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# Colonisation, institutions, and development: new evidence

## 1.- Introduction

Economic theory has identified productive factors and the level of aggregated efficiency as the main causes of economic progress. Although that approach is highly persuasive, it is doubtful that these factors can explain the extraordinary levels of inequality in GDP per capita among countries and the secular process of economic *divergence* to which Pritchett (1997) refers. Furthermore, the unequal dynamic of productive factor accumulation between countries still remains to be explained. Why are some countries capable of accumulating physical and human capital at a faster rate than others? What factors explain the fact that one economy makes better use than others of technological progress? Answering these questions involves looking at deeper factors and wider frameworks, in a bid to identify the *fundamental causes of long-run growth*: a task to which economists, politicians, naturalists and historians have recently contributed.

In this effort, institutions have emerged as one of the main explanatory factors of long-term development. Institutional structure defines the incentives and penalties which influence the behaviour of agents and shape collective action. In the uncertain world in which independent agents operate with imperfect information, institutions reduce uncertainty and transaction costs and facilitate social coordination (North, 2005; Greif, 2006). That is why institutional frameworks may explain long-term economic development trends.

Trying to prove this hypothesis, however, is not a simple task, firstly because of the elusive concept of institutions, which is the object of varying, and sometimes ambiguous, interpretations in economic literature. Frequently it is supposed that institutions are created to provide efficient responses to the transaction costs of the market. That idea is based on the assumption that human beings operate as efficient and rational agents, that the evolution of history will weed out inefficient institutions and that those left will increase overall levels of wellbeing in society. As a consequence, there is no problem in defining “optimal institutions” – those belonging to “successful” countries – and in generalising their implementation in any geographical location.

A large part of “institutional transplantation” promoted by international donors was based on this debatable assumption (Eggertsson, 2005). The failures of this approach reveal that: i) there is nothing close to an universally optimum institutional framework; ii) far from always being efficient, institutions are often interest-driven creations used by those who have the power to establish rules (North, 1993: 3); and finally iii) an institution does not properly exist if it is not capable of effectively shaping the behaviour of agents. That suggests that it is as important to consider the rules imposed as to analyse the motivations of the individuals which follow them. That underlines the importance of the social legitimacy of the institutional framework as a basic dimension of institutional quality; and reinforces the highly specific context of any institutional response which aims to be successful.

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3 Additionally, the institutional framework has to be treated as a framework which is not  
4 only made up of *formal* institutions (based on explicit and universal rules), but also of  
5 *informal institutions* (those which are more opaque and less defined). The relationship  
6 between both types of institutions may condition the efficiency of the institutional  
7 framework. That aspect is particularly relevant in the case of the former colonies which  
8 suffered the consequences of a new institutional framework superimposed on the  
9 traditional one (Alonso, 2007).  
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12 As well as the difficulties associated with the concept, institutional analysis also faces  
13 very diverse empirical problems. Problems that include: i) the existence of indicators of  
14 institutional quality which are still deficient; ii) the endogenous nature of the  
15 relationship between development and institutional quality; iii) the frequent correlation  
16 between the variables which potentially explain economic development; and iv) the  
17 possible existence of omitted variables which could condition the estimated  
18 relationships.  
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21 In spite of these difficulties, in the last few years, a wide collection of empirical studies  
22 has tended to confirm the relationship which exists between institutional quality and  
23 income per capita level (Aron, 2000). This is shown by cross-country analyses (Hall and  
24 Jones, 1999; Acemoglu et al., 2001, 2002; Rodrik et al., 2004 or Easterly and Levine,  
25 2003), those which use panel data (Henisz, 2000; Tavares and Wacziarg, 2001, or  
26 Varsakalis, 2006) or those based on case studies (Rodrik, 2003, for example).  
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29 This article seeks to offer additional elements to the analysis. In order to do that, the  
30 work starts off presenting the arguments on which the two main approaches that have  
31 dominated recent literature are based: the institutional and the geographical approach  
32 (section 2). Although the greater explanatory role of institutions is assumed, some of the  
33 arguments on which the institutional approach are based are debated (section 3).  
34 Afterwards, we consider other potential factors in the explanation of long-run growth,  
35 like trade openness and human capital (section 4) Using an approach which is  
36 deliberately eclectic, a new estimation is carried out through TSLS with instrumental  
37 variables in order to test the importance of geography, international trade, human capital  
38 and institutional quality in explaining development. The robustness of the results is  
39 tested, changing the indicators of institutional quality and repeating the estimation with  
40 different groups of developing countries (section 5). In section 6 final considerations are  
41 presented.  
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45 The results of the empirical model confirm the central role which institutions have in  
46 explaining long-term economic progress. However, certain geographic conditions also  
47 seem to have influenced countries' development, either directly or through the other  
48 factors considered. Human capital and trade openness are less robust factors in  
49 explaining economic development. Although the influence of institutions is confirmed,  
50 institutions are affected not so much by historical factors (such as colonial or legal  
51 traditions), but more by variables susceptible to social action such as income inequality  
52 or the way that the State is financed.  
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## 58 **2. The debate between institutional and geographical factors**

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3 The analysis of the deeper drivers of development has been dominated by two main  
4 hypotheses. The first primes the importance of *geographical factors*, such as location,  
5 climate, environment condition or geographical accessibility in determining the  
6 potential for economic progress<sup>1</sup>. Although the relevance of these factors was  
7 highlighted in the past, the most recent exploration of their significance was carried out  
8 by Gallup, et al. (1999), McArthur and Sachs (2001), Sachs (2001, 2003) or Diamond  
9 (1998). Three strands can be found in this approach: i) the climate, which conditions the  
10 productivity of the land and the people; ii) geographical characteristics, which  
11 determine the conditions of mobility and transport; iii) the persistence of certain  
12 diseases (*disease burden*), which appear to be influenced by the bio-physical conditions  
13 of the environment. As a consequence, those countries located between tropics or  
14 without access to the sea have more problems in implementing a successful  
15 development strategy.  
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20 Several arguments were presented against this hypothesis. The relative immutability of  
21 geographical conditions makes unlikely that they explain either the sudden change in  
22 the path of development (for example, China in the last two decades) or the divergent  
23 economic trends of countries which share similar geographical conditions (Mexico and  
24 the United States and North Korea and South Korea, for instance). However, the most  
25 direct rebuttal to this approach comes from the decline of some previously rich  
26 civilizations: this is the *reversal of fortune* to which Acemoglu et al. (2002) refers. The  
27 most striking cases of this phenomenon are the Inca, Aztec, Mongolian or Angkor's  
28 Jimma societies. Given the relative immutability of geographical conditions, these  
29 changes in the international development hierarchy, in the opinion of Acemoglu et al.  
30 (2002), call into question the geographical hypothesis.  
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34 However, the criticisms cited should not lead us to discount the potential effect that  
35 geographical conditions may have on the processes of development. Firstly, it is  
36 possible that geographical conditions are not as immutable as Acemoglu et al. (2002)  
37 assume. Changes in climatic and environmental conditions seem to have been behind  
38 the collapse of relatively evolved societies such as the Huari, Tiahuanaco, Calakmul,  
39 Mochica, Maya or Cahokia (Diamond, 2005; Fagan, 2008; or Mann, 2006).  
40 Additionally, certain geographical characteristics may be of limited significance in  
41 some contexts but highly significant in others. For example, the inland location of some  
42 Latin American colonial capitals was of little significance at the time of their  
43 establishment when defensive reasoning was central, but those locations could become  
44 an obstacle in a more internationalised economy.  
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48 In contrast, the institutional hypothesis is that *institutions* (and not geography)  
49 determine a country's possibilities of development. Institutions set the incentives and  
50 penalties which condition the behaviour of agents and, in this way, influence long-run  
51 growth. It is possible to find three main different interpretations within this approach.  
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53  
54 Acemoglu Johnson and Robinson (2001, 2002, 2005 y 2006) (from now AJR) insist on  
55 the impact that colonisers' patterns of settlement had on the type of institutions  
56 implemented in the conquered territories. In places where the Europeans did not settle  
57 because of hostile geographical conditions, like deadly disease environments, and in  
58 those where there were valuable resources and an abundant population which could be  
59 exploited, conscripted or dominated, the Europeans tended to implant mainly extractive  
60 institutions. By contrast, where the Europeans could settle occupying virgin territories,

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3 the colonisers tried to generate institutions – partly transplanted from their countries of  
4 origins – which defended private property and the functioning of the market.  
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7 In keeping with their approach, AJR estimate the causal effect of current institutions on  
8 the per capita income of former colonies, using European mortality rates at the time of  
9 colonisation as an instrument. In the first stage, AJR find a strong negative relationship  
10 between initial settler mortality and institutional quality today; and, in the second stage,  
11 they find that institutional quality has a positive effect on per capita income.  
12

13  
14 In the second variant of the institutional approach, Sokoloff and Engerman (2000) and  
15 Engerman and Sokoloff (1997, 2002, 2005 and 2006) (from now ES) suggest that initial  
16 differences in endowment of land not only influence the later distribution of income but  
17 also the institutions created in the country. Where there were conditions for the  
18 development of large-scale plantations, with slave labour, or where there was enough  
19 indigenous labour to be recruited and exploited, the patterns of distribution were highly  
20 unequal. In these cases exclusive and non-democratic institutions were created, with  
21 negative effects on future development. By contrast, in places where the conditions  
22 were more apt for family farming, more democratic institutions were developed which  
23 were capable of promoting public goods, defending property rights and stimulating  
24 economic opportunity. The ES analysis was qualitative in nature, based on so-called  
25 *natural experiments*<sup>2</sup>.  
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29 Finally, the third variant of the institutional approach, La Porta et al. (1997, 1998, 1999a  
30 and b, 2008) argues that the origin of the country's legal system is a determinant of its  
31 institutional framework. It is argued that the origins of the British system (common law)  
32 and to a lesser extent German or Scandinavian systems, are based on a greater  
33 recognition of economic freedom, which limits state intervention in the economy. On  
34 the contrary, the origins of the French legal system (civil law) and to a greater extent the  
35 Soviet system were designed to determine the state's ability to organise economic and  
36 social life, leading to a weaker recognition of property rights and individual freedom.  
37 Accordingly, British and Nordic legal traditions are expected to be associated with more  
38 successful development performance. La Porta et al. (1997, 1998) think that for former  
39 colonies legal origin is exogenous to country characteristics and could be a good  
40 instrument to estimate institutional quality. Authors such as La Porta et al. (1999a and  
41 b), Glaeser and Shleifer (2002), Chong and Zanforlin (2000) or Easterly and Levine  
42 (2003) find empirical support for this hypothesis.  
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46 A more extreme version of this approach is proposed by those authors that identify the  
47 country's colonial origin as the main factor to explain both economic backwardness  
48 (Lange et al., 2006; Mahoney, 2003) and current inequality (Angeles, 2007).  
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### 51 52 **3. The institutionalist approach: some critical comments**

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54 The institutionalist explanation has been well received in academic circles, but the  
55 historical evidence is insufficient to eliminate certain doubts about some of its  
56 arguments. It could be said that these magna interpretations ("meta-historical  
57 narratives" as Coatsworth, 2007, called them) have been built up from a very limited  
58 and not always consistent empirical base. The consequences are an excessive  
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3 interpretive simplification and an exaggerated confidence in historical inertia (Alonso  
4 2007).

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6 To take the first of those problems, it is difficult to use a limited binomial classification  
7 (extractive/exclusive institutions *versus* market/inclusive institutions) to explain the  
8 disparate development paths of countries. Latin America is a case in point<sup>3</sup>. Few  
9 colonial systems created an institutional framework as unified and homogenous as the  
10 Spanish Empire (Elliott, 2006). Nevertheless, as Coatsworth and Taylor (1998:26)  
11 remind us, differences in productivity in the richest and poorest Latin American  
12 colonies were, in 1800, “almost as great as for the entire world”.

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15 The second criticism is the importance that the authors place on historical *inertia*. It  
16 seems excessive to assume that the origin of today’s underdevelopment is in the  
17 colonisation period in every case. In Latin America, that approach would imply the  
18 reason for today’s economic backwardness lies in half a millennium earlier. That  
19 supposes an extreme “compression of history”(Austin, 2008). Historians do not seem to  
20 support that idea, rooting the origin of Latin America’s backwardness in much more  
21 recent times. For instance, Coatsworth and Taylor (1998) stress Latin America was not  
22 underdeveloped in terms of any conventional measure (such as GDP per capita) until  
23 some time roughly between 1750 and 1850. Harber (1997) and Bulmer-Thomas (1994)  
24 locate the origin of Latin American backwardness in the same period – the 19<sup>th</sup> century;  
25 and Prados de la Escosura (2005), who compares the region’s evolution not to the  
26 United States but to the rest of the OECD, puts that origin as late as the start of the 20<sup>th</sup>  
27 century.

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30 Doubts also arise about the empirical support of some assumptions made by AJR and  
31 ES. For example, the data suggests that the inequality in Spanish Latin America,  
32 although high, was not higher than in other regions that underwent successful processes  
33 of industrialisation. In a recent study, Milanovic et al. (2007) tried to reconstruct the  
34 levels of inequality of some pre-industrial societies, comparing them to those today. The  
35 Gini index for “Nueva España” (the territories which are today Mexico, a large part of  
36 Central America and the South of the United States) in 1790 was 63.5%, revealing a  
37 significant inequality (equivalent to that which exists today in Botswana, for example).  
38 However, the Gini index for the Netherlands was practically the same in that period  
39 (1732), 63%; and the corresponding index for England and Wales was not that different  
40 in 1801-3, at 51%. Why were market institutions compatible with high levels of  
41 inequality in the Netherlands and England and incompatible in “Nueva España”?

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44 In fact, the inequality existing in countries is not as unchangeable in history as AJR and  
45 ES suggest<sup>4</sup>. Brazil is an interesting example because it has high inequality levels today  
46 and part of its development was based on plantation and slave labour. Yet the Gini  
47 index estimated by Milanovic et al. (2007) puts its 1872 level of inequality at 38.7%, a  
48 relatively moderate level (equivalent to Portugal today). More detailed studies confirm  
49 the same result, putting Brazil’s Gini index in 1872 in somewhere between 38% and  
50 40% (Bertola et al., 2008). This result contradicts ES’s generalization that an extractive  
51 colonisation is associated with high levels of inequality; while it also forces us to  
52 consider why in this case limited inequality did not lead to market institutions and  
53 successful development.

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3 Nunn analyses the effects of slavery on development. Nunn (2008a) finds a robust  
4 negative relationship between the number of slaves exported from countries and their  
5 current economic performance; and Nunn (2008b) finds a strong relationship between  
6 slavery and inequality in the size of land holdings across either states or counties in US  
7 in 1860. However, the author cannot identify any evidence of a relationship between  
8 early economic inequality and current income levels in these states. As a consequence,  
9 the results do not support the ES argument, even if slavery is correlated to inequality.  
10 Furthermore, Nunn (2008b) tries to analyse if the negative correlation between slavery  
11 and economic development is being driven by large-scale plantation with slave labour,  
12 as ES suppose. Nevertheless, he does not find any evidence that large scale slavery was  
13 more detrimental for growth than other forms of slavery.  
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17 Otherwise, Acemoglu et al., (2008) try to analyse the validity of ES's hypothesis with  
18 micro-data on districts within the state of Cundimarca, in Colombia. The study shows a  
19 positive relationship between land inequality and current economic development,  
20 proxied by primary and secondary school enrolment rates: exactly the opposite to the  
21 relationship ES had hypothesised. Furthermore, their study also finds that in  
22 Cundimarca economic inequality is negatively correlated with political inequality, again  
23 running counter to the ES explanation.  
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26 Finally, Banerjee and Iyer (2010) find a relationship between land tenure systems in  
27 British India and current provision of public goods (such as schools or roads). Those  
28 areas that were under the control of landlords lag behind in the provision of public  
29 goods compare to areas in which control rights in land were given to small cultivators.  
30 Nevertheless, they do not find significant differences in economic inequality or political  
31 participation across these two types of areas. That result suggests that there should be a  
32 different way to explain the relationship from the one proposed by ES.  
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#### 35 **4. Alternative interpretations**

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37 Given the shortcomings of AJE and ES proposals, we should take into account other  
38 two potential explanatory factors: international trade and educational level.  
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41 Although initially stated by Adam Smith, the effects of trade openness on economic  
42 growth received considerable empirical attention since the 80s. A wide collection of  
43 studies initially analysed the relationship between both variables from cross-country  
44 regressions. Although the results tended to confirm a moderate positive relationship,  
45 those studies were unable to prove the existence of causality between trade and  
46 economic development, or to identify the direction of that relationship. In an attempt to  
47 overcome these problems, Frankel and Romer (1996), from the literature of  
48 gravitational models, instrumented trade through geographical variables, related to  
49 country size, distance among each other, the existence of borders and coastal access.  
50 While it is assumed these variables have an effect in trade, it is not clear they are  
51 correlated to other factors that influence the income levels of the country being  
52 considered. Through this procedure, they identified a solid and positive influence of  
53 trade on income.  
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56  
57 This result confirms the intuitions of many economists, who think that, under normal  
58 conditions, trade openness should contribute to fostering economic growth.  
59 Nonetheless, there have been more extreme versions of this judgment, with trade being  
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proposed the most central factor explaining economic growth. The opinions of Dollar and Kraay (2004) or Sachs and Warner (1997) could be integrated into this last approach. However, research results raise doubts about this more extreme statement, as illustrated in Rodríguez and Rodrik (2001).

Besides fostering growth, economic openness could affect institutional quality. The reasons to justify this relationship are: 1) openness creates a more dynamic environment, which implies a greater demand for quality institutions; 2) in a more open environment the room for rent-seeking activities is smaller; and 3) trade openness could facilitate knowledge diffusion. Studies by Ales and Di Tella (1999), Islam and Montenegro (2002), Leite and Weidmann (2002) tend to confirm this positive relationship, although with a loss of significance once the relationship is controlled by the per capita income.

Human capital is another factor to be considered as a fundamental cause of long-run growth. Lucas (1998) presents the level of people's education as the central variable in explaining endogenous economic growth. Likewise, that same variable appears as central in the explanation of the dynamics of economic convergence (Barro, 1991, 1997; or Barro and Lee, 1993 and 1994).

One of the ways through which educational levels could have an effect over long-term growth is through its impact on institutions. This is a version of the Lipset (1959) thesis which states that the quality of institutions does not determine income levels but that income levels determine institutional quality<sup>5</sup>. More specifically, Glaeser et al (2004) think that part of the positive relationship between European settlement and economic growth may stem from the knowledge brought by the settlers to the colony. They therefore try to estimate the effects of human capital and institutions on economic growth through instrumental variables. Their results confirm the greater explanatory role of schooling years. Nonetheless, the authors recognize that the effects of colonial settlement work through many channels, and the instruments used in the literature do not tell which channel matters.

## 5.- Empirical model

The above points can be translated into an empirical model which enters into dialogue with the previous studies. As Rodrik et al. (2004) stated, it would be preposterous to think that only one factor determines such a complex phenomenon as long-term economic development. We therefore adopt an eclectic approach, taking into consideration the main four factors that could explain the process of development. They are: i) geographical factors (in particular access to the sea and distance from the tropics), as Gallup et al. (1999) and Sachs (2001) suggest; ii) the quality of institutions, conditioned by the model of colonisation which the country had, as Acemoglu et al. (2002) and Engerman and Sokoloff (2002) propose; iii) international trade, measured through the openness of trade, as Frankel and Romer (1999) and Rodrik et al. (2004) propose<sup>6</sup>; and iv) lastly, human capital, as Glaeser et al. (2004) suggest. To compare the importance of each one of these factors, the four are incorporated into an explanation of development (in a similar way as Rodrik et al. 2004). In other words:

$$Y_j = \alpha_1 + \alpha_2 G_j + \alpha_3 T_j + \alpha_4 I_j + \alpha_5 E_j + \mu_1 \quad (1)$$

where Y is the GDP per capita (in PPP), G the geographical characteristics, T the degree of open trade, I and index of institutional quality, E the average educational level of the people and j refers to the country in question. The precise content of the variables is explained in Annex II.

The geographical characteristics are assumed to be acceptably exogenous. However, the three last variables (institutional quality, trade openness and educational level) may be endogenous: in other words, it is thought that they influence the level of development but development also affects the variables in question. Additionally, there may be relationships between the different factors considered. Therefore, the result system could be express as follow:

$$T_j = \pi_1 + \pi_2 Y_j + \pi_3 I_j + \pi_4 G_j + \pi_5 E_j + \pi_6 Z_j + \mu_2 \quad (2)$$

$$I_j = \beta_1 + \beta_2 Y_j + \beta_3 T_j + \beta_4 G_j + \beta_5 E_j + \beta_6 X_j + \mu_3 \quad (3)$$

$$E_j = \gamma_1 + \gamma_2 Y_j + \gamma_3 T_j + \gamma_4 I_j + \gamma_5 G_j + \gamma_6 W_j + \mu_4 \quad (4)$$

where X, Z and W are vectors of other exogenous variables to consider.

Since the system of relationships is very complex, we have adopted the following strategy. In a first step we have explored and estimated each one of the equations (2 to 4) The aim is to identify the factors behind each one of the dependent variables in order to test their endogeneity and to identify good instruments for each variable<sup>7</sup>. Afterwards, in a second step, we have estimated the equation (1), which comprises our final goal. In both steps we have to use techniques such as Two Stages Least Squares (TSLS), with instrumental variables, in order to contend with the problem of the endogeneity.

As is known, a good instrument should satisfy two requirements: i) it should be correlated to the endogenous variables included in the regression; and ii) it should be orthogonal to the error process (Baum et al., 2003). In order to test these requirements we have resorted to the following procedures. We may test the first condition through the fit of the first stage regressions, considering the explanatory power of the excluded instruments (through the  $R^2$  or the F-test) (Bound et al., 1995). But, at the same time, the test of Anderson allows us to check for the hypothesis that the instruments are the same at zero. Since our model has several endogenous variables, it is useful to consider the statistic proposed by Shea (1997) as a partial  $R^2$  that takes the intercorrelations among the instruments into account. A large value of the standard partial  $R^2$  and a small value of the Shea measure is a symptom of a model that is unidentified. In order to check the existence of weak instruments we used the statistic proposed by Stock and Yogo (2001), for which critical values based on the F-statistic of Cragg-Donald are offered, considering up to three endogenous variables. Finally, to test the second condition – instrument's independence from the unobservable error process – we used the J statistic of Hansen (1982). A rejection of the null hypothesis implies that the instruments do not satisfy the required orthogonality conditions. In a similar way, the test of Sargan verifies the exogenous nature of the instruments used. All these tests are set out in our tables with the results of the estimations.

## 5.1. PRIOR STEPS

In order to analyse the influence of geography an OLS regression (table 1) is sufficient. Results confirm that variables like the distance from the tropics and the average degree of humidity have a positive effect on income, while the absence of direct access to the sea has a negative influence on it. The average altitude (as a proxy to rough of the country) is not significant. These relationships are maintained even when diverse control variables associated with institutional quality are added, such as ethnic and linguistic fragmentation (in a negative sense) or a legal system based on *common law* (in a positive sense).

TABLE 1: EFFECT OF GEOGRAPHICAL CONDITIONS ON DEVELOPMENT

Variables	Per capita Income (2006) (t-stat)	Per capita Income (2006) (t-stat)	Per capita Income (2006) (t-stat)	Per capita Income (2006) (t-stat)
Latitude	3.970 *** (11.202)	3.354 *** (7.121)	3.493 *** (7.598)	3.521 *** (9.085)
Landlocked	-0.723 *** (-4.527)	-0.681 *** (-4.536)	-0.664 *** (-4.369)	-0.531 *** (-3.535)
Average altitude	-0.045 (-1.140)	-0.035 (-0.908)	-0.031 (-0.761)	-0.060 (-1.526)
Average humidity	0.011 ** (2.581)	0.011 ** (2.559)	0.013 *** (2.966)	0.013 *** (2.918)
Ethnic fragmentation		-0.876 ** (-2.360)	-0.915 ** (-2.470)	
Linguistic fragmentation				-0.312 *** (-4.079)
Common Law			0.356 * (2.024)	0.415 ** (2.432)
R <sup>2</sup> adjusted	0.467	0.490	0.499	0.532
Number of countries	154	151	149	147

Method: OLS.

Note: (\*\*\*),(\*\*) y (\*) : significant variable at 99, 95 and 90 percent, respectively.

The second factor to consider is economic openness, proxied through the average share of exports and imports on GDP in the five-year period 2000-04, expressed in logarithms. International integration may be conditioned by diverse factors: firstly, in a positive sense, by GDP per capita, since it is plausible that countries with higher income may trade more; secondly, negatively, by the size of a country – measured by the logarithm of the population - since this factor affects the measurement of trade openness; thirdly, in a positive sense, by the historical potential of the markets in the

region where the country is located. The approach adopted is not very different from a gravity model of trade (Frankel and Romer, 1999). Finally, in order to fulfil the equation (2), it is worth finding out whether institutional quality or human capital also influences the level of trade openness.

Of all factors proposed, the “potential of the regional market” requires an explanation. If a country has been historically surrounded by prosperous and populated markets, it is likely that it shows a higher share of trade in its GDP. In order to identify this factor a new variable was created. First, an estimation of the “potential of the national market” of each country was made, considering the population of urban nuclei (with more than 30,000 inhabitants) within the country and the distance between the capital and each one of those. Second, the potential of the regional market of each country comes from the weighted sum of the size of the potential of national markets of all those countries together whose capitals are located within a maximum radius of 3,000 kilometres. The weighting factor was the average per capita income of each country in the reference year (more details in on-line Annex II).

The OLS estimation confirms the role which income, population size and the potential of the regional market play in the explanation of trade openness. However, the potential presence of a two-way relationship between trade openness and income level makes it necessary to use TSLS with instrumental variables. In Table 2 (column 1) income per capita is instrumented by GDP per capita in 1900 and those geographical variables which appear associated with income level in Table 1 (latitude and landlocked). Again, the estimation confirms the relationships assumed above and verifies the relevance of the selected instruments. In particular, the instruments pass the test of exogeneity and both the possible under-identification of the model as well as the test of the presence of weak instruments is rejected.

It would be plausible to assume that trade openness may be conditioned by institutional quality or by the level of human capital (estimated through the indicator constructed by Barro and Lee, 2000). Given the high co-linearity between income per capita and institutional quality or human capital, the estimation had to be independently carried out<sup>8</sup>. In column (2) institutional quality is instrumented through ethnic fragmentation, latitude and the origin of *common law* of the legal system. The estimation confirms the relationships although the explanatory capacity of the model is significantly lower than the one which per capita income contributes. In column (3) human capital is considered as an explanatory variable. In this case, although the variable has the correct sign, it barely reaches significance; and the variable ceases to be significant when it is combined with institutional quality or GDP per capital.

**TABLE 2: ESTIMATION OF TRADE OPENNESS**

	Trade openness (z stat)	Trade openness (z stat)	Trade openness (z stat)
	(1)	(2)	(3)

Per capita income (ly06)	0.074 ** (2.07)		
Governance Index (ig)		0.126 ** (2.24)	
Years of education (lmae)			0.185 (1.76)
Population (lp)	-0.185 *** (-9.36)	-0.147 *** (-7.03)	-0.217 *** (-6.12)
Regional market (1900) (lcry)	0.100 *** (3.26)		
Europe and Central Asia (eco)		0.309 *** (4.31)	
Eastern Asia (ao)	0.623 *** (3.44)		
Adjusted R <sup>2</sup> Centred R2	0.456	0.339	0.330
Overidentification Sargan test (p-value)	$\chi^2(2)= 2.245 (0.325)$	$\chi^2(2)= 3.522 (0.17)$	$\chi^2(3)= 2.91 (2.91)$
Underidentification Anderson test (p-value)	$\chi^2(3)= 79.50 (0.000)$	$\chi^2(3)= 78.56 (0.000)$	$\chi^2(4)= 63.06 (0.000)$
Weak Instrum. Cragg-Donald (critical value)	57.504 (10%= 22.30)	52.06 (10%= 22.30)	60.90 (10%=24.58)
Shea partial R2 (partial R2)	0.562 (0.562)	0.520 (0.520)	0.759 (0.759)
N° of countries	141	157	92

Column (1) Instrumented variable: ly06; excluded instrument: ly1900, nsea lat

Column (2) Instrumented variable: ig; excluded instrument: lfetn, lat, legor\_uk

Column (3) Instrumented variable: lmae; excluded instrument: lfetn, lat, legor\_uk

Note: (\*\*\*),(\*\*) y (\*): significant variable at 99, 95 and 90 percent, respectively.

The third factor to consider is institutional quality (equation 3). Among the indicators of institutional quality, the World Bank Governance Indicators average (GIs) seems the best, not only for its greater accuracy, but also for its wider geographical coverage<sup>9</sup>. However, other indicators have also been employed to test the results obtained. As in Alonso and Garcimartín (2010), it will be assumed that institutional quality depends, firstly, on the income level per capita of the country (in a positive sense): in the end, the higher the income level, the greater the demand for good institutions and also the greater the supply of inputs required to generate it. Secondly, it depends (in a negative sense) on the levels of income inequality, which limit the extent to which agents are prepared to undertake cooperative action and reduce the legitimacy of the institutional framework (Alesina and Perotti, 1996; Easterly, 2001; or Easterly et al. 2006)). Inequality is estimated through the Gini Index. Thirdly, the quality of institutions may also depend on the nature of the relationship between citizens and the state: if there is a

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3 sound taxation system, there will be a more demanding relationship between citizens  
4 and State (Moore, 1998). That is why in cases where the State is financed through  
5 alternative resources to taxes the quality of the institutions will be poorer, as the  
6 literature on “resource curse” has demonstrated (Ross, 1999 or Dietsche, 2007). Finally,  
7 it would also be plausible to suppose that the level of openness of an economy (Rigobon  
8 and Rodrik, 2004; Wei, 2000; or Islam and Montenegro, 2002) and the level of human  
9 capital (Glaeser and Sacks, 2006 or Evans and Rauch, 2000) may play a role in the  
10 quality of the institutions (as suggested by equation 3).  
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14 Several of the explanatory variables mentioned may have an endogenous relationship  
15 with institutional quality, in defining adequate instruments and estimating relationships  
16 through TSLS. As we have seen, per capita income can be instrumented through per  
17 capita income in 1900, and through the geographical variables related to income level  
18 (latitude and landlocked); trade openness, through income level in 1900, the size of the  
19 country (estimated by the population’s logarithm) and the potential of the regional  
20 market; and the educational level, by the level of delayed income and ethnic  
21 fragmentation.  
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23  
24 It is also plausible to consider the Gini Index as endogenous. The variable resists a  
25 simple specification and proves highly susceptible to regional particularities.  
26 Nevertheless, the most general estimation suggests a non-linear relation, as Kuznets  
27 proposed: inequality grows in the initial phases of development and tends to correct  
28 itself once a certain level of per capita income has been exceeded. So, if the variable is  
29 considered as endogenous, it can be instrumented by per capita income of 1900, that  
30 same variable in the square and a regional dummy with reference to Latin America  
31 which has a specific performance in this sphere. Alternatively, the variable was also  
32 considered as exogenous.  
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35  
36 Table 3 presents the results of this estimation, confirming the relationships which were  
37 assumed. Institutional quality is negatively affected by inequality, both when the  
38 variable is considered exogenous (columns 1 and 2), as well as when it is considered  
39 endogenous (columns 3 and 4). The possibility of obtaining resources outside the tax  
40 system (estimated through the proportion of oil in exports) also negatively affects  
41 institutional quality. Trade openness, as has been suggested, seems to be positively  
42 related to institutional quality, while people’s educational level does not prove  
43 significant. Lastly, it should also be highlighted that other factors tackled by literature in  
44 this field, such as the legal tradition or the colonial origin, do not prove significant in  
45 this estimation once the other variables (particularly income level) have been  
46 incorporated (a result that refutes the arguments of Mahoney, 2003, and Lange et al.  
47 2006 about the legacy of colonialism). Instruments passed all the tests (under and  
48 overidentification and weakness).  
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54 **TABLE 3: ESTIMATION OF INSTITUTIONAL QUALITY**

Variables	Governance Index (z stat) (1)	Governance Index (z stat) (2)	Governance Index (z stat) (3)	Governance Index (z stat) (4)
Per capita income (ly06)	0.769 ***	0.713 ***	0.591 ***	0.547 ***



	(14.59)	(11.76)	(7.76)	(7.25)
Trade openness (ltr)		0.452 ** (2.28)		0.611 *** (3.00)
Oil exports (lfuel)	-0.098 *** (-3.87)	-0.084 *** (-2.90)	-0.127 *** (-3.76)	-0.079 ** (-2.50)
Inequality (lgini)	-0.387 * (-1.78)	-0.445 ** (-2.09)	-2.504 *** (-5.56)	-1.550 *** (-3.78)
Common Law (legor_uk)	0.136 (1.08)	0.082 (0.63)		
Eastern Asia (ao)		-0.505 ** (-2.28)		-0.740 *** (-4.64)
Europe and Central Asia (eco)	-0.432 *** (-3.55)	-0.669 *** (-4.17)	-1.119 *** (-6.88)	-0.996 *** (-5.55)
Centered R2	0.682	0.681	0.633	0.639
Overident. Sargan test (p-value)	$\chi^2(2)= 1.24 (0.535)$	$\chi^2(2)= 0.72 (0.697)$	$\chi^2(3)= 4.84 (0.183)$	$\chi^2(3)= 5.04 (0.168)$
Underident Anderson test (p-value)	$\chi^2(3)= 68.14 (0.000)$	$\chi^2(3)= 39.9 (0.000)$	$\chi^2(4)=30.84(0.000)$	$\chi^2(4)=29.45(0.000)$
Weak Instrum. Cragg-Donald (critical value)	63.06 (10% = 22.30)	14.81 (15% = 9.93)	8.15 (20% = 5.35)	6.22 (20% = 5.35)
Shea partial R2 (partial R2)	ly06: 0.668 (0.668)	ly06: 0.612 (0.670) ltr: 0.395 (0.432)	ly06: 0.548 (0.749) lgini: 0.309 (0.422)	ly06: 0.501 (0.751) lgini: 0.303 (0.426) ltr: 0.386 (0.422)
Number of countries	102	102	102	102

Column (1) Instrumented variable: ly06; excluded instrument: ly1900, lat, nsea

Column (2) Instrumented variable: ly06, ltr; excluded instrument: ly1900, lat, nsea, lp

Column (3) Instrumented variable: ly06, lgini; excluded instrument: ly1900, ly1900qua, lat, nsea, al

Column (4) Instrumented variable: ly06, ltr, lgini; excluded instrument: ly1900, ly1900qua, lat, nsea, lp, al

Nota: (\*\*\*),(\*\*) y (\*): significant variable at 99, 95 y 90 per cent, respectively.

Lastly, the fourth variable considered is human capital (equation 4), estimated by the average number of years of education (Barro and Lee, 2000). Initially, it is supposed that the level of human capital might be conditioned by the per capita level of the society: the higher the income, the higher the resources there will be to finance the educational system and the higher the demand for trained workers. It is also possible that good institutions are more concerned about promoting public goods like education. In both cases, it can be supposed that it is a two-way relationship (as Glaeser et al. 2004 assume). This is why it is necessary to carry out the estimation through TSLS. We instrument income per capita and institutional quality for the same variables as in equations (2) and (3)

The estimation confirms that per capita income is a solid explanatory variable for human capital (columns 1 and 2 of table 4). This result is enough to confirm the

endogeneity of the variable in equation (1). Nevertheless, institutional quality is not significant. That result could be due to the high level of correlation between income level and institutional quality. In fact, if the income variable is removed, institutional quality becomes significant. The incorporation of trade openness into these equations does not produce significant results.

**TABLE 4: ESTIMATION OF HUMAN CAPITAL**

Variables	Average years of education (1)	Average years of education (2)
Per capita income (ly06)	0.391 *** (3.97)	
Governance index (ig)	0.013 (0.12)	0.490 *** (9.63)
Europe and Central Asia (eco)	0.349 *** (5.65)	0.397 *** (5.23)
Centred R2	0.590	0.443
Overidentification Sargan test (p-value)	$\chi^2(3) = 0.196 (0.906)$	$\chi^2(1) = 0.079 (0.77)$
Underidentification Anderson test (p-value)	$\chi^2(4) = 40.16 (0.000)$	$\chi^2(2) = 63.21 (0.000)$
Weak Instruments Cragg-Donald (critical value)	17.10 (10% = 16.87)	94.43 (10% = 19.93)
Shea partial R2 (partial R2)	ly06: 0.479 (0.706) ig: 0.462 (0.680)	Ig: 0.679 (0.679)
Number of countries	88	93

Column (1) Instrumented variable: ly06, ig; excluded instrument: ly1900, ly1900qua, lftn, as

Column (2) Instrumented variable: ig; excluded instrument: ly1900, lftn

Note: (\*\*\*), (\*\*) y (\*): significant variable at 99, 95 and 90 percent, respectively.

## 5.2. SECOND STEP: FACTORS DETERMINING DEVELOPMENT

After the analysis carried out, it is possible to test the weight which the four factors (geography, institutions, trade and education) have on the processes of development. Three of the factors are endogenous (institutions, trade and human capital); geography can, by contrast, be considered exogenous. The previous steps have allowed us to identify the suitable instruments for the endogenous variables. The results of the estimation are presented on Table 5.

In accordance with the estimations, institutional quality seems to be the main determinant of long-term growth: it appears as significant and with the expected sign in all the estimates. This reinforces the interpretation of Rodrik et al. (2004) and those suggested by AJR y ES. As in the study by Rodrik et al. (2004), the variable referring to

trade integration does not prove significant in any of the tests, although they all present an adequate sign (which does not happen in Rodrik et al., 2004). Nevertheless, trade openness has an indirect influence on the level of development through its effect on institutional quality. Of all the geographical variables mentioned, it is the landlocked one that proves significant, with a negative sign, as might have been expected. The significance of the distance to the tropics is cancelled out once a dummy reference to Sub-Saharan Africa is incorporated.

Ethnic fragmentation, which influences institutional quality negatively, and the size of the regional markets in 1900, which operates through open trade, both work with the adequate sign in the estimation of the variable. In terms of regional particularities, both southern Asia as well as Sub-Saharan Africa present development results that are lower than the model assigns them. It is interesting to note that the origin of legal systems or the colonial background of the countries (only the former on the Table) are not significant.

**TABLE 5: FACTORS DETERMINING DEVELOPMENT**

	(1)	(2)	(3)	(4)	(5)
Governance index (ig)	0.857 *** (9.57)	0.852 *** (10.09)	0.852 *** (9.15)	0.766*** (10.85)	0.727 *** (5.92)
Trade openness (ltr)	-0.019 (-0.09)	0.207 (1.04)	0,221 (1,18)	0.066 (0.40)	0.075 (0.41)
Years of education (lmae)					0.535 * (1.96)
Landlocked (nsea)	-0.413 *** (-3.21)	-0,245 ** (-2.16)	-0,232 ** (-2,06)	-0.300*** (2.69)	-0.350*** (-2.74)
Latitude (lat)	1.704 *** (3.39)	0.088 (0.19)	0.108 (0.23)		
Common Law (legor_uk)			0,002 (0,02)	-0.073 (-0.60)	-0.709 (-0.56)
Sub-Saharan Africa		-0.944 *** (-6.79)	-0,962 *** (-6.57)	-0,819 *** (-4.42)	-0.683 *** (-3.35)
Centered R2	0,666	0,755	0,758	0,877	0,871
Overid Sargan test (p-value)	$\chi^2(1)= 2.62 (0.105)$	$\chi^2(2)= 0.67 (0.714)$	$\chi^2(2)= 0.69 (0.705)$	$\chi^2(3)= 3.81 (0.281)$	$\chi^2(3)= 3.70 (0.294)$
Underid Anderson test (p-value)	$\chi^2(2)= 48.54 (0.000)$	$\chi^2(3)= 48.59 (0.000)$	$\chi^2(3)= 46.87 (0.000)$	$\chi^2(4)=36.93 (0.000)$	$\chi^2(4)=21.94 (0.000)$
Weak Inst. Cragg-Donald (critical value)	23.63 (10% = 13.43)	17.48 (10% = 16.87)	16.48 (10% = 16.87)	11.52 (15% = 11.22)	4.46 (30% = 4.40)
Shea partial R2 (partial R2)	ig: 0.410 (0.417) ltr: 0.352 (0.358)	ig: 0.413 (0.419) ltr: 0.352 (0.357)	ig: 0.416 (0.429) ltr: 0.352 (0.363)	ig: 0.589 (0.623) ltr: 0.445 (0.471)	ig: 0.375 (0.773) ltr: 0.464 (0.495) Lmae: 0.303 (0.619)

Number of countries	141	141	141	85	76
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Instrumented variable:  $ig\ y\ ltr$ ; Included instrument:  $nsea, lat, as$ ; excluded instrument:  $ly1900, ly1900qua, lp, lcry$

Note: (\*\*\*) , (\*\*) y (\*) : significant variable at 99, 95 and 90 percent, respectively.

### 5.3. ANALYSIS OF ROBUSTNESS

Given the shortcomings of the institutional quality index, it seems reasonable to try to repeat the model using alternative indicators. In particular, firstly, the estimate was repeated using each one of the six components of the World Bank's Governance index as expressive variables for institutional quality (Table A.1., in the on-line Annex I). In order to make the comparison easier the structure of the selected instruments in table 5 was maintained. The results confirm the central role of institutions in explaining development. In the same way, education is significant in all estimations; and trade openness, although with adequate sign, does not prove significant in any case. With a single exception (Regulation component), landlocked factors seem a significant obstacle to promoting development; and the anomalous performance of Sub-Saharan Africa is confirmed.

Secondly, to confirm the results, the model was repeated substituting the Governance Index (and its components) for other alternative indicators of institutional quality. More precisely, the Institutions component of the Global Competitiveness Indicator (CGI) was used, as were the Objective Governance Indicators (OGI), the Corruption Perception Index (CPI) and Doing Business (through the ranking it creates). The results confirm those of the previous pages. Institutional quality is the only variable that is significant in the explanation of development, whichever indicator is adopted. Trade openness does not prove significant in any of the options; and the educational level is significant in two (CPI and GCI) (Table A2, in the on-line Annex I).

Lastly, an alternative means of checking the robustness of the results is to repeat the exercise with the strongest quality indicator (IG) but on sub-samples of the countries. The equation was estimated for two alternative groups: i) the poorest countries, those which make up the groups of middle-low and low income; and ii) the European former colonies. The results generally confirm those previously obtained: institutions seem to be a highly significant variable in both cases, trade openness only in the case of the colonies and educational level in those middle-low and low-income countries (Table A3 in the on-line Annex I). Sub-Saharan Africa tends to present a lower income level to that which would correspond to its relationship in the model.

### 6.- Final considerations

The empirical analysis shows some interesting results. Firstly, geography and institutions powerfully influence the developmental possibilities of countries. It is not

necessary to consider them as an alternative explanation. Out of all the geographical conditioners, the most relevant one is that related to the absence of direct sea access. Latitude and other geographical characteristics disappear as direct variables in the explanation when other exogenous variables are incorporated. Secondly, whichever indicator is adopted, the quality of the institutions seems to condition countries' levels of development. Nevertheless, institutional quality does not seem to be conditioned by those historical factors to which other studies allude (models of colonisation or the legal origin, for instance), but rather by the level of development, the degree of inequality and, in some cases, by the non-fiscal nature of the main resources of the State. By contrast with the former factors, the later ones are more malleable by collective action. Thirdly, the educational level of the population seems to influence developmental possibilities but that relationship is weaker, depending on the indicators which are used to measure institutional quality and the group of countries chosen for the estimation. Fourthly, the possible presence of a network of urban nuclei in the close region seems to have affected the possibilities for countries' international integration. That said, the model is incapable of confirming a robust effect of this variable (trade openness) on the level of development. Lastly, the model shows that Sub-Saharan Africa is an exception since its degree of development is lower than the level which the rest of the variables assign it.

The results of the empirical exercise confirm the hypotheses with which we started out. However, it is worth tempering optimism by recalling the warning which Bardhan (2005; 6) once made about this type of econometric procedure: "finding an instrument that identifies an exogenous source of variation in the income determinants is quite different from unearthing an adequate and satisfactory causal explanation".

Beyond the overall picture which the results present, crucial questions remain about how each country took advantage of the factors which were considered here. For example, what did Australia do to overcome its limited access to regional markets and, by contrast, why did Morocco not take advantage of its relative advantage in this respect; or why did Bostwana overcome its high level of inequality and Guatemala didn't? These are questions which call into doubt meta-historical constructions which propose the identification of a single and universal reason for economic backwardness and, by contrast, they underline the need to study the particularities of each case: a task which should go hand-in-hand with a deeper and imaginative historical study.

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<sup>1</sup> A good survey of this literature may be found in Nunn (2009)

<sup>2</sup> A debate about methodological issues in relation to natural experiments can be found in the Afterword of Diamond and Robinson (2010).

<sup>3</sup> The reference to Latin America seems particularly pertinent since it is frequently used by the institutionalist approach (Engerman and Sokoloff, 1997; Coatsworth, 1993); North et al., 2000; or Acemoglu et al. 2002, 2005).

<sup>4</sup> In fact, historical analysis shows that a high level of inequality seems to be a consequence of market mechanisms rather than a conditioner. For example, Latin American countries show an increase in the level of inequality in the last quarter of the 19<sup>th</sup> century, jut when the region started to integrate more in international markets (Williamson, 1999; Bertola, 2005; and Bertola et al. 2009).

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5 <sup>5</sup> An interesting exam of the relationship between democracy and income based on the trajectory followed  
6 by countries through time can be found in Goldstone and Kocornik-Mina (2005).

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8 <sup>6</sup> However, it should be highlighted that in Rodrik et al. (2002) this variable is not significant in the  
9 estimation and even appears with a negative sign.

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11 <sup>7</sup> It is worth pointing out that the estimates in this prior step are not designed to create structural models of  
12 the selected variables, but rather to confirm the assumed endogeneity and to identify those variables  
13 which can be used as instruments.

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15 <sup>8</sup> Additionally, the variables of institutional quality and educational levels appear as significant (and with  
16 the sign changed) when incorporated along with income in the explanation of the degree of openness. The  
17 results of these estimates can be requested to the author.

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19 <sup>9</sup> See Kaufman et al. (2006) for a methodological description of the Governance Indicators. For a  
20 discussion of their shortcomings, see Arndt and Oman (2006)

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# Colonisation, institutions, and development: new evidence: Appendix

## ANNEX I: ANALYSIS OF ROBUSTNESS

**TABLE A.1: FACTORS DETERMINING DEVELOPMENT WITH INSTITUTIONAL QUALITY MEASURED BY THE COMPONENTS OF THE GOVERNANCE INDEX**

Componet of Governance Index	(1) (Voice)	(2) (Stability)	(3) (Effectiveness)	(4) (Regulation)	(5) (Rule)	(6) (Corruption)
Governance Index	0.698 *** (4.78)	0.481 *** (3.09)	0.599 (5.20)	0.726 *** (5.09)	0.600 *** (5,29)	0.516 *** (4.60)
Openness of trade (ltr)	0.366 ** (2.05)	0.029 (0.16)	0,131 (0.80)	0,046 (0.26)	0.095 (0.45)	0.038 (0.70)
Educational level (lmae)	0.601 * (2.00)	1.084 *** (3.16)	0.664 ** (2.49)	0.640 * (2.07)	0.707 ** (2.68)	0.816 *** (2.93)
Absence of direct sea access (nsea)	-0.431 *** (-2.89)	-0,420 ** (-2.38)	-0,349 (-2.55)	-0,214 ** (-1.37)	-0.375 ** (2,73)	-0.450*** (-2.97)
Sub-Saharan Africa	-0.709 *** (-3.47)	-0.756 *** (-3.10)	-0,596 *** (-3.45)	-0.588 *** (-2.83)	-0.569 *** (-3.00)	-0.573 *** (-3.20)
Centred R2	0,816	0,796	0,873	0,832	0,852	0,843
Overid Sargan test (p-value)	$\chi^2(4)= 2.62$ (0.105)	$\chi^2(3)= 7.97$ (0.04)	$\chi^2(3)= 0.36$ (0.947)	$\chi^2(3)= 0.92$ (0.819)	$\chi^2(3)= 2.03$ (0.566)	$\chi^2(3)= 0.197$ (0.978)
Underid Anderson test (p-value)	$\chi^2(5)=48.54$ (0.000)	$\chi^2(4)=17.96$ (0.001)	$\chi^2(4)=20.012(0.000)$	$\chi^2(4)=17.56$ (0.000)	$\chi^2(4)=27.05$ (0.000)	$\chi^2(4)=25.13$ (0.000)
Weak Inst. Cragg-Donald (critical value)	23.63 (10% = 13.43)	17.48 (10% = 16.87)	3.98 (30% = 4.40)	3.35 (30% = 4.4)	6.08 (20% = 5.35)	5.49 (30% = 4.40)
Shea partial R2 (partial R2)	voice: 0.200 (0.664) ltr: 0.458 (0.513) lmae: 0.180 (0.646)	stab: 0.272 (0.614) ltr: 0.442 (0.513) lmae: 0.295 (0.644)	efect:0.355(0.779) ltr: 0.476 (0.513) lmae: 0.283 (0.644)	ig: 0.281 (0.684) ltr: 0.469 (0.513) lmae: 0.261 (0.644)	rule: 0.442 (0.739) ltr: 0.468 (0.495) lmae: 0.371(0.619)	corrup: 0.424 (0.807) ltr: 0.455 (0.513) Lmae: 0.342 (0.644)
Number of countries	77	77	77	77	77	76

Instrumented variables: institutional quality indicator, ltr, lmae; excluded instrument: ly1900, ly1900qua, lp, lfetn lmae60 al ecco

**TABLE A.2.: FACTORS DETERMINING DEVELOPMENT WITH INSTITUTIONAL QUALITY MEASURED BY ALTERNATIVE INDICATORS**

	(1) (OGI)	(2) CPI	(3) GCI (Institut)	(4) DB
Governance indicator (ig)	1.939 *** (5.23)	0.239 *** (4.98)	0.570 *** (3.52)	-0.022 *** (-4.62)
Openness of trade (ltr)	0.007 (0.03)	0.090 (0.39)	0.148 (0.57)	-0,050 (-0.21)
Educational level (lmae)	-0.055 (-0.12)	0.842 *** (2.93)	1.005 ** (2.53)	-0.137 (-0.33)
Absence of direct sea access (nsea)	0.148 (0.46)	-0,468 ** (-2.79)	-0.448 ** (-2.12)	-0,165 (-0.93)
Sub-Saharan Africa	-0.344 (-1.14)	-0.549 ** (-2.66)	-0.398 (-1.59)	-0.719 *** (-3.16)
Centred R2	0,679	0,813	0,705	0,739
Overid Sargan test (p-value)	$\chi^2(3)=0.49$ (0.920)	$\chi^2(3)=2.17$ (0.53)	$\chi^2(3)= 1.25$ (0.739)	$\chi^2(3)= 0.37$ (0.94)
Underid Anderson test (p-value)	$\chi^2(4)=9.34$ (0.052)	$\chi^2(4)=32.89$ (0.000)	$\chi^2(4)=27.64$ (0.000)	$\chi^2(4)=14.45$ (0.006)
Weak Inst. Cragg-Donald (critical value)	1.57 (30% = 4.40)	8.59 (10% = 7.77)	6.97 (20% = 5.35)	2.26 (30% = 4.40)
Shea partial R2 (partial R2)	ogi: 0.137 (0.513) ltr: 0.456 (0.517) lmae: 0.183 (0.640)	cpi: 0.551 (0.803) ltr: 0.474 (0.517) lmae: 0.447 (0.640)	gci: 0.507 (0.659) ltr: 0.554 (0.556) lmae: 0.473 (0.626)	ig: 0.207 (0.619) ltr: 0.414 (0.474) lmae: 0.224 (0.649)
Number of countries	75	75	64	75

Instrumented variables: institutional quality indicator, ltr, lmae; excluded instrument: ly1900, ly1900qua, lp, lfetn lmae60 al eco

**TABLE A.3: FACTORS DETERMINING DEVELOPMENT IN TWO GROUPS OF DEVELOPING COUNTRIES**

Sample	Medium-low and low income countries (1)	Former colonies (2)
Institutional quality (ig)	0.844 *** (4.14)	0.839 *** (3.69)
Openness (ltr)	0.098 (0.31)	0.491 ** (2.14)
Educational level (lmae)	0.396 * (1.85)	0.257 (0.97)
Absence of direct sea access (nsea)	-0.234 (-1.45)	-0.442 ** (-2.24)
Sub-Saharan Africa	- 0.700 ***	- 0.920 ***

	(-4.48)	(-4.53)
Centered R2	0.800	0.813
Overidentification Sargan test (p-value)	$\chi^2(2)= 0.783 (0.676)$	$\chi^2(2)= 0.708 (0.701)$
Underidentification Anderson test (p-value)	$\chi^2(3)= 10.46 (0.015)$	$\chi^2(3)= 14.33 (0.002)$
Weak Instruments Cragg-Donald (critical value)	2.294 (30% = 4.30)	3.405 (30% = 4.30)
Shea partial R2 (partial R2)	ig: 0.427 (0.527) ltr: 0.313 (0.373) lmae: 0.469 (0.610)	ig: 0.332 (0.620) ltr: 0.505 (0.507) lmae: 0.366 (0.689)
Number of countries	36	48

Instrumented variable: ig, ltr, lmae; Included instrument: nsea, as; excluded instrument: ly1900, lp, lfetn, lat, lmae60

Note: (\*\*\*),(\*\*) y (\*): significant variable at 99, 95 and 90 percent, respectively.

## ANNEX II: DATA SOURCES AND DESCRIPTION OF VARIABLES

*Institutional Quality*: 2006 World Bank Governance Indicators

*Per capita Income*: per capita GDP (PPP) 2006 and 1900. Source: Maddison

*Gini Index*: Latest year available. Source: World Bank.

*Education*: Average years of school for the population aged over 25 years. Source: Barro and Lee (2000)

*Taxes on GDP*: The main source of homogeneous information on tax revenue is provided by the IMF through Government Finance Statistics, which, in turn, is used by the World Bank in World Development Indicators. However, both sources face two serious problems. On the one hand, the series are incomplete for many developing countries. On the other, data usually refer to central governments, which is inaccurate information in highly decentralised countries. Therefore, to overcome these problems several sources have been used. For Latin America, Gomez Sabaini (2005) has been employed, except for Venezuela, where data is taken from the World Bank. For the OECD countries, we used the data provided by this organisation. For the rest of countries, two sources have been used. Firstly, the World Bank in countries for which data is available and reliable. The WB provides data on income tax excluding social security. It also provides separate data for the latter. We have, therefore, added the two together. The University of Michigan World Tax Database is the second source used in countries for which the WB has no data (<http://www.bus.umich.edu/OTPR/otpr/>) or where it is not reliable. The usual data year is 2000. In some cases, data was not available for that year, and we selected the closest year available, with a maximum difference of three years (see Garcimartin et al., 2006).

*Openness rate*: exports plus imports as a percentage of GDP (2000-4 average). Source: World Bank

*Ethnic Fragmentation*: Source: Alesina et al. (2003)

*Population*: 2004. Source: World Bank

*Oil exports*: Percentage of fuel exports out of total exports. 2004. Source: World Bank

*Geographic location*: Latitude in absolute value of each country's capital, divided by 90. Source: Central Intelligence Agency, The World Factbook 2007

*Common Law*: Origin of the legal system. Source: La Porta (1999) website of Quality of Government.

*Colonial Origin*: own elaboration based on Bertocchi and Canova (2002)

*Potential of regional market*: First, an estimation of the "potential of the national market" of each country was made, considering the population of urban nuclei (with more than 30,000 inhabitants) within the country and the distance between the capital and each one of those, on the assumption that main markets are concentrated in the cities. In other words, in the same way that with gravitation models the indicator of



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4 market potential is  $\sum L_n \frac{P_i P_j}{L_{ij}}$ , where P stands for population, i and j for urban nuclei  
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7 with that minimum population threshold and L stands for the distance between both.  
8 Population data refers to the period 1890-1900, based on data by Jan Lahmeyer  
9 (<http://www.populstat.info/>) In cases where no city was that size, the capital and the  
10 second largest city were considered. Therefore, the more urbanised a country was and  
11 the smaller the distance between the urban nuclei, the larger the effective size of the  
12 domestic market. The size of the regional market (which is the one which is  
13 incorporated into the estimate) comes from the weighted sum of the size of the potential  
14 of national markets of all those countries together, the capitals of which are located  
15 within a maximum radius of 3,000 kilometres from the capital of the country  
16 considered. The weighting factor was the per capita income of each country in the  
17 reference year, based on Maddison data.  
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