

Types of government and innovative performance of countries

By Mario COCCIA[†]

Abstract. The present study endeavours to explain the differences of technological performances among nations. In particular, the paper analyses the relation between type of government of nations, and their technological and socioeconomic performances. Results suggest that high levels of technological performance of nations seem to be associated with executive with parliamentary monarchy and monarchy, whereas nations with mixed executive tend to have lower innovative outputs. A possible reason is that, in general, some typologies of executive (e.g., Monarchy) support the political stability of countries with fruitful socioeconomic developmental paths over the long run. Overall, then, the structure of executives of nations may be one of contributing factors to explain dissimilar patterns of technological performances and economic growth of nations over time and space.

Keywords. Technological performance, Innovative outputs, Leadership, Executive, Government, Technology, Socioeconomic performance, Political stability.

JEL. O11, P16, P51.

1. Introduction

The general determinants of socioeconomic and technological performance of nations are of profound interest in social and political sciences to understand the historical developmental paths over timeⁱ. Many studies have analyzed several determinants of technical change and economic growth, such as the democratization (Coccia, 2010; Acemoglu *et al.*, 2008), demographic change and population (Coccia, 2014), religion and culture (Guiso *et al.*, 2003; Coccia, 2014a), energy systems (Coccia, 2010a; 2010b), climate (Smithers & Blay-Palmer, 2001; Coccia, 2015a), new products (Calabrese *et al.*, 2005; Cavallo *et al.*, 2014; 2014a; 2015; Coccia, 2016)ⁱⁱ, institutional evolution (Acemoglu *et al.*, 2005), regulation of public action (Guenoun & Tiberghien, 2007), quality of local governance (Van Roosbroek & Van Dooren, 2010), political economy of R&D investments (Coccia, 2008, 2008a, 2008b, 2009, 2012, 2010c, 2013; Coccia & Rolfo, 2000; Rolfo & Coccia, 2005), technology transfer (Coccia, 2004, 2010d; Coccia & Rolfo, 2002; Cariola & Coccia, 2004), radical innovation (Coccia, 2016; 2016a, 2016b) scientific collaboration (Coccia & Wang, 2016; Coccia & Bozeman, 2016); reforms of central government (Adhikari *et al.*, 2012), etc. In general, institutions play a vital role in national innovation systems because they are one of the main elements of the complex network of economic agents that supports the process of technical advance in economy (Coccia, 2010). In particular, political institutions influence innovative activities by developing a set of laws, policies, norms, and infrastructures under which interactions between economic subjects, groups, and organizations take place for wealth creation and sustainability (*cf.*, Olstrom, 1990;

[†] Arizona State University, Interdisciplinary Science and Technology Building 1 (ISBT1) 550 E. Orange Street, Tempe- AZ 85287-4804 USA.

☎ . + 85287-4804

✉ . mario.coccia@cnr.it

Edquist, 2005; Spencer *et al.*, 2005). A theoretical framework linking national-level institutions to innovative activity differences across countries is the varieties of capitalism (VOC) approach by Hall & Soskice (2001).

The varieties of capitalism's (VOC) theory of technological innovation claims that variance in political institutions is the principal determinant of differences in national innovative behaviour: "more a polity allows the market to structure its economic relationships, the more the polity will direct its inventive activity toward industries typified by 'radical' technological change. Conversely, the more a polity chooses to coordinate economic relationships via nonmarket mechanisms, the more it will direct its inventive activity toward 'incremental' technological change" (Taylor, 2004, p.601). The state, the strengths of its authority and social power are important characteristics that influence economic systems, policy and relationships of economic subjects for fostering innovation and industries (Broberg *et al.*, 2013). In general, the leadership is a feature that can improve the technological and socioeconomic performances of complex organizations (Zaccaro, 2007; Makri & Scandura, 2010; Ryan & Tipu, 2013). However, in the varieties of capitalism's theory of technological innovation and in other theoretical frameworks, the concept and role of structure of executive, state power and leadership of government are generally absent (*cf.*, Taylor, 2004; Broberg *et al.*, 2013). Especially, in this research field, the relation between typologies of executive and technological performances of countries is hardly known. A main research question is *how* typologies of executive affect national level of innovative activity. The problem underlying this research question is to explain the institutional determinants of dissimilar technological and economic performance of countries. This study confronts this problem and endeavours to integrate whenever possible, the varieties of capitalism framework by analyzing the relation between types of executive and technological-socioeconomic performance of nations. In particular, this essay here has two goals. The first is to show that different patterns of technological innovations of nations may be also affected by dissimilar structures of executive. The second is to show that some typologies of executive can be more leadership-oriented, maintain political stability and support innovative activity of nations. Before analyzing and clarifying this socioeconomic issue, next sections present the theoretical background and methodology of this study.

2. Theoretical framework

In economics of technical change, questions about the institutional causes of differences in technological performances of nations have remained at the periphery of research fields (Taylor, 2004). In this context, the varieties of capitalism's (VOC) theory of technological innovation makes its foray to explain cross-national differences of technological performances and dissimilar directions of technological progress among nations. VOC is a theory of capitalism in which: "some countries use markets more than others to coordinate economic actors and this variation is used to explain a myriad of comparative and international political-economic behaviour" (Taylor, 2004, p.603).

This theoretical framework argues that national institutions affect firms and other economic subjects by coordinating their socioeconomic activities. Countries in VOC theory can be either liberal market economies (LMEs), which are based on competitive market arrangements or coordinating market economies (CMEs) that are based on non-market arrangements of collaborating networks of interacting firms/economic subjects (Hall & Soskice, 2001). The variation of coordinating mechanisms can influence patterns of innovation and economic activity of countries. In particular, economic subjects (firms, universities, public research organizations, etc.) operating within LMEs tend to produce more radical innovation, where as economic subjects in CMEs tend to generate more incremental innovation (Hall & Soskice, 2001; Taylor, 2004; Broberg *et al.*, 2013, pp. 2575 *ff*). An alternative framework in this research field is by Spencer *et al.*, (2005) that include the structure of the state and society:

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the structure of the state encompasses strong state structures where government authority is derived inherently from the state or weak state structures where government authority originates from the people. The structure of the society varies according to whether a country is organized along the interest of individuals (i.e., associational structures) or to the interests of groups of individuals (i.e., corporatists)- (Broberg *et al.*, 2013, p.257).

Spencer *et al.*, (2005) argue that different features of the structure of state and society generate four institutional types of nations: State corporatist, Social corporatist, Liberal pluralist and State nation. These theories have not been confirmed in empirical studies (Taylor, 2004; Broberg *et al.*, 2013). While the validity of certain of criticisms may be debated, it is clear that there are at least some facts about differences of technological performances of countries that these approaches have trouble explaining. The general consensus among scholars is that the varieties of capitalism's theory of innovation and theory by Spencer *et al.*, (2005) are in need of additional explanatory elements that better explain economic and innovation differences across countries (*cf.*, Campbell & Pedersen, 2007; Broberg *et al.*, 2013, pp. 2575 *ff.*).

A main variable, not included in these theoretical frameworks, is the leadership based on the structure of executive (Zaccaro, 2007; Avrey *et al.*, 2006; *cf.*, Klavans & Boyack, 2008). As a matter of fact, the examination of the relation between leadership and innovation is basic since leader systems can positively influence innovation processes and innovative activities of economic subjects (*cf.*, Howell & Avolio, 1993).

Leadership is defined in terms of: "(a) influencing individuals to contribute to group goals and (b) coordinating the pursuit of those goals... leadership as building a team and guiding it to victory" (Van Vugt *et al.*, 2008, pp.182-3). "Leadership is a solution to the problem of collective effort –the problem of bringing people together and combining their efforts to promote success and survival" (Kaiser *et al.*, 2008, p.96). Some studies argue that the leadership is a universal feature of human societies, which affects the population and citizens in important ways (Van Vugt *et al.*, 2008, p.182; Bennis, 2007). In fact, "Leadership... has a long evolutionary history... Arguably, individual fitness would be enhanced by living in groups with effective leadership (Van Vugt *et al.*, 2008, p.184). Leadership is also a system of relationships that involves the power in varying degrees in organizations (*cf.*, Hollander & Offermann, 1990). Galton defined leadership with two main features (as quoted by Zaccardo, 2007, pp.6*ff.*): 1) as a unique property of extraordinary individuals whose decisions are capable of sometimes radically changing the streams of history; 2) the unique attributes of such individuals in their inherited or genetic makeup (*see* Zhang *et al.*, 2009 for the genetic basis and gene-environment interactions on leadership role). Arvey *et al.*, (2006, pp.2-4) claim that the leadership role occupancy is associated with genetic factors influencing the personality variables, such as social potency and achievement of specific goals. "Galton... argued that the personal qualities defining effective leadership were naturally endowed, passed from generation to generation" (Zaccaro, 2007, p.6). The leadership is in general affected by the situational context (*cf.* Vroom & Jago, 2007, pp. 17*ff.*) and social environment around economic subjects (Zhang *et al.*, 2009). In fact, Porter & Mc Laughlin (2006, p.559) state that: "leadership in organization does not take place in a vacuum. It takes place in organizational contexts".

Many studies argue that the leadership is one of the most important determinants for improving innovation and performance in organizations. Jung *et al.*, (2003) show a positive linkage between style of leadership, called "transformational", organizational innovation and innovation-supporting organizational climate. Krause (2004) considers the leadership in terms of specific factors of influence (such as granting freedom and autonomy, openness of the decision-making process, etc.) for innovative behaviour of organizations. Other scholars, such as Makri & Scandura (2010, pp.85-86), show that the leadership

seems to be an important driver of firm's ability to innovate. Carmeli *et al.*, (2010) confirm that the leadership significantly enhances the performance of firms. In particular, transformational leadership tends to be a catalyst in enhancing organizational outcomes and innovation propensity (Ryan & Tipu, 2013; Gardner & Avolio, 1998; Howell & Avolio, 1993). In short, the examination of the leadership–innovation connection is important in advancing and developing country context in the presence of intense competition, institutional instability and macroeconomic volatility (Tybout, 2000).

Although the vast literature in these topics, social studies lack of an integrative theoretical framework, which explains the relation between the leadership in the structure of executive and technological performances of countries. In fact, type of executive and dominant political class can play a main role for socioeconomic performances of nations. Mosca (1933) showed that the politicians can be considered as leader entrepreneurs and their activities are similar to political enterprises (*cf.*, Schumpeter (1975 [1942])). Weber (1919) argued that the essence of democracy consists of having charismatic leaders, which can be able to contrast the powers of the bureaucracy, to affect political institutions and support policy and economic outcomes (*cf. also* Persson & Tabellini, 2001)ⁱⁱⁱ. In general, several studies show that political structures can affect, positively or negatively, economic development of nations (Radu, 2015; Coccia, 2010). Some important typologies of executive in the geopolitical structure of nations are as follows:

1. Monarchy is a form of executive in which a group, usually a family called the dynasty, embodies the country's national identity and one of its members, called the monarch, exercises a role of sovereignty.
2. Parliamentary monarchy is a state headed by a monarch who is not actively involved in policy formation or implementation but it has a main institutional role; governmental leadership (formally) is carried out by a cabinet and its head –such as a prime minister, premier, etc. - who are drawn from a legislature (parliament).
3. Mixed executive can be a parliamentary system of government: the executive branch of government has the direct or indirect support of the parliament (vote of confidence). Parliamentary systems usually have a head of government and a head of state. The head of government is the prime minister, who has the real power.

This theoretical background shows that the national institutions, the structure of executive and associated leadership can play a vital role in economic and social activity of nations. This study here endeavours to integrate whenever possible, the theoretical frameworks of VOC and Spencer *et al.*, (2005) by analyzing the relation between typologies of executive and innovative activities to explain the difference in technological and socioeconomic performances of countries. The following sections present methodology and results about this *nexus (connection)* to clarify, as far as possible, one of contributing factors that affects the socio-economic progress and dissimilar historical developmental paths of nations.

3. Methodology and working hypothesis

Suppose that:

1. A *nation* is a system that can produce the same outcome in different ways.
2. *Monarchy and parliamentary monarchy* are based on stronger authority and leadership-oriented structure of executive.
3. *Mixed executives* are a type of government of nations *not* based on leadership-oriented government and with lower social power.
4. The focal hypothesis of this study is:
Hypothesis α (HP α): Nations with leadership-oriented executives (Monarchy and Parliamentary Monarchy) have higher technological and economic performances than Mixed executive (not leadership-oriented executive), *ceteris paribus*.

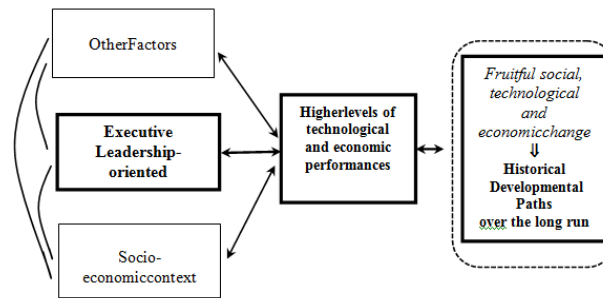


Figure 1. *Linkages between leadership-oriented executive and high levels of technological and economic performances of nations*

The purpose of the present study is to see whether the statistical evidence supports this hypothesis α that leadership-oriented executives are positively associated with higher technological and economic performances as represented in figure 1.

The source of Data is the Democracy Time-series Dataset by Norris (2008). The sample is based on all countries present in this dataset (Norris, 2008). The period under study is over 2010s. The study here considers the following classification of executive: parliamentary monarchy and monarchy that are assumed to be leadership-oriented executives, whereas mixed executive is supposed to be a not leadership-oriented executive^{iv}. In particular, Monarchy in the study here includes 13 countries; Parliamentary Monarchy includes 31 countries and Mixed executive includes 92 countries that for the sake of brevity, the list is not described in Appendix A.

The socio-economic variables and related years under study are:

- Gross Domestic Product (GDP) per capita purchasing power parity (PPP) annual by World Bank (2008). GDP is a measure of the economic activity. It is defined as the value of all goods and services produced minus the value of any goods or services used in their creation.
- Human Development Index (HDI) 2002 year (UNDP, 2004). The HDI is a summary measure of average achievement in key dimensions of human development: a long and healthy life, being knowledgeable and have a decent standard of living. The HDI is based on three dimensions: The health dimension is assessed by life expectancy at birth; the education dimension is measured by mean of years of schooling for adults aged 25 years and more and expected years of schooling for children of school entering age; the standard of living dimension is measured by gross national income per capita. The scores for the three HDI dimension indices are then aggregated into a composite index using geometric mean of normalized indices for each of the three dimensions (UNDP, 2016).
- Kaufmann political stability 2006. It measures perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including political violence and terrorism (WGI, 2016; Thomas, 2010).
- A main proxy of the technological potential of countries is the Energy consumption in Kilograms per capita and Electric power production (KWh) per capita.

The preliminary statistical analysis is performed with Arithmetic mean and Standard Deviation (SD) of these variables per typology of executive. Normality of distributions is checked with skewness and kurtosis coefficients. A logarithmic transformation is performed, when necessary, to obtain a normal distribution and apply correctly statistical analyses. The descriptive statistics are also represented with bar charts with average values of variables on y -axis and typology of executive on x -axis.

The main statistical analysis of this study compares the arithmetic means of key variables between specific executives by applying the Independent Samples *T* Test: this parametric test compares the means of two independent groups (*e.g.*, Monarchy/Parliamentary Monarchy *vs.* Mixed Executive) in order to determine whether the associated population means of variables among these sets of countries are significantly different. The null hypothesis (H_0) and alternative hypothesis (H_1) of the independent samples *T* test here are given by:

$H_0: \mu_1 = \mu_2$ (*i.e.*, arithmetic mean of Monarchy/Parliamentary Monarchy is equal to Mixed Executives)

$H_1: \mu_1 \neq \mu_2$ (*i.e.*, arithmetic mean of Monarchy/Parliamentary Monarchy is *NOT* equal to Mixed Executives)

This technique is a simple and reliable test to see whether statistical evidence supports the hypothesis α that nations governed by leadership-oriented executives (*e.g.*, Parliamentary Monarchy and Monarchy) have higher technological and economic performances than countries with Mixed executives (a not leadership-oriented executive), *ceteris paribus*. Statistical analyses are performed by means of the Statistics Software SPSS® version 15.0.

4. Statistical evidence

This section endeavours to substantiate the hypothesis α underlying the model of Figure 1. This study, as said above, hypothesizes that nations with a leadership-oriented executive, *e.g.*, Monarchy and Parliamentary Monarchy, have levels of socioeconomic and technological performances higher than Mixed Executives over time. Results of the descriptive statistics per typology of executive are in table 1.

Table 1. Descriptive statistics of variables per typology of executive

Classification of executive		GDP per capita US	Human Development Index 2002	Kaufmann Political Stability 2006	Energy Consumption Kg per Capita	Electric power production (KWh) Per Capita
Parliamentary Monarchy	Mean	\$11,055.52	0.83	0.597	3,434.97	16,121.58
Monarchy	SD	\$9,808.20	0.13	0.829	3,432.64	30,614.85
Monarchy	Mean	\$7,374.17	0.71	0.336	5,973.11	6,985.32
Mixed Executive	SD	\$5,512.96	0.13	0.721	7,912.94	12,226.46
Mixed Executive	Mean	\$5,757.65	0.68	-0.189	1,523.56	5,531.86
Mixed Executive	SD	\$6,668.25	0.18	0.975	2,198.42	12,007.55

Note: SD is Standard Deviation

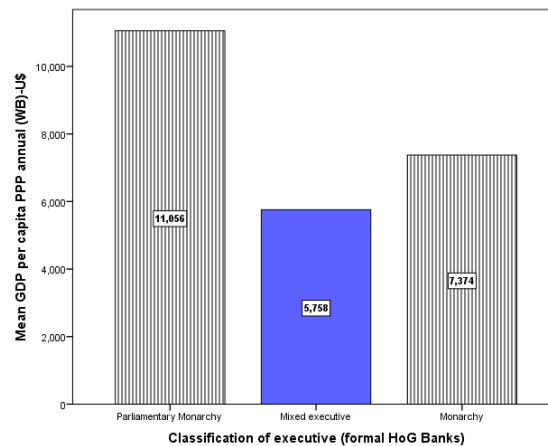


Figure 2. Average GDP per capita in US\$ per typology of executive

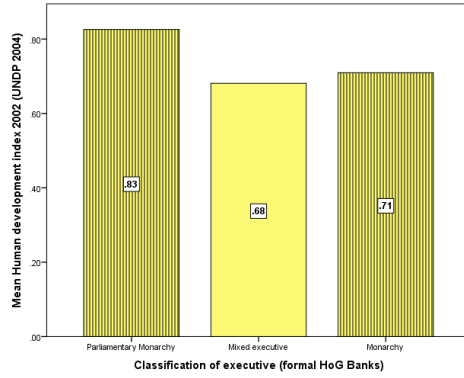


Figure 3. Average index of Human Development per typology of executive

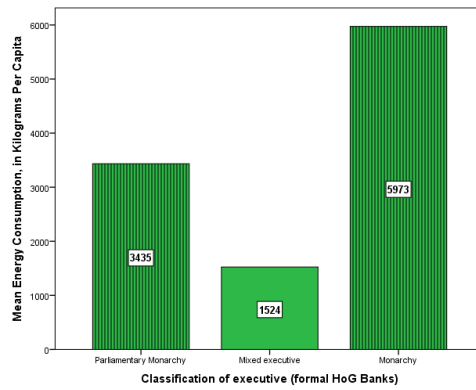


Figure 4. Average energy consumption (kg per capita) per typology of executive

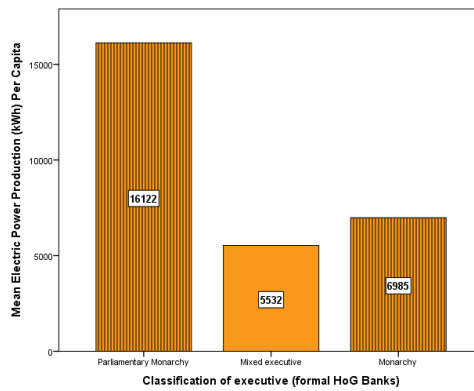


Figure 5. Average electric power production (in kwh per capita) per typology of executive

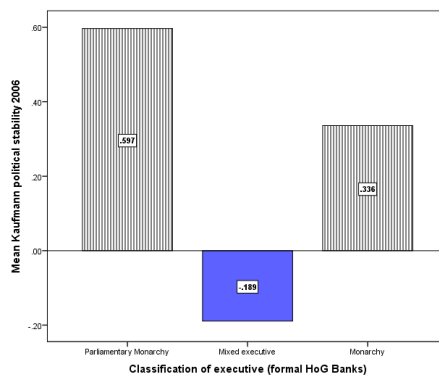


Figure 6. Average Kaufmann political stability 2006 per typology of executive

Figures 2-5 show that nations with parliamentary monarchy/monarchy have higher average levels of GDP per capita, HDI, and proxies of technological and economic performances.

One of the contributing factors that explains these results can be due to higher political stability of monarchy and parliamentary monarchy than mixed executive (*cf.* Tab. 1 and Fig. 6).

A logarithmic transformation is performed on some indicators to have normality of distribution and apply correctly further statistical analyses. Table 2 shows that the *p*-value of Test for Equality of Means (equal variances not assumed) is $p < 0.05$. In particular, considering this test, there is a significant difference at 5% in arithmetic mean performance of human development index (HDI), GDP per capita, electric power production and energy consumption per capita between countries with parliamentary monarchy/monarchy and mixed executive.

In short, results here seem to show that countries with leadership-oriented executives (*e.g.*, Parliamentary Monarchy and Monarchy) have a significant (statistically) higher average levels of economic and technological performance than countries with Mixed executive.

Table 2. Independent Samples Test

		Levene's Test for Equality of Variances		T-test for Equality of Means		
LN GDP per capita PPP annual						
Parliamentary Monarchy and Mixed executive	Equal variances assumed	25.024	0.00	17.727	2614	0.00
	Equal variances not assumed			18.572	1651.818	0.00
Mixed executive and Monarchy	Equal variances assumed	23.605	0.00	-7.219	2133	0.00
	Equal variances not assumed			-8.152	454.784	0.00
Human development index 2002						
Parliamentary Monarchy and Mixed executive	Equal variances assumed	195.576	0.00	21.14	3052.00	0.00
	Equal variances not assumed			24.62	2225.60	0.00
Mixed executive and Monarchy	Equal variances assumed	58.702	0.00	-2.82	2555	0.005
	Equal variances not assumed			-3.58	619.999	0.00
LN Kaufmann political stability 2006						
Parliamentary Monarchy and Mixed executive	Equal variances assumed	2.742	0.102	2.162	68	0.034
	Equal variances not assumed			2.321	66.361	0.023
Mixed executive and Monarchy	Equal variances assumed	2.887	0.096	-1.418	48	0.163
	Equal variances not assumed			-2.219	14.699	0.043
LN Energy consumption in kg per capita						
Parliamentary Monarchy and Mixed executive	Equal variances assumed	30.271	0.00	11.958	1458	0.00
	Equal variances not assumed			13.031	848.020	0.00
Mixed executive and Monarchy	Equal variances assumed	12.916	0.00	-6.854	1230	0.00
	Equal variances not assumed			-5.965	204.485	0.00
LN Electric power production (KWh) per capita						
Parliamentary Monarchy and Mixed executive	Equal variances assumed	13.783	0.00	14.722	2533	0.00
	Equal variances not assumed			15.351	1402.081	0.00
Mixed executive and Monarchy	Equal variances assumed	17.344	0.00	-6.058	2135	0.00
	Equal variances not assumed			-6.707	458.473	0.00

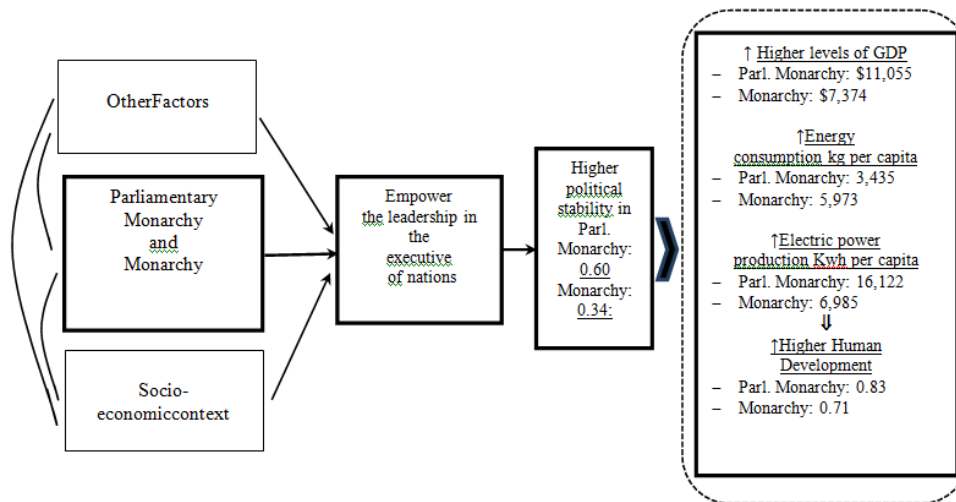


Figure 7. Empirical results of the linkage between Monarchy and Parliamentary Monarchy Executive and higher average levels of technological and economic performances, *ceteris paribus*

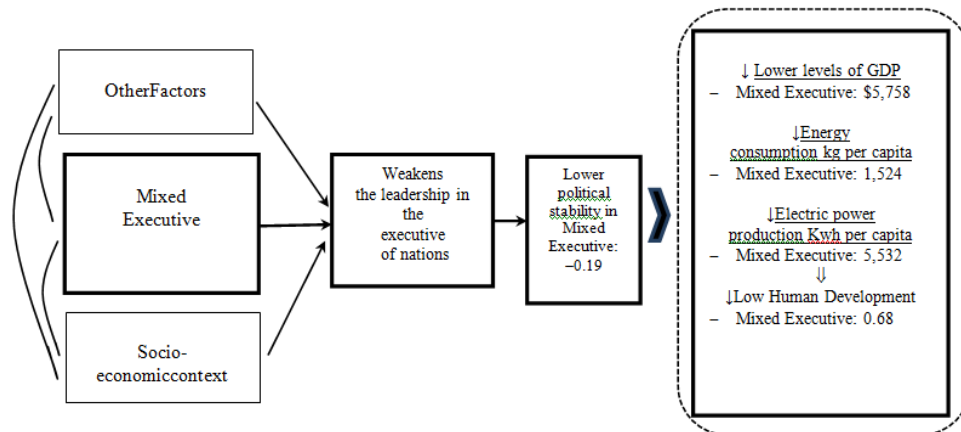


Figure 8. Empirical results of the linkage between Mixed executive and lower average levels of technological and economic performances, *ceteris paribus*

Hence, parliamentary monarchy/monarchy nations seem to have average levels of socioeconomic and technological performances higher than countries with mixed executive. These results are consistent with the hypothesis α stated above about the possible (*positive*) effect of leadership-oriented executives on technological and economic performances of nations, *ceteris paribus*. This result can be due to some systematic factors of nations, such as the higher political and economic stability of nations with a structure of executive based on parliamentary monarchy and monarchy (see Tables. 1-2; Fig. 6). These findings, based on statistical evidence, are synthesized in the figure 7 and 8. This study now moves on to discuss the results, trying, as far as possible, to clarify the relation between leadership-oriented executive and socioeconomic - technological performances of nations.

5. Discussion and concluding observations

Understanding the determinants of innovation is a key goal of the economics of technological change to explain dissimilar technological and economic performances of nations. One of the main problems in this research field is *how* the structure of executive affects national level of innovative activities. The study here can provide a conceptual integration of the VOC and Spencer *et al.*, (2005)

theoretical framework arguing that some typologies of structure of executive, leadership-oriented, can influence (*positively*) innovative activities of countries (fig. 10). Specifically, statistical evidence above seems in general to support the hypothesis α stated in the methodology that higher average levels of GDP per capita, energy consumption and electric power production per capita (proxy of economic and technological performances) of nations can be also explained by specific leadership-oriented executives, *e.g.* Monarchy and Parliamentary Monarchy, which induce a higher political stability over the long run, *ceteris paribus* (*cf.*, Guarini & Pattaro, 2016). *Vice versa*, countries based on mixed executives can have a weak leadership in the structure of government that generate a political instability and, as a consequence, lower levels of economic and technological performances.

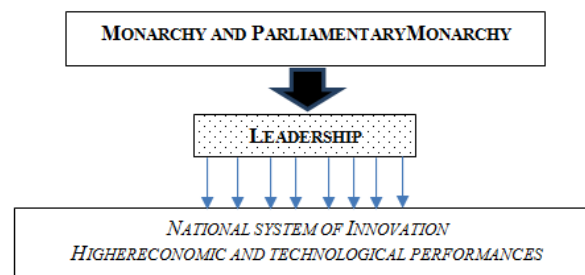


Figure 10. Percolation of leadership by specific structures of executive that support higher levels of technological and economic performances of nations, *ceteris paribus*

As debate surrounds the adequacy of the VOC theory of innovation and Spencer *et al.*, (2005) theoretical framework, the study's findings here suggest that the structure of government of countries may be a critical factor to explain some differences of innovative activities. In short, a clear and stronger leadership in executives of countries seems to be a main factor for supporting political stability and higher technological and socioeconomic performances over time. Broberg *et al.*, (2013) argue that: “national political institutions typified by strong state authority and corporatist societies were found to create higher levels of applied innovative activity”. Ryan & Tipu (2013) show that: “active leadership has a strong and significant positive effect on innovation propensity, while passive-avoidant leadership has a significant but weakly positive effect on innovation propensity” (*cf.*, Fernandez *et al.*, 2008).

One of the contributing factors of this positive relation between parliamentary monarchy/monarchy and higher levels of economic and technological performance can be due to longer political stability of countries with leadership-oriented executives. In fact, political stability has a positive effect on economic growth and other socioeconomic activities (*cf.*, Hussain Tabassam *et al.*, 2016).

This study provides some contributions to the socioeconomic literature on these topics, such as:

(1) A conceptual integration of VOC and Spencer *et al.*, (2005) theoretical framework by considering a new theoretical linkage between typologies of executive and a broader set of innovative and economic performances of countries (*e.g.*, GDP per capita, energy consumption and electric power production per capita).

(2) The conceptual framework here assigns a central role to the executive leadership-oriented, which is a factor neglected by certain of the dominant approaches to clarify contributing factors of higher levels of innovative activities and differences of technological – socioeconomic performances of nations;

(3) The conceptual framework here seems in general to show that specific types of executive, *e.g.* Monarchy and Parliamentary Monarchy established by

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Constitution and law, support a clear leadership of government that induces longer political stability, higher wealth and innovative activities over the long run;

This conceptual framework seems to be consistent (Thagard, 1988, Chp. 5), since it explains a greater number of socio-economic facts concerning higher technological performances of nations. Moreover, the simple elements of the study here are well known in economic and social sciences. The idea that leadership is associated with fruitful technological performance is not new and already used in social and political sciences (Jung *et al.*, 2008; Krause, 2004). However, the idea that leadership-oriented executives may be one of contributing factors that influences the political stability has not been used in literature to explain the different patterns of technological and economic performance across nations over time.

The characteristic of *analogy* of the results here is well-established in many studies of management and industrial organization (*cf.*, Makri & Scandura, 2010; Carmeli *et al.*, 2010; Nelson, 1999).

In short, the typology of executive can help to explain differences between countries innovative performances and can be a main factor to be considered in VOC and Spencer *et al.*, (2005) theories.

Perhaps the most interesting finding of this study is that Monarchy and Parliamentary Monarchy, rather than Mixed Executive support longer political stability, higher innovative activities and fruitful historical developmental paths.

However, the current study here is exploratory in nature and examines only a limited number of variables. Moreover, the findings are context-dependent because the geo-political structure of countries can change over time and space. Although this study offers important contributions to knowledge in these research fields, the study's findings need to be considered in light of their limitations. In fact, countries *within* the same political regime and type of executive have a high heterogeneity due to structural differences in political, cultural and social system that affect the technological and economic performances. Hence, some results discussed here should be considered with great caution because they are based on aggregate data of different countries with the same typology of executive. To explore the general implications of this study, future research should also consider some controls and intervening variables that may be useful in providing a deeper and richer explanation of these phenomena of interests (e.g., institutional contexts, electoral systems, level of democratization, etc.). Future efforts could also examine other techno metrics that more closely related to innovative activities.

Overall, then, the results of this study are of course tentative, since we know that other things are often not equal over time and space. In particular, more fine-grained studies will be useful in future, ones that can more easily examine other complex factors of socioeconomic systems that explain the dissimilar economic performance within and outside the same political regime and type of executive. Much work remains to understand the complex relations between executive of nations, their internal and external leadership and technological -socioeconomic performance to provide additional explanatory elements for a comprehensive VOC and Spencer *et al.*, (2005) theory. To conclude, most of the focus here is on some typologies of executives and variables, clearly important, but not sufficient for broader understanding of *how* political - institutional structures affect national level of innovative activity of several nations over the long run.

Notes

- ⁱ Calabrese *et al.*, 2005; Cariola & Coccia, 2004; Cavallo *et al.*, 2014, 2014a, 2015; Coccia, 2001, 2003, 2004, 2005, 2005a, 2005b, 2005c, 2006, 2006a, 2007, 2008, 2008a, 2008b, 2009, 2009a, 2010, 2010a, 2010b, 2010c, 2010d, 2010e, 2011, 2012, 2012a, 2012b, 2012c, 2012d, 2013, 2013a, 2014, 2014a, 2014b, 2014c, 2014d, 2014e, 2014f, 2014g, 2015, 2015a, 2015b, 2015c, 2015d, 2016, 2016a, 2016b, 2016c, 2017, 2017a, 2017b, 2017c, 2017d, 2018, Coccia & Bozeman, 2016; Coccia & Finardi, 2012, 2013; Coccia & Wang, 2015, 2016; Coccia & Cadario, 2014; Coccia *et al.*, 2015, 2012, Coccia & Rolfo, 2000, 2002, 2009, 2012, 2007, 2010, 2010, 2013; Coccia & Wang, 2015, 2016; Rolfo & Coccia, 2005.
- ⁱⁱ *Cf. also* Coccia 2009c, 2012a, 2012b, 2012c, 2012d, 2014b, 2015b, Coccia & Wang, 2015, Coccia *et al.*, 2012.
- ⁱⁱⁱ cf. Hernandez, 2008; Coccia (2001; 2008, 2009a, 2009b), Coccia & Cadario (2014), Coccia *et al.* (2015), Coccia & Rolfo (2007, 2010) for the relation between bureaucracy, organizational behaviour and performance of public organizations.
- ^{iv} Other types of executive, such as Presidential Republic, are not considered because data are misleading.

Appendix

Table 1A. Countries with Type of Executive in 2003

Monarchy		Parliamentary Monarchy	
Country	Region	Country	Region
Bahrain	Middle East	Andorra	Western Europe
Bhutan	Asia-Pacific	Antigua & Barbuda	South America
Brunei Darussalam	Asia-Pacific	Australia	Asia-Pacific
Jordan	Middle East	Bahamas	South America
Kuwait	Middle East	Barbados	South America
Monaco	Western Europe	Belgium	Western Europe
Morocco	Middle East	Belize	South America
Nepal	Asia-Pacific	Cambodia	Asia-Pacific
Oman	Middle East	Canada	North America
Qatar	Middle East	Denmark	Scandinavia
Saudi Arabia	Middle East	Grenada	South America
Swaziland	Africa	Jamaica	South America
Tonga	Asia-Pacific	Japan	Asia-Pacific
		Lesotho	Africa
		Liechtenstein	Western Europe
		Luxembourg	Western Europe
		Malaysia	Asia-Pacific
		Netherlands	Western Europe
		New Zealand	Asia-Pacific
		Norway	Scandinavia
		Papua New Guinea	Asia-Pacific
		Samoa	Asia-Pacific
		Solomon Islands	Asia-Pacific
		Spain	Western Europe
		St. Kitts & Nevis	South America
		St. Lucia	South America
		St. Vincent & Grenadine	South America
		Sweden	Scandinavia
		Thailand	Asia-Pacific
		Tuvalu	Asia-Pacific
		United Kingdom	Western Europe

Note: Mixed Executives are not reported due to the long list of countries. Other types of executive, e.g. Presidential Republic, are not considered because data are misleading.

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