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Culture, Institutions and Economic Growth

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Abstract

Are formal and informal institutions complementary or substitutable ? In this article, we argue that formal and informal institutions have a complementary relationship rather than a substitutable one. We study the possible complementarity between formal institutions, measured by Institutional Profiles Database (IPD), and informal institutions, measured by the World Value Survey (WVS), by including both into a growth model. Our main result shows that the interaction effect between informal and formal institutions in a country positively impacts growth, which support the hypothesis of a complementary between both of them.

1 Motivation

In 1957, Germany, the Netherlands, Belgium, France, Italy and Luxembourg signed the Treaty of Rome. The treaty created a common market between these six countries, promoting economic growth. European institutions were also introduced: the European Commission, the Council of Ministers, the Parliamentary Assembly and the European Court of Justice. In 1973, this common market expanded with the integration of Denmark, Ireland and the United Kingdom. In 1992, a considerably bigger European Union (EU), now with 28 member states, emerged with the Maastricht Treaty. Despite a growth rate of 2.44% in 2017 (source: World Bank) and an average growth rate of 2.71% for the 1961-2017 period, [1] the United Kingdom intends to leave the EU, a decision colloquially referred to as Brexit.

Many motivating factors for Brexit have been cited: including establishing more stringent immigration controls, restoring national sovereignty, gaining freedom from Brussels regulations, etc. The latter motivation reflects a mismatch between the EU's rules and institutions and British culture. In effect, a conflict between formal institutions and culture can have a negative impact on a country's economic performance (North et al., 2000).

This negative impact on economic performance has been observed in the past in Latin America, for example. When they became independent in the nineteenth century, Latin American countries endowed themselves with Constitutions inspired by the US model, providing for the election of political officials, the suppression of privileges and the establishment of a federal system. The United States and these countries did share a number of similarities, in that they had been colonized during the sixteenth and seventeenth centuries by European powers, possessed significant amounts of natural resources, trading cities and routes, and had declared their independence during the same historical period (1783 for the United States and 1825 for Latin America). However, the effects of formal institutions on economic performance diverged, yielding political and economic stability in the United States but political instability and very fluctuating growth in Latin America. Different cultural heritages may explain these divergent effects (North et al., 2000). The culture of the United States is marked by the importance of freedom, and of the political and economic rights of individuals. There is a strong confidence in individual initiative, private property rights, political freedom and limited public intervention. On the other hand, the culture of Latin American countries is marked by a set of rights and privileges granted to certain social groups as well as by a centralized and interventionist political power (North et al., 2000).

This historical illustration demonstrates the role played by the formal institu-

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[1] Average growth rate calculated by the author with World Bank's data

tions/culture couple in a country's present and future economic performance.

The links between formal institutions (*"rules, laws, contitutions"* (North, 1994, p. 360)), culture (*"norms of behaviour, conventions, self-imposed codes of conduct"* (North, 1994, p. 360)), enforcement characteristics and economic growth were studied theoretically by Douglass North in the late twentieth century. North showed that formal institutions, culture and enforcement characteristics influenced economic growth (North, 1989). The empirical literature was able to confirm some theoretical hypotheses such as (i) the effect of formal institutions on economic growth (Knack and Keefer, 1995) (Keefer and Knack, 1997) (Rodrik, 2000), (ii) the effect of culture on economic growth (Granato et al., 1996) (McCleary and Barro, 2006a) and (iii) the link between these two variables (Licht et al., 2007) (Klasing, 2013).

However, in North's theoretical analysis, *" it is the admixture of formal rules, informal norms and enforcement characteristics that shapes economic performance"* (North, 1994, p. 366).

Therefore, an institution's effect on economic performance would depend on the other institutions present at the same time (especially cultural). This is called a relationship of complementarity. The analysis of institutions in terms of complementarity calls for considering formal institutions and culture concurrently.

However, the complementarity hypothesis has not been genuinely investigated in the empirical literature. To our knowledge, only one article (Williamson and Mathers, 2011) has addressed the question of complementarity and considered the two variables simultaneously.

Their results show that formal institutions and culture are more substitutable than complementary. Therefore, in the presence of formal institutions, the impact of culture on growth is less significant, which contradicts the theory of complementarity. In order to go one step further, we will test this hypothesis of complementarity in a broader framework, i.e, endogenous growth, over a different period and with new measures of institutions and culture. Our analysis revisits Williamson and Mathers' results and allows us to better understand the relationships between culture, institutions and economic growth.

The paper is structured as follows: in Section 2 we present the main theoretical background and develop our hypotheses. In Section 3, we provide detail on the data and variables used for our estimated growth model. In Section 4, we present our empirical results and their interpretation. Finally, we summarize our main contributions in the conclusion.

2 Theoretical background

2.1 Determinants of growth: from exogenous factors to new variables

In the 1960s, the neo-classical growth models of Ramsey (Ramsey, 1928), Solow (Solow, 1956) and Swan (Swan, 1956) were predominant in the literature on growth theories. These models predicted that the lower the initial level of development, the higher the growth rate.

While interesting in their responses to Harrod's knife-edge equilibrium, these models were criticized because they assume that growth factors are exogenous. To remedy this, so-called endogenous growth models emerged.

Endogenous factors include private investment (Romer, 1986), the accumulation of human capital through the externalities it generates (Lucas, 1988) and public consumption (Barro, 1990). However, while these theoretical models are interesting to explain growth, the empirical studies have more heterogenous conclusions, suggesting a missing link akin to X-inefficiency in Leibenstein's classical study.

The missing link can be institutions, as Rodriguez-Pose suggests in his study of regional growth (Rodríguez-Pose, 2013).

At the end of the twentieth century, theoretical analyses began to consider institutions, culture and their links to economic growth (North and Thomas, 1976) (North, 1990). Douglass North was the first to be interested in institutions and their effects on economic growth. He defined institutions as follows :

> "Institutions are the humanly devised constraints that structure human interaction. They are made up of formal constraints (e.g., rules, laws, constitutions), informal constraints (e.g., norms of behaviour, conventions, self-imposed codes of conduct), and their enforcement characteristics" (North, 1994, p 360)

This definition can be broken down as follows, into:

- So-called informal constraints, i.e. *"traditions, customs, moral values, religious beliefs, and all other norms of behavior that have passed the test of time [and which are] the part of a community's heritage that we call* **culture**" (Pejovich, 1999, p. 166).

- So-called formal institutions, i.e. *"constitutions, statutes, common law and other governmental regulations"* (Pejovich, 1999, p. 167) that determines political and economic systems.

- Governance: this includes the implementation of the rules or institutions and their characteristics.

Theoretically, institutions, such as property rights, will influence economic growth through the incentives they generate (North and Thomas, 1976).

Empirically, Chong and Calderon (Calderón and Chong, 2000), using the causal analysis method developed by Geweke (Geweke, 1982), highlighted the link between institutions and economic growth. They also pointed out that the influence of institutions on growth takes times to be visible, unlike the opposite relationship. So, the longer the waiting time, the stronger the effect of institutional reforms on economic growth will be.

Many studies using other econometric analysis methods, particularly growth model estimation, confirmed the causal link between institutions and growth. These works showed that institutions, represented by property rights and their security, have a positive and significant impact on economic performance, particularly growth (Vijayaraghavan and Ward, 2001) (Knack and Keefer, 1995) (Keefer and Knack, 1997) (Acemoglu and Johnson, 2003). These studies provide empirical support for the theoretical analysis proposed by North (North, 1990) and North and Thomas (North and Thomas, 1976).

Accordingly, our first hypothesis will concern the direct links between institutions and economic growth:

Hypothesis 1.1: *Institutions (and their implementation, i.e. governance) have a positive effect on economic growth.*

Other empirical studies based on the North-Thomas theory have examined the relationship between political institutions (such as democracy) and economic growth. Political regimes that promote political participation such as democracy may be expected to have a positive and significant impact on long-term economic growth (Rodrik, 2000). However, this relationship between democracy and long-term growth does not appear to be linear (Henisz, 2000). Henisz also concludes that political constraints have a positive and significant effect on growth in contrast to constant executive turnover, which has a negative effect.

Although various studies confirm the links between institutions and growth, some authors question its predominant effect. Glaeser, La Porta, Lopez-De-Silanes and Shleifer (Glaeser et al., 2004) strongly contradict previous studies. Their results further confirm growth theories that emphasize the effect of human capital through the externalities it generates rather than those that emphasize the effect of institutions. For them, a country will emerge from poverty because of the accumulation

of human and physical capital allowed by the existing government (often dictatorships). When these countries become rich enough, they change their institutions (and in the process improve their quality), which allows them to generate growth.

Hence, regarding the impact of institutions on growth, two different points of view coexist in the empirical literature. Yet, a synthesis between these two visions is possible. As a matter of fact, Lee and Kim (Lee and Kim, 2009) showed that the effect of institutions and human capital on growth varies according to the initial level of development. For countries with low levels of development, the focus must first be on primary and secondary education as well as on institutions. States with a high level of development must promote tertiary education and technological innovation. Finally, Huynh and Jacho-Chavez (Huynh and Jacho-Chávez, 2009) obtain results confirming, on the one hand, the hypothesis put forward by Glaeser and al. (Glaeser et al., 2004) namely that : poor countries grow because of policies implemented by political authorities (usually dictatorships); and on the other hand the assumption that institutions and in particular their stability over time have an impact on economic growth (Rodrik and World Bank, 2006).
It appears, then, that the effect of the institutions on economic growth is robust although it varies according to the country's initial level of development. Therefore, our second hypothesis:

Hypothesis 1.2: *The effects of the institutional characteristics of democracies (like security of property, freedom of press, low intervention on the market) depend on the country's initial level of development:*

- *in countries with a higher level of development, institutional characteristics of democracies will have a positive effect on economic growth.*

- *in countries with a lower level of development, institutional characteristics of democracies will have a negative effect on economic growth, contrary to the institutional characteristics of dictatorships.*

Culture also affects economic growth through trust (Francis Fukuyama cited in (Ramocka, 2010)). Trust will affect economic growth while enhancing firm's abilities to cooperate. In addition, some cultures are considered pro-development (Mariano Grondona, cited in (Ramocka, 2010)). The pro-development culture is mainly characterized by individual selfishness as well as the promotion of private property which is considered as a natural right. In this type of culture, wealth is a source of personal satisfaction for the individual and a consequence of his personal work. This pro-development culture is also characterized by competition and market economy. In contrary, cultures seen as anti-development associate wealth with

fraud, crime or a symbol of power granted by certain authorities. Private property is not a right and can be prohibited by the authorities (religious authorities for example).

Empirical literature also studies the links between culture and economic growth. Some cultural values have a positive effect on economic growth while others have a negative one.
Some religions, particularly Judaism, have a positive impact on economic growth (McCleary and Barro, 2006b). The underlying mechanisms for this relationship are the following (Guiso et al., 2006):

- Religion influences individuals' preferences, pertaining for instance to savings. People who practice a religion, especially a monotheistic one, tend to teach the importance of saving to their children. This is conductive to investment and economic growth. Empirically, the positive relation between savings culture and economic growth was highlighted by Granato, Inglehart and Leblanc (Granato et al., 1996).

- Religion also affects the level of trust present in a society. In their articles, Zak (Knack and Zak, 2001) and Tabellini (Tabellini, 2010) showed that a high level of confidence is positively associated with the growth rate.

In addition to the level of trust, Tabellini (Tabellini, 2010) distinguishes three other cultural traits likely to promote economic growth: 1. the fact that individual efforts have paid off and individuals are free to make their own choices (measured by the "control" variable), 2. the type of morality (generalized or limited) practiced by the individual (measured by the "respect" variable) and 3. individual obedience to norms ("obedience" variable). Taken individually, each cultural trait cited above has a positive effect on growth. The last cultural variable used in Tabellini's paper, created using these four cultural traits, also has a positive effect on economic growth.
Among the cultural dimensions built by Hofstede[2] to measure culture, individualism has a central and robust effect on a country's economic growth (Gorodnichenko and Roland, 2010) (Gorodnichenko and Roland, 2011). However, this conclusion can be nuanced because economic growth is also promoted by community policies (Swank, 1996) characterized by collectivism, consensus and consultation, the opposite of individualism, competition and conflict, which define individualistic societies.

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[2]Hofstede distinguishes five cultural dimensions : power distance, long-term versus short-term orientation, uncertainty avoidance, individualism versus collectivism, and masculinity versus femininity

Finally, the power distance and the risk-taking dimensions (uncertainty avoidance) would also promote economic growth (Grenness, 2015). A culture characterized by risk-taking and meritocracy (which corresponds to a small power distance) would have a higher growth rate than those without these characteristics.

So, we conclude that the effect of culture and cultural traits on economic growth is robust because it has been highlighted by numerous studies. Then, our second hypothesis is the following:

> **Hypothesis 2:** *Cultures characterized by individualism and meritocracy (low power distance) have a positive effect on economic growth.*

2.2 In search of new explanations for growth: the interactions between culture and institutions

The results, confirming the institution/growth and culture/growth links appear robust. Nevertheless, they may suffer from an endogeneity bias due to an omitted variable. Indeed, the regressions carried out in the studies mentioned above consider either culture or institutions. These two variables have a simultaneous effect on economic growth. So, it therefore seems relevant to us to incorporate both culture and institutions into a growth model.

We must also consider the fact that culture and institutions are interconnected. Indeed, (formal) institutions are determined by agents who have a certain culture. Therefore, culture has a direct impact on the creation and establishment of institutions (North, 1990) and vice versa, which means that their relations are bilateral. However, the causal link from culture to institutions is stronger than the link from institutions to culture (Pryor, 2007). Hence, based on a case study on East and West Germany in Autumn 1990, the author concluded that the culture to institutions path is the most significant. Some cultural characteristics are influenced by the economic system, but this causality is weaker.

Other empirical studies have corroborated this result using different measures of cultural traits. The Hofstede and Schwartz measurements are most used in empirical studies. Hofstede distinguishes five cultural dimensions (Hofstede, 2007): power distance, long-term versus short-term orientation, uncertainty avoidance, individualism versus collectivism and masculinity versus femininity. As for Schwartz, he distinguishes seven (Schwartz, 2006): embeddedness, intellectual autonomy, emotional autonomy, hierarchy, egalitarianism, harmony and mastery. Among these different dimensions, institutions are mainly affected by individualism and power distance (Gorodnichenko and Roland, 2010) (Klasing, 2013) (Licht et al., 2007).

The results of the various studies are homogeneous, and the same cultural traits are highlighted in most articles. The impact of culture on institutions appears to be robust.

The second causal link goes from institutions to culture. Empirical results are less robust for that path. Indeed, Gorodnickenko and Roland (Gorodnichenko and Roland, 2010) showed that the effect of the institutions on culture is small, while on the contrary Zak and Knack (Knack and Zak, 2001) conclude that the institutions have a positive and highly significant effect on culture. These diverging conclusions can be explained by the use of different measures of culture in the two papers.
In conclusion, culture has an important effect on institutions; the inverse causal link exists but to a lesser extent and less systematically.

Finally, Douglass North's theory highlights a complementary link between culture and institutions, positing that cultural and formal institutions form the institutional matrix which *"is characterized by [...] complementarities"* (North, 1993, p. 6). They *"are the underlying determinants of economic performance"* (North, 1994, p. 359).
Hence, this complementary link, which means that the effectiveness of an institution depends on the other concurrently present institutions, is considered in our last hypothesis:

Hypothesis 3: *Institutions and culture are complementary, i.e. "the presence of one institution enhances the performance of another" (Aoki, 2001) (Hall and Soskice, 2001). In our case, this means that culture will increase the effect of institutions on economic growth.*

This complementarity hypothesis is seldom integrated in growth models; only Williamson and Mathers (Williamson and Mathers, 2011) do so. However, while their results seem to be robust, the variable used to measure economic institutions, i.e. the Economic Freedom of the World by the Fraser Institute, is subject to criticism because:

- The link between growth and this indicator is not robust (De Haan and Siermann, 1998).

- The indicator suffers from subjective biases. For example, it uses the top marginal tax rate as a measure of the degree of tax progressivity, without justifying this choice (Heckelman and Stroup, 2000).

In response to such criticisms, we propose to construct a new growth model with original measures of culture, institutions and their combined effects.

3 Data and Model design

3.1 Data

3.1.1 Measuring institutions

In order to estimate the effect of institutions on economic growth, we need to measure these institutions. This means creating institutional indicators and databases. To measure institutions, the indicators shall meet the following criteria (Voigt, 2009): (1) investigate a specific institution, (2) be objective, and (3) measure institutions *de jure* (i.e. the institution's form) and *de facto* (i.e. the institution's implementation).

Thus, in view of the criteria cited above, institutional measures widely used in the empirical literature such as Worldwide Governance Indicators[3] (WGI[4]) do not measure institutions well.

To measure institutions, we therefore chose to use a database called Institutional Profiles Database[5] (IPD). Several reasons have influenced our choice.

Firstly, the institutional indicators present in this database meet the three criteria mentioned above.

In addition, this database surveys developing and developed countries, which allows access to a wide variety of institutions and accounts for over 90 % of GDP and of the world's population.

Then, when we compare the database with the commonly used WGI base, we notice that the IPD indicator covers a larger institutional field. Indeed, the six indicators[6] included in the WGI are strongly correlated with each other and concentrated in the same area[7] when projected onto the circle of correlations of a principal component analysis (PCA). The IPD indicators are, on the other hand, scattered in many directions. This suggests that IPD indicators are better suited to determining a country's institutional profile than the WGI.

Although this database is an excellent alternative to other empirically used databases,

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[3]Indicators produced by the World Bank Institute

[4]Many articles use this database, for example : (Vijayaraghavan and Ward, 2001), (Licht et al., 2007),(Kraay and Kaufmann, 2002), (Dollar and Kraay, 2003), (Maseland, 2013).

[5]For more details on the database construction, questionnaire administration, data collection, control of responses, the rating system and the aggregation of variables refer to (Bertho, 2013).

[6]The six indicators are: 1. Voice and Accountability, 2. Political Stability and Absence of Violence, 3. Government Effectiveness, 4. Regularity Quality, 5. Rule of Law, 6. Control of Corruption.

[7]Appendix 1 includes the IPD and WBI correlations circle.

it has a substantial number of indicators, [8] which make it unusable in an econometric model. We have accordingly highlighted two indicators[9] using a factor analysis. The factor analysis (PCA[10]) is used in order to reduce the number of variables and to build a typology of the various countries according to their institutions.[11] The first indicator pertains to governance. The characteristics of "good governance" are the effectiveness of public administrations, the proper application of justice and low corruption. It is in the negative part of the axis which is exclusively explained by countries with high human development (measured using the HDI)such as Germany, Norway or Sweden. The positive part of this axis mainly includes Zimbabwe, which has low human development. This axis separates two types of societies :[12]

- Those with a high level of economic development (measured by GDP), high life expectancy and a high level of education. They also enjoy a number of rights, freedom and security.

- Those with a high level of corruption, few rights and little security. They face arbitrary state violence. They also have high mortality and low literacy rates.

The second indicator represents the degree of state intervention and control at

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[8]The IPD contained 110 institutional indicators as of 2006, 133 institutional indicators as of 2009 and 130 institutional indicators as of IPD 2012.

[9]Appendix 2 provides more detail on the analysis

[10]PCA is part of the multivariate statistics family. It extracts a small number of variables from a database while summarizing as much information as possible. This objective is to determine the underlying structure of a database by reducing the initial number of variables to a small number of factors named principal components. They are independent of each other and limit the loss of information.

[11]This method of analysis has several advantages :

1. The PCA constructs measures that are not based on vague and general subjective perceptions but objectively determined (Jellema and Roland, 2011).

2. The principal components are independent of each other, so that the variables are not redundant.

3. This analysis has been used to create some institutional and cultural measures. These include institutional variables built from ICRG data; those built from the IPD base by Desdoigts et al (Desdoigts et al., 2004), those by De Crombrugghe and Farla (De Crombrugghe and Farla, 2012) and the cultural variables used by Klasing (Klasing, 2013), Jellema and Roland (Jellema and Roland, 2011) or Tabellini (Tabellini, 2010)

[12]Desdoigts et al. obtain the same results on the 2006 IPD (Desdoigts et al., 2004).

the social and economic level.[13] Countries such as China, the Kingdom of Saudi Arabia or Cuba are in the positive part of this axis. This part represents an authoritarian government: the government is present in the economic sphere with public enterprises and banks and in the social sphere by controlling access to information or limiting the creation of organizations. The negative part of the axis includes countries such as Senegal, Mali and Benin. It is characterized by non-interventionist states.

We first project the countries of our database on a two-dimensional plan represented by the first and the second indicators.[14] Second, the PCA analysis (complemented with a k-means analysis) allows us to build a typology (that we will use in our econometric model) of three groups characterized as follows:[15]

- The first cluster is composed of countries with good enforcement of existing rules (governance), control of corruption and a judicial branch that promotes the security of property rights and private contracts. Innovation is supported by governments and by rules allowing compliance with private property. Lastly, authorities intervene in social matters, for example by providing unemployment benefits or pensions, open schools and public hospitals, etc. On the other hand, their direct intervention in the markets is weak, which is beneficial to the market economy.

- The second cluster represents countries where traditional solidarities are strong whereas institutional solidarities are weak. Governments do not intervene socially or economically. The "laissez-faire" policy is de rigueur. Corruption and insecurity are high. Governments do not have the capacity to enforce existing rules and the security of property rights.

- The latter cluster has low-quality governance and poorly standardized traditional solidarity. Governments intervene in social and economic life: the weight of the state is significant in the banking and entrepreneurial sector. The information available is filtered and civil society is less free than in the first cluster.

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[13]De Crombrugghe and Farla obtain similar results on the 2009 IPD (De Crombrugghe and Farla, 2012).

[14]Appendix 3 presents this projection

[15]Appendix 3 presents the graphic representation of these three clusters.

3.1.2 Measuring cultures

To measure culture, we will use the WVS database.[16] Created in 1981 under the helm of political scientist Ronald Inglehart, this database *"investigates human beliefs and values"*.[17] This investigation is conducted in nearly hundred countries using a common survey.[18]

Based on this questionnaire, following Chai and Kim's methodology (Chai and Kim, 2009),[19] we will create two cultural indicators:[20] Grid and Group.

The creation of these two indicators will allow us to use Mary Douglas's Grid/Group cultural theory as well as the associated typology. As suggested by sociologists Kemper and Collins, the Grid/Group cultural theory can be used to compare cultures among societies (Kemper and Collins, 1990, p. 48):

"We see that the structural features underlying the two-dimensional [Grid/Group] model can be usefully applied [...] to cross-cultural comparisons among whole societies"

The Grid and Group indicators that we will estimate can be described[21] as follows:

- The Grid variable is interested in the question: how can the individual act? It deals with the rules that are imposed on individuals during a social interaction. In some societies, individuals can organize their relationships and build their role within social interactions. This type of society is in the low part of the Grid variable. In societies located in the high part of this variable, the rules are imposed on the individual. The role is thus prescribed to the individual.

- The Group variable answers the question: with whom can the individual act? This variable promotes the individual against the group. The individual is free to choose the relationships that interest him and to build a network according to his personal interest. In this society, we can identify individuals belonging to the group. The group's claims are made on behalf of the community.

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[16]This database has been used by many authors such as (Pryor, 2005) (Guiso et al., 2006) (Williamson, 2009) to create cultural variables.

[17]http://www.worldvaluessurvey.org/WVSContents.jsp

[18]Appendix 4 includes an excerpt from this questionnaire.

[19]Their methodology has been applied in other articles to measure culture, namely (Torsello, 2013), (Castilla-Rho et al., 2017) and (Chai et al., 2018).

[20]Appendix 5 provides a more detailed methodology for choosing questions and processing answers.

[21]A description of the variables and a detailed analysis of Mary Douglas's theory was conducted by Calvez (Calvez, 2006).

The Grid and Group variables distinguish four cultural patterns:[22]

- The "individualism" pattern is characterized by low social constraints. The individual is free to interact with whoever he wants and to use his network of knowledge as he wishes. Social mobility is significant, and competition and risk are accepted.

- The "fatalism" pattern is characterized by a strong assignment of roles to individuals. At the same time the individual is socially isolated because the group is not very present.

- The "hierarchy" scheme refers to a group with a strong hierarchical organization and many rules. This scheme can be compared with Max Weber's bureaucracy.

- The "egalitarianism" scheme is characterized by a solidarity group. This group has few rules, which leads to internal differences. In this scheme, the use of a "fall guy" is socially accepted.

High grid	B. Fatalism Apathy, risk averse Nature capricious Blame fate	C. Hierarchy Bureaucracy, decisions from above Nature perverse/tolerant Blame deviants
Low grid	A. Individualism Free exchange, competition Nature benign Blame incompetence	D. Egalitarianism/enclave Sharing, concern with moral purity and boundaries against outsiders Nature is ephemeral Blame the system
	Low group	High group

Source : Caulkins, (Caulkins, 1999, p. 111)

Finally, we project the countries in our database on a two-dimensional plan to show what cultural pattern they fit:[23] the horizontal axis shows the estimated score on the Group variable and the vertical axis shows the estimated score of the Grid variable.

3.2 Model specification and estimation strategy

The estimated initial model is a neo-classical growth model of the following form:

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[22]Mary Douglas (Douglas, 1978) presents these patterns
[23]Appendix 6 presents this projection

$$y_i = \beta_0 + \sum_{j=1}^{6}(\beta_j * X_{ji})$$

with

- y_i: the dependent variable is the country's growth rate i.

- X_{ij}: the different variables j control[24] of the country i.

In order to test Hypothesis 1 (1.1 and 1.2), we add the two institutional variables calculated previously to this initial model. This gives us the following equation to estimate:

$$y_i = \beta_0 + \sum_{j=1}^{6}(\beta_j * X_{ji}) + \sum_{k=1}^{2}(\beta_k * I_{ki})$$

with

- I_{ki}: the institutional variables k (1 and 2) of the country i.

In order to test Hypothesis 2, we will add to the second equation our "Grid-Group" cultural variables. This gives us a third model to estimate.

$$y_i = \beta_0 + \sum_{j=1}^{6}(\beta_j * X_{ji}) + \sum_{p=1}^{2}(\beta_p * C_{pi})$$

with

- C_{pi}: the cultural variables p (Grid and Group) of the country i.

Estimating the Grid cultural variable's effect[25] on economic growth allows us to test whether a culture characterized by meritocracy has a positive effect on economic growth.
Estimating the Group cultural variable's[26] on economic growth allows us test whether an individualistic culture has a positive effect on economic growth.

Finally, in order to test Hypothesis 3, our last model includes institutional and cultural variables, and their terms of interaction into the original model. This gives us the following equation:

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[24]Appendix 7 lists the control variables used and where they come from.

[25]Hofstede's power distance variable and Mary Douglass' Grid variable estimate the same dimension of culture. They are both good estimators for meritocracy. This relationship between the two was highlighted by Maleki and Hendriks (Maleki and Hendriks, 2014)

[26]Mary Douglas's Group variable is correlated with Hofstede's individualism/collectivism variable. These two measures therefore consider the same cultural dimension. This was put forward by Maleki and Hendriks (Maleki and Hendriks, 2014)

$$y_i = \beta_0 + \sum_{j=1}^{6}(\beta_j * X_{ji}) + \sum_{k=1}^{2}(\beta_k * I_{ki}) + \sum_{p=1}^{2}(\beta_p * C_{pi}) + \sum_{n=1}^{4}(\beta_n * I_{ki} * C_{pi})$$

To test our hypothesis of complementarity between institutions and culture, we relied on the methodology advocated by Carree, Lokshin and Belderbos (Lokshin et al., 2004, p. 3-4).[27] These authors proposed, the following mathematical definition of complementarity:

"Practices x_i and x_j are considered complementary in the function f if and only if $\frac{\partial^2 f}{\partial x_1 \partial x_2}$ is always larger or equal to zero and larger than zero for at least on value of (x_1, x_2).
We use a cross-term specification of the objective function f to test for complementarity [...]. the expressions for n equal to 2 [...] are:
$f(x_1, x_2) = \alpha_0 + \alpha_1.x_1 + \alpha_2.x_2 + \alpha_{12}.x_1.x_2$
The cross-derivatives $\frac{\partial^2 f}{\partial x_1 \partial x_2}$ are equal to α_{12} [...]. This implies that there is complementarity for the case of practices 1 and 2 if $\alpha_{12} > 0$."

Therefore, in our latest model, if the estimator β_n is significant and positive, then the cultural and institutional variables associated with this estimator will be complementary.

To estimate the different models presented, we use ordinary least squares (OLS).

4 Empirical results and economic interpretation

In the following, we first present the results of our initial growth model and then analyze the results obtained for each of the assumptions.

4.1 The endogenous growth model

First, in this model (see Table 1 in Appendix 8), the GDP per capita variable has a negative and significant effect on economic growth. This result is consistent with the theoretical predictions of Solow and Swan (Solow, 1956) (Swan, 1956), who concluded that a lower initial level of development is associated with a higher growth rate.
The government spending variable has a significant and negative effect on economic growth. This means that the larger the government's spending, the more it will reduce the rate of economic growth. While this result does not match the predictions of the theoretical model, it is not extremely surprising, considering that

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[27]Article based on Arora's paper (Arora, 1996).

a similarly significant and negative relationship was highlighted by Barro (Barro, 1990).

The variable measuring Investment has a positive impact on economic growth. This result is consistent with both endogenous growth models incorporating this variable and with some empirical analyses like those from De Long and Summers (De Long and Summers, 1991).

Concerning the import variable, a positive effect is expected because imports, by allowing companies access to new technologies, can generate long-term growth (Grossman and Helpman, 1993) (Coe and Helpman, 1995). Our significant effect is then consistent with the theory and some empirical results as those from Yanikkaya (Yan[Pleaseinsertintopreamble]kkaya, 2003).

Second and surprisingly, the results for the other variables (i.e. the human capital variable and the population growth variable) are not significant. However, this appears consistent with previous studies.

Human capital should theoretically have a positive effect on growth through the externalities it generates. In our case, this variable is negative and not significant. The absence of positive effect is not surprising because on the one hand empirical results are very heterogeneous and the measure used to estimate human capital is rarely significant (Kalaitzidakis et al., 2001). On the other hand, Benhabib and Spiegel showed empirically that the effect of human capital is negative and not significant (Benhabib and Spiegel, 1994)[28] as in our study.

Finally, population growth should theoretically have a positive relationship with the growth rate (Peterson, 2017). Indeed, population growth leads to an increase in the useful stock of knowledge, which positively affects economic growth (Simon, 1990). In our model, this variable is not significantly different from zero. This result can be explained by the fact that the empirical effects of the population on growth depend very heavily on the measurement variable used as well as the other control variables present in the regression. Our result is thus consistent with Hodge and Headey's[29] (Headey and Hodge, 2009).

4.2   The institutions' effect

In order to test Hypothesis 1.1, we add the institutional variables to our initial growth model. (Results are presented in Appendix 9, Table 2).

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[28]According to Benhabib and Spiegel *"When one runs the specification implied by a standard Cobb-Douglas production function which includes human capital as a factor, human capital accumulation fails to enter significantly in the determination of economic growth, and even enters with a negative point estimate"* (Benhabib and Spiegel, 1994, p. 166)

[29]*"The expected t-statistic for total population growth is less than one and therefore insignificant"* (Headey and Hodge, 2009, p. 231).

We note that our PC2 variable is non-significant since the PC1 variable positively and significantly influences economic growth (column (1)).

This positive influence of PC1 on growth means that countries with "bad governance" (positive score on the PC1 axis) increase growth. This early result is not consistent with those obtained theoretically and empirically, particularly for the effect of "good governance" (represented by a negative score on the PC1 axis) on economic growth because endogenous growth models (Kong, 2011) and empirical studies (Knack and Keefer, 1995) (Kaufmann and Kraay, 2003) including this variable find a positive effect on growth, whereas in our model, good governance negatively affects growth.

This negative effect of "good governance" has also been highlighted by the empirical studies of Bardhan (Bardhan, 1997) and Mira and Hammadache (Mira and Hammadache, 2017). They explained this result by the negative link between direct foreign investment and "good governance". Indeed, companies looking to finance an investment project are prone to speeding up administrative procedures by paying a bribe.

This negative effect of PC1 does not vary depending on the country's initial level of development (measured using the HID) (column (2)), as Gradstein's theoretical analysis suggests (Gradstein, 2004).

However, the effect of our PC2 variable depends on the country's initial level of development, which verify our Hypothesis 1.2 . This is consistent with previous theoretical analyses and empirical results, namely Huynh and Jacho-Chavez (Huynh and Jacho-Chávez, 2009) and Glaeser and al. (Glaeser et al., 2004).

Thus, when the PC2 variable is close to zero or negative (i.e. countries are non-interventionist or do not intervene in all areas of social and economic life) and the level of development is high, the effect on economic growth is positive. Similarly, an interventionist policy associated with a low level of development positively affects economic growth.[30]

This means this second hypothesis on the effect of political institutions is verified. Additionally, the results obtained are robust when sample size is changed (with extreme individuals left out).

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[30]When we have a term of interaction in a regression then the effect of our variable (here PC2: State intervention) on economic growth is measured as follows: $\gamma_{PC2} = (\beta_{PC2} + \beta_{PC2:HID} * HID)$, so $\gamma_{PC2} = 0$ if $(\beta_{PC2} + \beta_{PC2:HID} * HID) = 0$. We obtain: $\frac{-\beta_{PC2}}{\beta_{PC2:HID}} = HID$ hence $\frac{0.580}{0.837} = HID$ and $HID = 0.69$

So, the effect of our variable PC2 on economic growth is positive in two cases:

1. If HID < 0.69 (then $\gamma_{PC2} > 0$) and if PC2 > 0 (interventionist state).

2. If HID > 0.60 (then $\gamma_{PC2} < 0$) and if PC2 < 0 (non-interventionist state).

Lastly, we observe that the different institutional clusters highlighted by our analysis (i.e. part 3.Data and Model design) have a significant and positively impact on economic growth (see Column 3, Table 2) whereas the individual effect of institutional measures is insignificant.[31]

These institutional clusters have different effects. This can be explained as follows: countries with Cluster 2 institutions are growing strongly. These are countries that have a low level of development and therefore significant growth. Those present in Cluster 3 are countries converging towards the institutional level and the growth rate of Cluster 1 countries. Therefore, the impact of institutions on growth is weaker than the previous cluster. Lastly, the countries in Cluster 1 are developed countries and their growth rate is lower than in the other two clusters. Hence, the effect of the institutions decreases compared to Cluster 2 and 3. When countries institutionally converge towards Cluster 1 (from Cluster 2 to Cluster 3), their levels of development also converge, and the effect of institutions on economic growth is therefore increasingly smaller. The results of this last column show that economic convergence (the rise in the level of development to the level of a developed country) goes with institutional convergence: corruption is lower, public administration is more effective, the country's governance converges with the governance of developing countries. Our results are consistent with the hypothesis formulated by Lee and Kim (Lee and Kim, 2009), who suggest that different institutions matter at different stages of development.

With this second model, we conclude that institutions have a positive effect on growth, which partly confirms our first hypothesis. However, it should be noted that these effects vary according to the country's initial level of development.

4.3   The culture effect

To verify this second hypothesis, we added cultural variables to our initial growth model.

Individually (column (1) of Appendix 9, Table 3), Group and Grid variables have a significant effect on economic growth.

We conclude, from our results, that our two cultural variables have a positive effect on economic growth, contradicting the results of Gorodnichenko and Roland (Gorodnichenko and Roland, 2010) (Gorodnichenko and Roland, 2011) and Grenness (Grenness, 2015) cited in our second part. Indeed these authors showed that meritocracy, i.e. the low part of the Grid variable, positively affects growth

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[31]The fact that the institutional cluster has a greater effect on growth than individual institutions was also observed by Siddiqui (Siddiqui, 2013).

whereas in our model it is the high part of the Grid variable, i.e. the roles imposed by society on individuals, which is positively correlated with growth. Moreover, the results of these authors highlighted the positive effect of the "individualism" dimension, which corresponds to the low part of our Group variable, whereas in our model, growth is positively affected by the high part of our Group variable, which represents collectivism and confirm Swank's conclusions (Swank, 1996).

When studying the Grid and Group variables simultaneously using cluster (column(2) of the Table 3), the effects of culture on growth are more visible.
Cluster 1, which represents an individualistic society, has a positive impact on economic growth. Thus, the cultural characteristics of meritocracy and individualism, taken together, have a significant and positive effect on growth. This result confirms the conclusions of Gorodnichenko and Roland (Gorodnichenko and Roland, 2010), who emphasize the positive effect of individualistic culture (Gorodnichenko and Roland, 2011), and Mariona Grondona's thesis on the pro-development culture which characterizes an individualistic society.
The effects of Cluster 2 (Egalitarianism) and Cluster 3 (Fatalism)on growth are similar and also positive, as is the effect of Cluster 4 (Hierarchy). Regarding the latter, our results show that societies with collectivist characteristics also stimulate economic growth. This can be explained by several factors. First, our conclusion confirms some theses advanced in the literature, as in Fukuyama's work, which highlighted the importance of trust. According to him, creating complex economic enterprises in individualistic societies is difficult because trust is confined to the family, but it is simpler in collectivist societies. Other authors focus on the importance of trust and social capital (which is especially present in collectivist society) in economic development, like Putman or Banfield (cited in (Ball, 2001)). These theses were supported by the empirical work of Knack and Keefer (Knack and Keefer, 1997, p. 1283), who stressed *"[...]the importance[...] of social capital, supplying the strongest evidence to date that trust and civic cooperation have significant impacts on aggregate economic activity."*. Second, collectivist societies have a static effect on growth, which can be observed in our cross-section regression, while individualistic cultures have a more dynamic effect (Kyriacou, 2016).

Finally, although cultural Cluster 1 has a positive effect on growth, it does to a lesser degree than the Cluster 4, which has the strongest effect. This result can be explained by the characteristics of our panel: among countries in the Hierarchy cluster (91 countries), 45.05 % have a low GDP,[32] whereas 80.35 % of countries in the Individualism cluster have a medium or high GDP. Countries with a low GDP

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[32]We divided our panel into three quantiles, respectively comprising: countries with low, medium GDP and high GDP. The exact distribution of our panel is detailed in Appendix 8.

are known to a higher growth than countries with a high GPD. Accordingly, the countries in Cluster 4 have a higher impact on growth (and higher growth) than countries in Cluster 1.

4.4 Are culture and Institutions complementary in impacting growth ?

Finally, to verify our final hypothesis, we look at the interaction effect between institutions and culture (Appendix 9, Table 4).

We note that this complementarity hypothesis is verified for the interaction variable between PC2 and Grid. Indeed, the PC2:Grid variable is positive and significant, which means that the Grid cultural characteristic increases the effects of PC2 on economic growth. Then, the PC2 variable has a positive effect on growth in two cases:

- When the Grid variable score is below 3.49 (approximately)[33], the coefficient of the PC2 effect on economic growth is negative. So, when the PC2 score is close to zero or negative, its impact on economic growth will be positive.

- When the Grid variable score is over 3.49, the coefficient of the PC2 effect on economic growth is positive. So, associated with a positive score of PC2, its impact on economic growth will also be positive.

Thus, the associations between imposed roles/ high degree of State intervention and meritocracy/low degree of State intervention are complementary.

The results obtained in this last model are consistent with the theoretical analyses that have highlighted the complementarity between culture and institutions (such as North for example). Nevertheless, they contradict the result obtained by Williamson and Mathers (Williamson and Mathers, 2011) because they observed a diminishing effect of culture on economic growth in regression including institutions, suggesting a substitute link between culture and institutions. This difference in our conclusions can be explained by diverging choices regarding databases and measures of culture and institutions (to measure institutions, they used the variable Economic Freedom variable, which we did not consider).

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[33]When we have a term of interaction in a regression then the effect of our variable (here PC2: State intervention) on economic growth is measured as follows: $\gamma_{PC2} = (\beta_{PC2} + \beta_{PC2:Grid} * Grid)$, so $\gamma_{PC2} = 0$ if $(\beta_{PC2} + \beta_{PC2:Grid} * Grid) = 0$. We obtain: $\frac{-\beta_{PC2}}{\beta_{PC2:Grid}} = Grid$ hence $\frac{0.356}{0.102} = Grid$ and $Grid = 3.49$

5   Conclusion

According to Douglass North's theoretical analyses, formal institutions and culture have a complementary relationship. This suggests that the effectiveness of an institution depends on the other institutions present at the same time, especially culture. There are many examples of non-complementarity between formal institutions and culture in economic history - for instance in Latin America countries, whose culture and formal institutions were in conflict, leading to a negative impact on economic growth (North et al., 2000).

In this article, we have developed a growth model allowing us to study the possible complementarity between institutions and culture. Our results conclude that the culture of a country (particularly certain values such as the Grid value) influences the effectiveness of its institutions, which supports the hypothesis of a complementarity between culture and institutions. Thus, when institutions (good governance and weak state intervention) are associated with a low Grid variable score, they have a greater effect than in other cases.

These results have many implications at different levels, but also some limitations. First, from an empirical point of view, our results are at odds with those of Williamson and Mathers (Williamson and Mathers, 2011) who concluded that institutions and culture are substitutes than complements. Thus, future studies with different cultural and institutional measures are needed in order to obtain consistent results.
Second, at the theoretical level, we need a growth model that integrates this notion of complementarity between the different institutions (formal institutions and culture). This will complement Douglass North's analysis. For now, we have studied the links between culture and institutions to determine whether they are complementary or substitutable. In future research, we also need to understand the links (of complementarity or substitutability)existing at the heart of the (formal) institutions themselves. It will allow us to better understand why economically, culturally and institutionally similar countries, or regions like the US states of Alabama and Louisiana, have different rates of growth.
Finally, at the political level, our results have value for institutional reform purposes. Indeed, if a reform is not in line with country's culture, the new institutions will create a long-term conflict with the "old" culture, raising the risk of a negative impact on growth.

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Appendix

Appendix 1: IPD and WBI correlation circle

Graphique 1 : projection des deux ensembles d'indicateurs sur le cercle des corrélations

Indicateurs de la base P.I.

Indicateurs de gouvernance du WBI

Sources : «Profils Institutionnels» et World Bank Institute. Logiciel SPAD.
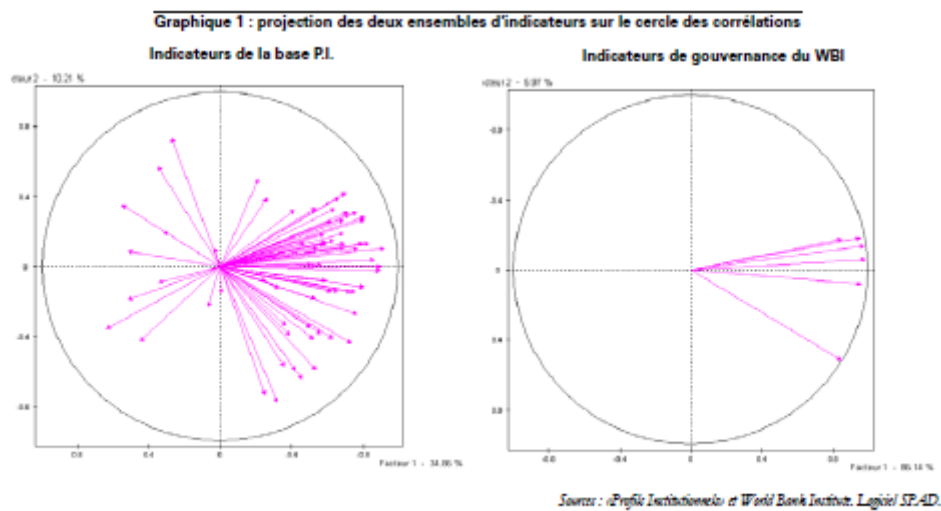
Appendix 2: Details of principal component analysis (PCA)

To reduce the number of indicators in each version of the IPD, we conducted a PCA. We chose to replace missing data with the average of the corresponding indicator. This does not affect the results of a standardized centered PCA, as total variance remains unchanged.

The PCA was performed in several steps:

1. We reduced the number of indicators by excluding those poorly projected on the circle of correlations. For the indicators to be visible in the circle of correlations, we grouped them by themes. Then we analyzed the themes one by one. The themes examined were derived from the typology of pre-existing indicators in the IPD. Analysis of correlation circles on each theme excluded several poorly represented indicators.

   All information on the themes used and the indicators excluded is provided in the following table:

Theme	Theme heading	Number of indicators			Code of indicators excluded		
		IPD 2006	IPD 2009	IPD 2012	IPD 2006	IPD 2009	IPD 2012
Theme 1	Political institutions	7	12	12	None	A102, A105, A107, A018	A101, A102, A107, A108, A109, D101
Theme 2	Security, law and order, control of violence	2	5	5	None	A203	None
Theme 3	Functioning of public administrations	10	19	20	A305, A306, B300	A304, A307, A313, B301, B302, B303	A304v, A307, A313v, B300, B302v, B304, B305v
Theme 4	Free operation of markets	9	2	11	B402, D400	B401, B405, C401, D400, D401	B402, D400
Theme 5	Coordination of stakeholders, strategic vision, innovation	19	19	19	A502, A503, A504, A509, A515, C501, D500	A507, A509, A510, C500	A501, A505, A510v, C501v, C502v
Theme 6	Security of transactions and contracts	24	25	21	A600, A602, A604, B606, C600, D601, D602	A604, A605, A606, B605, B607, B610, B611, D602	A605, B604v, B606v, B609, C600, D600, D602
Theme 7	Market regulations, social dialogue	18	16	13	B704, B705, B706, B707, V700, D700, D701	B705, C700, C704, D701	B702v, C702, D700
Theme 8	Openness	9	12	9	A802	A8011, A802, B802, B803, D800	A802v, B800, B803v, D800v
Theme 9	Social cohesion and social mobility	12	17	20	A902, A903, A906, D902	A900, A901, A902, D905, D906	A900v, A901, A902, A907, D906, D907, D909

	IPD 2006	IPD 2009	IPD 2012
Initial number of indicators	110	133	130
Final number if indicators	79	91	89

2. Using the remaining indicators, we identified two main components. To give meaning to the two main components, two pieces of information were needed:

    (a) the contribution of indicators for each of the axes. Only indicators with a high contribution were retained as explanatory indicators.

    (b) The direction (positive or negative) in which the indicators pointed.

The horizontal axis, which represents principal component 1 (PC1), can be interpreted using the following indicators:

IPD 2006				IPD 2009			
Indicators Code	Indicators heading	Inertia	Direction	Indicators Code	Indicators heading	Inertia	Direction
A101	Public freedoms and the autonomy of the civil society	1,8570	-0,14	A100	Legality of political institutions	1,5108	-0,12
A300	Transparency of public action in the economic field	1,8311	-0,14	A101	Population participation in political decisions	1,4607	-0,12
A301	Transparency of economic policy (fiscal, taxation, monetary, exchange-rate, etc)	1,6799	-0,13	A106	De facto political legitimay	1,4357	-0,12
A302	Corruption	2,4928	-0,16	A300	Transparency of pubic economic action	1,4669	-0,12
A303	Government-citizen relations	2,0086	-0,14	A301	Transparency of economic policy (Fiscal, budgetary, monetary, exchange rate, etc)	1,5205	-0,12
A304	Effectiveness of public action: tax system	2,1974	-0,15	A302	Control of corruption	1,6288	-0,13
A307	Running of the justice system	2,5486	-0,16	A303	Effectiveness of the fiscal system	1,5881	-0,13
A508	Co-ordination between ministries and within the administrations	1,6626	-0,13	A305	Functioning of th justice system	1,9404	-0,14
A510	Capacity of the political authorities	2,0339	-0,14	B300	Ease of starting a business	1,4186	-0,12
A511	Society's aptitude for adaptation and innovation	1,9998	-0,14	A503	Government strategies	1,5552	-0,12
B500	Technological environment, dissemination of technology	1,6101	-0,13	A504	The ruling classes' priorities	1,4722	-0,12
C500	Dissemination of technologie, innovation	1,5194	-0,12	A508	Society's responsiveness change and innovation	1,7677	-0,13
C502	Insurance companies, pension funds	1,8208	-0,13	B500	Technological environment and dissemination of technology	1,5829	-0,13
A601	Security of property rights: formal property rights	2,2303	-0,15	D500	Adult vocational training	1,5032	-0,12
A603	Security of contracts between private agents	1,5833	-0,13	A600	Security of property rights	1,8445	-0,14
A605	Settlement of economic disputes: justice in commercial matters	2,5136	-0,16	A601	Security of contracts between private actors	1,5148	-0,12
A606	Law on bankruptcies	1,9730	-0,14	A602	Effectiveness of commercial courts	1,7550	-0,13
B600	Information on the situation of firms	2,0448	-0,14	A603	Effectiveness of bankruptcy law	1,6412	-0,13
B602	Information on the quality of the goods: international norms and standards	2,3119	-0,15	B600	Information on firm situation	1,8084	-0,13
B603	Intellectual property	2,2057	-0,15	B601	Information on the quality of goods and services: national and international norms and standards	1,7652	-0,13
B604	Arrangements for the protection of intellectual property	2,1848	-0,15	B602	Intellectual property protection	1,7007	-0,13
B607	Agricultural sector: security of rights and property transactions	1,5365	-0,12	B603	Effectiveness of arrangements for the protection of intellectual property	1,6320	-0,13
C602	Lender guarantees: banking system (mortgages, etc)	1,6181	-0,13	B609	Security of land tenure rights	1,5394	-0,12
D600	Informal labour market	1,5798	-0,13	B701	Competition in distribution (household consumption)	1,4114	-0,12
B702	Competition between businesses: competition regulation arrangements	1,8521	-0,14	B702	Competition regulation arrangements	1,4118	-0,12
C701	Regulation of competition in the banking system	1,5457	-0,12	A905	Geographic coverage of public services	1,4318	-0,12
C704	Internal control of banks	1,5218	-0,12	A906	Institutional solidarity (from the government or other public or private institutions)	1,5321	-0,12
A904	Institutional solidarity	2,0207	-0,14	D903	Social mobility: recruitment and promotion in the public and private sector	1,6738	-0,13
A905	Equity in access to basic public goods: education, healtcare, water and electricity	1,8104	-0,13	D904	Origin of senior management and officals	1,5046	-0,12
D901	Social mobility: recruitement and promotion in the public and private sectors	2,3031	-0,15				
Inertia explained (%)		58,098		**Inertia explained (%)**		46,018	

Indicators Code	IPD 2012 Indicators heading	Inertia	Direction
A100	Functioning of political institutions	1,4129	-0,12
A103	Civil liberties	1,4185	-0,12
A300	Reliability official economic information	1,6679	-0,13
A301	Transparency of economic policy	1,4496	-0,12
A303	Efficiency of the tax administration	1,7983	-0,13
A305	Functioning of justice system	1,9380	-0,14
A504 V	Spaces for reflection on the major national issues	1,4660	-0,12
A507	Qy=uality of the publis policy making process	1,7168	-0,13
A509	Adaptation and innovation	1,9182	-0,14
B500	Technological environment of firms	1,7683	-0,13
B501	Public support for innovation	1,4070	-0,12
C500 V	Skills level of bank executives	1,4578	-0,12
A600	Security of property rights	2,0412	-0,14
A601	Security of private contracts	1,7865	-0,13
A602	Trade justice	1,8551	-0,14
A603	Insolvency law	1,5457	-0,12
B600	Standardisation accounting information on firms	1,7010	-0,13
B601	Standardisation of information on the quality of goods and services	1,7406	-0,13
B602	Respect for intellectual property	1,8134	-0,13
C601 V	Efficiency of the system of bank guarantees	1,6370	-0,13
A904	Equal treatment by the State	1,6148	-0,13
A905	territorial coverage of public services	1,8839	-0,14
A906	Institutional solidarity	1,8054	-0,13
D900	Quality of public services (provided by the public sector)	1,8988	-0,14
D908	Recognition of occupation health and safety	1,7354	-0,13
A202 V	Arbitrary violence by the State	1,4959	0,12
A302	Level of corruption	1,8196	0,13
D402	Significance of informal work	1,6218	0,13
B608	Land tenure insecurity	1,8353	0,14
D902	Significance of child labour	1,6701	0,13
D903	Barriers to upward social mobility	1,7832	0,13
Inertia explained (%)		52,704	

This PC1 axis accounts for 36 % of the total variance and represents governance, i.e. the effectiveness of public administrations, good enforcement of justice and low corruption. "Good governance" is in the negative part of the axis.

The vertical axis, which represents the principal component 2 (PC2), can be interpreted using the following indicators:

IPD 2006				IPD 2009				IPD 2012			
Indicators Code	Indicators heading	Inertia	Direction	Indicators Code	Indicators heading	Inertia	Direction	Indicators Code	Indicators heading	Inertia	Direction
A102	Concentration of the media	4,505	0,21	A103	Public freedoms and civil society autonomy	3,317	-0,18	A104	Freedom of information	5,364	-0,23
D100	Freedom of association	4,147	0,20	A104	Freedom of the media	6,703	-0,26	D100	Trade union freedoms	3,341	-0,18
D101	Trade union plurality and autonomy	5,977	0,24	D100	Freedom of association	5,796	-0,24	A309	Freedom of establish organisations	5,251	-0,23
B401	Share of public sector in GDP in 2006	4,462	0,21	D101	Trade union pluralism and autonomy	6,015	-0,25	A310	Autonomy of organisations	4,622	-0,21
C400	Share of banking sector in private hands in 2001	5,095	0,23	A309	Operating autonomy in practice, with respect to the political authorities, of [civil] organisations	3,360	-0,18	C402 V	Central bank independence	3,636	-0,19
C401	Share of banking sector in private hands in 2006	7,028	0,27	A310	In practice, possibility of creating new organisations in some areas	5,990	-0,24	A801	Freedom of access to foreign information	3,416	-0,18
C402	Level of government intervention in allocation of lending	4,028	0,20	C402	Freedom in the allocation of loans	4,751	-0,22	B400 V	Significance of public companies to the economy	4,884	0,22
A800	Free movement of persons, information, etc	7,758	0,28	A800	Free movement of persons, information, etc	7,061	-0,27	B401	Significance of th public sector in the delivery of public services	3,997	0,20
				A505	Government's independent arbitration capacity	3,520	0,19	C400 V	Weight of State-owned banks	4,755	0,22
				C502	National sovereign wealth funds: policy and timeline	4,007	0,20	C401	Credit policies	4,171	0,20
				B703	Shareholders: weight of the government	4,163	0,20	B703 V	Scale of public ownership	4,805	0,22
Inertia explained (%)		43,000		**Inertia explained (%)**		54,685		**Inertia explained (%)**		48,242	

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This axis represents the place of the state. Countries on the negative side have a state that guarantees flows of information and people and civil society freedoms. Moreover, the State intervenes little on the market, unlike in countries located in the positive part of the axis.

Appendix 3: Projection of individuals and representation of clusters

Projection of individuals and clusters present in IPD 2006
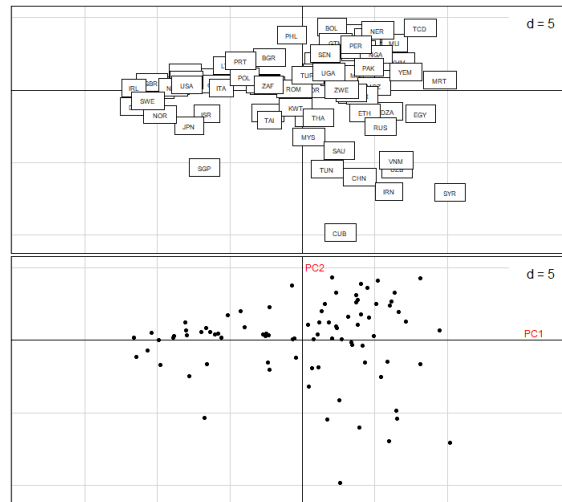
Figure 1: Projection of individuals on the two principal components

Figure 2: Representation of the clusters

Projection of individuals and clusters present in IPD 2009

Figure 3: Projection of individuals on the two principal components

Figure 4: Representation of the clusters

Projection of individuals and clusters present in IPD 2012

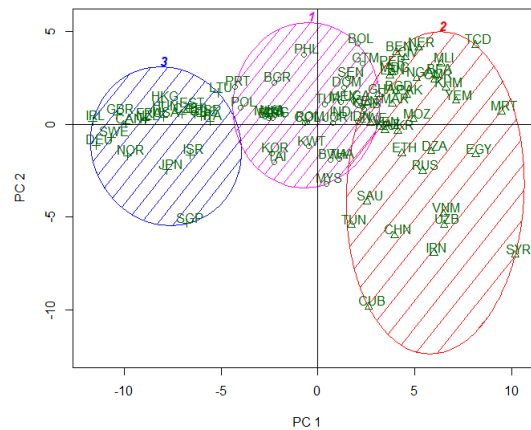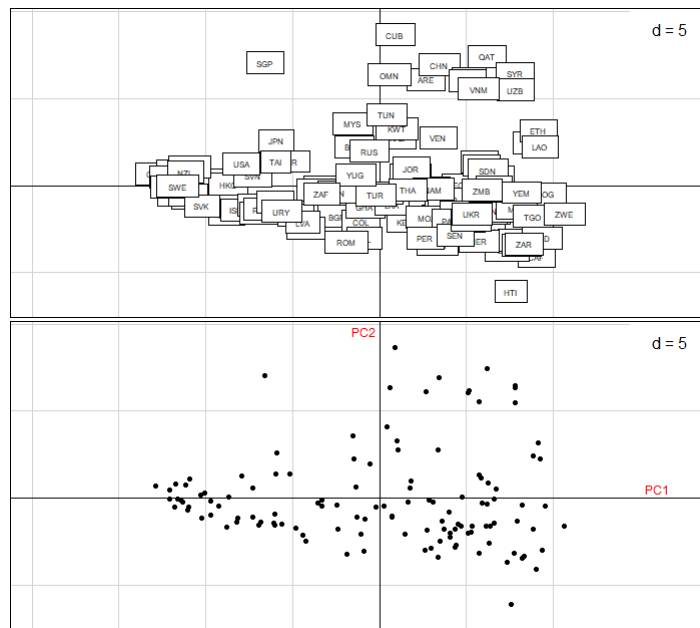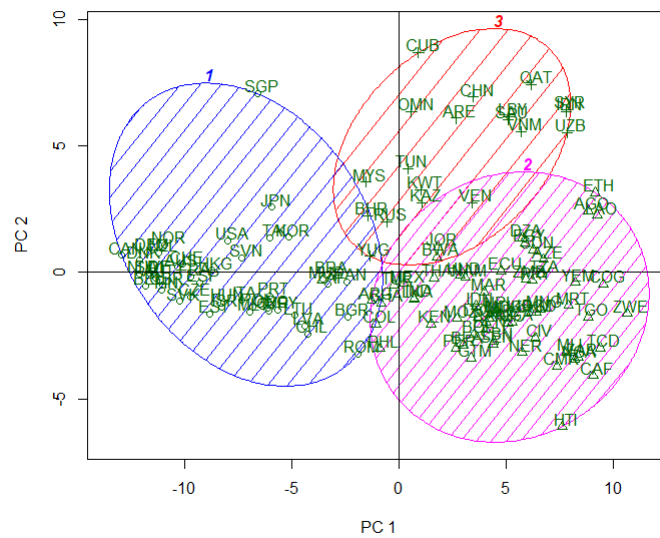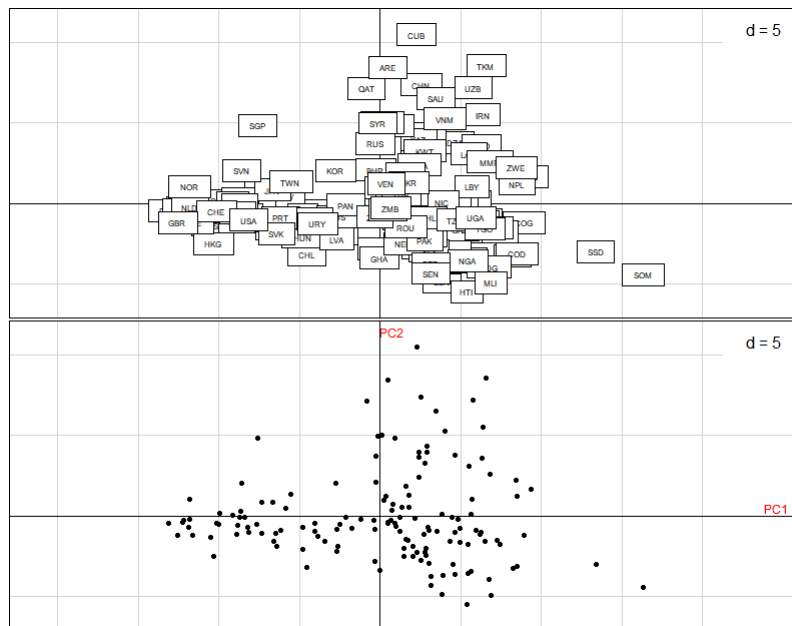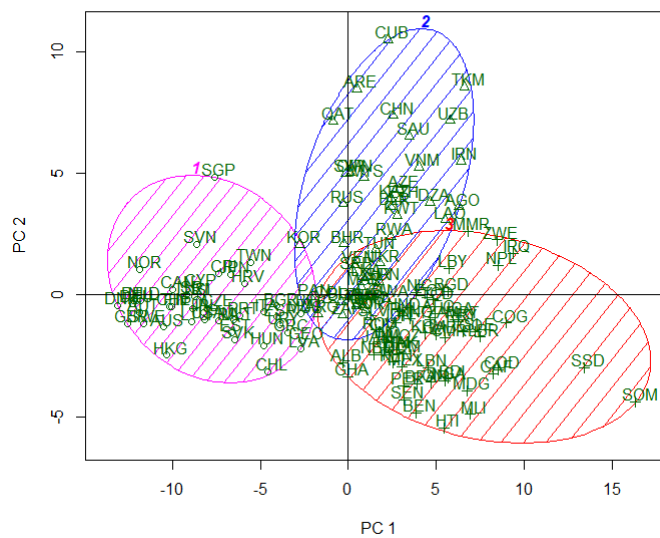Figure 5: Projection of individuals on the two principal components

Figure 6: Representation of the clusters

Appendix 4: Excerpt from the WVS questionnaire (Wave 6)

Excerpt 1: questions V4 to V9

(*Introduction by interviewer*):
Hello. I am from the _____ (*mention name of the interview organization*). We are carrying out a global study of what people value in life. This study will interview samples representing most of the world's people. Your name has been selected at random as part of a representative sample of the people in _____ (*mention country in which interview is conducted*). I'd like to ask your views on a number of different subjects. Your input will be treated strictly confidential but it will contribute to a better understanding of what people all over the world believe and want out of life.

(*Show Card A*)
For each of the following, indicate how important it is in your life. Would you say it is (*read out and code one answer for each*):

		Very important	Rather important	Not very important	Not at all important
V4.	Family	1	2	3	4
V5.	Friends	1	2	3	4
V6.	Leisure time	1	2	3	4
V7.	Politics	1	2	3	4
V8.	Work	1	2	3	4
V9.	Religion	1	2	3	4

NOTE: Code but do not read out-- here and throughout the interview: -1 **Don't know**
-2 **No answer**
-3 **Not applicable**

Excerpt 2: question V24

V24. Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people? (*Code one answer*):

1   Most people can be trusted.
2   Need to be very careful.

Appendix 5: Methodology used to create Grid and Group variables

We used twenty questions from the WVS survey to estimate cultural variables - ten to estimate the Group variable and ten to estimate the Grid variable.

The twenty questions used in our analysis are highlighted by three articles using the methodology of Chai and Kim: The first is the original article of Chai and Kim (Chai and Kim, 2009),[35], the second is Torsello's article (Torsello, 2013), which used the fifth version of the WVS[36] and the third is Castilla-Rho et al's article (Castilla-Rho et al., 2017) updating the methodology of Chai and Kim[37] on the sixth version of the WVS.

Questions estimating the Grid and Group variables were chosen by the authors as follows:[38]

1. Questions about a specific political system, a specific geographical area, happiness or individual weel-being were excluded from the analysis.

2. The most discriminating issues between countries were retained.

To calculate the value of the Grid and Group variables, the questions associated with these variables were treated as follows:

- The answers associated with the "high" value of each question were standardized between 0 and 1.

- The scores of the ten questions were aggregated. The aggregation score determined the score of each Grid or Group variable.

The last two steps are taken on the following questions:

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[35]The original article estimates the Grid and Group variables on the third and fourth version of the WVS.

[36]Torsello created Grid and Group variable using the same methodology as Chai and Kim to select questions.

[37]As the survey questionnaire was modified from one version to the next, some of the questions used on the original article were deleted and others included

[38]This is a succinct presentation of the applied methodology, for more detail, refer to Chai and Kim (Chai and Kim, 2009) or Castilla-Rho (Castilla-Rho et al., 2017)

Variable	Question Code WVS 5	WVS 6	Value orientation question	High	Low	Code associé au niveau High
GROUP						
Group 1 [1,2]	V4	V4	Importance : Family	Important	Not important	Code 1
Group 2 [2,1]	V5	V5	Importance : Friends	Important	Not important	Code 1
Group 3 [1,2]	V23	V24	Trust people	Most can be trusted	Have to be careful	Code 1
Group 4 [1,2]	V118	V98	Responsability : personal/government	Government	Personal	Code 1 à 3
Group 5 [2]	V20	V20	Being unselfish	Mentioned	Not mentioned	Code 1
Group 6 [1,3]	V117	V97	Private ownership of business	Government	Private	Code 7 à 10
Group 7 [2]	V88	V78	Looking after the environment is important to this person; to care for nature and save life resources	Very much like me	Not at all like me	Code 1
Group 8 [2]	V211	V213	I see myself as part of my local community	Strongly agree	Strongly disagree	Code 1
Group 9 [2]	V214	V216	I see myself as an autonomous individual	Strongly disagree	Strongly agree	Code 4
Group 10 [1,3]	V116	V96	Income equality	Important	Not important	Code 1 à 3
GRID						
Grid 1 [1,2,3]	V9	V9	Religion	Important	Not important	Code 1
Grid 2 [1,2]	V21	V21	Follow instructions	Yes	Not necessary	Code 1
Grid 3 [1,2]	V78	V69	Respect authority	Yes	No	Code 1
Grid 4 [1,2]	V193	V152	Religion (God)	God important	Not important	Code 7 à 10
Grid 5 [1,2]	V202	V203	Justifiable : Homosexuality	Never justifiable	Justifiable	Code 1 à 3
Grid 6 [1,2]	V203	V203A	Justifiable : Prostitution	Never justifiable	Justifiable	Code 1 à 3
Grid 7 [1,2]	V204	V204	Justifiable : Abortion	Never justifiable	Justifiable	Code 1 à 3
Grid 8 [1]	V205	V205	Justifiable: Divorce	Never justifiable	Justifiable	Code 1 à 3
Grid 9 [2]	V87	V77	Behave properly; to avoid doing anything people would say is wrong	Very much like me	Not at all like me	Code 1
Grid 10 [3]	V95	V84	Interest in politics	Interested	Not interested	Code 1

[1]Variable using by Chai and Liu.
[2]Variable using by Castillo-Rho and al.
[2]Variable using by Torsello.

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For example, to determine Australia's Group variables, we performed the following calculation:

Variable	Number of High responses	Score standardization between 0 and 1
Group 1	1328	0.9346
Group 2	823	0.5792
Group 3	676	0.4757
Group 4	295	0.2076
Group 5	762	0.5362
Group 6	306	0.2153
Group 7	283	0.1992
Group 8	107	0.0753
Group 9	401	0.2822
Group 10	302	0.2125
Score after sum:		3,7178
Total number of respondents: 1421		

Appendix 6: The projection of individuals on the plan created by Grid and Group variables

Projection of individuals Wave 5
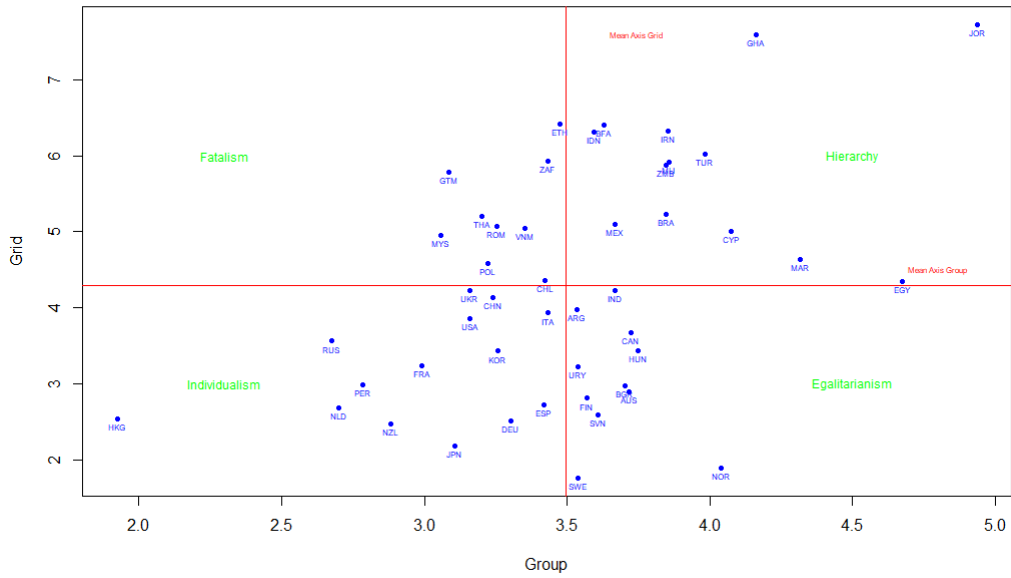
Projection of individuals Wave 6
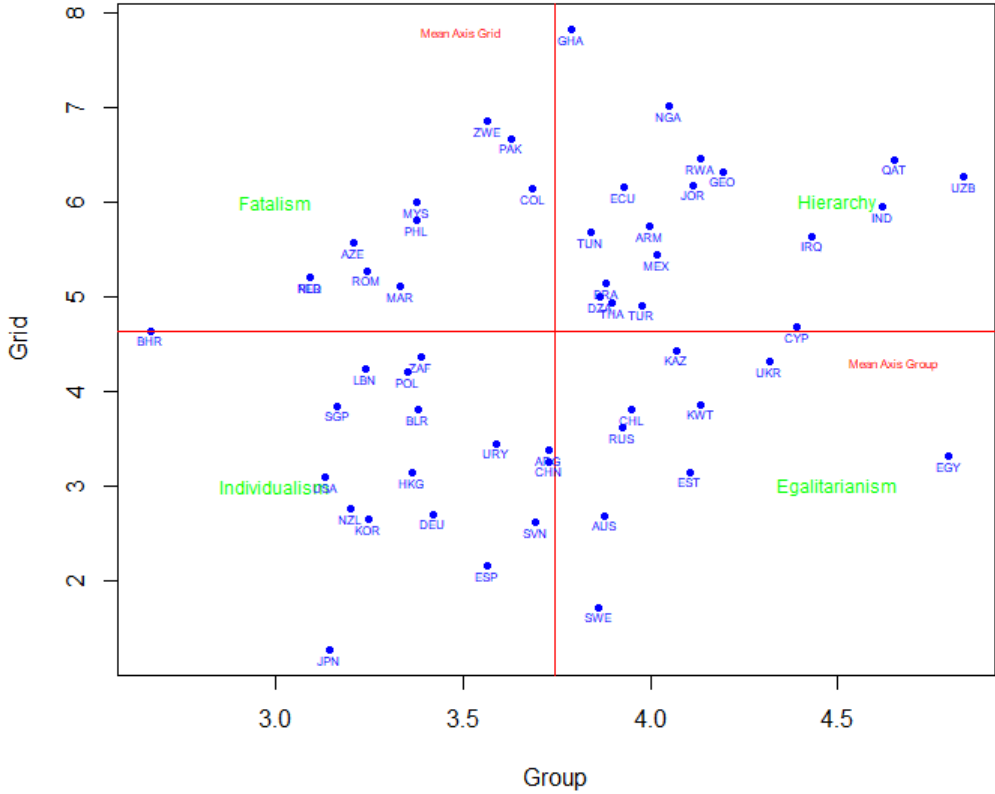
Appendix 7: List of control variables

Variable	Indicator used	Indicator origin
Growth	GDP growth (annual %)	World Bank national accounts data, and OECD National Accounts data files.
GDP per Capita	GDP per capita (constant 2010 US$) (Year t-1)	World Bank national accounts data, and OECD National Accounts data files.
Human Capital	Mean years of schooling (years) (Year t-1)	United Nations Development Program, Human Develpment Reports
Expenditure Government	General government total expenditure (% of GDP)	IMF - World Economic Outlook
Investment	Gross fixed capital formation (% of GDP)	World Bank national accounts data, and OECD National Accounts data files.
Population Growth	Population growth (annual %)	World Bank national accounts data, and OECD National Accounts data files.
Importation	Import volume index (2000 = 100)	World Bank national accounts data, and OECD National Accounts data files.
Governance	PC1 (ACP)	Institutional Profil Database (IPD 2006, IPD 2009, IPD 2012)
State Importance	PC2 (ACP)	Institutional Profil Database (IPD 2006, IPD 2009, IPD 2012)
Group	Group Axis/ Grid-Group Cultural Theory	World Values Survey (Wave 5, Wave 6)
Grid	Grid Axis/ Grid-Group Cultural Theory	World Values Survey (Wave 5, Wave 6)

Appendix 8: Distribution of individuals according to Cultural Cluster and GDP quantile

	Low GDP ∈ [5.12e+02,2.54e+04)	Medium GDP∈ [2.54e+04,1.48e+011)	High GDP ∈ [1.48e+11,1.55e+13]	Sum
Cult_1	22	50	40	112
Cult_2	30	12	25	67
Cult_3	18	19	24	61
Cult_4	41	29	21	91
Sum	111	110	110	331

Appendix 9: Results

Table 1: Endogenous economic growth model (OLS regression)

	Dependent variable:
	Growth
log(GDP)	−0.144***
	(0.014)
H_K	−0.087
	(0.053)
C_Gov	−0.114***
	(0.013)
I	0.067***
	(0.021)
Pop_X	−0.027
	(0.120)
M	0.010***
	(0.001)
Constant	4.242***
	(0.891)
Observations	331
R^2	0.538
Adjusted R^2	0.529
Residual Std. Error	2.046 (df = 324)
F Statistic	62.889*** (df = 6; 324)
Note:	*p<0.1; **p<0.05; ***p<0.01

Table 2: Endogenous economic growth model with institutions (OLS regression)

	Dependent variable:		
	Growth		
	(1)	(2)	(3)
log(GDP)	−0.140***	−0.152***	−0.141***
	(0.014)	(0.014)	(0.014)
H_K	0.057	0.036	0.022
	(0.065)	(0.072)	(0.057)
C_Gov	−0.100***	−0.093***	−0.103***
	(0.014)	(0.013)	(0.013)
I	0.076***	0.067***	0.074***
	(0.021)	(0.021)	(0.020)
Pop_X	−0.042	0.011	−0.067
	(0.118)	(0.116)	(0.117)
M	0.008***	0.008***	0.009***
	(0.001)	(0.001)	(0.001)
PC1	0.125***	−0.231*	
	(0.033)	(0.137)	
PC2	−0.029	0.580*	
	(0.056)	(0.326)	
HID		−1.863	
		(1.212)	
PC1:HID		0.425**	
		(0.166)	
PC2:HID		−0.837*	
		(0.449)	
Inst_1			2.289**
			(0.951)
Inst_2			3.840***
			(0.872)
Inst_3			3.475***
			(0.896)
Constant	2.936***	4.632***	
	(0.980)	(1.145)	
Observations	331	331	331
R^2	0.558	0.584	0.839
Adjusted R^2	0.547	0.570	0.835
Residual Std. Error	2.007 (df = 322)	1.957 (df = 319)	1.979 (df = 322)
F Statistic	50.877*** (df = 8; 322)	40.688*** (df = 11; 319)	186.814*** (df = 9; 322)

Note: *p<0.1; **p<0.05; ***p<0.01

Table 3: Endogenous economic growth model with culture (OLS regression)

	Dependent variable:	
	Growth	
	(1)	(2)
log(GDP)	−0.143***	−0.142***
	(0.014)	(0.014)
H_K	−0.009	−0.038
	(0.056)	(0.060)
C_Gov	−0.118***	−0.118***
	(0.014)	(0.014)
I	0.081***	0.074***
	(0.021)	(0.021)
Pop_X	−0.168	−0.070
	(0.125)	(0.122)
M	0.008***	0.010***
	(0.001)	(0.001)
Group	0.496*	
	(0.260)	
Grid	0.274**	
	(0.107)	
Cult_1		3.552***
		(0.992)
Cult_2		3.977***
		(0.928)
Cult_3		3.982***
		(1.042)
Cult_4		4.297***
		(0.926)
Constant	0.879	
	(1.318)	
Observations	331	331
R^2	0.555	0.830
Adjusted R^2	0.544	0.824
Residual Std. Error	2.014 (df = 322)	2.041 (df = 321)
F Statistic	50.186*** (df = 8; 322)	156.260*** (df = 10; 321)
Note:		*p<0.1; **p<0.05; ***p<0.01

Table 4: Endogenous economic growth model with institutions and culture (OLS regression)

	Dependent variable:
	Growth
log(GDP)	−0.140***
	(0.014)
H_K	0.063
	(0.067)
C_Gov	−0.110***
	(0.014)
I	0.085***
	(0.021)
Pop_X	−0.148
	(0.129)
M	0.008***
	(0.001)
PC1	0.098
	(0.156)
PC2	−0.356
	(0.473)
Group	0.470*
	(0.263)
Grid	0.174
	(0.125)
PC1:Group	−0.001
	(0.040)
PC1:Grid	−0.0002
	(0.018)
PC2:Group	−0.034
	(0.134)
PC2:Grid	0.102**
	(0.042)
Constant	0.796
	(1.407)
Observations	331
R^2	0.576
Adjusted R^2	0.557
Residual Std. Error	1.986 (df = 316)
F Statistic	30.604*** (df = 14; 316)

Note: *p<0.1; **p<0.05; ***p<0.01