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Corruption and Economic Growth: Empirical Evidence from Algeria

Chaib Bounoua and Siham Matallah

Department of Economics,
University of Tlemcen,
Tlemcen, Algeria

ABSTRACT: This study investigates the impact of corruption on economic growth in Algeria over the period 1995-2011 by using the Heritage Foundation's freedom from corruption index and the World Bank's control of corruption indicator. The Johansen cointegration test has been applied in order to investigate the existence of long-run relationships among the tested variables. As well as, the vector error correction model (VECM) has been employed to analyze the long-run and short- run dynamic relationships among the various time series. The initial findings indicate that both 'freedom from corruption' and 'control of corruption' have long run positive effects on enhancing economic growth in Algeria. It is also revealed that the human capital has an insignificant positive impact on economic growth in the long term. Moreover, VECM analysis suggests that all explanatory variables have positive and insignificant short-run effects on promoting economic growth except the 'control of corruption' indicator. These results support the view that corruption sands the wheels of economic growth. Thus, the Algerian government should root out this scourge by finding the relevant solutions that must be supported with effective weapons such as transparency and tougher accountability standards.

KEYWORDS: Corruption, Freedom from Corruption, Control of Corruption, Economic Growth, Algeria, Johansen Cointegration Test, VECM.

1 INTRODUCTION

Corruption is a widespread scourge in the past, present and future, in Third World and Western societies, it threatens economic growth and country's economic and political stability, this phenomenon has received much attention of international organizations, economists and politicians who focused on investigating its causes and consequences, as well as the implementation of the proposed solutions.

There is broad consensus that corruption is considered as a deadly disease which destroys the economic tissue cells. Further, it is more prevalent in natural resource-rich countries (especially those dependent on oil manna).

Corruption is a global problem that has been triggered by many structural and institutional factors such as the nature of the political system, the sociocultural background, low salaries, low risk of detection and punishment (Xiaobo Lu, 2000; Quah, Jon S.T, 2002) ([1], [2]). Moreover, it exacts many economic and social costs, and distorts the composition of government spending at the expense of health and education sectors, it also steers resources allocation towards unproductive direction, further, it discourages the entry of FDI, and thus harms economic growth (Vito Tanzi 2002, Ali M. Kutan, Thomas J. Douglas, William Q. Judge, 2009; Ebben & Albert de Vaal, 2011) ([3], [4], [5]). On the other hand, corruption can be considered as the oil that greases the economic growth engine (Emmanuel Anoruo and Habtu Braha, 2005) [6], but it is broadly perceived that its disadvantages far outweigh its advantages.

Algeria is one of the developing countries that are well endowed with natural resources. Hence, the Algerian economy is largely dependent on oil and gas sector, where corruption could find a place especially with rising rent seeking activities. Therefore, this scourge has a role to play in frustrating economic growth, especially that Algeria has been scored very low in terms of corruption by many international organizations such as: Transparency International, World Bank and Heritage

Corresponding Author: Siham Matallah

Foundation. Thus, this paper investigates the impact of corruption on economic growth in Algeria over the period (1995-2011). For this purpose, the remainder of this paper is organized as follows:

Section 2 presents a review of the theoretical and empirical evidence on the relationship between corruption and economic growth, section 3 describes and discusses corruption and economic growth in Algeria, section 4 introduces the data and econometric model, then section 5 analyzes the empirical results and finally section 6 concludes the paper.

2 THEORETICAL AND EMPIRICAL EVIDENCE ON THE RELATIONSHIP BETWEEN CORRUPTION AND ECONOMIC GROWTH

The impact of corruption on economic growth has occupied the attention of researchers especially in last decades. In fact, corruption is a serious institutional vacuum, based on North's (1990) [7] well-known definition: institutions are **"**the rules of the game in a society or, more formally, the humanly devised constraints that shape human interaction**".**

Corruption has been defined in many different ways and the commonly used definitions of corruption in the literature are as follows:

Joseph Nye (1967) defined corruption as **"**the behavior which deviates from the formal duties of a public role because of private-regarding (personal, close family, private clique) pecuniary or status gains; or violates rules against the exercise of certain types of private-regarding influence**"** [8]**.**

The World Bank (1997) defined corruption as **"**the abuse of public office for private gain**"** [9]**.**

Transparency International has defined corruption as **"**the abuse of entrusted power for private gain" [10].

Several global organizations have focused on corruption measurement for quantizing its effects on the whole economy. The more recent survey-based measures of corruption are as follow:

- ***Transparency International's Corruption Perceptions Index (CPI):***

Transparency International (2012) defined the circumstances in which corruption occurs, as follows: "When politicians put their own interests above those of the public, when officials demand money and favours from citizens for services that should be free" [11]**.**

Corruption Perceptions Index ranks countries according to the level of corruption in the public sector, and this ranking is based on experts' opinions. Before 2012 the CPI scored countries on a scale from 0 (highly corrupt) to 10 (very clean), but since 2012 all countries have been scored on a scale from 0 (highly corrupt) to 100 (very clean).

- ***World Bank's Control of Corruption Indicator (CC) :***

Kaufmann, Daniel, Aart Kraay and Massimo Mastruzzi (2008) introduced the Control of Corruption Indicator which indicates to **"**the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests" [12]**.** This index is scaled between -2.5 and +2.5, where a higher score means better control of corruption.

- ***Heritage Foundation's Freedom From Corruption Index (FFC) :***

In 1995, Heritage Foundation and Wall Street Journal introduced the Index of Freedom from Corruption, which one of the ten components of the Economic Freedom Index. Heritage Foundation (2013) defined corruption as **"**the failure of integrity in the economic system, a distortion by which individuals or special-interest groups are able to gain at the expense of the whole" [13]**.** Moreover, this foundation asserts that the size of government intervention in economic activity is closely linked with the level of corruption, because the excessive regulations and restrictions induce paying bribes, smuggling activities, and engaging in the informal sector. In general, the Freedom from Corruption Index reflects the level of corruption in the business climate, and it is scored on a scale of 0 (highly corrupt) to 100 (highly clean); the higher the level of corruption, the lower the level of Freedom from Corruption Index.

Corruption has highly damaging qualitative effects for example, it drives resources into unproductive ways; generally, it is associated with large public spending and low quality of public infrastructure. Also, it reduces the state's ability to exercise control and correct the market distortions, in addition to inducing political instability and violence (Ali M. Kutan, Thomas J. Douglas, William Q. Judge, 2009) [14]. Additionally, corruption creates uncertainty and reduces productivity, and thus harms economic growth (Ebben & Albert de Vaal, 2009) [15].

Vito Tanzi (2002) [16] indicated that corruption distorts fiscal policy by reducing public revenue and rising government spending and hence hinders government efforts to embark on the necessary fiscal adjustments for boosting the long-run growth potential. As well as, it further deepens the poverty gap by decreasing the average income of the poor, and thus pulling down the growth prospects. Furthermore, corrupt practices mislead the state's focus and force it to concentrate on eliminating corrupt bodies instead of finding effective solutions aimed at stimulating economic activity.

Pak Hung Mo (2001) [17] stated that corruption has a negative spillover effect on innovative activities and it steers talented people towards rent-seeking activities rather than productive business. In other words, individuals seek positions of bureaucratic authority in order to reap more benefits through corruption. However, in the presence of corrupt behavior, natural-resource rents could be used for private gain instead of exploiting them in human capital accumulation, productivity or even innovation.

McMillan, Margaret and Dani Rodrik (2011) [18] pointed out that rent-seeking activities reduce the potential for structural change aimed at maximizing productivity, because the natural resources abundance especially oil does not provide many job opportunities unlike manufacturing industries and associated services. In other words, corruption leads to a structural change which does not fit with the target of enhancing economic growth.

Corruption alters the composition of public spending and raises the public projects that are considered as a loophole for this scourge's entrance, or rather a hotbed of corruption. As well as, it encourages tax evasion and thus a limited number of companies and individuals will bear the tax burden. Furthermore, corruption leads to lower quality of public goods and services (Sergio Díaz-Briquets, Jorge Pérez-López, 2006) [19], it also reduces the share of health and education expenditures in total government spending, and thus erodes the human capital (Erwin Tiongson, Hamid Reza Davoodi, Sanjeev Gupta, 2000) [20].

In general, corruption results from government intervention in the economy (Isaac Ehrlich, Francis T. Lui, 1999) [21]. A high level of corruption is often associated with a lack of democratization and low levels of economic freedom, thereby it destroys the investment climate and discourages foreign investors (Claire Wallace, Christian W. Haerpfer, 2000) [22].

Corruption is deemed a form of taxation; it not only reduces FDI inflows but also changes the type of inward FDI. It also raises the cost of starting and doing business in the host country, because foreign investors may not know the unwritten rules, in this way, corruption can impede economic growth (John H. Dunning and Serianna M .Lundan, 2008) [23].

On the other hand, Corruption helps in providing fast and efficient public services and it is useful to gain time, for example: public service agents can reduce restrictions that hamper economic activity, when they receive bribes (Mushfiq us Swaleheen and Dean Stansel, 2007) [24]. Therefore, corruption is considered as the oil that greases the economic growth engine (Emmanuel Anoruo and Habtu Braha, 2005) [25]. But in general, the growth effects of corruption largely depend on institutional quality (Toke S. Aidt, 2009) [26].

The quantitative impact of corruption on economic growth has been a subject of intense debate over the past two decades; numerous studies have produced conflicting results: some of them suggest that corruption is highly and negatively correlated with economic growth, these studies are as follows:

Moe Farida and Fredoun Z. Ahmadi-Esfahani (2008) [27] studied the effect of corruption on economic growth in Lebanon between 1985-2005 by using the ordinary least squares (OLS) estimates , the main results indicated that corruption adversely affect economic growth by decreasing productivity, also indirectly by restricting investment. Similarly, Baliamoune-Lutz, Mina and Ndikumana, Léonce (2008) [28] employed the GMM estimation technique in a panel framework for testing the impact of corruption on economic growth through public and private investment channels in a sample of 33 African countries from 1982 to 2001. Findings suggested that corruption hampers economic growth directly by affecting public investment, especially when bureaucrats exploit the public spending for their own narrow ends.

As well as, A.Cooper Drury, Jonathan Krieckhaus and Michael Lusztig (2006) [29] investigated the growth effect of corruption in a sample of 100 countries between 1982 and 1997 by using the panel data analysis. Their study revealed that corruption exhibits an insignificant negative effect on economic growth. Furthermore, Alfredo Del Monte and Erasmo Papagni (2001) [30] explored the influence of corruption on economic growth through public expenditures channel by implementing a dynamic panel data approach for 20 regions in Italy during the period 1963-1991. They found that corruption has a significant and negative impact on growth, because corruption can change the composition of the government spending when corrupt decision-makers prefer non-productive activities.

In contrast, others support the positive impact of corruption on economic growth for example: Jac C. Heckelman, Benjamin Powell (2008) [31] examined the effect of corruption on economic growth in a set of 83 nations from 1995 to 2005 by using the ordinary least squares with a panel analysis, they found that corruption positively affects economic growth when economic freedom stays in low levels and vice versa. Mushfiq us Swaleheen and Dean Stansel (2007) [32] studied the impact of corruption on economic growth in 60 countries from 1995 to 2004 by using the ordinary least square (OLS); the results indicated that there is a positive and insignificant relationship between corruption and GDP growth rates.

Justifying this point of view, Boris Podobnik, Jia Shao, Djuro Njavro, Plamen Ch. Ivanov and H.E. Stanley (2008) [33] argued that there exists a positive relationship between corruption and economic growth over the period (1999 -2004) by using panel data analysis for all countries in the world.

In addition, Fabio Méndez , Facundo Sepúlveda (2006) [34] studied the dependence of growth rates on changes in corruption level by using the fixed effects regression for a large sample of countries from 1960 to 2000; the empirical results revealed that corruption displays a positive impact on growth.

The purpose of this study is to investigate the impact of corruption on economic growth in Algeria, depending on the assumptions derived from the above-mentioned theoretical and empirical studies, these hypotheses are as follows:

Hypothesis 1: High level of corruption impedes economic growth in Algeria.

Hypothesis 2: High scores of both 'Control of Corruption' and 'Freedom from Corruption'have a positive impact on economic growth in Algeria.

3 CORRUPTION AND ECONOMIC GROWTH IN ALGERIA

Algeria is one of the developing countries that are highly endowed with abundant natural resources.

Hence, the Algerian economy is largely dependent on oil and gas sector, where corruption could find a place especially with rising rent seeking activities. Therefore, this scourge has a role to play in frustrating economic growth. In order to analyze this phenomenon, much more light must be shed on economic growth and corruption in Algeria.

3.1 ECONOMIC GROWTH IN ALGERIA

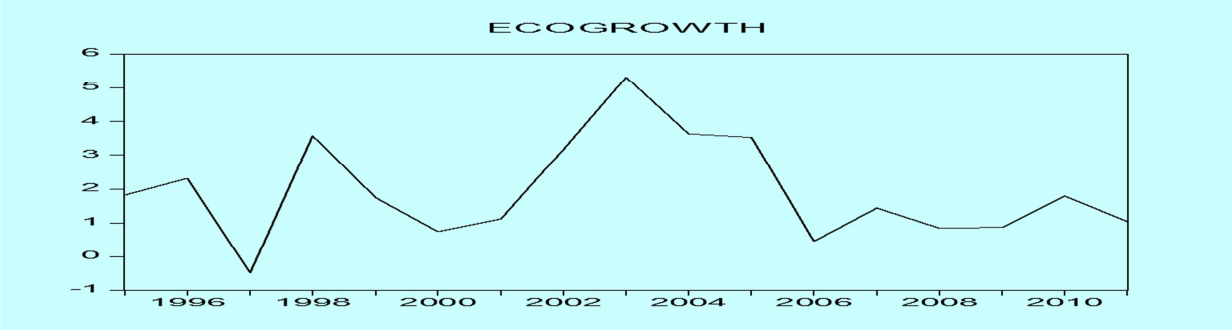

Fig. 1. Economic Growth (the annual percentage growth rate of GDP per capita) in Algeria, 1995-2011.

Source: World Bank, World Development Indicators, the data are available online at: http://data.worldbank.org (accessed 26/07/2014).

Algeria had a strong economic growth over the past decade due to high oil revenues and sound macroeconomic policies, especially those that have been taken since 1990 in the context of raising the hydrocarbons income, and this led to the acceleration of economic growth and the creation of a strong financial position with large foreign reserves (IMF, 2012) [35].

In 2003, GDP growth rose significantly as a result of increased oil production and accelerated services, construction and industrial activities, and the positive effects of the economic recovery program that allocated significant funds to improve the country's economic and social conditions (IMF, 2008) [36]. Then, it declined due to lower production and exports of oil and gas resulted from lower global demand for hydrocarbons, in addition to the significant decline in oil prices in 2009 under the impact of the global financial crisis. Further, the realized economic growth during the same period came as a result of good performance in other sectors (African Development Bank Group, 2011) [37].

In 2010, the non-oil economic growth increased by 6% reflecting the strong performance of the sectors that were supported by the public investment program (IMF, 2012) [38].

According to the World Bank (2012) report [39], high oil prices recorded during 2010 and public investment programs undertaken by the Algerian government pushed up the growth rate in 2011, and it is worthwhile to note that among very few countries, Algeria was able to maintain a positive current account to GDP ratio.

3.2 CORRUPTION IN ALGERIA

3.2.1 TRANSPARENCY INTERNATIONAL'S CORRUPTION PERCEPTIONS INDEX (CPI)

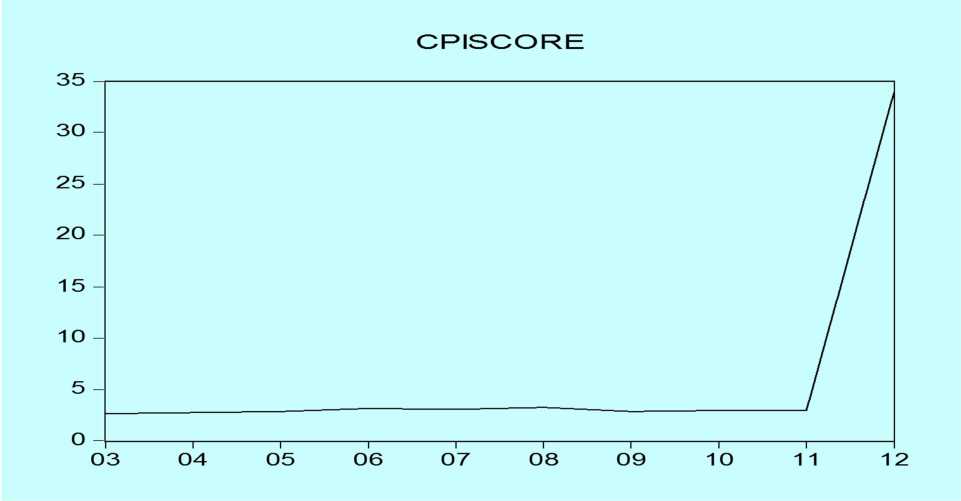

Fig. 2. Corruption Perceptions Index (CPI) Score in Algeria, 2003-2012.

Source: Transparency International's Corruption Perceptions Index, the data are available online at: http://www.transparency.org/research/cpi/overview(accessed 26/07/2014).

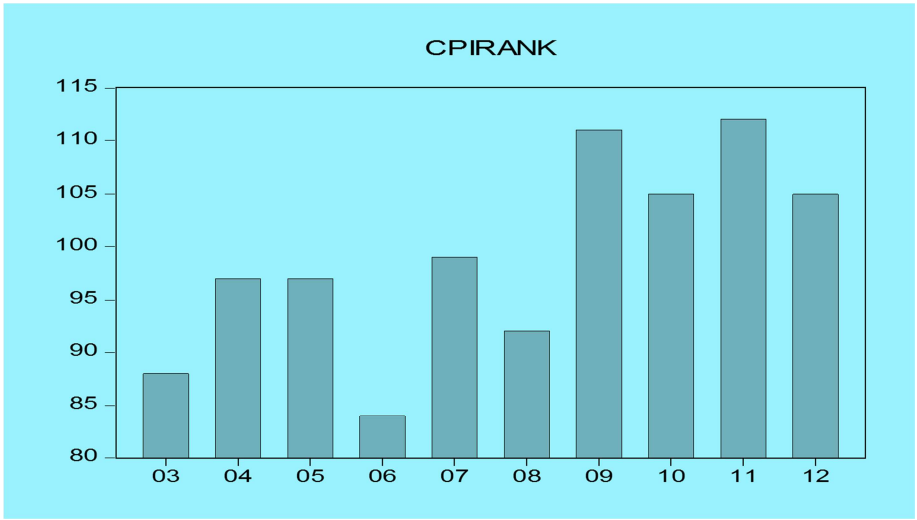

Fig. 3. Corruption Perceptions Index (CPI) Rank in Algeria, 2003-2012.

Source: Transparency International's Corruption Perceptions Index, the data are available online at: http://www.transparency.org/research/cpi/overview(accessed 26/07/2014).

According to Transparency International 2011 Corruption Perceptions Index, Algeria was ranked 112 th with a score of 2.9. In 2012, Algeria moved up seven ranks to the 105 th position out of 176 countries with a score of 34, and it came in the 12th place out of 17 countries in the Middle East and North Africa.

3.2.2 WORLD BANK'S CONTROL OF CORRUPTION INDICATOR (CC)

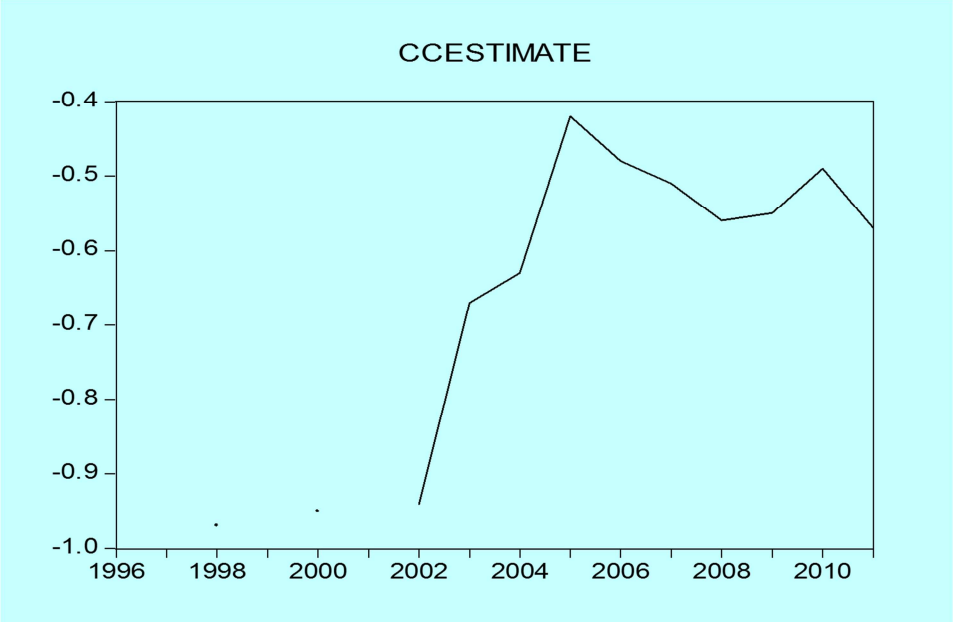

Fig. 4. Control of Corruption Indicator (CC) Esitimate in Algeria, 1996-2011.

Source: World Bank Governance Indicators, the data are available online at: http://info.worldbank.org/governance/wgi/index.asp (accessed 26/07/2014).

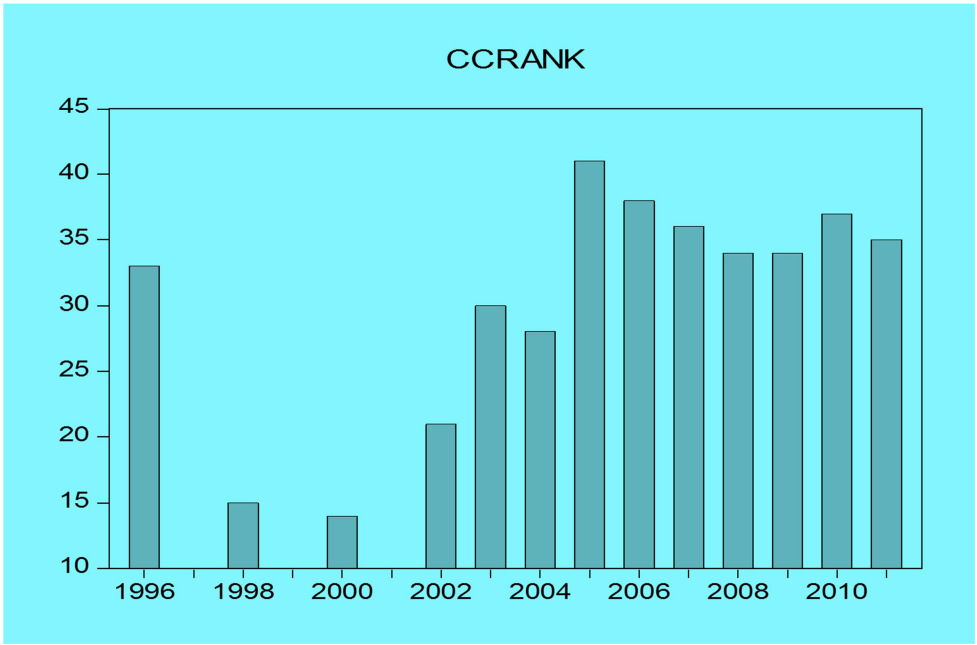

Fig. 5. Control of Corruption Indicator (CC) Rank in Algeria, 1996-2011.

Source: World Bank Governance Indicators, the data are available online at: http://info.worldbank.org/governance/wgi/index.asp (accessed 26/07/2014).

According to the World Bank's Control of Corruption Indicator (2011) Algeria was scored -0.57 on a scale from -2.5 to +2.5 with a rank of 35 on a range from 0 to 100 and the lowest rank means that the country has a high level of corruption. As well as, this indicator shows that corruption in Algeria still occupies the negative field, indicating that the targeted efforts to curb this scourge can't redirect corruption in Algeria towards the positive values.

3.3 HERITAGE FOUNDATION'S FREEDOM FROM CORRUPTION INDEX (FFC)

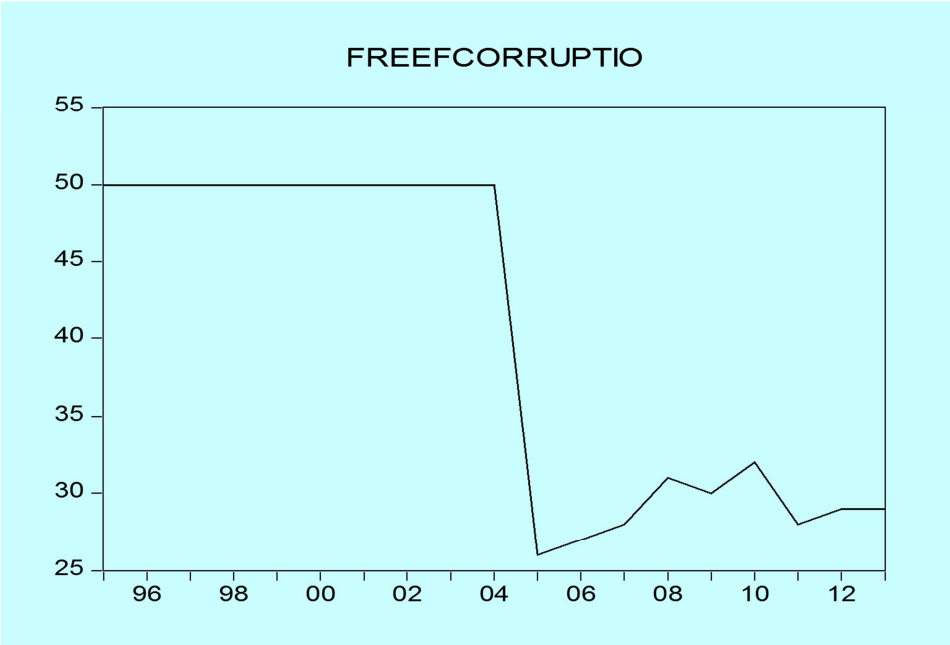

Fig. 6. Freedom from Corruption Index (FFC) Score in Algeria, 1995-2013.

Source: Heritage Foundation's Index of Economic Freedom, the data are available online at:

http://www.heritage.org/index/explore?view=by-region-country-year (accessed 26/07/2014).

According to the Heritage Foundation's 2013 Index of Economic Freedom, Algeria was ranked the 145th freest country with a score of 49.6 and this score was 1.4 points lower than in 2012. Freedom from corruption index appeared as one of the reasons for this deterioration with a score of 29 in 2012 and 2013, and the figure above shows that corruption has spread in recent years, especially with high oil and gas revenues and increased government spending. The results of studies conducted by this foundation showed from the citizen's point of view that the pervasive corruption is considered as a big problem that threatens the economy, and it is worthwhile to note that the Algerian government has expanded its efforts in order to root out corruption.

In the Global Competitiveness Report 2012–2013, Algeria was ranked 110 out of 144 countries with a score of 3.7 on a scale of 1-7. The "irregular payments and bribes" is one of the factors that weakened this result with a score of 2.6 (a higher score means less corruption) (Klaus Schwab, 2012) [40].

These ratings were low compared with many other countries, especially that the Algerian government has recently witnessed big scandals in different public sectors.

In 2005, the ministry of justice dismissed 8 judges on charges of corruption and abuse of authority (USA International Business, 2012) [41].

At the end of 2010, seven officials of the Ministry of Public Works were involved in cases of corruption and bribes for providing illegal facilities and services to foreign companies, notably the Chinese company charged with realizing the east - west highway project (Carol Midgalovitz, 2010; Yahia H. Zoubir and Louisa Dris-Aït-Hamadouche, 2013) ([42], [43]), some parts of this road are still under way, while others are repaired. Moreover, the recent bad weather revealed the fragility of materials and the poor quality of work done. In addition to the unsafe working conditions, a number of Algerian workers have been employed unlike what has been agreed.

A major corruption scandal has swept Sonatrach and the former chief executive officer, Mohamed Meziane was sentenced to two years in prison in May 2011 (Freedom House, 2012) [44].

In 2012, the Public Telecommunications Company had a share in the corruption as well; both Mohamed Boukhari and Chami Madjdoub were accused of suspicious transactions and money laundering. The investigation also revealed that they received bribes from two Chinese companies (Freedom House, 2013) [45].

In 2013, the current CEO of the National Gas and Electricity Company Sonelgaz, Noureddine Bouterfa, his predecessor and several executives were charged and placed under judicial supervision, as part of an investigation about the "additional costs" related to the construction of two power plants by the French group Alstom and U.S. General Electric (Les Afriques, 2013) [46].

The causes of this scourge are varied for example: William C. Byrd (2003) [47] pointed out that there is a widespread corruption in Algeria, as well as the cumbersome regulations and slow administrative procedures have contributed to the expansion of the informal sector.

According to Lahouari Addi: “The rise of oil prices drives the billionaires to achieve their desires through bribing state employees, law officers and many others”, (Rodriguez, Diana and Ehrichs, Linda, 2007) [48].

Lahcen Achy (2011) [49] indicated that this phenomenon has become increasingly rampant in the Algerian economy that is characterized by a high level of public spending and modest non-oil growth, and this is the result of inadequate institutional quality; thus, the government must embark on important reforms in the judicial and administrative system to enhance transparency and release many transactions from the state intervention.

In fact, many prominent measures have been taken by the Algerian government in order to fight against corruption such as: the implementation of the anti money laundering legislation especially that the informal financial system had the lion's share in this scourge. In 2006, the government has ratified the anti corruption bill and created a national commission for the prevention and fight against corruption in August 2010 (USA International Business, 2011) [50], and this is important step forward in promoting transparency in government and public procurement and strengthening the existing penal sanctions (Doing Business in Algeria, 2011) [51].

The President of the Algerian Association to Fight against Corruption, Djilali Hadjadj, confirmed that the solution to corruption is to ratify international treaties against corruption and the most important is to find ways to make them more effective (Stephen J. King, 2009) [52].

In general, corruption is a serious threat to the Algerian economy, it can even make matters worse by damaging the country's image abroad, and it is worthwhile to note that this poison has emanated from the dominant public sector where actors commit irregularities (Freedom House, 2011) [53].

The opinions of international organizations, economists and politicians have shown that any weaknesses in the control of corruption or even the lack of freedom from corruption will severely impede Algeria's economic growth prospects, and this must be confirmed by conducting an empirical study in the next sections.

4 DATA AND ECONOMETRIC MODEL

This study examines the impact of corruption on economic growth in Algeria over the period (1995-2011) using the following variables:

GDP: the annual percentage growth rate of GDP per capita is used as a proxy for economic growth, from the World Bank’s World Development Indicators (WDI).

FFC: Freedom from Corruption introduced by the Heritage Foundation.

CC: Control of Corruption from the World Governance Indicators database.

HC: Human Capital proxied by secondary school enrolment which is obtained from WDI database.

Transparency International's Corruption Perceptions Index is not included in this study because of missing data.

Johansen cointegration test wihch is based on both trace and maximum eigenvalue statistics has been employed in order to investigate the existence of long-run relationships among the variables included in the model, then we apply the Vector Error-Correction Model (VECM) to test the long-run and short- run dynamic relationships among the various time series,

besides using both impluse response functions and variance decomposition that facilitate the VAR model interpretation, through employing Eviews 8.0 software package.

5 ANALYSIS OF EMPIRICAL RESULTS

5.1 PHILLIPS PERRON UNIT ROOT TEST

According to the table bellow, the Phillips Perron value is greater than the critical t-value at 5% level of significance for the following variables: GDP, FFC, CC and HC. Thus, null hypothesis of a unit root cannot be rejected and these variables are not stationary at their levels. Then again, after first differencing the previously mentioned variables, the null hypothesis of a unit root in the PP test can be rejected at the 5% level, so these variables are integrated of the order one I(1). Hence, we can now proceed with the Johansen cointegration test.

Table 1. Unit Root Test Results

	Level			**First Difference**		
	Trend & Intercept	**Intercept**	**None**	**Trend & Intercept**	**Intercept**	**None**
GDP	-2.834644 (-3.733200)	-2.904053 (-3.065585)	-1.477177 (-1.964418)	-6.341016* (-3.759743)	-6.042986* (-3.081002)	-6.283741* (-1.966270)
FFC	-2.219441 (-3.733200)	-0.919555 (-3.065585)	-1.147916 (-1.964418)	-3.850062* (-3.759743)	-3.994064* (-3.081002)	-3.903816* (-1.966270)
CC	-2.264972 (-3.733200)	-1.650359 (-3.065585)	-0.311759 (-1.964418)	-4.786945* (-3.759743)	-4.102923* (-3.081002)	-3.889907* (-1.966270)
HC	-1.863533 (-3.733200)	1.227385 (-3.065585)	3.805719 (-1.964418)	-4.569406* (-3.759743)	-3.670717* (-3.081002)	-2.706724* (-1.966270)

**indicates statistically significant at 5% level of significance.*
(Test critical values at 5% level of significance).

5.2 TRACE AND MAX EIGEN VALUE TESTS

According to the trace test, the null hypothesis which indicates 1 cointegrating equation cannot be rejected because the Trace value is less than the critical value at 5% level of significance. Thus, there is one long-run relationship between GDP, FFC, CC, and HC. But this hypothesis cannot be accepted by the Max Eigen Value test because the value of this statistic is greater than the critical value at 5% level of significance, while the next null hypothesis which indicates 2 cointegrating equations cannot be rejected. Hence, the Max Eigen Value test confirms the existence of two cointegrating eqn(s) between the following variables: GDP, FFC, CC and HC (see Appendix A, Table A.1).

Despite these conflicting results, we rely on the trace test results because G. S. Maddala and In-Moo Kim (1999) have confirmed that the trace test is found to be more robust to skewness, excess kurtosis and nonnormality than the Maximum Eigen value test.

5.3 COINTEGRATING EQUATION

GDP= 1.059194 FFC + 25.73915 CC + 0.615047 HC (see Appendix A, Table A.2)

According to the cointegrating equation, there is a positive long-run relationship between economic growth and freedom from corruption. Likewise, control of corruption exerts a positive long run impact on economic growth. As well as, the human capital displays a positive influence on economic growth in the long term.

5.4 VECTOR ERROR CORRECTION MODEL

Using VAR lag order selection criteria, it is found that one (1) lag is the suitable lag length for the vector error correction model (VECM) (see Appendix B, Table B.1).

The table in (see Appendix B, Table B.2) does not show the probability value of all coefficients, thence, the VECM equation (where GDP is a dependent variable) has been estimated using the least squares method in order to obtain the probability value of each coefficient (see Appendix B, Table B.3).

5.4.1 THE LONG RUN CAUSALITY

The error correction term C(1) carries the expected negative sign, emphasizing the existence of a long run cointegrating relationship among economic growth, freedom from corruption, control of corruption and human capital (see Appendix B, Table B.3).

5.4.2 THE SHORT RUN CAUSALITY

The coefficients of freedom from corruption, human capital C (3), C (5) respectively appear with positive signs and insignificant values at 5 % level of significance in the short term. In contrast, control of corruption C (4) exhibits a negative but statistically insignificant effect on economic growth (see Appendix B, Table B.3).

- ***The shortrun causality of freedom from corruption***

The p-value of the Wald test chi- square statistic (0.5520) is greater than 0.05.Thus, the null hypothesis (which indicates that FFC doesn't cause GDP in the short term) has been accepted (see Appendix B, Table B.4).

- ***The shortrun causality of control of corruption***

The Wald test chi- square statistic is statistically insignificant at the 5% significance level. Hence, the alternative hypothesis has been rejected and CC doesn't cause GDP in the short term (see Appendix B, Table B.5).

- ***The shortrun causality human capital***

The p-value of the Wald test chi- square statistic (0.5158) is greater than 0.05.Thus, the null hypothesis (which indicates that HC doesn't cause GDP in the short term) has been accepted (see Appendix B, Table B.6).

5.5 DIAGNOSTIC TESTS OF VECTOR ERROR CORRECTION MODEL (VECM)

5.5.1 HETEROSKEDASTICITY TEST: BREUSCH-PAGAN-GODFREY

Prob (CHi^2) = 0.4701 that accompanies the amount (Obs*R^2) is greater than 0.05. Thus, the null hypothesis (which refers that there is homoskedasticity) can be accepted (see Appendix C, Table C.1).

5.5.2 HETEROSKEDASTICITY TEST: ARCH

ARCH test asserts the absence of ARCH effect because Prob (CHi^2) = 0.2578 is greater than 0.05 (see Appendix C, Table C.2).

5.5.3 BREUSCH-GODFREY SERIAL CORRELATION LM TEST

The null hypothesis of no serial correlation can be accepted, because the Prob (CHi^2) = 0.3606 is greater than 0.05 (see Appendix C, Table C.3).

5.5.4 JARQUE BERA NORMALITY TEST

Prob (Jarque Bera) = 0.9562 is greater than 0.05. Hence, the null hypothesis which indicates that the residuals are normally distributed has been accepted (see Appendix C, Fig C-4).

All these diagnostic tests confirm that the VECM is well specified.

5.6 IMPLUSE RESPONSE FUNCTION OF GDP, FFC, CC, HC RELATION (SEE APPENDIX D, TABLE D.1, FIG D-1)

5.6.1 THE RESPONSE OF GDP TO ONE STANDARD DEVIATION GDP SHOCK

By giving one standard deviation GDP shock, GDP decreases to 0.81 units in the second period but it rises to 1.04 units in the third year, and it falls again to its lowest value of 0.66 units in the fourth year, then it keeps fluctuating up and down in the positive field.

5.6.2 THE RESPONSE OF GDP TO ONE STANDARD DEVIATION FFC SHOCK

GDP rises to 1.05 units in the second year as a result of giving one standard deviation FFC shock, then it decreases to 0.82 units in the next third year, but it increases slightly again to 1.07 units in the next fourth period, after that it sees a smooth fluctuation in the positive area.

5.6.3 THE RESPONSE OF GDP TO ONE STANDARD DEVIATION CC SHOCK

A positive CC shock has an immediate negative impact on GDP which reaches its lowest value of -0.60 units in the second year, and then it continues fluctuating in the negative field.

5.6.4 THE RESPONSE OF GDP TO ONE STANDARD DEVIATION HC SHOCK

A positive HC shock causes a rise of 0.33 units in GDP in the second year, then GDP goes down to its lowest value of 0.01 units in the next fifth year and it continues fluctuating around the line zero.

5.6.5 VARIANCE DECOMPOSITION OF GDP, FFC, CC, HC RELATION (SEE APPENDIX E, TABLE E.1, FIG E-1)

The forecast error variance in GDP reaches 1.73 units in the first period, then it rises to 4.56 units in the tenth period and this is due to the interaction between the following independent variables FFC, CC, HC.

In the short term (the second year), 69.62 % of the forecast error variance of GDP is explained by its own innovations, followed by FFC (21.13 %), CC (7.06 %) and HC (2.18 %).

In the medium term (the fifth period), 53.57 % of the variability in GDP is explained by its own shocks, while 35.38% is due to FFC's shocks, 9.98% of CC's shocks and 1.14% to HC's shocks.

In the long term (the tenth period) GDP's innovations explain 47.49 % of its forecast error variance while FFC'innovations, CC'innovations and HC'innovations explain 40.76 %, 10.72%, 1.01 % respectively.

These results indicate that freedom from corruption explains the largest proportion of the forecast error variance of GDP, while control of corruption is the second key determinant of GDP, whereas human capital plays a minor role in interpreting the forecast error variance of GDP.

6 CONCLUSION

This study has examined the effect of corruption on economic growth in Algeria over the period 1995-2011 using Johansen cointegration test and vector error correction model (VECM). The main results indicate that both 'freedom from corruption' and 'control of corruption' have positive long-run effects on economic growth in Algeria. It is also revealed that the human capital has an insignificant positive impact on economic growth in the long term. Moreover, the VECM confirmed the existence of a long-run relationship between economic growth, freedom from corruption, control of corruption and human capital. Furthermore, it indicated that both 'freedom from corruption' and 'human capital' have an insignificant positive impact on economic growth in the short term. These empirical results proved the validity of the previously mentioned assumptions, and support the view that corruption sands the wheels of economic growth.

Thus, the Algerian government must root out this scourge by finding the most relevant solutions to the country's political and economic situation. It is also recommended that enhancing transparency and implementing tougher accountability standards will definitely fight corruption. Indeed, there is a need to change the structure of the economy in order to reduce the heavy dependence on oil manna. In other words, greater economic diversification in Algeria is a priority

for expanding the productive sectors. Additionally, more attention should be paid to strengthening institutional quality that plays an intrinsic role in boosting Algeria's long term growth prospects.

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APPENDIX A. TRACE AND MAX EIGEN VALUE TESTS, AND COINTEGRATING EQUATION

Table A.1 Trace and Max Eigen Value Tests

Sample (adjusted): 1997 2011
Included observations: 15 after adjustments
Trend assumption: Linear deterministic trend
Series: GDP FFC CC HC
Lags interval (in first differences): 1 to 1
Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.880139	61.34020	47.85613	0.0017
At most 1	0.775698	29.51881	29.79707	0.0538
At most 2	0.376056	7.097404	15.49471	0.5663
At most 3	0.001464	0.021976	3.841466	0.8821

Trace test indicates 1 cointegrating eqn(s) 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 *	0.880139	31.82139	27.58434	0.0134
At most 1 *	0.775698	22.42141	21.13162	0.0328
At most 2	0.376056	7.075428	14.26460	0.4803
At most 3	0.001464	0.021976	3.841466	0.8821

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table A.2 Cointegrating Equation

1 Cointegrating Equation(s): Log likelihood -86.14131

Normalized cointegrating coefficients (standard error in parentheses)

GDP	FFC	CC	HC
1.000000	-1.059194	-25.73915	-0.615047
	(0.12137)	(4.88365)	(0.11825)

Adjustment coefficients (standard error in parentheses)

D(GDP)	-0.018020
	(0.09146)
D(FFC)	0.725347
	(0.31891)
D(CC)	0.003743
	(0.00816)
D(HC)	0.259715
	(0.29442)

APPENDIX B. VECTOR ERROR CORRECTION MODEL (VECM)

Table A.1 VAR Lag Order Selection Criteria

VAR Lag Order Selection Criteria
Endogenous variables: GDP FFC CC HC
Exogenous variables: C
Sample: 1995 2011
Included observations: 16

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-135.5601	NA	443.2577	17.44501	17.63815	17.45490
1	-100.4459	48.28201*	44.28889*	15.05573*	16.02147*	15.10519*

* 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

Table A.2 Vector Error Correction Model (VECM)

Vector Error Correction Estimates
Sample (adjusted): 1997 2011
Included observations: 15 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1			
GDP(-1)	1.000000			
FFC(-1)	-1.059194			
	(0.12137)			
	[-8.72703]			
CC(-1)	-25.73915			
	(4.88365)			
	[-5.27047]			
HC(-1)	-0.615047			
	(0.11825)			
	[-5.20108]			
C	70.14107			
Error Correction:	D(GDP)	D(FFC)	D(CC)	D(HC)
CointEq1	-0.018020	0.725347	0.003743	0.259715
	(0.09146)	(0.31891)	(0.00816)	(0.29442)
	[-0.19704]	[2.27442]	[0.45885]	[0.88212]
D(GDP(-1))	-0.259529	0.500141	0.007091	1.135666
	(0.25701)	(0.89622)	(0.02292)	(0.82739)
	[-1.00979]	[0.55806]	[0.30935]	[1.37260]
D(FFC(-1))	0.054828	0.139607	0.005620	0.235388
	(0.09218)	(0.32144)	(0.00822)	(0.29675)
	[0.59479]	[0.43432]	[0.68356]	[0.79322]
D(CC(-1))	-6.805341	5.551020	0.320459	3.238545
	(4.50922)	(15.7239)	(0.40218)	(14.5163)
	[-1.50921]	[0.35303]	[0.79680]	[0.22310]
D(HC(-1))	0.063393	0.284288	0.008968	0.274282
	(0.09755)	(0.34018)	(0.00870)	(0.31405)
	[0.64982]	[0.83571]	[1.03067]	[0.87337]
C	-0.191409	-2.022676	-0.021901	2.351610
	(0.51949)	(1.81149)	(0.04633)	(1.67236)
	[-0.36846]	[-1.11658]	[-0.47267]	[1.40616]
R-squared	0.485437	0.431025	0.196619	0.298260
Adj. R-squared	0.199568	0.114928	-0.249703	-0.091595
Sum sq. resids	26.93988	327.5778	0.214310	279.1916
S.E. equation	1.730121	6.033037	0.154312	5.569676
F-statistic	1.698111	1.363585	0.440532	0.765053
Log likelihood	-25.67576	-44.41164	10.57879	-43.21294
Akaike AIC	4.223434	6.721552	-0.610506	6.561725
Schwarz SC	4.506654	7.004772	-0.327286	6.844945
Mean dependent	-0.084503	-1.466667	-0.006000	2.768920
S.D. dependent	1.933812	6.412785	0.138037	5.330882
Determinant resid covariance (dof adj.)		8.822469		
Determinant resid covariance		1.143392		
Log likelihood		-86.14131		
Akaike information criterion		15.21884		
Schwarz criterion		16.54053		

Table A.3 Vector Error Correction Model (VECM) using Least Squares Method

Dependent Variable: D(GDP)
Method: Least Squares
Sample (adjusted): 1997 2011
Included observations: 15 after adjustments
D(GDP) = C(1)*(GDP(-1) - 1.0591937245*FFC(-1) - 25.7391508956*CC(-1) - 0.615046648918*HC(-1) + 70.1410712809) + C(2)*D(GDP(-1)) + C(3)*D(FFC(-1)) + C(4)*D(CC(-1)) + C(5)*D(HC(-1)) + C(6)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.018020	0.091457	-0.197036	0.8482
C(2)	-0.259529	0.257013	-1.009792	0.3390
C(3)	0.054828	0.092181	0.594788	0.5666
C(4)	-6.805341	4.509219	-1.509206	0.1655
C(5)	0.063393	0.097554	0.649823	0.5320
C(6)	-0.191409	0.519489	-0.368456	0.7211

R-squared	0.485437	Mean dependent var	-0.084503
Adjusted R-squared	0.199568	S.D. dependent var	1.933812
S.E. of regression	1.730121	Akaike info criterion	4.223434
Sum squared resid	26.93988	Schwarz criterion	4.506654
Log likelihood	-25.67576	Hannan-Quinn criter.	4.220418
F-statistic	1.698111	Durbin-Watson stat	1.468746
Prob(F-statistic)	0.230779		

Table A.4 The Shortrun Causality of freedom from corruption

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	0.353773	(1, 9)	0.5666
Chi-square	0.353773	1	0.5520

Table A.5 The Shortrun Causality of control of corruption

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	2.277703	(1, 9)	0.1655
Chi-square	2.277703	1	0.1312

Table A.6 The Shortrun Ccausality of human capital

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	0.422270	(1, 9)	0.5320
Chi-square	0.422270	1	0.5158

APPENDIX C. DIAGNOSTIC TESTS OF VECTOR ERROR CORRECTION MODEL (VECM)

Table C.1 Breusch-Pagan-Godfrey Test

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.777079	Prob. F(8,6)	0.6395
Obs*R-squared	7.632995	Prob. Chi-Square(8)	0.4701
Scaled explained SS	2.382501	Prob. Chi-Square(8)	0.9670

Table C.2 ARCH Test

Heteroskedasticity Test: ARCH

F-statistic	1.208253	Prob. F(1,12)	0.2932
Obs*R-squared	1.280680	Prob. Chi-Square(1)	0.2578

Table C.3 Breusch-Godfrey Serial Correlation LM Test

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.472056	Prob. F(1,8)	0.5115
Obs*R-squared	0.835788	Prob. Chi-Square(1)	0.3606

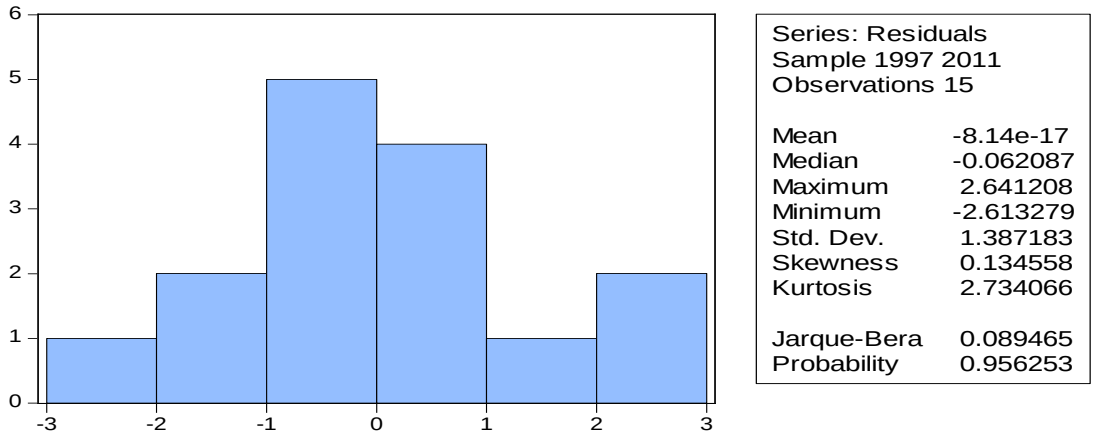

Fig C-4. Jarque Bera Normality Test

APPENDIX D. IMPLUSE RESPONSE FUNCTION

Table D.1 Impluse Response Function of GDP, FFC, CC, HC Relation

Response of GDP: Period	GDP	FFC	CC	HC
1	1.730121	0.000000	0.000000	0.000000
2	0.817629	1.054327	-0.609496	0.338754
3	1.044658	0.829133	-0.483240	0.087270
4	0.669062	1.072767	-0.538320	0.052110
5	0.809168	0.957587	-0.432050	0.019148
6	0.860408	0.972715	-0.446471	0.113323
7	0.968139	0.928737	-0.461558	0.161241
8	0.935630	0.954538	-0.499631	0.162145
9	0.881496	0.967919	-0.501343	0.117596
10	0.837617	0.980350	-0.486918	0.088611

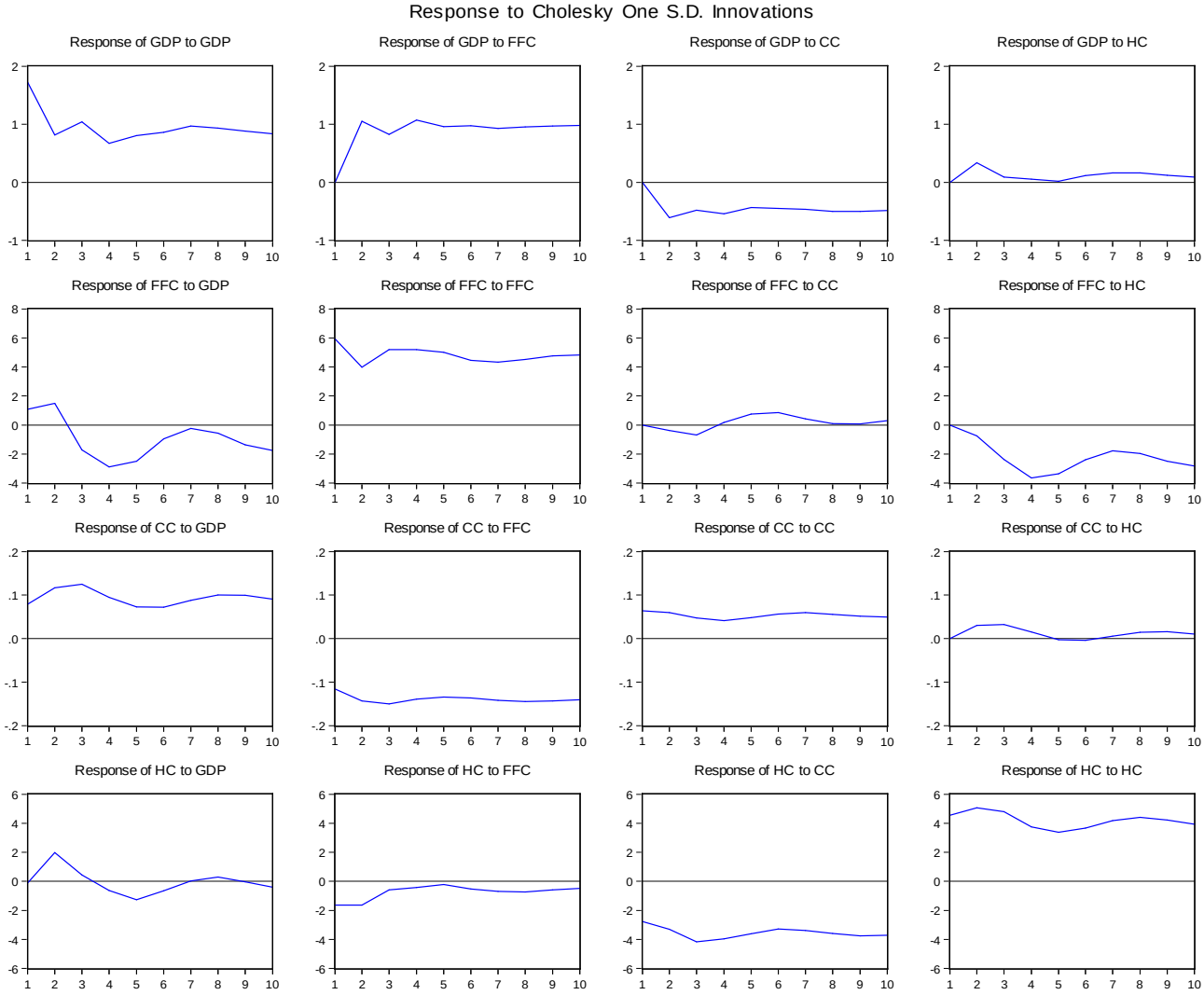

Fig D-2. Impluse Response Function of GDP, FFC, CC, HC Relation

APPENDIX E. VARIANCE DECOMPOSITION

Table E.1 Variance Decomposition of GDP, FFC, CC, HC Relation

Variance Decomposition of GDP: Period	S.E.	GDP	FFC	CC	HC
1	1.730121	100.0000	0.000000	0.000000	0.000000
2	2.293399	69.62090	21.13445	7.062883	2.181769
3	2.698071	65.29418	24.71383	8.310984	1.681004
4	3.028294	56.71178	32.16699	9.757238	1.363990
5	3.305953	53.57644	35.38067	9.895037	1.147850
6	3.581617	51.41765	37.51988	9.984403	1.078068
7	3.855757	50.67068	38.17615	10.04808	1.105095
8	4.114527	49.66849	38.90726	10.29849	1.125762
9	4.348380	48.57934	39.78974	10.54986	1.081069
10	4.562459	47.49790	40.76036	10.72202	1.019717

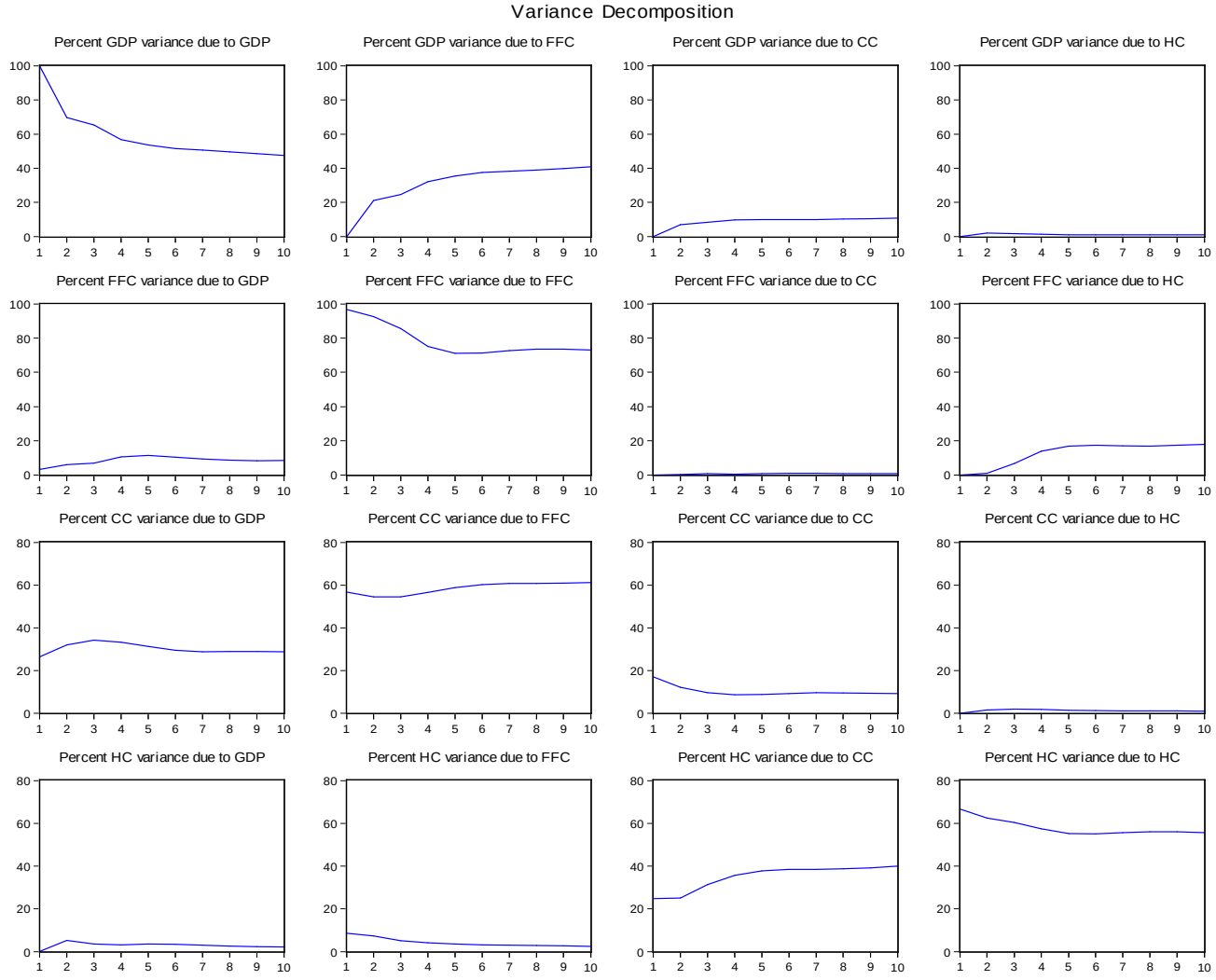

Fig E-2. Variance Decomposition of GDP, FFC, CC, HC Relation