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# Democracy, Economic Growth and the Identification Problem in Macroeconomics

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# Democracy, Economic Growth and the Identification Problem in Macroeconomics

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Abstract

This article analyzes and deals with the so-called "identification problem" in macroeconomics to study the causal relationships between the type of political regime and the path of medium and long-term economic growth with a time series approach. Taking as a starting point the estimation of an Autoregressive Vector (VAR), the identification problem is presented, and then the solution strategies used in the macroeconomic literature to trace and estimate the consequences of democratic shocks on per capita GDP growth are explained. The article presents novel empirical evidence for the neo-institutionalist literature, exploiting long-term series of the Polity index and GDP per capita. Thus, it is possible to estimate the effects of democratic improvements on economic growth. For the 13 countries analyzed, the results are diverse, so the statement that "*democracy does causes growth*" must be qualified and put into each country-specific historical context.

Key words: *Democracy, Economic Growth, Time-series*

JEL Classification:*C30, O11, O43, O47, P16*

## *1. Introduction*

The objective of the empirical research program in macroeconomics is to identify historical regularities in the relationships between a set of variables and to understand how unanticipated changes in some of them impact on, and propagate in the economic structure. The efforts towards this objective are framed in the search for an adequate

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mixture between good economic theory, empirical evidence and a convincing historical narrative.

Macroeconomics has been guided by a series of key questions: What are the effects of an unanticipated change or monetary policy shock? What are the consequences for growth or consumption of an unprecedented fiscal boost? What effects does a "technological shock" or productivity have on product and leisure-work decisions? What are the long-term determinants of economic growth and the causes of its cycles?

To answer these questions, modern macroeconomic time series thinking and modeling is based on the idea that the economic system is driven, moment by moment, by structural shocks. Thus, the main challenge of empirical work in macroeconomics consists in trying to evaluate the impacts of the so-called "policy variables" on the economic system.

In this type of inference, the estimation of "identified moments", or in other words, the estimation of the responses to the identified structural shocks, plays a key role. The equivalent of this exercise in applied microeconomics is called the estimation of causal effects.

In an economic system, a shock spreads dynamically and its effects are captured through statistics, such as the analysis of variance decomposition and in particular through the estimation of the impulse-response functions (IRFs) and accumulated impulse-response functions (AIRFs).

In an ideal model, the estimated coefficients of the VAR would reflect agents' decisions at the macro-level. The economic system in this sense is the result of these exogenous shocks plus the responses of economic agents.

The problem is that the mere estimation of the VAR only illustrates the historical regularities of the statistical relationships between the variables, and does not allow us to draw any conclusions about the possible economic or structural relationships between them. A VAR by definition is a-theoretical and, in order to turn it into a tool that reflects some underlying economic theory and therefore allows for testing alternative hypotheses, it must deal with the identification problem by making certain *identification assumptions*.

In this article, two strategies are reviewed to address the identification problem. The first consists of assuming a temporal order of causality between the variables, obtaining a series of orthogonal shocks or, analogously, a system of linearly independent linear equations. These assumptions are usually justified based on the framework defined by the research question, the attempt to test the predictions of a theoretical model and the previous evidence. Making these assumptions is equivalent to imposing certain restrictions on the estimation of the VAR, assuming a priori that some coefficients are null, thus making it possible to isolate and trace the effects of a given innovation or disturbance. These restrictions can be short-term (Sims, 1980) or long-term, as introduced in the

literature by Blanchard and Quah (1989). A refinement of this strategy is to obtain IRF and AIRF that do not depend on this pre-defined ordering. The latter are the so-called Generalized Impulse Response Functions (Pessaran and Shin, 1998) that are often used to confirm the robustness of the results obtained.

A second approach to solving the identification problem goes from the general to the specific and allows a choice between over-identified models. This approach was defended early by Sargan (1980) and later developed in Krolzig and Hendry, (2001) Campos et al., (2003), Hendry and Krolzig (2004, 2005). In Campos, Ericsson and Hendry, (2005) it is possible to find an adequate introduction, an overview and the main articles, while in Hendry and Doornik (2014), the background and methodological details of the approach are systematically developed.

This procedure identifies a minimal model based on the results of an automatic variable reduction algorithm. In this approach, the estimation process begins with an unrestricted general model and, according to a series of statistical tests, we proceed by discarding variables until a parsimonious model is reached. In this approach, from the English school of econometrics, exogeneity becomes an empirical problem whose answer is based on a series of criteria established by the researcher and is a priori agnostic about causal relationships. The type of exogeneity required depends on the problem to be solved, whether it is the estimation of consistent parameters (weak exogeneity), predicting a series (strong exogeneity) or evaluating the effect of a policy (super-exogeneity). Unlike the structural VAR approach, this approach provides us with information about the long-term relationships between the variables and bases its identification strategy on an empirical procedure that defines ex-post the minimum model that best represents the data generating process.

### *1.1 Economic Performance and Political Institutions*

The neo-institutionalist literature establishes that "institutions matter" and that they are capable of influencing the long-term economic performance of societies. However, this literature has not incorporated the methodological tools of time series for the study of this hypothesis. In contrast, the standard macro-econometric research program has also not incorporated the analysis of political variables in its analysis of long-term real cycles.

One reason for this is the scarcity of long-term data for economies. In particular, Lloyd and Casey (2018) point out that the absence of long-term series for institutional variables makes it difficult to study the adaptive or evolutionary aspects of institutions and how they are related to economic processes and results. Chang (2011) argues in favor of the use

of time series complemented by a congruent historical narrative and criticizes the excessive weight of cross-sectional studies.

Chang (2011) and López (2020) question why that the bulk of this literature does not consider the possibility that it is economic variables that cause movements in institutional variables, claim that there are more complex relationships, with self-generated cycles or bi-directional relationships. Added to these criticisms is the inability to capture non-monotonic effects with respect to time.

This work is inserted precisely in these debates. Taking advantage of the recent publication of long-term series for the Polity Index, and the data for the growth rate of GDP per capita obtained from the Maddison Project Database (2018), a reduced VAR is estimated and the dynamic effects of a low VAR are reported.

The identification problem has been addressed in various ways in the literature that explores the relationships between democracy and economic performance. On the one hand, there are the cross-sectional studies by Papaioannou and Siourounis (2008), Acemoglu et al. (2008), Acemoglu et al., (2015) and Acemoglu et al., (2019), which use dynamic panels with increasingly refined econometric specifications. For example, Acemoglu (2019), in addition to various robustness exercises and the use of instrumental variables, incorporates the dynamics of GDP per capita to better model the fall in GDP that precedes the moment of "democratization". This also makes it possible to obtain the long-term effect of democratization in a way that is similar to the AIRFs estimated in this work.

Persson and Tabellini (2009) coined the idea of "democratic capital", which interacts in a virtuous circle with physical capital, mutually reinforcing each other. In this way, as democracy consolidates and becomes more stable, the income of the population grows more rapidly. This validates and promotes more democratic stability and even more economic growth. At the same time, the accumulation of democratic capital generates even greater stability and growth.

Meyersson (2015) studied the effects of coups on economic growth, comparing "successful" and "failed" coups. Coups d'etat in autocratic countries show imprecise and sometimes positive effects on economic growth. Meanwhile, when they occur in democratic societies there is clearly a negative effect on growth: *"When overthrowing democratic leaders, coups not only fail to promote economic reforms or stop the occurrence of economic crises, but they also have substantial negative effects across a number of standard growth-related outcomes including health, education, and investment."*

An important channel through which democracy translates into a higher level of income for a country is related to human capital.

For example, Fujiwara (2015) exploiting the sequential pattern of the introduction of electronic voting in Brazil, found that the reduction of barriers to voting translates into

better indicators of human capital in the newborns of low-income women, with all of the future cognitive advantages that this implies. Naidu (2012) finds that the voting restriction that was imposed on African-Americans in the 19th century in the United States implied a reduction in the teacher / student ratio in black schools.

Miller (2008) studied how access to the right to vote for American women was able to influence child survival. Through political pressure, the dissemination of the health advances of the time accelerated, which is also consistent with the models of electoral competition. Along the same lines are the works of Duflo (2003), Chattopadhyay and Duflo 2004 and Duflo and Topalova 2004.

Franck and Michalopoulos (2017) studied the long-term economic consequences of the French Revolution and found that greater equality expressed in greater fragmentation in land ownership reduces labor productivity and income in the short term. However, in the long run, this facilitates the process of human capital accumulation, reversing the process. This work presents interesting empirical evidence in favour of theoretical models that study the link between inequality, human capital and long-term development process, such as those developed in the works of Galor (2000), and Galor and Moav (2004), among others.

Taken together, these studies indicate that the effects of improving democracy may be relevant for the accumulation of human capital and that the reduction of inequalities plays a key role in this process.

The time series approach, in an effort analogous to that of the study of the effects of monetary policy, seems ideal to explore the relationships between changes in political regime and economic performance and, to the extent of data availability, to study the possible channels through which the political variables interact with the economic variables. Additionally, the focus on a single economic system allows for better control of the characteristics of unobservable variables that can produce biases in cross-sectional studies.

Through the separate estimation of a bivariate VAR for 13 countries and specifying the identification strategies used, the AIRFs are obtained that correspond to the measure of the long-term impact of democratic shocks on the economic growth rate. A positive effect of the growth rate of GDP per capita is observed in the cases of Chile (2.5%), Italy (3%) and France (4%). The effect is negative in the cases of Spain (-2.8%) and Bolivia (-3.8%). Finally, there are a number of countries (Botswana, Nigeria, Argentina, Colombia, Brazil, Portugal, Austria, and Sweden) for which the effect is not significant.

The rest of the article is structured as follows. In section 2 the identification problem in the context of time series is reviewed, with a conceptual framework that incorporates political variables in the context of the propagation mechanism proposed by Frisch and Slutzky,

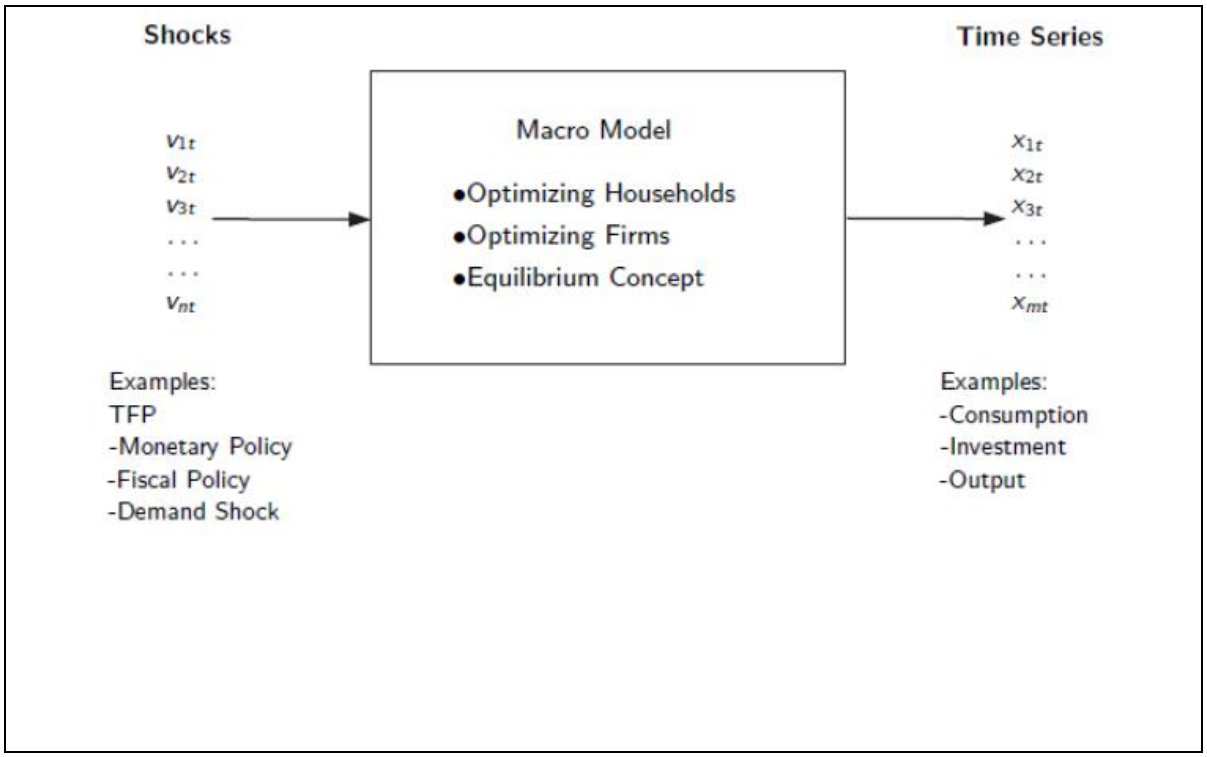
and identification strategies based on short and long-term a priori restrictions on the causal relationships between the variables are presented. Section 3 shows the data used, the definitions and their sources. In section 4 the time series tools are applied to the problem of plotting the consequences on the growth rate of GDP per capita triggered by an unexpected change in the type of political regime. The IRF and AIRF for each country and the results are estimated and reported. The general results of the automatic variable reduction algorithm are also reported in search of evidence of long-term relationships. Section 5 presents the conclusions.

## 2. *Time-series, political economy and the identification problem*

Figures 1 and 2 present in very simple terms the conceptual framework underlying the empirical research developed in this work. As mentioned, a key idea in modern macroeconomic thinking and modeling is that the economic system is driven by structural shocks. The main challenge for empirical work in macroeconomics is to identify plausibly exogenous changes in so-called "policy variables" and to use this variation to analyze and evaluate the effects of a given policy. This line of research has been called direct causal inference (Nakamura and Steinsson, 2018)

Figure 1

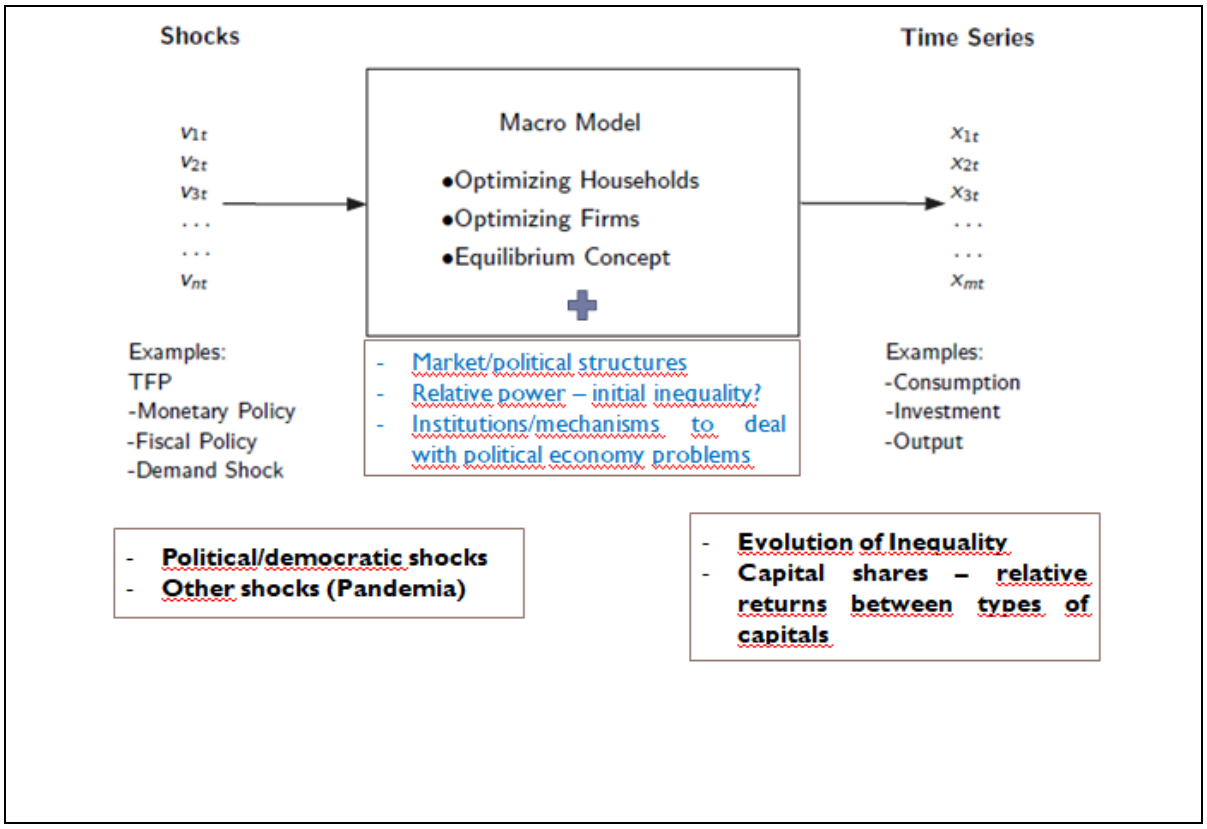
GE Macro Models in a Nutshell




Taken from Engel (2020)

Figure 2

Political Economy GE Macro Models in a Nutshell




Adaptedfrom Engel (2020)

The standard approach outlined in figure 1 is expanded in figure 2 allowing for the introduction of "political" or institutional shocks. In this way, the "black box" of macro models, which assumes optimizing agents in an environment of competitive equilibrium, must be enriched by considering at least the institutions and mechanisms through which a society solves its political economy problems. In this way, as extended model allows for incorporating the study of inequality and the differences between the relative returns of the different types of capital.

In this work, the notion of exogenous impulses and propagation mechanisms of Frisch and Slutsky will be used, but now unexpected changes in the political regime will be incorporated as possible exogenous shocks. Thus, it will be possible to use traditional time series tools in this expanded context.

### *2.1 Autoregressive vectors and the identification problem*

A VAR with a highly flexible specification is a standard macroeconomic modeling tool, which allows for estimating and tracking the short and long-term effects of different types of shocks: technological (Galí et al., (2003), monetary (Christiano et al. (2010)) or fiscal (Blanchard and Perotti (2002) Christiano et al. (2011). This flexible, unrestricted estimate is intended to "let the data speak" by reporting the relevant statistical relationships that arise between the variables of interest. These stylized facts should serve as input for the elaboration of general equilibrium models that adequately incorporate the political/institutional aspects, in a way similar to what was done by Giacominni (2013) and Del Negro and Schorfheide (2006).

The estimation of VARs and their main statistics (IRF, AIRC and variance decomposition) is a widely used tool in empirical analysis that seeks to test the existence of causal links between variables, as well as in the analysis of the design and evaluation of the effectiveness of economic policies. By their very structure, VARs represent a natural tool for economic practice. According to Christiano (2012):

*"VARs are a fruitful way to organize data because they can be used as a sort of battleground for testing alternative theories…Economists are accustomed to thinking about models in terms of impulses and propagation mechanisms, and VARs are a device for organizing the data precisely into these categories*".

When estimating a VAR directly we obtain what is called the "reduced form", which is an a-theoretical representation of the behavior of the data. The VAR in its reduced form only describes the history of the statistical relationships between the variables; it does not allow fordrawing conclusions about causal relationships or for making any kind of direct causal inference. In order to transform this reduced VAR into a tool that allows for studying the possible economic or structural relationships between the variables, certain identification assumptions must be made. Thus, from a reduced VAR we obtain a structural VAR.

The identification problem can be illustrated from the structural model described by (1), which is assumed to represent the true and underlying structure of the economy.

$$\Gamma Y_t = BX_t + e_t \quad (1)$$

$Y_t$is a$(n \times 1)$vector of endogenous variables, $X_t$contains lags of the endogenous variables and may include variables considered a priori exogenous.$\Sigma_e = E(ee')$es lais thevariance-covariance matrix of the structural innovations.The coefficients in$\Gamma$and$B$are the parameters of interest.

The problem is that the sample information is not enough to directly estimate (1) and thus obtain the "true" values of the coefficients. Indeed, there is an infinite set of different

values for Γ and $B$that imply exactly the same probability distribution for the observed data. This makes it impossible to infer and hence obtain the values for Γ and $B$ from the data alone; therefore, these parameters are said to be unidentified.

By estimating a reduced form of (1) we will obtain:

(2) $Y_t = B_\Gamma X_t + u_t$where$B_\Gamma = \Gamma^{-1}B;\ u_t = \Gamma^{-1}e_t$

This reduced form summarizes the sample information (historical) of the data set, expressing each endogenous variable only as a function of predetermined variables, unlike the structural VAR, which allows contemporary interactions between the variables. The variance-covariance matrix of the reduced form is given by $\Sigma_u = E(uu')$

Now, let's do the following exercise: we pre-multiply (1) by a full-rank $Q$ matrix. This means a different structural model from the first:

(3) $\Gamma_Q Y_t = B_Q X_t + e_{Qt}$ with $\Gamma_Q = Q\Gamma;\ \ B_Q = QB;\ \ e_{Qt} = Qe_t$

The reduced form of (3) is given by:

(4) $Y_t = \Gamma_Q^{-1} B_Q X_t + \Gamma_Q^{-1} e_{Qt} = \Gamma^{-1}Q^{-1}QBX_t + \Gamma^{-1}Q^{-1}Qe_t = \Gamma^{-1}BX_t + \Gamma^{-1}e_t$

This reduced form coincides with that obtained in (2), implying that both models are *observationally equivalent*. Here is the core of the identification problem. If no additional assumptions are made, ("identification assumptions"), it will not be possible to draw conclusions about the structural parameters of the "true" model. And this is because, given the data, different structural models give rise to the same reduced shape.

One way to solve this problem is to use the Cholesky decomposition to obtain "structural" errors, which means that these errors are not correlated with each other. Under this assumption it is possible to identify the effect of a policy shock or innovation.

The Cholesky decomposition method, popularized by Sims (1980), imposes a set of "zero constraints" on contemporary coefficients. In this work the first approach will be to suppose that the "policy variable" does not respond within the same period to the other endogenous variables. In Blanchard and Perotti (2002), this type of restriction is imposed to identify and trace the consequences of a fiscal expenditure shock on output. There, the

assumption used is that government spending does not respond at the same time to production or tax movements.

The procedure is then based on obtaining results from a first identification strategy based on a Cholesky decomposition, assuming a priori the exogeneity of the democratic shock. This assumption answers the main research question: What is the effect of a democratic shock on economic growth?

The main criticism of this focuses on the arbitrary decomposition that is carried out to identify shocks. A partial way of solving the problem is proposed by Pesaran and Shin (1998). The Generalized Impulses Functions construct an orthogonal set of innovations that does not depend on the VAR ordering. In this work the results of the first strategy are reported. The results are extensively reported in a companion article (Accorsi 2021)

Another approach consists of imposing a combination of identification assumptions in the form of restrictions on the short- and long-term effects of shocks on endogenous variables (Blanchard and Quah (1989), (Galí, 1992) assumes that demand shocks only have short and medium-term effects and that they do not modify the output level in the long term; therefore the restriction is imposed that the cumulative effect of output responses to the demand shock is zero. In turn, supply shocks are the only source of long-term variation in output.

### *2.2 A minimal Political Economy Macro model*

In a research effort analogous to that devoted to exploring the effects of monetary, fiscal or technological shocks on output, the purpose here is to identify regularities in the relationship between the level of democracy or type of political regime and the growth rate of the economy.

For the purposes of fixing ideas, let us consider a stationary bivariate VAR (1), $(y_t, x_t)$ in which $y_t$ represents the indicator associated with the type of political regime (to its first difference, strictly speaking), while $x_t$ symbolizes the growth rate of GDP per capita.

Expressed in equations, the first order VAR for this bivariate system is:

$$y_t = \phi_{11} y_{t-1} + \phi_{12} x_{t-1} + u_t$$
$$x_t = \phi_{21} y_{t-1} + \phi_{22} x_{t-1} + v_t$$

Which can be written as follows:

(1) $\begin{pmatrix} y_t \\ x_t \end{pmatrix} = \begin{pmatrix} \phi_{11} & \phi_{12} \\ \phi_{21} & \phi_{22} \end{pmatrix} \begin{pmatrix} y_{t-1} \\ x_{t-1} \end{pmatrix} + \begin{pmatrix} u_t \\ v_t \end{pmatrix}$

Or:

(2) $z_t = \phi z_{t-1} + w_t$ ,

Where $z_t = \begin{pmatrix} y_t \\ x_t \end{pmatrix}$ ; $\phi = \begin{pmatrix} \phi_{11} & \phi_{12} \\ \phi_{21} & \phi_{22} \end{pmatrix}$ ; $w_t = \begin{pmatrix} u_t \\ v_t \end{pmatrix}$ ; $\Omega = E(w_t w_t') = \begin{pmatrix} \sigma_u^2 & \sigma_{u,v} \\ \sigma_{u,v} & \sigma_v^2 \end{pmatrix}$

The model described by (1) and (2) is called a *reduced form* of a VAR. It is a purely a-theoretical econometric model. The problem is that it is not possible to assume that $u_t$ and $v_t$ are not contemporaneously correlated. In general, it is very likely that they are correlated, that is, they are non-orthogonal or in other words: $\sigma_{u,v} \neq 0$. If this is the case, it will not be possible to isolate the effects of a shock in one of the variables since it is not possible to keep $v$ constant while only $u$ varies.

However, taking as a starting point the estimation of the reduced form of the VAR, and using the Cholesky decomposition, it is possible to obtain a model in which the variance-covariance matrix of the errors is diagonal and therefore the errors are orthogonal.

The Cholesky decomposition method consists of finding a lower triangular matrix $A$such that:

(3) $\Omega = AA'$

Let $A = \begin{pmatrix} a & 0 \\ b & c \end{pmatrix}$. The Cholesky decomposition solves:

(4) $AA' = \Omega \leftrightarrow \begin{pmatrix} a & 0 \\ b & c \end{pmatrix} \begin{pmatrix} a & b \\ 0 & c \end{pmatrix} = \begin{pmatrix} \sigma_u^2 & \sigma_{u,v} \\ \sigma_{u,v} & \sigma_v^2 \end{pmatrix}$

The solutions for $a$, $b$ and $c$ always exist and are given by:

(i) $a = \sqrt{\sigma_u^2}$

(ii) $b = \frac{\sigma_{u,v}}{\sqrt{\sigma_u^2}}$

(iii) $c = \sqrt{\sigma_v^2 - \frac{\sigma_{u,v}^2}{\sigma_u^2}}$

A new error vector $\widetilde{w}_t$ is defined as a linear transformation of $w_t$.

(5) $\widetilde{w}_t = A^{-1} w_t$

By construction, the variance-covariance matrix for this error is diagonal:

$$var(\widetilde{w}_t) = A^{-1} var(w_t) A^{-1\prime} = A^{-1} \Omega A^{-1\prime} = A^{-1} A A' A^{-1\prime} = I$$

Using the Wold decomposition for covariance stationary time series, the system in (2) can be written in the form of an $MA(\infty)$ process:

(6) $z_t = w_t + \phi w_{t-1} + \cdots + \phi^j w_{t-j} + \cdots = AA^{-1} w_t + AA^{-1} \phi w_{t-1} + \cdots + AA^{-1} \phi^j w_{t-j} =$
(7) $z_t = A\widetilde{w}_t + \phi A \widetilde{w}_{t-1} + \cdots + \phi^j \widetilde{w}_{t-j}$

Thus, the response to the impulse triggered by the orthogonal error, $\widetilde{w}_t$, $j$ periods ahead, is $\phi^j A$.

Recall that in (2) the error $w_t$ is not orthogonal. On the other hand, in the structural form specified in (7) it is possible to isolate the effects of a shock, since the error $\widetilde{w}_t$ is orthogonal.

(5) $z_t = \phi z_{t-1} + w_t$
(6) $A^{-1} z_t = A^{-1} \phi z_{t-1} + A^{-1} w_t$
(7) $A^{-1} z_t = A^{-1} \phi z_{t-1} + \widetilde{w}_t$

When observing the structural form in (7), it is noted that $A^{-1}$is lower triangular, and therefore:

(8) $A^{-1} z_t = \begin{pmatrix} 1/a & 0 \\ -b/ac & 1/c \end{pmatrix} \begin{pmatrix} y_t \\ x_t \end{pmatrix} = \begin{pmatrix} (1/a) y_t \\ (-b/(ac)) y_t + (1/c) x_t \end{pmatrix}$

This implies that when the system is expressed in equations, $x_t$ does not appear in the regression for$y_t$ (the policy variable), while $y_t$ does appear in the regression for $x_t$. Here is an *identification assumption*.

In summary, (i) from the estimation of Ω and its elements, (ii) assumptions about short-term relationships or (iii) the imposition of long-term restrictions, it is possible to identify and estimate the model and characterize the dynamic response to a given shock. Thus, it is possible to overcome the "*curse of dimensionality*" and a meaningful economic system– a structural VAR - is obtained from its reduced form.

### 3. *Data used, definitions and sources*

The type of political regime is captured through the Polity index. For each country and year, it defines a value in a range that goes from -10 to +10 and a higher index reflects a better democratic institutionality. The ranges and the respective type of political institutionality are shown in table 1.

The Polity Index has been widely used in studies with similar purposes (Papaioannou and Siourounis, (2008), Acemoglu et al. (2008), Acemoglu et al., (2015) and Acemoglu et al., (2019)), although never in a specific time series frame. This indicator measures and weights a series of components associated with three dimensions: (i) the existence of an impersonal or non-discretionary executive power, (ii) the (formal) restrictions to the executive power and (iii) the level of observable competitiveness in the political sphere, and classifies the type of political regime according to a defined range.

**TABLE 1**

Polity score, definition and characterization

| **Range** | **Political regime** | **Characterization** |
|---|---|---|

| | | |
|---|---|---|
| [-10, -6] | Autocracies | An authoritarian regime, characterized by the concentration of all power in a dictator or despot.<br>Its decisions are not subject to any type of legal restrictions or mechanisms of popular representation. |
| [-5, 5] | Annocracies | A set of government systems that can be defined as "part democracy" and "part dictatorship".<br>It combines at different levels democratic aspects with autocratic aspects. |
| [6, 10] | Democracies | A government system that allows citizens to express their political preferences.<br>The main executive and legislative authorities are elected by individuals. |

The data for the GDP per capita of the respective countries were obtained from the *Maddison Project Database*, version 2018.

*4. An application: The relationship between democracy and economic growth*

There are different approaches to the identification problem to establish links between what are very loosely called "institutions" and variables associated with economic performance. The most popular econometric strategy consists of finding a suitable instrumental variable and thereby obtaining an exogenous variation of the institutional variable. This approach is used in Acemoglu et al., (2001) and extended for the case of the relationship between democracy and GDP per capita in Acemoglu et al. (2019)

A critical reflection on this literature should recognize that such an econometric strategy may not be the best instrument for evaluating the effects of institutional variables on

economic performance. From a logical point of view, it is not correct to extrapolate the conclusions of these studies, and from the empirical side they exhibit serious econometric flaws, as Acemoglu et al. (2019) point out.

Unlike cross-sectional studies or studies based on discontinuous regression techniques or propensity score matching, the strategy based on time series provides evidence about the temporal causality between variables, with flexible models that allow for bi-causality or a certain degree of interdependence between them. This is generally not possible in cross-sectional studies or "experimental" type studies.

Thus, this approach provides a natural ground for testing some of the predictions of theoretical models, often conceived in terms of dynamic general equilibrium models for a single economy, as for example in the study of the economic performance of oligarchic versus democratic societies (Acemoglu, 2008).

Another attractive aspect is that it provides information about the causality between the variables of interest. The effect may well be from the economic variables to the institutional ones. This part of the puzzle, mentioned in the past but not seriously addressed by the neo-institutionalist literature, has been neglected both theoretically and empirically.

### *4.1 A VAR with economic and political variables*

For each country a bivariate VAR (6) is estimated:

$$(9)\quad z_t = \phi_1 z_{t-1} + \phi_2 z_{t-2} + \cdots + \phi_6 z_{t-6} + w_t \qquad \text{, donde } z_t = \begin{pmatrix} p_t \\ g_t \end{pmatrix} \; ; w_t = \begin{pmatrix} u_t \\ v_t \end{pmatrix}$$

Where $p_t$corresponds to the variable of the type of political regime (its first difference), while $g_t$ is the growth rate of GDP per capita.

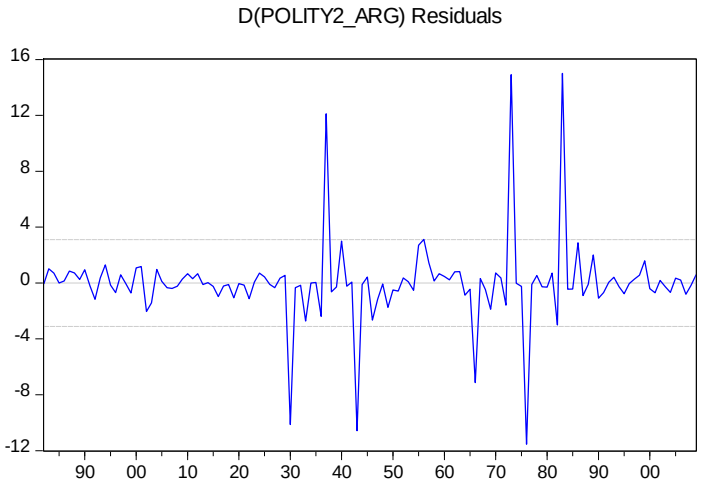
As indicated in the previous section, from this reduced form of the VAR it is possible to obtain a structural form through the identification assumption based on the Cholesky decomposition. This implies a model in which $p_t$appears in the regression for $g_t$ while $g_t$does not appear in the regression for $p_t$.

The shocks in the type of political regime are obtained as the residuals of a regression that includes current and lagged values of both variables of the VAR. In this sense, a shock will be a realization of a variable that signifies a large deviation from its best linear projection or expectation for a given set of information. It is an unexpected value of one of the variables, typically the so-called "policy variable" and has a propagation mechanism that depends on the parameters of the model.

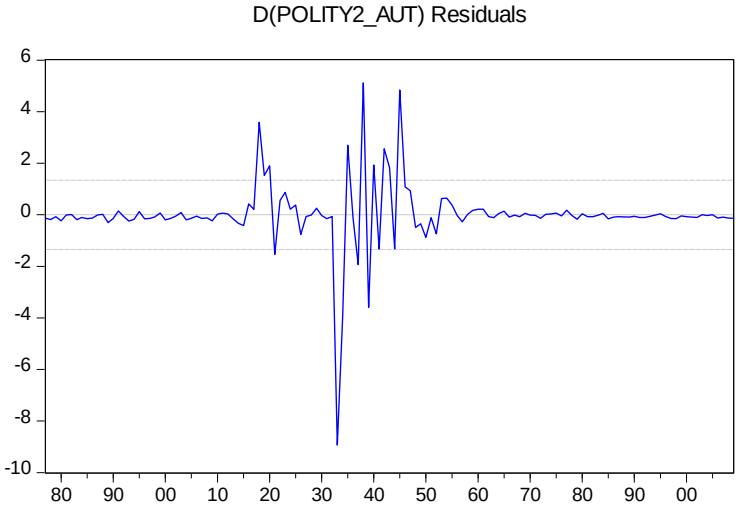
Next, the series of residuals for the countries analyzed are presented. In the Chilean case for instance, it is possible to identify two dates (1973 and 1988-'89) associated with "political shocks", that is, when the effective value of the policy variable was very far from the linear projection based on current and lagged values of both variables. The first was a drastic worsening of the democratic conditions that was not predictable from the economic conditions; that is, what happened in the year '73and later in '88 was of a greater magnitude than what could have been predicted under the best set of information and previous structure of the relationship between the variables. For Chile, thanks to data availability, the identification of these shocks is still valid, and a large number of additional variables are even incorporated into the VAR, among which are average schooling, growth of gross fixed capital formation per capita, and inflation (Figure 3.b).

Figure3 – Series of residuals

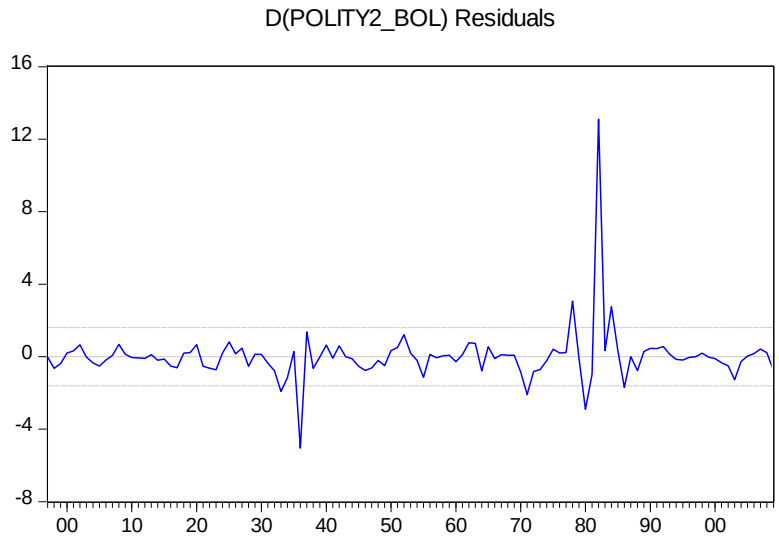
(a) Argentina



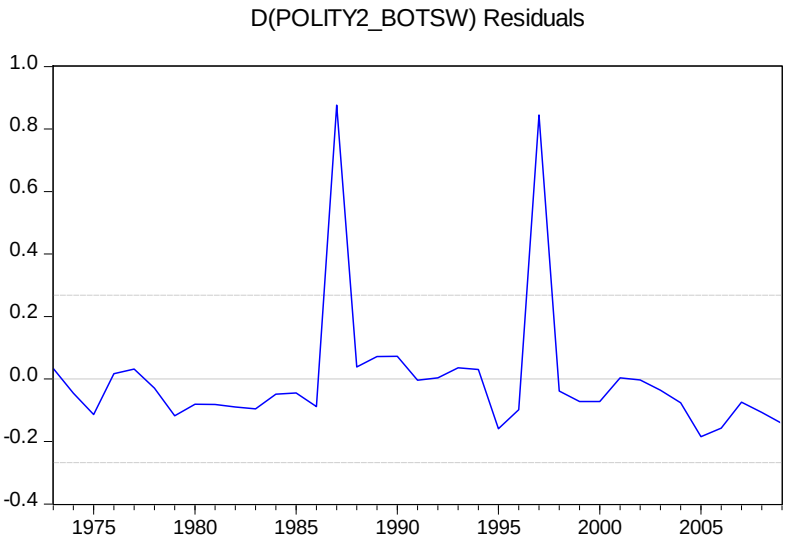

(b) Austria



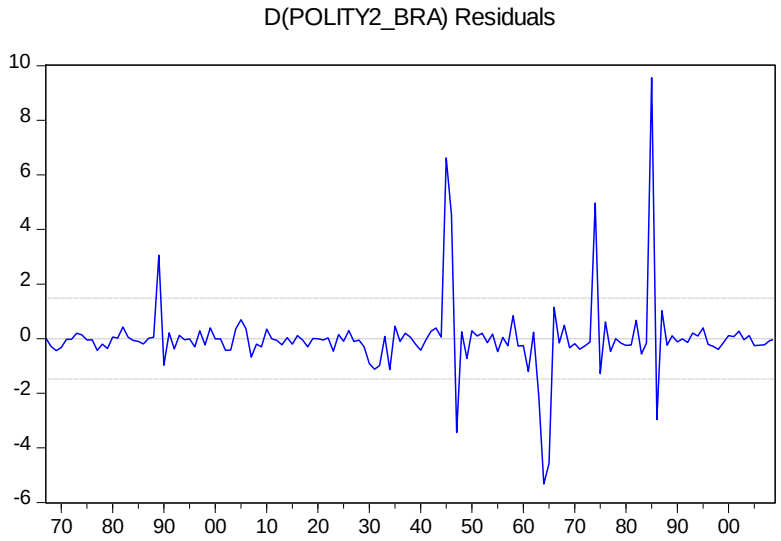
(c) Bolivia




(d) Botswana

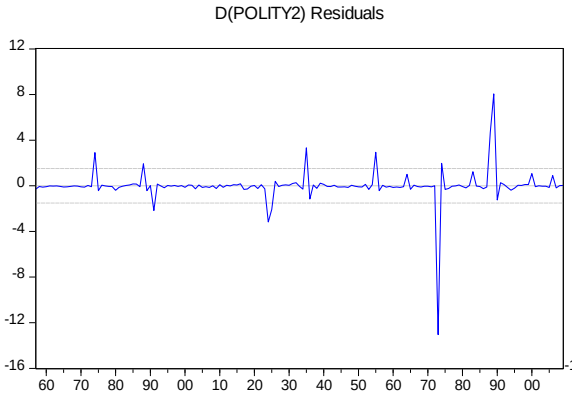


(e) Brazil

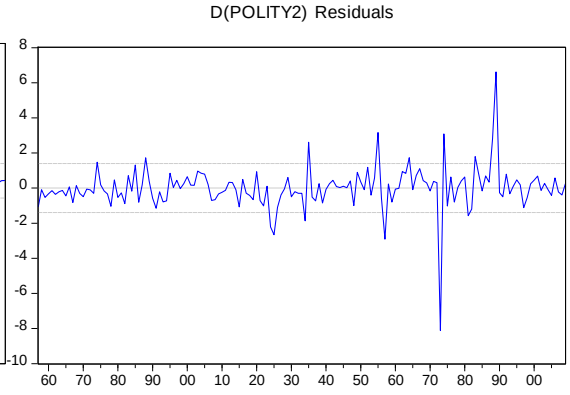



(f) Chile

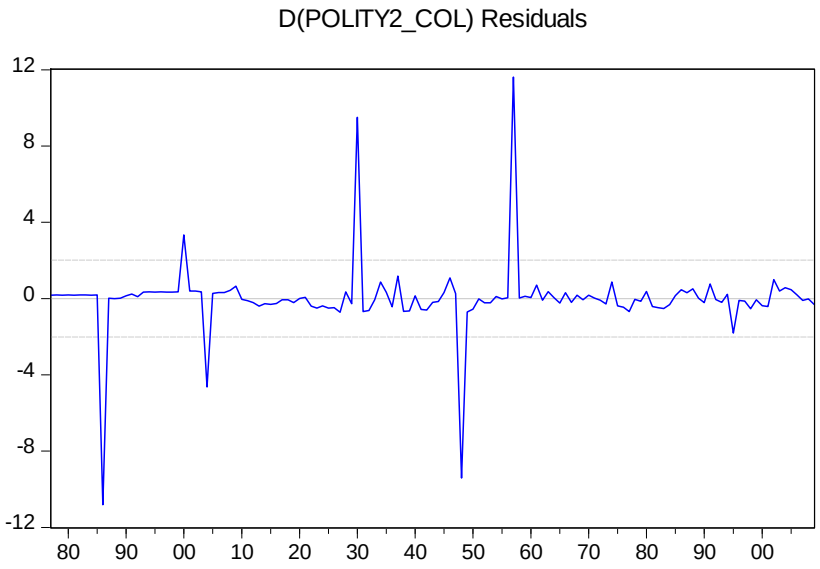
(i) Usual residuals



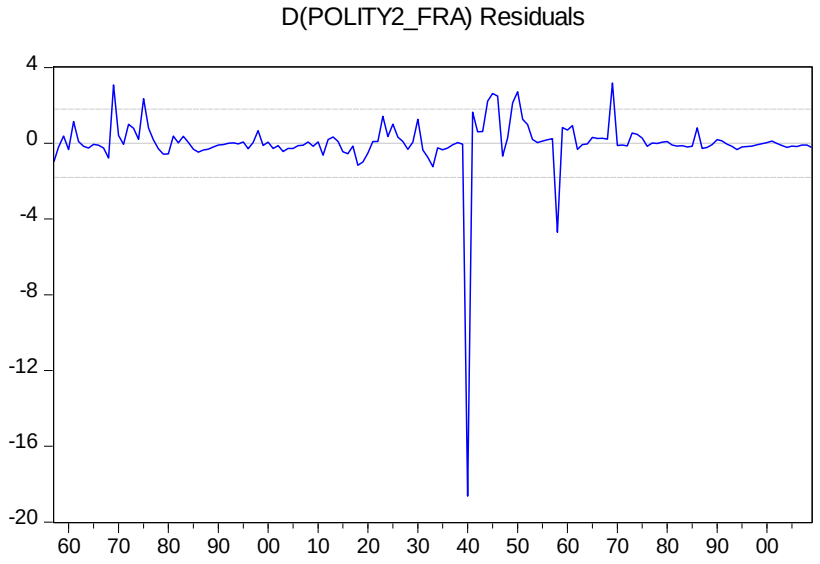

(ii) Including other control variables



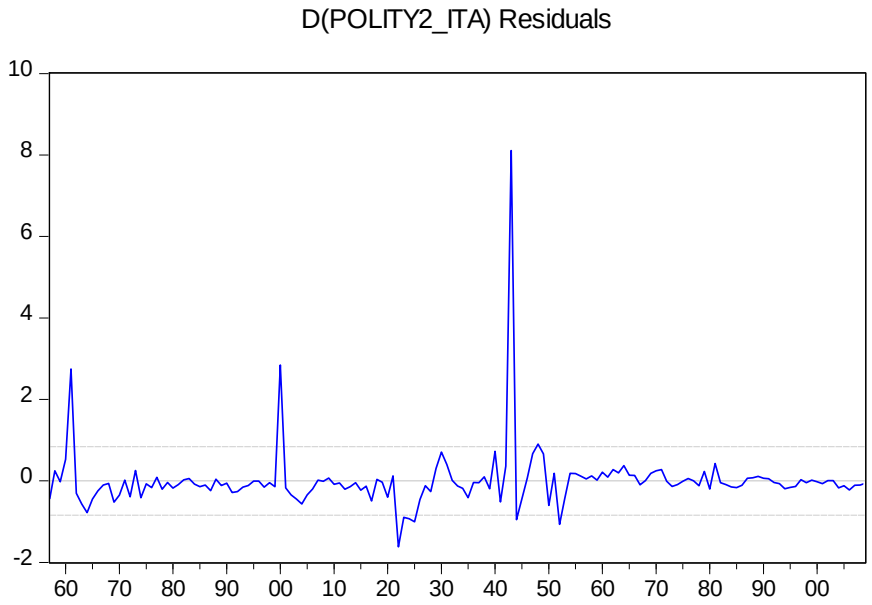
(g) Colombia



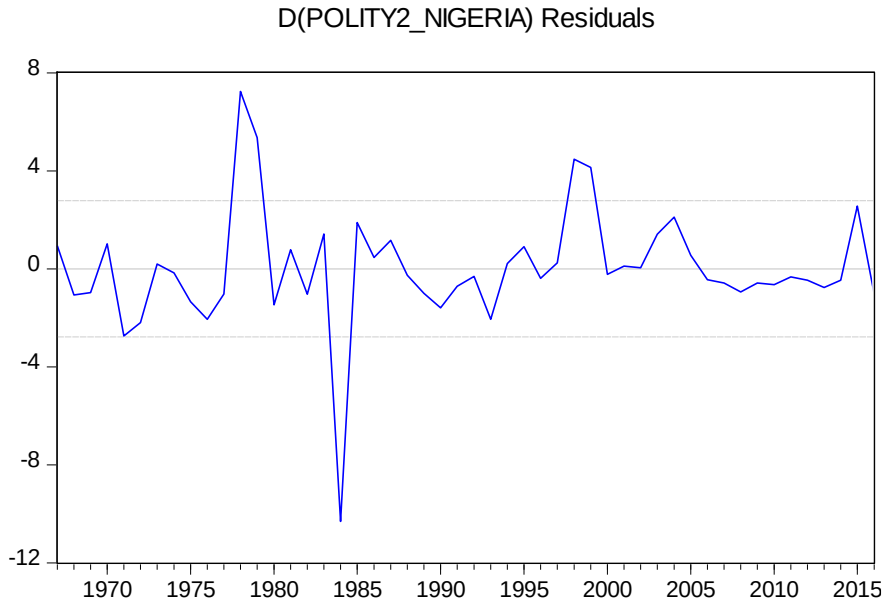

(h) France



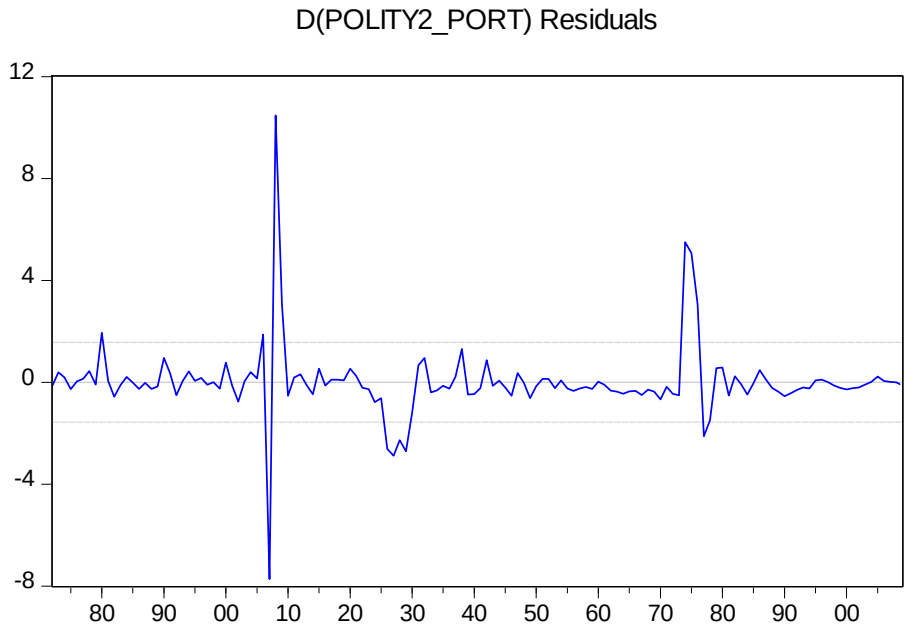
(i) Italy



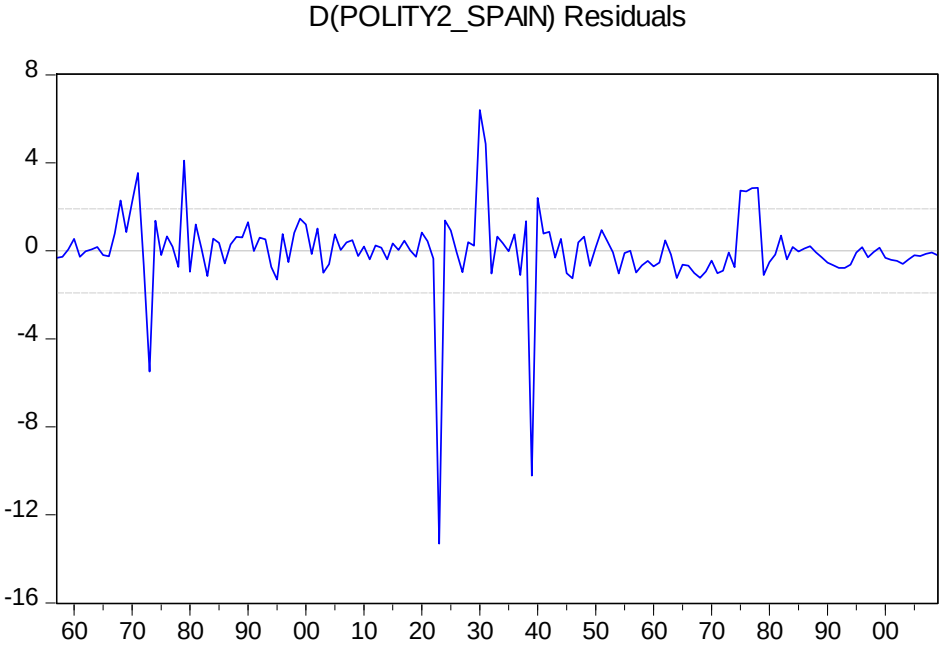

(j) Nigeria



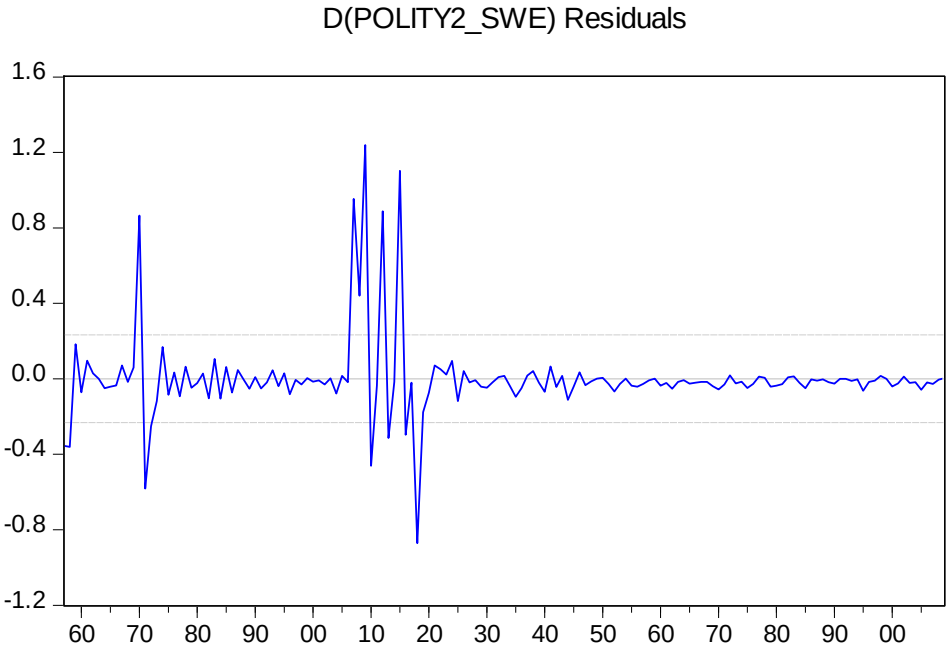
(k) Portugal




(l) Spain



(m) Sweden




*4.2 The dynamic effects of a "democratic shock" on economic growth*

This section shows the estimates of the short- and long-term responses to a "democratic shock", represented by the IRF and AIRF, respectively.

The results identify patterns that are specific to each of the selected countries. Through the estimation of the VAR and the corresponding IRFs and AIRFs, we can classify the countries according to the long-term effects that a democratic shock has on the growth rate of GDP per capita. Three of the countries studied show a positive and significant effect of democracy on growth (Chile, France and Italy), while for two of the countries (Bolivia and Spain) the long-term effect is negative. For the remaining seven cases studied (Argentina, Colombia, Brazil, Nigeria, Portugal, Austria and Sweden) the long-term effect is not different from zero.

Some interesting patterns are identified. While for some countries the effect is monotonic, for other countries the empirical relationship obtained is non-monotonic. In Italy, there is an effect on the growth rate of GDP per capita and only after a certain number of periods

does the effect turn positive. This is consistent with recent evidence regarding the long-term consequences of the French Revolution on growth, income, and inequality (Franck and Michalopoulos (2017)). The political economy dilemma of such a dynamic is obvious.

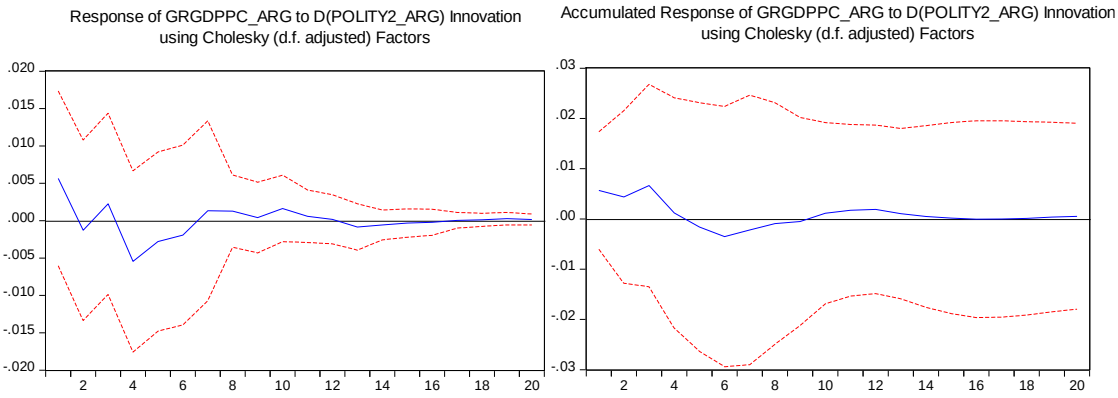
The Chilean case shows an oscillatory pattern of response, measured by the IRF, but with a positive cumulative effect.The Italian case shows a special pattern with a non-monotonic effect:a democratic shock initially has a marked negative effect on economic growth in the short term, but its long-term effect is positive. This is similar to what was found for the French case and is consistent with the evidence highlighted by Franck and Michalopoulos (2017).

Meanwhile, the cases of Bolivia and Spain show how the democratic shock has a negative effect on the long-term economic performance. This is partly explained by the good economic performance of the Franco era and the specific forms of democratization in the 1980s for the Bolivian case. This illustrates that behind each statistic there must be a coherent historical context. Each country has its own idiosyncratic response to what we have called a democratic shock or disturbance. Authoritarian regimes may have promoted important advances in industrialization, as seems to be the case of the Franco regime in Spain.

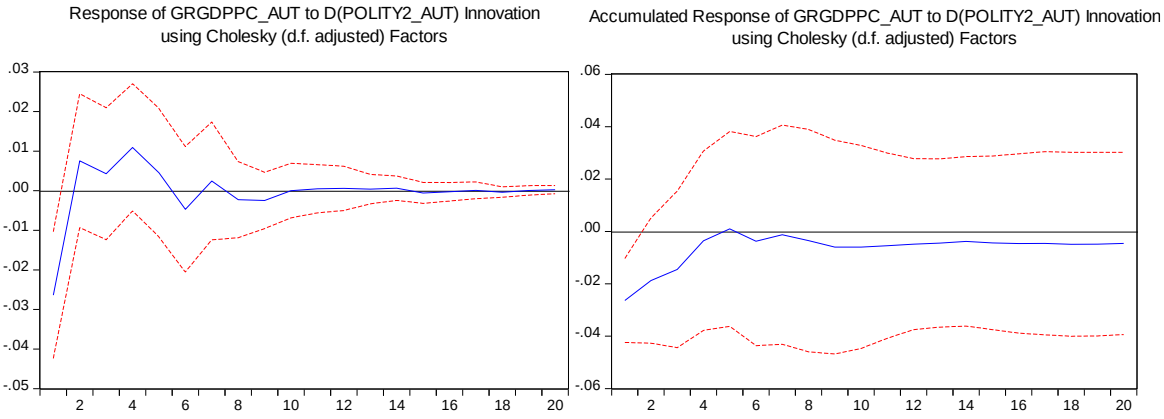
The dynamics of evolution also raise interesting questions. Consider the case of Italy. The short-term effect associated with the democratic shock of the years 1946-48 is negative until the third year, which raises the question of the fragility of democratic consolidation if it involves costs in terms of the short-term economic performance. This is the challenge of the Political Economy and highlights the importance of having solid democratic institutions. Development is learning about how to move towards a legitimate social contract that is capable of putting the common good and a long-term perspective of public policy and economic policy decision-making.

Figure 4

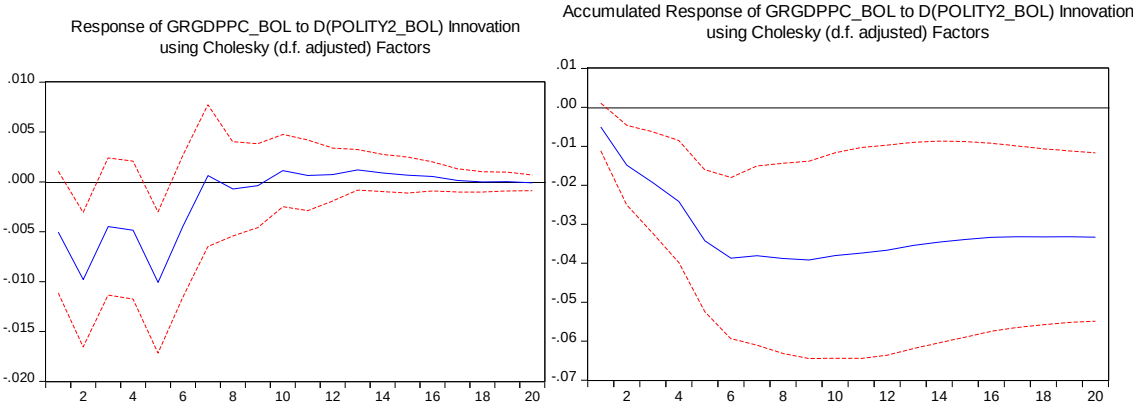
(a) Argentina



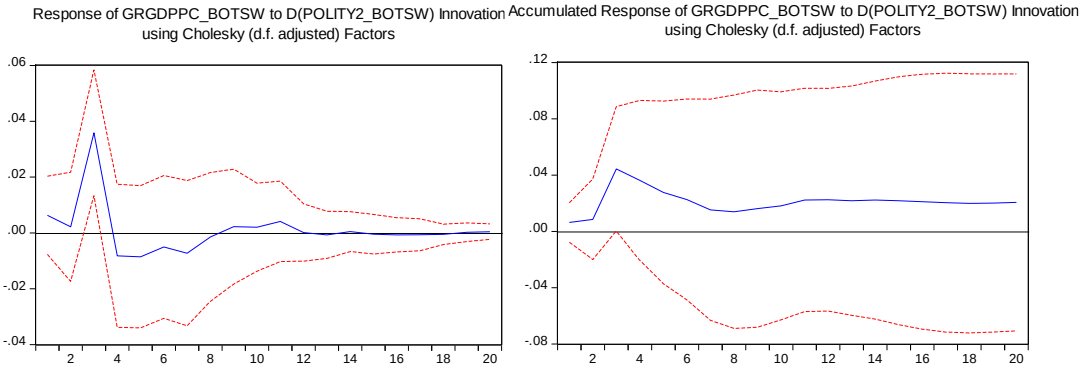

(b) Austria



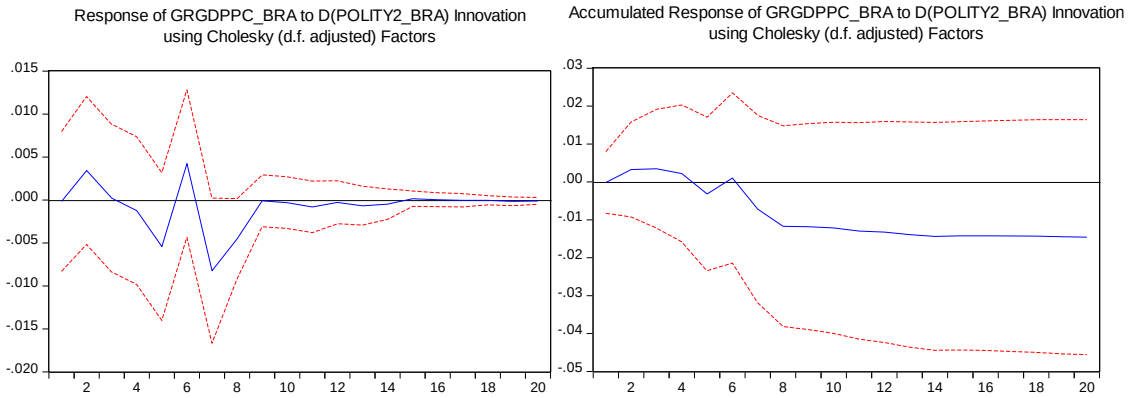
(c) Bolivia



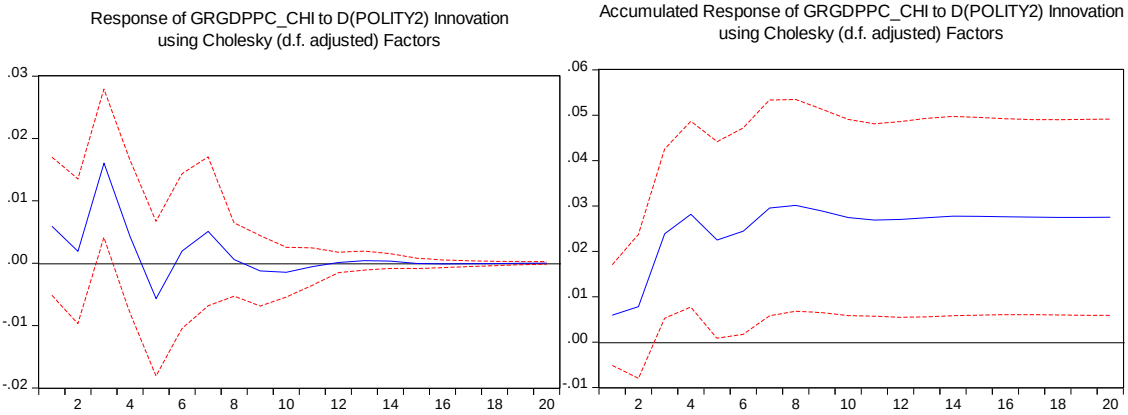

(d) Botswana



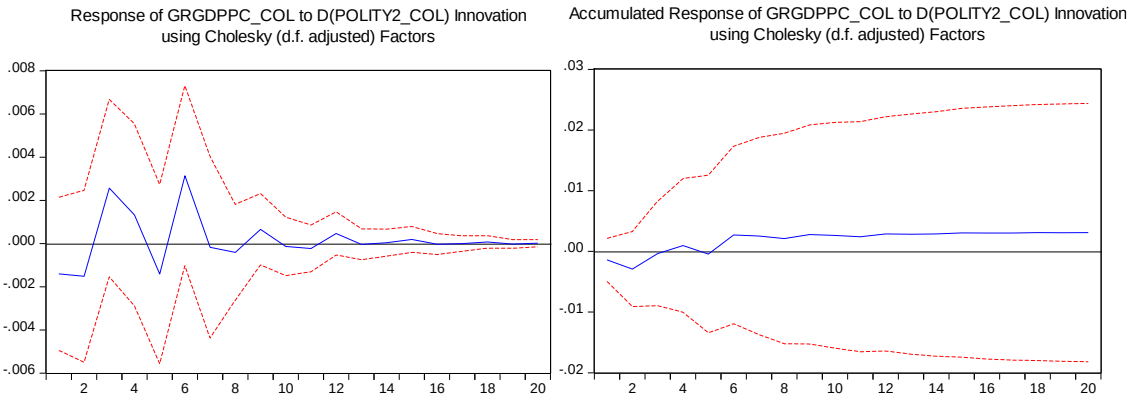
(e) Brazil



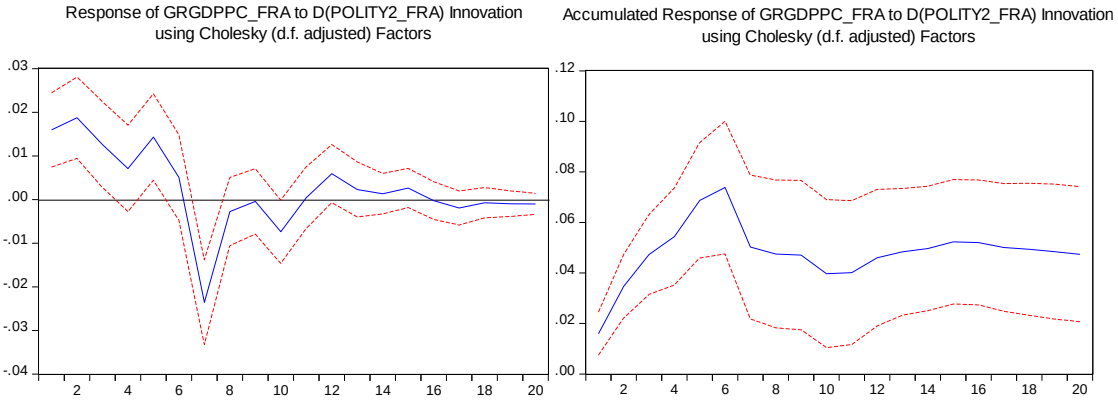

(f) Chile



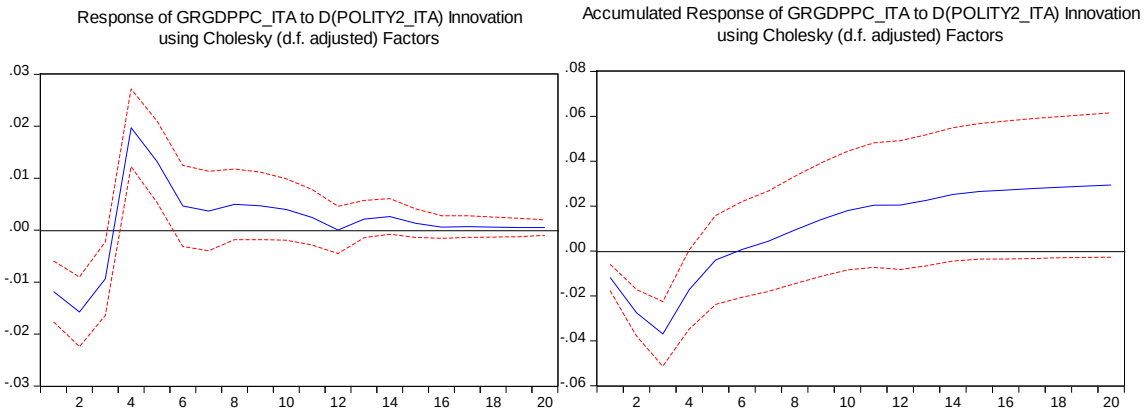
(g) Colombia



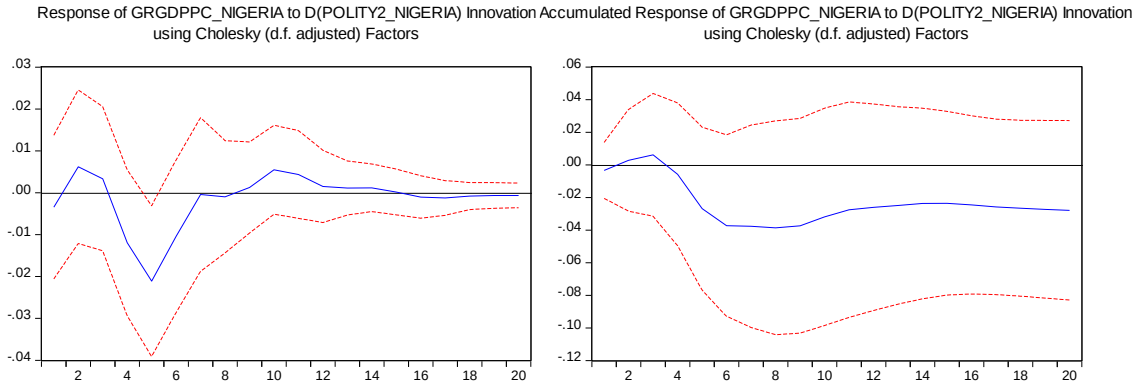

(h) France



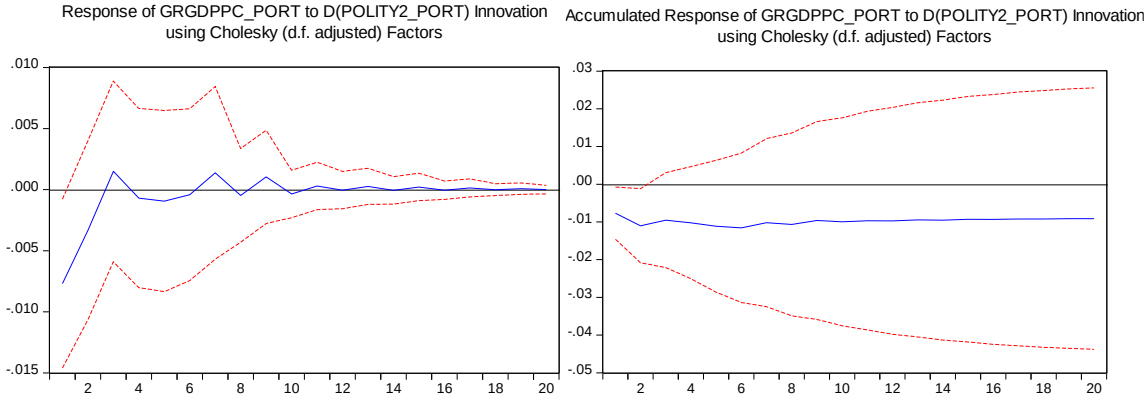
(i) Italy



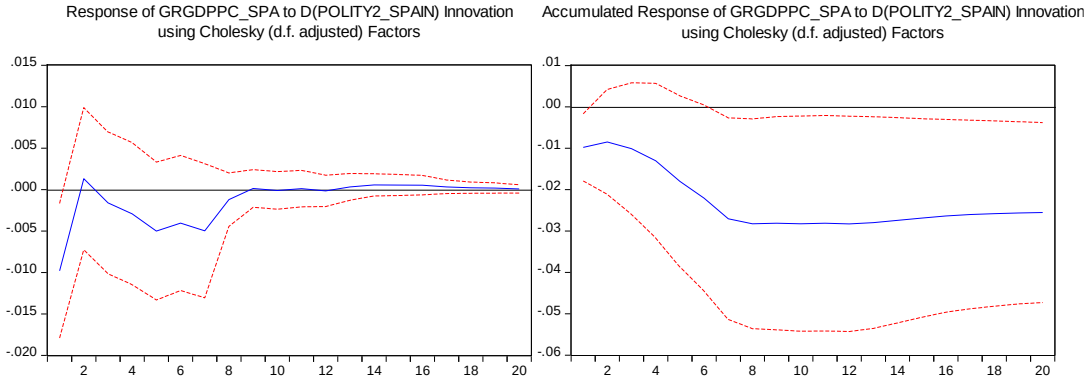

(j) Nigeria



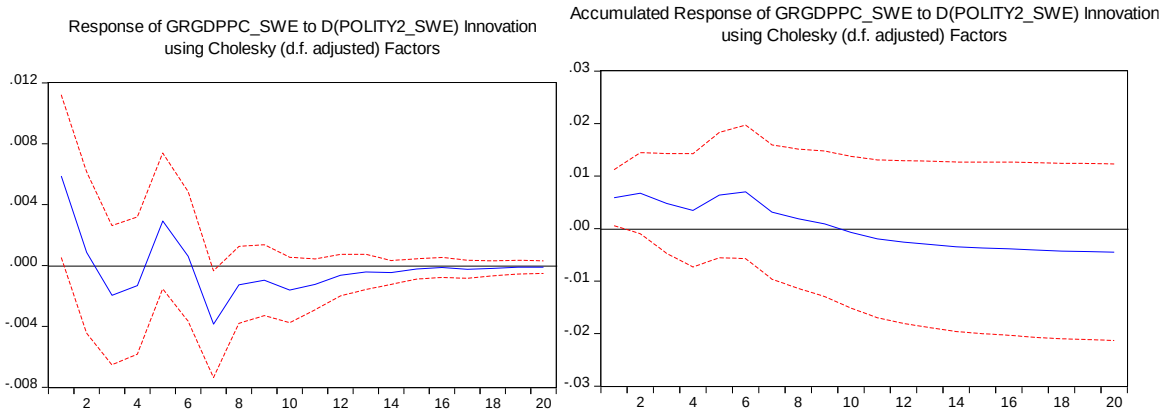
(k) Portugal




(l) Spain



(m) Sweden




*4.3 From General to Specific: Looking for long-term relationships*

The problem of model selection is central to empirical economic research. In general, there are only a priori theories that do not have to be applicable to new research and therefore are at least risky when used as a guide for econometric specification. In the same way, a problem arises when it is necessary to evaluate or contrast the existing theories about the same phenomenon.

There is a branch of the so-called "British econometrics" literature of a marked empirical nature that uses automatic model selection methods that proceed from the General to the Specific (GETS). This procedure was used to obtain parsimonious autoregressive vector models in Hendry and Krolzig (2005), while Heinlin and Krolzig (2012) applied this methodology to find a VAR with which they examined the consequences of exchange rate overreactions.

The objective of this approach is to identify or discover an empirical model that does not deviate substantively from the evidence and that in turn can account for alternative models that use the same data. The first idea refers to the notion of congruence of the model, that is, its ability to reproduce the data in a coherent way, and the second idea is summarized in the notion of matching.

In the previous sections, an unrestricted general model (GUM) has been estimated and the IRFs and AIRFs have been obtained. The objective in this subsection is to find patterns that are indicative of the long-term relationship between the (change in) political regime and economic growth, and thus complement the evidence found in the previous sections.

The "General to Specific" (GETS) procedure is a form of model reduction based on the specification of certain relevant criteria that "searches" in different ways until it reaches a minimum model. This methodology was proposed by Hendry in 1995 and is based on a series of reduction stages, which are described below.

Generally speaking, an automatic model selection process is based on a series of reduction stages and proceeds by initially estimating a General Unrestricted Model (GUM) from the available data. With this, a bound is obtained for the fit of the model based on the standard deviation of the estimated errors. The selection and elimination of variables then involves a trade-off between minimizing the presence of irrelevant variables and losing too many relevant variables. The process leads to a terminal model, where all of the acceptable reductions by the algorithm have been made.

In this framework, the concepts of weak, strong and super-exogeneity correspond to the objectives of estimation, prediction and policy analysis, respectively (Ericsson, Hendry &Mizon, 1998). Weak exogeneity assures the consistency of the estimated parameters and magnitudes of interest. The GETS procedure allows us to select the minimum number of significant variables that meet this condition. By combining weak exogeneity with the results of the Granger non-causality tests, we arrive at the concept of strong exogeneity. Each of these notions of exogeneity is associated with some of the levels of knowledge expected in the research: consistent estimation of the magnitudes in the case of weak exogeneity and predictive capacity in the case of strong exogeneity. Another concept, that of "super-exogeneity" assures us that the conditioning variables are weakly exogenous for the parameters of interest and that, furthermore, the distributions of these variables can change without altering the estimated parameters.

With this process, it is possible to identify a reduced linear system that is considerably simpler and easier to interpret than the unrestricted VAR, with estimated parameters that are consistent and with a model that has predictive capacity and a certain level of stability in its parameters that allows it to be carried out.

### *4.3.1 Results*

Two specifications or models are estimated for each country. Column M serves to distinguish them. Model 1 has incorporated the political regime variable as a contemporary variable, while in model 2 only lags have been incorporated. The results are

reported for a significance level of 95%. The initial GUM considered between 6 and 8 lags and the results were practically coincident. For reasons of space, only the sign of the coefficients is shown.

**TABLE 2**

Aggregate results of the *General to Specific* Procedure

| | *M* | Lags of GDP per capita growth | | | | | | Political variable | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Botswana | 1 | + | | | | | | | | + | | | | |
| | 2 | + | | | | | | | | + | | | | |
| Brazil | 1 | | | | | | | | | | | | | |
| | 2 | | | | | | | | | | | | | |
| Chile | 1 | | - | - | | | | | | + | | | | |
| | 2 | | - | - | | | | | | + | | | | |
| Colombia | 1 | + | | | | | | | | | | | + | |
| | 2 | + | | | | | | | | | | | + | |
| France | 1 | | | + | | | | + | + | | | + | | - |
| | 2 | | | + | | | | | + | | | + | | - |
| Italy | 1 | - | | | | | + | - | - | | + | + | | |
| | 2 | - | - | | + | | | | - | - | + | + | | - |
| Sweden | 1 | | | | | | | | | | | | | |
| | 2 | | | | | | | | | | | | | |
| Austria | 1 | | | | | | - | - | + | | + | | | |
| | 2 | | | | | | - | | | | + | | | |
| Bolivia | 1 | + | | | | | | | | | | - | | |
| | 2 | + | | | | | | | | | | - | | |
| Portugal | 1 | | + | | + | | | | | | | | | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2 | | | | + | | | | | | | | | |
| Spain | 1 | + | | | | | | | | | | | | |
| | 2 | | | | | | | | | | | | | |
| Argentina | 1 | | | | | | | | | | | | | |
| | 2 | | | | | | | | | | | | | |

*Nigeria was not included

For the case of Chile, France and Italy, the results are confirmed, and even reflect the non-monotonic effect described above. In the case of Bolivia, a coefficient with a negative sign is associated with the policy variable, but this does not occur in the Spanish case, where no lag of the political variable is statistically significant. In line with what was previously found, no lag of the political variable is different from zero in the cases of Brazil, Sweden, Portugal, Spain and Argentina. Some discrepancies are observed in the cases of Botswana and Colombia (both with a positive lag of the political variable) and also in the case of Austria, which exhibits two positive lags.

## *5. Conclusions*

The discussion about the relationship between economic performance and democratic institutions turns out to be an extremely relevant research topic today. On the one hand, democracy could represent an obstacle to economic growth (due to greater insecurity regarding property rights, redistributive measures that decrease the net profitability of capital, etc.) or, on the other, democracy could represent a true "social technology " that allows information to be used in the best possible way, since it allows knowledge to flow and power to be dispersed, but also allows the socioeconomic system greater evolutionary flexibility around the application of best self-governance practices and accountability, regarding, for example, control over the political class, the possibility of carrying out citizen consultation processes for certain issues, the best management that could exist in a participatory local budget design, and addressing pressing issues such as climate change. This entails a recognition that the nature of problem has to do with the political institutionality that defines the incentives and shapes the material results in the economic sphere.

For 13 countries, an empirical study was carried out with the objective of identifying long-term regularities that could be identified through the specification of highly flexible time series models, complemented by the use of an automated model reduction algorithm.

It was found that a higher level of democracy does not necessarily cause a higher growth rate of GDP per capita. In three of the countries studied (Chile, France and Italy), democracy was shown to have a positive effect on the long-term growth path, while for two countries (Bolivia and Spain) the long-term effect was found to be negative. No significant effect was found for the remaining seven cases studied (Argentina, Colombia, Brazil, Nigeria, Portugal, Austria and Sweden).

This should lead to contextualizing the statement that "*democracy does generate growth*" and should also guide long-term economic development studies to incorporate the evidence of time series with a coherent narrative of the socio-economic processes and the specific historical context of each country.

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