Institutions, Geography and Trade: A Panel Data Study[1]

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ABSTRACT

A number of recent papers study the impact of institutions, trade and geography known as "deep determinants" of economic development using cross-section data. This paper instead employs a panel data approach to examine the impact of these three determinants on per capita income. Our approach enables us to account for unobserved heterogeneity across countries, an issue that cannot be addressed in a cross-section framework. Moreover, employing the Hausman and Taylor (1981) approach allows us to obtain direct parameter estimates of the time invariant explanatory variables like geography or some institutional measures, making our results comparable to the existing cross-section literature. Also, by using lagged explanatory variables whenever possible we can account for contemporaneous correlation between these variables and the idiosyncratic error term. We find that the quality of institutions and openness to trade both have positive and statistically significant coefficient estimates throughout most specifications, while geography, captured by malaria ecology measure, has negative estimates that are often, but not always statistically significant. In terms of their economic impact, institutional measures appear to have the strongest impact, followed by openness to trade measures. In comparison, geography measures have rather small elasticity estimates.

***JEL*:** O1, N1, H1, F1

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I. Introduction

A cursory look at the national income data suggests that the income gap between the rich and the poor nations of the world has been widening. According to data from the Penn World Tables Mark 6.1 (Heston et al., 2002), the per capita GDP of Sierra Leone in 1961 was 9% of that of the United States. By 2000, it had fallen to 2% of the U.S. level. This trend is true for many less developed countries. And while the United States remains one of the highest per capita income countries in the world, a few countries were able to pull ahead of the United States. Luxemburg's per capita income in 1961 was almost the same as that of U.S., but it exceeded it by about 37% in 2000. The persistence of large disparities in income levels between rich and poor countries is a matter of concern for both developing and developed countries, and the issue of what determinants matter most for development has been at the core of a large number of studies in the growth and development literature.

Since this literature is too extensive to be adequately reviewed here, we focus instead on some of the more recent contributions. For the last 10 years or so, attention has shifted to the study of the "deeper" determinants of economic development as coined by Rodrik et al. (2004). According to this approach, factors which affect economic development can be classified into two tiers. While inputs in the production function such as labor, physical and human capital directly affect income and thus economic development, they are themselves determined by deeper and more fundamental factors. And although it remains an open question what exactly constitutes a "deeper" determinant of development, three broad categories have emerged in the literature: geography, institutions, and international trade (integration).[2]

Geographical factors typically characterize the physical location of a nation such as distance from the equator, access to sea, agro-climatic zone, disease environment, soil type, and natural resources. Geography may matter for development through its impact on transaction costs. For example, a country's size, access to sea and topography can crucially affect transport costs and the extent of its integration with the world market. Latitude and climate are also related to disease environment which directly impacts labor productivity and life expectancy, among others. Geography can also impact economic development through institutions. Climate and soil affect the types of crops planted. This, along with the availability of natural resources, can dictate whether the early institutions were extractive or productive. In fact, some

[2] Easterly and Levine (2003) provide a good overview of studies analyzing the three determinants.

authors like Gallup et al. (1999) and, more recently, Sachs (2003) argue that geography is the most important variable of interest for development, even after controlling for the quality of institutions.

The importance of institutions was emphasized in the work of Douglas North (1993, 1994a, b, c). The motivation to consider institutions can be linked to the inability of the neo-classical theory to explain widespread differences in economic performances across countries. If only factor accumulation led to progress, then all countries would do so, provided there was a high-enough payoff involved. Differences in income thus require differences in "payoffs" which is where institutions come in (North, 1994a). Institutions are the rules of game which a society lays down for itself and which determine the incentives people face and thus the choices they make. Another way of looking at institutions is through their impact on transaction costs. Well defined rules and their smooth enforcement, i.e. better institutional quality, greatly reduce transaction costs economic agents face and thus lead to more efficient outcomes (North 1993, 1994b). Hall and Jones (1999) was one of the first empirical studies to examine the impact of institutions on economic development. Unlike geography, however, there is a potential problem with institutions - endogeneity. Hall and Jones use a measure of language fractionalization as an instrumental variable for institutions. The search for appropriate instruments for institutions was pushed further by Acemoglu et al. (2001). They argue that current institutions are manifestations of past institutions which have prevailed over time. Since past institutional quality can be linked to settler mortality, they use that variable as an instrument for current institutions.

The argument for economic integration as a fundamental determinant of development is based on the gains from trade literature. Next to the classic case of comparative advantage gains are more modern approaches that stress the importance of trade in the transfer of new technologies and ideas, which in turn enhance productivity. Moreover, supplying to a larger international market allows higher degrees of specialization and thus entails productivity gains. There are many empirical studies on the link between international trade or integration and economic development. One of the more influential ones is Sachs and Warner (1995) who constructed an index of openness and found that greater openness leads to higher growth. As with institutions, trade variables are likely to be endogenous with regard to income. Frankel and Romer (1999) examine this issue in detail. Their predicted trade share variable is derived from a gravity equation, thus effectively using distance between countries as an instrumental variable. The findings point to a positive link between integration and income.

While there are a large number of empirical studies that investigate the link between a single deep determinant and development, only a few consider all three deep determinant categories at the same time, and those that do work within a cross-section framework. The findings from these cross-section studies point into different directions. While Sachs (2003) argues that it is mostly geography that matters for development, the findings in Rodrik et al. (2004) emphasize institutions as the most important overall determinant.

Our empirical approach differs from the aforementioned studies in that we examine the link between the three deep determinants and development within a panel data framework[3] Using a panel data framework instead of the standard cross-section approach has several advantages. First and foremost, we can control for unobserved, time-invariant cross-country heterogeneity through the use of a fixed-effect (FE) estimator. Inasmuch as the endogeneity of explanatory variables such as institutions and trade has its roots in the omission of time-invariant unobservables (as recently argued in Baier and Bergstrand (2007) for the case of trade), accounting for unobserved cross-sectional heterogeneity allows us to reduce or even eliminate the bias of the parameter estimates of the endogenous variables. Unfortunately, using the FE estimator will cause all time-variant variables such as all geography measures as well as many institutional measures to be excluded from the regression. However, an estimator that is closely related to the FE estimator but allows the estimation of time-invariant covariates is available: the Hausman and Taylor estimator (1981). This is the precisely the estimator we use extensively throughout this paper. Second, a panel data framework permits the use of lagged values of the time-varying explanatory variables to account for any bias caused by the contemporaneous correlation between the endogenous variables and the idiosyncratic error term. On the other hand, using a panel instead of a cross-section approach causes new problems, in particular the need to neutralize the impact of short-term (business cycle) effects on income. To do so, we use ten-year averages for all time-varying variables. Finally, our approach differs from previous studies in terms of variable selection. We strongly believe that ideal measures of deep determinants do not exist, though we find some measures more suitable than others, as discussed later on. We thus use a large variety of measures for institutions, trade, and geography to determine the robustness of our baseline estimates.

[3] The only other panel data framework within the deep determinant literature that we are aware of is Dollar and Kraay (2003). However, while they examine only the impact of trade and institutions on economic growth, we include geography measures as well.

Using data from over 90 countries over the 1961 to 2000 period, we find that institutions and international linkages have a positive and statistically significant impact on economic development, while the adverse impact of geography is typically smaller in magnitude. This result thus provides an interesting as well as encouraging outlook: Determinants that can be influenced by public policies (institutions and trade relations) matter for development and their joint, positive impact may help to overcome any exogenous, geographical disadvantage a developing country may have.

The rest of the paper is organized as follows. Section 2 contains the empirical model and a discussion of the estimation methodology. We describe the data in Section 3 and interpret the estimation results in section 4. Section 5 concludes. Appendix A contains a formal description of the Hausman-Taylor estimator, while Appendix B consists of variable definitions and summary statistics. The estimation results are given in Appendix C.

2. Empirical Model

Following Rodrik et al. (2004), the starting point of our empirical investigation is the following linear cross-section specification:

$$Inc = \theta_1 + \theta_2 Inst + \theta_3 Intg + \theta_4 Geog + \varepsilon \qquad (1)$$

where *Inc* is the log of income per capita and *Inst*, *Intg* and *Geog* are measures of institutions, integration and geography, respectively. Estimation of (1) poses a number of difficulties that need to be addressed. First, institution and integration measures are likely to be endogenous due to measurement error, survey bias, and/or reverse causality[4]. Consequently, appropriate instruments are needed for both measures. Of the various instruments found in the literature, two stand out due to their widespread use: *settler mortality* as an instrument for institutions (see Acemoglu et al., 2001) and predicted trade shares as an instrument for a country's degree of integration (see Frankel and Romer, 1999). Since the exogeneity of the geography measure is indisputable, the first stage regressions for the two endogenous regressors are:

$$Inst = \alpha_1 + \alpha_2 SM + \alpha_3 Geog + \alpha_4 FR + \eta \qquad (2a)$$

[4] See Frankel and Romer (1999), Hall and Jones (1999), Acemoglu et al. (2001), and Baier and Bergstrand (2007).

$$Intg = \beta_1 + \beta_2 FR + \beta_3 SM + \beta_4 Geog + \nu \qquad (2b)$$

where *SM* is log settler mortality (Acemoglu et al., 2001), *FR* is the Frankel-Romer (1999) predicted trade share and *Inst*, *Geog* and *Intg* are as defined above. A shortcoming of the above model is that it assumes that all the three determinants have the same impact for all the countries. In other words, the model ignores unobserved cross-country heterogeneity. Using a panel data approach enables us to exploit the time dimension of the data to account for unobserved country-specific heterogeneity.

A panel data extension of the above model is, however, not completely straightforward since some of the right-hand side variables in Eqs. (1-2) are time invariant. Thus, when using mean- or first-differencing to remove country-specific effects, time invariant covariates would be removed from the estimation equation as well. An alternative approach that allows parameter estimation of time-invariant regressors within the panel data framework is the random effects specification. However, random effects models assume independence between the individual error terms and the explanatory variables, an assumption that is often violated in economic applications, and is not likely to hold in the above model as well.

To circumvent both problems - accounting for unobserved, time invariant country-specific effects and obtaining estimates of the observed time-invariant variables - we use the estimation method proposed by Hausman and Taylor (1981), referred to as HT hereafter. Though the HT approach enables us to account for the potential correlation between the explanatory variables and country-specific time invariant unobservables, there may still be simultaneity between the dependent variable and some of the observed right-hand side variables, in particular certain measures of trade and institutions. To the extent that the explanatory variables are time varying, we account for the existence of contemporaneous endogeneity by using lagged values of these variables whenever possible.

Hausman and Taylor (1981) Estimation

Below we provide a brief non-technical introduction to the HT procedure. A detailed treatment can be found in Appendix A. The HT approach allows for the presence of both time varying and time invariant endogenous regressors, but only to the extent that these regressors are correlated with the individual-specific unobservable term and not with the idiosyncratic disturbance term. A HT model can be represented by the following specification:

$$y_{it} = X_{1it}\beta_1 + X_{2it}\beta_2 + Z_{1i}\lambda_1 + Z_{2i}\lambda_2 + \nu_i + \mu_{it} \tag{3}$$

for i = 1,2…N and t = 1,2….T, where *X* and *Z* are vectors of time-varying and time-invariant variables, respectively, and subscript 1 (2) represents variables independent of (correlated with) the individual specific error term. The HT estimation proceeds in four steps. First, Eq. (3) is estimated using a fixed effect model to obtain consistent estimates of β_1 and β_2. This procedure however will eliminate the time invariant variables (Z_1 and Z_2) from the model. The second step involves obtaining consistent but inefficient estimates of γ_1 and γ_2. This is done by first obtaining the within residuals from the first step and regressing on them the time invariant variables, Z_1 and Z_2 via 2SLS where the individual specific means of X_1 are used as instruments for Z_2. This removes the correlation between Z_2 and ν_i, thereby enabling us to obtain consistent estimates of γ_1 and γ_2. As mentioned before, these estimates are consistent, but not efficient. In the third step we estimate a quasi-differenced version of Eq. (3) using a 2SLS procedure with mean-differenced X's and individual specific means of X_1 and Z_1 as instruments. The quasi-differencing is necessary for the efficiency of the estimates, while 2SLS accounts for the correlation between the endogenous variables and ν_i.

To choose the appropriate estimation technique for the panel data model, we follow the approach suggested in Baltagi et al. (2003). First, we test whether we need to use panel data methods in the first place using the Breuch-Pagan (BP) test for error components. Second, if panel data methods are warranted, we check the exogeneity of *each* time-varying variable by testing whether the variable of interest is correlated with the individual country-specific error term. This is done through a Hausman specification test between random and fixed effect specification. The resulting classification of the time-varying explanatory variables is given in the top half of Table B7[5]. Third, we check the appropriateness of the random effect (RE) versus the fixed effect (FE) estimator of our panel specification using a Hausman test. Finally, we test the HT estimator (Eq. 3) against the winner from the previous step, again using a Hausman test. We report the selected estimation model (HT, RE, or FE) at the bottom of each table (Tables 2-7 in Appendix C).

3. Data

[5] The test results are available from the authors upon request. In Table B7, an X1 behind a time-varying variable indicates that this variable can be considered exogenous, while an X2 indicates endogoneity. There is no equivalent test for the time-invariant covariates listed in the bottom half of Table B7. The classification of these variables into exogenous (Z1) and endogenous (Z2) covariates is based instead on practice in the cross-section literature.

The data set covers the four decades from 1961 to 2000. Time varying variables are averaged over 10 years to smoothen out temporary shocks and business cycle fluctuations common across countries. As a result, the time dimension of the sample is four. The cross-section dimension varies between the various specification of the baseline regression model, ranging from N=65 to N=125.

Economic Development - Our measure of economic development (the dependent variable in all regressions) is the log of per capita GDP, expressed in 1996 international dollars, taken from the Penn World Tables 6.1 (Heston et al., 2002).

Institutions – As briefly mentioned in the introduction, institutions impact an economy in two broad ways. Institutions govern the payoffs which agents receive from economic and social interactions and they also determine the transaction costs of contract enforcement. These two dimensions of institutions can be characterized as "rules of the game" and "organization", respectively (North 1993, 1994a). Institutions as rules of the game govern how humans interact with each other. Naturally, the enforcement of rules is part of the effectiveness of institutions. Rules determine the incentives and hence the choices which people make in interpersonal interactions. They can be formal or informal, like conventions and customs. Institutions as organizations on the other hand affect the players of the game which are groups of people brought together by a common purpose to achieve a common objective. They include political, economic and educational bodies. Organizations maximize their objective functions subject to the constraints and incentives given by the institutions matrix. While we include both types of institutional measures in our empirical analysis, it is at times difficult to clearly differentiate between them.

Institutions as Rules of the Game

Our favorite measure of this aspect of institutions is contract intensive money (CIM) proposed by Clague et al. (1999). It is defined as the ratio of non-currency money to total money in an economy. The basic argument for such a measure stems from the fact that in societies where the property and contract rights are well defined, even transactions which heavily rely on outside enforcement can be advantageous. Currency in this setting is used only in small transactions. Agents are increasingly able to invest their money in financial intermediaries and exploit several economic gains. Clague et al. (1999) also show that CIM is a measure of contracting environment and not of financial development, as one might suspect. Moreover, CIM is more objective than most organization measures which are survey-based and thus suffer from biases and measurement errors.

Institutions as Organizations

Our favorite measure of the quality of public organizations deals with the extent of checks and balances within the government and is obtained from the World Bank's *Data on Political Institutions* database (Beck et al., 2001). The motivation here is that countries with multiple decision makers offer greater protection to individuals and minorities from arbitrary government action (Keefer et al., 2003). This measure counts the number of veto players or decision makers in the government, taking into consideration whether they are independent from each other. Since this measure also takes into account the extent of electoral competition and the electoral rules, it is effectively a measure of both aspects of institutions.

Details on all measures of institutions used in this study can be found in Table B1 in Appendix B.

Trade - We measure the extent of a country's integration into the world economy by its share of trade (exports plus imports) in GDP, a widely used, but not uncontroversial measure of openness. In addition, we employ direct measures of trade policies such as the average import duty imposed by a country. Since foreign currency restrictions imposed by the government can stifle trade, we use the black-market premium as a proxy for the extent of foreign currency restrictions. We also use Sachs and Warner's (1995) openness index (updated and extended by Wacziarg and Welch, 2003). It is an indicator variable based on the years a country is considered open to trade. Specifically, we look at periods of uninterrupted openness. If a country has been open since the 1960's, a score 4 is assigned, if open since the 70's, a score of 3, and so on. An economy which was closed to trade throughout the sample period gets a score of 0. Further details on these and other trade measures are presented in Table B1 in Appendix B.

Geography - A measure of geography recently introduced in the literature is disease environment. Gallup et al. (1999) constructed a malaria index for two years, 1966 and 1994. This measure has been used in a number of studies involving geography and development. However, Sachs (2003) has argued that the traditional malaria index used in the literature is not a good indicator of the disease environment. Instead, he uses a new measure that combines temperature, mosquito abundance and vector specificity. The new measure is called Malaria Ecology (ME). In contrast to the old malaria index, ME is an ecology-based measure that is predictive of malaria risk. We include both, the traditional malaria index and the ME variable in our study. Additional geographical measures used in our empirical analysis include hydrocarbons per capita, a dummy for landlocked countries, and the percentage of land area in the tropics. For details on all geography measures used, see Table B1 in Appendix B.

4. Empirical Results

4.1 Cross-section framework

To contrast our empirical results with the existing literature, we first estimate the cross-section specification used by Rodrik et al. (2004). As in that study, the measure of economic development in the cross-section model is the log of per capita GDP in 1995, measured in international prices. Openness to international trade is measured as average trade shares over 1961-2000[6] (*trade shares*). For institutions, we use the *Rule of Law* indicator as described in the data appendix. The measure of geography used is absolute distance from the equator[7] (*Dist Equator)*. We estimate the model for two sample sizes due to the use of different instruments for institutions. The first instrument – settler mortality – allows for a sample size of 70, while the second one - language fractionalization – permits a sample size of 123. Both instruments are used in Rodrik et al. (2004). Hall and Jones (1999; hereafter HJ) are the first to use language fractionalizations as an instrument for institutions, while Acemoglu et al. (2001; hereafter AJR) introduced settler mortality as an alternative instrumental variable. The instrument for trade is the constructed trade share from Frankel and Romer (1999).

We first report the results for the two samples, denoted by AJR and HJ, assuming that all explanatory variables are exogenous (Panel A of Table 1). While the magnitude of the coefficient estimates are not exactly identical to the ones reported in Rodrik et al. (2004), all signs are the same and levels of significance are similar. Geography and institutions are statistically significant (at the 5% and 1%, respectively) and have the expected positive sign, while trade shares are not statistically significant in both samples.

In Panel B of Table 1, we report the results from the two-stage least square estimation of equations (1)-(2), using instruments for both trade and institutions (see Panel C for the first-stage regressions). For both samples, we find that geography is significant only when it is the sole explanatory variable. When

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[6] The GDP and openness measures are taken from the Penn World Tables, version 6.1 (Heston et al., 2002).
[7] We also used relative distance from the equator but the coefficient estimates and t-statistics turned out to be quite different from those reported by Rodrik et al. *(2004)*.

measures of institutions and trade are added, the estimates for the geography measure change signs and become statistically insignificant (columns 2-3 and 5-6). Similarly, the integration measure, added in columns 3 and 6, is also statistically insignificant and has the wrong sign in both samples. 2SLS coefficient estimates of institutions are almost twice as large as those in Panel A, indicating possible attenuation bias. The results in Panel B are the basis for the claim in Rodrik et al. (2004) that *only institutions* matter for economic development.

In the next subsection, we reexamine the relationship between the three "deep determinants" and per capita income, but this time within a panel data setting.

4.2 Panel Estimations

As explained in section 2, the HT approach to panel data estimation requires the ex-ante identification of those covariates that are correlated with the country-specific time-invariant unobservable characteristics. Among the time-varying regressors, we find that only contract intensive money (*CIM)* and number of veto players (*Veto Players*) are uncorrelated with country-specific effects and thus qualify as an exogenous X1(it) variables (see Table B7 in Appendix B). All other time-varying covariates are treated as endogenous X2(it) variables[8]. Among the time-invariant covariates, we assume that the multi-dimensional measure of the quality of institutions (*Rule of Law)*, the absence of corruption index (*NoCorrupt*), and Sachs and Warner's (1995) openness index (*SW open*) are correlated with country-specific effects and thus considered Z2(i) variables since these variables are typically considered endogenous in the cross-section literature. All other time-invariant covariates (i.e., all geography measures, region dummies, legal origin dummies, and language and religious fractionalization measures) are treated as endogenous Z1(i) variables.

4.2.1 Baseline Specification

Table 2 contains the panel regressions of our benchmark specifications of Eq. (3). The dependent variable in all models is the log of GDP per capita in 1996 international dollars (*ln GDP capita*). In columns 1-4, we use *CIM* as our time-varying measure of institutions. In cols. 5-8 *CIM* is replaced with an alternative measure, *Veto Players*. In the last three columns (9-11), both measures are included in the

[8] The test results for democracy index (*Democracy*) and constraints on the executives (*Constraints on Exec*) were inconclusive. In this case, we decided to treat both variables as X2(it) variables.

estimations. We employ two measures of openness to trade. In columns 1-2 and 5-6, we use the widely used share of exports and imports in GDP (*Trade Share*), while in Cols. 3-4 and 7-8, we use the black market premium (*BMP*) as a proxy for distortions to international trade flows. In Cols. 9-11, both measures are used simultaneously. We employ two measures of geography: *Malaria Ecology* and a malaria incidence measure for the year 1966 (*Malaria Index, 1966*). The latter measure is used in Cols. 3-4 and 7-8, while *Malaria Ecology* is used in all other specifications. Finally, two time-invariant measures of institutions are considered as well. In columns 2, 4, 6, 8 and 10 we use a measure of the absence of corruption (*NoCorrupt)*, while in columns 1, 3, 5, 7 and 9 we use the *Rule of Law*. In the last column (11), both measures are included.

As mentioned in Section 2, we use a series of tests to identify the appropriate estimation approach - pooled OLS, random effects (RE), fixed effects (FE) or Hausman-Taylor (HT) - for each specification of the benchmark model. Based on the corresponding p-values for each test (reported in the middle of Table 2), we select the appropriate estimation procedure as shown in the last row of the table. In most cases, the chosen model is HT. Only in Cols. 4 and 10 RE is preferred. Since the HT model involves carrying out an instrumental variable (IV) regression in step 3 of its estimation procedure (see Appendix A for details), we report the F-values from the first stage of that IV approach as well as the p-values of the overidentification tests from the second stage, when applicable. The F-statistics reported in Table 1 indicate that the instruments all HT specifications are strong and the p-values for both the Basmann and the Sargan test (see footnote to Col. 9) indicate that the exclusion restrictions of the instruments are valid.[9]

The estimation results show that most regressors have point estimates that are statistically significant at the 5% level or higher. In addition, all explanatory variables have the expected sign. In terms of their economic significance, *CIM* and *NoCorrupt* have the strongest impact. The *CIM* elasticity estimates range from 0.392 to 0.711, while the statistically significant *NoCorrupt* elasticities[10] fall into the range from 0.62 to 2.34. The statistically significant *Malaria Index* elasticity estimates range from -0.2 to -0.39, while the similar sized *Trade Share* elasticities range from 0.123 to 0.313. Compared to the *Malaria Index*, the *Malaria Ecology* elasticity estimates are smaller (in absolute values) ranging from –0.08 to –0.2. The average elasticity estimate for *Veto Players* is around 0.07, roughly one-seventh the

[9] Column 9 and 10 are the only specifications in Table 2 where the number of exogenous X1 variables exceeds that of the endogenous Z2 variables, a necessary condition for the use of the overidentification tests. No overid test are reported for col. 10 since RE, not HT, is the preferred model.

[10] All parameter estimates of variables that are not in logs are appropriately adjusted to generate elasticity estimates, with evaluations taken at the mean.

size of the average *CIM* elasticity. *BMP* elasticity estimates are generally small, ranging from –0.03 to –0.06. The other time-invariant measure of institutions, *Rule of Law*, has the lowest elasticity estimates ranging from 0.009 to 0.01 (for statistically significant estimates).

Table 2 yields a number of additional insights. When *CIM* is replaced with *Veto Players*, the point estimates of the trade variables, *Trade Share* and *BMP*, are larger and more significant (see col. 5-8 compared to Cols. 1-4), a result of the relative weaker explanatory power of *Veto Players*. A similar pattern can be observed for the geography measures. Including all time-varying variables simultaneously (Cols. 9-11) does not change the results for the most part. *Malaria Ecology* remains negative but is significant in only one case. The time-invariant measures of institutions when entered one at a time (Cols. 9-10) are significant. However, when both of them are included simultaneously (Col. 11), none of them is statistically significant, while all time-varying trade and institution measures remain statistically significant and display similar magnitudes.

In terms of economic relevance, we find that a 10% increase in *CIM* and the *Trade Share* together will improve per capita income by around 6%, while a 10% increase in Malaria risk would lower income by 2%[11]. Thus, income losses due to unfavorable geographic factors, i.e. a rise in a country's exposure to malaria risk, can be more than offset by an equi-proportionate improvement in its institutions combined with a rise in its exposure to international trade.

The above results are both novel and plausible. Institutions, trade and geography turn out to be statistically significant and economically important determinants of economic development. In contrast to the findings in Rodrik et al. (2004) that were based on cross-section estimates, we do not find that, within the context of our panel data estimates, the inclusion of several measures of institutions renders the impact of openness to trade and geography statistically insignificant or leads to implausible coefficient signs of those measures. However, we concur with Rodrik et al. (2004) that in terms of their economic impact institutional measures seem to matter more than either openness or geography.

In the following section, we investigate how sensitive the results from Table 2 are to changes in the length of the time dimension of the panel (Table 3) and to alternative measures of institutions (Tables 4-5), openness (Table 6), and geography (Table 7).

[11] Based on averages of statistically significant parameter estimates from Cols 9-11 in Table 2, with Malaria estimates evaluated at the mean of 3.78 (see Table B6).

4.2.2 Robustness Checks

As a first pass at checking the robustness of the results in Table 2, we replicate the results of that table using time averages of five rather than ten years for the time-varying covariates, X1(it) and X2(it). The immediate advantage of this change is the substantial increase in the number of observations, ranging from 333 to 672 (see Table 3). As in Table 2, we determine the appropriate estimation model based on a series of specification tests. Since the error component model is always chosen over pooled OLS, we no longer report the BP test. As before, we report the Hausman test between RE and FE (Test 1 in Table 3) as well as the Hausman test between the chosen model from Test 1 and the HT model (Test 2). [12]

Interestingly, there is little qualitative change in the point estimates compared to Table 2. The sign of all estimates is the same as in the previous table and all statistically significant estimates in Table 2 continue to be so in Table 3. With regard to quantitative differences, the increase in sample size leads to more precisely estimated coefficients in many cases. As a result, a number of previously insignificant estimates are now significant, all of them with the expected sign. Most of these changes occur for three variables - *Malaria Ecology, Rule of Law,* and *NoCorrupt*. Some variables experienced a noticeable increase in their economic significance. The elasticity of *CIM* now ranges between 0.58 and 0.8, while the average *Trade Share* estimates increased from 0.21 to 0.27 and the average *NoCorrupt* estimates changed from 0.22 to 0.35. All other covariates including *Malaria Ecology* and *Malaria Index* exhibit similar sized average point estimates. Despite the encouraging results from Table 3, we return to 10-year averages for the remainder of the paper since it adds plausibility to our assumption of exogeneity of the lagged explanatory variables with regard to the idiosyncratic disturbance term.

In Table 4, we test the sensitivity of our results to the inclusion of alternative *time-varying* measures of institutions that have been used in the literature. As explained in Section 3, some of the alternative variables can be considered measures of organization or political structure rather than rule of law. In contrast to our core time-varying institutional measures used in Table 2 and 3 (*CIM* and *Veto Players*), all alternative time-varying measures fall into the X2(it) group as far as the HT estimator is concerned (see Table B7 in Appendix B). In contrast to the previous two tables, we now include *CIM* and *Veto Players* in all specifications (cols. 1-10).

[12] To conserve space, we no longer report the under-and overidentification tests of the instruments used in the HT procedure from Table 3 on. The results, which in almost all cases support the validity of the instrumental variables, are available from the authors upon request.

The five additional time-varying measures of institutions - added one at a time - are: an index of legislative competitiveness (*Leg. Comp. Index)*, the extent of turnovers in the legislative (*Stability of Tenure*), a comprehensive score of democracy (*Democracy)*, a measure of the constraints on the executive (*Constraints on Exec.*) and a democracy index measuring civil liberties and political rights (*FH Democracy Index*). To account for the non-linearity of some of the alternative time-varying institutional measures, we include quadratic terms when necessary. In Cols. 1-5, we use *Malaria Ecology* as measure of geography, which is replaced by *Malaria Index* in Cols. 6-10. In addition to *CIM* and *Veto Players*, *Trade Share* and *Rule of Law* are included in all regressions.

With regard to *CIM*, *Veto Players*, *Trade Share* and *Rule of Law*, the results from Table 4 are similar to those from Table 2. *CIM* remains highly significant with an elasticity of at least 0.34. The impact of *Trade Share* remains positive and significant throughout, with its elasticity in the range of 0.17 to 0.24. *Veto Players* also enters significantly in all the regressions. Its estimated elasticity ranges from 0.06 to 0.12 with a mean value of 0.08, compared to 0.07 in Table 2. *Rule of Law* and *Malaria Ecology/Index* are also significant in all regressions.

Table 4 underscores another important point. In a recent paper, Glaeser et al. (2004) argue that many institutional measures, in particular when they are survey-based, capture the most recent political experience or election outcomes and thus can be considered *outcome* measures rather than measures of institutional *constraints* or *quality*. As outcome measures, they tend to be highly variable over time. Following Glaeser et al. (2004), we tabulate the average within-country deviation of the dependent variable and of the seven time-varying institutional variables (see Table 4.1). The average within-country variation in income is 5.5%. In contrast, all institutional measures show larger fluctuations. Among the latter, *CIM* has the lowest variation (7.8%), while *Stability of Tenure* has the highest (27.2%). In general, the additional time-varying institutional measures have substantially higher variability over-time than the core time-varying institutional measures, *CIM* and *Veto Players.* It can therefore be argued that these two measures are less likely to be outcome variables and are better able to capture the underlying institutional constraints or quality than the additional institution variables investigated in Table 4.

Table 4.1: Variability* of income and time-varying institutional measures

GDP per capita	CIM	Veto Players	Leg. Comp. Index	Stability of Tenure	Democracy	Constraints on Exec	FH Democracy Index
5.47%	7.82%	9.76%	20.59%	27.21%	20.78%	18.37%	15.44%

** Cross-country average of the within country standard deviations.*

Note: All variables are normalized to lie between 0 and 1; T=40; N_min = 90; N_max = 125

Another interesting feature of Table 4 is the non-linearity of some of the additional institutional variables. The quadratic terms for *Leg. Comp. Index* (Cols. 1 & 6) and *FH Democracy Index* (Cols. 5 & 10) are positive and significant, while the significant linear terms are negative. This implies that countries with low or high values of these measures have higher per capita income levels than countries with intermediate values. The opposite holds for *Constraints on Exec* (Cols. 4 and 9*)* where the positive linear and the negative quadratic term imply that countries with medium levels of constraints on the decision makers exhibit the highest levels of per capita income. For the remaining institutional variables (*Stability of Tenure* and *Democracy*), we find no evidence for non-linearity and even the linear specifications, while exhibiting the expected sign, are not statistically significant.

Next, we examine alternative *time-invariant* institutional measures used in the cross-section literature as determinants of economic development (see Table 5). Following this literature, we classify all variables as uncorrelated with the country-specific effects (i.e. Z1(i)). The specific covariates we use are: language, ethnic, and religious fractionalization in the 90s (*LER Fractional.),* percentage of population adhering to the Protestant, Catholic and Islamic faith in the 1980s (*Religious Fraction)*, percentage of population speaking one of the four major European Languages as a native tongue (*European Lang.),* dummies for British and French *Legal Origins,* and a set of regional dummies for Sub-Saharan Africa (*SSA*), *Latin America* and East-Asia and Pacific (*E. Asia and Pacific).* These variables enter alternatively with *Malaria Ecology* (Cols. 1-5) and *Malaria Index* (Cols. 6-10), while *CIM, Veto Players, Trade Share* and *Rule of Law* enter all specifications. We find that the coefficient estimates of the latter four variables are, on average, similar to the estimates reported in Table 2. In addition, all of them remain highly significant. The main difference between Table 5 and 2 occurs in the geography measures. *Malaria Ecology* is now significant in only 1 out of 5 specifications, although the coefficient estimates carry the expected signs and similar magnitudes (except for Col. 5). The *Malaria Index* performs somewhat better (i.e., it is significant in 3 out of 5 cases), but its point estimates are half as large as in Table 2. The F-test for joint significance of the *LER Fractional* variables indicates that these variables do not exert a joint influence on economic development (Cols. 1 and 6), while a larger percentage of the population speaking one of the four major European languages (*European Lang Fraction*) has a positive impact on economic development (Cols. 2 and 7). The F-test for joint significance of the religious fraction variables in the eighties is statistically significant. British legal origin seems to be uncorrelated with economic development, while there is evidence for a positive influence of French legal origin. Regarding regional dummies, Latin America exerts a positive impact, while the opposite holds for Sub-Saharan African countries. The dummy for East Asian and Pacific countries is insignificant. In sum, we find that including additional time-invariant measures of institutions does not change our main results regarding the importance of institutions and trade. However, given the weaker performance of the two malaria measures, the additional time-invariant measures appear to capture some of the impact of the main geography covariates. This may not come as a surprise given that some of the time-invariant institutional measures are regional dummy variables, while others capture elements of geography (British and French legal origin).

In Table 6 we check the robustness of our results to the inclusion of alternative measures of trade that have been used in the literature. The time-varying alternative trade variables are the black market premium (*BMP*), the extent to which the exchange rate is overvalued (*ER Overvaluation*), *Import Tariffs* and total taxes on trade as a percentage of total trade value (*Taxes on Trade*). Pretests indicate that all these covariates should be treated as X2(it) variables in the context of the HT estimator. In addition, we use an alternative time-invariant measure of openness capturing the number of decades a country was open to trade (*Index Open*), specified as a Z2(i) variable. As before, we include *CIM*, *Veto Players* and *Malaria Ecology* in all specifications, while we alternate between the *Rule of Law* (Cols. 1-5) and the openness index (Cols. 6-10). We find that, with one exception, all alternative measures of openness are statistically significant. Among the time-varying trade measures, *Trade Share* exerts the strongest economic impact with an average elasticity of 0.23, followed by *ER Overvaluation* with an average elasticity estimate of 0.14 (in absolute terms). The remaining time-varying trade measures have lower average elasticities ranging from 0.07 for *Import Tariffs* and *Taxes on Trade* to 0.04 for *BMP*. The only time-invariant trade measure, *Index Open*, exerts a strong positive impact on economic development with an average elasticity of 1.15.

Among the remaining covariates, we find that *CIM* is significant in all specifications, while *Veto Players* is significant in more than half of them. Both variables display average elasticities similar to Table 2. As a measure of geography, *Malaria Ecology* is statistically significant in all but one case when combined with the *Rule of Law* (with an average elasticity of -0.08, compared to -0.15 in Table 2). However, when *Rule of Law* is replaced with the openness index, the coefficient estimates for *Malaria Ecology*, while similar in magnitude, are statistically insignificant throughout at the 10% level. There are two reasons for the reduced precision of the malaria risk estimates once we include *Index Open*. First, most trade measures are correlated with a country's malaria risk, a reflection of the fact that poorer countries in the tropics tend to rely more heavily on tariff revenues as source of government income. Second, unlike the other trade measures, *Index Open* is the only time invariant trade measure, making it an even better substitute for malaria measures which are also time invariant.

Finally, in Table 7, we look at a number of alternative measures of geography: a dummy for landlocked non-European countries (*Landlocked*); the percentage of a country's land area in the tropics (*Area in Tropics*); a measure of a country's 1993 per capita endowment of fossil and other organic fuels (*Hydrocarbon per capita*); a crop index measuring the share of land area devoted to wheat and maize (*Good Crops Index*); and the relative distance of a country from the equator (*Dist Equator*). Akin to Table 4, we allow the alternative measures to enter non-linearly. As in the previous tables, *CIM* and *Veto Players* are present in all specifications. We alternate between two trade measures. In Cols. 1-5, we use *Trade Share*, while in Cols. 6-10 we employ *Import Tariffs*. As in Tables 4 and 5, *Rule of Law* enters in all specifications. The qualitative impact of institutions and openness measures is similar to Table 2. The average elasticities for *CIM*, *Veto Players* and *Trade Share* are 0.46, 0.08, and 0.22, respectively, compared to 0.54, 0.07 and 0.21 in Table 2. Among the alternative measures of geography, *Landlocked*, *Hydrocarbons*, and *Good Crops* are highly significant in all specifications. Being a non-European landlocked country exerts a negative, statistically significant impact on income, most likely due to the country's inability to fully exploit world trade opportunities and therefore to gain access to outside institutional and technological innovations. In fact, the simple bivariate correlation between the landlocked dummy and per capita income is -0.47. Another interesting result concerns the coefficient estimates on hydrocarbons per capita which are positive (Cols. 3 and 8), with an average elasticity of 0.049. Thus, greater reserves of oil and other energy sources appear to exert a positive impact on per capita income. The relationship between food crops and per capita income is non-linear. Countries that devote either a small or a large area to cultivation of wheat and maize relative to rice and sugarcane seem to perform better than countries with medium production levels of these food crops (Cols. 4 and 9). This result is driven by several facts. First, some high-income countries such as the United States are big wheat and maize producers and thus score high on the good crop index. Second, a number of medium-income countries such as Gabon, Panama and Brazil are small producers of wheat and maize but large producers of sugarcane causing their good crop index to be rather low. The majority of countries, including many poor SSA countries, produce both food and cash crops and thus exhibit medium scores on the index.

The remaining alternative geography measures, *Area in Tropics* (Cols. 2 and 7) and *Dist Equator* (Cols. 5 and 10) are mostly statistically insignificant, except for the quadratic terms for *Area in Tropics* (Col. 2) and for *Dist Equator* (Col. 5). Based on the signs of the coefficient estimates alone, there appears to exist an inverted-U relationship between each of the above variables and per capita income. This result is intuitive as it suggests that countries with the most suitable climate enjoy higher income levels than countries that are either close to the equator or far away from it.

5. Conclusions

This paper represents the first attempt to study the economic impact of the three deep determinants studied in Rodrik et al. (2004) within a panel data context allowing us to account for the endogeneity bias due to unobserved time-invariant country-specific heterogeneity. Our findings indicate that institutions, economic integration, and geography are valid determinants of economic development. In terms of their economic impact, however, institutions appear to matter the most. This is especially true if we measure the quality of institutions as the extent of contract intensive money which has a very high elasticity with respect to per capita income. Openness to trade is another economically important covariate, but for most measures to a lesser extent than contract intensive money. Finally, geography, when measured through the malaria ecology index, is also important but to a smaller extent than many measures of trade and institutions. In contrast, distance from the equator, which has traditionally been used as a measure of geography, performs poorly. The results thus provide an interesting as well as encouraging outlook: institutions and trade matter for development and their joint, positive impact should help developing countries to overcome any geographical disadvantage they may have.

One shortcoming of our approach is that we have ignored the dynamic structure of the economy. In theory, these dynamics can be brought about by the introduction of past income levels as an additional covariate. However, the Hausman-Taylor model has not yet been extended to allow for lagged dependent variables. A different kind of extension, suggested by North (1993), is to model the interplay of organizations and institutions (as rule of the game) and their joint impact on economic development. While one should be able to capture both ideas within the Hausman Taylor framework, the specifics of the implementation may be difficult and are left for future research.

References

Acemoglu, Daron, Simon Johnson and James A. Robinson (2001), "The Colonial Origins of Comparative Development: An Empirical Investigation," *American Economic Review*, 91, 1369-1401.

Alesina, Alberto, Arnaud Devleeschauwer, William Easterly, Sergio Kurlat, and Romain Wacziarg (2003), "Fractionalization," *Journal of Economic Growth*, 8, 155-194.

Baier, Scott L. and Jeffrey H. Bergstrand (2007), "Do free trade agreements actually increase members' international trade?" *Journal of International Economics*, 71(1), 72-95.

Baltagi, Badi, Georges Brensson and A. Pirotte (2003), "Fixed Effects, random effects or Hausman-Taylor? A pretest estimator," *Economics Letters*, 79(3), 361-369.

Beck, Thorsten, Asli Demirguc-Kunt and Ross Levine (2000). "A New Database on the Structure and Development of the Financial Sector," *World Bank Economic Review*, 14(3), 597-605.

Beck, Thorsten, George Clarke, Alberto Groff, Philip Keefer and Patrick Walsh (2001), "New tools in comparative political economy: The Database of Political Institutions," *World Bank Economic Review*, 15(1), 165-176.

Bittik, R.M. (2004). Data downloaded from: http://som.csudh.edu/depts/public/rbittick/Data%20and%20Information%20webpages/CIM%20National%20data.xls

Breusch, Trevor S., Grayham E Mizon and Peter Schmidt (1989), "Efficient Estimation Using Panel Data," *Econometrica*, 57(3), 695-700.

Clague, Christopher, Stephen Knack and Mancur Olson (1999), "Contract-Intensive Money: Contract Enforcement, Property Rights, and Economic Performance," *Journal of Economic Growth*, 4(2), 185-211.

Dollar, David and Aart Kraay (2003), "Institutions, trade, and growth," *Journal of Monetary Economics*, 50(1), 133-162

Easterly, William and Levine, Ross (2003), "Tropics, Germs, and Crops: How Endowments Influence Economic Development," *Journal of Monetary Economics*, 50(1), 3-39.

Frankel, Jeffrey A. and David Romer (1999), "Does Trade Cause Growth?" *American Economic Review*, 89(3), 379-99.

Gallup, John Luke, Jeffrey D Sachs and Andrew D Mellinger (1999), "Geography and Economic Development," *Harvard Institute of Economic Research Working Papers*, Harvard - Institute of Economic Research. Downloaded from: http://www.ksg.harvard.edu/CID/cidwp/001.pdf

Glaeser, Edward, Rafael La Porta, F. Lopez-de-Silanes and A. Shleifer (2004), "Do Institutions Cause Growth?" *Journal of Economic Growth*, 9(3), 131-165.

Hall, Robert E. and Charles I Jones (1999), "Why Do Some Countries Produce So Much More Output Per Worker Than Others?" *Quarterly Journal of Economics*, 114(1), 83-116.

Hausman, Jerry A. and William E. Taylor (1981), “Panel Data and Unobservable Individual Effects,” *Econometrica*, 49(6), 1377-98.

Heston, Alan, Robert Summers and Bettina Aten (2002), “Penn World Table Version 6.1” Center for International Comparisons at the University of Pennsylvania (CICUP).

Jaggers, Keith and Monty G. Marshall (2000), “Polity IV Project,” Center for International Development and Conflict Management, University of Maryland.

Kaufmann, Daniel and Massimo Mastruzzi (2003), “Governance Matters III: Governance Indicators for 1996–2002.” Data from: www.worldbank.org/wbi/governance/govdata2002/

Keefer, Philip (2002). “DPI2000 Database of Political Institutions: Changes and Variable Definitions,” Development Research Group, The World Bank.

Keefer, Philip and David Stasavage (2003), “The Limits of Delegation: Veto Players, Central Bank Independence and the Credibility of Monetary Policy,” *American Political Science Review*, 93(3), 407-423.

La Porta, R., F. Lopez-de-Silanes, A. Shleifer and R. Vishny (1999), “The quality of government,” *Journal of Law and Economic Organization,* 15, 222 – 279.

Mankiw, Gregory N., David Romer and David N. Weil (1992), “A Contribution to the Empirics of Economic Growth,” *The Quarterly Journal of Economics*, 107(2), 407-437.

North, Douglass C. (1993), “Five Propositions about Institutional Change,” *Working Paper # 9412001*, Working Paper Archive at Washington University in St. Louis.

--- (1994 a), “Institutions Matter,” *Working Paper # 9411004*, Working Paper Archive at Washington University in St. Louis.

--- (1994b), “Transaction Cost Through Time,” *Working Paper # 9411006,* Working Paper Archive at Washington University in St. Louis.

--- (1994c), “Institutional Change: A framework for Analysis,” *Working Paper # 9412001*, Working Paper Archive at Washington University in St. Louis.

Rodrik, Dani, Arvind Subramanian and Francesco Trebbi (2004), “Institutions Rule: The Primacy of Institutions Over Geography and Integration in Economic Development,” *Journal of Economic Growth*, 9(2), 131-165.

Sachs, Jeffrey D. (2003), “Institutions Don't Rule: Direct Effects of Geography on Per Capita Income,” *NBER Working Papers: 9490*, National Bureau of Economic Research, Inc. Data on Malaria Ecology obtained from: http://www.earthinstitute.columbia.edu/people/gmccord/documents/institutions_NBER2003_updated_002.xls

Sachs, Jeffrey D. and Andrew M. Warner (1995), “ Economic Reform and the Process of Global Integration,” *Brookings Papers on Economic Activity,* 1, 1-95.

Wacziarg, Romain and Karen Horn Welch (2003), “Trade Liberalization and Growth: New Evidence,” *NBER Working Papers: w10152*, National Bureau of Economic Research, Inc.

World Bank (2003), *World Development Indicators CD ROM, 2003,* Washington DC, USA.

Appendix A

Formal Description of the Hausman-Taylor (1981) Estimator

The starting point for the HT estimation procedure is the following set of equations:

$$y_{it} = X_{it}\beta + Z_i\lambda + \varepsilon_{it}$$

$$\varepsilon_{it} = \nu_i + \mu_{it} \qquad \text{(A1)}$$

where X_{it} is a (TN x k) matrix of time-varying regressors and Z_i is a (TN x g) matrix of time-invariant regressors. ε_{it} is the composite error term that contains individual specific effects, μ_{it}, and an idiosyncratic error term, ν_i. We suspect endogeneity of the following form: $E\left[\varepsilon_{it} \mid X_{it}, Z_i\right] = E\left[\nu_i \mid X_{it}, Z_i\right] \neq 0$. Thus in this model, endogeneity enters through the individual heterogeneity.

X and Z matrices are further subdivided into two sets of regressors, [X_{1it} | X_{2it}] of dimensions [NT *x* k_1 | NT *x* k_2] and [Z_{1i} | Z_{2i}] of dimensions [NT *X* g_1 | NT *X* g_2], where the subscript 1 denotes variables uncorrelated with the error term, ε_{it}, and 2 denotes variables correlated with the individual specific error term, ν_i. We can thus rewrite **(A1)** as

$$y_{it} = X_{1it}\beta_1 + X_{2it}\beta_2 + Z_{1i}\lambda_1 + Z_{2i}\lambda_2 + \nu_i + \mu_{it} \qquad \text{(A2)}$$

for i = 1,2…N and t = 1,2….T.

For the subsequent derivations, it is useful to define two orthogonal projection operators, P_v and Q_v such that the former operator converts a vector into its mean and the latter into deviations from the mean: $P_v y_{it} = {}^1\!/_T \sum y_{it} = y_{i.}$ and $Q_v y_{it} = \tilde{y}_{it} = y_{it} - y_{i.}$.

The estimation procedure proposed by HT evolves in three steps.

<u>Step 1:</u>

By premultiplying (A2) with Q_v, HT carry out a within transformation to obtain consistent estimates of β_1 and β_2, denoted by $\hat{\beta}_w$. This process, however, removes the time invariant explanatory variables.

<u>Step 2:</u>

The second step involves obtaining consistent but inefficient estimates of the vector λ. Let $\hat{d}_i$ denote the within residual, where $\hat{d}_i = \tilde{y}_i - \tilde{X}_i\hat{\beta}_W$ is a TN vector of group means. After expansion it can be shown that

$$\hat{d}_i = Z_i\lambda + \nu_i + \left[P_V - X_{i.}\left(\tilde{X}'_{it}\tilde{X}_{it}\right)^{-1}\tilde{X}'_{it}\right]\mu_{it}. \qquad \text{(A3)}$$

The last two terms can be treated as unobservables. To obtain intermediate within-estimates of λ, take averages over time and then use a 2SLS procedure to account for the correlation between Z_{2i} and ν_i. Formally,

$$\hat{\lambda}_W = \left(Z_i'P_AZ_i\right)^{-1} Z_i'P_A\hat{d}_i \qquad \text{(A4)}$$

where A = [X_{1it} | Z_{1i}] and P_A is the orthogonal projection operator, $A(A'A)^{-1}A'$. The identifying condition for this model is $k_1 \geq g_2$. However, the intermediate parameter estimates of β and λ thus obtained are not fully efficient.

Step 3:

Using the estimates of β and λ obtained in the second step, we can now obtain consistent estimates of the variances of ν_i and μ_{it}. First, we obtain the within sum of square residuals:

$\hat{\tilde{\mu}}_{it} = \tilde{y}_{it} - \tilde{X}_{it}\hat{\beta}_W = Q_{\tilde{X}}\tilde{y}_{it}$, where $Q_{\tilde{X}} = \left[I_{NT} - \tilde{X}_{it}\left(\tilde{X}'_{it}\tilde{X}_{it}\right)^{-1}\tilde{X}_{it} \right]$. Thus, a consistent estimate of it's variance, σ_μ^2, can be obtained as

$$\hat{\sigma}_\mu^2 = \tilde{y}_{it}{}'Q_{\tilde{X}}\tilde{y}_{it} \Big/ NT - N \,. \tag{A5}$$

Next, one can obtain a consistent estimator of σ_ν^2. This is done as follows: Let $s^2 = \dfrac{\left(y_{i.} - X_{i.}\hat{\beta}_W - Z_i\hat{\lambda}_W\right)'\left(y_{i.} - X_{i.}\hat{\beta}_W - Z_i\hat{\lambda}_W\right)}{N}$, where $\hat{\beta}_W$ and $\hat{\lambda}_W$ are the intermediate estimates obtained above. In the limit, $s_2 = \sigma_\nu^2 + \frac{1}{T}\sigma_\mu^2$. Thus,

$$\hat{\sigma}_\nu^2 = s^2 - \frac{1}{T}\hat{\sigma}_\mu^2 \,. \tag{A6}$$

Finally, a GLS transformation of Eq. (A2) is carried out and the transformed model is estimated using 2SLS to get consistent and efficient parameter estimates. Note that since the GLS transformation renders all right hand side variables endogenous, all variables including the transformed X_1 and Z_1 need to be instrumented. The transformation which HT suggest is the following

$$\Omega^{-1/2}y_{it} = \Omega^{-1/2}X_{1it}\beta_1 + \Omega^{-1/2}X_{2it}\beta_2 + \Omega^{-1/2}Z_{1i}\lambda_1 + \Omega^{-1/2}Z_{2i}\lambda_2 + \Omega^{-1/2}\varepsilon_{it} \tag{A7}$$

$$\text{where } \Omega^{-1/2} = I_{NT} - (1-\theta)P_V \text{ and } \theta = \left[\sigma_\mu^2 \Big/ \left(\sigma_\mu^2 + T\sigma_\nu^2\right)\right]^{1/2} \tag{A8}$$

Since θ is unknown, its estimate is obtained as: $\hat{\theta} = \left[\hat{\sigma}_\mu^2 \Big/ \left(\hat{\sigma}_\mu^2 + T\hat{\sigma}_\nu^2\right)\right]^{1/2}$.

As an alternative to Eq. (A7) that is computationally easier to implement, one can quasi-difference Eq. (A2) which yields the following estimating equation:

$$\begin{aligned} y_{it} - (1-\theta)y_{i.} = {} & \left[X_{1it} - (1-\theta)X_{1i.}\right]\beta_1 + \left[X_{2it} - (1-\theta)X_{2i.}\right]\beta_2 + \theta Z_{1i}\lambda_1 + \theta Z_{2i}\lambda_2 + \\ & \theta\nu_i + \left[\mu_{it} - (1-\theta)\mu_{i.}\right] \end{aligned} \tag{A9}$$

where θ is being replaced by its estimate $\hat{\theta}$ given above. Note that estimating Eq. (A7) or (A9) via 2SLS using $A = [Q_V \vdots X_{1it} \vdots Z_{1it}]$ as set of instruments is not feasible since A is not of full rank and thus cannot be inverted, as pointed out by Breusch, Mizon and Schmidt (1989). They therefore suggest an alternative set of instruments

$A_{BMS} = [Q_V X_{it} \vdots P_v X_{1i} \vdots Z_{1i}] = \left[\tilde{X}_{1it} \vdots \tilde{X}_{2it} \vdots X_{1i.} \vdots Z_{1i} \right]$, which always is of full rank. The Breusch et al. (1989) set of instruments allows not only estimation of Eq. (A9) via 2SLS, but also meets the HT condition for identifiability, $k_1 \geq g_2$. Finally, note that all instruments needed for the 2SLS estimators in step 2 and 3 of the HT model are found within the model, thereby eliminating the need to search for viable external instruments.

Appendix B: Variable Definitions and Summary Statistics

Table B1: Variable Definitions and Data Sources

	Institutions
Name	Definition and Source(s)
CIM	*Contract Intensive Money*: Defined as the ratio of non-currency (M1excluding currency) to total money (M2). From Bittik (2004)
Veto Players	*Number of Veto Players:* This variable counts the number of veto players in a political system, adjusting for whether these veto players are independent of each other, as determined by the level of electoral competitiveness in a system, their respective party affiliations, and the electoral rules. Veto players are defined as the president, largest party in the legislature, for a presidential system; and as the prime minister and the parties in the government coalition in a parliamentary system. (Also see Keefer, 2002). From DPI2000 (Beck at al., 2001), where it is coded as *CHECKS*.
Leg. Comp. Index	*Legislative Index of Electoral Competitiveness:* Scaled as: (1) no legislature (2) unelected legislature (3) elected, one candidate (4) one party, multiple candidates (5) multiple parties are legal, but only one won seats (because other parties did not exist, compete, or win seats) (6) multiple parties competes and won seats (but one party won 75 percent or more of the seats) (7) the largest party received less than 75 percent of the seats. From DPI 2000 (Beck et al., 2001) where it is coded as LEIC.
Stability of Tenure	*Stability of Tenure:* Measure of government stability that captures the extent of turnover in any one year of a government's key decision makers. It is calculated by dividing the number of exits between year *t* and *t+1* by the total number of veto players in year *t*. The variables are therefore on a 0-1 scale, with zero representing no exits and one representing the exit and replacement of all veto players. From DPI 2000 (Beck et al., 2001) where it is coded as STABS.
Democracy	*Institutionalized Democracy*: Democracy is conceived as three essential, interdependent elements. One is the presence of institutions and procedures through which citizens can express effective preferences about alternative policies and leaders. Second is the existence of institutionalized constraints on the exercise of power by the executive. Third is the guarantee of civil liberties to all citizens in their daily lives and in acts of political participation. The Democracy indicator is an additive eleven-point scale (0-10). From Polity IV dataset (Jaggers and Marshal, 2000), where it is coded as DEMOC.
Constraints on Exec	*Constraints on Executive:* This variable refers to the extent of institutionalized constraints on the decision-making powers of chief executives, whether individuals or collectivities. (1) unlimited authority (2) intermediate category (3) Slight or moderate limitation on executive authority (4) intermediate category (5) Substantial limitations of executive authority (6) intermediate category (7) Executive parity or subordination. From Polity IV dataset (Jaggers and Marshal, 2000), where it is coded as XCONST.
FH Democracy Index	Average of Political Rights and Civil Liberty; both indicators from Freedom House (FH), (2004)
LER Fractional.	*Language, Ethnic and Religious Fractionalization*: Denotes the following three variables: *Ethnic Fractionalization*: is the probability that two randomly selected individuals in a country will not belong to the same ethnic group in the 1990s. From Alesina et al. (2003) *Linguistic diversity*: is the probability that two randomly selected individuals in a country will not speak the same language in the 1990s. From Alesina et al. (2003) *Religious Fractionalization*: is the probability that two randomly selected individuals in a country will not belong to the same religious group in the 1990s. From Alesina et al. (2003)
European Lang . Fraction	*European Languages*: Fraction of population speaking one of the four major Western European languages (English, French, German, Spanish and Portuguese) at birth. From Hall and Jones (1999)
Region: S.S.A.	Dummy variable for countries in *Sub-Saharan Africa*. From World Bank, Global Development Network Database
Region: Latin America	Dummy variable for countries in *Latin America*. From World Bank, Global Development Network Database
Region: E Asia and Pacific	Dummy variable for countries in *East Asia and Pacific*. From World Bank, Global Development Network Database
British Legal Origin	Dummy variable for countries with British legal system. From La Porta et al. (1999)
French Legal Origin	Dummy variable for countries with French legal system. From La Porta et al. (1999)
Religious Fraction	Denotes the following three variables: Fraction of the population in the 1980s that is Catholic, Muslim, and Protestant, respectively. From La Porta et al. (1999)
Rule of Law	Measures the quality of contract enforcement, police and courts, as well as the likelihood of crime and violence, average for 1996, 98 and 2000. From Kaufmann et al., 2003
NoCorrupt	*Index of government corruption*: Low ratings indicate "high government officials are likely to demand special payments" and "illegal payments are generally expected through lower levels of government" in the form of "bribes connected with import and export licenses, exchange controls, tax assessment, policy protection, or loans." Scale from 0 to 10. Average of the months of April and October in the monthly index between 1982 and 1995. Source: *International Country Risk Guide (ICRG)*. From La Porta et al. (1999)

Table B1: Variable Definitions and Data Sources (cont'd)	
Trade	
Name	Definition and Source(s)
Trade Share	Imports plus exports relative to GDP; From PWT Mark 6.1 (Heston et al., 2002)
ER Overvaluation	*Real Exchange rate overvaluation*: From World Bank, Global Development Network Database
BMP	*Black Market premium*. From World Bank, Global Development Network Database
Import Tariffs	*Imports Tariffs*: Import duties as a percentage of total imports. From World Bank, World Bank (2003); own calculations.
Taxes on Trade	*Total taxes on International trade:* Total taxes on international trade as a percentage of total trade. From World Bank (2003); own calculations.
Openness Index	*Index of Openness*: This index is based on the openness dummy constructed by Sachs and Warner (1995) and updated by Wacziarg and Welch (2003). The Sachs-Warner index takes the value of 1 for each decade in which a country was open to trade. Our openness index is constructed as sum across decades and thus takes values between 0 to 4. From Wacziarg and Welch (2003); own calculations
Geography	
Name	Definition and Source(s)
Dist Equator	*Relative Distance from the equator:* Calculated as distance from the equator, divided by 90. From Gallup et al. (1998) and Hall and Jones (1999)
Malaria Ecology	A measure of malaria incidence that combines temperature, mosquito abundance and vector specificity. The underlying index is measured on a highly disaggregated sub-national level, and then is averaged for the entire country. Because ME is built upon climatological and vector conditions on a country-by-country basis, it is exogenous to public health interventions and economic conditions. From Sachs (2003)
Malaria Index (1966)	*Falciparam malaria index, 1966*: A measure of the prevalence of malaria disease environment in the sixties. From Gallup et al. (1998)
Landlocked (not C/W Europe)	Dummy variable for non-Western and non-Central European landlocked countries. From Gallup et al. (1999)
% of land in tropics	Percentage of a country's surface area located in the tropical region. From Gallup et al. (1999)
Hydrocarbons per capita	Amount of fossil fuels per capita in 1993. From Gallup et al. (1999)
Good Crops Index	The index equals log(1+%maize+%wheat)/(1+%rice+%sugarcane), where %X equals the share of the land area suitable for growing crop X according to FAO. From Easterly and Levine (2003)
Instrumental Variables for 2SLS Regressions in Table 1	
Name	Definition and Source(s)
Settler Mortality	Mortality rate of European colonialists in the 1500s. From Acemoglu et al. (2001)
F-R Trade Share	*Frankel and Romer Predicted Trade Shares:* Predicted trade shares obtained from bilateral gravity type equations and controlling for geography. From Frankel and Romer (1999)

Table B2: Correlation coefficients of Time Varying Measures of Institutions

	GDP per capita	CIM	Veto Players	Leg. Comp Index	Stability of Tenure	Democracy	Constraints on Exec	FH Democracy Index
GDP per capita	1	*0.68*	*0.51*	*0.48*	*0.08*	*0.63*	*0.57*	*0.68*
CIM	0.65	1	*0.50*	*0.51*	*0.09*	*0.60*	*0.60*	*0.63*
Veto Players	0.55	0.49	1	*0.71*	*0.38*	*0.85*	*0.82*	*0.81*
Leg. Comp Index	0.56	0.54	0.68	1	*0.20*	*0.75*	*0.78*	*0.78*
Stability of Tenure	0.09	0.07	0.22	0.06	1	*0.35*	*0.35*	*0.34*
Democracy	0.67	0.56	0.80	0.72	0.27	1	*0.97*	*0.94*
Constraints on Exec	0.64	0.57	0.77	0.75	0.26	0.97	1	*0.91*
FH Democracy Index	0.71	0.57	0.75	0.75	0.23	0.93	0.90	1

Note: Below diagonal cells denote correlations between time varying variables;
Above diagonal elements denote correlations between time-averaged variables.

Table B3: Correlation coefficients of Time Invariant Measures of Institutions

	GDP per capita	Language Fractional.	Ethnic Fractional.	Religious Fractional.	% Eurp Lang	S.S. Africa	Latin America	East Asia	UK Legal Orig	Fr Legal Orig	% Catholic (80s)	% Muslim (80s)	% Protest't (80s)	Rule of Law	No Corrupt
GDP per capita	1														
Lang. Fractional.	-0.34	1													
Ethnic Fractional.	-0.53	0.48	1												
Relig. Fractional.	-0.10	0.35	0.23	1											
% European Lang	0.38	-0.43	-0.15	0.15	1										
S.S. Africa	-0.70	0.52	0.57	0.31	-0.39	1									
Latin America	0.04	-0.46	0.05	-0.02	0.66	-0.27	1								
East Asia	0.11	0.15	-0.15	0.00	-0.07	-0.27	-0.13	1							
UK Legal Origin	-0.13	0.22	0.06	0.28	0.03	0.06	-0.05	0.13	1						
Fr Legal Origin	-0.08	-0.13	0.18	-0.23	-0.04	0.12	0.13	-0.14	-0.79	1					
% Catholic (80s)	-0.03	0.05	0.18	0.42	0.53	0.19	0.36	-0.05	-0.08	0.19	1				
% Muslim (80s)	-0.41	0.36	0.41	-0.13	-0.51	0.27	-0.35	-0.06	0.14	0.11	-0.49	1			
% Protest't (80s)	0.07	0.04	-0.07	0.53	0.30	0.15	0.13	0.01	0.12	-0.29	0.50	-0.58	1		
Rule of Law	0.87	-0.25	-0.59	-0.08	0.32	-0.65	-0.13	0.21	0.03	-0.28	-0.08	-0.38	0.17	1	
NoCorrupt	0.64	-0.16	-0.44	0.11	0.24	-0.30	-0.22	0.09	-0.06	-0.20	0.12	-0.50	0.33	0.78	1

Table B4: Correlation coefficients of Time Varying Measures of Trade

	GDP per cap	Trade Share	BMP	ER Over-valuation	Import Tariff	Taxes on Trade	Index Open
GDP per cap	1	*0.09*	*-0.51*	*-0.23*	*-0.53*	*-0.59*	*0.52*
Trade Share	0.13	1	*-0.22*	*0.16*	*-0.20*	*-0.24*	*0.02*
BMP	-0.40	-0.22	1	*0.09*	*0.39*	*0.45*	*-0.41*
ER Overvaluation	-0.14	0.02	0.19	1	*0.19*	*0.15*	*-0.32*
Import Tariff	-0.50	-0.18	0.26	0.05	1	*0.97*	*-0.49*
Taxes on Trade	-0.58	-0.22	0.35	0.09	0.96	1	*-0.49*

Note: Below diagonal cells denote correlations between time varying variables;
Above diagonal elements denote correlations between time-averaged variables.
Last column: the only time-invariant trade variable: Index Open

Table B5: Correlation coefficients of Measures of Geography

	GDP per cap	Malaria Ecology	Malaria Ind (66)	Dist Equator	Land-locked	% area tropics	Ln HC per cap	Good Crop Ind
GDP per cap	1							
Malaria Ecology	-0.48	1						
Malaria Ind (66)	-0.68	0.68	1					
Dist Equator	0.55	-0.40	-0.61	1				
Landlocked	-0.41	0.30	0.25	-0.23	1			
% area tropics	-0.36	0.66	0.43	-0.49	0.02	1		
Ln HC per cap	0.41	-0.23	-0.16	0.17	-0.31	-0.20	1	
Good Crop Ind	0.14	-0.12	-0.22	0.42	-0.03	-0.15	-0.11	1

Table B6: Summary Statistics of Country Means

Variable	Obs	Mean	Min	Max
GDP per cap	166	8.25	6.26	10.06
Measures of Institutions				
Ln CIM	108	4.29	3.55	4.54
Veto Players	167	2.37	1.00	7.28
Leg. Comp. Index	167	5.08	1.00	7.00
Stability of Tenure	167	0.11	0.00	0.33
Democracy	158	3.66	0.00	10.00
Constraints on Exec	158	3.83	1.00	7.00
FH Democracy Index	171	2.95	0.00	6.00
Language Fractionalization	165	3.19	-1.56	4.52
Ethnic Fractionalization	169	3.53	-1.61	4.53
Religious Fractionalization	174	3.45	-1.47	4.45
% European Language	143	0.27	0.00	1.06
Region: SSA	176	0.27	0.00	1.00
Region: Latin America	176	0.19	0.00	1.00
Region: East Asia	176	0.11	0.00	1.00
British Legal Origin	175	0.31	0.00	1.00
French Legal Origin	175	0.43	0.00	1.00
% Catholic (80s)	157	2.24	-2.30	4.58
% Muslim (80s)	125	1.89	-4.61	4.60
% Protestant (80s)	145	1.21	-2.30	4.58
Rule of Law	174	0.01	-1.83	2.21
No Corrupt	123	5.69	1.01	10.00
Measures of Trade				
Ln Trade Share	166	4.08	-1.70	5.49
Ln BMP	138	2.39	-2.33	10.84
Ln ER Overvaluation	104	4.68	3.92	5.48
Ln Import Tariff	146	1.58	-5.12	4.49
Ln Taxes on Trade	147	1.11	-5.83	4.21
Index Open	141	1.64	0.00	4.00
Measures of Geography				
Malaria Ecology	163	3.78	0.00	31.55
Malaria Index (1966)	143	0.32	0.00	1.00
Dist. Equator	176	0.29	0.00	0.71
Landlocked (not C/W Europe)	149	0.19	0.00	1.00
% land area in tropics	149	0.16	0.00	1.00
Ln Hydrocarbons per cap	147	0.72	-4.61	10.59
Good Crops Index	64	0.97	0.41	2.44
Instrumental Variables for 2SLS Regressions in Table 1				
Ln Settler Mortality	74	4.65	2.15	7.99
F-R Trade Share	142	2.98	0.83	5.64

Table B7. Classification of Variables for HT Model Estimation

Time Varying			
Institutions		**Trade**	
Name	Category	Name	Category
CIM	X1	Trade Share	X2
Veto Players	X1	BMP	X2
Leg Comp. Index	X2	ER Overvaluation	X2
Stability of Tenure	X2	Import Tariff	X2
Democracy	X2	Taxes on Trade	X2
Constraints on Exec	X2		
Democracy Index (FH)	X2		
Time Invariant			
Institutions		**Trade**	
Name	Category	Name	Category
LER Fractional.	Z1	Index Open	Z2
European Lang Fraction	Z1	**Geography**	
Region: S.S. Africa	Z1	Name	Category
Region: Latin America	Z1	Malaria Ecology	Z1
Region: East Asia and Pacific	Z1	Malaria Ind (66)	Z1
British Legal Origin	Z1	Dist Equator	Z1
French Legal Origin	Z1	Landlocked	Z1
Religious Fraction	Z1	% area tropics	Z1
Rule of Law	Z2	Ln HC per cap	Z1
No Corrupt	Z2	Good Crop Index	Z1

Note: X1 and Z1 (X2 and Z2) denote variables independent of (correlated with) the country-specific time-invariant unobservables.

Appendix C: Estimation Results

Table 1: Cross Section Estimates: OLS and 2SLS Regression

Panel A: OLS Regressions

	AJR Sample			HJ Sample		
Dependent Variable: Log GDP per capita	1	2	3	4	5	6
Geography (abs[Latitude])	0.046	0.015	0.018	0.046	0.01	0.01
	(4.76)**	(1.85)	(2.08)*	(9.70)**	(1.99)*	(2.12)*
Institutions (Rule of Law)		0.877	0.849		0.879	0.868
		(7.80)**	(7.38)**		(10.70)**	(10.42)**
Integration (Ln Trade Share)			0.135			0.075
			(1.10)			(0.85)
Observations	70	70	70	123	123	123
Adjusted R-squared	0.25	0.61	0.61	0.44	0.71	0.71

Panel B: 2SLS Regressions

	AJR Sample			HJ Sample		
Dependent Variable: Log GDP per capita	7	8	9	10	11	12
Geography (abs[Latitude])	0.046	-0.005	-0.006	0.046	-0.016	-0.02
	(4.76)**	(0.41)	(0.45)	(9.70)**	(1.39)	(1.31)
Institutions (Rule of Law)		1.436	1.447		1.491	1.47
		(6.11)**	(5.74)**		(5.85)**	(5.76)**
Integration (Ln Trade Share)			-0.06			-0.11
			(0.27)			(0.72)
Observations	70	70	70	123	123	123
Adjusted R-squared	0.25	0.46	0.45	0.44	0.58	0.71
Overidentification Test					0.0378	

Panel C: 2SLS: First Stage Regressions

Dependent Variable	Rule of Law		Ln Trade Share	Rule of Law		Ln Trade Share
Geography (abs[Latitude])	0.02	0.02	-0.01	0.04	0.04	-0.01
	(2.06) *	(2.32) *	(0.96)	(11.73) **	(11.70) **	(2.56) *
Ln Settler Mortality	-0.37	-0.38	-0.1			
	(5.52) **	(5.64) **	(1.83)			
FR Trade Share		0.14	0.65		0.12	0.54
		(1.41)	(8.03)		(1.66)	(10.58) **
English Fraction				0.56	0.58	0.48
				(2.24) *	(2.28) *	(2.63) **
European Language				0.34	0.35	-0.26
				(1.96)	(2.06) *	(2.15) *
F-Stat	30.8	21.51	23.86	53.78	41.93	32.62
Adjusted R Square	0.48	0.47	0.5	0.56	0.575	0.5111

Absolute value of t statistics in parentheses

* significant at 5%; ** significant at 1%

Table 2: Panel Regressions: Benchmark Specification, 10 yr averages

	Dependent Variable: Log GDP per capita	1	2	3	4	5	6
X1(it)	Ln CIM (t-1)	0.499	0.553	0.512	0.711		
		(4.71)**	(5.02)**	(5.25)**	(5.94)**		
	Veto Players (t)					0.039	0.045
						(2.61)**	(3.23)**
X2(it)	Ln Trade Share (t-1)	0.211	0.251			0.241	0.313
		(4.33)**	(5.30)**			(4.96)**	(6.65)**
	Ln BMP (t-1)			-0.039	-0.049		
				(3.36)**	(3.73)**		
Z1(i)	Malaria Ecology	-0.021	-0.047			-0.03	-0.044
		(1.69)+	(3.74)**			(2.77)**	(3.43)**
	Malaria Index, 1966			-0.79	-1.204		
				(0.77)	(8.06)**		
Z2(i)	Rule of Law	0.941		0.639		0.89	
		(5.54)**		(0.51)		(7.53)**	
	NoCorrupt		0.318		0.11		0.413
			(4.19)**		(2.89)**		(5.60)**
	Observations	272	244	191	173	340	291
	Countries	94	84	71	65	122	102
	B-P test of OLS vs EC‡	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
	Hausman test of RE vs FE‡	[0.0039]	[0.0004]	[0.0000]	[1.0000]	[0.0000]	[0.0000]
	Hausman test of HT vs FE‡	[1.0000]	[1.0000]	[1.0000]		[1.0000]	[1.0000]
	Hausman test of RE vs HT‡				[1.0000]		
	F values from first stage regressions of Step 3 of the HT estimation (dependent variables in italics)	*CIM*	*CIM*	*CIM*		*Veto Player*	*Veto Player*
		862.24	1222.51	874.40		9431.56	28736.13
		Trade sh.	*Ttrade sh.*	*BMP*		*Trade sh.*	*Ttrade sh.*
		269.99	394.59	969.05		88.55	411.202
		ME	*ME*	*Malaria 66*		*ME*	*ME*
		76128.19	59876.89	2686.34		34928.52	23939.99
		Rule	*No corrupt*	*Rule*		*Rule*	*No corrupt*
		28.59	20.10	19.30		71.95	31.55
	Selected Estimation:	HT	HT	HT	RE	HT	HT

Absolute value of z statistics in parentheses

+/*/**: significant at 10% / 5% /1%, respectively

‡: p values in square brackets

Table 2: Panel Regressions: Benchmark Specification, 10 yr averages, cont'd.

	Dependent Variable: Log GDP per capita	7	8	9†	10	11
X1(it)	Ln CIM (t-1)			0.392	0.518	0.44
				(3.30)**	(3.91)**	(3.54)**
	Veto Players (t)	0.044	0.048	0.022	0.033	0.03
		(2.95)**	(3.26)**	(1.44)	(1.98)*	(1.95)+
X2(it)	Ln Trade Share (t-1)			0.136	0.123	0.185
				(2.49)*	(2.33)*	(3.47)**
	Ln BMP (t-1)	-0.059	-0.062	-0.033	-0.047	-0.032
		(4.66)**	(5.02)**	(2.44)*	(3.41)**	(2.46)*
Z1(i)	Malaria Ecology			-0.013	-0.052	-0.026
				(0.86)	(5.51)**	(0.73)
	Malaria Index, 1966	-0.647	-1.134			
		(1.69)+	(3.97)**			
Z2(i)	Rule of Law	0.751		1.241		0.775
		(1.86)+		(3.34)**		(0.58)
	NoCorrupt		0.225		0.149	0.12
			(0.96)		(3.44)**	(0.33)
	Observations	237	211	200	175	175
	Countries	89	79	74	65	65
	B-P test of OLS vs EC‡	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
	Hausman test of RE vs FE‡	[0.3964]	[0.0106]	[0.0000]	[1.0000]	[0.0000]
	Hausman test of HT vs FE‡	[1.0000]	[1.0000]	[0.9528]		[1.0000]
	Hausman test of RE vs HT‡				[1.0000]	
	F values from first stage regressions of Step 3 of the HT estimation (dependent variables in italics)	*Veto Player*	*Veto Player*	*CIM*		*CIM*
		19931.89	27079.73	2721.06		187.09
		BMP	*BMP*	*Veto Player*		*Veto Player*
		624.83	979.72	170.61		515.78
		Malaria 66	*Malaria 66*	*Trade sh.*		*Trade sh.*
		1079.98	976.67	495.79		8.97
		Rule	*No corrupt*	*BMP*		*BMP*
		30.72	5.64	10.54		41015.49
				ME		*ME*
				528.40		534.59
				Rule		*Rule*
				38625.55		6.19
						No corrupt
						2198.44
	Selected Estimation:	HT	HT	HT	RE	HT

Absolute value of z statistics in parentheses

+/*/**: significant at 10% / 5% /1%, respectively

‡: p values in square brackets

†: for Col 9, Basmann p val for overid. restrictions is 0.8642 and Sargan p val. is 0.8615

Table 3: Panel Regressions: Benchmark Specification, 5 yr averages

	Dependent Variable: Log GDP per capita	1	2	3	4	5	6	7	8	9	10	11
X1(it)	Ln CIM (t-1)	0.637	0.701	0.704	0.8					0.579	0.597	0.629
		(9.86)**	(10.03)**	(10.01)**	(9.82)**					(6.84)**	(6.35)**	(6.61)**
	Veto Players (t)					0.025	0.03	0.028	0.032	0.023	0.024	0.025
						(3.12)**	(3.76)**	(3.59)**	(4.05)**	(2.55)*	(2.75)**	(2.77)**
X2(it)	Ln Trade Share (t-1)	0.286	0.328			0.265	0.324	0.283	0.339	0.157	0.215	0.189
		(9.38)**	(10.65)**			(8.99)**	(10.76)**	(9.68)**	(11.14)**	(4.60)**	(5.95)**	(5.36)**
	Ln BMP (t-1)			-0.039	-0.035					-0.028	-0.016	-0.024
				(4.19)**	(3.53)**					(2.99)**	(1.66)+	(2.44)*
Z1(i)	Malaria Ecology	-0.02	-0.039			-0.037	-0.042			-0.029	-0.041	-0.035
		(1.85)+	(3.26)**			(3.58)**	(3.13)**			(3.57)**	(3.04)**	(3.86)**
	Malaria Index (1966)			-0.305	-0.869			-0.831	-0.953			
				(0.81)	(3.29)**			(4.17)**	(3.51)**			
Z2(i)	Rule of Law	0.876		1.215		0.812		0.767		0.713		0.594
		(6.21)**		(2.64)**		(7.42)**		(6.14)**		(7.04)**		(4.29)**
	NoCorrupt		0.358		0.468		0.431		0.409		0.409	0.036
			(5.10)**		(2.28)*		(5.56)**		(4.39)**		(2.54)*	(0.72)
	Observations	629	565	415	377	672	567	618	550	377	333	333
	Countries	94	84	70	64	135	104	125	101	74	65	65
Test 1	validity of RE†	[0.0003]	[1.0000]	[0.0000]	[1.0000]	[0.0001]	[1.0000]	[0.0001]	[0.0000]	[1.0000]	[0.0196]	[1.0000]
Test 2	validity of HT‡	[1.0000]	[0.0026]	[1.0000]	[0.0006]	[1.0000]	[0.0065]	[1.0000]	[1.0000]	[1.0000]	[0.7733]	[1.0000]
	Selected Estimation:	HT	HT	HT	HT	HT	HT	HT	HT	RE	HT	RE

Absolute value of z statistics in parentheses

+/*/**: significant at 10% / 5% /1%, respectively

†: p values of Hausman test between RE and FE

‡: p value of Hausman test between HT and FE (RE and HT) if RE rejected (not rejected) in Test 1

Table 4: Panel Regressions: Additional Time Varying Measures of Institutions, 10 yr averages

	Dependent Variable: Log GDP per capita	1	2	3	4	5	6	7	8	9	10
X1(it)	Ln CIM (t-1)	0.591	0.39	0.496	0.441	0.411	0.575	0.346	0.384	0.416	0.379
		(5.36)**	(3.47)**	(4.67)**	(4.04)**	(4.01)**	(5.34)**	(3.15)**	(3.59)**	(3.92)**	(3.71)**
	Veto Players (t)	0.03	0.034	0.025	0.029	0.04	0.036	0.037	0.028	0.031	0.046
		(1.67)+	(2.22)*	(1.72)+	(2.02)*	(2.67)**	(2.06)*	(2.50)*	(1.96)*	(2.22)*	(3.08)**
X2(it)	Ln Trade Share (t-1)	0.173	0.227	0.16	0.215	0.227	0.176	0.224	0.218	0.214	0.236
		(4.09)**	(4.69)**	(3.70)**	(4.50)**	(4.99)**	(4.20)**	(4.73)**	(4.56)**	(4.60)**	(5.12)**
	Leg. Comp. Index (t)	-0.156					-0.141				
		(3.33)**					(2.99)**				
	(Leg. Comp. Index)^2 (t)	0.016					0.014				
		(2.91)**					(2.50)*				
	Stability of Tenure (t)		0.094					0.059			
			(0.75)					(0.47)			
	Democracy (t-1)			0.014					0.007		
				(1.61)					(0.72)		
	Constraints on Exec (t-1)				0.114					0.141	
					(2.17)*					(2.72)**	
	(Constraints on Exec)^2 (t-1)				-0.014					-0.017	
					(1.96)*					(2.45)*	
	FH Democracy Index (t)					-0.227					-0.195
						(4.75)**					(3.97)**
	(FH Democracy Index)^2 (t)					0.037					0.029
						(4.93)**					(3.63)**
Z1(i)	Malaria Ecology	-0.029	-0.023	-0.027	-0.021	-0.023					
		(3.82)**	(2.29)*	(3.36)**	(2.24)*	(2.24)*					
	Malaria Index (1966)						-0.858	-0.664	-0.6	-0.613	-0.654
							(6.00)**	(2.83)**	(2.47)*	(2.87)**	(2.68)**
Z2(i)	Rule of Law	0.731	0.878	0.714	0.904	0.824	0.601	0.782	0.808	0.819	0.773
		(12.84)**	(7.48)**	(10.81)**	(8.09)**	(6.64)**	(9.66)**	(5.54)**	(5.19)**	(6.19)**	(5.03)**
	Observations	270	268	262	262	270	251	249	250	250	251
	Countries	94	94	90	90	94	87	87	86	86	87
Test 1	validity of RE†	[1.0000]	[0.0004]	[0.0700]	[0.0129]	[0.0001]	[1.0000]	[0.0063]	[0.0152]	[0.0000]	[0.0005]
Test 2	validity of HT‡	[1.0000]	[0.8727]	[0.1429]	[0.1855]	[0.9188]	[1.0000]	[0.8983]	[0.8927]	[0.1212]	[0.9644]
	Selected Estimation:	RE	HT	RE	HT	HT	RE	HT	HT	HT	HT

Absolute value of z statistics in parentheses ; +/*/**: significant at 10% / 5% /1%, respectively

†: p values of Hausman test between RE and FE ; ‡: p value of Hausman test between HT and FE (RE and HT) if RE rejected (not rejected) in Test 1

Table 5: Panel Regressions: Additional Time-invariant Measures of Institutions, 10 yr averages

	Dependent Variable: Log GDP per capita	1	2	3	4	5	6	7	8	9	10
X1(it)	Ln CIM (t-1)	0.461	0.427	0.568	0.425	0.427	0.422	0.38	0.522	0.38	0.381
		(4.14)**	(3.89)**	(4.79)**	(3.93)**	(3.90)**	(3.88)**	(3.54)**	(4.56)**	(3.63)**	(3.54)**
	Veto Players (t)	0.027	0.027	0.03	0.028	0.027	0.029	0.03	0.033	0.03	0.03
		(1.87)+	(1.87)+	(1.70)+	(1.94)+	(1.88)+	(2.09)*	(2.16)*	(1.91)+	(2.22)*	(2.13)*
X2(it)	Ln.Trade Share (t-1)	0.232	0.223	0.128	0.223	0.223	0.229	0.223	0.121	0.223	0.222
		(4.81)**	(4.60)**	(2.68)**	(4.70)**	(4.63)**	(4.83)**	(4.69)**	(2.60)**	(4.83)**	(4.67)**
Z1(i)	Malaria Ecology	-0.014	-0.016	-0.005	-0.014	0.002					
		(1.19)	(1.65)+	(0.56)	(1.30)	(0.15)					
	Malaria Index (1966)						-0.528	-0.54	-0.648	-0.273	-0.298
							(1.73)+	(2.36)*	(2.86)**	(0.87)	(1.06)
	LER Fractional.#	[0.3114]					[0.4546]				
	European Lang. Fraction		0.318					0.348			
			(2.06)*					(2.24)*			
	Religious Fraction#			[0.0211]					[0.0354]		
	British Legal Origin				0.067					0.025	
					(0.23)					(0.08)	
	French Legal Origin				0.657					0.615	
					(1.97)*					(1.61)	
	Region : SSA					-0.483					-0.323
						(2.18)*					(1.45)
	Region: Latin America					0.348					0.398
						(1.70)+					(1.97)*
	Region: E. Asia and Pacific					-0.054					0.022
						(0.30)					(0.11)
Z2(i)	Rule of Law	0.933	0.89	0.827	1.126	0.854	0.859	0.769	0.662	1.09	0.793
		(5.83)**	(7.59)**	(10.43)**	(6.77)**	(6.31)**	(4.45)**	(5.53)**	(6.92)**	(4.79)**	(5.56)**
	Observations	259	269	180	270	270	242	250	168	251	251
	Countries	90	93	62	94	94	84	86	58	87	87
Test 1	validity of RE†	[0.0080]	[0.0383]	[0.8148]	[0.0000]	[0.0249]	[0.0073]	[0.0244]	[0.8675]	[0.0000]	[0.0453]
Test 2	validity of HT‡	[0.7722]	[0.8287]	[0.9990]	[0.9804]	[0.8153]	[0.8768]	[0.9230]	[0.9995]	[0.9357]	[0.9754]
	Selected Estimation:	HT	HT	RE	HT	HT	HT	HT	RE	HT	HT

Absolute value of z statistics in parentheses

+/*/**: significant at 10% / 5% /1% respectively

† : p values of Hausman test between RE and FE

‡: p value of Hausman test between HT and FE (RE and HT) if RE rejected (not rejected) in Test 1

Table 6: Panel Regressions: Alternative Measures of Trade, 10 yr averages

	Dependent Variable: Log GDP per capita	1	2	3	4	5	6	7	8	9	10
X1(it)	Ln CIM (t-1)	0.425	0.49	0.685	0.714	0.669	0.419	0.487	0.635	0.4	0.373
		(3.90)**	(4.34)**	(5.88)**	(3.65)**	(3.45)**	(3.96)**	(3.91)**	(5.27)**	(1.91)+	(1.75)+
	Veto Players (t)	0.028	0.017	0.026	0.034	0.033	0.03	0.02	0.027	0.043	0.041
		(1.91)+	(1.12)	(1.61)	(1.99)*	(1.96)*	(2.12)*	(1.14)	(1.63)	(2.59)**	(2.47)*
X2(it)	Ln Trade Share (t-1)	0.223					0.223				
		(4.65)**					(4.81)**				
	Ln BMP (t-1)		-0.038					-0.039			
			(2.91)**					(2.70)**			
	Ln ER Overvaluation (t-1)			-0.147					-0.13		
				(2.30)*					(2.01)*		
	Ln Import Tariffs (t-1)				-0.059					-0.068	
					(2.80)**					(3.21)**	
	Ln Taxes on Trade (t-1)					-0.068					-0.071
						(3.31)**					(3.34)**
Z1(i)	Malaria Ecology	-0.021	-0.018	-0.019	-0.024	-0.024	-0.024	-0.004	-0.005	-0.024	-0.022
		(2.02)*	(0.95)	(2.19)*	(2.99)**	(3.09)**	(1.53)	(0.12)	(0.26)	(1.32)	(1.23)
Z2(i)	Rule of Law	0.923	1.038	0.737	0.736	0.725					
		(7.76)**	(2.35)*	(11.78)**	(11.63)**	(11.52)**					
	Index Open						0.719	1.021	0.743	0.667	0.684
							(5.05)**	(1.40)	(4.39)**	(3.59)**	(3.74)**
	Observations	270	205	238	169	170	267	199	237	165	166
	Countries	94	79	87	92	92	92	74	86	88	88
Test 1	validity of RE†	[0.0069]	[0.0000]	[0.5576]	[0.1680]	[0.1376]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
Test 2	validity of HT‡	[0.9743]	[0.9600]	[0.7597]	[0.1080]	[0.1193]	[0.6469]	[1.0000]	[0.9390]	[0.8136]	[0.8470]
	Selected Estimation:	HT	HT	RE	RE	RE	HT	HT	HT	HT	HT

Absolute value of z statistics in parentheses

+/*/**: significant at 10% / 5% /1% respectively

† : p values of Hausman test between RE and FE

‡: p value of Hausman test between HT and FE (RE and HT) if RE rejected (not rejected) in Test 1

Table 7: Panel Regressions: Alternative Measures of Geography, 10 yr averages

	Dependent Variable: Log GDP per capita	1	2	3	4	5	6	7	8	9	10
X1(it)	Ln CIM (t-1)	0.409	0.413	0.411	0.265	0.44	0.634	0.448	0.75	0.255	0.408
		(3.77)**	(3.81)**	(3.80)**	(2.30)*	(3.98)**	(3.27)**	(2.03)*	(3.94)**	(1.13)	(1.91)+
	Veto Players (t)	0.028	0.027	0.027	0.032	0.027	0.036	0.039	0.033	0.048	0.041
		(1.94)+	(1.88)+	(1.92)+	(1.80)+	(1.85)+	(2.11)*	(2.17)*	(1.91)+	(2.67)**	(2.41)*
X2(it)	Ln Trade Share (t-1)	0.218	0.217	0.218	0.087	0.204					
		(4.53)**	(4.50)**	(4.52)**	(1.59)	(4.23)**					
	Ln Import Tariffs (t-1)						-0.069	-0.066	-0.062	-0.067	-0.068
							(3.25)**	(2.83)**	(2.92)**	(0.85)	(3.07)**
Z1(i)	Landlocked (not C/W Europe)	-0.424					-0.625				
		(2.30)*					(4.34)**				
	% of land in tropics		0.996					0.188			
			(1.12)					(0.20)			
	(% of land in tropics)^2		-1.648					-0.843			
			(1.75)+					(0.90)			
	Ln hydrocarbons per capita			0.047					0.05		
				(3.36)**					(4.21)**		
	Good crops index				-5.589					-3.889	
					(3.46)**					(2.81)**	
	(Good crops index)^2				1.652					1.137	
					(3.08)**					(2.34)*	
	Dist Equator					1.895					1.604
						(1.52)					(1.22)
	(Dist Equator)^2					-4.094					-2.508
						(1.79)+					(1.24)
Z2(i)	Rule of Law	0.917	0.965	0.932	1.416	1.161	0.734	0.805	0.766	1.344	0.875
		(8.14)**	(8.47)**	(9.32)**	(6.34)**	(4.91)**	(12.32)**	(6.20)**	(13.14)**	(3.72)**	(2.86)**
	Observations	257	257	257	162	275	160	160	160	98	174
	Countries	89	89	89	55	96	86	86	86	54	96
Test 1	validity of RE†	0.0010	0.0012	0.0005	0.0000	0.0003	0.2778	0.0396	0.0806	0.0002	0.0537
Test 2	validity of HT‡	0.8815	0.8813	0.9975	0.2636	0.7895	0.2482	0.5932	0.1252	0.4220	0.9052
	chosen model	HT	HT	HT	HT	HT	RE	HT	HT	RE	HT

Absolute value of z statistics in parentheses

+/*/**: significant at 10% / 5% /1% respectively

† : p values of Hausman test between RE and FE

‡: p value of Hausman test between HT and FE (RE and HT) if RE rejected (not rejected) in Test 1