The Development-enhancing Impact of Culture Dehomogenized: The Role of Different Cultural Layers

Judit Kapás

Professor
Institute of Economics
Faculty of Economics and Business
University of Debrecen
e-mail: judit.kapas@econ.unideb.hu

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Abstract

The aim of this paper is to take a step towards improving our understanding of how culture affects economic development, by introducing two novel aspects in the empirical investigations, inspired by two economic theories. Firstly, based on the theory of institutional stickiness (Boettke et al. 2008), I will unbundle culture by distinguishing a rigid and a slow-moving layer within it, and then analyze the impact of each particular layer individually. Secondly, following the model of Bisin and Verdier (2017), I will take the coevolution of culture (cultural layers) and institutions into account, and will try to establish the development-enhancing effect of this interplay. Cross-country empirical analyses, including IV estimations, have provided evidence that the two cultural layers "behave" differently: the rigid (deep) culture has proved to be a factor in development besides institutions, while the slow-moving culture has not, probably because the development-enhancing effect of the slow-moving culture works only via institutions (due to the high level of stickiness between them). Furthermore, I have documented that the rigid cultural layer reinforces the positive impact of institutional changes on long-run income, meaning that these two are complements. Finally, I have found that the rigid (deep) culture is hard to substitute; only high-quality institutions can substitute it. These findings are very robust for various robustness checks.

Keywords: culture, institutions, economic development, institutional stickiness, coevolution
JEL Codes: E02, O43

1. Introduction

Although Adam Smith (1759) was the first to analyze how norms, beliefs, morality and culture affect economic development, an upsurge of interest in the role of culture has occurred only recently.[1] Nowadays, the majority of research on the impact of culture is empirical, and up to the present time a relatively large and widespread literature has developed (e.g., Putnam et al. 1993, Knack and Keefer 1997, Zak and Knack 2001, Tabellini 2010, Williamson 2009), Gorodnichenko and Roland 2011).[2]

While the insight that culture *matters* in economic performance is commonly shared by the scholars in the field, views and arguments differ when it comes to the details: how culture matters, directly or indirectly; which particular component of culture matters; through which channels culture matters; what the causal mechanisms are; etc. Clearly, there are many questions in the field which remain open for further analyses. After years of research devoted to "grandiose" questions[3], further research should now focus on (aspects of) the above-mentioned questions.

In this spirit, this paper intends to propose a possible way to progress further in "culture-development" research. More specifically, on the basis of two economic theories, namely the theory of institutional stickiness (Boettke et al. 2008), and of the coevolution of culture and institutions (Bisin and Verdier 2017) I will introduce two novel aspects in the empirical investigations. Firstly, I will unbundle culture by distinguishing meaningful layers within it, and then analyze the impact of each particular layer individually. Secondly, I will take the coevolution of culture (cultural layers) and institutions into account, and will try to establish the development-enhancing effect of this interplay.

The theory of institutional stickiness (Boettke et al. 2008) can provide us with theoretical reasoning as to how to unbundle culture: this can be based on the degree of stickiness between a particular cultural layer and institutions. The *rigid cultural layer* includes "deep" culture, consisting of those values that are to a large extent exogenous to people, reflecting the most basic norms, judgments, and beliefs in relation to how to interact with and behave towards others, transmitted from generation to generation. As opposed to this rigid cultural layer, a

[1] Probably the most prominent contribution to the field which is not recent – besides Adam Smith's book –, is the influential work by Max Weber (1930).

[2] However, some studies, such as Landes (2000), Sen (2002), or Greif (1994) have taken a theoretical or historical approach to show that differences in culture matter for long-run development.

[3] "Empirical analyses need to step back from grandiose approaches to social capital and focus on the more mundane but potentially far more fruitful task of analyzing specific social components to individual behavior" (Durlauf and Fafchamps 2005:1689).

slow-moving layer includes those cultural components that depend upon individuals' circumstances, and can change if these circumstances change; accordingly they are not exogenous in economic development, but rather endogenous. The key difference between the two cultural layers lies in their differing degree of stickiness towards institutions: the degree of stickiness is lower for the rigid, and it is higher for the slow-moving layer. This difference is likely to lead to a heterogeneous effect of the layers on development.

Besides unbundling culture, the other novel aspect of my analysis comes from the model of the coevolution of culture and institutions of Bisin and Verdier (2017), which allows us to assess the interplay of a particular cultural layer and institutions in economic development. Answering the question of how a particular cultural layer *in conjunction with* institutions affects development requires us to look at whether culture and institutions are substitutes or complements in fostering economic development.

While it is possible to derive some hypotheses based on the above two theories, and test them empirically, empirical investigations can also help derive further insights. Cross-country regression analyses, including IV estimations, have provided evidence that the two cultural layers "behave" differently: the rigid (deep) culture has proved to be a factor in development besides institutions, while the slow-moving culture has not, probably because the development-enhancing effect of the slow-moving culture works only via institutions (due to high stickiness). Furthermore, I have documented that the rigid cultural layer reinforces the positive impact of institutional changes on long-run income, meaning that these two are complements. Finally, I have found that the rigid (deep) culture is hard to substitute; only high-quality institutions can substitute it. These findings are very robust for various robustness checks.

The paper is organized as follows. In section 2 I will give a short review of the empirical literature on the impact of culture on development. In section 3 I will present the theoretical background and will set out my main hypotheses. Section 4 will introduce the model and present the data. Section 5 will discuss the results of the empirical investigations. Section 6 will conclude.

2. Review of the literature: how culture affects economic performance

The quantitative analyses on the impact of culture that have developed up to the present time are diverse in terms of the measure of culture, the empirical strategy, and the samples of countries or regions used in the studies. Because of the focus of my concern, in this review I

will briefly summarize only those studies that are interested in analyzing the impact of culture on long-run development, i.e., those in which the dependent variable is a measure of economic performance.

Undoubtedly, the early "reference studies" are Hofstede (1980), Putnam et al. (1993), and Inglehart (1990), all documenting that cultural differences are the primary source for growth/income differences across countries. "The opening through which culture entered the economic discourse was the concept of trust" (Guiso et al 2006:29).[4] In the literature trust has been seen as the most important dimension of social capital (e.g., Fukuyama 1995). The first study to investigate the economic effect of social capital, which "has opened a Pandora's box of research" (Casey 2004:96), was Putnam et al. (1993). In their book Putnam et al. (1993) analyze Italian regions and argue that the critical factor in explaining differences in the economic performance of various Italian regions can be found in regional differences in social capital: in regions with a horizontal social structure, based on trust, social capital is higher, and economic outcomes are greater.

This work has been followed up by numerous analyses, of which Knack and Keefer (1997) is the most influential. The two scholars associate social capital with *interpersonal trust* and *civic cooperation*. To measure them, they take data from the World Values Survey. In their cross-country regression Knack and Keefer (1997) find that both cultural variables significantly affect economic growth. More importantly, when including an interaction term of trust and GDP per capita in the regression besides trust and civic cooperation, they provide evidence that both trust and civic cooperation are stronger in countries with higher and more equal incomes, with institutions that restrain the predatory actions of chief executives, and with better-educated and ethnically homogeneous populations.

Zak and Knack (2001), in some respects, is an extension of Knack and Keefer (1997), by confirming its main findings, but at the same time, providing new insights, as well: they prove the existence of the low-trust poverty trap. Another interesting result is that they are able to identify trust as a channel, and not only a factor on its own to induce growth.

A few studies have examined whether social capital is a prerequisite for prosperity at the sub-national level. Schneider et al. (2000) is one example. This paper analyzes how political

[4] Note that outside economics, political scientists have been analyzing the effects of culture on growth, too. Jackman and Miller (1996) for instance explore the idea that the relationship between political culture and growth is very weak, if not inexistent, a conclusion that challenges Inglehart's (1990) findings. Granato et al. (1996) can be considered an important improvement on Jackman and Miller (1996), leading to quite different results: their measures of culture are significant predictors of economic growth, together with the traditional economic factors. Edwards and Patterson (2009) extend the analysis of Granato et al. (1996) in several ways, but their results show that the links between culture and growth are not as clear as was found by Granato et al. (1996). Swank (1996) is another study to highlight and refine the results of Granato et al. (1996).

culture and social capital affects growth on a wider sample of the regions of Europe. As opposed to Putnam et al.'s (1993) results, these authors argue that the impact of culture on economic growth is marginal, at best.

Beugelsdijk and van Schaik (2005a) is another paper looking at regional differences in Europe in the field of social capital-development. In their empirical investigations they come to a very similar conclusion to that drawn by many others: social capital is positively and significantly related to regional economic growth. With the intention of answering the question of whether the findings of Putnam et al. (1993) on Italian regions can be generalized, the two authors refine their investigations in another paper (Beugelsdijk and van Schaik 2005b). In this study they renew the regression analysis, by modifying the specification, but more importantly, by providing an extensive set of robustness checks. The main finding is that *trust* is not a significant determinant of regional growth, but another dimension of social capital, namely *active group membership* is, a result that partly confirms Putnam et al.'s (1993) hypothesis.

Akçomak and ter Weel (2009) focus on the indirect effects of social capital on economic growth. As a channel, this paper identifies innovation. The authors apply 3SLS strategy, and throughout the empirical investigation, *trust* is instrumented by historical institutions. For 102 regions in Europe, this paper provides evidence for the fact that innovation has a strong positive impact on growth, the former being significantly affected by social capital, but social capital does not have a significant effect on growth.

The only paper discovering a negative relationship between trust and growth is Roth (2009).[5] This paper uses panel data, and reveals that when excluding transition countries from the sample, the relationship becomes curvilinear, meaning that in low-trust countries an increase in trust leads to higher growth, but in high-trust countries an increase in trust leads to a decrease in growth. But, interestingly, when analyzing the relationship in a cross section of countries, the positive association of trust with growth detected my many, appears.

The research question of Ahlerup et al. (2009) is unique because the authors' primary interest lies in understanding whether social capital substitutes or complements institutions in growth. The results obtained from a standard cross-country Barro-type growth regression provide evidence that trust and formal institutions substitute each other in growth. In the interpretation of the authors this indicates that the marginal effect of social capital decreases

[5] According to the author, the theoretical underpinning for a possible negative relationship between trust and growth is the collective action theory of Olson (1982).

with better institutions: trust matters the most when formal institutions are weak. On the other hand, the marginal effect of an improvement in institutions depends on the level of trust.

The basic econometric difficulties with the social capital (trust) literature, including robustness (sensitivity) has been illustrated by many (e.g., Durlauf 2002, Durlauf and Fafchamps 2005, Beugelsdijk et al. 2004, Beugelsdijk 2006). For instance the paper by Beugelsdijk et al. (2004) explicitly and extensively analyzes the robustness of the results of two seminal papers, namely Zak and Knack (2001), and Knack and Keefer (1997). The results reveal that Zak and Knack's (2001) results are very robust, which is not the case for Knack and Keefer (1997). Berggren et al. (2007) also provides an extensive robustness analysis concerning, in general, the link between trust and growth, and discovers that this relationship is less robust than claimed by earlier studies.

Tabellini (2008, 2010) opens up a new branch in the analysis of the impact of culture on development by introducing and pioneering the use of a composite measure based on answers to four WVS questions, diverging in this way from the social capital concept. The variables he focuses on are *trust*, *respect*, *individual self-control*, and *obedience*.

In his 2010 paper (Tabellini 2010) he shows that the aggregate variable constructed from the four introduced above significantly correlates with current development in different regions of Europe, after controlling for country fixed effects and for human capital. He also uses an IV estimation in which he uses past literacy and past political institutions as instruments. His finding is that the data do not reject the hypothesis that the effect of these two variables on regional output only operates through culture.

The four measures suggested by Tabellini are extensively used by Williamson in several empirical studies. In her 2009 paper (Williamson 2009) she investigates the relationship between formal and informal institutions (culture) and how the interaction between the two can impact development. Her results, in an important respect, are different from those of Tabellini because she identifies a dominant effect of informal institutions (culture): strong informal institutions are determinants of economic development regardless of the strength of the formal institutions.

More recently, she and her co-author (Williamson and Mathers 2011) show that culture, and the institutions of economic freedom are both independently important for economic growth. They find that when controlling for both culture and economic freedom simultaneously, the strong association between culture and growth becomes much weaker, suggesting that culture and economic freedom may act as substitutes. Mathers and Williamson (2011) is another paper which investigates how the interaction between culture and economic

freedom affects economic prosperity. Here a new result is that the same institutions combined with different cultures have diverse outcomes.

Gorodnichenko and Roland (2010, 2011) analyze the effect of culture on output per capita by using data from the three main cultural databases (the WVS, the Hofstede database and the Schwartz Value Survey). In the 2011 paper they find that the Hofstede's *individualism* index is always significant, whereas this is not the case for most cultural variables. In their more detailed analysis (Gorodnichenko and Roland 2010), they assume that culture plays a key role in stimulating innovations and hence explaining long-run economic growth. They hypothesize that culture is a basic force underlying formal institutions and long-run growth. They show empirically a strong causal effect from culture to long-run growth and the level of innovation; and that culture makes an important contribution to economic development which is independent of institutions. In terms of magnitudes, culture explains income differences across countries at least as much as institutions.

3. Theoretical background and hypotheses

The above review clearly shows that every time scholars refer to culture, they simply reduce its meaning to a much narrower concept, such as social capital, generalized trust, and others, which is an implicit acknowledgement of the fact that an "aggregate" culture is hard to conceptualize; instead, culture is to be seen as a multidimensional phenomenon, as has been suggested by many (e.g., Beugelsdijk and van Schaik 2005b, Klasing 2013). In this spirit, researchers in the field should step back from "grandiose approaches", and instead, focus on an analysis of the impact of a very specific aspect or dimension of culture (Durlauf and Fafchamps 2005).

Another important criticism vis-à-vis the literature is that in the majority of studies scholars investigate the impact of culture separately from the impact of institutions, that is, they try to identify the unique causal effect of both culture and institutions on an aggregate measure. However, institutional economics has taught us a lot about the relationship between institutions and culture, insights which have converged into the view that institutions and culture evolve jointly in an endogenous process (e.g., Murrell and Schmidt 2011, Bisin and Verdier 2017). In the light of the coevolution of culture and institutions, when it comes to the question of how culture affects development, the right question is how culture *in conjunction with institutions* affects development.

To sum up the above, in order to progress further with an analysis of the development-enhancing effects of culture, I propose to introduce the following two novel aspects in the analysis.

(1) Unbundling culture, i.e., distinguishing meaningful layers[6] within culture, and then analyzing the impact of each particular layer individually.

(2) Taking the fact that culture (cultural layers) and institutions coevolve in the developmental process, and trying to establish the development-enhancing effect of the interplay of culture (cultural layers) and institutions.

As regards the first proposition, my argument is that the theory of institutional stickiness (Boettke et al. 2008) can provide us with theoretical reasoning as to how to unbundle culture: this can be based on the degree of stickiness between a particular cultural layer and institutions.

As a first step, I apply the logic of the categorization of formal institutions proposed by Boettke et al. (2008) for the case of culture. As shown in Figure 1, Boettke et al. (2008) distinguish the following institutions and the *metis*:

- *metis*

The *metis* comprises unwritten (informal) norms, practices, beliefs, and conventions, i.e., informal institutions, and it can be thought of as the glue that gives institutions their stickiness. *Metis* constitutes a core onto which formal institutions are stuck.

- indigenously introduced endogenous (IEN) institutions

IEN institutions are associated with spontaneous order and evolve informally over time. They are grounded in the practices, customs, values, and beliefs of indigenous people; accordingly they ensure their foundation in *metis*. In this sense IEN institutions are institutionalized *metis*, and the stickiest institutions of all. Examples of IEN institutions are the rule of law, commercial law, common law, the constitution, property rights, money, etc.

- indigenously introduced exogenous (IEX) institutions

IEX institutions are indigenous, but exogenously introduced by a formal authority, such as the state. Since the formal authority lacks knowledge of *metis*, it is very likely that incongruities between IEX institutions and *metis* will emerge. That is, IEX institutions are less sticky than IEN institutions and they very often fail to conform to *metis*. IEX institutions include, for instance, state-made laws, state regulatory institutions, etc.

[6] Note that layers are different from dimensions: dimensions are independent from one other while layers differ from one other alongside a given criteria, namely the degree of stickiness. For more details see below.

- foreign-introduced exogenous (FEX) institutions

FEX institutions are introduced by foreigners; accordingly, they tend to be the least sticky, since foreigners are less aware of the local norms and practices found in *metis*.

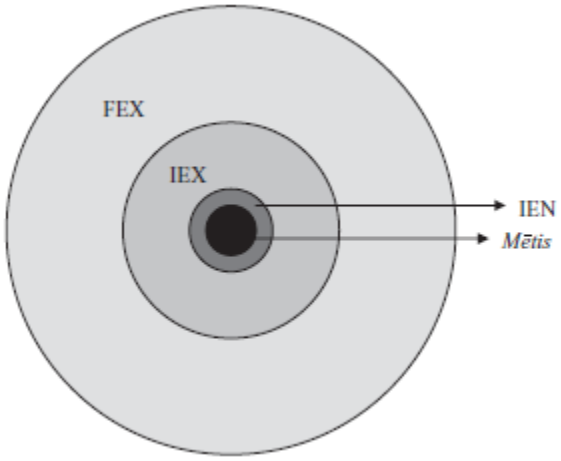

Figure 1: Types of institutions based on stickiness
Source: Boettke et al. (2008: 344)

As can be seen in Figure 1, the connection to *metis*, that is, the stickiness, weakens when we move from IEN to FEX institutions.

The authors, however, fail to analyze the *metis* in detail, although based on their brief description, it is thought to consist of those values that are to a large extent exogenous to people, reflecting the most basic norms, judgments, and beliefs in relation to how to interact with and behave towards others, transmitted from generation to generation. These values act as external and unalterable conditions on individuals.[7] In my understanding, the *metis* is nothing other than the "deepest" or *rigid cultural layer*, consisting of cultural values.

As opposed to this rigid cultural layer, a *slow-moving cultural layer* can include those cultural components that depend upon individuals' circumstances, and can change if these circumstances change; accordingly they are not exogenous in economic development, but rather endogenous, at least in part. Cultural components in this layer can change, but do so slowly, in the endogenous developmental process. Probably the best example of this cultural layer is generalized trust. The literature summarized in Section 2 has clearly documented a slow change in generalized trust as measured on the basis of a question in the World Values Survey, and various studies have demonstrated that trust is endogenous in development and is affected by multiple (historical) institutions.

[7] Values are inherited from generation to generation rather than being voluntarily acquired, they are "largely a 'given' to individuals throughout their lifetimes" (Becker 1996:16).

Based on the above, the model of Boettke et al. (2008) can be extended by explicitly including the two cultural layers. However, I will not include the IEX, nor the FEX institutions in my investigations because including only the IEN institutions is sufficient if we wish to look at the possibly different impact of various cultural layers in conjunction with institutions. So, the layers in my model are the following:

- the rigid cultural layer
- the slow-moving cultural layer
- IEN institutions

My second proposition introduced above about how to make progress in an analysis of culture's impact on development relies on the idea that culture and institutions evolve jointly, a view which goes back to Hayek's theory of cultural evolution, but finds more recent explanations in institutional economics.

An analysis of the joint dynamics of culture and institutions is still missing in the literature summarized in Section 2, even though scholars widely accept the view that the same institutional change can have different effects on development, depending on the culture of a particular country. To overcome this important shortcoming, Bisin and Verdier (2017) have developed a formal model to explain the coevolution of culture and institutions, the "inclusion" of which in the regression model can significantly contribute to a better understanding of how culture affects economic outcomes.

In the model of Bisin and Verdier (2017) culture and institutions are jointly and endogenously determined, and they jointly affect economic outcomes. In the process of coevolution, both culture and institutions can reinforce the impact of the other by ending up either weakening or strengthening the equilibrium outcome. Bisin and Verdier (2017) refer to this phenomenon as a multiplication process which can be characterized by the cultural and institutional multipliers. In their understanding, the cultural (resp. institutional) multiplier shows the long-run change in any economic outcome in response to a change in institutions (resp. culture) relative to a counterfactual long-run change that would happened if the cultural (resp. institutional) environment remained fixed. A positive cultural (resp. institutional) multiplier reinforces the effect of a change in institutions (resp. culture) at economic equilibrium, meaning that culture and institutions are complements. However, with a negative multiplier, culture and institutions tend to mitigate each other's effect as substitutes. Consequently, the multipliers govern the interaction between culture and institutions on an aggregate economic variable.

The question now is, what hypotheses can be derived for my concern based on the above two economic theories, namely the theory of institutional stickiness (Boettke et al. 2008) and the coevolution of culture and institutions (Bisin and Verdier 2017)? First of all, I can hypothesize that the impact of the different cultural layers on development will be different because of the differing degree of stickiness between them and the IEN institutions. The degree of stickiness between the slow-moving cultural layer and the IEN institutions is much greater than the one between the rigid cultural layer and the IEN institutions because the slow-moving cultural layer and the IEN institutions are "neighboring" layers: IEN institutions find their roots directly in the cultural layer below, and in the long run they can mutually adjust to one other. Due to this adjustment process, the slow-moving culture is embodied and crystallized in IEN institutions; accordingly, I expect that the slow-moving culture will not exercise an effect on development beyond the IEN institutions, that is, it "works" exclusively via institutions.

However, the rigid cultural layer and IEN institutions are a bit "further" from one other, which allows a certain level of "detour" between them, meaning that the rigid culture may contain "more" or "different" elements than merely institutions. Accordingly, I hypothesize that both the rigid cultural layer and IEN institutions will influence development on their own, and their interaction (coevolution) is deemed to be an additional factor in development. Keeping in mind the argument of Bisin and Verdier (2017), namely that the joint evolution of culture and institutions is likely to be non-linear, I can hypothesize that under some "conditions" culture and institutions may act as substitutes, and under different "conditions" as complements. However, based on the above two hypotheses, I expect that the substitution and the complementarity will work differently for the two cultural layers: it is more likely that the rigid culture can reinforce the impact of institutional changes on development while the slow-moving one is less likely to do so. Empirical research in which both the cultural and the institutional multipliers will be calculated for both cultural layers can help me discover the way in which culture and institutions interact in the developmental process.

4. The model and data

The key when testing the above hypotheses, and trying to derive more accurate insights about the complementarity or the substitution between culture and institutions, is to capture in some way, and include in the regression, the coevolution of a particular cultural layer and institutions. In the spirit of Bisin and Verdier (2017), to express this phenomenon I will

include an interaction term between the particular cultural layer and the institutions. Since the main focus is on long-term development, I will be interested in explaining income levels rather than growth rates. The empirical analysis will consist of a cross-country regression analysis in which I will rely on the following model:

$$\ln(GDP\ pc)_i = const + \beta_1 culture_i + \beta_2 \ln(institution)_i + \beta_3 (culture * \ln(institution))_i + \mathbf{X\beta_4} + \varepsilon_i$$

The dependent variable is log per capita GDP in 2010 from the Penn World Table (PWT) 7.1. The *culture* variable can be a measure of either the rigid cultural layer, or the slow-moving one; the *institution* variable is the measure of a formal (IEN) institution, *culture*ln(institution)* is the interaction term, while the vector ***X*** includes certain control variables (human capital, geography variable), and ε_i is the error term. Amongst control variables, to minimize the risk of endogeneity of education in the development process, as a measure for human capital I will use historical data, the primary enrollment ratio in 1920 from Benavot and Riddle (1988), and as a widely used geographical variable, the latitude of country centroid from Gallup et al. (1999)[8].

The *institution* variable is the Area 2 sub-index (in its chain-linked form, averaged from 1990 to 2010) of the Economic Freedom of the World Index (EFW) complied by the Fraser Institute (Gwartney et al. 2012). This measure is widely used in the literature to capture the rule of law which is a good proxy for an IEN institution.[9]

As for *culture*, when referring to the rigid cultural layer, I will use data about the values of individuals from the Schwartz Values Survey (Schwartz 1994, 1999, 2006). An advantage of this dataset is that the survey questions and the variables derived from them rely on *a priori* theorizing.[10] Of course, not all the 7 values in the Schwartz dataset are related to economic development. Simply based on Schwartz's theory I can determine the affecting values, but to provide a statistical ground for the selection of values I have regressed each of them on per capita GDP. As a result, I have been left with three significant values, namely *embeddedness*, *hierarchy*, and *mastery*. To be able to include an interaction term in the regression, I must

[8] The dataset is available at: http://www.cid.harvard.edu/ciddata/geographydata.htm

[9] The Area 2 sub-index includes the following: judicial independence, impartial courts, protection of property rights, military interference in the rule of law and politics, integrity of the legal system, legal enforcement of contracts, regulatory restrictions on the sale of real property, reliability of the police, and the business costs of crime (Gwartney et al. 2012).

[10] The starting point for Schwartz (1994, 1999, 2006) is that all societies confront three basic issues when forming the social relations, and the answers to these questions are inherently different in different societies. For a description of these issues see Schwartz (2006). Based on these, he identifies seven value types.

have only one measure for *values*; that is why I will use the first principle component of these three values.[11]

I will proxy the slow-moving cultural layer by generalized *trust*, and will use data from the WVS in which the following question is used to assess the level of trust: "Generally speaking, would you say that most people can be trusted, or that you can't be too careful with dealing with people?" Trust is measured as the percentage of respondents in each country that replied "most people can be trusted".

Based on my estimations, I will calculate both the institutional and the cultural multipliers for both cultural layers in order to be able to observe how the coevolution "works". When operationalizing the multipliers, I rely on the conceptualization of Bisin and Verdier (2017). The institutional multiplier (m_I) and the cultural multiplier (m_C) are the following, and the parameter estimates come from the above model specification:

$$m_I = \frac{\text{total effect of culture}}{\text{direct effect of culture}} = \frac{\beta 1 + \beta 3 * \text{institutions}}{\beta 1}$$

$$m_c = \frac{\text{total effect of institutions}}{\text{direct effect of institutions}} = \frac{\beta 2 + \beta 3 * \text{culture}}{\beta 2}$$

As mentioned above, Bisin and Verdier (2017) warned us that the relationship between culture and institutions is likely to be non-linear; accordingly we have to be very careful about how to interpret the results from a linear regression. One possibility to account for the non-linearity of this relationship is to determine threshold values for both multipliers, which separate combinations of culture and institutions for which, for instance, the reinforcement works in a positive or a negative direction.[12]

5. Empirical results

5.1. The impact of the rigid cultural layer

5.1.1. Baseline results

[11] As a result of the first principal component analysis, the *values* variable runs between -3.12 and 3.97. The lowest value (-3.12) is for Switzerland whose values are expected to promote economic development the most. See Table 1.

[12] This procedure is in line with the model of Bisin and Verdier (2017) in which the authors distinguish different cases for substitution and complementarity.

The results on how the rigid cultural layer (measured by *values*) in interaction with the IEN institutions affect development are reported in Table 2. Since values are deemed to be exogenous in the developmental process, I do not assume any risk of reverse causality between *values* and per capita GDP. However, *a priori* there may be a suspicion of endogeneity in institutions in the process of development, so besides the OLS regressions, I have also used an instrumental variable approach. To instrument the institutional variable (*ln area2*) I have used the formalism index[13] of Djankov et al. (2003). This measure (the number of formal legal procedures necessary to resolve a simple case of collecting on an unpaid check) seems to be a valid instrument for an institutional variable expressing the rule of law because, as Djankov et al. (2003) showed, formalism is systematically greater in civil law as opposed to common law countries, the former being associated with a lower, the latter with a higher, rule of law. On the other hand, one does not have a theory about the possible direct impact of procedural formalism on long-run income. On the side of econometrics, both the exclusion restriction and the strength of the instrument are supported by the appropriate tests (LM statistic, and Cragg-Donald Wald F statistic, respectively).

Column 1 and 3 of Table 2 contains the OLS results without the interaction term. The *values* variable is highly significant with a negative sign[14], as expected. *Ln area2* is statistically significant at a 1% level. However, the geographical and the human capital variables are not significant, but it seems that they have an indirect effect, working via institutions since the coefficient of *ln area2* is reduced once we control for *ln cen_lat* and *ln edu_1920*.[15]

At first glance, the insignificance of the human capital variable seems to be strange and contradictory to the results of the literature (e.g., Glaeser et al. 2004, Barro 2001). But once we take into account that as a proxy for human capital I have used the primary school enrollment ratio in 1920[16], it turns out that the missing significance does not necessarily act against the view that human capital is a factor in economic development, because of two things. First, the view that education is a root cause of development (e.g., Glaeser et al. 2004)

[13] This index reflects the effectiveness of courts as mechanisms of resolving simple disputes.

[14] The sign of the coefficient of the first principal component of the three values is expected to be negative. This is because the countries whose values are more favorable to development have negative *values*, and those countries whose *values* are unfavorable to development have positive *values*. See Table 1.

[15] Note, however, that concerning the question of whether geography affects development or not, the literature is divided: according to Sachs (2003) geography has a direct impact on long-run income, while Rodrik et al. (2004) finds that it does not have a direct impact once one controls for institutions.

[16] As explained above, the reason for using this historical data is that this allows me to minimize the reverse causality effect between education and economic development: we have some reasons to believe that education in 1920 is related to GDP per capita in 2010, but there is no reason to assume the other way round.

is contested by many scholars, arguing that education basically raises the quality of institutions, which, in turn, causes economic development (e.g., Acemoglu et al. 2001). This latter view suggests that education does not increase productivity; instead its effect is indirect, working via institutions.[17] Second, the simple fact that the data refer to 1920 may lead to a much weaker association between today's income and education.[18]

In columns 2 and 4 of Table 2 I have added the interaction term of the *values* and *ln area2* variables. The results prove that the inclusion of the interaction term is statistically meaningful – not only theoretically – since the interaction-term specifications (columns 2 and 4) are better models than those in columns 1 and 3, respectively, as suggested by the Akaike criterion. But what is more, similarly to the cultural and institutional variables, their interaction term has proven to be highly significant, too, which suggests that individual values and institutions exert an impact on long-run income not only on their own –, there is an additional impact due to their interaction in the developmental process. The instrumental variable estimation results in columns 5 to 8 show exactly the same thing, but since the *ln area2* variable is not endogenous (as suggested by the Hausman test), we can rely on the OLS results because the estimations are consistent.

To understand the nature of the interplay between the rigid cultural layer and institutions, we have to look at the cultural and institutional multipliers. Based on Table 2, the threshold value of the cultural variable (c^*) required for the cultural multiplier (m_c) to be positive is -3.88. Since the lowest value of the cultural variable (*values*) in the sample is -3.12, the cultural multiplier is positive for all countries. As argued above, the positive cultural multiplier means that institutions and culture complement one other in supporting economic development, or more precisely: the rigid cultural layer reinforces the positive impact of institutional changes on long-run income.

Because of the coevolution of culture and institutions, the multiplication effect must be checked from the perspective of the institutions as well: the question is not only whether culture reinforces the impact of institutions, but vice versa, namely whether institutions reinforce the effect of culture. When looking at the institutional multiplier, it turns out that it works differently than the cultural one: now the threshold value of institutions (i^*) divides the

[17] Note also that it is much more likely that secondary and/or tertiary school enrollment would be better candidates for productivity increases than primary school enrollment.

[18] To get some information about the „presence" of the above possible explanations for the insignificance of my variable, I have run regressions including only *ln edu_1920* and *ln cen_lat*, and both variables have become highly significant (adjusted R-squared is 0.4627), but when controlling for institutions (*ln area2*), *ln edu_1920* loses its significance and its coefficient decreases a lot. This suggests that primary school enrollment exercises only an indirect effect on development when controlling for institutions.

sample of countries into two, meaning that for one group of countries the institutional multiplier is negative, while for the other group it is positive. The threshold value of the institutions (i^*) required for the institutional multiplier (m_i) to be positive is 2.16, to which the closest country is Canada, in 48th place (out of 54) in the ranking of *ln area2*. So, if the institutional variable is greater than 2.16, the institutional multiplier is negative, suggesting that institutions and culture are substitutes. The results indicate that only in countries with the best institutions – in the sample Canada, Switzerland, New Zealand, Sweden, Finland, Denmark, the Netherlands – can institutions substitute for the rigid culture. In the majority of countries, in which institutions are not of the best quality, institutions and culture are complements, meaning that when institutions are poor, institutions reinforce the impact of cultural changes.

All in all, the above two findings concerning the multipliers suggest that the rigid cultural layer plays a unique role in development: on the one hand, the rigid cultural layer reinforces the positive impact of institutional changes on long-run income, and on the other, deep culture is hard to substitute, and only high-quality institutions can substitute it.

5.1.2. Robustness checks

To avoid worries about the baseline specification and the variables, I will turn to a series of robustness checks. To test whether the results depend on the choice of the institutional variable, as robustness checks I have used two different institutional variables: the rule of law[19] (averaged from 1996 to 2010) from the Worldwide Governance Indicators (WGI) developed by Kaufmann et al. (2010)[20] (*rule of law_WGI*), and a recently developed rule of law measure from Gutmann and Voigt (2015)[21] (*rule of law_G&V*). Table 3 displays the results with the *rule of law_WGI* variable, Table 4 with *rule of law G&V*. The pattern of the results with the two alternative formal institutions is exactly the same as I had in the baseline specification.

Table 5 displays parameter estimates for specification with log GDP per capita averaged for the period 1962-2010. The only difference as compared to the results in Table 2 is that the

[19] The rule of law measures the extent to which individuals "have confidence in and abide by the rules of society, and in particular, the quality of contract enforcement, the police, and the courts, as well as the likelihood of crime and violence" (Kaufmann et al. 2010:4).
[20] Available at: http://info.worldbank.org/governance/wgi/index.aspx#home
[21] This measure is the only *de facto* indicator for the rule of law, taking the quality of the legal norms explicitly into account. Gutmann and Voigt (2015) use questions from the World Justice Project Rule of Law survey (http://worldjusticeproject.org/) to construct their theory-driven measure.

human capital variable (*ln edu_1920*) is now significant, which is even more in line with the results of the literature (for instance Barro 2001), but the geographical variable is not (see also footnote 15). So seemingly, the baseline results are not sensitive to a different measure of long-run income.

Table 6 reports the results with different control variables: instead of education in 1920 and the latitude of a country's centroid, I have included an alternative geographical variable, the percentage of a country's land area in the tropics (*ln tropical area*) from Gallup et al. (1999), and *ethnic fractionalization* from Fearon (2003). Neither *ln tropical area* nor *ln ethnic fractionalization* is statistically significant, which is not a surprise since the results of the literature on the effect of these variables are rather mixed.[22]

In addition to the original control variables, I have included two more variables: a dummy for *English legal origin* (La Porta et al. 1999) and a dummy for whether the country is *landlocked* (GeoDist database)[23]. Results shown in Table 7 reaffirm those presented in Table 2. Parameter estimates in column 2 as compared to those in column 4 in Table 2 are only slightly different.

In order to test whether the results are sensitive to the inclusion of an additional interaction term, Table 8 compares the results obtained with the baseline specification to results for a specification that includes the interaction of individual values (*values*) with human capital (*ln edu_1920*). The purpose of this exercise is twofold. First, this estimation tests whether the interaction effect found so far potentially takes up the variation of another different effect of individual values. Second, we have to test whether the estimate accounts for another factor that might be necessary for *values* to "successfully" affect development. This factor could be human capital as identified in the literature by many as a factor affecting long-run income (e.g., Barro 2001).

Columns 1 and 2 in Table 8 replicate the baseline results. In column 3 an interaction of individual values and education in 1920 is added, but not the interaction of values and the institution. Now the coefficient of the *values* variable changes to an important extent. Column 4 includes both interaction terms. The results indicate that adding an additional source does not quantitatively affect the parameter estimates for *values*, *ln area2* and the interaction term (comparing column 4 to column 2). Moreover, the standard errors remain almost unaffected when the additional interaction term is added. In addition, as shown by the Akaike criterion the best model is the baseline specification (column 2).

[22] For the geographical variables, see footnote 15; for fractionalization, see Fearon (2003).
[23] Available at: http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=6

As for the cultural multiplier, I was able to reconfirm that it is positive for each country, implying that the rigid cultural layer reinforces the development-enhancing impact of institutional changes, so these two complement one other in stimulating long-run income. In addition, the other main finding is also further evidenced by the robustness checks: institutions can substitute for the rigid culture only when they are of a very high level. For some specifications (in Tables 5 and 8), there is no country in which culture and institutions are substitutes, otherwise the group of countries with the sufficiently high level of institutions differ only slightly across specifications (the threshold values are shown in Table 9).

To sum up, the pattern of the results of the robustness checks is exactly the same as I had in the baseline specification.

5.2. The impact of the slow-moving layer

Table 10 shows the estimations for various specifications with the slow-moving culture (proxied by *trust*) and the institutional variable, and their interaction term. To control for the usual potential bias with the OLS model, I also display instrumental variable estimation results.

To instrument the *trust* variable, I use Barro's data[24] on religious adherence to Protestantism as a share of the population that can be associated with religion in general (that is, the relative proportion of Protestants within the total number of religiously-inclined people). The choice of this variable as an instrument is supported by the Weberian theory that Protestantism promoted economic development (Weber 1930). Of course, the key question is through which channels could Protestantism favor development? As Weber argued, the protestant spirit induced people to engage in entrepreneurship, which, in its turn, extended the market, inducing generalized trust. So, on the basis of this theory we have good reasons to think that the share of Protestants is correlated with trust, but we do not have a theory about how Protestantism in itself could be directly linked to economic development. As reported in the table, the required statistics (the LM statistic, and the Cragg-Donald Wald F statistic) validate the use of the proportion of Protestants variable as an instrument. The institutional variable will not be instrumented for two reasons: (1) the results in Tables 2-8 indicate no sign for the endogeneity of institutions in my model, (2) instrumenting two variables which also

[24] The Religion Adherence Data is available at: https://scholar.harvard.edu/barro/publications/religion-adherence-data

have an interaction term will make estimation impossible (because this would imply three endogenous variables).

In specifications in which both *trust* and the interaction term are included, only the *trust* variable will be instrumented. The reason for this is that in a model with an interaction term in which one of the independent variables is endogenous, instrumenting only the endogenous variable will lead to an unbiased estimation (Ozer-Barri and Sorensen 2010). Bun and Harrison (2014) support this argument, saying that in linear regression models which include an endogenous regressor and an interaction term with this endogenous and another exogenous regressor, it is valid to assume the exogeneity of the interaction term under fairly weak conditions, meaning that we only need to instrument the endogenous variable, but not the interaction term.

As can be seen from Table 10, *trust* is statistically significant only when institutions are not controlled for (columns 1 and 8 in Table 10). This result is not very surprising in the light of the mixed findings of the literature. As the Durbin-Wu-Hausman test indicates, *trust* is not endogenous in economic development, meaning that higher income does not increase the level of generalized *trust*.

Comparing the results in columns 3 and 4 indicates that the predictive power of the model is only slightly higher if we include *trust* besides the institutional variable. The full model in column 6 demonstrates the most important difference as regards the impact of the slow-moving cultural layer compared to that of the rigid cultural layer, namely that neither the cultural variable nor the interaction term is statistically significant. This finding suggests that unlike my previous results with the rigid cultural layer, there is no interplay between institutions and the slow-moving layer. So, the two cultural layers "behave" very differently. When looking at the goodness of fit as shown by the Akaike criteria, the full specification (column 6) is worse than the specification without the interaction term (column 4), but the specification without the institutional variable (column 8) is even worse than the full specification (column 6). To sum up, the best model is the one which includes only institutions with *trust* (column 4). These results seem to provide evidence for what I hypothesized, namely that since the slow-moving culture and the IEN institutions are "neighboring" layers, they have mutually adjusted to one another, accordingly, institutions can fully "embody" the slow-moving culture, leading to no slow-moving culture effect on development.

Clearly, two conclusions seem to emerge. First, the slow-moving culture has not proved to be a factor in economic development; instead institutions are the determinants of long-run

income. Second, the slow-moving culture and institutions do not interact in the developmental process; accordingly, no multiplication effects emerge.

As before, we have to check the robustness of the results. Table 11 displays the estimation results including *trust* together with an alternative institutional measure (*rule of law_WGI*). As shown, the results are not sensitive to the use of an alternative institutional variable. Table 12 indicates that the pattern of results in Table 10 do not change when using an alternative measure of long-run economic performance (GDP per capita averaged for 1962-2010 instead of GDP per capita in 2010).

6. Conclusion

In this paper my goal has been to take a step towards improving our understanding of how culture affects economic development. In this endeavor, I have introduced two novel aspects in the empirical investigations, inspired by two economic theories. Firstly, based on the theory of institutional stickiness (Boettke et al. 2008), I have unbundled culture by distinguishing a rigid and a slow-moving layer within it, and then analyzed the impact of each particular layer individually. Secondly, following the model of Bisin and Verdier (2017), I have taken the coevolution of culture (cultural layers) and institutions into account, and tried to establish the development-enhancing effect of this interplay.

The cross-country empirical analyses, including IV estimations, have provided some new evidence about the development-enhancing impact of culture. More specifically, I have found that the two cultural layers "behave" differently: the rigid (deep) culture has proved to be a factor in development besides institutions, while the slow-moving culture has not, probably because the development-enhancing effect of the slow-moving culture works only via institutions (due to a high degree of stickiness between them). Furthermore, I have documented that the rigid cultural layer reinforces the positive impact of institutional changes on long-run income, meaning that these two are complements. Finally, I have found that the rigid (deep) culture is hard to substitute; only high-quality institutions can substitute it. These findings are very robust for various robustness checks.

All in all, my results shed light on the unique role of "deep" culture in economic development, an insight which has been emphasized by several prominent scholars in the theoretical literature, including McCloskey (2006) and Mokyr (2010). They have argued, respectively, that the "bourgeois virtues" and "gentlemanly" attitudes caused the unique development of Britain, together with high-quality formal institutions. Seemingly, the cultural

multiplier was largely positive in Britain around the Industrial Revolution, indicating a strong complementary effect between “deep” culture and institutions. However, the British case suggests that – since the “deep” culture cannot be acquired in a planned process, and accordingly, the multiplication effect cannot be initiated on purpose – the rise of the West (Britain) is to be considered a unique developmental process.

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Appendix

Country	values
Switzerland	-3,1228541
France	-3,0937073
Finland	-2,5536907
Norway	-2,5230127
Denmark	-2,4076238
Italy	-2,3953686
Czech Republic	-2,1345057
Netherlands	-2,1201832
Austria	-2,1009044
Germany	-1,8312891
Estonia	-1,7676773
Sweden	-1,7043800
Japan	-1,4996631
Spain	-1,3207466
Slovenia	-1,1034672
New Zealand	-1,0027514
Portugal	-0,7533094
Ireland	-0,6954554
Slovakia	-0,6348483
Russia	-0,5190318
Argentina	-0,3472935
Poland	-0,3207448
Hungary	0,0140658
Brazil	0,0140685
Greece	0,0363893
Canada	0,0760916
UK	0,1638548
Namibia	0,2520442

Country	values
Korea, South	0,2789461
Australia	0,3383221
Hong Kong	0,3663400
Bolivia	0,4612732
US	0,5137944
Israel	0,5586731
Cyprus	0,5674211
Chile	0,5725719
Mexico	0,5924775
Venezuela	0,7193094
Georgia	0,7355377
China	0,7911763
Egypt	0,9930118
Peru	1,0420053
Singapore	1,1437892
Zimbabwe	1,1626794
Taiwan	1,1871312
Ghana	1,4322880
Malaysia	1,4597242
Nepal	1,6027512
Macedonia	1,6234492
Bulgaria	1,7670387
Indonesia	1,8128017
Turkey	1,8470820
India	2,1693425
Philippines	2,3608735
Jordan	3,3235513
Nigeria	3,9726322

Table 1: The *values* variable (first principle component of embeddedness, hierarchy, and mastery)

dependent variable: ln GDP per capita 2010								
	OLS				**TSLS**			
	1	2	3	4	5	6	7	8
const	4,9524*** (0,9648)	5,4999*** (0,8988)	3,4334* (1,7903)	3,4716* (1,7509)	5,9313*** (0,9481)	6,2603*** (0,9348)	3,6456** (1,4796)	3,5224** (1,4684)
values	−0,1448** (0,0604)	−0,9633*** (0,3266)	−0,1226*** (0,0541)	−0,9329*** (0,2371)	−0,1871** (0,0877)	−1,0042*** (0,3559)	−0,1416** (0,0701)	−0,9863*** (0,3536)
ln area2	2,5047*** (0,4993)	2,2772*** (0,4597)	1,9258*** (0,5429)	1,6734*** (0,4957)	1,9860*** (0,5319)	1,8784*** (0,5113)	1,6231** (0,7369)	1,5200** (0,7106)
values*ln area2		0,4287** (0,1641)		0,4310*** (0,1192)		0,4345** (0,1656)		0,4555*** (0,1676)
ln edu_1920			0,1367 (0,1337)	0,1577 (0,1265)			0,1728 (0,1472)	0,1802 (0,1362)
ln cen_lat			0,4528 (0,2836)	0,5560* (0,2817)			0,5003 (0,3833)	0,5916 (0,3928)
N	54	54	52	52	52	52	51	51
adjusted R^2	0,6613	0,6826	0,6705	0,6959	0,6507	0,6715	0,6666	0,6947
Durbin-Wu-Hausman chi-sq test					1,0844 p=0,2977	0,6427 p=0,4227	0,4749 p=0,4907	0,0936 p=0,7637
Cragg-Donald Wald F statistic					43,303 p=0,0000	43,524 p=0,0000	40,890 p=0,0000	42,485 p=0,0000
Anderson canonical corr. LM statistic					24,395 p=0,0000	24,729 p=0,0000	24,000 p=0,0000	24,767 p=0,0000
Akaike criterion	106,5504	103,9685	97,7042	94,4178	100,8145	98,3707	97,5205	93,8489

Table 2: Regressions on log per capita GDP in 2010 with the Area 2 sub-index of the EFW Index
Standard errors are in parentheses and are robust. Letters in the upper index refer to significance: ***: significance at 1%, **: significance at 5%, *: significance at 10%.

dependent variable: ln GDP per capita 2010								
	OLS				TSLS			
	1	2	3	4	5	6	7	8
const	9,1026*** (0,1468)	9,2945*** (0,1337)	6,7002*** (1,1969)	6,3616*** (1,1251)	9,1945*** (0,1185)	9,3591*** (0,1377)	6,4696*** (1,7544)	6,2366*** (1,2989)
values	−0,1403** (0,0636)	−0,2654*** (0,0837)	−0,1164* (0,0592)	−0,2275*** (0,0723)	−0,1769** (0,0832)	−0,2893** (0,1107)	−0,1405** (0,0677)	−0,2471** (0,0733)
rule of law_WGI	0,7574*** (0,1527)	0,7121*** (0,1299)	0,6282*** (0,1865)	0,5927*** (0,1571)	0,6288*** (0,1682)	0,6214*** (0,1552)	0,5292** (0,2265)	0,5361*** (0,1675)
values*rule of law_WGI		0,1644** (0,0624)		0,1592*** (0,0555)		0,1616** (0,0649)		0,1641** (0,0461)
ln edu_1920			0,0991 (0,1254)	0,0948 (0,1101)			0,1356 (0,1450)	0,1151 (0,1178)
ln cen_lat			0,4567* (0,2623)	0,5702** (0,2448)			0,4918 (0,3440)	0,5903* (0,2557)
N	56	56	53	53	53	53	51	51
adjusted R^2	0,7138	0,7593	0,7233	0,7730	0,7139	0,7606	0,7163	0,7695
Durbin-Wu-Hausman chi-sq test					0,7355 p=0,3911	0,4287 p=0,5126	0,5522 p=0,4574	0,2227 p=0,6370
Cragg-Donald Wald F statistic					25,720 p=0,0000	25,743 p=0,0000	24,774 p=0,0000	24,936 p=0,0000
Anderson canonical corr. LM statistic					18,003 p=0,0000	18,254 p=0,0000	17,852 p=0,0000	18,184 p=0,0000
Akaike criterion	100,1787	91,42108	89,63431	80,01936	409,1476 92,3137	399,8024 83,5509	373,7722 89,3900	363,6707 79,5736

Table 3: Regressions on log per capita GDP in 2010 with the Rule of Law measure of the WGI
Standard errors are in parentheses and are robust. Letters in the upper index refer to significance: ***: significance at 1%, **: significance at 5%, *: significance at 10%.

dependent variable: ln GDP per capita 2010								
	OLS				TSLS			
	1	2	3	4	5	6	7	8
const	6,8075*** (0,6862)	7,0879*** (0,5994)	4,8391*** (1,6528)	4,3791*** (1,5782)	7,5368*** (0,6018)	7,7569*** (0,5636)	4,7359*** (1,5598)	4,0838*** (1,5001)
values	−0,1761*** (0,0639)	−0,9530*** (0,2265)	−0,1382* (0,0713)	−0,8946*** (0,2107)	−0,2263** (0,0897)	−0,9999*** (0,2591)	−0,1611* (0,0853)	−0,9504*** (0,2515)
rule of law_G&V	4,3282*** (1,0201)	4,2198*** (0,9110)	3,4977*** (1,1090)	3,5319*** (0,9844)	3,2210*** (1,0002)	3,2152*** (0,9025)	2,6148** (1,2784)	2,7438** (1,1202)
values* rule of law_G&V		1,2250*** (0,3456)		1,2185*** (0,3542)		1,2329*** (0,3520)		1,2941*** (0,3650)
ln edu_1920			0,1421 (0,1154)	0,1248 (0,0937)			0,2076 (0,1279)	0,1951** (0,0929)
ln cen_lat			0,4314 (0,2679)	0,5833** (0,2560)			0,5258 (0,3590)	0,7070** (0,3411)
N	49	49	46	46	47	47	45	45
adjusted R^2	0,6908	0,7488	0,7098	0,7752	0,6877	0,7522	0,7026	0,7786
Durbin-Wu-Hausman chi-sq test					1,8875 p=0,1695	2,2011 p=0,1379	1,2766 p=0,2585	1,5682 p=0,2105
Cragg-Donald Wald F statistic					46,87 p=0,0001	46,8868 p=0,0000	44,9559 p=0,0012	43,3144 p=0,0006
Akaike criterion	94,9099	85,6594	83,5156	72,6314	179,5345	168,8479	161,9103	148,8400

Table 4: Regressions on log per capita GDP in 2010 with the Rule of Law measure of Gutmann and Voigt (2015)
Standard errors are in parentheses and are robust. Letters in the upper index refer to significance: ***: significance at 1%, **: significance at 5%, *: significance at 10%.

dependent variable: ln GDP per capita 1962-2010_average				
	OLS		TSLS	
const	5,2403*** (1,0305)	5,2530*** (0,9940)	5,3911*** (0,9977)	5,2996*** (0,9653)
values	−0,1339** (0,0526)	−0,6183*** (0,1479)	−0,1497** (0,0651)	−0,7009*** (0,229)
ln area2	1,3324*** (0,3797)	1,1765*** (0,3690)	1,0508 (0,6433)	0,9651 (0,6381)
values*ln area2		0,2608*** (0,995)		0,3006*** (0,1034)
ln edu_1920	0,1891* (0,1029)	0,2095** (0,0996)	0,2277* (0,1201)	0,2435** (0,1140)
ln cen_lat	0,1207 (0,1527)	0,1810 (0,1493)	0,1719 (0,2030)	0,2333 (0,2067)
N	50	50	49	49
adjusted R^2	0,7122	0,7239	0,7087	0,7245
Durbin-Wu-Hausman chi-sq test			0,6383 p=0,4243	0,2588 p=0,6110
Cragg-Donald Wald F statistic			43,2023 p=0,0000	45,7705 p=0,0000
Akaike criterion	64,9242	63,7164	200,5212	193,8680

Table 5: Regressions on log per capita GDP averaged for the period 1962-2010 with the Area 2 sub-index of the EFW Index
Standard errors are in parentheses and are robust. Letters in the upper index refer to significance: ***: significance at 1%, **: significance at 5%, *: significance at 10%.

dependent variable: ln GDP per capita 2010				
	OLS		TSLS	
	1	2	3	4
const	5,1474*** (1,1242)	5,7108*** (0,8408)	6,9156*** (1,3946)	7,2207*** (1,3320)
values	−0,1155* (0,0655)	−1,3240** (0,5082)	−0,1452* (0,0732)	−1,2488** (0,5504)
ln area2	2,3226*** (0,5595)	2,0887*** (0,4310)	1,4723** (0,6967)	1,3592** (0,6642)
values*ln area2		0,6140** (0,2536)		0,5612** (0,2717)
ln tropical area	−0,1761 (0,6044)	−0,0575 (0,5603)	−0,7463 (0,7665)	−0,5652 (0,7079)
ln ethnic fractialization	−0,1172* (0,0635)	−0,1215 (0,0598)	−0,0748 (0,0594)	−0,0839 (0,0566)
N	52	52	50	50
adjusted R^2	0,6416	0,6714	0,6263	0,6538
Durbin-Wu-Hausman chi-sq test			2,4016 p=0,1212	2,1054 p=0,1468
Cragg-Donald Wald F statistic			51,8367 p=0,0000	55,6083 p=0,0000
Akaike criterion	104,5998	100,9727	235,8428	232,5921

Table 6: Regressions on log per capita GDP in 2010 with the Area 2 sub-index of the EFW Index with different control variables
Standard errors are in parentheses and are robust. Letters in the upper index refer to significance: ***: significance at 1%, **: significance at 5%, *: significance at 10%.

dependent variable: ln GDP per capita 2010 control variables: ln edu_1920, ln cen_lat, landlocked, English legal origin				
	OLS		**TSLS**	
	1	2	3	4
const	3,9785*** (1,2980)	4,0174*** (1,2706)	3,9708*** (1,2915)	3,7995*** (1,3165)
values	−0,0791 (0,0870)	−0,8884** (0,3130)	−0,0589 (0,1166)	−0,7188* (0,3645)
ln area2	2,0118*** (0,6259)	1,7538*** (0,5686)	2,2979** (1,0648)	2,3559** (1,0323)
values*ln area2		0,4299*** (0,1573)		0,3667** (0,1668)
N	52	52	51	51
adjusted R^2	0,7122	0,7395	0,7136	0,7322
Durbin-Wu-Hausman chi-sq test			0,1640 p=0,6855	0,8685 p=0,3514
Cragg-Donald Wald F statistic			22,6885 p=0,0000	24,8216 p=0,0000
Akaike criterion	92,4063	88,0529	230,5024	221,5681

Table 7: Regressions on log per capita GDP in 2010 with the Area 2 sub-index of the EFW Index, and with more control variables
Standard errors are in parentheses and are robust. Letters in the upper index refer to significance: ***: significance at 1%, **: significance at 5%, *: significance at 10%.

dependent variable: ln GDP per capita 2010				
	1	2	3	4
const	5,4999*** (0,8988)	3,4716* (1,7509)	3,2347* (1,8272)	3,3670* (1,7572)
values	−0,9633*** (0,3266)	−0,9329*** (0,2371)	−0,5446*** (0,1394)	−0,8861*** (0,2451)
ln area2	2,2772*** (0,4597)	1,6734*** (0,4957)	2,0434*** (0,5301)	1,8048*** (0,4859)
values*ln area2	0,4287** (0,1641)	0,4310*** (0,1192)		0,3001* (0,1607)
ln edu_1920		0,1577 (0,1265)	0,0607 (0,1356)	0,1157 (0,1330)
ln cen_lat		0,5560* (0,2817)	0,5285* (0,2896)	0,5603* (0,2889)
values*ln edu_1920			0,1264*** (0,0354)	0,0593 (0,0542)
N	54	52	52	52
adjusted R^2	0,6826	0,6959	0,6909	0,6923
Akaike criterion	103,9685	94,4178	95,26503	95,8868

Table 8: OLS regressions on log per capita GDP in 2010 with an additional interaction term
Standard errors are in parentheses and are robust. Letters in the upper index refer to significance: ***: significance at 1%, **: significance at 5%, *: significance at 10%.

	c^*	i^*	first country in the sample for i>i*, implying substitution
ln area2 (Table 2)	-3,88	2,16	Canada, 48/54
rule of law_WGI (Table 3)	-3,77	1,42	USA, 42/56
rule of law_V&G (Table 4)	-2,89	0,73	Estonia, 34/49
ln area2 (Table 5)	-4,50	2,37	no country
ln area2 (Table 6)	-3,40	2,15	UK, 43/54
ln area2 (Table 7)	-4,07	2,07	France, 39/54
ln area2 (Table 8)	-6,00	2,95	no country

Table 9: threshold values for the cultural and institutional variables

dependent variable: ln GDP per capita 2010									
	1	2	3	4	5	6	7	8	9
	OLS	IV	OLS	OLS	IV	OLS	IV	OLS	IV
const	2.7667 (2.1495)	2.9271* (1.6672)	2.2708 (1.6204)	2.0897 (1.8695)	2.0256 (1.4406)	1.8858 (2.8112)	1.1980 (2.1813)	4.5680* (2.3275)	2.2467 (2.5335)
ln edu_1920	0.5760*** (0.1304)	0.5362*** (0.1161)	0.2109 (0.1433)	0.1244 (0.1630)	0.0860 (0.1420)	0.1369 (0.1669)	0.1960 (0.1741)	0.2763 (0.1755)	0.6593** (0.3204)
ln cen_lat	0.9392** (0.4310)	0.9583*** (0.3630)	0.5454* (0.2721)	0.5377* (0.2938)	0.5531* (0.3044)	0.5346* (0.2860)	0.5227* (0.3050)	0.8392* (0.4243)	0.9546** (0.3865)
trust	1.4231** (0.6058)	1.1827 (1.0595)		-0.3521 (0.3394)	-0.9331 (1.2383)	0.5111 (4.7646)	4.6840 (7.5772)	-8.3309** (3.4014)	6.2722 (10.2125)
ln area2			2.1897*** (0.5190)	2.5314*** (0.6303)	2.7027*** (0.7061)	2.6232** (0.9929)	2.8778*** (0.9030)		
trust*ln area2						-0.4377 (2.3537)	-2.4556 (3.7571)	4.5697*** (1.5793)	-2.1720 (4.7234)
R^2	0.5305	0.5068	0.6791	0.6923	0.6549	0.6926	0.6556	0.5901	0.4343
N	47	45	52	46	45	46	45	46	45
Durbin-Wu-Hausman chi-sq test		0.0292 p=0.8643			0.4146 p=0.5197		0.4184 p=0.5178		2.8962 p=0.0888
Cragg-Donald Wald F statistic		26.083 p=0.0000			15.572 p=0.0003		15.8334 p=0.0003		8.924 p=0.0048
Anderson canonical corr. LM statistic		17.497 p=0.0000			12.610 p=0.0004		12.994 p=0.0003		8.208 p=0.0042
Akaike criterion	105.2357	99.3827	98.5763	86.1834	85.3073	88.1365	87.2267	99.3732	107.5491

Table 10: Regressions on log per capita GDP in 2010 with trust and the Area2 sub-index of the EFW Index
Standard errors are in parentheses and are robust. Letters in the upper index refer to significance: ***: significance at 1%, **: significance at 5%, *: significance at 10%.

dependent variable: ln GDP per capita 2010									
	1	2	3	4	5	6	7	8	9
	OLS	IV	OLS	OLS	IV	OLS	IV	OLS	IV
const	2.7667 (2.1495)	2.9271* (1.6672)	5.9952*** (1.1451)	6.2366*** (1.3295)	6.4730*** (1.4835)	6.1431*** (1.4186)	6.117*** (1.4230)	4.4346** (2.0904)	2.8011 (1.9836)
ln edu_1920	0.5760*** (0.1304)	0.5362*** (0.1161)	0.17085 (0.1414)	0.1347 (0.1557)	0.0889 (0.1268)	0.1758 (0.1462)	0.1956 (0 .1330)	0.2868 (0.1604)*	0.5630 (0.2195)
ln cen_lat	0.9392** (0.4310)	0.9583*** (0.3630)	0.5472** (0.2591)	0.5477* (0.2874)	0.5845** (0.2927)	0.5208* (0.2759)	0.5026* (0.2856)	0.8498** (0.4069)	0.9505*** (0.3582)
trust	1.4231** (0.6058)	1.1827 (1.0595)		-0.3773 (0.3722)	-1.3093 (1.1849)	0.0830 (0.7519)	0.4629 (0.9601)	-0.5273 (0.8314)	1.5400 (1.4486)
rule of law_WGI			0.6987*** (0.1678)	0.7218*** (0.1981)	0.8005*** (0.1745)	0.8341** (0.3204)	0.8813*** (0.2272)		
trust* rule of law_WGI						-0.4682 (0.6625)	-0.7803 (0.7593)	1.2333*** (0.4002)	-0.1378 (0.8194)
R^2	0.5305	0.5068	0.7283	0.7252	0.6776	0.7302	0.6985	0.5974	0.4909
N	47	45	53	47	45	47	45	47	45
Durbin-Wu-Hausman chi-sq test		0.0292 p=0.8643			1.0482 p=0.3059		0.3604 p=0.5482		4.3507 p=0.0370
Cragg-Donald Wald F statistic		26.083 p=0.0000			15.1727 p=0.0004		33.0199 p=0.0000		20.779 p=0.0000
Anderson canonical corr. LM statistic		17.497 p=0.0000			12.375 p=0.0000		20.632 p=0.0000		15.384 p=0.0001
Akaike criterion	105.2357	99.3827	90.9161	82.0597	82.24547	83.2107	81.2325	100.0195	102.8063

Table 11: Regressions on log per capita GDP in 2010 with trust and the Rule of Law measure of the WGI
Standard errors are in parentheses and are robust. Letters in the upper index refer to significance: ***: significance at 1%, **: significance at 5%, *: significance at 10%.

dependent variable: ln GDP per capita 1962-2010_average									
	1	2	3	4	5	6	7	8	9
	OLS	IV	OLS	OLS	IV	OLS	IV	OLS	IV
const	4.4065*** (1.1759)	4.8167*** (1.2692)	4.0083*** (0.8244)	3.8744*** (1.0022)	4.2942*** (1.0790)	4.8558*** (1.6337)	4.9700*** (1.6357)	6.3710*** (1.2065)	5.6430*** (1.5099)
ln edu_1920	0.5403*** (0.1123)	0.4824*** (0.0887)	0.2753** (0.1047)	0.1959* (0.1102)	0.2215** (0.1062)	0.1308 (0.1147)	0.1333 (0.1336)	0.2031 (0.1237)	0.3302* (0.1886)
ln cen_lat	0.5174** (0.2345)	0.4441 (0.2760)	0.2159 (0.1493)	0.2134 (0.1520)	0.2093 (0.2284)	0.2335 (0.1630)	0.2353 (0.2211)	0.4082* (0.2163)	0.4470* (0.2431)
trust	0.7649 (0.4710)	1.3116 (0.8565)		-0.5340 (0.3271)		-4.8236 (3.8488)	-4.3562 (5.9851)	-9.9537*** (3.0047)	-4.8336 (5.5962)
ln area2			1.6066*** (0.3629)	1.9255*** (0.4345)	1.5554*** (0.5289)	1.4769** (0.7091)	1.3978** (0.6847)		
trust*ln area2						2.1884 (1.8842)	1.9964 (2.9862)	5.0931*** (1.3717)	2.6504 (2.6664)
R^2	0.5630	0.5235	0.7044	0.7174	0.6765	0.7296	0.7016	0.6761	0.6279
N	46	44	50	45	44	45	44	45	44
Durbin-Wu-Hausman chi-sq test		0.7963 p=0.3722			0.5721 p=0.4494		0.0055 p=0.9412		0.9145 p=0.3389
Cragg-Donald Wald F statistic		22.6783 p=0.0000			14.3926 p=0.0005		12.8451 p=0.0009		12.6212 p=0.0010
Anderson canonical corr. LM statistic		15.920 p=0.0000			11.861 p=0.0006		11.116 p=0.0009		10.758 p=0.0010
Akaike criterion	77.2096	73.2965	68.5167	58.8009	58.2567	58.8091	56.7145	64.9303	64.4228

Table 12: Regressions on log per capita GDP averaged for the period 1962-2010 with trust and the Area2 sub-index of the EFW Index
Standard errors are in parentheses and are robust. Letters in the upper index refer to significance: ***: significance at 1%, **: significance at 5%, *: significance at 10%.