



Economic growth and cultural change

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ABSTRACT

The paper contributes to the interpretation of annual growth rates based on the effect of the basic growth factors (capital, labour, human capital) and the cultural background as part of the “remaining factors”. It uses a series of variables to express these effects, which are analysed with a principal component analysis and a regression analysis, in the context of a Solow–Romer augmented growth framework. Cultural background variables are divided in two main groups: “Efficiency Orientation” and “Social Orientation” variables. We formulate the hypothesis that within the well-known growth framework “Efficiency Orientation” variables significantly affect economic growth, while “Social Orientation” influences are unpredicted in principle. The results confirm that cultural background positively affects annual growth rates. However, “Social Orientation” plays the main (positive) role. Furthermore, performing a sensitivity analysis on the cultural background, the conclusions confirm that cultural background has a strong interpretive role in annual growth rates. The deterioration of the “Social Orientation” cultural background negatively affects annual GDP growth. The paper points the crucial explanatory power of the “Social Orientation” cultural background for annual growth rates.

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1. Introduction

The purpose of this paper is to contribute to the interpretation of gross domestic product (GDP) annual growth rates, with specific reference to the basic growth factors (capital, labour and human capital) and the cultural background as part of the remaining factors.

The topic, of course, is quite old. As [Acemoglu \(2009\)](#) remarks, references to the general circumstances of the environment that possibly have an impact on attitude and human conventions can be found in [Montesquieu \(1989\)](#), [Machiavelli \(1987\)](#) and [Marshall \(1997\)](#). The role of religion was stressed by [Weber \(1958\)](#) and more recently by [Harrison and Huntington \(2000\)](#), while [Putnam \(1993\)](#) broadened the meaning of cultural factors and trust as they relate to the concept of social capital. Culture and economics can be seen as two of the more powerful forces shaping human behaviour ([Throsby, 2001](#)).

The present paper contributes to the literature above mainly regarding the fact that it extends the basic growth function by

adding the cultural background of societies and interpreting its effect on annual GDP growth rates, tackling the old topic. Doing so, it contributes towards the quantification of naturally qualitative forces – and thus less manageable and measurable – responsible for the growth process. Furthermore, it tests for possible endogeneity between the variables used, in order to take position on controversial issues in the literature about the direction of the relationships between the variables used. In addition, the paper divides cultural background variables in two main groups – as far as we know, for the first time in the literature: the first covers the variables that represent the “Efficiency Orientation” and the second covers the variables that represent the “Social Orientation” of societies. Lastly, through a sensitivity analysis, it examines eight different cases of change in the structure of the cultural background of societies and the new conditions shaped for annual GDP growth rates.

The order of the paper is as follows: Section 2 presents the theoretical work on growth and the cultural background and describes the variables used. Section 3 describes the methodology employed, the empirical model and measurements, while Section 4 presents the empirical work and the discussion of the results. Finally, Section 5 presents the conclusions.

2. The theoretical background and the variables used

2.1. The contribution and theoretical construction of the “remaining factors”

In the neoclassical theoretical substratum of Solow and Romer, the uninterpreted part of growth – the rate of change of the

Abbreviations: GDP, gross domestic product; CAP, capital; L, labour; HC, human capital; PCA, principal component analysis; PC, principal component; OLS, ordinary least squares; PEOC, pro-efficiency oriented component; PSOC1, pro-social oriented component 1; PSOC2, pro-social oriented component 2; MESOC, mixed pro-efficiency and social oriented component.

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“remaining contributing factors to growth” – is the so-called Solow residual (Solow, 1957). It constitutes the part of growth that cannot be interpreted by the contribution of capital, labour, human capital and technology. Usually, it is attributed to factors such as the cultural and institutional background of the growth process that characterises a society.

It has been argued that the unexplainable part of development, excepting the contribution of capital and labour, can be attributed to technological change (Aghion and Howitt, 1998; Romer, 1990), the conditions of acceptance of new technologies or the role of endogenous forces of growth or external economies through the accumulation of human capital (Lucas, 1988; Romer, 1986). Furthermore, economic policy (Easterly, 2001), the degree of economic extroversion (Frankel and Romer, 1999), the role of the financial system (Levine et al., 2000) and the effects of macroeconomic policies and inflation (Fischer, 1993) can all have significant influences.

According to growth accounting literature and following the Cobb–Douglas hypothesis of constant returns to scale, the exponents (capital and labour elasticities) sum to one. Because we know the amount by which the GDP has grown and the extent of this growth that is due to capital, labour and human capital, we can interpret what remains as an effect of the “remaining contributing factors” to growth. This is the increase of total productivity (total factor productivity).

In this paper, we focus on cultural background as an influential element of growth, which can be considered a “remaining factor”. Whether directly or indirectly, culture influences the outcome of economic process. Culture may be considered as the sum of the values, and perceptions dominating a group of people. The formed views of the people and the grid of values influence the organization and the operation of the institutions and, hence, the way the available resources of the society are directed. Furthermore, economic growth of a society is unbreakably linked to the materialization of personal achievements and the mutual trust among its members. Determination, absorption in targets, hard work and the tendency of the members of the society to be independent, are some of the values that can interpret the high growth rates of certain countries over some others.

Although we intuitively comprehend the importance of culture, its quantification and formal analysis can prove challenging.

2.2. The formation of cultural background

The exact impact of culture on growth, a question posed across the disciplines of economics (Schumpeter, 1934), sociology (Weber, 1958) and psychology (McClelland, 1961), concerns several complex issues attributable to several social characteristics, which consequently constitute what we understand as “culture”. “Culture is defined as a set of shared values, beliefs and expected behaviours” (Hayton et al., 2002). Throsby (2001) introduces the concept of cultural capital, which includes cultural expressions that are intangible (set of ideas, practices, beliefs, traditions and values) or tangible (buildings, structures, sites, locations, paintings, sculptures and other objects with cultural significance).

The cultural characteristics of societies reflect psychological social stereotypes that have been created in over time and are prior human constructs to the current transactions and institutions. These characteristics remain stable over time. In general, cultural stereotypes present great resistance to change and to their own redefinition (Johnston, 1996). As Jones (2006) remarks, culture often appears fixed to the observer at any one point in time because cultural mutations occur incrementally.

The long-lasting character of social stereotypes that form the cultural background is based on two alternative hypotheses. The first is connected with the exogenous character (climate, environment, etc.) of the forces that shaped the construction

of the stereotypes (Schwartz, 2009). This view contains references to the external environment (McClelland, 1961; Triandis, 1995) that address the interrelationship of the physical condition of human and external environment through “homeostasis” (Tavassoli, 2009). The second hypothesis states that cultural background is an endogenous creation of human civilisation (Hong, 2009; Oyserman, 2009). Cultural background is conceptualised as a total of “shared knowledge” consisting of (a) taught thought procedures, (b) belief, behaviour and value constructs and (c) underlying theories of the physical and social world. Thus, the cultural background is constituted by cultural syndromes that can be considered intermediate mental constructions that originate from the distant past and connect it with the present (Hong, 2009). Even so, these constructions are generated endogenously – particularly from the point of view of the present – and should be considered constant and endogenously generated through the present time. Whichever of the two hypotheses we choose to adopt, we have to accept that cultural background is a variable exogenous to the present, and it changes in the long term.

The basic process that shapes cultural background, is the process of its activation. Cultural background activation borrows its terms from shared knowledge activation which are availability, accessibility and applicability (Wyer and Srull, 1986; Higgins, 1996). Availability refers to the situation, in which some particular knowledge is available to the individual’s cognition system. It should be noted that accessibility to shared knowledge is considered as a given fact, given that there are knowledge sums that may be temporarily available. Applicability refers to the individual’s ability to apply shared knowledge in every undertaking.

Individuals are not passive receivers of their cultural environment. They use cultural background as a tool for understanding their experiences (Hong, 2009). Any matching of geographical boundaries and uniqueness in cultural background characteristics is not scientifically acceptable, since this would reduce the likelihood of the appearance of the same syndromes at the same periods of time in different societies.

The “portfolio” of syndromes” within a society and the specific weight each of them carries within such portfolio is of particular importance. Thus, the extent to which a society cultivates the various syndromes in its population during the process of socialization is significant. Furthermore, the significance of the process of adding syndromes is stressed out. Therefore, a big road of intervention in the “adding” processes of such syndromes opens and, hence, of a dynamic shaping of the cultural map of a society.

Cultural syndromes constitute the link between the distant factors that created such syndromes and today’s cultural conditions. Nevertheless, different distant factors shaping cultural syndromes (history, language traditions, philosophical and religious beliefs – Protestantism, Confucianism) create similar cultural syndromes. Therefore, while societies often do not share common origins, cultural syndromes may have exceptional similarities.

The distant past and modern cultural consequences are interconnected through the immediate external realities and the immediate internal realities. Immediate external realities are social structures, which reflect invoked cultural syndromes. Hence, we can claim that societies do not differ because they include different dominant cultural syndromes, but because there are institutional reflections of them in abundance. On the contrary, immediate internal realities are subjective psycho-structural circumstances.

Hence, when cultural syndromes are used, then cultural background can offer different notions, according to everyday situations and consequently, cultural syndromes may create different current real situations. The procedure described above is presented in Fig. 1.

However, cultural capital does not overlap social capital. Bourdieu (1986), one of the founders of research on social capital,

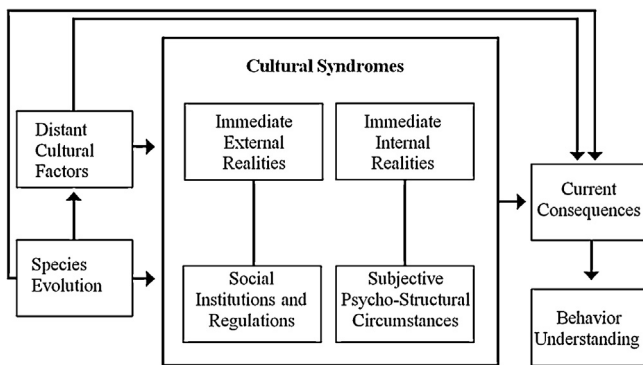


Fig. 1. The formation of cultural syndromes.

dissociates social from economic and cultural capital, defining the first as the sum of the real and conditional sources creating a stable network of mutual familiarity. Coleman (1990), defined social capital not based on the resources arising from being part of networks but as the networks themselves, which facilitate the actions of their members. Putnam (1995) extended Coleman's approach, defining social capital as those characteristics of the societal organization that "facilitate coordination and cooperation towards the common good". These characteristics include three concepts: networks, rules and trust.

2.3. The role of culture in growth

Many studies have quantified the "effects" of cultural background and provided data for a large number of countries (McClelland, 1961; Hofstede and Culture's Consequences, 1980; House et al., 2004). The interrelation of the studies' results with economic growth indices demonstrates that culture can have particular and significant impacts (Minkov and Blagoev, 2009).

Inglehart (1997) has located groups of countries that seem to share common cultural values. Based on three WVS measurements (1970–1971, 1981 and 1990), he attempts to identify the possible relationships between cultural background and economic growth, indentifying causation relationships to both directions. High incomes have led the biggest part of the population to ensure those necessary for living and not to be interested in its survival any more. Materialistic safety of economic blossoming leads to the displacement of the individual's priorities. Individuals are now less interested in the accumulation of wealth and focus on "feminine values", such as quality of life, environment protection, respect towards fellow beings and solidarity. Hence, economic growth may lead to a change of values. On the one hand, the fact that post-modern societies lack performance orientation leads to reduced growth rates.

The different social and political procedures that shape the cultural background of each society guide human behaviour and the character of all involved. Thus, Greif (1994) highlights the fact that different cultural values lead to different societal structures of economic relationships and affect the dynamics of wealth distribution. Additionally, he examines the phenomenon of economic growth as it relates to cultural stereotypes and the effect of such stereotypes on economic transactions.

Since the late 20th century, we have been witnessing a gradual appearance of papers that, using empirical models, try to explain the impact of the cultural background on economic growth (Hofstede and Bond, 1988; Marini, 2004; Pryor, 2005).

Granato et al. (1996) examine the explanatory power of the standard endogenous growth model and compare it with that of two types of cultural values capturing motivational factors—achievement motivation and postmaterialistic values. They create

an index, in order to measure the extent of incentives achievement, by relying on cultural background data from the World Values Survey (WVS). Hence, they ascertain that for a total of 25 countries economic growth is influenced not only by economic factors, but also by cultural background. They conclude that both economic and cultural factors affect growth and they play complementary roles, as both models explain aspects of growth that the other cannot.

Marini (2004) attempted to perfect the work of Granato et al. (1996), by means of constructing a cultural variable for each of the three periods mentioned above. The first period, the one of traditional economy, includes values such as obedience, faith in religion and tolerance. The second period is characterized by personal achievements and the general trust in fellow human beings. Lastly, the values linked to the post-modern period are imagination and unselfishness. By using the same countries as Granato et al. (1996) used in their analysis, Marini (2004) discovered a negative association between economic growth and the values of the traditional economy, a positive association with values such as independence, austerity and diligence, whereas he did not find any statistically significant relationship in the third period of development of the economy.

Paldam (2002) using a set of dummies for "cultural areas", argues that the transition from a poor high corrupted traditional country to a wealthy liberal democracy is influenced by culture, so countries with the same "basic culture" cluster along the transition path. However, he found little basis for the belief that corruption is so deeply embedded in the culture of the society as to be unchangeable. He concludes that culture is an inferior explanation of the level of corruption due to the fact that countries are more similar in GDP level than in the corruption level within the same cultural area and that corruption varies greatly within the same cultural area.

Furthermore, Barro and McCleary (2003) examine religion as a determinant of economic growth. They find that economic growth responds positively to the extent of religious beliefs, but negatively to church attendance. They support that growth depends on the extent of believing relative to belonging. These results accord with a perspective in which religious beliefs influence individual traits that enhance economic performance.

Tabellini (2005) analyzes 69 regions from 8 different countries of Europe, by defining cultural background as a result of historical developments and divergences. He uses trust, belief that personal efforts are rewarded, respect and teaching obedience to children of each region, as well as indices regarding the political institutions for the period 1600–1850. Initially, literacy level and political institutions explain cultural background. Further on, such values are used in the regressions, in order to measure the influence of cultural background over per capita income. According to the results, trust, as a cultural background index, influences per capita income positively. The same applies for obedience. According to Tabellini (2005), the currently applicable cultural background of every society is a result of long-lasting fermentation and is largely owed to historical factors, such as political institutions and illiteracy level. The institutions of each society, which are the outcome of long-lasting processes, influence economic results, through cultural background.

Another controversial issue in the literature lies between the effects of individualistic or collectivistic societies in the economic outcome (Triandis, 1995). Collectivistic societies may give a competitive edge in the production of the final goods in the economy, however, their connection with tradition, creates obstacles in economic growth as well as in decision making that would benefit society. In-group collectivism is incompatible with competitiveness and the development of free entrepreneurship: it favours conceptualism and small, low-risk businesses. Furthermore, the increased responsibilities of the individual in the group, lack the necessary energy to innovate and create putting one more obstacle

in the direction of wealth accumulation. In contrast, according to Pareek (Pareek, 1968), economic growth is a function of “need for progress” which is often associated with privacy and competition. The quality of intermediate inputs that lead to final goods, is determined by individual effort, which in turn is a function of rewards to innovation.

De Jong (2009) explains how culture affects institutions and economic activity. He considers culture as the sum of the values and attitudes that pervades a group of people, which directly or indirectly affects the outcome of the economic process. The opinions of the individuals and the value grid affect the organisation and functioning of institutions and therefore the way in which the available resources of a society are directed. However, he does not detect a direct influence of culture on economic results. With regard to richer countries, he concludes that the dimension of “Individuality” is negatively associated with economic growth and positively with per capita GDP and the Human Development Index, although not statistically significantly, whereas “Uncertainty Avoidance” is negatively associated with per capita GDP. These results oppose those of Hofstede (2001), who sees a powerful relationship between per capita GDP and “Individualism”. At the same time, the dimensions of “Power Distance” and “Masculinity” can provide significant explanations regarding the income divergences between countries. High scores to these two dimensions entail big inequalities to the distribution of income. Lastly, his regressions corroborate the negative relationship of the GDP’s growth rate with uncertainty. Hence, values may indeed be significant for the way society is organized, but they do not necessarily influence the level of income or the rate of growth.

More recently, Sacco and Segre (2009) suggest an endogenous growth mechanism sustained by investments in culture, thereby elucidating the factors through which culture may affect economic growth. Bucci and Segre (2011) suggest that in a world where complementarities are important (especially those involving human capital), culture is of particular interest in explaining economic growth. Building a two-sector endogenous growth model where two different types of capital (human and cultural capital) can be accumulated, Bucci and Segre (2011) argue that the investment in culture can affect economic growth in the long run only through the complementarity between the two forms of capital accumulation.

2.4. The data

In collecting the data, we treat the world as a typical country, assuming that the production process is homogenous around the world because we do not allow for heterogeneous growth experiences (Bos et al., 2010). Our limited degrees of freedom (the small sample is constrained by the limited number of observations for entrepreneurial variables) do not permit us to deepen our analysis in this respect. The variables are precisely defined in Table 1.

The data for the dependent variable (GDP) concern the average annual gross domestic product growth rates during the period 2001–2006. To measure capital, we use the investment rates as a percentage of GDP during the period 1998–2003, leaving a time margin of 3 years for return on investment. It is measured by the total value of the gross fixed capital formation and changes in inventories and acquisitions less disposals of valuables for a unit or sector, and it is calculated annually by the International Monetary Fund. As human capital, we use the average years of schooling for people aged over 25 years. It is calculated as the distribution of educational attainment among the population, combined with the information for each country on the duration of school at each level. Years of schooling has long been considered a good proxy for human capital (Benhabib and Spiegel, 1994; Klenow and Rodriguez-Clare, 1997; Browning, 1999; Hall and Jones, 1999; Cohen and Soto, 2007). As labour, we use the mean annual growth rate of the working

population (aged 25–64) during the period 2000–2005 (Owen et al., 2009). Average years of schooling and working population (aged 25+) growth are calculated every 5 years by Barro and Lee database.

For the variables capturing cultural background, we use the nine cultural dimensions of the GLOBE study (House et al., 2004). There has not been a more recent organised effort to measure the cultural background in so many countries. GLOBE is the most comprehensive study to date that empirically researched the relationship between culture and behavior in so many societies, with so many different quantitative and qualitative measures. It is based on results from about 17,300 middle managers from 951 organizations in the food processing, financial services, and telecommunications services industries, in 62 societies all over the world. The cultural dimensions are derived using questionnaires based on a 7-point scale. These data refer to the period 1997–1998, however, the social stereotypes forming the cultural background may be characterised as long lasting, and cultural values present stability through time. Therefore, for the periods analysed, the variables related to the cultural background may be regarded as constants.

Descriptive statistics of the variables used are given on Table 2.

3. The methodology employed and the empirical results

Following Owen et al. (2009), the empirical model we estimate includes regressors that capture the proximate determinants of economic growth. Investments in the economy, education of the members of the society and population growth of the labour force are considered direct measures of the growth of productive factors. Furthermore, growth factors of the basic model are those of the augmented neoclassical model introduced by Mankiw et al. (1992), as well as the robust determinants of economic growth identified by Levine and Renelt (1992). The standard growth equation that we examine is as follows:

$$GDP_i = \beta_1 * CAP_i + \beta_2 * L_i + \beta_3 * HC_i + \beta_4 * C_i + \varepsilon_i \quad (1)$$

where the dependent variable (gross domestic product – GDP) is the average annual GDP growth rate in constant prices; CAP (capital) is defined by the average investment rate (percentage of GDP); L (labour) is the sum of “ $n + g + \delta$ ”, where n is the average population growth of the working population aged between 25 and 64 years, g is the growth rate of technology and δ the depreciation rate; HC (human capital) is defined as the average years of schooling in the initial year period; and C is the principal component (PC) that arises from the variables capturing cultural background. Based on Mankiw et al. (1992), we assume that the annual rates of technological growth (g) and depreciation (δ) are constant and sum to 0.05. The subscripts i refer to the countries used.

To abstract from the complexity of the explanatory variables, we use principal component analysis (PCA). PCA allows us to reduce the number of variables representing cultural background, while detecting the structure in the relationships between these variables. Smith (2002) commented that PCA is a way of identifying patterns in data and expressing the data in such a way as to highlight their similarities and differences. More specifically, PCA is a factor extraction method used to form uncorrelated linear combinations of the observed variables, which are then used to obtain the initial factor solution when a correlation matrix is singular. The first PC has a maximum variance. Successive components explain progressively smaller portions of the variance, and all are uncorrelated with each other.

We apply PCA to the group of variables capturing cultural background. The effects of the PCs on GDP are examined through a linear regression using the ordinary least squares (OLS) method, as in the model presented above. In our linear regression, we use the

Table 1
Description, sources and periods of reference of the variables used.

		Variables	Description	Reference period	Source of elements
Cultural background	Efficiency Orientation	Performance orientation	The degree to which a society encourages and rewards its members for performance improvement and excellence.	1995–1997	House et al. (2004)
		Future orientation	The extent to which individuals engage in future-oriented behaviours, such as delaying gratification, planning and investing in the future.		
		Assertiveness	The degree to which individuals are assertive, confrontational and aggressive in their relationships with others.		
		Power distance	The degree to which members of a society expect power to be distributed equally.		
		Uncertainty avoidance	The extent to which members of an organization or society strive to avoid uncertainty by reliance on social norms, rituals, and bureaucratic practices to alleviate the unpredictability of future events.		
	Social Orientation	Gender Egalitarianism	The degree to which a society minimises gender inequality.		
		Institutional collectivism	The degree to which organisational and societal practices encourage and reward collective distribution of resources and collective action.		
		In-group collectivism	The degree to which individuals express pride, loyalty and cohesiveness in their organisations or families.		
		Human orientation	The degree to which a society encourages and rewards individuals for being fair, altruistic, generous, caring and kind to others.		
		Capital	Investment rates (percent of GDP)		
Human capital	Average years of schooling	It is the number of years of schooling achieved by the average person at various levels and at all levels of schooling combined.	2000	Barro and Lee Database, v. 1.2 www.barrolee.com	
Labour	Working population (age 25+) growth	Annual growth of working population aged 25 and over.	Mean of the period 2000–2005		
Target variable	GDP annual growth rate (constant prices)	Annual percentages of constant price GDP are year-on-year changes; the base year is country-specific.	Mean of the period 2001–2006	World Economic Outlook Database www.imf.org	

Table 2
Descriptive statistics.

Variables/statistics	N	Median	Mean	Std. dev.	Min	Max
GDP annual growth rate	41	3.416	3.641	1.83	0.92	10.25
Performance orientation	41	4.110	4.107	0.41	3.20	4.90
Future orientation	41	3.860	3.861	0.52	2.85	5.07
Assertiveness	41	4.130	4.109	0.35	3.38	4.79
Power distance	41	5.180	5.154	0.39	3.89	5.64
Uncertainty avoidance	41	4.150	4.192	0.62	2.88	5.32
Gender egalitarianism	41	3.465	3.435	0.34	2.50	4.08
Institutional collectivism	41	4.290	4.292	0.46	3.25	5.22
In-group collectivism	41	5.270	5.042	0.75	3.53	6.36
Human orientation	41	3.940	4.046	0.46	3.32	5.12
Investment rates	41	22.396	22.363	4.07	15.82	37.35
Average years of schooling	41	8.732	8.835	2.29	3.58	13.00
Working population (age 25+) growth	41	0.136	0.135	0.05	0.06	0.23

The 41 countries in the sample represent 90.44% of world GDP in 2007 (IMF database). These countries are Argentina, Australia, Austria, Brazil, Canada, China, Colombia, Denmark, Ecuador, Finland, France, Germany, Greece, Hong Kong, Hungary, India, Indonesia, Ireland, Israel, Italy, Japan, Malaysia, Mexico, Netherlands, New Zealand, Philippines, Poland, Portugal, Russian Federation, Singapore, Slovenia, South Africa, South Korea, Spain, Sweden, Switzerland, Thailand, Turkey, United Kingdom, United States, and Venezuela.

Table 3
Descriptive statistics for cultural background variables after a 30% increase in the values of the variables.

	Variables/statistics	N	Median	Mean	Std. dev.	Min	Max
+30% on Efficiency Orientation	Performance orientation	41	4.550	4.659	0.37	4.11	5.33
	Future orientation	41	4.390	4.389	0.34	3.71	5.07
	Assertiveness	41	4.620	4.668	0.37	4.13	5.32
	Power distance	41	3.927	4.279	0.57	3.62	5.15
	Uncertainty avoidance	41	3.612	3.565	0.36	2.88	4.18
+30% on Social Orientation	Gender egalitarianism	41	3.930	3.897	0.31	3.25	4.42
	Institutional collectivism	41	4.900	4.896	0.37	4.23	5.58
	In-group collectivism	41	5.525	5.536	0.43	4.59	6.42
	Human orientation	41	4.758	4.700	0.34	4.10	5.19

principal components with the greatest variances (initial eigenvalues > 0.91).

To check for endogeneity between the variables used, we use a version of the Hausman test (Hausman, 1978) proposed by Davidson and MacKinnon (1989, 1993), which employs a test statistic for exogeneity by running an auxiliary regression. The null hypothesis states that the model yields consistent estimates and the reported *p*-values state the probability that the test statistic is zero, which would imply the acceptance of the null hypothesis. In this test, we use a set of instrumental variables that are correlated with the “suspect” variable but not with the error term of the regression that applies GDP as a dependent variable. Only if endogeneity is not present will the OLS estimates be consistent and unbiased. In addition, the partial instrumental variables R^2 are reported to describe how much of the squared residuals can be explained by the instrumental variables. The partial *p*-value, which is the probability that the *F*-value for each instrumental variable is zero, is also reported. Both tests describe how effective the instrumental variables are in explaining annual GDP growth rates.

Furthermore, a sensitivity analysis of this basic scenario is included. The scope of this experiment is to evaluate the effect of culture on annual GDP growth rates under changing societal circumstances. We create eight combinations of cultural background in societies through increasing or decreasing the values of some of the cultural variables and maintaining the effect of the basic growth factors in all cases. We divide the cultural background variables in two main groups (see Table 1). The first group covers the variables that represent the “Efficiency Orientation” of the societies: performance orientation, future orientation, assertiveness, power distance and uncertainty avoidance. The second covers the variables that represent the “Social Orientation” of societies, i.e., the attitudes and lifestyles of their members. These variables include gender egalitarianism, institutional collectivism, in-group collectivism and human orientation. The sensitivity analysis we conduct examines all the possible cases where the values of the variables of each group are improved, weakened or remain unchanged. To improve/weaken the value, a variable is increased/reduced by 30% for the countries scoring below/over the average score of the sample. For power distance and uncertainty avoidance, which are reverse scored, to become improved their values are reduced by 30% for the countries scoring over the average score of the sample (and vice versa).

Tables 3 and 4 present the descriptive statistics after the sensitivity analysis.

Fig. 2 represents the sensitivity analysis plan.

After the sensitivity analysis, we run a new PCA with the PCs shaped by new forces for each case. Subsequently, for each case, we evaluate the effect of the new PCs on the variable GDP growth rates in combination with the basic growth factors.

To reach these goals (apart from the description of the new findings), a structural change check is performed, relating the alternative circumstances to the basic scenario. In other words, we want to assess the statistical significance of the structural change from

the basic model (Regression 1) in the model formulated under the new forces arising from each case of the sensitivity analysis. In effect, for each of the cases of the sensitivity analysis, we constructed two groups of 41 observations. These two groups create a new variable for each of the variables used. The first (Group 1) concerns the variable's values in the basic scenario and the second (Group 2) concerns the variable's prices for each case of the sensitivity analysis. Subsequently, a dummy variable is created whose value is 0 for Group 1 and 1 for Group 2. The estimates concerning the statistical importance of newly created factors led us to some conclusions regarding the new configuration and conditions of annual GDP growth rates.

4. Empirical work and discussion of the results

The empirical work and the discussion of the results are presented in two paths: the first refers to the basic model examined and the second to the sensitivity analysis.

4.1. The basic model

In terms of cultural background, four PCs are determined (PEOC, PSOC1, PSOC2 and MESOC in Table 5) that explain 37.86%, 20.24%, 14.86% and 10.11% of the total variance and present initial eigenvalues 3.41, 1.82, 1.33 and 0.91, respectively. Pro-Efficiency Oriented Component (PEOC) is determined by the positive effects of performance orientation, future orientation, institutional collectivism, human orientation, and uncertainty avoidance and the negative effects of assertiveness and power distance. It is a PC that is shaped by the cultural characteristics that promote efficiency and growth.

Pro-social oriented component 1 (PSOC1) is positively shaped by gender egalitarianism, institutional collectivism, in-group collectivism and human orientation, while assertiveness has a negative effect. Pro-social oriented component 2 (PSOC2) is characterised by the positive influence of gender egalitarianism and institutional collectivism and the negative effects of in-group collectivism and power distance. Lastly, mixed pro-efficiency and social oriented component (MESOC) is positively shaped by performance orientation and institutional collectivism and negatively by gender egalitarianism.

Table 5 presents the contents of the PCs, i.e., the variables that affect the PC configuration and have partial correlation values greater than 0.3 in terms of absolute values. Table 6 presents the empirical results of the estimated regressions. The first column (Regression 1) shows the estimated basic model and presents the effect of the basic growth factors and the cultural background on annual GDP growth rates. The basic growth factor HC, PEOC, PSOC2 and MESOC are not statistically significant in Regression 1. This may be due to endogeneity between the dependent and the independent variables. Table 7 presents the correlations between the variables used. Observing the correlation matrix, GDP may be endogenously determined by CAP, L, HC or PSOC2.

Table 4
Descriptive statistics for cultural background variables after a 30% reduce in the values of the variables.

	Variables/statistics	N	Median	Mean	Std. dev.	Min	Max
–30% on Efficiency Orientation	Performance orientation	41	3.320	3.426	0.40	2.88	4.10
	Future orientation	41	3.150	3.231	0.33	2.71	3.86
	Assertiveness	41	3.353	3.435	0.42	2.89	4.09
	Power distance	41	5.600	5.825	0.52	5.06	6.70
	Uncertainty avoidance	41	4.780	4.822	0.41	3.74	5.43
–30% on Social Orientation	Gender egalitarianism	41	2.849	2.866	0.34	2.43	3.40
	Institutional collectivism	41	3.640	3.608	0.40	3.01	4.29
	In-group collectivism	41	3.948	4.024	0.36	3.53	4.94
	Human orientation	41	3.490	3.486	0.36	2.87	3.99

(1) -30% on Efficiency Orientation Cultural Background -30% on Behavioural Attitudes of Cultural Background	(2) 0% on Efficiency Orientation Cultural Background -30% on Behavioural Attitudes of Cultural Background	(3) +30% on Efficiency Orientation Cultural Background -30% on Behavioural Attitudes of Cultural Background
(4) -30% on Efficiency Orientation Cultural Background 0% on Behavioural Attitudes of Cultural Background	(5) Basic Model	(6) +30% on Efficiency Orientation Cultural Background 0% on Behavioural Attitudes of Cultural Background
(7) -30% on Efficiency Orientation Cultural Background +30% on Behavioural Attitudes of Cultural Background	(8) 0% on Efficiency Orientation Cultural Background +30% on Behavioural Attitudes of Cultural Background	(9) +30% on Efficiency Orientation Cultural Background +30% on Behavioural Attitudes of Cultural Background

Fig. 2. Sensitivity analysis.

Because of the concern about endogeneity, we use a version of the Davidson and MacKinnon (1989, 1993) test described above for all independent variables separately. To test the hypothesis, we use an instrumental variable that correlates with the suspect variable but not with the error term of the GDP equation. We need to determine whether the instrumental variables are weak or not as robust as the exogeneity test. Choosing the appropriate instrument is a crucial step. We check for the instruments using the correlation matrix, the partial R^2 and the partial F -statistic. All the variables used as instruments are assessed as strong instrumental variables and are considered exogenous with respect to GDP, as they present a strong correlation with each independent variable but not with GDP. The instruments yield a sufficient partial R^2 and a partial F -statistic larger than 10 when regressed on each independent variable but not when regressed on GDP. The results of the exogeneity tests do not reveal the existence of endogeneity,

as the first stage residuals are not significantly different from zero. Therefore, the evaluations we receive from Regression 1 are consistent and unbiased. The estimation of the basic model (Table 6) shows that an increase of CAP, L or PSOC1 would positively affect the annual GDP growth, as they present positive and statistically significant estimates. The R^2 of the regression amounts to 86.7%, and the regression is statistically strong according to the F -statistic.

4.2. Sensitivity analysis

Next, we cause a shock in the economies by increasing or decreasing the values of the variables capturing cultural background by 30% or by maintaining them at a constant, achieving all possible combinations. In other words, we run a new PCA for the “new” cultural background for each case of Fig. 2. For each case, we create the new variables PEOC', PSOC1', PSOC2' and

Table 5
Principal component matrix.

		PEOC	PSOC1	PSOC2	MESOC
Efficiency Orientation	Performance orientation	0.78			0.35
	Future orientation	0.82			
	Assertiveness	-0.38	-0.78		
	Power distance	-0.69		-0.53	
	Uncertainty avoidance	0.85			
Social Orientation	Gender egalitarianism	0.78	0.41	0.70	-0.38
	Institutional collectivism	0.46	0.36	0.50	0.71
	In-group collectivism		0.41	-0.53	
	Human orientation		0.46		

We present only the values of partial correlations that are greater than 0.3 in terms of absolute values.

Table 6
The basic model.

	Dependent variable: GDP
CAP	0.17*** (3.58)
L	8.11* (1.68)
HC	-0.14 (-1.59)
PEOC	-0.04 (-0.18)
PSOC1	0.42* (1.82)
PSOC2	-0.26 (-0.98)
MESOC	0.11 (0.48)
Adjusted R^2	0.86
F -statistic	39.43***

The parentheses include the t -test statistics for the coefficients of the regressions. Significance at the 1% and 10% levels is denoted by *** and *, respectively.

MESOC'. To check for the structural change between the basic model and each case of the sensitivity analysis, we create the variables PEOC", PSOC1", PSOC2" and MESOC" (i.e., the difference of the basic scenario from the case of the sensitivity analysis), which arise as values of PEOC, PSOC1, PSOC2 and MESOC for Group 1 and PEOC', PSOC1', PSOC2' and MESOC' for Group 2. The dependent variable GDP is now called GDP", and its values for Group 1 are repeated for Group 2. The same procedure is also implemented for the basic growth factors (CAP, L, HC), whose values do not differ between the basic scenario and the case of the sensitivity analysis. Table 8 presents the variables dum x PEOC", dum x PSOC1", dum x PSOC2" and dum x MESOC", which are the products of the created dummy variable and the variables PEOC", PSOC1", PSOC2" and MESOC", respectively, for each case of the sensitivity analysis.

The shock in the economies produced some statistically significant structural differences. Table 8 presents the cases where we observe statistically significant structural changes from the eight different cases of Fig. 2. For Cases 6–8, no statistically significant structural change occurred, and they are not presented in Table 8. The same table also presents the regressions of the sensitivity analysis shock.

Case 1. In this case, the values of all variables representing the cultural background are undervalued by 30%. More specifically, the values of performance orientation, future orientation, assertiveness, gender egalitarianism, in-group collectivism, institutional collectivism and human orientation are reduced by 30% and the values for power distance and uncertainty avoidance, which are scored adversely, are increased by 30%. The new conditions lead to two statistically significant structural changes for the second and

fourth cultural background PCs (see Table 8). The second cultural background PC (PSOC1') continues to be statistically significant and is determined by the positive effects of performance orientation, future orientation, uncertainty avoidance, gender egalitarianism and institutional collectivism and the negative effect of the human orientation variable. Furthermore, MESOC' is statistically significant at a level of 5% and is determined by the positive effects of uncertainty avoidance, in-group collectivism and human orientation. The adjusted R^2 of the sensitivity analysis equals 87%, while the F -statistic shows that the regression is statistically strong. In conclusion, after the sensitivity analysis for this case, the second PC shows a negative effect of cultural background on GDP; the influence of the cultural environment is strengthened by MESOC', which impedes annual GDP growth rates.

Case 2. In this case, the values of all variables representing "Social Orientation" are undervalued by 30%, while "Efficiency Orientation" cultural background variables remain unchanged. The sensitivity analysis reveals two statistically significant structural changes for the second and the fourth cultural background PCs (see Table 8). The influence of PSOC1' is lost, and it is replaced by MESOC', which is determined by the positive effects of assertiveness, gender egalitarianism and institutional collectivism and is statistically significant at the 10% level. The adjusted R^2 of the sensitivity analysis equals 86.9%, while according to the F -statistic, the regression is statistically strong. After the sensitivity analysis for this case, the effect of the PSOC1 on GDP is lost, and this structural change is statistically significant. The effect of the cultural background in shaping annual GDP growth rates is negative and is shaped by the MESOC'.

Case 3. In Case 3, the values of all variables representing "Social Orientation" are undervalued by 30%, while "Efficiency Orientation" cultural background variables are increased by 30%. These new conditions lead to two statistically significant structural changes for the PSOC1 and the MESOC (see Table 8). PSOC1' has a statistical significance level of 5% and is now determined by the positive effects of performance orientation, uncertainty avoidance, gender egalitarianism and institutional collectivism and the negative effect of human orientation. In parallel, MESOC' has a statistical significance level of 10% and is determined by the positive effects of uncertainty avoidance, in-group collectivism and human orientation and the negative effect of future orientation and power distance. The adjusted R^2 of the sensitivity analysis equals 87.7%: according to the F -statistic, the regression is statistically strong. In this case, the effect of PSOC1 on GDP becomes a negative effect (PSOC1'). The effect of the cultural background is strengthened by a further PC (MESOC') that impedes annual GDP growth rates.

Case 4. In this case, the values of all variables representing "Social Orientation" remain unchanged, while the "Efficiency Orientation" variables are undervalued by 30%. The sensitivity analysis in this case shows only one statistically significant structural change for the MESOC (see Table 8). Under the new conditions, MESOC' is determined by the positive effects of performance orientation, future orientation, uncertainty avoidance and in-group collectivism, and it is a statistically significant PC with a 10% level of significance. The adjusted R^2 of the sensitivity analysis equals 86.8%; the F -statistic supports a statistically strong regression. The promoting effect of the PSOC1 on GDP is lost following this sensitivity analysis. The effect of the cultural background on annual GDP growth rates is negative and determined by the MESOC'.

Table 7
Correlation matrix.

Variable	GDP	CAP	L	HC
CAP	0.438***			
L	0.444***	0.156		
HC	-0.384***	-0.059	-0.545***	0.140
PEOC	0.005	0.126	0.023	-0.006
PSOC1	0.199	-0.047	-0.067	0.343**
PSOC2	-0.382**	-0.180	-0.483***	-0.019
MESOC	0.182	0.191	0.192	

Significance at the 1% and 5% levels is denoted by *** and **, respectively.

The correlations between the PCs expressing cultural background are not reported, as there is zero correlation between them.

Table 8
Sensitivity analyses and structural change.

	Case (1)		Case (2)		Case (3)		Case (4)		Case (5)		Case (6)		Case (7)		Case (8)	
	Sensitivity	Structural change	Sensitivity	Structural change	Sensitivity	Structural change	Sensitivity	Structural change	Sensitivity	Structural change	Sensitivity	Structural change	Sensitivity	Structural change	Sensitivity	Structural change
CAP	0.18*** (3.68)		0.16*** (3.47)		0.18*** (3.69)		0.20*** (4.08)		0.19*** (4.09)		0.17*** (3.53)		0.17*** (3.47)		0.18*** (3.80)	
L	11.23** (2.53)		10.41** (2.26)		12.71*** (2.84)		10.78** (2.40)		12.74*** (2.84)		11.75** (2.42)		9.45* (1.89)		13.30*** (2.77)	
HC	-0.21*** (-2.42)		-0.16* (-1.96)		-0.24** (-2.63)		-0.25*** (-2.74)		-0.26*** (-2.91)		-0.21** (-2.30)		-0.16* (-1.75)		-0.26*** (-2.81)	
PEOC'	0.18 (0.82)		-0.12 (-0.53)		0.29 (1.29)		0.24 (1.09)		0.32 (1.46)		-0.22 (-0.93)		-0.19 (-0.79)		-0.16 (-0.71)	
PSOC1'	-0.40* (-1.77)		-0.24 (-1.02)		-0.46** (-2.08)		0.33 (1.32)		0.44* (1.72)		0.24 (1.03)		-0.08 (-0.33)		0.17 (0.73)	
PSOC2'	-0.10 (-0.44)		-0.05 (-0.22)		-0.26 (-1.03)		0.13 (0.81)		-0.22 (-0.99)		-0.27 (-1.07)		-0.34 (-1.41)		-0.68* (-2.60)	
MESOC'	-0.48** (-2.06)		-0.45* (-1.97)		-0.42* (-1.82)		-0.47* (-1.93)		-0.46* (-1.96)		-0.38 (-1.55)		0.03 (0.14)		0.23 (0.97)	
dum x PEOC"	0.22 (0.69)		-0.08 (-0.24)		0.33 (1.02)		0.29 (0.89)		0.35 (1.09)		-0.18 (-0.54)		-0.15 (-0.44)		-0.12 (-0.37)	
dum x PSOC1"	-0.83** (-2.54)		-0.66** (-2.01)		-0.89*** (-2.76)		-0.09 (-0.26)		-0.06 (-0.18)		-0.18 (-0.55)		-0.51 (-1.46)		-0.25 (-0.77)	
dum x PSOC2"	0.15 (0.43)		0.21 (0.58)		-0.004 (-0.01)		0.45 (1.27)		0.008 (0.02)		-0.01 (-0.03)		-0.07 (-0.21)		-0.42 (-1.11)	
dum x MESOC"	-0.59* (-1.79)		-0.57* (-1.72)		-0.53 (-1.62)		-0.58* (-1.72)		-0.33 (-1.27)		-0.50 (-1.45)		-0.07 (-0.22)		0.11 (0.34)	
Adjusted R ²	0.87	0.87	0.86	0.87	0.88	0.87	0.87	0.87	0.88	0.87	0.89	0.87	0.86	0.86	0.88	0.87
F-statistic	43.58***	41.41***	40.21***	39.82***	45.13***	42.11***	42.15***	40.75***	44.52***	40.94***	40.59***	40.00***	37.39***	38.39***	44.43***	41.80***

The parentheses include the *t*-test statistics for the coefficients of the regressions.

In the structural changes, the variables PEOC", PSOC1", PSOC2", and MESOC" as well as the groups for the basic growth factors are also included, but their estimates are not displayed because they are the same as in the basic model. In addition, we include the products of the groups of the basic growth factors with the dummy variable, but they are not displayed.

Significance at 1%, 5% and 10% is denoted by ***, ** and *, respectively.

5. Conclusions

This paper attempts to analyse cultural background as part of the “remaining factors” in the growth process that cooperate with the capital, labour and human capital factors in the framework of a complete growth theory, beyond the Romer–Lucas augmented growth function. The paper divides the cultural background into two main groups of variables: the “Efficiency Orientation” and the “Social Orientation” aspects of the cultural background of societies.

To a great degree, this paper succeeds in highlighting the importance of cultural background in interpreting GDP growth rates within the basic Solow–Romer augmented growth function. To achieve this, we allowed these variables to cooperate with the basic growth factors. The interceptive and promoting factors of annual growth rates are defined with considerable clarity to highlight the importance that the improvement of the special conditions of growth would have in the way the growth rates are formed.

The empirical results confirm the effect of the basic growth factors on annual GDP growth rates. Regarding the effects between culture and economic growth, an one way relationship accrues, as suspicions for endogeneity problems are not confirmed. The “Social Orientation” cultural background of the societies positively affects annual GDP growth rates. The effects of the “Social Orientation” variables are not captured by any other explanatory variables (capital, labour, human capital), in contrast with the “Efficiency Orientation” variables, whose effect on economic function, due to their nature, may be included in the effect of the rest of the research variables. Thus, the “Social Orientation” cultural background in societies may be a reinforcing element for long-run economic growth, and these “Social Orientation” factors certainly can be promoted by policy interventions. However, the issue is quite complex and has not been thoroughly investigated to date.

Furthermore, sensitivity analysis, through examining all possibilities, has established the effects of special circumstances that improve societies as far as promoting and interceptive factors are concerned. This analysis shows that statistically significant structural changes are noted only in the cases where the “Social Orientation” cultural background is reduced (Cases 1–3) and in Case 4, where it remains stable, regardless of what happens to the values capturing the “Efficiency Orientation” cultural background. The reduction of the “Social Orientation” cultural background affects annual GDP growth rates negatively. At the same time, when the “Social Orientation” factors remain stable, the statistically significant structural change of the model concerns the entry of new variables expressing the cultural background (MESOC’), regardless of the changes to the “Efficiency Orientation” factors.

One shortcoming of this paper could be that the sample was reduced in the effort to find common data among many countries for the variables used. In addition, using years of schooling to measure human capital ignores within-year investment of time and investment in products and services that increase the quality of a year of education (Cohen and Soto, 2007; Krueger and Lindahl, 2001). The analysis also ignores the dimension of learning from living in communities (Feinstein, 2006).

Future research may analyse the contribution of the basic growth factors and cultural background in addition to other factors representing the remaining factors in the growth process. Such factors may include the transaction characteristics of the societies or the institutions that characterise economies.

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