INSTITUTO
UNIVERSITÁRIO
DE LISBOA

Democracy and Income: A comparison using a VAR models on a range of countries

Cláudia Pereira Eusébio

Dissertation submitted as partial requirement for the conferral of Master in Economics

Supervisor: PhD Luís Filipe Farias de Sousa Martins, Associate Professor, Iscte - Iul

October 2021

BUSINESS
SCHOOL

Department of Economics

Democracy and Income: A comparison using a VAR models on a range of countries

Cláudia Pereira Eusébio

Dissertation submitted as partial requirement for the conferral of Master in Economics

Supervisor: PhD Luís Filipe Farias de Sousa Martins, Associate Professor, Iscte - Iul

October 2021

Acknowledgments

Firstly, I would like to thank all those who helped me during my academic journey. I would like to extend my deepest gratitude to my mentor, Professor Luís Martins. Also, I would like to thank to my family for the support, patience, and comprehension that I have needed throughout my academic life.

Finally, it is my friends. It is your belief and support that made me persist in completing this process, as well as my colleagues in the company where I was intern, that have encouraged and supported me to conclude this project and accomplish my goals.

Thank you very much to all!

Resumo

Uma das evidências empíricas mais notáveis na economia política é a relação entre rendimento per capita e democracia. Por isso, o principal objetivo desta dissertação é perceber qual a real influência e impacto da democracia no nível de rendimento da população e de como esta terá ou não influenciado o estilo de vida das populações, em diferentes países. A amostra usada neste estudo corresponde a um total de 7 países com diferentes caraterísticas, quer a nível do regime eleitoral como de crescimento.

Ao longo dos diferentes estudos, também foi evidenciado que algumas variáveis comumente conhecidas, como taxas de poupança, abertura comercial, entre outras, foram influenciadas pelo regime político de cada país. Toda a análise foi feita baseada em métodos econométricos, incluindo o modelo multivariado autorregressivo, com a ajuda do programa STATA.

Para além de testar somente a influência das duas variáveis principais, este estudo pretende também evidenciar se existe impacto de variáveis que sejam referentes as características socioculturais dos países.

Um dos resultados importantes desta análise é a influência ser unidirecional, ou seja, a variável PIB real, em nenhum país, influencia a democracia, embora alguns artigos na literatura mostrem esse impacto. Por outro lado, países como Portugal e Tunísia, têm mais variáveis que o nível democrático se torna implicativo, seja no nível de escolaridade da população ou as interações com o comércio internacional.

Palavras-chave: Democracia, Produto Interno Bruto Real, Modelo Vetor Autorregressivo

Códigos de classificação: Modelos de série temporal (C32); Geral (E20)

Abstract

One of the most notable empirical evidence in political economy is the relationship between per capita income and democracy. Therefore, the main objective of this dissertation is to understand the real influence and impact of democracy on the income level the population and how it will or will not influence the lifestyle of populations in different countries. The final sample corresponds to a total of 7 countries with different characteristics, either in terms of electoral regime or economic growth.

Throughout the different existing studies, it was also found that some commonly known variables, such as savings rates, trade opening, among others, were influenced by the political region of each country. All analysis were performed based on econometric methods, including the multivariate autoregressive model, with the help of the STATA program.

In addition to testing only the influence of the two main variables, this study also aims to show whether there is an impact of variables that refer to the sociocultural characteristics of the countries.

One of the important results of this analysis is that the influence is unidirectional, that is, the real GDP variable, in no country, influences democracy, although some articles in the literature show this impact. On the other hand, countries like Portugal and Tunisia have more variables that the democratic level becomes implicative, whether in terms of the population's education level or interactions with international trade.

Key Word: Democracy, Real Gross Domestic Product, VAR Model (Vector Auto Regressive Model)

JEL Classifications: Time-Series Models (C32); General (E20)

Table of Contents

Acknowledgments 5

Resumo i

Abstract iii

1.Introduction 1

1.1.Relevance of the Research 1

1.2.Attributed Credibility and Political Bias 2

1.3.Aim and Objectives of Study 3

2.Literature Review 4

3.Methodology 7

3.1.The variables of the model 7

3.2.Procedure 8

4.Results 11

4.1.Framework 11

4.2.Main Findings 11

Case of Portugal 11

Case of USA 15

Case of China 19

Case of Tunisia 23

Case of South Africa 26

Case of Venezuela 30

Case of Argentina 33

4.3.Endogenous variables 37

4.4.All variables in model 37

Case of Portugal 37

Case of USA 38

Case of China 39

Case of Tunisia 40

Case of Venezuela 42

Case of Argentina 42

5.Discussion 43

5.1.Limitations 43

5.2.Future Studies 43

6.Conclusion 45

References 47

Appendix 49

Table of Figures

Figure 1 - The Impulse-Response Function for the case of Portugal *13*
Figure 2 - The ex ante and values for the last two years for Portugal *14*
Figure 3 - The ex post forecast for the future years for Portugal *14*
Figure 4 - Variance Decomposition for the case of Portugal *15*
Figure 5 - The Impulse-Response Function for the case of USA *17*
Figure 6 - The ex ante values for the last two years for USA *18*
Figure 7 - The ex post forecast for the future years for USA *18*
Figure 8 - Variance Decomposition for the case of USA *19*
Figure 9 - The Impulse-Response Function for the case of China *21*
Figure 10 - The ex ante values for the last two years for China *21*
Figure 11 - The ex post forecast for the future years for China *22*
Figure 12 - Variance Decomposition for the case of China *22*
Figure 13 - The Impulse-Response Function for the case of Tunisia *24*
Figure 14 - The ex ante values for the last two years for Tunisia *25*
Figure 15 - The ex post forecast for the future years for Tunisia *25*
Figure 16 - Variance Decomposition for the case of Tunisia *26*
Figure 17 - The Impulse-Response Function for the case of South Africa *28*
Figure 18 - The ex ante values for the last two years for South Africa *28*
Figure 19 - The ex post forecast for the future years for South Africa *29*
Figure 20 - Variance Decomposition for the case of South Africa *29*
Figure 21 - The Impulse-Response Function for the case of Venezuela *31*
Figure 22 - The ex ante values for the last two years for Venezuela *32*
Figure 23 - The ex post forecast for the future years for Venezuela *32*
Figure 24 - Variance Decomposition for the case of Venezuela *33*
Figure 25 - The Impulse-Response Function for the case of Argentina *35*
Figure 26 - The ex ante values for the last two years for Argentina *35*
Figure 27 - The ex post forecast for the future years for Argentina *36*
Figure 28 - Variance Decomposition for the case of Argentina *36*

Table of Appendix

1. Results of Dickey–Fuller test for Stationary 49

Annex A - Case of Portugal *49*

Annex B - Case of USA *5*1

Annex C - Case of China *5*3

Annex D - Case of Tunisia *5*5

Annex E - Case of South Africa *5*7

Annex F - Case of Venezuela *5*9

Annex G - Case of Argentina *6*1

2. Results of Dickey–Fuller test for Cointegration 63

Annex H - Case of South Africa *6*3

1. Introduction

1.1. Relevance of the Research

The association between democracy and per capita income is not always positive in the post-colonial era either. In most of the Asian and European countries, democracy came together with economic growth after World War II. The same was true for South Korea until the 1980s, but worldwide democracy declined in the 1980s as economic growth declined. Despite the heterogeneity of the relationship between democracy and income per capita, the question of whether democracy is a good thing has been hotly debated. It is not an easy question to answer, but some basic facts are agreed upon:

Democracy promotes economic growth because it provides incentives for firms to expand. Democracy creates favorable conditions for the exchange of goods and services. Firms in democracies are more productive and have higher quality products.

The recognition of these facts has precipitated interest in the question of whether democracy promotes economic growth. The general view is that at the margin, democracy promotes economic growth by providing incentives for firms to expand by creating more favorable conditions for the exchange of goods and services. The debate is about whether this is the whole story.

Different scholars have different views on the importance of the incentives to expand provided by democracy. Przeworski and Limongi (1993), for example, argues that democracies provide the same incentives for firms to expand as dictatorships do. This paper argues that an entirely different mechanism is at work. In the next section, I review the debate on the incentive's argument. I then look at the effects of democracy on firms. I conclude that the incentives argument is not the whole story. Democratic states provide incentives for firms to expand as well, but in a different way.

The incentives argument for the relationship between growth and democracy has been constantly challenged. The challenge is about the nature of the incentives to grow that democracies provide. Firms in democracies have an incentive to expand because of incentives to expand in the democratic state. This argument is based on the premise that economic growth in democratic states is not only based on the incentives provided by the state. Instead, economic growth in democracies is also based on the incentives provided by the private sector. Because of the capitalist property rights regime, firms have an incentive to expand when the state allows them to do so. This argument is not new. It has been made, for example, by the economists John Stuart Mill and Karl Marx. More recently, it has been re-emphasized by economists such as Paul Krugman, Larry Summers, Adam Przeworski, and Fernando Limongi.

According to the incentive's argument, democracies provide incentives for firms to expand in two different ways. First, democracies provide incentives for firms to expand by providing competition for firms. Instead of limiting competition through state intervention, democracies allow competition. Second, democracies provide incentives for firms to expand by providing freedom of trade. Firms can move to new markets where they can sell their goods and services at a higher price. This is not true in dictatorships, where firms are prevented from moving to new markets, because of national borders that are immovable. In addition to the incentives provided by the democratic state, firms can expand because of the incentives provided by the market. The state does not provide incentives for firms to expand, but the market does. The state does not provide incentives for firms to expand, but the market does. Both types of incentives work together to create positive incentives for firms to expand in the democratic state.

1.2. Attributed Credibility and Political Bias

In some cases, it is assumed that the growth of democracies is based on the incentives provided by the democratic state. When firms are prevented from moving to new markets, they can expand only because of the incentives provided by the state. The incentives argument is that it is not the incentive provided by the market that works to create positive incentives for firms to expand in democracies. Rather, the incentives provided by the democratic state work to create positive incentives for firms to expand.

This claim is not new. It assumes that the state is the main agent that creates economic growth. On the other hand, sometimes the main generator of economic growth is the market. The democratic state creates only incentives for firms to expand. This paper also argues that the incentives provided by the state and the incentives provided by the market work together to create positive incentives for firms to expand.

Two problems exist with the incentive's argument. The first problem is that the incentives provided by the democratic state and the incentives provided by the market work in different ways. When firms are prevented from moving to new markets, they can expand only because of the incentives provided by the state. The effect is like the effect that agents have on a capitalist system. In the case of capitalism, a state does not only provide incentives for the private sector. Instead, it also works as a quasi-agent for the private sector by enforcing property rights. The state enforces the property rights of private owners by preventing firms from doing things that would be considered taking property without permission.

The incentives argument is not convincing for two reasons. The first reason is that the incentives provided by the democratic state do not work to create positive incentives for firms to expand in the

same way that incentives work in a capitalist system. The capitalist property rights make it hard for firms to expand. The incentives provided by the democratic state only constrain firms to expand if they violate the property rights of private owners. The incentives provided by the democratic state do not constrain firms to expand because of the incentives provided by the market. The incentives argument is also not convincing because it does not consider the different ways in which the incentives of the state and the market work. The incentives provided by the market and the incentives provided by the state work in different ways. The incentives provided by the democratic state work to create incentives for firms to expand but the incentives provided by the market work in a different way. The incentives provided by the democratic state work to create incentives for firms to expand because of the incentives provided by the market. Incentives provided by the democratic state work to create incentives for firms to expand.

1.3. Aim and Objectives of Study

The study aims to make a broad contribution to the ongoing debate on the democracy-income relationship, there has been a diversity of ways of studying this topic, even the same authors study the effects in different ways, if it is the role of democracy which influences the level of economic growth or whether the political regime of the countries is defined by the income of the population. Although the role of democracy in economic growth appears to be unchallenged in recent literature, over the past half century, the real role of democracy in understanding economic growth between countries has witnessed a paradigmatic shift. During the protectionist years, the relevance of democracy was called into question where underdeveloped empirical and static theoretical methods helped to support this view. Subsequently, the years under "free trade" - which meant high internationalization of world economies - foresaw a restoration of the role of democracy / democratization in economic growth. Moreover, this study makes use of a standard vector autoregressive model, without imposing any structural restrictions, so that the direction of the causality between the level of democracy in a country and its product can be empirically assessed. As a worldwide comparison, this study considers the cases of seven countries.

2. Literature Review

One of the first author, Lipset in “Some Social Requisites of Democracy: Economic Development and Political Legitimacy” 1959, emphasizes that democracy is related to the state of economic development, that is, the wealthier a nation is, the greater the chances of sustaining democracy. Economic growth influences four important variables involved in democracy. Partly originating, a democratic political culture due to increased education, the migration of the rural poor to cities and the growth of the middle class. For the lower class, economic development means increased income, greater economic security, and greater education, reducing the level of political extremism. Summarize individual countries must become more democratic if they are richer, not just because rich countries must be democratic. The dynamic dashboard strategy controls the country's fixed effects and the rich GDP dynamics, which otherwise confuse the effect of democracy. To reduce the measurement error, he has introduced a new democracy indicator that consolidates previous measures.

In the article “Income and Democracy” by Acemoglu, Johnson, Robinson and Yared in 2008, it was studied the effect that income would have on democracy, based on the central result in the political economy literature, that higher per capita income causes democracy. This modernization hypothesis was estimated for purely cross-country models and for panel estimates of fit models. They stated that the correlation between income and democracy is spurious, except in the very long term. The positive association between democracy and economic performance may be being defined because omitted elements, most likely historical, seem to have shaped the divergent paths of political and economic development of several societies. Therefore, the results raise considerable doubts about conventional wisdom, both in academic literature and in the popular press, that "per capita income is a determining factor of democracy and that a general increase in per capita income will bring improvements in institutions". However, some caution is needed with the conclusions. First, although the results obtained by the authors mentioned in this paragraph do not provide evidence of a causal effect of income on democracy, such an effect may be present, but working at much lower frequencies (e.g., over horizons of 100 years or more), or this causal effect may be conditioned to some other features (although we have found no evidence for this type of interaction effects using available cross-country data). Second, results do not imply that democracy has no effect on economic growth. Finally, while we have emphasized the importance of historical development paths, we do not want to suggest that there is an historical determinism in political or economic institutions; the fixed effects in the regressions and the presence of divergent development paths create a tendency, but many other factors influence equilibrium political institutions. The potential effects of democracy and political institutions on economic growth, the possible conditional relationship between income and

democracy, and the impact of various time-varying and human factors on the evolution of equilibrium political institutions appear to be important areas for future theoretical and empirical research.

In 2009, Thomas L. Friedman highlighted the characteristics of the two major economies in the world, comparing which could reap more fruits in the future. For Friedman, "there is only one thing worse than the autocracy of a party, and that is the democracy of a party, which is what we have in America today." However, if it is "led by a group of reasonably enlightened people, as China is today, it can also have great advantages. That party can simply impose the politically difficult, but extremely important, policies necessary to move a society forward in the 21st century. " For this reason, countries like China tend to realize that in an undo of exploding populations and growing middle classes in emerging markets, the demand for clean energy and energy efficiency will skyrocket, investing in the production of electric cars, solar energy, energy efficiency, batteries, nuclear power and wind power. However, Thomas did not consider that in the long run, capitalism and freedom work together and that they are not separable from each other, making it necessary to frame countries in their timelines. "The past 100 years of US economic performance are unparalleled in the history of mankind. The engine of the United States economy has driven huge improvements in the health, well-being and living standards of hundreds of millions of people. The freedoms political and economic policies guaranteed by our government system have made this prosperity, innovation and achievements possible."

This theme has already been studied by some authors and has been a major issue in the economy, whether democracy is beneficial for economic growth or not. Kejriwal and Zhao, in 2019, showed that "while democracy advocates argue that at least a quarter of political rights and civil liberties are needed to preserve citizens' motivation to work and invest, maintaining an effective allocation of resources in the market, opponents promote the view that democracies are vulnerable to popular demands at the expense of profitable investments and are unable to suppress ethnic, religious and class conflicts that are detrimental to growth." This article is based on the common dynamic effects approach. correlated (DCCE) advanced by Chudik and Pesaran (2015), the results indicate a positive and statistically significant efficiency of democracy in economic growth, with a point estimate between approximately 1.5-2% depending on the specification.

More recently, in 2019, Acemoglu elaborated a different perspective. Firstly, he shows that the estimation of the causal effect of democracy on GDP faces several challenges, namely, the existing democracy indexes are subject to considerable measurement errors, leading to spurious changes in democracy scores that do not correspond to real changes in democratic institutions. As well, democracies differ from non-democracies in unobserved characteristics, such as institutional, historical, and cultural aspects, which also have an impact on their GDP. The study was prepared using

annual panel data that includes 175 countries from 1960 to 2010, the index combines information from various data sets, including Freedom House and Polity IV, and considers a country democratic only when several sources classify it as such. The first approach to estimate the effects of democracy on GDP is to postulate a complete dynamic model for GDP: the study variable is the log of GDP per capita in country *c* over time and Dct is our dichotomous measure of democracy in country *c* over time t. In short, since GDP dynamics are controlled in a fixed-effect MQO regression, there is a positive effect of economic democracy and a statistically significant one on future per capita GDP. Preferred specifications) showed that democratizations increase GDP per capita by about 20% in the long run. The effects are similar at different levels of development and appear to be driven by increased investments in capital, education, and health. For this reason, regional aspects were presented: "a country is more likely to make the transition to democracy or undemocratic when the same transition has recently occurred in other countries in the same region. We explore this source of variation to identify the effect of democracy on GDP. " Finally, Acemoglu showed that there is some heterogeneity depending on the level of human capital, but these effects are not large enough to lead to negative effects of democracy in countries with low human capital. In this sense, the results show that "democracy is more conducive to economic growth than its detractors have argued and that complementarities between democratic institutions and the immediate causes of economic development".

Despite being a topic mentioned numerous times, the relationship between the two variables of interest is studied in different ways even by the same author. In this sense, it is pertinent to analyze how a VAR model clarifies this important relationship.

3. Methodology

The methodology used in this dissertation was the analysis of economic variables, calculation of statistical measures, indexes, indicators, analysis of the historical context, legislation, articles of press, policies and plans of the Government and IMF and articles written by academics and other scholars on the subject, and from that build, estimate and analyze a VAR-type model for each economy under study. Descriptive statistics, quantitative and graphical analysis of the variables defined by the World Bank, OECD and Fred databases were compiled in the form of regressions in time series and graphs. The selection period chosen was from 1960 to 2019 (for most variables) for all countries, as it portrays different phases of expansion of the economic cycle and the political regime of each.

When choosing the countries, I considered the diversity of continents, that is, trying to represent different socio-economic realities. The most represented continent concerns America, but with quite different characteristics, since the reality between the Southern and Northern Hemispheres is evident. In this case, the chosen countries were the United States of America, Argentina, and Venezuela, one of the largest economies in the world and countries that present a greater volatility of variables. From the East, the only country in the analysis is the People's Republic of China. Finally, on the African continent, it includes two more countries demarcated with episodes of electoral changes, in Tunisia there was the so-called Arab Spring and in South Africa, despite being a democratic country, there was a great variety between 1960 and 2019.

3.1. The variables of the model

The evolution of the effect of democracy on income involves many of the usual suspects studied in the empirical growth literature. These are variables directly or indirectly associated with the exercise of government power. The main dependent variable is Freedom House Political Rights Index, ranging from zero to one, the variable that explains democracy: a country receives the highest score if political rights come closest to the ideals suggested by a checklist of questions, beginning with whether there are free and fair elections, whether those who are elected rule, whether there are competitive parties or other political groupings. Some studies show evidence supporting an impact of democracy on GDP per capita growth, i.e., per capita GDP increasing in democracies at low levels, but after a certain moderate level of democracy, this relationship changes negatively. A substantial part of education spending is publicly financed and thus contains a strong redistributive element; if democracies are more responsive to the basic needs of the population than dictatorships, they will choose policies that promote human capital accumulation. As far as human capital is concerned, a serious problem of endogeneity needs to be considered: A higher level of human capital is likely to be a determinant of democracy as well as one of its outcomes. The level of savings is often used to know what part of national disposable income is not used for final consumption expenditure. The degree of income

inequality also results from societal choices that are affected by the political regime. A move from dictatorship to democracy is expected to give a greater weight to the preferences of the poor in collective decision-making. This variable is measured say by the Gini coefficient. The stability of governance is an important characteristic of political systems. Political instability leads to uncertainty about future policies and creates an incentive for rulers to adopt predatory behavior vis-a-vis the private resources of the economy. Generally, Government debt as a percent of GDP is used by investors to measure a country ability to make future payments on its debt, thus affecting the country borrowing costs and government bond yields. Inflation refers to an overall increase in the Consumer Price Index (CPI), which is a weighted average of prices for different goods. The effect of democracy on the trade regime remains an open empirical question. Numerous studies document a robust positive effect of trade openness on economic growth. International trade allows countries to reap the full benefits of comparative advantage, thus raising both the steady-state level of per capita income and the transitional growth rate.

3.2. Procedure

The method chosen for carrying out the research in this thesis is based on the various methodologies used by the several authors over the years, namely VAR-type models. That is, the VAR model is the most appropriate to answer the question raised: "Does the level of democracy affect income and the level of wealth determines the political regime in each country?". A Vector autoregressive (VAR) model is useful when one is interested in predicting multiple time series variables using a single model. A Vector autoregressive (VAR) model is useful when one is interested in predicting multiple time series variables using a single model. The vector autoregression (VAR) model extends the idea of univariate autoregression to k time series regressions, where the lagged values of all k series appear as regressors. Put differently, in a VAR model we regress a vector of time series variables on lagged vectors of these variables. The vector autoregression (VAR) model extends the idea of univariate autoregression to k time series regressions, where the lagged values of all k series appear as regressors. Put differently, in a VAR model we regress a vector of time series variables on lagged vectors of these variables. Although the sample size and the time horizon are already considerable for an econometric analysis, in some countries it is difficult to register significant changes during this period. Taking as an example the data used by Acemoglu (2008), the dependent variable, calculated as an index, has almost the same value in many countries along 50 years, namely USA, Portugal, China, Tunisia, South Africa, Venezuela, and Argentina. So, to choose the country of analysis I must consider those countries for which Free Household Index has different values over time.

The VAR model can be considered as a means of conducting causality tests, or more specifically Granger causality tests. Granger causality really implies a correlation between the current value of one variable and the past values of others, it does not mean changes in one variable cause changes in another. By using a F-test to jointly test for the significance of the lags on the explanatory variables, this in effect tests for 'Granger causality' between these variables. The 'Granger causality' test can also be used as a test for whether a variable is exogenous. i.e., if no variables in a model affect a particular variable it can be viewed as exogenous. The impulse response functions can be used to produce changes along the time path of the dependent variables in the VAR, to shocks from each of the explanatory variables. If the system of equations is stable any response should decline to zero, an unstable system would produce an explosive time path. Variance Decomposition is a complementary method to impulse response functions to examine the effects of shocks on dependent variables. This technique determines how much of the forecast error variance for any variable in a system is explained by innovations for each explanatory variable over a function of time horizons. Normally, the series shocks themselves explain most of the error's variance, although the shock also affects other variables in the system. It is also important to consider the ordering of the variables when performing these tests, as in practice the error terms of the equations in the unrestricted VAR will be correlated, so the result will depend on the order in which the equations are estimated in the model. Additionally, in each country the point forecast was also analyzed to generate the h-step ahead forecast, as we could iterate the VAR model forward through a series of observations. More details about VAR models can be found in "Applied econometric time series" by Walter Enders publish in 2004.

In the next chapter we find the results of the tests performed in STATA. Initially, to analyze the level of stationarity of the variables, we started from the DFC hypothesis tests, Dickey-Fuller test with a constant, a drift. Also, we need to know how many lags to apply in the test. So, to confirm the non-stationary of the type in the DF test, when we accept the null hypothesis, we need to apply the second test, DFCT. If we get the same results before and accept the null, the variable remains nonstationary of type ct in the DF test, and we pass to the first differences model under stationarity, with the number of lags equal to p - 1. For cointegration use the test of Engle Granger, by Robert Engle and Clive Granger (1987). This test uses the residuals (errors) to see if the unit's roots are present, using Dickey-Fuller estimation, augmented without constant. Residuals will be practically stationary if the time series is cointegrated. The cointegration of -variables is only studied if they are not stationary, since cointegration can only occur if the individual time series are integrated (thus not stationary).

Granger (1969) introduced the concept of causality, which is easy to insert from a VAR model. Consider the case of a bivariate time series and the forecast is steps ahead. In this case, we can use the VAR model and the univariate model for each component and produce the forecasts. We say that r1t causes

r2t if the bivariate prediction of r2t is more accurate than the univariate prediction. In other words, regarding Granger's approach (1969), we say that r1t causes r2t if the information passed from r1t increases the accuracy of the r2t forecast in relation to the forecast obtained through a univariate model for r2t. However, the test does not report anything about causality in literal terms, but it does provide statistical evidence that past oscillations of one variable are correlated with those of another variable. In a bivariate system, testing whether r_{2t} Granger-causes r_{1t} is equivalent to estimating whether for the equation above, $\beta_{2,\,t-i} = 0$ for any *i* = 1, ..., k. Thus, we have the following conventional F test (for any *i* = 1, ..., k). Basically, we check the p-value of the test statistic and decide whether to reject or accept the null hypothesis. Such a test is performed after estimating a VAR model. In addition to the objective proposed by the test, we can use it after estimating a VAR model and verifying that there are non-statistically significant lags and thus deciding whether to remove them or not from any VAR model equation.

The Impulse-Response Function shows the effects of shocks on the system variables and makes it possible to calculate the dynamic impact (signal and magnitude) of change in a variable on it and the other variables of the model over time. Thus, we seek to measure the effect of a unit shock on a variable in period t on all variables in subsequent periods.

4. Results

4.1. Framework

The results obtained so far in the literature raise some considerable doubts when we say that "per capita income is a determining factor in democracy and that a general increase in per capita income will bring about improvements in institutions" (Acemoglu, 2008). Although conventional wisdom indicates a causal effect between the two variables, some countries may have reached a path of development with the help of democracy and economic growth, while others with a dictatorship regime and with a lower level of growth.

4.2. Main Findings

For all countries, it is important to analyze stationarity, cointegration, Granger causality, impulse-response function, and variance Decomposition in the VAR model.

Case of Portugal

A. Stationary

For the first country, Portugal, out of 13 variables only two variables are stationary: Freedom House Index and Gini coefficient. This happen because the P-value of Z(t) of DF with constant are lower than the significance level (α= 5%), so rejects the null hypothesis. The other variables, GDP, Years of schooling, Savings rate, Total and the ages of Population, the level of research and development, Researchers in FTE, Corruption Rank, the Government DEBT, Inflation rate and Trade openness are all nonstationary variables (Annex A).

B. Cointegration

First, for Portugal, as the Freedom House Political Rights Index variable is stationary, there is no discussion of cointegration between it and real GDP per capita.

C. Optimal Model

For comparison purposes, both Free and GDP are at growth rates for all countries under study, there are variables that are stationary. As per below, we can see a balance between the highest and lowest values. Even though the growth rate of Free Household and Real GDP per capita have a positive correlation, meaning that both variables tend to move together, in the same direction. For example, when one variable decreases the other variable decreases too, and vice-versa. The cross-correlation measurement tracks the movements of the two variables. If the growth rate of Real GDP per capita influences the growth rate of Free and the two are positively correlated, we can say that the variables are cross correlated, their behavior is positively correlated because of individual relationship to

variable. The correlation of the growth rate of Free and the growth rate of Real GDP per capita with no lags is almost 0.5. When lags increase to 20 years, the correlation between level of democracy in t and Real GDP per capita in t – 20 is almost 0, so the effect of relation on growth rate of Free in growth rate of Real GDP per capita disappear when t tend to + ∞.

To choose the most useful model level in terms of lags, we look for the Lagrange-multiplier test and in case of Portugal we have 2 lags. First look for VAR (2), with two lags difference, we obtain:

$$\begin{pmatrix} dlFree\ t \\ dlRGDPper\ capita\ t \end{pmatrix} = \begin{pmatrix} 0.0554 \\ 0.0146 \end{pmatrix} + \begin{pmatrix} 0.0025 & -0.0032 \\ -1.6513 & 0.5403 \end{pmatrix} \begin{pmatrix} dlFreet-1 \\ dlRGDPper\ capitat-1 \end{pmatrix} + \begin{pmatrix} -0.0116 & -0.0349 \\ 0.2126 & -0.0573 \end{pmatrix} \begin{pmatrix} dlFreet-2 \\ dlRGDPper\ capitat-2 \end{pmatrix}$$

For VAR (2) to be an "optimal" model it is necessary to test normality and stability. Using a Jarque-Bera test we can explain if the error terms have a Normal Distribution (0;1). The error term does follow a normal distribution. For testing the stability of the model, we consider the sentence "VAR satisfies stability condition", so VAR (2) is stable and normal distributed, so it is a good model.

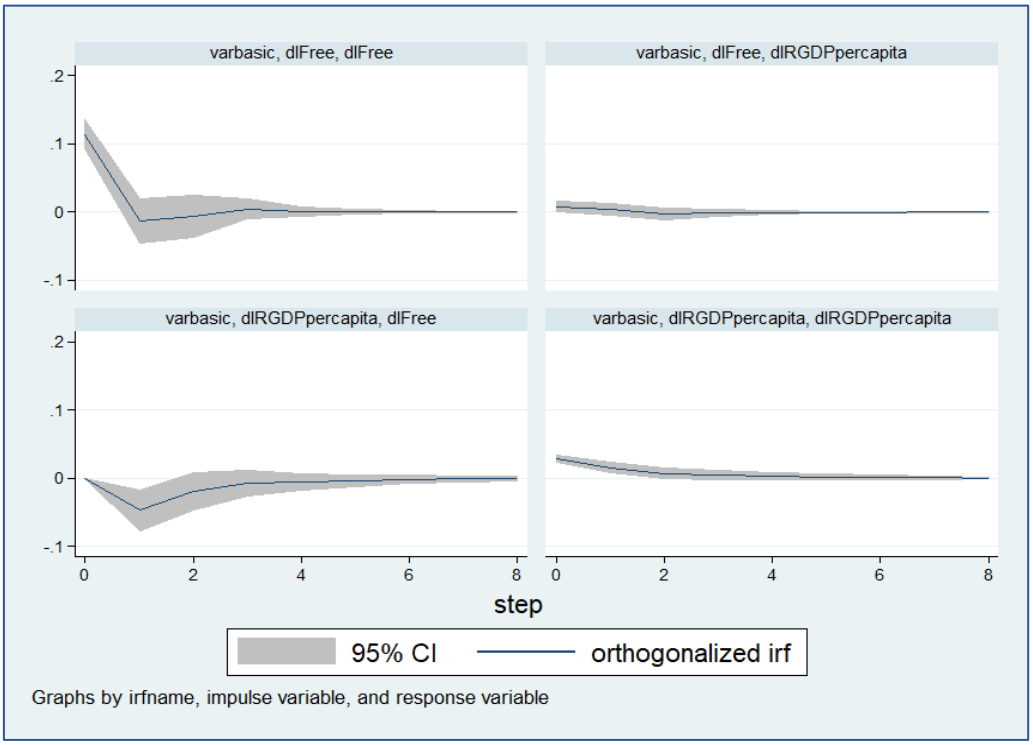
D. Granger Causality

The results obtain in this case are that the growth rate of Real GDP per capita doesn't GC the growth rate of Free, this means that growth rate of Real GDP per capita in t -1 doesn't affect the current growth rate of Free. But the growth rate of Free does GC growth rate of Real GDP per capita, so growth rate of Free in t -1 does affect the current growth rate of Real GDP per capita. So, by Granger Causality only the past values of Free House Political Rights Index will affect the level of Real GDP per capita.

E. Impulse-Response Function

The top left panel of Figure 1 shows that when we have an impact on error of growth rate of Free this effect will die out after 2 years, suggesting that the growth rate of Free House Political Rights Index is a short-memory process (is more evident on short run, h = 1, 2, than in the long run, the effect is null). The top right panel shows that a zero shock in the current period growth rate of Free, will not have a response in Real GDP per capita. The bottom left panel proves that a strong shock on the error of growth rate of Real GDP have some impact on current and future growth rate of Free, but this doesn't agree with the results of Granger causality, because the growth rate of Real GDP does help predict the growth rate of Free in short run. The bottom right panel explains how a strong shock on growth rate of Real GDP per capita will affect the future growth rate, this result is significant in almost 2 years, but then become null in long run.

Figure 1 - The Impulse-Response Function for the case of Portugal



F. Point Forecast

Prediction is a natural and straightforward extension of how the AR model works. The original data is until 2019, but in this part, it is essential to impose a restriction. Thus, the sample becomes 1960 to 2016. For the observation between 2017 and 2019 we use the predicted values, and we can see a gap between the prediction (blue line) and the observed values (red line), they are never coincident, the observed values fluctuate more. The predicted error is the difference between the two and is much smaller in Free's growth rate forecast (Figure 2). The next step is to look at the forecast values for the next two years of 2020 and 2021 and analyze that the change in the assessment of the growth rate is greater. In this case, the future values of the main variable are almost null (Figure 3).

Figure 2 - The ex ante and values for the last two years for Portugal

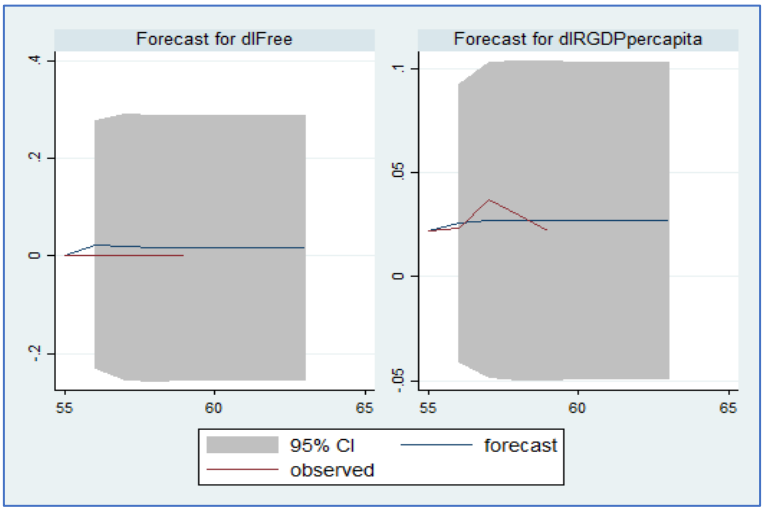
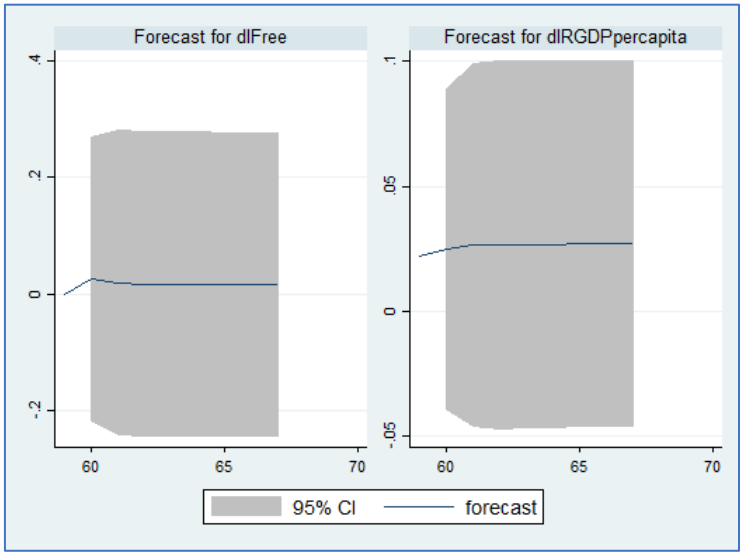


Figure 3 - The ex post forecast for the future years for Portugal

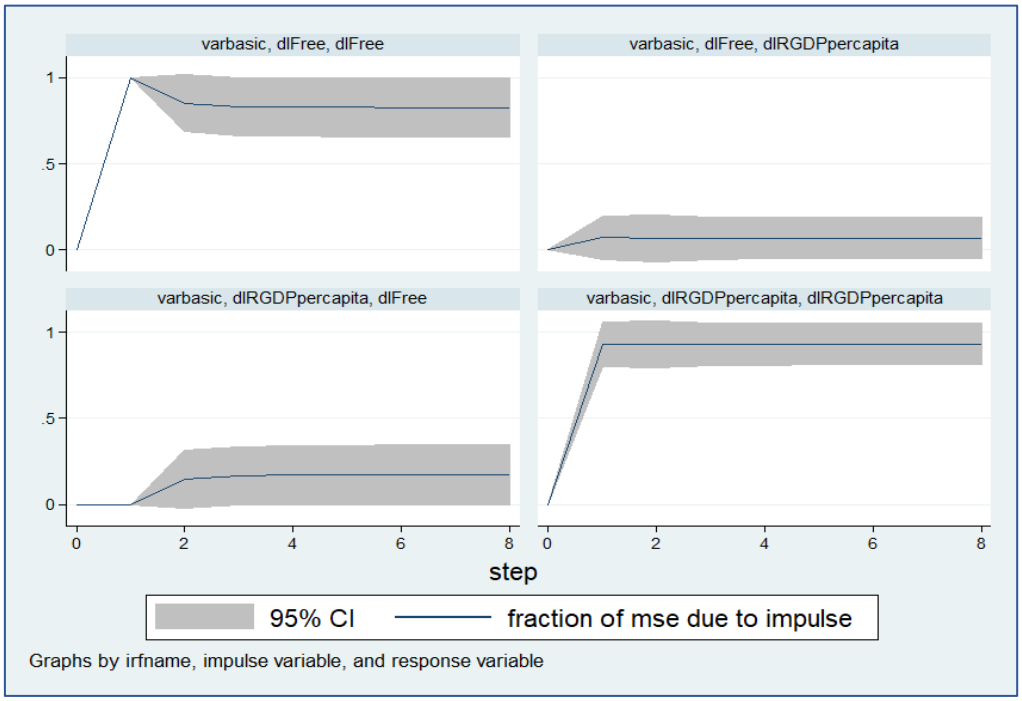


G. Variance Decomposition

The top and bottom right panels of Figure 4 show where uncertainty comes from on growth rate of RGDP per capita. In the short and long run the uncertainty comes from itself in all horizons.

In the left-side uncertainty on growth rate of Free Political Rights Index is balanced, until h = one year the uncertainty came also from the variable of GDP. But in the Long Term, the uncertainty on growth rate of Free came from itself, converge to 70%.

Figure 4 - Variance Decomposition for the case of Portugal



Case of USA

A. Stationary

For USA, out of 13 variables only two variables are stationary: Freedom House Index and Inflation rate. This happen because the P-value of Z(t) of DF with constant are lower than significant level (α = 5%), so reject the null hypothesis. The other variables, GDP, Years of schooling, Savings rate, Total and the ages of Population, the level of research and development, Researchers in FTE, Corruption Rank, the Government DEBT, Trade openness and Gini Coefficient are all nonstationary variables (Annex B).

B. Cointegration

Like Portugal, the Freedom House Political Rights Index variable is stationary, in this case, so there is no discussion of cointegration between it and real GDP per capita.

C. Optimal Model

For comparison purposes, both Free and GDP are at growth rates for all countries under study, there are variables that are stationary. As per below, we can see a balance between the highest and lowest values. Even though the growth rate of Free Household and Real GDP per capita have a positive correlation, meaning that both variables tend to move together, in the same direction. For example, when one variable decreases the other variable decreases to, and vice-versa. The cross-correlation measurement tracks the movements of the two variables. If the growth rate of Real GDP per capita

influences the growth rate of Free and the two are positively correlated, we can say that the variables are cross correlated, their behavior is positively correlated because of individual relationship to variable. The correlation of the growth rate of Free and the growth rate of Real GDP per capita with no lags is almost 0.25. When lags increase to 20 years, the correlation between level of democracy in t and Real GDP per capita in t – 20 is almost 0, so the effect of relation on growth rate of Free in growth rate of Real GDP per capita disappear when t tend to + ∞.

To choose the most useful model, we look for the Lagrange-multiplier test and we see same autocorrelation in 2 lags. First look for VAR (2), with two lags difference, we obtain:

$$\begin{pmatrix} dlFree\ t \\ dlRGDPper\ capita\ t \end{pmatrix} = \begin{pmatrix} 0.0005 \\ 0.0153 \end{pmatrix} + \begin{pmatrix} 0.1733 & 0.0236 \\ 0.1191 & 0.3617 \end{pmatrix} \begin{pmatrix} dlFreet-1 \\ dlRGDPper\ capitat-1 \end{pmatrix} + \begin{pmatrix} 0.174 & -0.1169 \\ -0.2779 & -0.152 \end{pmatrix} \begin{pmatrix} dlFreet-2 \\ dlRGDPper\ capitat-2 \end{pmatrix}$$

For VAR (2) to be an "optimal" model it is necessary to test normality and stability. Using a Jarque-Bera test we can explain if the error terms have a Normal Distribution (0;1). The error term does follow a normal distribution. For testing the stability of the model, we consider the sentence "VAR satisfies stability condition", so VAR (2) is stable and normal distributed, so it is a good model.

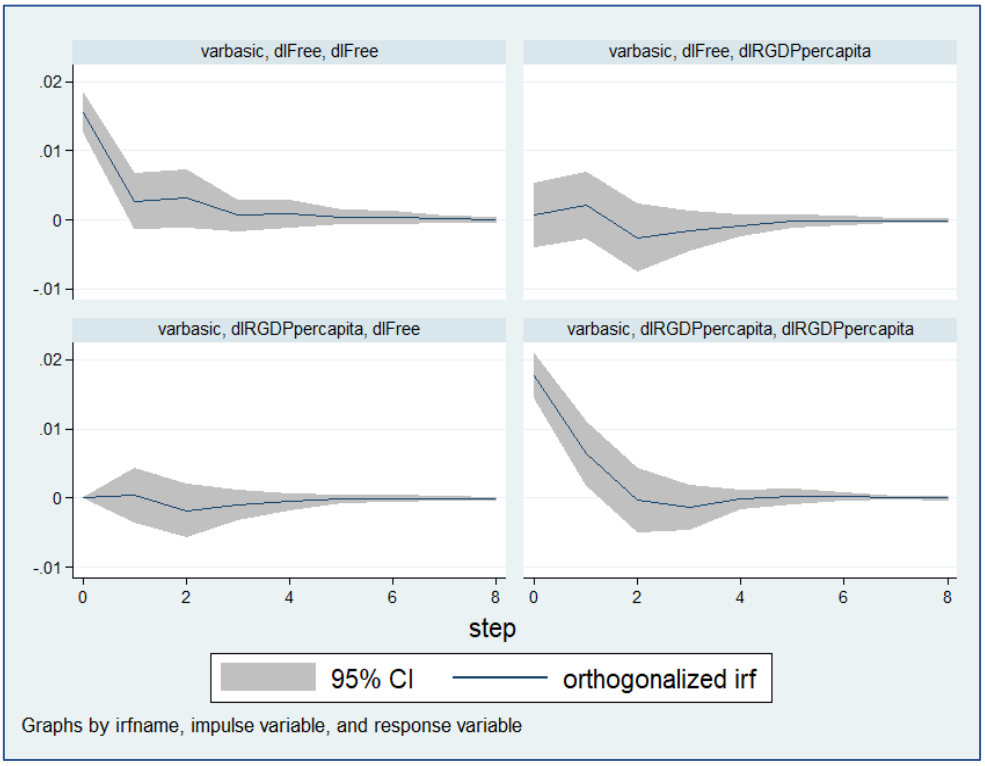
D. Granger Causality

The results obtain in this case are that the two variables don't predict each other. The growth rate of Real GDP per capita doesn't GC growth rate of Free and the growth rate of Free doesn't GC growth rate of Real GDP per capita. So, by Granger Causality the past values will not affect the current one.

E. Impulse-Response Function

The top left panel of Figure 5 shows that when we have an impact on error of growth rate of Free this effect will die out after 3 years, suggesting that the growth rate of Free House Political Rights Index is a short-memory process (is more evident on short run, h = 1, 2, than in the long run, the effect is null). The same happens in top right panel, have a shock in the current period growth rate of Free, will have a response in Real GDP per capita only in SR, although not statistically significant. The bottom left panel proves that a strong shock on the error of growth rate of Real GDP doesn't have impact on current and future growth rate of Free, but this will agree with the results of Granger causality. The bottom right panel explains how a strong shock on growth rate of Real GDP per capita will affect the future growth rate, this result is significant in almost 2 years, but then become null in long run.

Figure 5 - The Impulse-Response Function for the case of USA



F. Point Forecast

For the observation between 2017 and 2019 we use predicted values, and we can see a gap between forecast and the observed values, they are never coincident, the observed values fluctuate more. The predicted error is the difference of the two and is higher on the forecast of growth rate of Free (Figure 6). The next step is to look at the forecasted values of the next two years 2020 and 2021, and to analyze if the change on valuation of growth rate is higher (Figure 7).

Figure 6 - The ex ante values for the last two years for USA

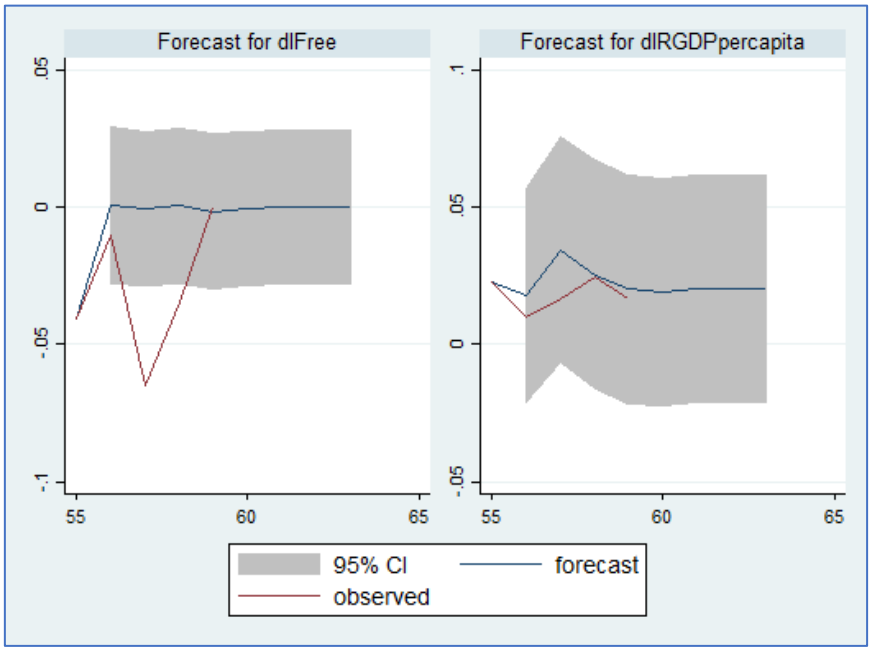
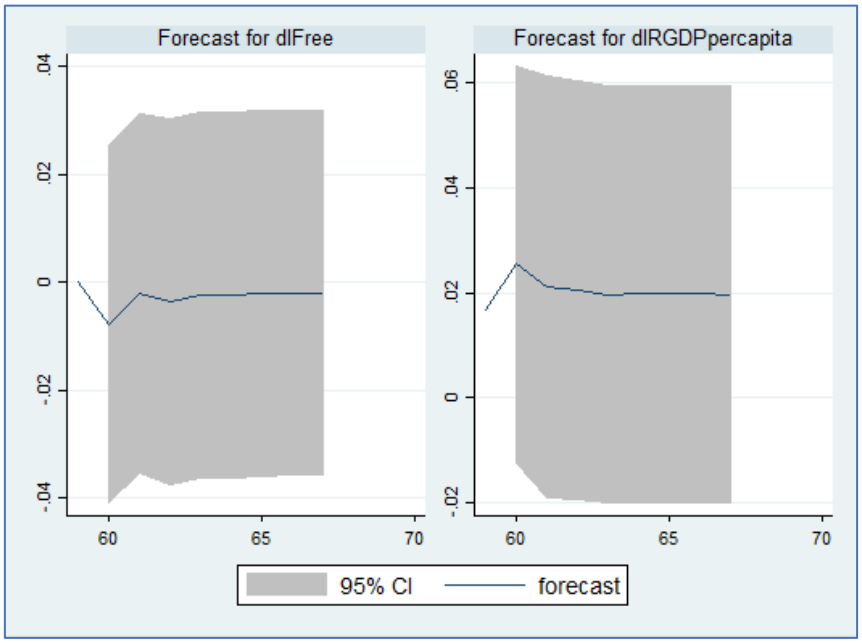


Figure 7 - The ex post forecast for the future years for USA

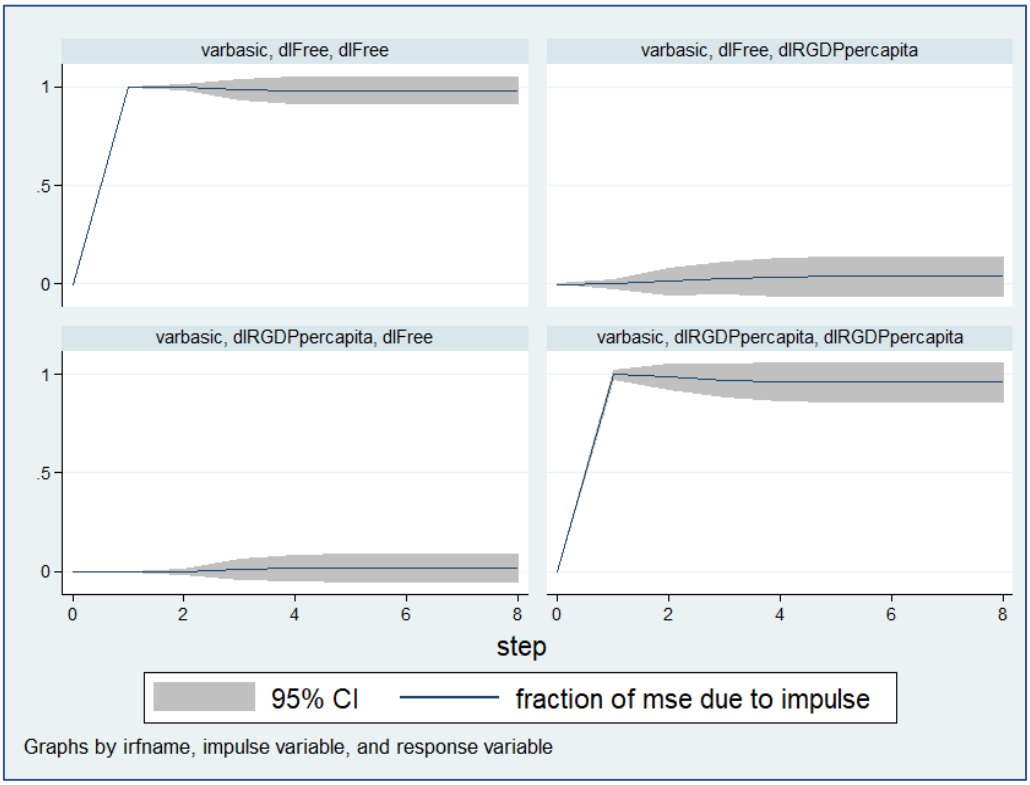


G. Variance Decomposition

The top and bottom right panels of Figure 8 show where uncertainty comes from on growth rate of RGDP per capita. In Short and Long run the uncertainty come from itself in all horizons.

In the left-side uncertainty on growth rate of Free Political Rights Index happen the same, in short and long run the uncertainty is 100% from itself.

Figure 8 - Variance Decomposition for the case of USA



Case of China

A. Stationary

For China, out of 13 variables only two variables are stationary: Freedom House Index and Inflation rate. This happen because the P-value of Z(t) of DF with constant are lower than significant level (5%), so reject the null hypothesis. The other variables, GDP, Years of schooling, Savings rate, Total and the ages of Population, the level of research and development, Researchers in FTE, Corruption Rank, the Government DEBT, Trade openness and Gini Coefficient are all nonstationary variables (Annex C).

B. Cointegration

How do we get in previous countries, the Freedom House Political Rights Index variable is stationary, there is no discussion of cointegration between it and real GDP per capita.

C. Optimal Model

For comparison purposes, both Free and GDP are at growth rates for all countries under study, there are variables that are stationary. As per below, we can see a balance between the highest and lowest values. Even though the growth rate of Free Household and Real GDP per capita have a positive correlation, meaning that both variables tend to move together, in the same direction. For example, when one variable decreases the other variable decreases to, and vice-versa. The cross-correlation

measurement tracks the movements of the two variables. If the growth rate of Real GDP per capita influences the growth rate of Free and the two are positively correlated, we can say that the variables are cross correlated, their behavior is positively correlated because of individual relationship to variable. The correlation of the growth rate of Free and the growth rate of Real GDP per capita with no lags is almost 0.5. When lags increase to 20 years, the correlation between level of democracy in t and Real GDP per capita in t – 20 is almost 0, so the effect of relation on growth rate of Free in growth rate of Real GDP per capita disappear when t tend to + ∞.

To choose the most useful model, we look for the Lagrange-multiplier test and became again we autocorrelation in 2 lags. First look for VAR (2), with two lags difference, we obtain:

$$\begin{pmatrix} dlFree\ t \\ dlRGDPper\ capita\ t \end{pmatrix} = \begin{pmatrix} 0.016 \\ 0.0408 \end{pmatrix} + \begin{pmatrix} -0.154 & -0.5443 \\ 0.1293 & 0.4759 \end{pmatrix} \begin{pmatrix} dlFreet-1 \\ dlRGDPper\ capitat-1 \end{pmatrix} + \begin{pmatrix} -0.249 & -0.2562 \\ 0.122 & -0.2379 \end{pmatrix} \begin{pmatrix} dlFreet-2 \\ dlRGDPper\ capitat-2 \end{pmatrix}$$

For VAR (2) to be an "optimal" model it is necessary to test normality and stability. Using a Jarque-Bera test we can explain if the error terms have a Normal Distribution (0;1). The error term does follow a normal distribution. For testing the stability of the model, we consider the sentence "VAR satisfies stability condition", so VAR (2) is stable and normal distributed, so it is a good model.

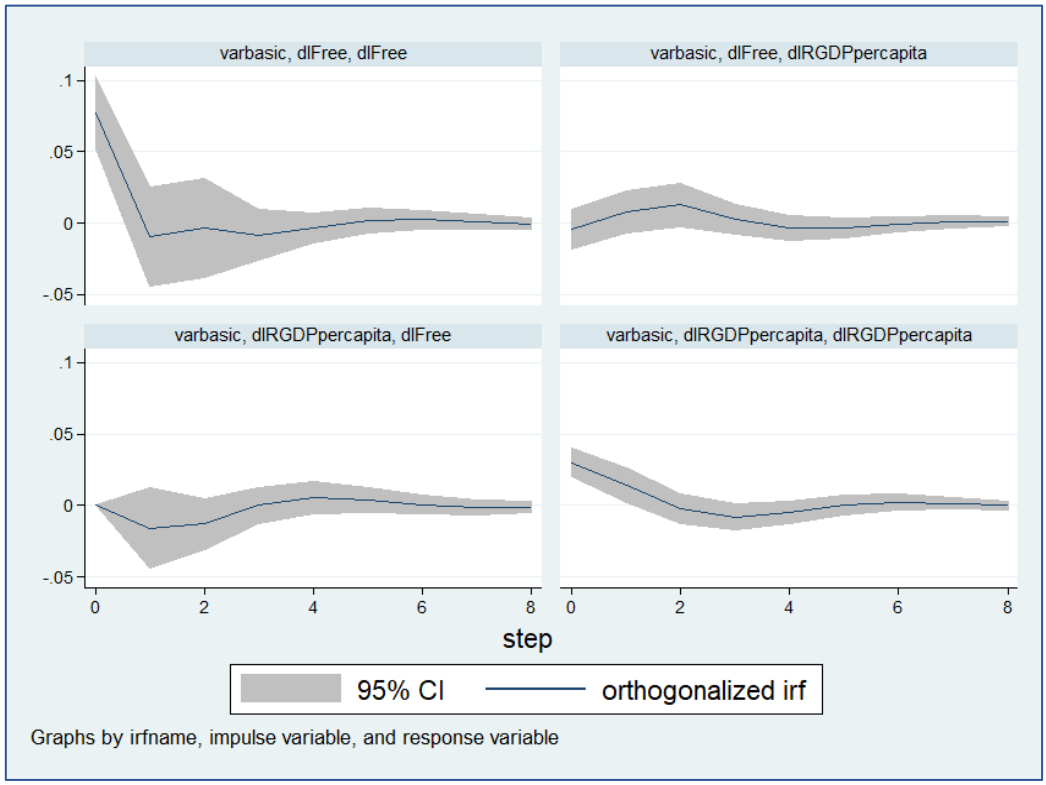
D. Granger Causality

The results obtain in this case are that the two variables don't predict each other. The growth rate of Real GDP per capita doesn't GC growth rate of Free and the growth rate of Free doesn't GC growth rate of Real GDP per capita. So, by Granger Causality the past values will not affect the current one.

E. Impulse-Response Function

The top left panel of Figure 9 shows that when we have an impact on error of growth rate of Free this effect will die out after 4 years, suggesting that the growth rate of Free House Political Rights Index is a short-memory process (is more evident on short run, h = 1, 2, 3 than in the long run, the effect is null). In top right panel, have a shock is almost zero in current and future period growth rate of Free. The bottom left panel proves that a strong shock on the error of growth rate of Real GDP doesn't have impact on current and future growth rate of Free, but this will agree with the results of Granger causality. The bottom right panel explains how a strong shock on growth rate of Real GDP per capita will affect the future growth rate, this result is significant in almost 2 years, but then become null in long run.

Figure 9 - The Impulse-Response Function for the case of China



F. Point Forecast

For the observation between 2017 and 2019 we use predicted values, and we can see a gap between forecast (blue line) and the observed values (red line), they are never coincident, the observed values fluctuate more (Figure 10). But we don't have observed values for the growth rate of Free (Figure 11).

Figure 10 - The ex ante values for the last two years for China

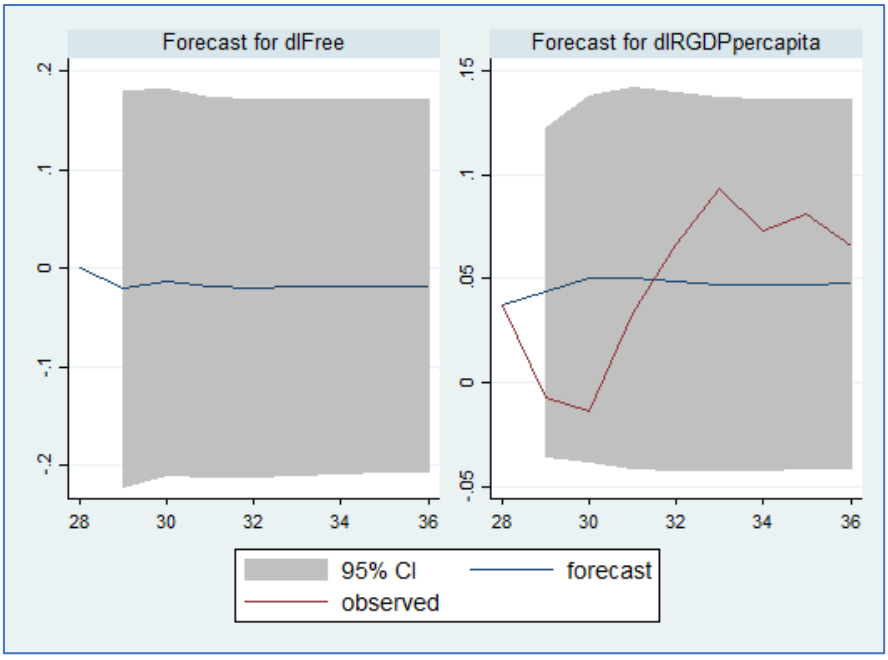
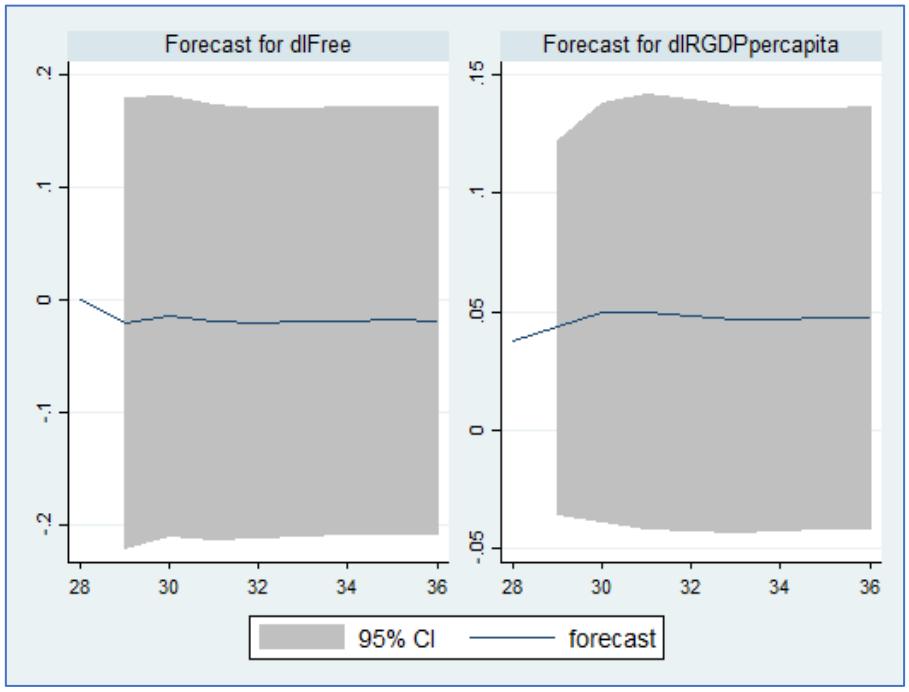


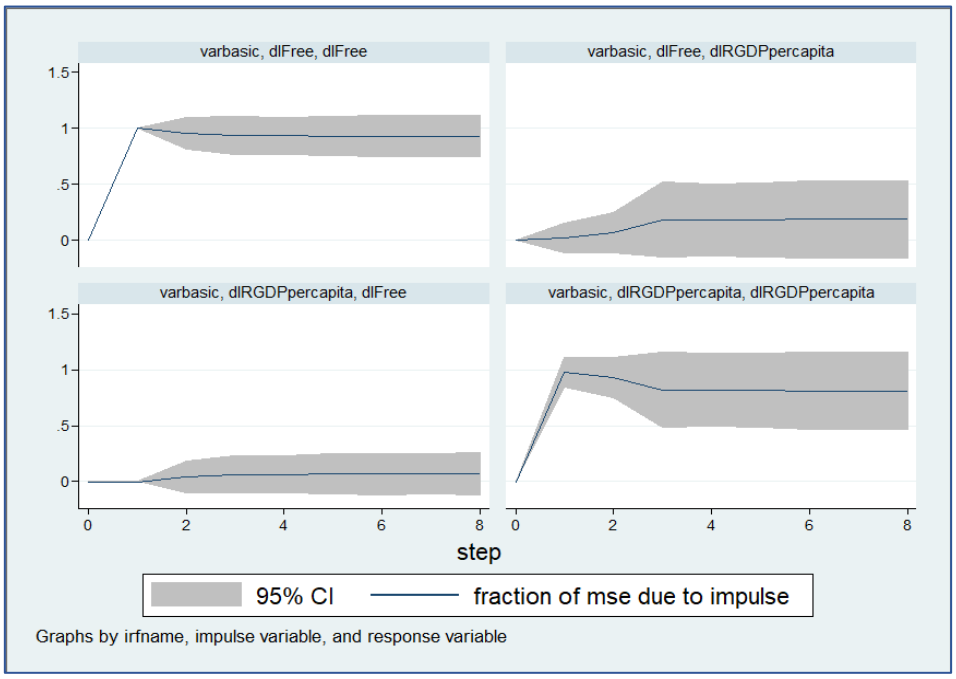
Figure 11 - The ex post forecast for the future years for China



G. Variance Decomposition

The top and bottom left panels of Figure 12 show where uncertainty on Free Political Rights Index comes from itself in short and long run. In the right-side uncertainty is more balanced, especially in long run, because the uncertainty in RGDP will be almost 20%.

Figure 12 - Variance Decomposition for the case of China



Case of Tunisia

A. Stationary

For Tunisia, out of 13 variables only two variables are stationary: Freedom House Index and Inflation rate. This happen because the P-value of Z(t) of DF with constant are lower than significant level (α = 5%), so reject the null hypothesis. The other variables, GDP, Years of schooling, Savings rate, Total and the ages of Population, the level of research and development, Researchers in FTE, Corruption Rank, the Government DEBT, Trade openness and Gini Coefficient are all nonstationary variables (Annex D).

B. Cointegration

The variable that defines democracy continues not to oscillate, hence it is stationary, and therefore there is no mention of cointegration between Free and Real GDP per capita.

C. Optimal Model

For comparison purposes, both Free and GDP are at growth rates for all countries under study, there are variables that are stationary. As per below, we can see a balance between the highest and lowest values. Even though the growth rate of Free Household and Real GDP per capita have a positive correlation, meaning that both variables tend to move together, in the same direction. For example, when one variable decreases the other variable decreases to, and vice-versa. The cross-correlation measurement tracks the movements of the two variables. If the growth rate of Real GDP per capita influences the growth rate of Free and the two are positively correlated, we can say that the variables are cross correlated, their behavior is positively correlated because of individual relationship to variable. The correlation of the growth rate of Free and the growth rate of Real GDP per capita with no lags is almost 0.4. When lags increase to 20 years, the correlation between level of democracy in t and Real GDP per capita in t – 20 is almost 0, so the effect of relation on growth rate of Free in growth rate of Real GDP per capita disappear when t tend to + ∞.

To choose the most useful model, we look for the Lagrange-multiplier test and do with autocorrelation in 2 lags. First look for VAR (2), with two lags difference, we obtain:

$$\begin{pmatrix} dlFree\ t \\ dlRGDPper\ capita\ t \end{pmatrix} = \begin{pmatrix} 0.1215 \\ 0.0161 \end{pmatrix} + \begin{pmatrix} -0.3364 & 0.0233 \\ -1.4321 & 0.0644 \end{pmatrix} \begin{pmatrix} dlFreet-1 \\ dlRGDPper\ capitat-1 \end{pmatrix} + \begin{pmatrix} 0.0458 & 0.0107 \\ -2.825 & 0.3929 \end{pmatrix} \begin{pmatrix} dlFreet-2 \\ dlRGDPper\ capitat-2 \end{pmatrix}$$

For VAR (2) to be an "optimal" model it is necessary to test normality and stability. Using a Jarque-Bera test we can explain if the error terms have a Normal Distribution (0;1). The error term does follow a

normal distribution. For testing the stability of the model, we consider the sentence "VAR satisfies stability condition", so VAR (2) is stable and normal distributed, so it is a good model.

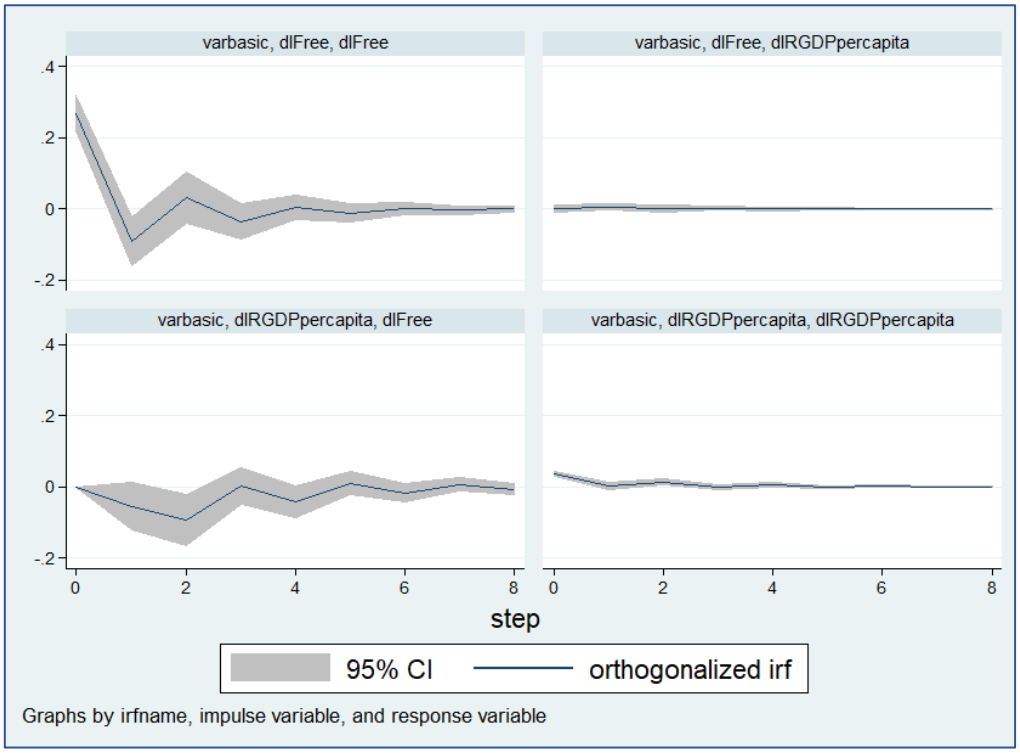
D. Granger Causality

The results obtain in this case are that one of the variables predict the other. The growth rate of Free does GC growth rate of Real GDP per capita. But the opposite doesn't happen, the growth rate of Real GDP per capita doesn't GC growth rate of Free. This mean, by Granger Causality the past values of Free House Political Rights Index will affect the Real GDP.

E. Impulse-Response Function

The top left panel of Figure 13 shows that when we have an impact on error of growth rate of Free this effect will die out after 4 years, suggesting that the growth rate of Free House Political Rights Index is a short-memory process (is more evident on short run, h = 1, 2, 3 than in the long run, the effect is null). In top right panel, we don't have any shock in current and future period growth rate of Free. The bottom panel proves some shock on the error of growth rate of Real GDP in current and future growth rate of Free, but the error terms of variable itself doesn't statistically affect in short and long run.

Figure 13 - The Impulse-Response Function for the case of Tunisia



F. Point Forecast

We can see a gap between blue and the red, they are never coincident, the forecast values are higher. The predicted error is the difference of the two and is higher on the forecast of growth rate of Free (Figure 14). The next step is to look at the forecasted values of the next two years 2020 and 2021, and

to analyze that the growth rate of Real GDP per capita will fluctuate more than the depend variable (Figure 15).

Figure 14 - The ex ante values for the last two years for Tunisia

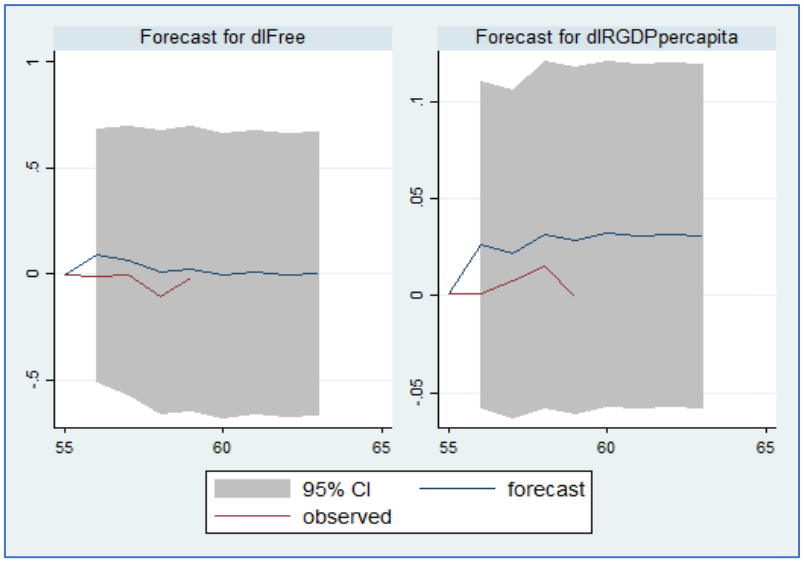
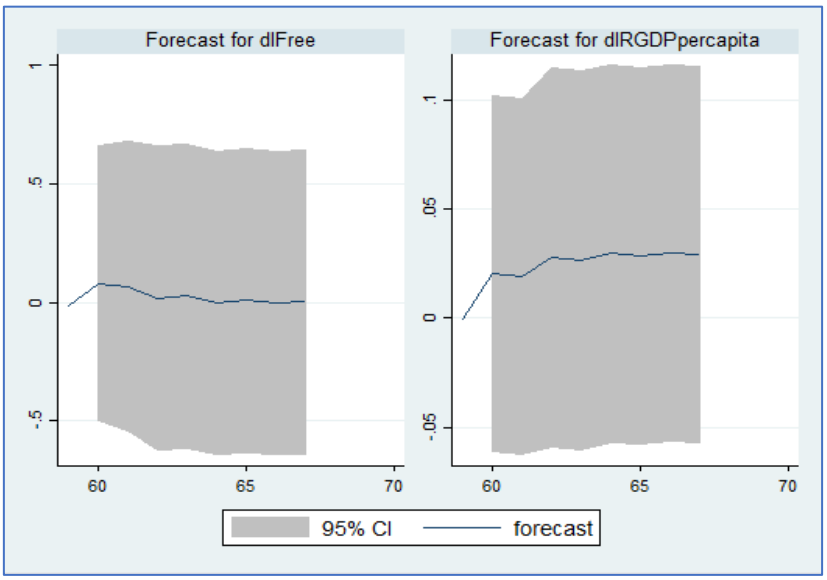


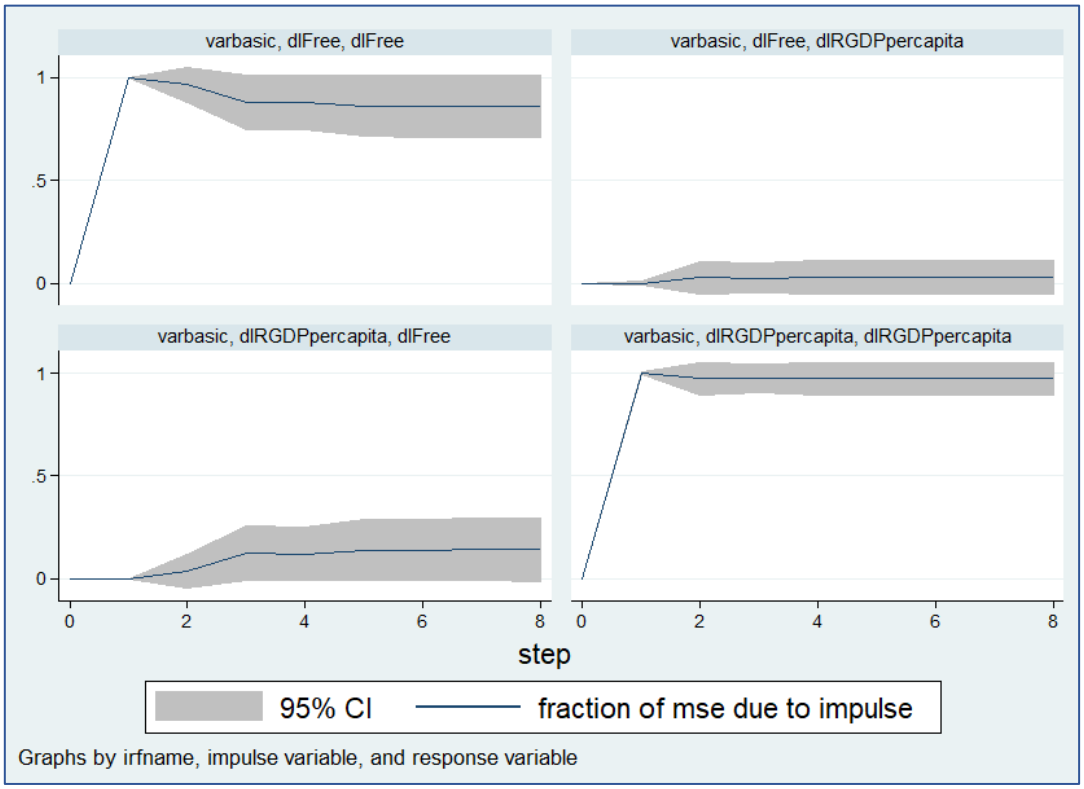
Figure 15 - The ex post forecast for the future years for Tunisia



G. Variance Decomposition

The top and bottom left panels of Figure 16 show where uncertainty on Free Political Rights Index comes from itself in short and long run, however, converge to some uncertainty became from real GDP per capita. The uncertainty became always from variable itself.

Figure 16 - Variance Decomposition for the case of Tunisia



Case of South Africa

A. Stationary

For South Africa, out of 12 variables only four variables are stationary: Savings rate, Corruption Rank, Trade openness and Inflation rate. This happen because the P-value of Z(t) of DF with constant are lower than significant level (5%), so reject the null hypothesis. The other variables, Freedom House Political Rights Index, RGDP per capita, Years of schooling, Total and the ages of Population (<14, <64 and >65), the Government DEBT and Gini Coefficient are all nonstationary variables (Annex E).

B. Cointegration

In South Africa, when study the cointegration of Free and GDP per capita on levels, we conclude that the two are spurious because the statistic is -1,81, for p equal to 1. If the CV of EG is equivalent to -3,130 (two variables, T=50 and with a significant level of 10%), we accept the Null Hypothesis, the statistic stays on right of CV (Annex H).

C. Optimal Model

For comparison purposes, both Free and GDP are at growth rates for all countries under study, there are variables that are stationary. As per below, we can see a balance between the highest and lowest values. Even though the growth rate of Free Household and Real GDP per capita have a positive

correlation, meaning that both variables tend to move together, in the same direction. For example, when one variable decreases the other variable decreases to, and vice-versa. The cross-correlation measurement tracks the movements of the two variables. If the growth rate of Real GDP per capita influences the growth rate of Free and the two are positively correlated, we can say that the variables are cross correlated, their behavior is positively correlated because of individual relationship to variable. The correlation of the growth rate of Free and the growth rate of Real GDP per capita with no lags is almost 0.5. When lags increase to 20 years, the correlation between level of democracy in t and Real GDP per capita in t – 20 is almost 0, so the effect of relation on growth rate of Free in growth rate of Real GDP per capita disappear when t tend to + ∞.

To choose the most useful model, we look for the Lagrange-multiplier test and we look again the autocorrelation in 2 lags. First look for VAR (2), with two lags difference, we obtain:

$$\begin{pmatrix} dlFree\ t \\ dlRGDPper\ capita\ t \end{pmatrix} = \begin{pmatrix} 0.0187 \\ 0.0422 \end{pmatrix} + \begin{pmatrix} -0.1864 & -0.0833 \\ 0.0414 & 0.3838 \end{pmatrix} \begin{pmatrix} dlFreet-1 \\ dlRGDPper\ capitat-1 \end{pmatrix} + \begin{pmatrix} -0.0575 & -0.0648 \\ -0.2221 & -0.3081 \end{pmatrix} \begin{pmatrix} dlFreet-2 \\ dlRGDPper\ capitat-2 \end{pmatrix}$$

For VAR (2) to be an "optimal" model it is necessary to test normality and stability. Using a Jarque-Bera test we can explain if the error terms have a Normal Distribution (0;1). The error term does follow a normal distribution. For testing the stability of the model, we consider the sentence "VAR satisfies stability condition", so VAR (2) is stable and normal distributed, so it is a good model.

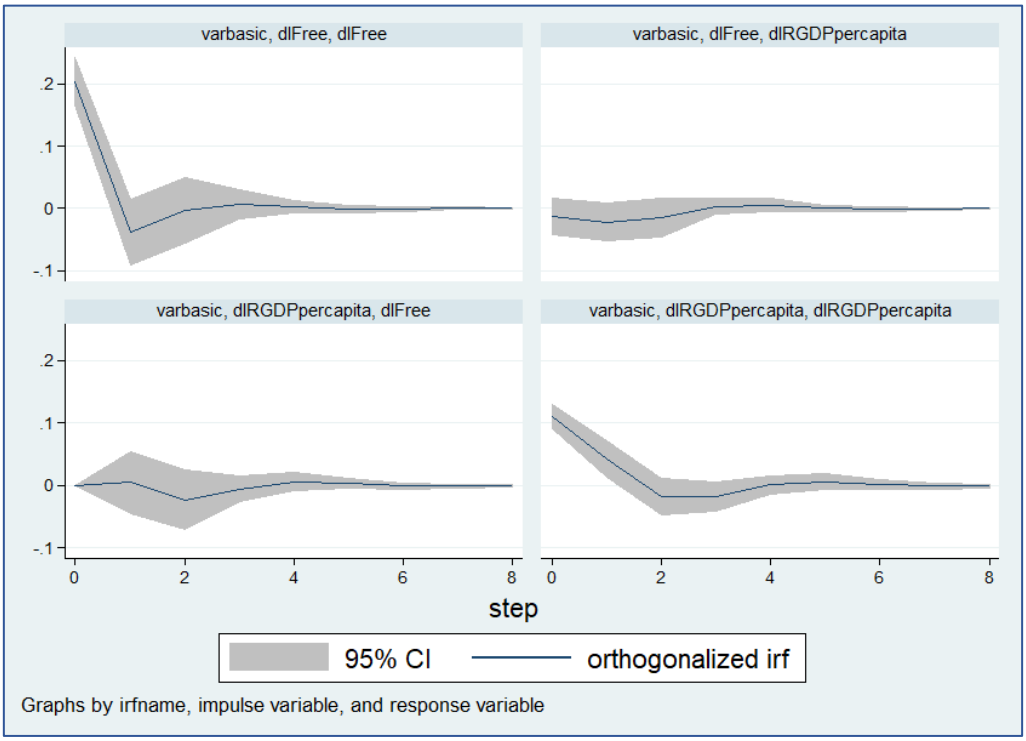
D. Granger Causality

The results obtain in this case are that any variable predict the other. The growth rate of Free doesn't GC growth rate of Real GDP per capita. And the same in other case, the growth rate of Real GDP per capita doesn't GC growth rate of Free House Political Rights Index.

E. Impulse-Response Function

The top left panel of Figure 17 shows that when we have an impact on error of growth rate of Free this effect will die out after 4 years, suggesting that the growth rate of Free House Political Rights Index is a short-memory process (is more evident on short run, h = 1, 2, 3 than in the long run, the effect is null). But is strong in short run period. In top right panel, we have some shock in current growth rate of Free, despite not statistically significant. The bottom panel proves some shock on the error of growth rate of Real GDP in current and future growth rate of Free, the error terms of variable itself does only affect in short run.

Figure 17 - The Impulse-Response Function for the case of South Africa



F. Point Forecast

The predicted error is the difference of the two and is higher on the forecast of growth rate of Real GDP (Figure 18). For the forecasted values of the next two years 2020 and 2021, we see any change on valuation of growth rate of Free (Figure 19).

Figure 18 - The ex ante values for the last two years for South Africa

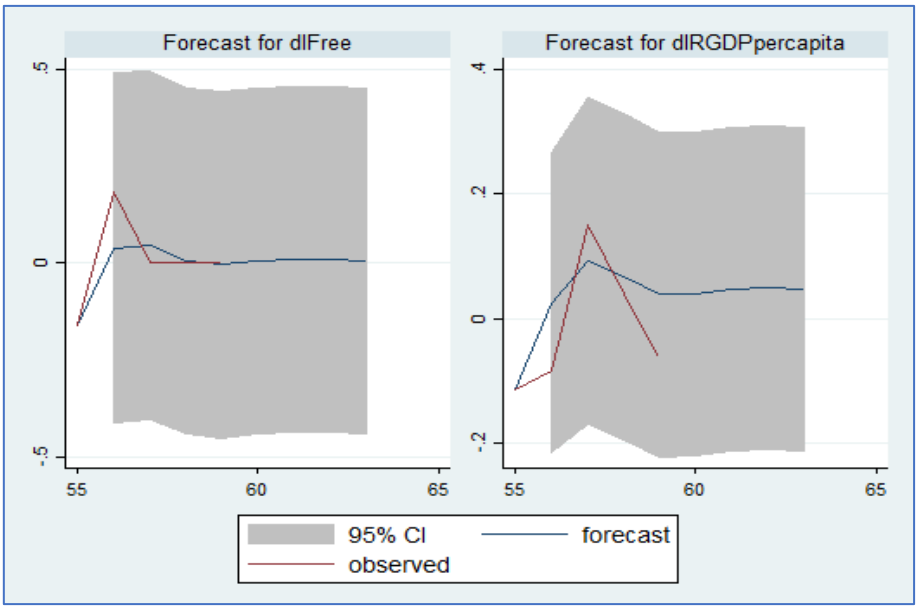
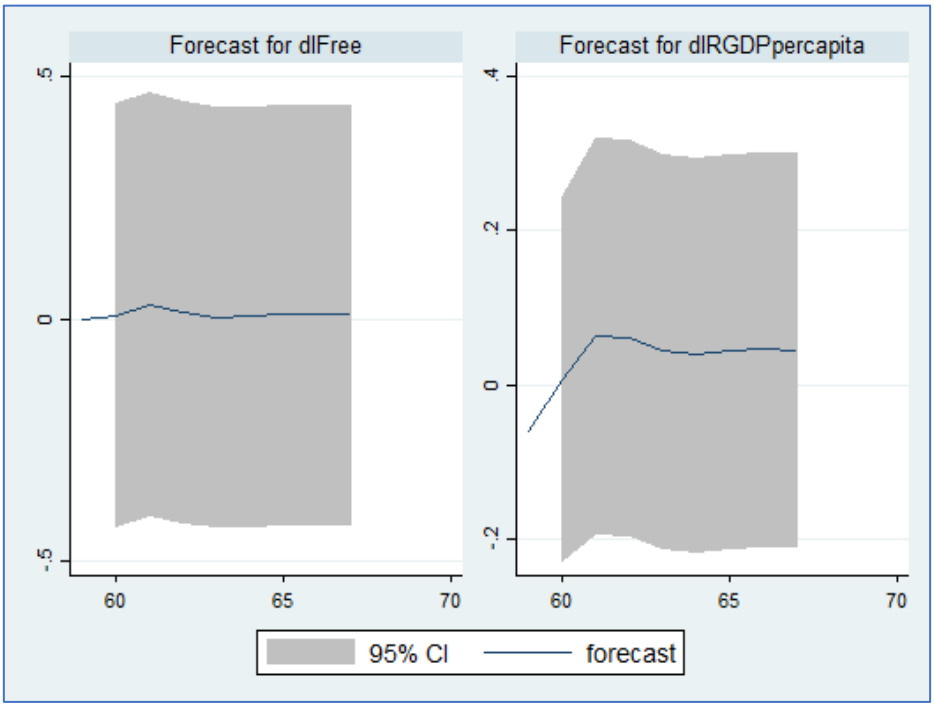


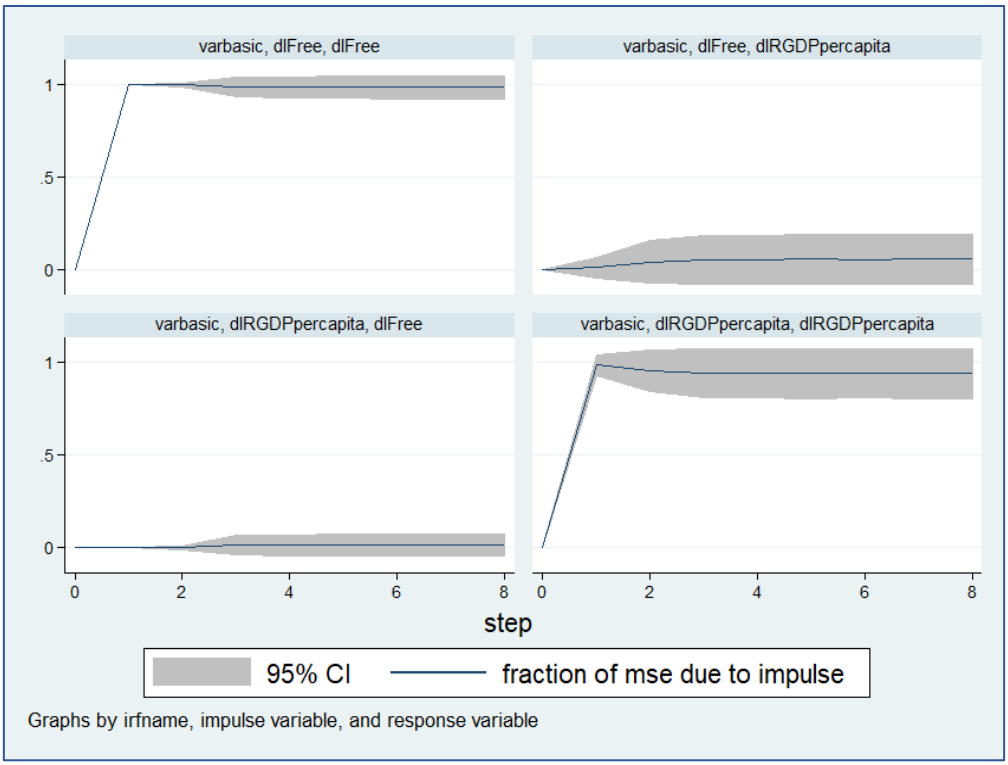
Figure 19 - The ex post forecast for the future years for South Africa



G. Variance Decomposition

In all panels of Figure 20 we can see that the uncertainty became from variable itself. This mean that if we have impulse in error term in a variable, the uncertainty reproduce will be from the on variable.

Figure 20 - Variance Decomposition for the case of South Africa



Case of Venezuela

A. Stationary

For Venezuela, out of 12 variables only four variables are stationary: Freedom House Index, Savings rate, Trade openness and Inflation rate. This happen because the P-value of Z(t) of DF with constant are lower than significant level (5%), so reject the null hypothesis. The other variables, GDP, Years of schooling, Total and the ages of Population, the Government DEBT and Gini Coefficient are all nonstationary variables (Annex F).

B. Cointegration

As in other countries, the cointegration of this case has not been studied because the main variable is already stationary.

C. Optimal Model

For comparison purposes, both Free and GDP are at growth rates for all countries under study, there are variables that are stationary. As per below, we can see a balance between the highest and lowest values. Even though the growth rate of Free Household and Real GDP per capita have a positive correlation, meaning that both variables tend to move together, in the same direction. For example, when one variable decreases the other variable decreases to, and vice-versa. The cross-correlation measurement tracks the movements of the two variables. If the growth rate of Real GDP per capita influences the growth rate of Free and the two are positively correlated, we can say that the variables are cross correlated, their behavior is positively correlated because of individual relationship to variable. The correlation of the growth rate of Free and the growth rate of Real GDP per capita with no lags is almost 0.4. When lags increase to 20 years, the correlation between level of democracy in t and Real GDP per capita in t – 20 is almost 0, so the effect of relation on growth rate of Free in growth rate of Real GDP per capita disappear when t tend to + ∞.

To choose the most useful model, we look for the Lagrange-multiplier test and verify that exist no autocorrelation in 4 lags. First look for VAR (4), with two lags difference, we obtain:

$$\begin{pmatrix} dlFree\ t \\ dlRGDPper\ capita\ t \end{pmatrix} = \begin{pmatrix} -0.0022 \\ 0.0083 \end{pmatrix} + \begin{pmatrix} -0.2712 & -0.0453 \\ -0.1892 & 0.2331 \end{pmatrix} \begin{pmatrix} dlFreet-1 \\ dlRGDPper\ capitat-1 \end{pmatrix} +$$
$$\begin{pmatrix} -0.0103 & -0.005 \\ -0.0839 & -0.1413 \end{pmatrix} \begin{pmatrix} dlFreet-2 \\ dlRGDPper\ capitat-2 \end{pmatrix} +$$
$$\begin{pmatrix} -0.1457 & 0.099 \\ 0.5556 & 0.0254 \end{pmatrix} \begin{pmatrix} dlFreet-3 \\ dlRGDPper\ capitat-3 \end{pmatrix} +$$
$$\begin{pmatrix} 0.0639 & -0.699 \\ 0.7233 & -0.0097 \end{pmatrix} \begin{pmatrix} dlFreet-4 \\ dlRGDPper\ capitat-4 \end{pmatrix}$$

For VAR (4) to be an optimal model it is necessary to test normality and stability. Using a Jarque-Bera test we can explain if the error terms have a Normal Distribution (0;1). The error term does follow a normal distribution. For testing the stability of the model, we consider the sentence "VAR satisfies stability condition", so VAR (4) is stable and normal distributed, so it is a good model.

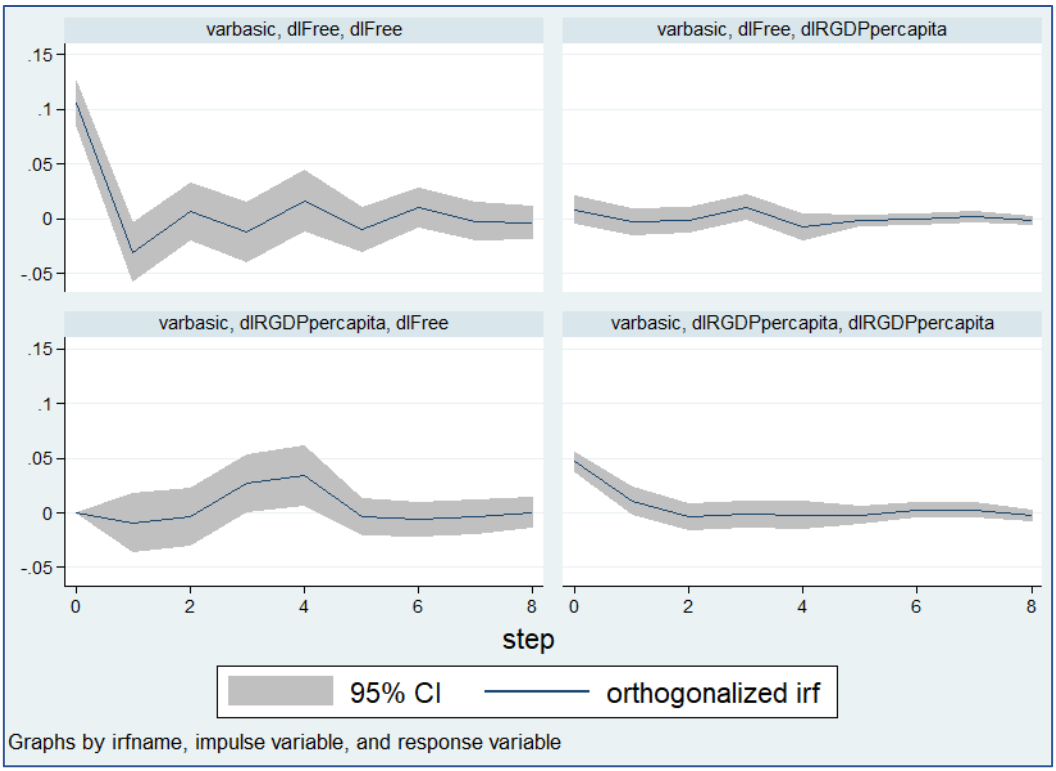
D. Granger Causality

The results obtain in this case are that one of the variables predict the other. The growth rate of Free does GC growth rate of Real GDP per capita. But the opposite doesn't happen, the growth rate of Real GDP per capita doesn't GC growth rate of Free. This mean, by Granger Causality the past values of Free House Political Rights Index will affect the Real GDP.

E. Impulse-Response Function

The top left panel of Figure 21 shows that when we have an impact on error of growth rate of Free House Political Rights Index is more evident on short run, h = 1, 2, 3 than in the long run, the effect became null. In top right panel, we don't have any shock in current and future period growth rate of Free. The bottom left panel proves some shock on the error of growth rate of Real GDP in current and future growth rate of Free but is more evident in short run despite not statistically significant.

Figure 21 - The Impulse-Response Function for the case of Venezuela



F. Point Forecast

For the observation between 2017 and 2019 we use predicted values, and we can see a gap between forecast and the observed values, the observed one fluctuate most more than the blue line (Figure 22). The last step is look for the future periods, 2020 and 2021, and we saw an increase but almost neutral evolution on the two variables (Figure 23).

Figure 22 - The ex ante values for the last two years for Venezuela

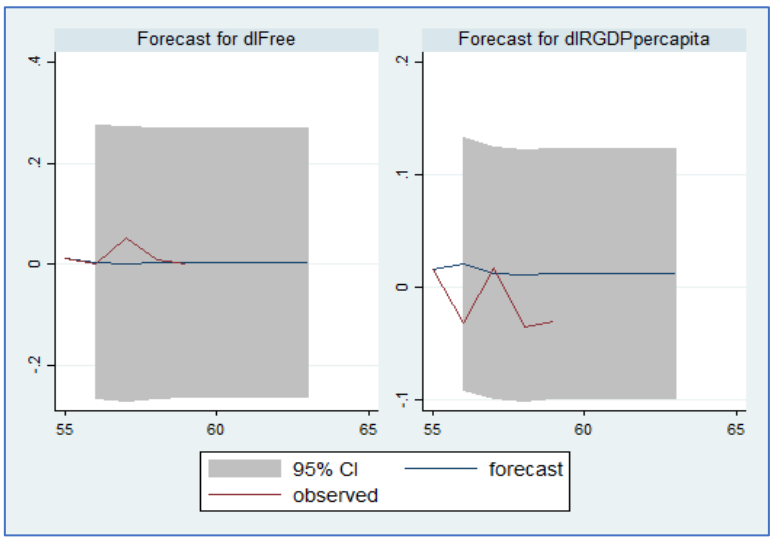
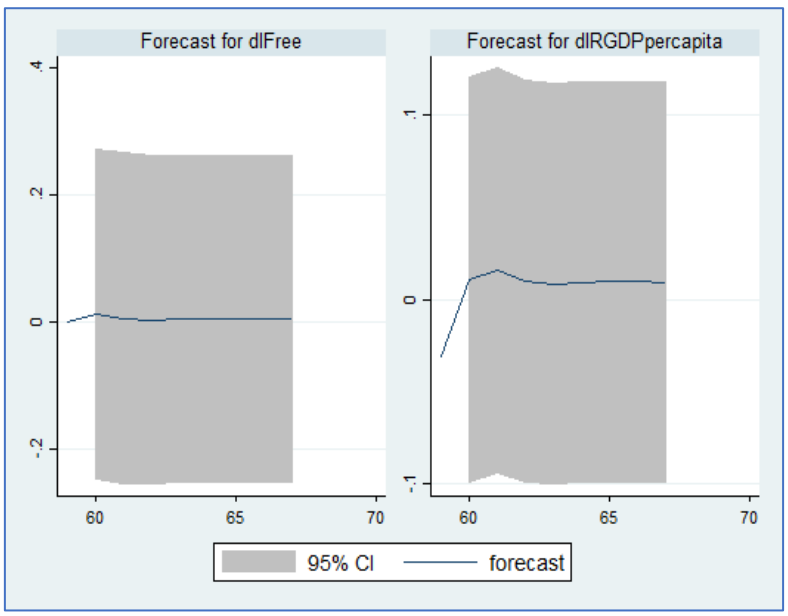


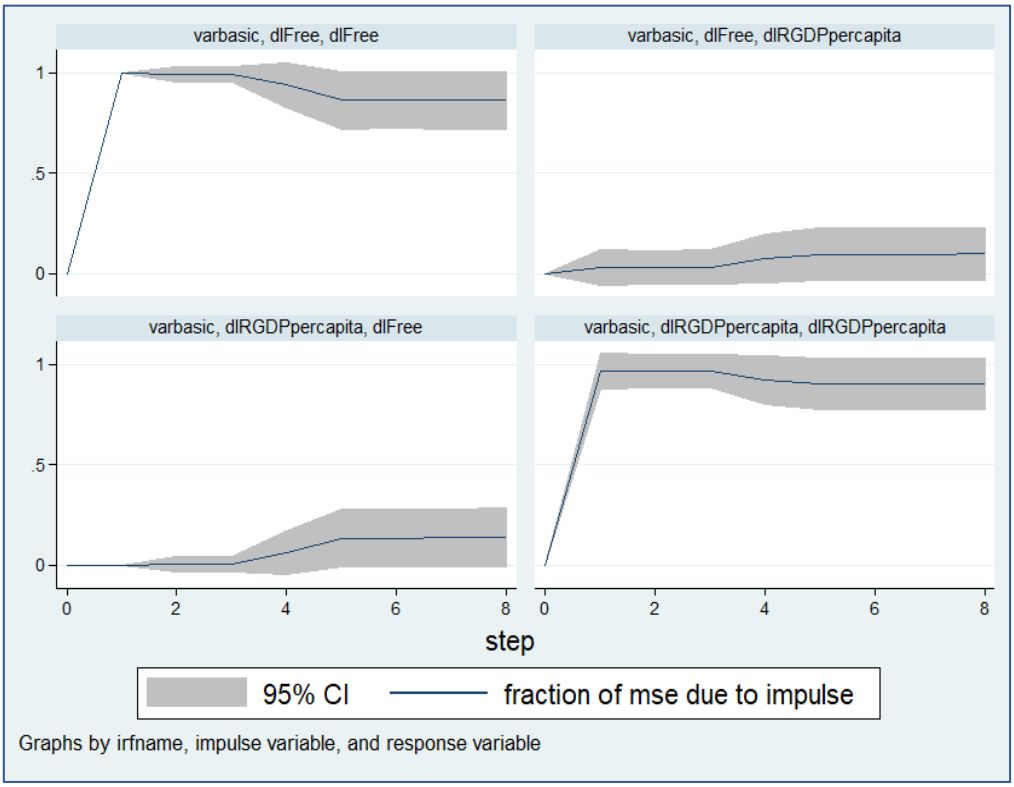
Figure 23 - The ex post forecast for the future years for Venezuela



G. Variance Decomposition

The top and bottom left panels of Figure 24 show where uncertainty on Free Political Rights Index comes from itself in short run, however, converge to some uncertainty became from real GDP per capita in long run. In the left-side uncertainty became always from variable itself.

Figure 24 - Variance Decomposition for the case of Venezuela



Case of Argentina

A. Stationary

For Argentina, out of 12 variables only four variables are stationary: Freedom House Index, Savings rate, Trade openness and Inflation rate. This happen because the P-value of Z(t) of DF with constant are lower than significant level (5%), so reject the null hypothesis. The other variables, GDP, Years of schooling, Total and the ages of Population, the Government DEBT and Gini Coefficient are all nonstationary variables (Annex G).

B. Cointegration

In the last case of the sample, the same is true as in most countries, cointegration cannot be studied.

C. Optimal Model

For comparison purposes, both Free and GDP are at growth rates for all countries under study, there are variables that are stationary. As per below, we can see a balance between the highest and lowest values. Even though the growth rate of Free Household and Real GDP per capita have a positive correlation, meaning that both variables tend to move together, in the same direction. For example, when one variable decreases the other variable decreases to, and vice-versa. The cross-correlation measurement tracks the movements of the two variables. If the growth rate of Real GDP per capita

influences the growth rate of Free and the two are positively correlated, we can say that the variables are cross correlated, their behavior is positively correlated because of individual relationship to variable. The correlation of the growth rate of Free and the growth rate of Real GDP per capita with no lags is almost 0.25. When lags increase to 20 years, the correlation between level of democracy in t and Real GDP per capita in t – 20 is almost 0, so the effect of relation on growth rate of Free in growth rate of Real GDP per capita disappear when t tend to + ∞.

To choose the most useful model, we look for the Lagrange-multiplier test and verify that exist no autocorrelation in 3 lags. First look for VAR (3), with three lags difference, we obtain:

$$\begin{pmatrix} dlFree\ t \\ dlRGDPper\ capita\ t \end{pmatrix} = \begin{pmatrix} 0.0199 \\ 0.0111 \end{pmatrix} + \begin{pmatrix} -0.0291 & -0.9309 \\ -0.0065 & 0.1185 \end{pmatrix} \begin{pmatrix} dlFreet-1 \\ dlRGDPper\ capitat-1 \end{pmatrix} + \begin{pmatrix} -0.056 & -0.3345 \\ -0.0085 & -0.1506 \end{pmatrix} \begin{pmatrix} dlFreet-2 \\ dlRGDPper\ capitat-2 \end{pmatrix} + \begin{pmatrix} -0.3324 & 0.1673 \\ -0.0203 & 0.0328 \end{pmatrix} \begin{pmatrix} dlFreet-3 \\ dlRGDPper\ capitat-3 \end{pmatrix}$$

For VAR (3) to be an "optimal" model it is necessary to test normality and stability. Using a Jarque-Bera test we can explain if the error terms have a Normal Distribution (0;1). The error term does follow a normal distribution. For testing the stability of the model, we consider the sentence "VAR satisfies stability condition", so VAR (3) is stable and normal distributed, so it is a good model.

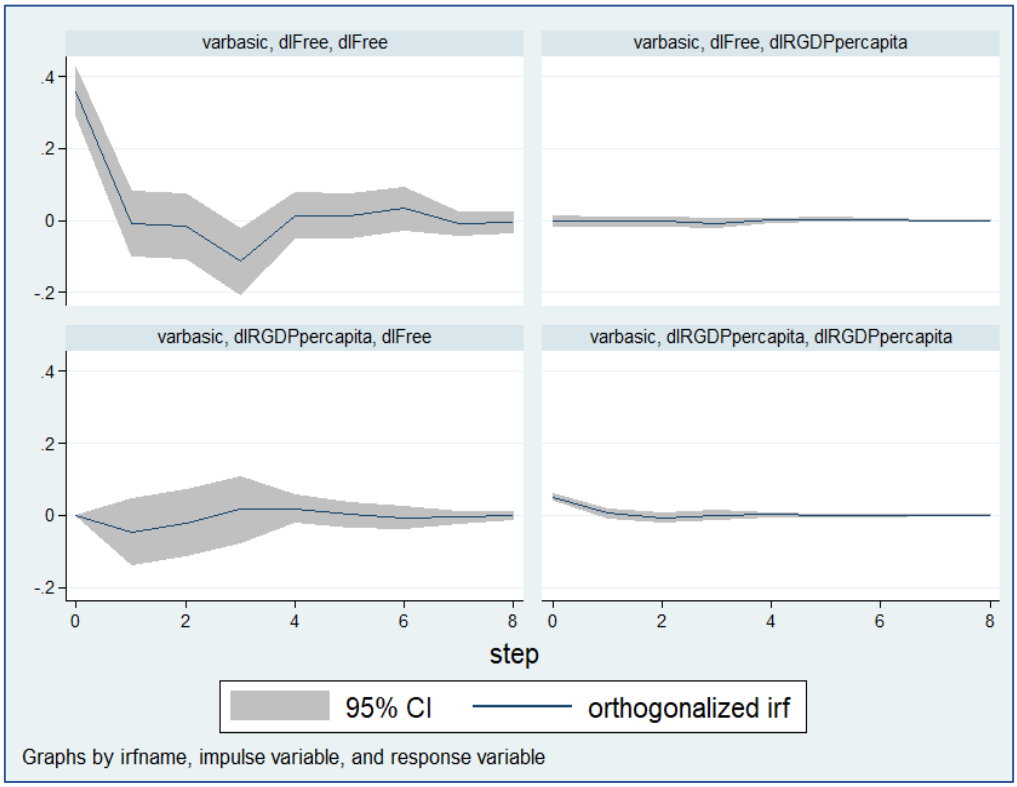
D. Granger Causality

The results obtain in this case are that none of the variables predict the other. The growth rate of Free doesn't GC growth rate of Real GDP per capita, and the growth rate of Real GDP per capita doesn't GC growth rate of Free.

E. Impulse-Response Function

The top left panel of Figure 25 shows that when we have an impact on error of growth rate of Free House Political Rights Index is evident on short run and long run. In top right panel, we don't have any shock in current and future period growth rate of Free. The bottom panel proves some shock on the error of growth rate of Real GDP in current growth rate of Free but null when the impulse and response are in growth rate of Real GDP.

Figure 25 - The Impulse-Response Function for the case of Argentina



F. Point Forecast

In case of the growth rate of Free Political Rights Index doesn't has any gap between forecast (blue line) and the observed values (red line), in 2017, 2018 and 2019. But the opposite happens in the dependent variable (Figure 26). To look for the next two years, the values are almost the same (Figure 27).

Figure 26 - The ex ante values for the last two years for Argentina

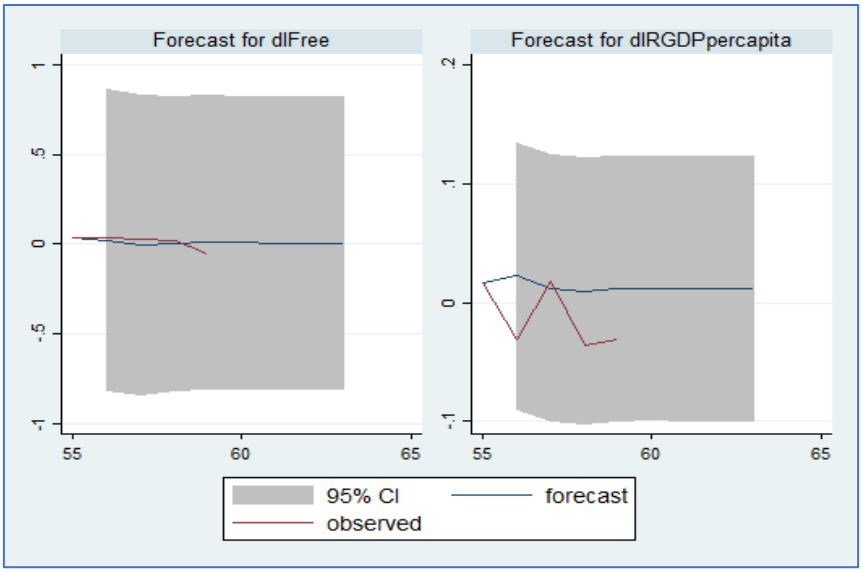
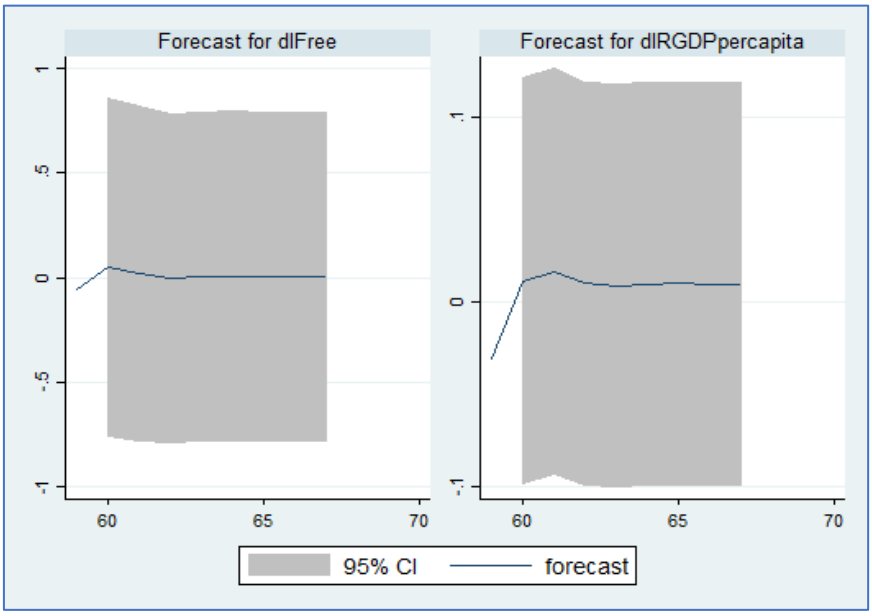


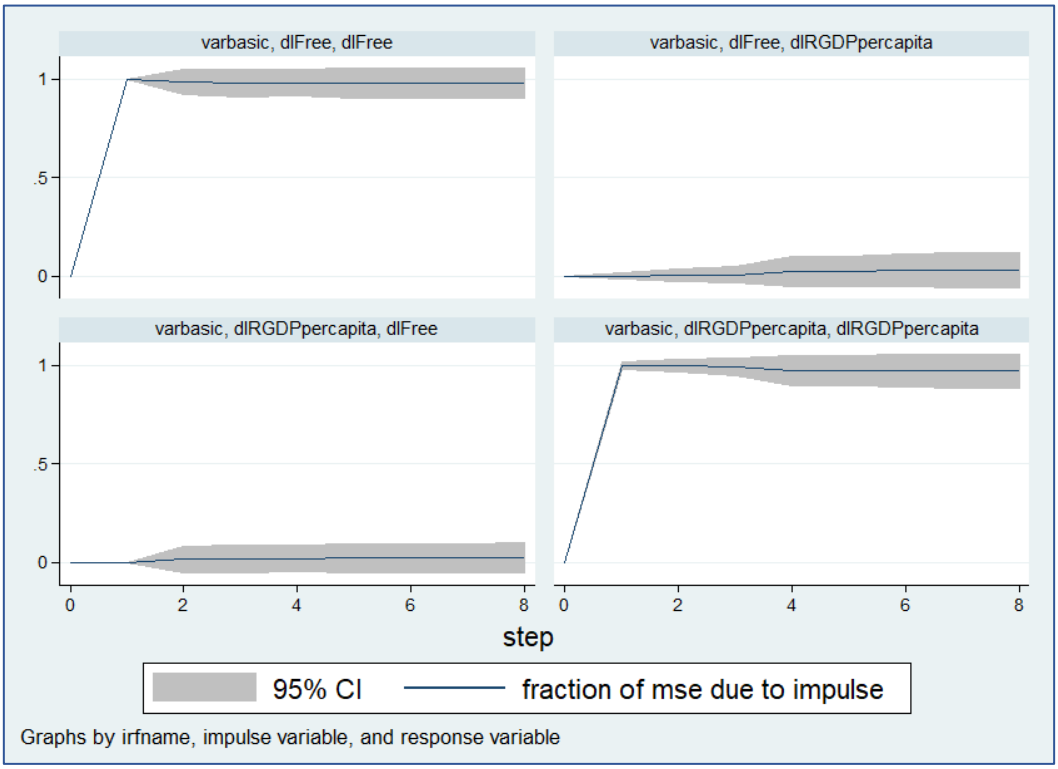
Figure 27 - The ex post forecast for the future years for Argentina



G. Variance Decomposition

The panels of Figure 28 show where uncertainty comes. And we can see that, in both cases, becomes from itself. So, the uncertainty on Free Political Rights Index comes from itself in all period and the same from uncertainty on growth rate of real GDP per capita.

Figure 28 - Variance Decomposition for the case of Argentina



4.3. Endogenous variables

A variable is called endogenous if it appears as a causal variable in a system of equations while being correlated with model errors. One possible reason is that there is a variable that has an impact on the causal and dependent variables at the same time. If the correlation between the omitted variable and the causal variable is positive, the effect of the causal variable is overestimated; if the correlation is negative, the effect is underestimated. Early studies in the labor economics literature argued that the relationship between education and labor income is endogenous (Blackburn and Neumark 1993; for a summary, see Ashenfelter et al. 1999). It can happen for several reasons, among which, the first group of omitted variables concerns the relationship between education and intelligence capacity or resistance. Second, it concerns the occupational choice itself (Block et al. 2009, Parker 2009). Riley (1979, 2002) argues that whether employers demand a high degree of education from their employees as an unproductive screening device or whether potential employees use a high degree of education to signal their ability to potential employers. The savings rate and the percentage of Debt in GDP are exogenous (external) in growth factors. The inflation rate variable proves to be exogenous. Fischer (1993) showed that inflation and growth are negatively related. More specifically, he argues that growth, investment, and productivity are negatively related to inflation and that capital accumulation and productivity growth are also negatively affected by budget deficits. An increase in inflation means that prices have gone up. With the increase in inflation, there is a fall in the purchasing power of the currency, which reduces consumption and, therefore, GDP decreases. It has been shown that in the long-run, trade openness can potentially enhance economic growth by providing access to goods and services, achieving efficiency in the allocation of resources, and improving total factor productivity through technology diffusion and knowledge dissemination (Barro & Sala-i-Martin, 1997; Rivera-Batiz & Romer, 1991).

4.4. All variables in model

The results previously obtained using a bivariate VAR may be biased due to the issue of endogeneity of variables in the model. In this section, I will include the other variables into the model depending on whether they are exogenous and stationary.

Case of Portugal

Previously the conclusion for Portugal was that only democracy could affect the income of the consumers. It may be since we are omitting variables relevant to the model. Now, the VAR model with three variables (the Freedom House Index, real GDP per capita and the years of schooling) the results appear with some significance, especially when we analyze the causality of democracy in years of schooling, that is, the higher the level of liberalism, the greater the degree of literacy. In contrast, the

saving rate and Corruption Rank will not have significance in this VAR model since the two variables do not influence the democracy and with the other variables, considering the Granger Causality test. This happens also with more three variables, such as the percentage of Debt on Real GDP, the Coefficient of Gini, and the inflation rate, will not be determined in this model. The Trade openness in Portugal means that the democracy will affect the level of resources export between the countries.

Then including the years of schooling and trade openness variables in the model:

$$\begin{pmatrix} dlFree\ t \\ dlRGDPper\ capita\ t \\ dlYearsofschooling\ t \\ dlTradeopen\ t \end{pmatrix} = \begin{pmatrix} 0.01573 \\ 0.00829 \\ 0.00363 \\ 0.01605 \end{pmatrix} + \begin{pmatrix} -0.0762 & -0.0358 & 0.0711 & -0.2144 \\ -0.9118 & 0.6297 & -0.138 & 0.5941 \\ 1.2186 & 0.2158 & 0.3726 & 0.06965 \\ -0.5401 & -0.8339 & 0.9875 & 0.164 \end{pmatrix}$$

$$\begin{pmatrix} dlFree\ t-1 \\ dlRGDPper\ capita\ t-1 \\ dlYearsofschooling\ t-1 \\ dlTradeopen\ t-1 \end{pmatrix} +$$

$$\begin{pmatrix} 0.0256 & -0.0382 & 0.0122 & -0.0083 \\ -0.5118 & -0.1578 & 0.4145 & -0.4893 \\ 0.0059 & 0.0271 & 0.1404 & -0.0748 \\ 0.3192 & -0.1314 & 0.0323 & -0.1323 \end{pmatrix} \begin{pmatrix} dlFree\ t-2 \\ dlRGDPper\ capita\ t-2 \\ dlYearsofschooling\ t-2 \\ dlTradeopen\ t-2 \end{pmatrix}$$

Now, with these two more variables, the conclusion in case of Portugal is very different. We can see causality of democracy on the other three variables, with GC P-values almost zero. The current values of the Free House Political Rights Index will affect the growth rate of the years of schooling that citizens will have and, therefore, it will fluctuate, one of the main reasons may be because in most cases dictatorial regimes consider that productivity increases with most of the population contributing to it, even if we are still talking about children starting their working lives. Regarding trade openness, which is measured as the sum of a country's exports and imports as a share of that country's GDP, this variable represents a large fraction of Portuguese production. We can see that there is a causality between the electoral regime and the amplitude of exports and imports in % GDP, since a democracy is always more exposed to possible partner countries and possible trade exchanges.

Case of USA

As with Portugal, the VAR model with the two variables of the model was not significant. It can be due to not including the other variables to the model. First, we have the case of the population's level of education, which despite the literature presenting some empirical evidence of its effect on the country's democracy, there is no causality in these variables. The same happen in case of the variables like the savings rate, the percentage of Debt of RGDP, the inflation rate, and Gini coefficient.

In the case of the Corruption rate and Trade openness variables, determinants of this model appear, as they present a P-value equal to 0.0671 and 0.0195, respectively, when we analyze whether the variable influences the future values of the Freedom House Index.

Then including the corruption rate and trade openness variables in the model:

$$\begin{pmatrix} dlFree\ t \\ dlRGDPper\ capita\ t \\ dlCorrpRank\ t \\ dlTradeopen\ t \end{pmatrix} = \begin{pmatrix} -0.0040 \\ 0.006 \\ 0.0311 \\ 0.0107 \end{pmatrix} + \begin{pmatrix} 0.1312 & 0.0352 & -4.0256 & 0.2076 \\ 0.4712 & 1 & 0.4343 & 2.0607 \\ 0.0398 & 0.0381 & -0.2568 & 0.3456 \\ 0.0269 & -0.1781 & 0.0311 & -0.5761 \end{pmatrix} \begin{pmatrix} dlFree\ t-1 \\ dlRGDPper\ capita\ t-1 \\ dlCorrpRank\ t-1 \\ dlTradeopen\ t-1 \end{pmatrix} + \begin{pmatrix} 0.4372 & 0.1078 & 1.0588 & 0.7548 \\ -0.5918 & -0.3408 & -2.4653 & -2.0436 \\ -0.019 & 0.0329 & -0.1459 & 0.2609 \\ 0.1629 & 0.0261 & 0.0313 & 0.1246 \end{pmatrix} \begin{pmatrix} dlFree\ t-2 \\ dlRGDPper\ capita\ t-2 \\ dlCorrpRank\ t-2 \\ dlTradeopen\ t-2 \end{pmatrix}$$

In opposition to the case of Portugal, this model has fewer variables with CG causality. We can verify that some effects on future values in the level of transportability of products produced in the United States of America are influenced by the present values of the level of democracy in the country, with a P-value of 0.03 inferior of 0.1, significant level.

Case of China

A totally different country, in the VAR model, the variables that are included also differ, so far it is the only one that includes the savings rate and removes the population's education rate, which can be explained by the fact that it is a highly educated country and the families save a lot because they need to cover most of the expenses with health, education and welfare, since the government charges for these services, even though a significant portion of the population receives some subsidies for health and education. Democracy rate can affect future results in consumer savings rate.

Then including the savings rate variable in the model:

$$\begin{pmatrix} dlFree\ t \\ dlRGDPper\ capita\ t \\ dlSavingsrate\ t \end{pmatrix}$$

$$= \begin{pmatrix} -0.0457 \\ 0.0419 \\ 0.0523 \end{pmatrix} + \begin{pmatrix} -0.3604 & 0.0586 & -0.4399 \\ 0.197 & 0.0742 & 0.1822 \\ -0.4399 & -0.7198 & 0.9444 \end{pmatrix} \begin{pmatrix} dlFree\ t\ -\ 1 \\ dlRGDPper\ capita\ t\ -\ 1 \\ dlSavingsrate\ t\ -\ 1 \end{pmatrix}$$

$$+ \begin{pmatrix} -0.1319 & 0.0783 & 0.2306 \\ 0.4129 & 0.0249 & 0.0493 \\ -0.1421 & -0.1759 & -0.6425 \end{pmatrix} \begin{pmatrix} dlFree\ t\ -\ 2 \\ dlRGDPper\ capita\ t\ -\ 2 \\ dlSavingsrate\ t\ -\ 2 \end{pmatrix}$$

Although the influence is almost non-existent, one can see some impact of the Chinese political regime on the level of consumer savings, one of the reasons may be the lack of predictability that may exist in dictatorial regimes, that is, they may impose extremist measures that can change fully the lives of citizens.

Case of Tunisia

We include the initial variable, years of schooling, to see if the results are different. Now, the VAR model with the three variables (Freedom House Index, real GDP per capita and years of schooling) has results that do not seem significant. Granger causality does not exist between variables, so past values do not affect future values of other variables. However, we need to know whether the problem of non-causality remains when we include real GDP per capita in the VAR model. In this sense, the results are the same as those found above, in the case of Tunisia, the level of education may not be decisive for the model.

Now, including the variable that explain the savings of consumers, the consequences are different. We can see some causality effect of Freedom House Index on the savings rate. But not the opposite, the savings rate will not affect the other variables in the model. This is even more evident when we analyze the VAR model with only the two variables, with P-value equal to zero. This means that we need to involve this variable in the original model.

The third variable the corruption rank of the country doesn't influence the level of democracy, this is show with the betas of each variables and the P-values higher than the significant value. The same happen with the percentage of Debt on GDP, despite the P-value of the test of Granger causality in VAR model with the two variables is very close to 0,1 but the conclusion is that variable doesn't have significant for the model. The last variable, the trade openness of the economy, we can see some implication of Freedom House Index on that variable, taking the Granger Causality test.

For Tunisia, the VAR model can be composed by the variable of Freedom House Index, real GDP per capita, the savings rate and trade opens of the economy:

$$\begin{pmatrix} dlFree\ t \\ dlRGDPper\ capita\ t \\ dlSavingsrate\ t \\ dlTradeopen\ t \end{pmatrix}$$

$$= \begin{pmatrix} 0.1059 \\ 0.01558 \\ -0.4268 \\ 0.0127 \end{pmatrix}$$

$$+ \begin{pmatrix} -0.2546 & 0.0292 & -0.1086 & -0.9416 \\ -1.8712 & 0.079 & -0.3499 & 0.024 \\ -0.9131 & -0.0049 & -0.1141 & -0.0089 \\ 1.528 & 0.0625 & -0.1429 & -0.0691 \end{pmatrix} \begin{pmatrix} dlFree\ t-1 \\ dlRGDPper\ capita\ t-1 \\ dlSavingsrate\ t-1 \\ dlTradeopen\ t-1 \end{pmatrix}$$

$$+ \begin{pmatrix} 0.1248 & 0.0145 & -0.0846 & -0.1061 \\ -2.6404 & 0.4281 & 0.2883 & 0.0072 \\ 0.8592 & 0.0144 & -0.1638 & -0.0857 \\ 0.4149 & -0.0628 & 0.701 & 0.0262 \end{pmatrix} \begin{pmatrix} dlFree\ t-2 \\ dlRGDPper\ capita\ t-2 \\ dlSavingsrate\ t-2 \\ dlTradeopen\ t-2 \end{pmatrix}$$

This is the case that the influence of the Freedom House Political Rights indicator on the other variables that in a country like Tunisia is verified that both the level of consumer savings and the opening to other economies over the period of 1960 to 2019, with P-value very close to zero in tree variables. The influencing variable has varied considerably during the years of analysis, with an abrupt decrease in the savings rate and, on the opposite side, an increase in the percentage of engaged in the global trading system.

Case of South Africa

Like China, many variables aren't important to explain the dependent variable and we don't have causality effect. The only one that we can consider some effect is the percentage of Debt on GDP, the P-value is almost 0.1, but is lower. This means that the present values of democracy would affect the future ones of Debt.

$$\begin{pmatrix} dlFree\ t \\ dlRGDPper\ capita\ t \\ dlDebt\ t \end{pmatrix}$$

$$= \begin{pmatrix} 0.0101 \\ 0.0446 \\ 0.0048 \end{pmatrix} + \begin{pmatrix} -0.2477 & -0.0706 & -0.0575 \\ 0.1401 & 0.3546 & 0.06 \\ 0.7625 & -0.332 & 0.4902 \end{pmatrix} \begin{pmatrix} dlFree\ t\ -\ 1 \\ dlRGDPper\ capita\ t\ -\ 1 \\ dlDebt\ t\ -\ 1 \end{pmatrix}$$

$$+ \begin{pmatrix} -0.0462 & -0.0801 & 0.0485 \\ -0.2323 & -0.2955 & -0.0349 \\ 0.1519 & 0.0687 & 0.0125 \end{pmatrix} \begin{pmatrix} dlFree\ t\ -\ 2 \\ dlRGDPper\ capita\ t\ -\ 2 \\ dlDebt\ t\ -\ 2 \end{pmatrix}$$

As mentioned before, in this model we can only analyze a P-value lower than the level of significance in the case of democracy influencing the percentage of debt in relation to GDP. More democratic countries will tend to consider the opinions of citizens, which may lead to greater use of public money to satisfy needs.

Case of Venezuela

This country was the only one that we didn't find a single variable to explain the level of democracy, all the P-values are superior to the level of significance. So, the initial model with only the Real GDP is that we use in this section, a VAR (4).

Case of Argentina

As it happened in the South African model, the only variable that becomes decisive in the model is the percentage of debt in GDP.

$$\begin{pmatrix} dlFree\ t \\ dlRGDPper\ capita\ t \\ dlDebt\ t \end{pmatrix} = \begin{pmatrix} 0.0332 \\ 0.0009 \\ 0.1215 \end{pmatrix} +$$
$$\begin{pmatrix} -0.6021 & 0.0497 & -0.8608 \\ -0.5256 & 0.3587 & -3.006 \\ -0.0936 & 0.085 & -0.3336 \end{pmatrix} \begin{pmatrix} dlFree\ t\ -\ 1 \\ dlRGDPper\ capita\ t\ -\ 1 \\ dlDebt\ t\ -\ 1 \end{pmatrix} +$$
$$\begin{pmatrix} -0.5782 & -0.1354 & 0.2911 \\ 0.0986 & 0.2439 & -2.695 \\ -0.1286 & 0.06 & -0.3291 \end{pmatrix} \begin{pmatrix} dlFree\ t\ -\ 2 \\ dlRGDPper\ capita\ t\ -\ 2 \\ dlDebt\ t\ -\ 2 \end{pmatrix} +$$
$$\begin{pmatrix} -0.0495 & -0.1235 & 0.2616 \\ -0.5813 & 0.1617 & -1.556 \\ -0.1337 & 0.0849 & -0.6685 \end{pmatrix} \begin{pmatrix} dlFree\ t\ -\ 3 \\ dlRGDPper\ capita\ t\ -\ 3 \\ dlDebt\ t\ -\ 3 \end{pmatrix}$$

Although we did not find any influence of the main variable in VAR (3), in this case, the variable we included has a P-value in the Granger Causality test which shows that the present values of the Debt percentage will influence the level of democracy in the future despite being a P -value equal to 0.09.

5. Discussion

5.1. Limitations

VAR models, of course, have their limitations, which have been the subject of a great deal of research in the following decades. Two limitations are often reminded. The first refers to the high number of parameters of the VAR models, reflected in the sample size needed to obtain a reliable estimate. The second concerns the fact that each VAR model is simply a "reduced form", that is, the same relationships between variables and their lags are simultaneously compatible with several different models that also describe contemporary relationships between variables (called "forms structures”). One of the limitations that we will always have in this type of study is the lack of variability over time for some variables of the model, such as Free, which is also one of the reasons why I chose certain countries, such as Argentina or Venezuela. Also, some variables become exogenous to the VAR model and therefore cannot be included in it.

5.2. Future Studies

We suggest that future studies be carried out with a complementarity of disciplines, that is, show more how a political regime can influence economies so much. That is, complement it with support from the areas of political economy or whether in the future there will be economies that will suffer "reprisals" for more influence from democracy. Additionally, it is also interesting to think about how to reinvent democracy for the new era ahead, as will be done by the Future of Democracy Program, which will bring together thoughtful leaders and thinkers to develop new ideas on how to reinvent democratic institutions and rebuild the public square for the 21st century.

When analyzing democracy, it is also considered whether public administrations manage to find a balance between efficiency and democracy in defining their agendas and actions. For example, and more specifically, whether it will be important to continue to develop social and healthy mechanisms to support active aging, with quality of life in retirement, and not continue to make financial cuts in pensions for the elderly. On the other hand, and because democratic practice extends to all mechanisms of provision of the common good, if economic growth could also be offset with measures that develop greater support for maternity, whether in terms of legislation applied to the labor market, either in terms of support in health centers and other hospital organics, in terms of education and legal support, if necessary and/or applicable.

6. Conclusion

This study analyzes the relationship between the level of democracy and per capita income in a sample of selected countries, regardless of whether they are democratic or non-democratic, developed, or underdeveloped, and with high or low per capita income. In addition to studying the impact of democracy on per capita income (i.e., real Gross Domestic Product per capita), by using a VAR model, we were also able to study the inverse, the impact on democracy on other variables. The results obtained are quite different when compared to the sample under analysis, that is, between countries, and from there we were able to draw important conclusions. First, when the bivariate VAR models only contain the real GDP variable, in no country does income per capita influence democracy, even though some articles show this influence. Second, this situation remains when we separately place the variables in the VAR model that are significant for each country, that is, these variables become influenced by democracy but do not influence income.

Estimates reveal that democracy has a non-negligible effect on per capita income, as previously reported in Acemoglu (2014) and Madsen, Raschky and Skali (2015) in contrast to relevant literature such as Doucouliagos and Ulubasoglu (2008) and Kurzman, Werum and Burkhart (2002). As explained above, the initial model was smaller and had only two variables, but we found some influence of the political regime on economic growth in three countries, such as Portugal, Tunisia, and Venezuela. In the period of analysis, 1960-2019, there were different phases in these countries. Portugal faced a fall in the existing dictatorship until 1974. In the case of Tunisia, many consider that “true democracy” is lacking, despite the spread of the movement known as the Arab Spring, which began in 2010. Venezuela has lived for several years in a democracy but with persistent political instability, which extends into daily life, with increasing levels of violence and low purchasing power. Of course, it's no coincidence that the world's leading developed or prosperous countries have developed democratic systems. The creation or membership of associations such as the European Union may also emerge as another variable that will increase the level of democracy and may increase per capita income.

When additionally, we put variables in the model, the conclusions differ in certain situations. The examples given earlier in Portugal and Tunisia in this section have the same conclusions, that is, in addition to the domestic product, the democratic level will affect the years of schooling and the opening of the country to international trade. One of the reasons could be the fact that there was a great evolution of these two variables over the period of analysis.

Of the countries that before had no impact of the political regime on the level of per capita income, such as the United States of America, China, Argentina, and South Africa. Now, in addition to the trade opening variable, the level of consumer savings and the percentage countries' debt is also seen to have

some influence. However, this last variable is not very high in the countries in question, be it South Africa or Argentina (with a percentage around 70% or 90%, respectively).

Studying with a large amount of data gives the chance to include different time points for each country, making an analysis even more specific. Determining the effect of democracy on the per capita income of countries that have suffered coups d'état separately for different regions with big data will also be beneficial. And one can add some of the regional factors, such as language, historical ties, culture, commercial relations and/or economic integrations. To analyze the determinants of democracy in a similar vein, additional research is also needed.

The potential effects of democracy on economic growth, the possible conditional relationship between income and democracy, and the impact of various human factors and time variables on the evolution of political institutions appear to be important areas for further theoretical and empirical research.

References

Acemoglu, D., Johnson, S., Robinson, J. A., & Yared, P. (2008). *Income and Democracy*. American Economic Review, Vol. 98 (no. 3), 808–842.

Acemoglu, D., Naidu, S., Restrepo, P., & Robinson, J. A. (2019). *Democracy Does Cause Growth*. Journal of Political Economy, Vol. 127 (no. 1), 47-100.

Acemoglu, D., Johnson, S., & Robinson, J. A. (2005*). The Rise of Europe: Atlantic Trade, Institutional Change, and Economic Growth*. American Economic Review, Vol. 95 (no. 3), 546–79.

Barro, R. (1996). *Democracy and Growth*. Journal of economic growth, Vol. 1 (no. 1), 1-27.

Barro, R. (1999). *Determinants of Democracy*. Journal of Political Economy, Vol. 107 (no. 6).

Blaydes, L., & Kayser, M. (2011). *Counting Calories: Democracy and Distribution in the Developing World*. Internat. Studies Q. Vol. 55 (no. 4), 887–908.

Doucouliagos, H., & Ulubasoglu, M. (2008). *Democracy and Economic Growth: A Meta-Analysis.* American World of Political Science.

Enders, W. (2004). *Applied econometric time series*. J. Wiley.

Frankel, J., & Romer, D. (1999). *Does Trade Cause Growth?*. American Economic Review, Vol. 89 (no.3), 379–99.

Geelmuyden, E., Knutsen, C., & Hegre, H. (2020). *The determinants of democracy: a sensitivity analysis.* Public Choice, Vol. 185, 87–111.

Giuliano, P., Mishra, P., & Spilimbergo, A. (2013). *Democracy and Reforms: Evidence from a New Dataset*. American Economic Journal: Macroeconomics 5 (4), 179–204.

Hausman, J. (1978). *Specification Tests in Econometrics*. Econometrica, Vol. 46 (no. 6), 1251-71.

Jetter, M., Agudelo, A., & Hassan A. (2015). *The Effect of Democracy on Corruption: Income is Key.* World Development, Vol. 74, 286–304.

Kejriwaly, M., & Zhaoz, H. (2019). *Revisiting the Democracy-Growth Nexus: New Evidence from a Dynamic Common Correlated Effects Approach.* Purdue University Economics Department Working Paper No 1317.

Kurzman, C., Werum, R., & Burkhart, R. (2002). *Democracy's Effect on Economic Growth: A Pooled Time-Series Analysis, 1951–1980*. Studies in Comparative International Development, Vol. 37, 3-33.

Madsen, J. Raschkya P., & Skalib, A. (2015). *Does democracy drive income in the world, 1500–2000?*. European Economic Review, Vol. 78, 175-195.

McCarty N., Poole K. & Rosenthal H. (2003). *Political Polarization and Income Inequality*. World Politic.

Murtin, F., & Wacziarg, R. (2011). *The Democratic Transition.* Journal of Economic Growth, No. 8599.

Przeworski, A., & Limongi, F. (1993). *Political Regimes and Economic Growth,* Journal of Economic Perspectives, Vol. 7 (no. 3), 51-69.

Rode, M., & Gwartney J. (2012). *Does Democratization Facilitate Economic Liberalization?*. European J. Polit. Econ. 28 (no. 4), 607–19.

Saray, M. (2018). *The effect of democracy on income: An analysis of countries affected by coups d'état.*

Sunde, U. & Cervellati, M. (2014). *Democratizing for Peace? The Effect of Democratization on Civil Conflicts*. Oxford Econ. Papers 66 (no. 3), 774–97.

Tavares, J., & Wacziarg, R. (2001). *How Democracy Affects Growth*. European economic review, Vol. 45 (no. 8), 1341-1378.

Treisman, D. (2013). *Democratization over Time*. Manuscript, Dept. Polit. Sci., Univ. California, Los Angeles.

Appendix

1. Results of Dickey–Fuller test for Stationary

Annex A – Case of Portugal

Variable	P	P-value of DF_C / DF_{CT}	Result	Model
Freedom House Index	1	0,0785 < 0,1	Reject H_0 – Stationary variable	Level model
RGDPpercapita	2	0,5498 > 0,1 0,2491> 0,1	Accept H_0 – Nonstationary variable	First differences model with 1 lag
Years of schooling	5	0,0302 > 0,01 0,8207 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 4 lags
Savings rate	4	0,1624 > 0,1 0,1648 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 3 lags
Population	5	0,0579 > 0,05 0,5213 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 4 lags
Population < 14	5	0,3487 > 0,1 0,3972 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 4 lags
Population < 64	5	0,0331 > 0,01 0,9136 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 4 lags
Population > 65	3	0,9588 > 0,1 0,2780 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 2 lags
Corruption Rank	1	0,0892 > 0,05 0,8147 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 1 lag
Government DEBT (%)	2	0,1374 > 0,1 0,2364 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 1 lag
Inflation rate	3	0,10 > 0,1	Reject H_0 – Stationary variable	Level model

Trade openness (%)	1	0,1079 > 0,1 0,0113 > 0,01	Accept H_0 – Nonstationary variable	First differences model with 1 lag
Gini Coefficient	0	0 < 0,1	Reject H_0 – Stationary variable	Level model

Annex B - Case of USA

Variable	P	P-value of DF_C / DF_{CT}	Result	Model
Freedom House Index	3	0,0742 < 0,1	Reject H_0 – Stationary variable	Level model
RGDPpercapita	2	0,5498 > 0,1 0,2491 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 1 lag
Years of schooling	1	0,0001 < 0,01 0,691 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 1 lag
Savings rate	1	0,1189 > 0,1 0,762 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 1 lag
Population	3	0,3628 > 0,1 0,4464 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 2 lags
Population < 14	2	0,0069 < 0,01	Reject H_0 – Stationary variable	Level model
Population < 64	2	0,0798 > 0,05 0,7965 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 1 lag
Population > 65	3	0,8866 > 0,1 0,2444 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 2 lags
Corruption Rank	1	0,0321 > 0,01 0,2938 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 1 lag
Government DEBT	2	0,4266 > 0,1 0,3599 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 1 lag
Inflation rate	4	0,0589 < 0,1	Reject H_0 – Stationary variable	Level model
Trade openness	1	0,1378 > 0,1 0,1119 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 1 lag

Gini Coefficient	1	0,527 > 0,1 0,0384 > 0,01	Accept H_0 – Nonstationary variable	First differences model with 1 lag

Annex C - Case of China

Variable	P	P-value of DF_C / DF_{CT}	Result	Model
Freedom House Index	1	0,0183 < 0,1	Reject H_0 – Stationary variable	Level model
RGDPpercapita	4	0,571 > 0,1 0,9272> 0,1	Accept H_0 – Nonstationary variable	First differences model with 3 lags
Years of schooling	1	0,5989 > 0,1 0,54 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 1 lag
Savings rate	3	0,0158 > 0,01 0,3863 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 2 lags
Population	8	0,0212 > 0,01 1 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 7 lags
Population < 14	7	0,1057 > 0,1 0,0257 > 0,01	Accept H_0 – Nonstationary variable	First differences model with 6 lags
Population < 64	7	0,0164 > 0,01 1 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 6 lags
Population > 65	3	0,98 > 0,1 1 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 2 lags
Corruption Rank	1	0,0596 > 0,01 0,5035 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 1 lag
Government DEBT	1	0,3705 > 0,1 0,1455 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 1 lag
Inflation rate	3	0,0066 < 0,1	Reject H_0 – Stationary variable	Level model
Trade openness	1	0,1329 > 0,1 0,9408 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 1 lag

Gini Coefficient	3	0,2841 > 0,1 0,288 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 2 lags

Annex D - Case of Tunisia

Variable	P	P-value of DF_C / DF_{CT}	Result	Model
Freedom House Index	1	0,0468 < 0,1	Reject H_0 – Stationary variable	Level model
RGDPpercapita	1	0,618 > 0,1 0,765 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 1 lag
Years of schooling	2	0,3512 > 0,1 0,7906 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 1 lag
Savings rate	2	0,1853 > 0,1 0,5805 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 1 lag
Population	5	0,1428 > 0,1 0,4867 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 4 lags
Population < 14	5	0,0705 > 0,05 0,7675 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 4 lags
Population < 64	7	0,0006 < 0,01 0,4815 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 6 lags
Population > 65	4	0,9741 > 0,1 0,8165 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 3 lags
R&D	5	0,7442 > 0,1 1 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 4 lags
Researchers in FTE	1	0,2062 > 0,1 0 < 0,1	Accept H_0 – Nonstationary variable	First differences model with 1 lag
Corruption Rank	1	0,15 > 0,1 0,9377 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 1 lag
Government DEBT	1	0,2931 > 0,1 0,8257 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 1 lag

Inflation rate	1	0 < 0,1	Reject H_0 – Stationary variable	Level model
Trade openness	1	0,1134 > 0,1 0,0606 > 0,05	Accept H_0 – Nonstationary variable	First differences model with 1 lag
Gini Coefficient	1	0,3275 > 0,1 0,2148 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 1 lag

Annex E – Case of South Africa

Variable	P	P-value of DF_C / DF_{CT}	Result	Model
Freedom House Index	1	0, 1155 > 0,1 0,6682 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 1 lag
RGDPpercapita	7	0,1058 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 6 lags
Years of schooling	1	0,0520 > 0,05 0,9533 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 1 lag
Savings rate	7	0,0549 < 0,1	Reject H_0 – Stationary variable	First differences model with 6 lags
Population	5	0,6424 > 0,1 0,1507 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 4 lags
Population < 14	6	0,0179 > 0,01 0,9648 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 5 lags
Population < 64	2	0,2104 > 0,1 0,4322 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 1 lag
Population > 65	7	0,9934 > 0,1 0,9944 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 6 lags
Corruption Rank	1	0,0499 < 0,1	Reject H_0 – Stationary variable	Level model
Government DEBT	3	0,4854 > 0,1 0,9923 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 2 lags
Inflation rate	7	0,0546 < 0,1	Reject H_0 – Stationary variable	Level model
Trade openness	1	0,0160 < 0,1	Reject H_0 – Stationary variable	Level model

Annex F - Case of Venezuela

Variable	P	P-value of DF_C / DF_{CT}	Result	Model
Freedom House Index	1	0,0422 < 0,1	Reject H_0 – Stationary variable	Level model
RGDPpercapita	1	0,0967 > 0,05 0,3925 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 1 lag
Years of schooling	1	0,3501 > 0,1 0,6445 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 1 lag
Savings rate	1	0,0038 < 0,01	Reject H_0 – Stationary variable	First differences model with 1 lag
Population	8	0,0174 > 0,01 1 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 7 lags
Population < 14	7	0,2879 > 0,01 1 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 6 lags
Population < 64	7	0 < 0,1 1 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 6 lags
Population > 65	7	0,9802 > 0,1 1 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 6 lags
Corruption Rank	6	0,1321 > 0,1 0.9424 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 5 lags
Government DEBT	2	0,0188 > 0,01 0,0610 > 0,05	Accept H_0 – Nonstationary variable	First differences model with 1 lag
Inflation rate	2	0,0045 < 0,1	Reject H_0 – Stationary variable	Level model
Trade openness	1	0,0020 < 0,1	Reject H_0 – Stationary variable	Level model

Annex G - Case of Argentina

Variable	P	P-value of DF_C / DF_{CT}	Result	Model
Freedom House Index	1	0,0145 < 0,1	Reject H_0 – Stationary variable	Level model
RGDPpercapita	1	0,0967 > 0,05 0,3925 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 1 lag
Years of schooling	1	0,0509 > 0,05 0,8452 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 1 lag
Savings rate	1	0,0226 < 0,05	Reject H_0 – Stationary variable	Level model
Population	3	0, 5740 > 0, 1 0,0476> 0,01	Accept H_0 – Nonstationary variable	First differences model with 2 lags
Population < 14	2	0,0203 > 0,01 0,3736 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 1 lag
Population < 64	6	0,8508 > 0,1 0,6043 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 5 lags
Population > 65	8	0,9987 > 0,1 0,9343 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 7 lags
Corruption Rank	6	0,1376 > 0,1 0,9967> 0,1	Accept H_0 – Nonstationary variable	First differences model with 4 lags
Government DEBT	2	0,0175 > 0,01 0,3420 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 1 lag
Inflation rate	2	0,0007 < 0,1	Reject H_0 – Stationary variable	Level model
Trade openness	1	0,1391 > 0,1 0,5121 > 0,1	Accept H_0 – Nonstationary variable	First differences model with 1 lag

2. Results of Dickey–Fuller test for Cointegration

Annex H – Case of South Africa

```
. dfuller lFreeRGDPpercapitaresid, regress noconst lags(1)

Augmented Dickey-Fuller test for unit root         Number of obs   =        58

                                 ------------ Interpolated Dickey-Fuller ------------
                 Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value            Value
------------------------------------------------------------------------------
 Z(t)            -1.810            -2.617            -1.950           -1.610
------------------------------------------------------------------------------

------------------------------------------------------------------------------
D.
lFreeRGDPpercapitaresid |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
------------------------+-----------------------------------------------------
lFreeRGDPpercapitaresid
                   L1.  |  -.1132061   .0625426    -1.81   0.076    -.238494    .0120818
                   LD.  |   .0518171   .1336031     0.39   0.700    -.215822    .3194562
------------------------------------------------------------------------------
```