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How Do Culture and Institutions Jointly Impact Income?

Empirical Evidence Based on Cultural and Institutional Multipliers

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Abstract

The aim of this paper is to look at the *joint* impact of culture and institutions on economic development by operationalizing the cultural and institutional multipliers conceptualized in the literature. The study uses regression analyses to estimate the two multipliers which are key in an understanding of the interaction of culture and institutions. As for culture, two layers are distinguished, deep culture (values) and a slow-moving cultural layer (beliefs). The cross-country empirical analyses, including IV estimations, provide evidence that the two cultural layers "behave" differently. Deep culture is not a substitute for (better) institutions, however, high-quality institutions can substitute improvement in deep culture, while in the majority of countries, in which institutions are not of high quality, institutions complement improvement in deep culture. Contrary to that, the slow-moving layer does not appear to be a significant determinant of development once institutions are controlled for. But what is more, no sign of interaction with institutions has been detectable. These findings shed light on the unique role of deep culture in economic development.

Keywords

culture, institutions, long-run income, coevolution

1 Introduction

Over the last 30 years the literature on how culture and institutions affect economic development has bourgeoned, providing us with substantive knowledge on the subject under investigation. This branch of the literature has implicitly assumed that culture and institutions are distinct factors of economic development; accordingly, scholars have tried to identify the unique causal effect of both culture and institutions on an aggregate macroeconomic measure, separately from the impact of the other (Bisin and Verdier, 2017).

Concerning the impact of institutions on economic development, there is a consensus that institutions such as secure property rights, democracy, free markets or good contract enforcement promote development (e.g., Acemoglu et al., 2001; 2005; Rodrik et al., 2004). More specifically, these scholars have empirically demonstrated that institutions, and not geography or culture, must be seen as the cause of economic development.

Research on the development-enhancing role of culture is also widespread. The main finding is that cultural differences are the primary source for growth/income differences across countries (e.g., Gorodnichenko and Roland, 2011; Putnam et al., 1993; Tabellini, 2010). Since the early "reference studies" such as Hofstede (1980) or Inglehart (1990) many have provided more nuanced evidence on how specific cultural dimensions such as trust or individualism affect development independently of institutions (e.g., Gorodnichenko and Roland, 2011; Tabellini, 2008).

However, there has not been much connection made between the above two lines of research; accordingly, looking at culture and institutions as factors jointly influencing economic development is only a recent phenomenon. This "history" of this research is somewhat strange since scholars have widely accepted the view that the effect of the same or a similar institutional setting on development can be different, depending on the culture of a particular country (e.g., Putnam et al. 1993). Although economic historians such as Murrell and Schmidt (2011) have emphasized that institutions and culture interact in economic development, and they have provided us with historical examples on the subject matter, development economists have mainly documented that the interaction of culture and institutions occurs in the form of substitution (e.g., Ahlerup et al., 2009).

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This paper intends to be a contribution to this novel strand in the literature; namely the one focusing on an empirical analysis of the joint impact of culture and institutions. The novelty of my study is twofold. Firstly, in my empirical investigation I will explicitly rely on a theoretical model of the coevolution of culture and institutions (Bisin and Verdier, 2017), and will use regression analyses to estimate the institutional and cultural multipliers which these two scholars put at the heart of an understanding of the interaction of culture and institutions. Thus, answering the question of how culture and institutions interact in economic development requires us to look at whether culture and institutions are substitutes or complements in fostering economic development, or more specifically to look at the circumstances under which they may act as substitutes or complements. And this is what cultural and institutional multipliers refer to. Secondly, to avoid issues related to definitions of culture (see Beugelsdijk and Maseland, 2011), as suggested by Alesina and Giuliano (2015) I will differentiate between theoretical and empirical definitions of culture, and will base my empirical investigations on this distinction.

According to Alesina and Giuliano (2015), the empirical definition of culture is given by Guiso et al. (2016:p.23): "those customary beliefs and values that ethnic, religious, and social groups transmit fairly unchanged from generation to generation". Clearly, this definition merges values and beliefs in the same meaning. However, in the theoretical definition, values and beliefs are treated differently: beliefs can be updated through experience, meaning that they can change from one generation to the next, although very slowly; while culture as embodying values do not change.

In harmony with the above distinction, I will treat beliefs and values as different layers within culture. Values represent more primitive components of culture, which can be referred to as deep culture, consisting of those values that are to a large extent exogenous to people, reflecting the most basic norms and judgments in relation to how to interact with and behave towards others, transmitted from generation to generation. As opposed to this deep cultural layer, a slow-moving cultural layer can include those cultural components that depend upon individuals' circumstances, and can change if these circumstances change, e.g., beliefs.

My hypothesis is that the two cultural layers interact with institutions in a different way (for details see Section 2). To substantiate this difference, based on the theoretical definition of culture, I will run two sets of cross-country regressions, including IV estimations, one with a measure expressing values (deep culture), and another with a measure expressing beliefs (slow-moving culture). Deep culture will be measured by individual values from Schwartz (1999), while the slow-moving culture will be expressed by trust, a widely used measure in studies, from World Values Survey (World Values Survey Association, 2021).

When it comes to deep culture, my results document that it is not a substitute for (better) institutions, which implies that culture alone does not appear to be favorable enough to development to be able to substitute (better) institutions. However, looking at the interaction from the perspective of institutions, the results suggest that high-quality institutions in the top 19-33% of the countries in my sample can substitute improvement in deep culture, while in the majority of countries, in which institutions are not of high quality, institutions complement improvement in deep culture. These results have proven to be robust in various robustness checks.

When measuring culture by trust – expressing beliefs – results are very different. More importantly, trust has not appeared to be a significant determinant of development once institutions are controlled for. But what is more, no sign of interaction with institutions has been detectable, which might be due to the fact that what is "embodied" in trust is not very different from what is "embodied" in institutions, meaning that trust is stuck in institutions, which is not the case for values.

The paper is organized as follows. In Section 2 I will present the theoretical background of the interaction of culture and institutions developed by Bisin and Verdier (2017) which will be operationalized in the empirical investigation. Section 3 will introduce the model, present the data and discuss empirical methods. Section 4 contains empirical analyses with the deep cultural layer together with the interpretation of the results, and Section 5 does the same with the slow-moving culture. Section 6 will conclude.

2 Theoretical background and hypotheses

The literature on the coevolution of culture and institutions has a long tradition, not only in economics but in the social sciences in general. One line of the theories relies on the idea of natural selection and evolution. Here both institutions and culture are seen as evolving and being subject to natural selection (see for instance Bowles et al., 2003; Boyd and Richerson, 1985). This literature is very much embedded in anthropology, and accordingly, is not directly linked to my concern, namely how the coevolution of culture and institutions affects economic development. Instead, what is crucial for my concern is the theoretical

line which focuses on the issue of whether the coevolution happens in an optimal or efficient way. The reason is that when culture and institutions coevolve in an optimal pattern, this enhances growth and development, but when their coevolution deviates from this optimal path, it hinders economic outcomes (Kafka et al., 2020). This latter point means that culture and institutions mismatch, leading to conflicts between them, an issue related to the pace of evolution: institutions change much more rapidly than culture does, if they do at all (Williamson, 2000).

Thus, it is the seemingly existent difference in the pace of evolution of culture and institutions that can cause culture and institutions to evolve in a way in which the two evolutional paths are not compatible with one other. And what is more, these incompatible paths do not necessarily lead to a transitory status quo; instead, they may lead to long-lasting equilibrium (Kafka et al., 2020). A recent paper by Bisin and Verdier (2017) addresses this issue in a general framework.

In the analysis of the joint dynamics of culture and institutions the two scholars developed a formal model which can be used as a powerful tool in an understanding of how culture and institutions matter in development because it allows us to account for their joint impact on development, besides the individual impacts of both. The theory behind the formal model is presented on Fig. 1.

As shown in Fig. 1, on the one hand, both culture and institutions evolve on their own, i.e., along their own evolutionary paths. But on the other hand, they are jointly and endogenously determined due to the bidirectional impacts running from one to the other both at their current and future levels. As a result of this joint evolution, they jointly affect economic outcomes. This model moves the focus from the direct causal effects of culture and/or institutions on socioeconomic outcomes to the process by which these two coevolve.

The formal model of the above in Bisin and Verdier (2017) is a construction enabling us to study the political game between society and a centralized authority (state).

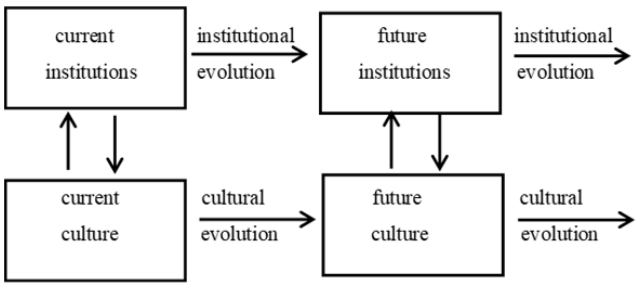

Fig. 1 The model of the coevolution of culture and institutions (based on Bisin and Verdier, 2017)

Institutions are seen as the political mechanisms to implement social choices, and culture is defined as norms, attitudes and traits transmitted across generations, which affect individual incentives, and as a result, 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 have happened if the cultural (resp. institutional) environment had remained fixed. Put differently, the cultural (resp. institutional) multiplier is the ratio of the total effect of institutional (resp. cultural) change on economic output and its direct effect. A positive cultural (resp. institutional) multiplier reinforces the effect of a change in institutions (resp. culture) on economic outcome, 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 cultural (institutional) multiplier measures the strength of the interaction between culture and institutions.

Basically, the model of the two scholars concerns the determination of conditions under which the interaction of culture and institutions tends to strengthen each of these elements in a complementary way, or on the contrary, tends to mitigate them as substitutes.

The question now is what hypotheses can be derived for my concern based on this coevolution model. First of all, I can hypothesize that the impact of the two cultural layers – the deep and the slow-moving one – on development will be different. This is deemed to be the case because of the differing pace at which they can adapt to the relatively quickly changeable institutions: deep culture cannot keep pace with the change in institutions for reasons laid down by Williamson (2000) and Boettke et al. (2008), while the slow-moving cultural layer serves as a hotbed for institutional changes, leading to a mutual adjustment process between them. Accordingly, I expect that the slow-moving culture will not exercise an effect on development beyond institutions, meaning that this cultural layer "works" exclusively via institutions, suggesting no interaction between this cultural layer and institutions.

However, the deep cultural layer is expected to "behave" in an independent way from institutions, which probably makes it a unique factor in economic development, besides institutions. In addition, the theory of the coevolution of culture and institutions, in this case, suggests that an interaction of deep culture and institutions will manifest itself, which can have an additional impact on development besides the individual impacts of the two.

To discover details of the interaction of deep culture and institutions in the developmental process, I will calculate the cultural and the institutional multipliers defined by Bisin and Verdier (2017) from the results of the regression analyses, which allow me to decide under which conditions they substitute and complement one other.

3 The model, data and empirical methods

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 culture and institutions. In the spirit of Bisin and Verdier (2017), to express this phenomenon I will include an interaction term between culture and institutions. Since the main focus is on long-term development, I will be interested in explaining income levels rather than growth rates. Assuming the ergodicity of the examined processes, the empirical analysis will consist of a cross-country regression analysis in which I will rely on the following model (Eq. (1)):

$$\ln\left(\mathrm{GDP}pc\right)_i = \beta_0 + \beta_1 \mathrm{culture}_i + \beta_2 \mathrm{institutions}_i + \beta_3\left(\mathrm{culture}_i * \mathrm{institutions}_i\right) + \boldsymbol{X}\boldsymbol{\beta}_4 + \varepsilon_i. \quad (1)$$

The dependent variable is log GDP per capita in 2016 taken from the Penn World Table 10.0 (*rgdpe* in the data set) (Feenstra et al., 2015); on the side of explanatory variables, $\mathrm{culture}_i$ is a measure of culture in country *i*, $\mathrm{institutions}_i$ is a measure of formal institutions in country *i*, $\mathrm{culture}_i$* $\mathrm{institutions}_i$ is an interaction term, while the vector $\boldsymbol{X}$ includes certain control variables (human capital, geography variables), and ε_i is the error term. Amongst control variables, to minimize the risk of endogeneity of human capital in the development process, as a measure for human capital I will use historical data, the primary school enrollment ratio in 1920 from Benavot and Riddle (1988), and – as widely used geographical variables – the latitude of the country centroid and a dummy variable of whether the country is landlocked, from the GeoDist Database (Mayer and Zignago, 2011).

To assure the robustness of the results I will use two widely used measures of institutions averaged for different time periods: the rule of law from the World Governance Indicators (WGI) (World Bank, 2021), and the Area2 subindex of the Economic Freedom of the World (EFW) Index (Gwartney et al., 2021) which is a measure of the strength of the legal system and property rights, i.e. the rule of law. The reason why I take the rule of law as a proxy for institutions is the almost universally accepted finding of the literature saying that the rule of law embodying secure property rights, efficient law enforcement, judicial independence, impartial courts etc. is the key institution in long-run economic development (e.g., Acemoglu et al., 2005).

Since the rule of law of the WGI runs between −2.5 and 2.5, for the sake of the ease of the interpretation of the interaction term, I will normalize it to run between 1 and 10, which will have no effect on the results because the sign has no special meaning. Such a transformation is not needed for the Area2 subindex since it runs between 0 and 10.

As for culture, when referring to the deep cultural layer, I will use the individual values data from the Schwartz Values Survey (Schwartz, 1999; 2006). An advantage of this dataset is that the survey questions and the variables derived from them rely on a priori theorizing. Of the seven value types identified by Schwartz (1999), based on theoretical and statistical grounds, I will use three values, namely embeddedness, hierarchy, and mastery. To be able to include an interaction term in the regression, I must have only one measure for values; that is why I calculate the first principle component of these three values. To avoid negative values, I normalize the first principal components to run between 1 and 10 such that the country with the "best" values is given 10 on a cardinal scale.

I will proxy the slow-moving cultural layer by generalized trust, and will use data from the World Values Survey (World Values Survey Association, 2021) 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".[1]

Since institutions might be endogenous in the process of development (see for instance Acemoglu et al. 2001), besides the OLS regressions, I will apply an instrumental variable approach, too. One of the instruments I will use is

1 As a matter of curiosity, I have calculated the correlation coefficient of trust and institutions, which is 0.636 with the WGI measure and 0.73 with the Area2 subindex.

the prevalence rate of Toxoplasma gondii, a parasite commonly found in the intestines of cats and other felines which can cause latent infection among humans (Flegr and Dama, 2014). It has been shown that infection with this parasite has an effect on individual personality: a stronger focus on competition and personal achievement, at the expense of concerns for others, and reduced conscientiousness, and morality (Flegr and Hrdy, 1994). These changes in personality translate into increased vigilance and reduced moral consciousness making people more opportunistic and suspicious of the behavior of others, which is in line with an institutional setting in which the enforcement of the law, and the rule of law is weaker. Since the prevalence rate of *Toxoplasma gondii* affects income only through institutions it can serve as an instrumental variable.

The other instrument is the share of Protestants within the total number of religiously-inclined people from Barro (2003). The theory behind the use of this instrument is Weber's theory on the Protestant ethic (Weber, 1930). Weber (1930) argued that the development after the fall of the Roman Empire has to do with the different attitudes towards wealth accumulation, and the differences in the desire for wealth. He said that the "spirit of capitalism" stems from the West, because in the West people were more focused on self-fulfillment and wealth accumulation. In the West, people were not using their wealth to live a lavish life. Instead, they took advantage of their wealth and started their own business, or invested it. In his book, Weber (1930) wrote that capitalism in Northern Europe evolved when the Protestant (particularly Calvinist) ethic influenced large numbers of people to engage in work in the secular world, developing their own enterprises and engaging in trade and the accumulation of wealth for investment. In other words, according to Weber (1930), the Protestant ethic was an important force behind the unplanned and uncoordinated emergence of modern capitalism.

Basically, the channel through which the Protestant ethic contributed to development was institutions, because actors with these attributes "developed" market-friendly institutions such as the rule of law, secure property rights, impartial courts etc., which reduced transaction costs and led to development. So, this ethic can influence development only via the above institutions because there is no reason to believe that the Protestant ethic in itself would have had a direct impact on development.[2]

Note that in specifications in which both institutions and the interaction term are included, only the institutional variable will be instrumented. The reason for this is 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 (Bun and Harrison, 2014), meaning that we only need to instrument the endogenous variable, not the interaction term.

Besides OLS and 2SLS methods, I will use three more methods to provide additional robustness checks. The first is the Generalized Linear Model (GLM), relying on maximum likelihood estimation, in which I use the identity link function. The second method is quantile regression which estimates the conditional quantile (median) of the response variable. And thirdly, since I have only 44–53 countries in my preferred specifications while the entire dataset contains more countries, I will re-estimate all models using a missing data estimation method, namely the Structural Equation Model with Maximum Likelihood with a Missing Values (SEM MLMV) estimation which provides an estimation for countries with missing data, too.[3] Stata 16 will be used for the econometric analyses.

4 Regression analysis with deep culture

4.1 Results

In the first series of regressions, I will deal with the deep cultural layer proxied by values. Table 1 indicates that both deep culture and institutions are significant determinants of economic development, together with their interaction term. The results also prove that the inclusion of the interaction term is statistically meaningful – not only theoretically – since the interaction-term specifications (columns 4 and 7 of Table 1) are better models than those in columns 3 and 5 of Table 1, respectively, as suggested by the Akaike Information Criterion (AIC). Furthermore, Table 1 provides evidence that human capital and one geographical variable (cen_lat) are statistically significant. Although the landlocked dummy variable is not statistically significant, its inclusion increases the goodness-of-fit of the model (see column 7 vs. column 6 of Table 1); accordingly, column 7 of Table 1 is the preferred specification.

2 Whether Protestant countries have higher income today has been intensively researched, a topic which has produced "negative" findings, too (e.g., Cantoni, 2015).

3 Note that concluding statements will be based on the regression analyses, as usual in empirical works. By saying that I would like to avoid entering in epistemological debates as regards how one can prove a law. This issue has been raised by an anonymous reviewer by referring to Popper's Falsification Principle, for which I am indebted to her.

Table 1 Regressions on log per capita GDP in 2016 with the Area2 subindex of the 2015 EFW Index and values as explanatory variables

Dependent variable: ln GDP per capita 2016											
	OLS							2SLS	Quantile (50)	GLM	SEM MLMV
	1	2	3	4	5	6	7	8	9	10	11
Cons	8.446*** (0.272)	7.476*** (0.344)	7.404*** (0.332)	5.398*** (0.912)	8.077*** (0.248)	5.917*** (0.790)	6.193*** (0.698)	6.763*** (0.683)	6.391*** (0.794)	6.192*** (0.717)	6.099*** (0.748)
Values	0.267*** (0.033)		0.100** (0.039)	0.444*** (0.131)	0.082** (0.032)	0.393*** (0.101)	0.383*** (0.096)	0.335*** (0.089)	0.380*** (0.119)	0.383*** (0.114)	0.393*** (0.121)
Area2_2015		0.416*** (0.047)	0.330*** (0.063)	0.672*** (0.150)	0.181*** (0.063)	0.579*** (0.148)	0.517*** (0.136)	0.450*** (0.130)	0.521*** (0.145)	0.517*** (0.132)	0.517*** (0.135)
Values*Area2_2015				−0.056*** (0.020)		−0.055*** (0.017)	−0.051*** (0.016)	−0.042*** (0.015)	−0.053*** (0.017)	−0.051*** (0.018)	−0.051*** (0.019)
Edu_1920					0.007** (0.003)	0.005* (0.003)	0.006** (0.003)	0.004** (0.002)	0.006** (0.002)	0.006** (0.003)	0.008*** (0.003)
Cen_lat					0.005*** (0.002)	0.006*** (0.002)	0.006*** (0.002)	0.002** (0.001)	0.004** (0.002)	0.006*** (0.002)	0.005** (0.002)
Landlocked					"0.350* (0.188)		−0.294 (0.177)	−0.056 (0.082)	−0.239** (0.113)	−0.294* (0.158)	−0.436** (0.160)
N	54	54	54	54	51	51	51	42	51	51	56
Adjusted R^2	0.412	0.600	0.626	0.662	0.725	0.748	0.761	0.842			
Durbin-Wu-Hausman test								0.000 $p = 0.996$			
First stage F statistic								15.98 $p = 0.000$			
AIC	108.168	87.462	84.717	80.147	58.643	54.144	52.279				

Robust standard errors are in parentheses. Letters in the upper index refer to significance: *** :1%, **: 5%, *: 10%.
Instrument: adjusted prevalence rate of *Toxoplasma gondii* (Flegr and Dama, 2014)

The instrumental variable estimation is shown in column 8 of Table 1. My instrument is valid in statistical terms (see the first stage F statistic in Table 1). The test of endogeneity indicates that we cannot reject the hypothesis that the variables are exogeneous, which implies that both the OLS and 2SLS estimators are consistent, but the OLS estimator is more efficient. Accordingly, we should prefer the OLS estimation results to those of the 2SLS estimation.

In the remaining columns of Table 1, as robustness checks, alternative estimation methods are applied. The GLM estimations on coefficients are exactly the same as in the OLS estimation, although the standard errors are slightly different. As for the quantile (median) regression, the difference in the estimated coefficients is negligeable, while the SEM MLMV in column 11 of Table 1 gives us basically the same estimations on values, Area2_2015 and the interaction term as the OLS, but different ones on the control variables. All this signifies that the results are not specific to a particular estimation technique.

For my concern, the key variable is the interaction term, which has proven to be significant at a 1% level, suggesting that deep culture and institutions exert an impact on long-run income not only on their own but also because there is an additional impact due to their coevolution in the developmental process.

The estimated coefficients on the explanatory variables are not only statistically significant (except for landlocked); these variables exercise an economically sizeable impact on income per capita. At the mean value of the Area2 index (6.1877) a one unit increase in values – which corresponds more or less to the difference in values between Ghana and Chile – increases GDP per capita by 6.97%; at the mean value of values (6.0389) a one unit increase in Area2 – which corresponds more or less to the difference in Area2 between Taiwan and Poland – increases GDP per capita by 23.24%, ceteris paribus. One extra year in edu_1920 leads to a 0.6% higher GDP per capita, ceteris paribus.

As a robustness check, now I use an alternative measure of the rule of law, namely the one from the World Governance Indicators, averaged between 1996 and 2015[4]

4 Here I use an averaged value instead of a given year's value which is also frequent in cross-country settings.

(see Table 2). The results suggest exactly the same as in Table 1, except for the impact of human capital.

4.2 Interpretation of the results

Based on my estimations, I will now calculate both the institutional and the cultural multipliers 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) discussed earlier. The institutional multiplier (m_i) and the cultural multiplier (m_c) arising from my model specification are the following (Eqs. (2) and (3)):

$$m_i = \frac{\text{total effect of culture}}{\text{direct effect of culture}} = \frac{\beta_1 + \beta_3 \times \text{institutions}}{\beta_1}, \quad (2)$$

$$m_c = \frac{\text{total effect of institutions}}{\text{direct effect of institutions}} = \frac{\beta_2 + \beta_3 \times \text{culture}}{\beta_2}. \quad (3)$$

As suggested by Bisin and Verdier (2017), a positive multiplier implies that culture and institutions complement one other in the developmental process, while a negative multiplier signifies substitution. Basically, what I need to calculate is a threshold value of the cultural variable (values*) required for the cultural multiplier (m_c) to be positive (or negative), and in the same way, a threshold value of the institutional variable (institutions*) required for the institutional multiplier (m_i) to be positive (or negative).

In all regressions I have run, the sign of the coefficient on deep culture (β_1) and institutions (β_2) is positive, while the sign of the coefficient on their interaction term (β_3) is negative, which implies that the sign of the multiplier depends on the sign of the numerator of Eqs. (2) and (3). More precisely, if values is greater than values* (the threshold value which equals $-\beta_2/\beta_3$), then the cultural multiplier is negative; similarly, if institution is greater than institutions* (the threshold value which equals $-\beta_1/\beta_3$), then the institutional multiplier is negative. Table 3 contains the threshold values for the cultural and the institutional variables used in the regressions, together with the list of countries in which the multipliers are negative.

As can be seen from Table 3, except for one regression the threshold value for values (values*) is equal or greater than 10, which is indeed the theoretical maximum

Table 2 Regressions on log per capita GDP in 2016 with the rule of law from WGI (mean, 1996–2015) and values as explanatory variables (World Bank, 2021)

Dependent variable: ln GDP per capita 2016										
	OLS						2SLS	Quantile (50)	GLM	SEM MLMV
	1	2	3	4	5	6	7	8	9	10
Cons	8.446*** (0.272)	8.190*** (0.237)	8.012*** (0.233)	6.838*** (0.768)	8.300*** (0.199)	7.286*** (0.551)	6.943*** (0.833)	8.031*** (0.569)	7.286*** (0.428)	7.035*** (0.448)
Values	0.267*** (0.033)		0.070 0.043)	0.293** (0.134)	0.076** (0.035)	0.261*** (0.090)	0.357*** (0.129)	0.202*** (0.077)	0.261*** (0.079)	0.287*** (0.083)
Rol_96-15		0.283*** (0.029)	0.246*** (0.042)	0.430*** (0.1069	0.160*** (0.048)	0.324*** (0.088)	0.376*** (0.113)	0.208** (0.089)	0.324*** (0.072)	0.368*** (0.075)
Values*rol_96-15				−0.032* (0.017)		−0.028** (0.012)	−0.038** (0.016)	−0.019* (0.011)	−0.028*** (0.011)	−0.033*** (0.011)
Edu_1920					0.004 (0.003)	0.004 (0.003)	0.003 (0.002)	0.006*** (0.002)	0.004 (0.003)	0.005* (0.003)
Cen_lat					0.005** (0.002)	0.005*** (0.002)	0.002 (0.001)	0.004*** (0.001)	0.005*** (0.002)	0.004** (0.002)
Landlocked					−0.256* (0.142)	−0.219*** (0.130)	-0.032 (0.097)	−0.179* (0.095)	−0.219 (0.150)	−0.340** (0.150)
N	54	54	54	54	51	51	40	51	51	56
Adjusted R2	0.412	0.710	0.722	0.750	0.766	0.792	0.793			
Durbin-Wu-Hausman chi-sq test							1.1525 $p = 0.283$			
First stage F statistic							7.06 $p = 0.003$			
AIC	108.168	70.046	68.778	63.954	50.539	45.221				

Robust standard errors are in parentheses. Letters in the upper index refer to significance: ***: 1%, **: 5%, *: 10%.
Instruments: adjusted prevalence rate of *Toxoplasma gondii* (Flegr and Dama, 2014), and the share of Protestants (Barro, 2003)

Table 3 Threshold values for the cultural and institutional multipliers, and list of countries

	Regression in Table 1 (Area2_2015)			Table 2 (rol_96-15)		
	Column 7 and 10 of Table 1	Column 9 of Table 1	Column 11 of Table 1	Column 6 and 9 of Table 2	Column 8 of Table 2	Column 10 of Table 2
Values* $= -\beta_2/\beta_3$	10.137	9.83	10.137	11.571	10.947	11.151
Countries with negative cultural multiplier	None	CHE, FRA	None	None	None	None
Institutions* $= -\beta_1/\beta_3$	7.510	7.169	7.705	9.321	10.631	8.697
Countries with negative institutional multiplier	AUS, AUT, CAN, CHE, DNK, FIN, GBR, HKG, IRL, JPN, NLD, NOR, NZL, SGP, SWE	AUS, AUT, CAN, CHE, DNK, EST, FIN, GBR, GER, HKG, IRL, JPN, NLD, NOR, NZL, SGP, SWE, USA	AUS, AUT, CAN, CHE, DNK, FIN, GBR, HKG, IRL, NLD, NOR, NZL, SGP, SWE	AUS, AUT, CAN, CHE, DNK, FIN, GBR, NLD, NOR, NZL, SWE	None	AUS, AUT, CAN, CHE, DNK, FIN, GBR, GER, IRL, NLD, NOR, NZL, SGP, SWE, USA

of this variable. This means that (in my sample) the cultural multiplier is almost always positive, which implies that if institutions improve then the impact of institutional improvement on development will be reinforced due to the complementarity of institutions and deep culture. In other words, deep culture is not a substitute for (better) institutions, which implies that deep culture alone does not appear to be favorable enough to development to be able to substitute (better) institutions in general.

However, in the regression in Table 1 column 9 deep culture has proven to be favorable enough to development (which is very rare, as it only happens in 2 countries in my sample) to be able to substitute the improvement in institutions. To sum up, only highly development-favorable deep culture can substitute improvement in institutions.

Because of the coevolution of culture and institutions, the question is not only whether deep culture reinforces the impact of improvement in institutions, but vice versa, too, namely whether institutions reinforce the effect of improvement in deep culture, an issue related to the institutional multiplier. When looking at the institutional multiplier, it turns out that it works differently from the cultural one: now the threshold value of institutions (institutions*) divides the 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 most striking feature of the results in Table 3 is that the group of countries in which the institutional multiplier is negative for the two alternative institutional measures is more or less the same: there are 11 core countries, namely AUS, AUT, CAN, CHE, DNK, FIN, GBR, NLD, NOR, NZL, SWE which have proven to have negative institutional multipliers with both institutional measures. That is, when high-quality institutions are in place, there is a substitution effect: high-quality institutions can substitute improvement in deep culture. However, as indicated by the results, in order to work, this mechanism requires very good institutions: only the top 19-33% of the countries in my sample can experience this. In the majority of countries, in which institutions are not of high quality, institutions complement improvement in deep culture.

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

5 Empirical investigations with the slow-moving cultural layer

Having obtained the above results on deep culture, the question is whether the impact of the slow-moving culture on income per capita is different, conforming to earlier hypothesis. In what follows I will run regressions in which, instead of a measure for deep culture, I will use a proxy for the slow-moving culture (trust). However, as opposed to values which are deemed to express exogenously formed values, trust is suspected to be endogenous in development, and in fact, this is well documented in the literature (e.g., Tabellini, 2010). Accordingly, one has to account for this potential bias in the OLS model by instrumenting the trust variable. However, the institutional variable will not be instrumented for two reasons: (1) in the regressions presented above there was no sign for the endogeneity of institutions, and (2) instrumenting two variables which also have an interaction term will make estimation impossible (because this would imply three endogenous variables).

First, I will use the Area2 subindex of the 2015 EFW Index as a proxy for institutions, and I include only those countries out of my original sample containing 56 countries for which trust data has been available (see Table 4).

Columns 1–3 of Table 4 show the results without including control variables. As can be seen, trust is not statistically significant if institutions are controlled for, but what is more important for my concern is that the specification including the interaction term is worse than the one without it (column 3 vs. column 2 of Table 4) as indicated by BIC. We can conclude the same if we include control variables in columns 4 to 6 of Table 4: the specification not including an interaction term (column 5 of Table 4) is a better model than the one including it (column 6 of Table 4), as suggested by the BIC.

To further corroborate that the full model in column 6 of Table 4 is not the preferred specification, I performed a joint significance test of trust and the interaction term, in which the p-value of the F statistic is 0.054, meaning that we fail to reject at a 5% significance level the hypothesis that the coefficients on the two variables are jointly zero; accordingly, they can be excluded from the model. This suggests that the best model should be the one in column 7 of Table 4 including only the institutional variable, which is corroborated by the lowest value of the BIC.

In the IV estimation in column 8 of Table 4, as the Durbin-Wu-Hausman test indicates, trust is not endogenous in economic development, which means that OLS estimation in column 5 of Table 4 is more efficient than the 2SLS one. And since the specification in column 7 of Table 4 is better than in column 5 of Table 4, the main conclusion is that trust and the interaction term are not only statistically insignificant, but they should not be included in the regression, whereas institutions should.[5]

To avoid the risk that the results are driven by the sample of countries, I repeat the regression on a larger sample of 74 countries. The dependent variable, the institutional and the human capital variables are also different, to make the results more robust (see Table 5). The conclusions I can draw from the regression do not change: as the BIC indicates, the best specification is the one in column 5 of Table 5, which does not include trust and the interaction term. Note that in the full specification in column 6 of Table 5, the institutional variable and the interaction term are significant at least at a 5% significance level, but trust is so only at a 10% significance level. Because of the low individual significance of trust I perform a joint significance test of trust and the interaction term (the p-value of the F statistic is 0.0532), which indicates that these two variables are jointly insignificant, and accordingly, both should be excluded from the model. The 2SLS estimation results provide additional support for the conclusions from the OLS. In column 7 of Table 5 the results indicate that trust is not endogenous, so we should rely on OLS results.

To conclude, unlike my previous results with the deep cultural layer, the ones with the slow-moving culture do not indicate any interplay between institutions and the slow-moving culture, meaning that the two cultural layers "behave" very differently.

6 Conclusions

In this paper my goal has been to take a step towards improving our understanding of how the interplay of culture and institutions affects economic development, a question which lies at the heart of a novel research stand which differs from those looking at the separate impact of culture and institutions on development. In this endeavor, I have operationalized the concepts of cultural and institutional multipliers introduced by Bisin and Verdier (2017) who built their formal model of the joint evolution of culture and institutions upon these concepts. More specifically, relying on cross-country empirical analyses, including IV estimations, I have calculated the cultural and institutional multipliers which help us understand under what conditions culture and institutions can substitute or complement one other in the developmental process.

To avoid issues arising from the multidimensional character of culture resulting in definitional ambiguities, I have distinguished two "layers" of culture, a deep one (proxied by values) and a slow-moving one (proxied by trust), conforming to the definitional distinction by Alesina and Giuliano (2015).

My empirical results indicate, on the one hand, that the two cultural layers "behave" differently: the 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 (see Boettke et al., 2008). Furthermore, I have found that deep culture and institutions interact in development, while

5 I have also estimated the model by using my alternative institutional measure (the rule of law from WGI averaged for 1996–2015). The results are not sensitive to the use of this institutional variable, i.e., the pattern of the results is exactly the same as before. Because of a lack of space, the results are not presented here, but are available upon request.

Table 4 Regressions on log per capita GDP in 2016 with Area2_2015 and trust as explanatory variables

Dependent variable: log GDP per capita in 2016								
	OLS							2SLS
	1	2	3	4	5	6	7	8
Const	9.623*** (0.237)	7.724*** (0.352)	7.072*** (0.876)	9.131*** (0.196)	8.173*** (0.292)	7.597*** (0.726)	8.361*** (0.708)	8.161*** (0.356)
Edu_1920				0.016*** (0.003)	0.008** (0.003)	0.008** (0.003)	0.008** (0.003)	0.007** (0.003)
Cen_lat				0.009*** (0.003)	0.006*** (0.002)	0.006*** (0.002)	0.006** (0.002)	0.007*** (0.002)
Trust	1.780*** (0.596)	−0.488 (0.373)	1.718 (2.299)	0.208 (0.377)	−0.754** (0.360)	1.120 (1.761)		−1.860** (0.928)
Area2_2015		0.409*** (0.052)	0.512*** (0.130)		0.275*** (0.057)	0.368*** (0.116)	0.226*** (0.051)	0.338*** (0.095)
Trust*Area2_2015			-0.323 (0.31			−0.279 (0.251)		
Landlocked				−0.439 (0.273)	−0.373 (0.242)	−0.364 (0.222)	−0.304 (0.233)	−0.477 (0.295)
Adjusted R^2	0.124	0.647	0.651	0.631	0.748	0.752	0.761	0.678
N	47	47	47	45	45	45	45	43
Durbin-Wu-Hausman chi-sq test								2.011 $p = 0.156$
First stage F statistic								13.08
BIC	106.546	66.632	68.802	69.142	54.598	56.603	53.824	

Robust standard errors are in parentheses. Level of significance: ***: 1%, **: 5%, *: 10%.
Instrument: share of Protestants (Barro, 2003)

Table 5 Regressions on log per capita GDP (1980–2010) with Area2 (1990–2010) and trust as explanatory variables

Dependent variable: log GDP per capita averaged for 1980-2010							
	OLS						2SLS
	1	2	3	4	5	6	7
Const	8.605*** (0.173)	8.170*** (0.155)	8.165*** (0.136)	7.221*** (0.302)	7.230*** (0.268)	6.206*** (0.599)	6.081*** (0.722)
Edu_1930		0.021*** (0.003)	0.021*** (0.002)	0.014*** (0.003)	0.014*** (0.003)	0.015*** (0.003)	0.008** (0.004)
Cen_lat			0.009*** (0.002)	0.007*** (0.002)	0.007*** (0.002)	0.006*** (0.002)	0.004*** (0.002)
Trust	3.279 (0.550)	1.681*** (0.470)	0.778 (0.389)	−0.058 (0.467)		3.507* (1.833)	2.045 (2.585)
Area2_mean				0.263*** (0.084)	0.259*** (0.066)	0.437*** (0.116)	0.551*** (0.129)
Trust*Area2_mean						−0.568** (0.255)	−0.440 (0.344)
Landlocked			−0.279 (0.250)	−0.299 (0.226)	−0.295 (0.223)	−0.311 (0.204)	−0.091 (0.104)
Adjusted R^2	0.215	0.436	0.677	0.721	0.726	0.735	0.758
N	74	74	72	72	72	72	45
Durbin-Wu-Hausman test							1.017 $p = 0.313$
First stage F statistic							17.761
BIC	142.721	138.027	122.016	116.633	112.37	116.312	

Robust standard errors are in parentheses. Level of significance: ***: 1%, **: 5%, *: 10%.
Instrument: share of Protestants (Barro, 2003)

this effect is missing in the case of the slow-moving culture and institutions.[6]

As regards the details of the interaction of deep culture and institutions, the cultural and institutional multiplier can suggest how their joint impact works:

1. The cultural multiplier is positive for all countries in my sample, meaning that if institutions improve then deep culture reinforces the impact of this institutional improvement on development (complementarity).
2. Based on the institutional multiplier, countries in my sample are divided into two groups; in one the institutional multiplier is positive, in the other it is negative.

This suggests that if deep culture improves then good institutions can substitute deep culture only if institutions are at a very high level (this impact is observable only in the top 19–33% of countries in terms of institutions).

All in all, my results have thrown 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.

6 Note that an investigation of the relationship between deep and slow-moving culture require a separate analysis.

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