean that Chile has solved all its economic and social problems, a proof of that is the level of unemployment. Nonetheless, Ecuador can learn from the Chilean experience.

First, the idea behind analyzing the oil-exporting countries and non-oil exporting countries was to establish a difference on the impact of an oil shock in the real economy in a ten-year forecast horizon. In the case of the non-oil exporting countries, it is expected a decrease during two periods, the first one is in the two first years and the other from the fifth to the eighth year with about 1.5% drop in GDP in both periods. There are two positive periods when the increase in GDP is about 1% in the first period and almost 2% in the second period. On the other hand, the oil price shock for the exporting countries is totally negative in all the forecast period. The peak is the second year with 1.5% drop in the GDP.

The drop in the GDP for the oil importing countries is expected and can be easily explained by the economic theory. However, the negative response of GDP to the high oil price in oil exporting countries needs a deep analysis of the price elasticity of demand. By differentiating the revenue function, I found that a negative GDP results when the price elasticity of the demand is less than -1. This implies an elastic elasticity. This condition is fulfilled given that oil demand is inelastic in the short term but elastic in the long term.

Unexpectedly, the impact of governance indicator does not have a huge impact in any of the models. Nonetheless, the effect is mostly positive, which means that governance improves GDP in a certain level, not higher than 1%. In the case of the importing countries, the positive periods are higher in magnitude than the negative periods, with a positive impact of about 1% in GDP. In my opinion, oil importing countries (developed countries in most of the cases), value more the governance than oil exporting countries.

According to the World Bank, a good governance stimulates the economic development by improving the business environment. Moreover, the business sector is very sensitive to good governance. Foreign direct investments typically represent long-term commitments. For these types of investors, political stability, rule of law, the quality of the judiciary and protection of property rights are important.

Another variable of interest was trade and its response to oil price shock. The forecast trend in both models was similar to the response of GDP to the oil price shock. For instance, the oil importing countries experience up and downs periods. Once again, the down periods are of a lower magnitude compared to the up periods. In the case of oil exporting countries, the effect is negative, with the big impact in the two first years when the shock affects GDP in about 4%.

Both negative effects on trade and GDP affect the oil exporting countries in a different way. That will depend on the degree of dependency in that commodity. For example, Norway has developed an economic system which allows it to keep relatively the same outputs even with the low oil price. On the other hand, Ecuador does not have an economic model that counteracts the effects of a shock in the oil price. Nowadays, higher unemployment, less liquidity in the market, higher government debt and so on, are some of the signals of the economic crisis in Ecuador, only two years after of the last fall of oil price.

As a conclusion, Ecuador should implement policies to leave the oil dependency. Some of them, in the criteria of the author, were mentioned in the policy recommendation section. Among the most important are the efficient use of government resources, provide the society with a good environment for spreading business and diversify industries, this is better law framework and appropriate tax system. Additional, good accountability and a cost-benefit analysis of the investment projects are needed, as well as a reduction of government expenditure and debt, which have worsened the oil dependency. In the long run, all these changes will improve the economy and consequently, the standard of living of all Ecuadorians.

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9. REFERENCE LIST

Acosta A. 2009. “La Maldición de la Abundancia”. Quito: Abya- Yala. First Edition.

Alesina, A., and D. Rodrik. 1994. “Distributive Politics and Economic Growth”. The Quarterly Journal of Economics, Vol. 109, No. 2, 465-490.

APEC. 2012. “Interim reports on implementation of APEC Anti-corruption Commitments”. Anti-corruption and Transparency Working Group. Rusia.

Baffes J., Kose M., Ohnsorge F., and Stocker M. 2015 “The Great Plunge in Oil Prices: Causes, Consequences, and Policy Responses” Development Economics. World Bank.

Banco Central del Ecuador (Central Bank of Ecuador). Información Económica. Sistema de Información Macroeconómica. Retrieved from https://www.bce.fin.ec

Barro R. 1991. “Economic Growth in a Cross-section of Countries”. Quarterly Journal of Economics 106(2): 407-43

Barro, R. 2000. “Inequality and Growth in a Panel of Countries”. Journal of Economic Growth, 5, 5-32.

Barro, R. 2008. “Inequality and Growth revisited”. Working paper series on regional economic integration, n. 11.

Bettinger M., Finel B., Mesnikoff A., Prentice-Dunn J., and Ross L. “Ending our Dependence on oil” American Security Project Sierra Club.

Cunado J. and Perez de Gracia F. 2003. “Do oil price shocks matter? Evidence from some European countries”. Energy Economics 25 (2), 137-154.

Daicz L. and Monlezun G. 2016. “El derrumbe del precio del petróleo y sus consecuencias para América Latina.” Dirección Nacional Centro de Economía Internacional. Ministerio de Relaciones Exteriores y Culto. República de Argentina.

Dixit A.K. 2004. “Lawlessness and Economics”. Princeton: Princeton University Press.

Economic Commission for Latin America and the Caribbean. Data and Statistics. Databases and Statistical Publications. http://estadisticas.cepal.org/cepalstat/WEB_CEPALSTAT/

Elder, J. 2004. “Another perspective on the effects of inflation volatility”. Journal of Money, Credit, and Banking 36: 911-928.

Ferreira Francisco H. G., Messina J., Rigolini J., López-Calva L., Lugo M. and Vakis R. 2012. “Economic mobility and the rise of the Latin American middle class”. Washington, D.C.: World Bank.

Ftiti Z., Guesmi K., and Teulon F. 2014. “Oil Shocks and Economic Growth in OPEC countries”. Ipag Business School. Working Paper Series. Paris.

Forbes, K. J. 2000. “A Reassessment of the Relationship between Inequality and Growth”. The American Economic Review, Vol. 90, No. 4, 869-887.

Fournier J.-M. and Koske I. 2012. “Less Income Inequality and More Growth – Are they Compatible? Part 2: The Distribution of Labour Income”, OECD Economics Department Working Papers, No. 925.

Fournier J.-M., Koske I., and Wanner I. 2012. “Less Income Inequality and More Growth – Are they Compatible? Part 7: The Drivers of Labour Earnings Inequality – An Analysis Based on Conditional and Unconditional Quantile Regressions”, OECD Economics Department Working Papers, No. 930.

Fukuyama F. 2008. “What do we know about the relationship between the Political and Economic Dimensions of Development” In World Bank, Governance, Growth, and Development Decision-making. Reflections by: Douglas North, Daron Acemoglu, Francis Fukuyama, Dani Rodrik. World Bank.

Gastambide A. 2010. “El camino hacia la dolarización”

Hall R., and Jones C. 1999. “Why do some countries produce so much more output per worker than others?” Quarterly Journal of Economics 114(1): 83-116

Knack S. and Keefer P. 1995. “Institutions and Economic Performance: Cross-country Test Using Alternative Measures” Economics and Politics 7:207-27

Kaufmann D., and Kraay A. 2008. “Governance Indicators: Where are we, where should we be going? World Bank Research Working Paper No. 2195. World Bank.

Kaufmann D., Kraay A and Zoido-Lobaton P. 1999. “Aggregating Governance Indicators” Manuscript. The World Bank.

Kaufmann D., Kraay A. and Mastruzzi M. 2006. “Governance Matters V: Governance Indicators for 1996-2005.” World Bank Policy Research Working Paper 4012.

International Energy Agency. “World Energy Outlook 2016”. OECD/IEA. France

Larrea C., Freire W. and Lutter C., 2001. “Equidad desde el principio: situación nutricional de los niños ecuatorianos”. Washington, D.C: Pan American Health Organization /Ministerio de Salud Pública.

Levine, R and Renelt, D. 1992. “A sensitivity analysis of cross-country growth regressions”. American Economic Review, 82, 942-963.

Li, H., and H. Zou. 1998. “Income Inequality is not Harmful for Growth: Theory and Evidence”. Review of Development Economics, 318-334.

Limin D., He Y., and Chu W., 2010. “The relationship between oil price shocks and China's macro-economy: An empirical analysis”. Energy Policy 38 (8), 4142-4151.

López-Calva L., and Lustig N. 2010. “Declining Inequality in Latin America: A Decade of Progress?” Brookings Institute Press.

Madala,G.S 1996 “Introducción a la Econometría”. Tercera Edición.Editorial Prentice Hall. México.

Mauro P.1995. “Corruption and Growth” Quarterly Journal of Economics. 110:681-712

Miguel C., Manzano B., and Martin-Moreno J. 2003, “Oil price shocks and aggregate fluctuations”. The Energy Journal 24 (2), 47-61

OECD. 2012. “Reducing income inequality while boosting economic growth: Can it be done? Part II. Chapter Five. OECD Publishing

OECD. 2016. “Estudio de la OECD sobre la Política Regulatoria en Chile: La capacidad del gobierno para asegurar una regulación de Alta Calidad”. Paris. Ediciones OECD.

Persson, T., and G. Tabellini. 1991. “Is inequality harmful for growth? Theory and evidence”. NBER Working Paper No. 3599. http://www.nber.org/papers/w3599

Plossner, C. 1992. “The search for growth in policies for long-run economic growth”. Federal Reserve Bank of Kansas City. Kansas City, MO.

Quibria M. 2006. “Does Governance Matter? Yes, No, or Maybe: Some Evidence from Developing Asia” Kyklos 59(1):99-114

Rodrik D. 2003. “Growth Strategies”, in: P. Aghion and S. Durlauf (eds.), Handbook of Economic Growth. Amsterdam: North-Holland.

Rodriguez R., and Sanchez M. 2004. “Oil Price shocks and real GDP growth Empirical Evidence for some OECD countries” European Central Bank. Working Paper Series No.362

Sims C.1980 “Macroeconomics and Reallity”. Econometrica, vol.48.

United Nations. 2013. “Inequality matters: Report of the World Social Situation 2013” Department of Economic and Social Affairs

Welsch F. 2007. “Reelección Limitada o Indefinida?” ILDIS Instituto Latinoamericano de Investigaciones Sociales

World Bank. World Development Indicators. Retrieved from http://data.worldbank.org/indicator

Zhuang J., De Dios E., Lagman-Martin A. 2010. “Governance and Institutional Quality and the Links with Economic Growth and Income Inequality: With Special Reference to Developing Asia” Asian Development Bank. ADB Economics Working Paper Series No.193

10. APPENDIX

10.1. List of Countries Considered in the Model

Non-oil exporting countries:

Cambodia, Chile, Cyprus, Dominican Republic, Germany, Italy, Netherlands, Panama, Peru, Philippines, Portugal, Serbia, South Africa, Switzerland, Turkey, United States, Uruguay.

Oil-exporting countries:

Cameroon, Congo, Ecuador, Iran, Kazakhstan, Malaysia, Mexico, Norway, Russian Federation, Trinidad and Tobago, United Arab Emirates, United Kingdom, Venezuela, Vietnam.

10.2. Unit Root test: Non-oil exporting countries

Panel unit root test: Summary
Series: LNGDP
Date: 03/10/17 Time: 13:27
Sample: 2002 2015
Exogenous variables: Individual effects, individual linear trends
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 1
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-3.37239	0.0004	17	214
Breitung t-stat	0.59434	0.7239	17	197
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	0.03597	0.5143	17	214
ADF - Fisher Chi-square	36.8418	0.3388	17	214
PP - Fisher Chi-square	17.3856	0.9919	17	221

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality

Panel unit root test: Summary
Series: LNGOV_EXP
Date: 03/10/17 Time: 13:29
Sample: 2002 2015
Exogenous variables: Individual effects, individual linear trends
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 1
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-3.51767	0.0002	17	217
Breitung t-stat	3.37683	0.9996	17	200
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-0.16451	0.4347	17	217
ADF - Fisher Chi-square	47.0960	0.0669	17	217
PP - Fisher Chi-square	50.2080	0.0382	17	220

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality

Panel unit root test: Summary
Series: LNOIL_PRICE
Date: 03/10/17 Time: 13:29
Sample: 2002 2015
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-5.40405	0.0000	17	221
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-3.40409	0.0003	17	221
ADF - Fisher Chi-square	58.6459	0.0054	17	221
PP - Fisher Chi-square	63.8334	0.0015	17	221

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality

Panel unit root test: Summary
Series: LNTRADE
Date: 03/10/17 Time: 13:30
Sample: 2002 2015
Exogenous variables: Individual effects, individual linear trends
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 1
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-4.43878	0.0000	17	219
Breitung t-stat	-0.23561	0.4069	17	202
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	0.03967	0.5158	17	219
ADF - Fisher Chi-square	30.7972	0.6254	17	219
PP - Fisher Chi-square	30.5264	0.6386	17	220

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality

Panel unit root test: Summary
Series: GOV_IND
Date: 03/10/17 Time: 13:31
Sample: 2002 2015
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 2
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-2.72520	0.0032	17	212
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-1.48060	0.0694	17	212
ADF - Fisher Chi-square	47.4901	0.0621	17	212
PP - Fisher Chi-square	76.9530	0.0000	17	221

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

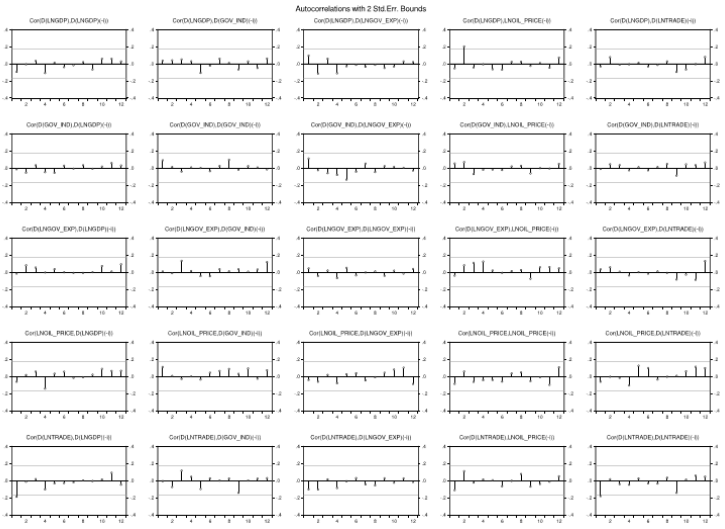
10.3. Lag Length Selection Criteria: Non-oil exporting countries

VAR Lag Order Selection Criteria
Endogenous variables: D(LNGDP) D(GOV_IND) D(LNGOV_EXP) LNOIL_PRICE D(LNTRADE)
Exogenous variables: C D1
Date: 03/10/17 Time: 13:34
Sample: 2002 2015
Included observations: 135

Lag	LogL	LR	FPE	AIC	SC	HQ
0	1003.847	NA	2.77e-13	-14.72365	-14.50845	-14.63620
1	1103.546	189.0596	9.18e-14	-15.83031	-15.07709	-15.52422
2	1170.324	121.6845	4.95e-14	-16.44925	-15.15801*	-15.92452
3	1195.692	44.34758	4.95e-14	-16.45470	-14.62545	-15.71135
4	1221.291	42.85344	4.94e-14	-16.46357	-14.09630	-15.50158
5	1309.560	141.2311*	1.96e-14*	-17.40089*	-14.49562	-16.22027*

* 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

10.4. Autocorrelation Test: Non-oil exporting countries



VAR Residual Serial Correlation LM Te...
Null Hypothesis: no serial correlation at...
Date: 03/10/17 Time: 13:36
Sample: 2002 2015
Included observations: 135

Lags	LM-Stat	Prob
1	60.02683	0.0001
2	32.57004	0.1422
3	26.24366	0.3947
4	33.45458	0.1201
5	36.61324	0.0628

Probs from chi-square with 25 df.

10.5. Heteroskedasticity test: Non-oil exporting countries

VAR Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)
Date: 03/10/17 Time: 16:47
Sample: 2008 2015
Included observations: 135

Joint test:

Chi-sq	df	Prob.
749.2983	720	0.2179

Individual components:

Dependent	R-squared	F(48,86)	Prob.	Chi-sq(48)	Prob.
res1*res1	0.359899	1.007372	0.4789	48.58641	0.4492
res2*res2	0.280995	0.700204	0.9104	37.93439	0.8508
res3*res3	0.374241	1.071522	0.3840	50.52250	0.3741
res4*res4	0.433719	1.372254	0.1007	58.55213	0.1415
res5*res5	0.265793	0.648607	0.9483	35.88201	0.9015
res2*res1	0.435796	1.383900	0.0949	58.83250	0.1359
res3*res1	0.319676	0.841881	0.7399	43.15622	0.6712
res3*res2	0.323849	0.858136	0.7155	43.71960	0.6487
res4*res1	0.396851	1.178853	0.2508	53.57487	0.2690
res4*res2	0.358264	1.000238	0.4900	48.36560	0.4581
res4*res3	0.342500	0.933303	0.5967	46.23754	0.5453
res5*res1	0.331710	0.889307	0.6671	44.78090	0.6055
res5*res2	0.454444	1.492446	0.0532	61.34997	0.0934
res5*res3	0.459004	1.520127	0.0457	61.96555	0.0848
res5*res4	0.422475	1.310654	0.1370	57.03417	0.1744

10.6. Johansen Cointegration Test: Non-oil exporting countries

Date: 03/08/17 Time: 13:21
Sample (adjusted): 2008 2015
Included observations: 135 after adjustments
Trend assumption: Linear deterministic trend
Series: LNGDP GOV_IND LNGOV_EXP LNTRADE
Exogenous series: D1
Warning: Critical values assume no exogenous series
Lags interval (in first differences): 1 to 5

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.076989	15.15423	47.85613	0.9998
At most 1	0.025047	4.338749	29.79707	1.0000
At most 2	0.005834	0.914323	15.49471	1.0000
At most 3	0.000922	0.124481	3.841466	0.7242

Trace test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.076989	10.81548	27.58434	0.9699
At most 1	0.025047	3.424426	21.13162	0.9999
At most 2	0.005834	0.789842	14.26460	1.0000
At most 3	0.000922	0.124481	3.841466	0.7242

Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

10.7. Granger Causality: Non-oil exporting countries

Pairwise Granger Causality Tests
Date: 03/10/17 Time: 16:51
Sample: 2008 2015
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
GOV_IND does not Granger Cause LNGDP	136	3.97011	0.0212
LNGDP does not Granger Cause GOV_IND		0.50252	0.6062
LNGOV_EXP does not Granger Cause LNGDP	135	9.31569	0.0002
LNGDP does not Granger Cause LNGOV_EXP		17.0720	3.E-07
LNOIL_PRICE does not Granger Cause LNGDP	136	66.3351	1.E-20
LNGDP does not Granger Cause LNOIL_PRICE		0.14072	0.8689
LNTRADE does not Granger Cause LNGDP	135	9.75273	0.0001
LNGDP does not Granger Cause LNTRADE		0.66697	0.5150
LNGOV_EXP does not Granger Cause GOV_IND	135	0.59085	0.5553
GOV_IND does not Granger Cause LNGOV_EXP		4.41467	0.0140
LNOIL_PRICE does not Granger Cause GOV_IND	136	0.20397	0.8157
GOV_IND does not Granger Cause LNOIL_PRICE		0.60558	0.5473
LNTRADE does not Granger Cause GOV_IND	135	0.77819	0.4614
GOV_IND does not Granger Cause LNTRADE		1.87822	0.1570
LNOIL_PRICE does not Granger Cause LNGOV_EXP	135	0.81701	0.4440
LNGOV_EXP does not Granger Cause LNOIL_PRICE		0.00713	0.9929
LNTRADE does not Granger Cause LNGOV_EXP	135	1.01426	0.3655
LNGOV_EXP does not Granger Cause LNTRADE		4.11156	0.0186
LNTRADE does not Granger Cause LNOIL_PRICE	135	1.54216	0.2178
LNOIL_PRICE does not Granger Cause LNTRADE		55.1225	5.E-18

VAR Granger Causality/Block Exogeneity Wald Tests
Date: 03/10/17 Time: 17:39
Sample: 2008 2015
Included observations: 135

Dependent variable: D(LNGDP)

Excluded	Chi-sq	df	Prob.
D(GOV_IND)	5.935100	5	0.3126
D(LNGOV_E...	7.937375	5	0.1597
LNOIL_PRIC...	50.38211	5	0.0000
D(LNTRADE)	0.618217	5	0.9872
All	103.8746	20	0.0000

Dependent variable: D(GOV_IND)

Excluded	Chi-sq	df	Prob.
D(LNGDP)	1.151341	5	0.9495
D(LNGOV_E...	4.326824	5	0.5034
LNOIL_PRIC...	6.600905	5	0.2521
D(LNTRADE)	5.664852	5	0.3402
All	18.83145	20	0.5328

Dependent variable: D(LNGOV_EXP)

Excluded	Chi-sq	df	Prob.
D(LNGDP)	17.44767	5	0.0037
D(GOV_IND)	4.181423	5	0.5236
LNOIL_PRIC...	5.835439	5	0.3226
D(LNTRADE)	4.406870	5	0.4924
All	38.85903	20	0.0069

Dependent variable: LNOIL_PRICE

Excluded	Chi-sq	df	Prob.
D(LNGDP)	5.827577	5	0.3234
D(GOV_IND)	4.964980	5	0.4202
D(LNGOV_E...	2.604962	5	0.7606
D(LNTRADE)	75.12999	5	0.0000
All	216.7907	20	0.0000

Dependent variable: D(LNTRADE)

Excluded	Chi-sq	df	Prob.
D(LNGDP)	6.994569	5	0.2210
D(GOV_IND)	13.02214	5	0.0232
D(LNGOV_E...	13.30919	5	0.0206
LNOIL_PRIC...	70.95312	5	0.0000
All	148.4481	20	0.0000

10.8. VAR Model – Non-oil exporting countries

Vector Autoregression Estimates
Date: 03/14/17 Time: 00:24
Sample (adjusted): 2008 2015
Included observations: 135 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	D(LNGDP)	D(GOV_IND)	D(LNGOV_E...	LNOIL_PRIC...	D(LNTRADE)
D(LNGDP(-1))	0.667254	0.068085	0.506389	0.179045	0.440837
	(0.11316)	(0.30752)	(0.17575)	(0.76210)	(0.26361)
	[5.89681]	[0.22140]	[2.88131]	[0.23493]	[1.67232]
D(LNGDP(-2))	-0.191744	0.007359	-0.222183	-0.206387	-0.566049
	(0.13527)	(0.36762)	(0.21009)	(0.91103)	(0.31512)
	[-1.41753]	[0.02002]	[-1.05755]	[-0.22654]	[-1.79630]
D(LNGDP(-3))	0.146439	-0.218297	0.356784	-0.840459	-0.079810
	(0.13704)	(0.37243)	(0.21285)	(0.92296)	(0.31925)
	[1.06859]	[-0.58614]	[1.67626]	[-0.91061]	[-0.24999]
D(LNGDP(-4))	0.224246	-0.171312	-0.020035	2.062057	-0.184694
	(0.13762)	(0.37400)	(0.21374)	(0.92685)	(0.32059)
	[1.62952]	[-0.45806]	[-0.09373]	[2.22481]	[-0.57610]
D(LNGDP(-5))	0.012095	0.135337	0.036665	-1.107816	-0.140210
	(0.12334)	(0.33521)	(0.19157)	(0.83072)	(0.28734)
	[0.09806]	[0.40374]	[0.19139]	[-1.33357]	[-0.48796]
D(GOV_IND(-1))	0.026030	-0.067845	0.001043	-0.392935	0.234624
	(0.03642)	(0.09897)	(0.05656)	(0.24526)	(0.08483)
	[0.71481]	[-0.68552]	[0.01843]	[-1.60210]	[2.76566]
D(GOV_IND(-2))	0.044962	0.124305	0.084153	0.112360	0.167260
	(0.03518)	(0.09561)	(0.05464)	(0.23695)	(0.08196)
	[1.27798]	[1.30007]	[1.54004]	[0.47419]	[2.04074]
D(GOV_IND(-3))	-0.043474	-0.009275	-0.034472	0.287288	-0.024504
	(0.03204)	(0.08706)	(0.04976)	(0.21576)	(0.07463)
	[-1.35707]	[-0.10654]	[-0.69282]	[1.33153]	[-0.32834]
D(GOV_IND(-4))	-0.046869	0.085307	-0.011870	0.225014	0.025556
	(0.03130)	(0.08506)	(0.04861)	(0.21080)	(0.07291)
	[-1.49749]	[1.00291]	[-0.24418]	[1.06745]	[0.35050]
D(GOV_IND(-5))	-0.020189	0.145628	-0.030938	0.109431	0.002661
	(0.02849)	(0.07743)	(0.04425)	(0.19189)	(0.06637)
	[-0.70860]	[1.88077]	[-0.69914]	[0.57029]	[0.04010]
D(LNGOV_EXP(-1))	-0.022066	0.029089	0.003610	0.202899	0.149053
	(0.03368)	(0.09152)	(0.05230)	(0.22681)	(0.07845)
	[-0.65525]	[0.31784]	[0.06901]	[0.89370]	[1.89994]
D(LNGOV_EXP(-2))	-0.067854	0.047511	0.232000	0.127450	-0.091403
	(0.03292)	(0.08946)	(0.05113)	(0.22170)	(0.07669)
	[-2.06131]	[0.53107]	[4.53769]	[0.57487]	[-1.19191]
D(LNGOV_EXP(-3))	0.010578	-0.019716	0.119609	0.137883	0.110797
	(0.03212)	(0.08730)	(0.04989)	(0.21636)	(0.07484)
	[0.32928]	[-0.22582]	[2.39722]	[0.63729]	[1.48050]
D(LNGOV_EXP(-4))	0.035585	-0.008582	-0.021104	0.173250	0.137392
	(0.03039)	(0.08260)	(0.04721)	(0.20471)	(0.07081)
	[1.17077]	[-0.10389]	[-0.44704]	[0.84633]	[1.94037]
D(LNGOV_EXP(-5))	0.042737	0.161226	-0.024403	0.151056	0.068345
	(0.02936)	(0.07980)	(0.04560)	(0.19776)	(0.06840)
	[1.45549]	[2.02043]	[-0.53509]	[0.76385]	[0.99916]

LNOIL_PRICE(-1)	-0.106794	-0.091035	0.030861	-0.493943	-0.329899
	(0.01775)	(0.04824)	(0.02757)	(0.11955)	(0.04135)
	[-6.01666]	[-1.88717]	[1.11942]	[-4.13184]	[-7.97819]
LNOIL_PRICE(-2)	0.059750	-0.043963	0.009312	-0.922318	0.044001
	(0.02127)	(0.05779)	(0.03303)	(0.14323)	(0.04954)
	[2.80962]	[-0.76067]	[0.28193]	[-6.43952]	[0.88816]
LNOIL_PRICE(-3)	-0.013966	0.053810	-0.031474	-0.738196	-0.032866
	(0.02189)	(0.05948)	(0.03399)	(0.14741)	(0.05099)
	[-0.63812]	[0.90464]	[-0.92586]	[-5.00783]	[-0.64458]
LNOIL_PRICE(-4)	0.008084	0.064702	0.049341	-0.495271	0.014285
	(0.02012)	(0.05468)	(0.03125)	(0.13551)	(0.04687)
	[0.40177]	[1.18327]	[1.57890]	[-3.65486]	[0.30476]
LNOIL_PRICE(-5)	0.025938	-0.053850	-0.025725	0.968966	0.099047
	(0.01711)	(0.04651)	(0.02658)	(0.11527)	(0.03987)
	[1.51550]	[-1.15772]	[-0.96773]	[8.40609]	[2.48417]
D(LNTRADE(-1))	0.020652	0.090219	-0.150119	0.143900	0.095662
	(0.04897)	(0.13307)	(0.07605)	(0.32979)	(0.11407)
	[0.42177]	[0.67796]	[-1.97389]	[0.43634]	[0.83862]
D(LNTRADE(-2))	0.021321	0.124374	0.028162	0.224517	0.145697
	(0.05124)	(0.13926)	(0.07958)	(0.34510)	(0.11937)
	[0.41611]	[0.89314]	[0.35386]	[0.65058]	[1.22055]
D(LNTRADE(-3))	0.024727	0.143731	0.021782	-0.055132	0.077892
	(0.05302)	(0.14408)	(0.08234)	(0.35706)	(0.12351)
	[0.46641]	[0.99758]	[0.26453]	[-0.15440]	[0.63068]
D(LNTRADE(-4))	0.002267	-0.168161	-0.019375	0.325751	0.238489
	(0.04882)	(0.13268)	(0.07583)	(0.32881)	(0.11373)
	[0.04644]	[-1.26742]	[-0.25552]	[0.99070]	[2.09691]
D(LNTRADE(-5))	-0.011389	-0.176196	0.042833	-2.050539	-0.063728
	(0.03614)	(0.09822)	(0.05614)	(0.24342)	(0.08420)
	[-0.31512]	[-1.79381]	[0.76303]	[-8.42386]	[-0.75688]
C	0.128944	0.320732	-0.148001	12.04957	0.967118
	(0.08800)	(0.23916)	(0.13668)	(0.59269)	(0.20501)
	[1.46526]	[1.34108]	[-1.08283]	[20.3304]	[4.71748]
D1	-0.017549	-0.016930	0.010043	-0.061655	-0.054039
	(0.00833)	(0.02264)	(0.01294)	(0.05612)	(0.01941)
	[-2.10617]	[-0.74765]	[0.77603]	[-1.09867]	[-2.78394]
R-squared	0.774219	0.191216	0.594175	0.798714	0.747211
Adj. R-squared	0.719864	-0.003492	0.496477	0.750256	0.686354
Sum sq. resids	0.034996	0.258479	0.084423	1.587454	0.189928
S.E. equation	0.018001	0.048922	0.027959	0.121238	0.041936
F-statistic	14.24381	0.982067	6.081722	16.48265	12.27823
Log likelihood	365.8443	230.8728	306.4036	108.3555	251.6744
Akaike AIC	-5.019915	-3.020338	-4.139313	-1.205266	-3.328510
Schwarz SC	-4.438860	-2.439283	-3.558258	-0.624211	-2.747455
Mean dependent	0.024654	0.004302	0.027607	4.403882	0.033167
S.D. dependent	0.034011	0.048836	0.039401	0.242600	0.074879

Determinant resid covariance (dof adj.)	7.88E-15
Determinant resid covariance	2.58E-15
Log likelihood	1309.560
Akaike information criterion	-17.40089
Schwarz criterion	-14.49562

10.9. Unit Root test: Oil exporting countries

Panel unit root test: Summary
Series: LNGDP
Date: 03/14/17 Time: 09:58
Sample: 2002 2015
Exogenous variables: Individual effects, individual linear trends
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 1
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-2.75454	0.0029	14	175
Breitung t-stat	-0.23139	0.4085	14	161
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	0.75121	0.7737	14	175
ADF - Fisher Chi-square	22.3615	0.7643	14	175
PP - Fisher Chi-square	21.9637	0.7830	14	180

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: GOV_IND
Date: 03/14/17 Time: 09:59
Sample: 2002 2015
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 2
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-2.39826	0.0082	14	178
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-1.06193	0.1441	14	178
ADF - Fisher Chi-square	33.0886	0.2325	14	178
PP - Fisher Chi-square	40.4560	0.0602	14	182

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: LNGOV_EXP
Date: 03/14/17 Time: 10:01
Sample: 2002 2015
Exogenous variables: Individual effects, individual linear trends
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 1
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-3.64629	0.0001	14	177
Breitung t-stat	2.03996	0.9793	14	163
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-0.04793	0.4809	14	177
ADF - Fisher Chi-square	27.8951	0.4700	14	177
PP - Fisher Chi-square	33.2318	0.2273	14	179

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: LNOIL_PRICE
Date: 03/14/17 Time: 10:04
Sample: 2002 2015
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-4.90410	0.0000	14	182
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-3.08916	0.0010	14	182
ADF - Fisher Chi-square	48.2966	0.0100	14	182
PP - Fisher Chi-square	52.5687	0.0033	14	182

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: LNTRADE
Date: 03/14/17 Time: 10:05
Sample: 2002 2015
Exogenous variables: Individual effects, individual linear trends
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 1
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-3.92196	0.0000	14	178
Breitung t-stat	0.94329	0.8272	14	164
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	0.44191	0.6707	14	178
ADF - Fisher Chi-square	21.6371	0.7978	14	178
PP - Fisher Chi-square	16.9829	0.9489	14	180

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

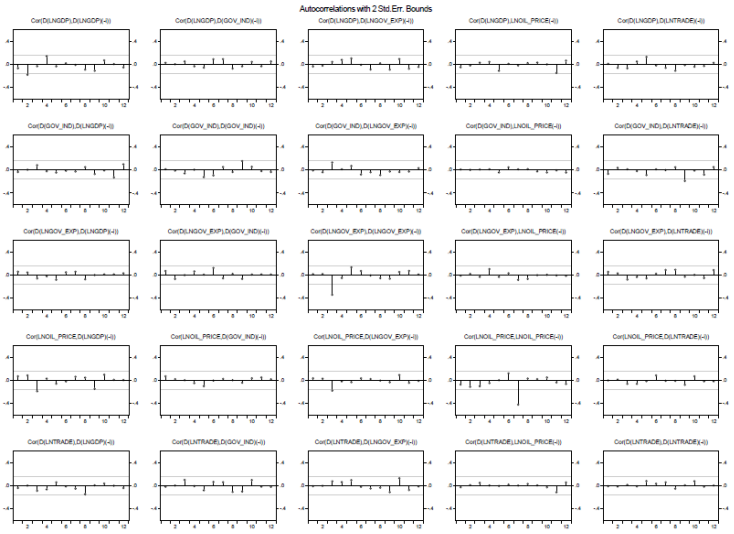
10.10. Lag Length Selection Criteria: Oil exporting countries

VAR Lag Order Selection Criteria
Endogenous variables: D(LNGDP) D(GOV_IND) D(LNGOV_EXP) LNOIL_PRICE D(LNTRADE)
Exogenous variables: C D1
Date: 03/14/17 Time: 10:08
Sample: 2002 2015
Included observations: 151

Lag	LogL	LR	FPE	AIC	SC	HQ
0	944.0279	NA	2.92e-12	-12.37123	-12.17141*	-12.29005
1	1002.518	111.5568	1.87e-12	-12.81480	-12.11544	-12.53068*
2	1027.805	46.55449*	1.87e-12*	-12.81860*	-11.61968	-12.33154

* 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

10.11. Autocorrelation Test: Oil exporting countries



VAR Residual Serial Correlation LM Te...
Null Hypothesis: no serial correlation at...
Date: 03/14/17 Time: 10:13
Sample: 2002 2015
Included observations: 151

Lags	LM-Stat	Prob
1	37.01173	0.0576
2	41.49118	0.0204
3	66.57635	0.0000
4	24.60199	0.4848
5	37.23882	0.0548
6	20.22547	0.7349

Probs from chi-square with 25 df.

10.12. Heteroskedasticity test: Oil exporting countries

VAR Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)
Date: 03/14/17 Time: 10:14
Sample: 2002 2015
Included observations: 151

Joint test:

Chi-sq	df	Prob.
326.1355	315	0.3210

Individual components:

Dependent	R-squared	F(21,129)	Prob.	Chi-sq(21)	Prob.
res1*res1	0.127879	0.900726	0.5904	19.30973	0.5653
res2*res2	0.094220	0.638988	0.8827	14.22727	0.8596
res3*res3	0.162591	1.192696	0.2682	24.55126	0.2671
res4*res4	0.261174	2.171489	0.0044	39.43724	0.0087
res5*res5	0.092651	0.627262	0.8922	13.99037	0.8700
res2*res1	0.135394	0.961952	0.5141	20.44456	0.4933
res3*res1	0.166888	1.230534	0.2370	25.20016	0.2386
res3*res2	0.153999	1.118195	0.3377	23.25385	0.3306
res4*res1	0.091084	0.615584	0.9012	13.75364	0.8799
res4*res2	0.092271	0.624420	0.8944	13.93285	0.8725
res4*res3	0.131942	0.933693	0.5491	19.92322	0.5261
res5*res1	0.099382	0.677855	0.8483	15.00666	0.8226
res5*res2	0.089790	0.605977	0.9083	13.55827	0.8878
res5*res3	0.187852	1.420864	0.1200	28.36572	0.1301
res5*res4	0.096026	0.652532	0.8713	14.49988	0.8472

10.13. Johansen Cointegration Test: Oil exporting countries

Date: 03/14/17 Time: 10:19
Sample: 2002 2015
Included observations: 151
Trend assumption: Linear deterministic trend
Series: LNGDP GOV_IND LNGOV_EXP LNTRADE
Exogenous series: D1
Warning: Critical values assume no exogenous series
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.120658	31.17758	47.85613	0.6569
At most 1	0.065589	11.76181	29.79707	0.9398
At most 2	0.009837	1.518163	15.49471	0.9990
At most 3	0.000168	0.025402	3.841466	0.8733

Trace test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.120658	19.41576	27.58434	0.3830
At most 1	0.065589	10.24365	21.13162	0.7215
At most 2	0.009837	1.492761	14.26460	0.9981
At most 3	0.000168	0.025402	3.841466	0.8733

Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

10.14. Granger Causality: Oil exporting countries

VAR Granger Causality/Block Exogeneity Wald Tests
Date: 03/14/17 Time: 10:55
Sample: 2002 2015
Included observations: 151

Dependent variable: D(LNGDP)

Excluded	Chi-sq	df	Prob.
D(GOV_IND)	1.536729	2	0.4638
D(LNGOV_E...	8.672193	2	0.0131
LNOIL_PRIC...	21.77907	2	0.0000
D(LNTRADE)	2.702764	2	0.2589
All	28.18181	8	0.0004

Dependent variable: D(GOV_IND)

Excluded	Chi-sq	df	Prob.
D(LNGDP)	3.023157	2	0.2206
D(LNGOV_E...	6.884240	2	0.0320
LNOIL_PRIC...	11.53849	2	0.0031
D(LNTRADE)	3.433693	2	0.1796
All	24.76531	8	0.0017

Dependent variable: D(LNGOV_EXP)

Excluded	Chi-sq	df	Prob.
D(LNGDP)	2.335069	2	0.3111
D(GOV_IND)	3.279068	2	0.1941
LNOIL_PRIC...	0.544995	2	0.7615
D(LNTRADE)	1.206179	2	0.5471
All	13.61734	8	0.0923

Dependent variable: LNOIL_PRICE

Excluded	Chi-sq	df	Prob.
D(LNGDP)	0.411742	2	0.8139
D(GOV_IND)	3.668857	2	0.1597
D(LNGOV_E...	0.365584	2	0.8329
D(LNTRADE)	2.249426	2	0.3247
All	6.995875	8	0.5371

Dependent variable: D(LNTRADE)

Excluded	Chi-sq	df	Prob.
D(LNGDP)	0.292352	2	0.8640
D(GOV_IND)	1.685342	2	0.4306
D(LNGOV_E...	2.546765	2	0.2799
LNOIL_PRIC...	24.66245	2	0.0000
All	29.16132	8	0.0003

Pairwise Granger Causality Tests
Date: 03/14/17 Time: 11:04
Sample: 2002 2015
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
GOV_IND does not Granger Cause LNGDP	166	0.94466	0.3910
LNGDP does not Granger Cause GOV_IND		0.29296	0.7464
LNGOV_EXP does not Granger Cause LNGDP	165	1.51876	0.2221
LNGDP does not Granger Cause LNGOV_EXP		6.12558	0.0027
LNOIL_PRICE does not Granger Cause LNGDP	166	19.9475	2.E-08
LNGDP does not Granger Cause LNOIL_PRICE		0.23496	0.7909
LNTRADE does not Granger Cause LNGDP	166	1.11693	0.3298
LNGDP does not Granger Cause LNTRADE		0.73208	0.4825
LNGOV_EXP does not Granger Cause GOV_IND	165	0.49070	0.6131
GOV_IND does not Granger Cause LNGOV_EXP		0.01622	0.9839
LNOIL_PRICE does not Granger Cause GOV_IND	168	2.00975	0.1373
GOV_IND does not Granger Cause LNOIL_PRICE		0.19058	0.8267
LNTRADE does not Granger Cause GOV_IND	166	0.20019	0.8188
GOV_IND does not Granger Cause LNTRADE		0.90016	0.4085
LNOIL_PRICE does not Granger Cause LNGOV_EXP	165	0.72413	0.4863
LNGOV_EXP does not Granger Cause LNOIL_PRICE		0.07259	0.9300
LNTRADE does not Granger Cause LNGOV_EXP	165	6.22181	0.0025
LNGOV_EXP does not Granger Cause LNTRADE		2.56034	0.0804
LNTRADE does not Granger Cause LNOIL_PRICE	166	0.04508	0.9559
LNOIL_PRICE does not Granger Cause LNTRADE		23.2747	1.E-09

10.15. VAR Model – Oil exporting countries

Vector Autoregression Estimates
Date: 03/14/17 Time: 11:29
Sample: 2002 2015
Included observations: 151
Standard errors in ( ) & t-statistics in [ ]

	D(LNGDP)	D(GOV_IND)	D(LNGOV_E...	LNOIL_PRIC...	D(LNTRADE)
D(LNGDP(-1))	0.281678	0.047168	0.316850	-0.265803	-0.124019
	(0.09254)	(0.22062)	(0.24064)	(0.77841)	(0.26416)
	[3.04392]	[0.21380]	[1.31671]	[-0.34147]	[-0.46949]
D(LNGDP(-2))	0.047671	-0.350275	0.077306	0.448369	-0.028313
	(0.08590)	(0.20478)	(0.22337)	(0.72255)	(0.24520)
	[0.55498]	[-1.71047]	[0.34609]	[0.62054]	[-0.11547]
D(GOV_IND(-1))	-0.002095	-0.073183	-0.013647	0.066812	-0.130041
	(0.03553)	(0.08470)	(0.09239)	(0.29886)	(0.10142)
	[-0.05896]	[-0.86399]	[-0.14771]	[0.22355]	[-1.28221]
D(GOV_IND(-2))	0.040761	0.083657	0.154157	-0.524429	0.011526
	(0.03308)	(0.07887)	(0.08603)	(0.27829)	(0.09444)
	[1.23208]	[1.06068]	[1.79191]	[-1.88449]	[0.12205]
D(LNGOV_EXP(-1))	0.003490	-0.027198	0.054930	0.133932	-0.126153
	(0.03245)	(0.07737)	(0.08439)	(0.27298)	(0.09264)
	[0.10755]	[-0.35155]	[0.65092]	[0.49063]	[-1.36183]
D(LNGOV_EXP(-2))	0.092745	0.199840	0.130875	-0.111514	0.091584
	(0.03195)	(0.07616)	(0.08308)	(0.26874)	(0.09120)
	[2.90303]	[2.62378]	[1.57533]	[-0.41495]	[1.00425]
LNOIL_PRICE(-1)	-0.058660	-0.001603	-0.023739	0.278222	-0.201156
	(0.01474)	(0.03514)	(0.03833)	(0.12399)	(0.04208)
	[-3.97968]	[-0.04561]	[-0.61932]	[2.24393]	[-4.78081]
LNOIL_PRICE(-2)	0.023905	0.053079	0.022717	0.081691	0.111014
	(0.01183)	(0.02821)	(0.03077)	(0.09954)	(0.03378)
	[2.02009]	[1.88143]	[0.73824]	[0.82066]	[3.28638]
D(LNTRADE(-1))	0.054081	0.155553	0.097796	0.033075	0.421145
	(0.03885)	(0.09263)	(0.10104)	(0.32683)	(0.11091)
	[1.39192]	[1.67930]	[0.96792]	[0.10120]	[3.79717]
D(LNTRADE(-2))	-0.042421	0.027788	0.023462	-0.437793	-0.081504
	(0.03534)	(0.08424)	(0.09189)	(0.29725)	(0.10087)
	[-1.20046]	[0.32985]	[0.25533]	[-1.47282]	[-0.80800]
C	0.173285	-0.222521	0.020555	2.824637	0.438554
	(0.03516)	(0.08383)	(0.09143)	(0.29577)	(0.10037)
	[4.92835]	[-2.65458]	[0.22481]	[9.55020]	[4.36941]
D1	-0.064413	-0.014045	0.015496	-0.324093	-0.155022
	(0.01052)	(0.02507)	(0.02735)	(0.08847)	(0.03002)
	[-6.12462]	[-0.56016]	[0.56661]	[-3.66343]	[-5.16373]
R-squared	0.516734	0.157533	0.122084	0.266660	0.397309
Adj. R-squared	0.478490	0.090863	0.052609	0.208626	0.349614
Sum sq. resids	0.084725	0.481552	0.572931	5.995040	0.690383
S.E. equation	0.024689	0.058859	0.064201	0.207677	0.070475
F-statistic	13.51148	2.362868	1.757233	4.594884	8.330194
Log likelihood	350.9049	219.7159	206.5977	29.32951	192.5184
Akaike AIC	-4.488807	-2.751204	-2.577453	-0.229530	-2.390972
Schwarz SC	-4.249023	-2.511420	-2.337669	0.010254	-2.151188
Mean dependent	0.035380	-0.002660	0.043641	4.345755	0.038904
S.D. dependent	0.034187	0.061730	0.065960	0.233452	0.087388

Determinant resid covariance (dof adj.)	1.27E-12
Determinant resid covariance	8.42E-13
Log likelihood	1027.805
Akaike information criterion	-12.81860
Schwarz criterion	-11.61968