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Untangling the Quality of Governance from the Level of Income: Are Sub-Saharan African Countries Governed Well?

by

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Abstract: We consider whether Sub-Saharan African (SSA) countries are mainly poor because they are governed worse than other countries, as suggested by recent studies on the supremacy of institutions. Our empirical results show that the supremacy of institutions does not hold. SSA countries appear to face very specific development problems. Given their geographic and economic constraints, we conclude that SSA countries are on average not governed worse than other comparable countries. Our finding supports the basic argument of a recent UN report (UN Millennium Project 2005). However, we find that the UN report is based on empirical evidence that appears to imply the supremacy of institutions.

Keywords: Development, institutions, disease ecology, Sub-Saharan Africa

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1 Introduction

Sub-Saharan Africa is poorer than any other developing region in the world. Its average GDP per capita lags greatly behind the rest of the developing countries. What are the reasons for this asymmetric development? Are Sub-Saharan African (SSA) countries poor due to cultural or geographic factors, due to a lack of trade integration or mainly because they are governed worse than other regions? A new report published by the United Nations and directed by Jeffrey Sachs (UN Millennium Project 2005) is based on the premise that being a poor country is one of the major reasons for relatively weak governance. Hence large amounts of development aid may be necessary and at the same time sufficient to overcome poverty in SSA countries, despite an apparent lack of good governance.

The new UN report is likely to initiate a new debate about the effectiveness of development aid. We focus on its basic underlying premise, which has been a contentious issue in the recent academic debate about the vast differences in the level of economic development. The present mainstream view in development economics appears to favor the hypothesis that the quality of governance is a causal factor for development that trumps all other factors. According to this view, it is the power of incentives generated by the institutional framework of a country that determines efficient investment. According to the alternative view envisaged by the UN report (UN Millennium Project 2005), which may revoke memories of development approaches based on financing-gap models, it is large-scale investment that determines development by overcoming poverty traps and improving the quality of governance.

While the present consensus in mainstream development economics emphasizes the relevance of good governance for growth and development, some disagreement has remained in the literature about the direction of causality and about the relevance for development of other factors besides the institutional framework of a country, such as geography or trade integration. A majority of recent papers that focuses on the impact of the institutional framework on income, and in particular on the role of property rights and the rule of law, denies any significant direct effect of other factors than the quality of institutions (e.g. Hall and Jones (1999), Acemoglu et al. (2001), Easterly and Levine (2003), and Rodrik et al. (2004)). Other studies claim to show the significance of geographic characteristics for long-run growth and development (Diamond (1997), Sachs et al. (1998), Sachs and Gallup (2001), Sachs (2001), Sachs (2003), Sachs et al. (2004), Hibbs and Olsson (2004)). An even more fundamental critique of the present mainstream view, which is in line with the basic premise of the new UN report (UN Millennium Project (2005)), holds that good governance is a consequence rather than a cause of development (Glaeser et al. (2004)).

Taking the present consensus view at face value, it follows that SSA countries are poor due to the low quality of governance, which is in turn a consequence of an institutional infrastructure that does not provide sufficient incentives for investment in physical and human capital. In contrast, the dissenting view by Jeffrey Sachs and others suggests that Africa's development crisis is not only due to a government crisis. Based on empirical results by Radelet (2004), Sachs et al. (2004) and also the UN Millennium Report (2005) affirm that many SSA countries can actually be considered as relatively well governed once their low level of income is properly taken into account, thereby concluding that development is a complex interaction of institutions, policies and geography rather than a process solely determined by the supremacy of institutions.

The question whether SSA countries are actually governed well conditional on their low level of income, is obviously relevant for an understanding of the determinants of development and growth in general and especially so for deciding about the allocation of development aid. It is common practice to allocate aid above all to countries with sound institutions. If SSA countries are perceived to be governed worse than they actually are, this would have far reaching consequences for the amount and the structure of the aid that SSA countries can expect to receive.[1]

We review the existing empirical evidence that has been presented by Radelet (2004) to support the hypothesis that SSA countries are not governed worse than

[1] For recent accounts of the allocation of aid flows by characteristics of recipient countries, see Nunnenkamp (2004) and Nunnenkamp et al. (2004).

other developing countries. We begin by estimating the relative impact of institutions and other factors on income, thereby using alternative measures of institutional quality, different instrumental variables and alternative samples of countries. Based on our findings, we then construct a measure of institutional quality that is conditional on income and other factors. This measure of conditional governance quality can be compared to the actual measure of governance quality. The difference between the two measures should reveal whether SSA countries are systematically governed worse than other countries.

Our paper is organized as follows. The next section briefly reviews the ongoing debate on the supremacy of institutions for development and the empirical evidence that claims to show that SSA countries are not governed worse than other developing countries. We think that this evidence is not entirely convincing because of the underlying empirical specification. Our own empirical analysis begins with a simple regression of income on institutions, which reproduces the well-known fact that SSA countries deviate systematically from the regression line. However, this conclusion does no longer hold once we take into account measures of disease ecology as additional explanatory variables. Hence SSA countries appear to face specific development problems that are not relevant for other countries. Given their economic and geography-specific constraints, we conclude that SSA countries are on average not governed worse than other countries.

2 Review of the Literature

In order to find answers to the question of African governance one has to take a closer look at the debate between advocates of the institutions supremacy hypothesis and the alternative view of Jeffrey Sachs and others. The different hypotheses are backed by different empirical results. The institutions supremacy literature provides empirical evidence that a measure of institutional quality is the only statistically and economically significant variable in cross-county regression models that explain international income differences. Sachs and others emphasize the statistical and economic significance of geographic variables besides measures of institutional quality. Thus, the debate does not question the importance of institutions for development but focuses on the question whether income is affected directly or indirectly by additional variables, such as measures of geographic conditions like disease ecology.

Different answers to the question are partly due to differences in samples, variables and estimation procedures used. Hall and Jones (1999), for instance, focus on the impact of so-called social infrastructure[2] as the major explanatory variable for international income differences. Social infrastructure influences capital accumulation, educational attainment, and total factor productivity, which together in turn influence output per worker. Social infrastructure is

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[2] Social infrastructure is defined as “the institutions and government policies that determine the economic environment within which individuals accumulate skills and firms accumulate capital and produce output”. (Hall and Jones (1999))

measured by the average of an index of government antidiversion policies (GADP) and the Sachs-Warner index of trade openness. Acemoglu et al. (2001) use a different measure to proxy for institutional quality, namely the risk of expropriation that current and potential investors face. Their claim of the primacy of institutions is based on empirical results showing that other possible explanatory variables turn out to be statistically insignificant. Rodrik et al. (2004) focus on measures of institutions, geography, and trade integration as simultaneous explanatory variables for international income differences, where the governance indicators of Kaufmann et al. (2003) are used to identify the quality of the institutional infrastructure. Rodrik et al. (2004) show that measures of geography, namely distance from the equator, have at best a weak direct effect on income, but that they have a strong indirect effect by influencing the quality of institutions. Similar results are presented by Easterly and Levine (2003), who also deny any direct income effects of geographic factors such as a tropical location, the presence of germs, or the availability of cultivatable crops.

Using the same institutional variables as some of the above work (risk of expropriation and the Kaufmann indicator), Sachs and others reach a different conclusion by also taking into account the geographical variable malaria risk. Sachs (2003) shows that a measure of malaria risk has a statistically significant and economically important influence on income. However, the robustness of his results has been rejected by Acemoglu et al. (2001) and by Rodrik et al.

(2004), mainly with regard to sample specification and the chosen instrument variables.

Sorting out causality is a major difficulty in the analysis of the impact of different factors on income. Institutions apparently influence the productivity and thereby the income level of a country. But at the same time richer countries have the resources available to afford good institutions, which are missing in poor countries. Hence the income of a country may also exert some influence on the quality of its institutions. Appropriate instrumental variables for institutions are required to address these problems of endogeneity and reverse causality. The instruments need to identify the exogenous variation of institutional quality that may cause the observed variation in the level of income across countries. The instruments therefore have to be correlated with measures of institutions, and at the same time have to be independent from the present level of income and without any direct effect on it.

Different instruments have been used in the recent literature to control for the endogeneity of institutional quality. Hall and Jones (1999) use distance from the equator, the fraction of the population speaking English or other Western European languages, and the (log of the) predicted trade share of a country[3] as instruments for social infrastructure. The former three instruments are assumed to reflect the influence of Western European institutions on a country. The

[3] As constructed by Frankel and Romer (1999).

motivating assumption is that the more a country has been influenced by Western European institutions, the more likely it is that its present social infrastructure would support efficient production.

Acemoglu et al. (2001) question the validity of these instruments and introduce settler mortality in the early nineteenth century as a new instrument for the quality of institutions. Their critique of Hall and Jones is directed at the possible endogeneity of the two measures of the language(s) spoken in a country, at a possible direct effect of distance from equator on income, and at the missing explanation for the different effect that Western European institutions had on countries in different climatic zones. By contrast, their new instrument settler mortality has obviously no direct effect on present output, and cannot be affected by present output. The reasoning behind this instrument is that about 200 years ago lower mortality rates induced more settlements, and settlements in turn led to the creation of good institutions that protected the property rights of the settlers in places with favorable settling conditions. Colonies with higher mortality rates were less favorable for settlements, which led to institutions that mainly focused on the extraction of resources and did not provide much protection for private property. Because of the average persistence of initial institutions, settler mortality in the early nineteenth century may be taken as a valid instrument for the quality of contemporary institutions. Settler mortality has proved to be the most widely used instrument in the recent empirical literature on cross-country income differences.

The potential causality running from the level of income to the quality of institutions, which is held to be a second order effect in the mainstream development literature, is held to be a first order effect in the new UN report (UN Millennium Project 2005). The empirical support for this contrasting hypothesis, which implies that the supremacy of institutions does not hold, comes from a background study by Radelet (2004). Radelet uses a nonlinear specification where a measure of governmental quality is regressed on a measure of per capita income for a cross section of countries $i = 1,...,n$:

$$G_i = \alpha - ß\, e^{(-GNP_i / \delta)} + \varepsilon_i \qquad (1)$$

where G is a country's composite governance score, e is the base of the natural logarithm, GNP is per capita income, and α, β, and δ are the estimated parameters. For this specification, α is the horizontal asymptote of the function (the estimated maximum government score), $\alpha - \beta$ is the vertical intercept of the function (the governance score for a hypothetical country with zero income), and δ is the degree of curvature of the function as constrained by α and $\alpha - \beta$. Radelet (2004) uses equation (1) to control governmental quality for the level of income. That is, the residuals ε_i of equation (1) are used to identify which countries display a measure of governmental quality that is below or above the estimated government score for a given level of per capita income. Radelet (2004) reports that by controlling for the level of income, SSA countries do not systematically deviate from the estimated regression line.

Based on the limited information given in Radelet (2004), it cannot be ruled out that the results for the SSA countries are mainly due to the specific functional form employed. Moreover, this way of controlling for levels of income ignores the causality running from governmental quality or institutions to GDP, which is emphasized by several recent empirical studies, including studies by Sachs and his coauthors and especially by Sachs (2003). Therefore, results based on equation (1) may suffer from a simultaneous equation bias. More importantly, results based on equation (1) may also suffer from an omitted variables bias. Following studies by Sachs and his coauthors and especially as emphasized in Sachs (2003), there appear to be geographic factors in addition to measures of institutions that influence the level of income in cross-country comparisons, such as the prevalence of malaria. If such geography-specific factors are indeed relevant for explaining the low relative income levels of SSA countries independent from measures of the quality of governance, then results based on equation (1) should actually indicate that the residuals for SSA countries deviate significantly from the estimated regression line.

Since this reportedly is not the case, there remain two possibilities. First, geography-specific factors may indeed be irrelevant for explaining the low relative income level of SSA countries, as the majority of recent studies would have it and as is implied by equation (1). Second, geography-specific factors may affect income levels independent from measures of the quality of governance as emphasized by Sachs (2003), which would imply that the results by Radelet (2004) are driven by the specific functional form of equation (1). The point is that equation (1) cannot be used to identify the quality of a country's institutions conditional on income once the hypothesis is accepted that SSA countries face specific development problems due to a specific disease environment and other possible geography-related factors. Put differently, the Radelet specification is only correct if measures of the quality of governance are the only factor that explains international income differences. However, such a view is in conflict with the recent UN report (UN Millennium Project 2005) and with a study by Sachs et al (2004), which do refer to the results by Radelet (2004) but at the same time presume that the (weak) quality of governance is definitely not the only factor that explains the low relative income levels of SSA countries.

3 The Impact of Institutions on Income: OLS Estimation

The following empirical analysis aims at untangling the observed quality of governance from the level of income in order to see whether SSA countries significantly deviate from an average pattern for a larger group of countries. To check the robustness of the alternative hypothesis discussed in the previous section, we begin by taking a closer look at the estimation of the relationship between institutions and income. A specification like

$$\ln GDPW_i = c + \alpha\ INST_i + \varepsilon_i\ , \qquad (2)$$

where *GDPW* is real GDP per worker, *INST* is a measure of governmental quality and ε_i is the residual, helps to identify the different implications that arise from the alternative interpretations of the link between income and institutions. The literature that favors the primacy of institutions hypothesis would suggest that the low income of SSA countries can mainly be explained by their low institutional government scores (*INST*). Therefore, the GDP per worker of SSA countries should be fairly well predicted by the estimates based on equation (2). This should be reflected by statistically insignificant deviations of the residuals of SSA countries from the estimated regression line. In contrast to the supremacy of institutions hypothesis, the Sachs et al. (2004) hypothesis would suggest that Sub-Saharan Africa's problem may not only be caused by the weak quality of its governance but by other factors as well. This hypothesis would imply that a regression of income on institutions systematically overestimates the income of SSA countries given their institutional scores. So if the Sachs hypothesis is right, then the GDP per worker of SSA countries should in fact be systematically lower than would be predicted by equation (2).

Adding a dummy variable for SSA is a convenient way to check whether GDP per worker of SSA countries is systematically overestimated by equation (2):

$$\ln GDPW_i = c + \alpha \; INST_i + \beta \; SSA_i + \varepsilon_i \tag{3}$$

With this specification, we can see whether SSA countries, once the quality of institutions is controlled for, have a statistically significantly lower GDP per worker on average than other sample countries. A statistically significant negative coefficient β would thus be supportive of the Sachs hypothesis.

We use two alternative samples and five alternative governance indicators for the estimation of equation (3) and in the subsequent analysis. Our larger sample includes 66 former colonies for which data on settler mortality is available. Our smaller sub sample of 45 countries is obtained from the larger sample by deleting countries that are either small (less than one million inhabitants in 1990), or mainly dependent on oil production, or are known for providing unreliable data.[4] We use the logarithm of GDP per worker in 1995 (*lnGDPW*) as the dependent variable, which is taken from the Penn World Tables 6.1 revision of Summers et al. (2002). For the measurement of institutional quality (INST), we use alternative indicators throughout the paper: social infrastructure (*socinf*), government antidiversion policies between 1985 and 1995 (*gadp*), risk of expropriation between 1985 and 1995 (*exprop*), rule of law in 1996 (*rl96*), control of corruption in 1996 (*cc96*), and the 1996 average value of the six aggregate governance indicators (*kk96*) of Kaufmann et al. (2003).[5]

Table 1 presents the OLS estimates of equation (3); Table A1 in the appendix presents the estimates for the alternative sample with 45 countries. We find statistically and economically significant coefficients of the measure of institutional quality and of the SSA-dummy. Adding the SSA-dummy clearly adds additional explanatory power to the model, as has been emphasized in earlier cross-country regressions that focused on measures of factor accumulation as

[4] Rated as D-countries in Summers and Heston (1991).
[5] We provide a detailed description of all variables and a list of sample countries in the appendix.

explanatory variables.[6] This result is robust to using different institutional variables. Hence we find that in line with the Sachs hypothesis, SSA countries appear to have a statistically significantly lower GDP per worker on average than the other sample countries, even if the quality of their institutions is controlled for. The problem with these OLS estimates is that they neglect the possible reverse causality from measures of income to measures of institutions. As a consequence, the estimated coefficients are likely to be biased.

4 Controlling for the Endogeneity of Institutions: IV Estimation

The problem of reverse causality can be addressed by using instrumental variable (IV) estimation instead of OLS. That is, in addition to equation (3) we have the first stage regression:

$$INST_i = \lambda + \gamma_{INST} \cdot Instrument_i^{INST} + \phi_{Inst} \cdot SSA_i + \mu_i \tag{4}$$

The most challenging step of the IV estimation is to find appropriate instruments. Instruments must satisfy the conditions that they are uncorrelated with the error term ε_i and that they influence the dependent variable *only* via the independent variable, in our case the measure of institutional quality. As mentioned in the previous section, several alternative instruments have been suggested in the recent literature on the cross-country empirics of growth. Recent work has highlighted the pitfalls of using instrumental variables with little ex-

[6] For a review of this literature, see Collier and Gunning (1999).

planatory power.[7] The consequence of using so-called weak instruments is that they can lead to substantial bias in the estimated IV coefficients. In order to test whether the instruments are weak, Stock and Staiger (1997) suggest computing the F-statistics from the first-stage regression. As a rule of thumb they suggest that for a single equation endogenous regressor an F-statistic below 10 is cause for concern. Table 2 presents the F-statistics from estimating the first-stage regression equation (4). The results show that *lnmort* and to some extent *lat* fulfill the Stock-Staiger criterion for valid instruments, whereas other variables were found to be weak instruments.[8] In the following regressions we therefore only use *lnmort* and *lat* as instrumental variables.

Estimating equation (4) with *lnmort* or alternatively *lat* as instruments yields the results reported in Table 3 (Table A2 presents the results for the small sample). Concerning the statistical significance of the coefficients, the IV estimation produces results that are similar to the results of the OLS estimation. After controlling for endogeneity, the estimated coefficients of the measure of institutional quality and of the SSA dummy variable turn out to be statistically significant and economically important, independent of the specific measure of institutional quality. This confirms the importance of institutions and of the SSA-dummy for explaining the cross-country variation in levels of income. The

[7] See Hahn and Hausman (2002).

[8] This finding is in contrast to the findings reported by Rodrik et.al. (2004), who report an F-statistics above 10 for their instrument *eurfrac*. Detailed results are available upon request.

negative coefficient of the SSA-dummy highlights that institutions alone are not sufficient to explain the lagging behind of SSA countries.

The results in Table 3 (and in Table A2) also reveal that the IV coefficients for the measures of institutional quality are generally larger than the OLS estimates. There are several explanations for this finding, which has been noted before. Hall and Jones (1999) and Rodrik et al. (2004) claim that it indicates that the attenuation bias from measurement error in the institution variables crowds out the simultaneous equation bias. Another possible explanation could be that the IV estimates reflect omitted variable bias. An upward bias in the estimate of the coefficient of the institutional variable could be the result of an omitted variable that affects both the institutional variable and the dependent variable *lnGDPW* in the same direction. Therefore, as soon as we have an omitted variable that is positively correlated with the instruments and negatively affects *lnGDPW*, the coefficient of the institutional variable will be biased upward. At the same time, an omitted variable that is positively correlated with the SSA-dummy and negatively correlated with *lnGDPW* will lead to a downward bias of the SSA-dummy.

Up to this point it can be summarized that our regression results find more evidence in favor of the Sachs hypothesis than of the institution supremacy hypothesis. The SSA-dummy is negative and statistically highly significant no matter which sample or which institutional indices are used. This suggests that even if the quality of governance in Africa is poor, it may not be as bad as is widely assumed. But if it is not only institutions that are responsible for Africa's poverty, what else plays a role? This question is tackled in the remaining two sections of the paper.

5 Extension of the Empirical Model: Adding Geographic Variables

5.1 IV Estimation

The finding of a statistically significant and economically important SSA-dummy together with a possible omitted variable bias suggest that there could be additional explanatory variables along with institutions that have a direct impact on income per worker. For understanding and fostering the African development process it is of great significance to investigate which factors might be captured by the SSA-dummy. We are looking for an omitted variable that lowers income significantly and that is particularly severe in Sub-Saharan Africa. This leads us to considering the impact of specific geographic variables on Africa's low level of development, as already discussed in Section 2.

Among the geography-related factors that are discussed in the literature, a SSA-specific disease variable appears to be the most promising candidate. Sub-Saharan Africa's disease burden is unique. SSA countries are and always have been severely affected by tropical diseases and more recently have to deal with the highest percentage of HIV infections in the world. So it is tempting to conclude that an ecology that is particularly favorable for the biological evolution of diseases may provide an explanation for the economic relevance of the

SSA dummy. To test this presumption, we extend our model by adding disease ecology (*DIS*) as an additional explanatory variable to equation (3):

$$\ln GDPW_i = c + \alpha\ INST_i + \beta\ SSA_i - \delta\ DIS_i + \varepsilon_i \qquad \textbf{(5)}$$

There are different possibilities to measure disease ecology. For instance, one could consider the prevalence of a range of tropical diseases like malaria, dengue fever, yellow fever or sleeping sickness, or one could consider the prevalence of HIV infections. The HIV burden is not used to proxy for disease ecology because by 1995 it was still sufficiently small to cause only minor economic impacts. Among the prevailing tropical diseases, malaria seems to be particularly suitable for capturing the SSA-specific disease ecology. Malaria is not only a problem of the tropics in general, but as the so-called Index of Malaria Transmission[9] indicates, it is especially a burden in SSA countries. Therefore, a measure of the prevalence of malaria seems to capture particularly well the SSA-specific disease ecology.[10]

For an estimation of equation (5), we use two alternative disease variables that measure the risk of malaria transmission. The variable *malrisk* reports the percentage of the population of a country living in areas of high malaria risk, including three non-fatal species and the fatal species of malaria[11]. The variable *mfalrisk* measures the percentage of the population at risk of transmission of the

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[9] See Kiszewski et al. (2004), see also Figure 1.

[10] For a further discussion of the economic impact of malaria see also Gallup et al. (1999), Gallup and Sachs (2001), Malaney et al. (2004), and Gundlach (2004).

[11] The nonfatal species included are: Plasmodium Vivax, Plasmodium Malariae and Plasmodium Ovale, the fatal species is Plasmodium Falciparum.

fatal species, Plasmodium Falciparum. This fatal species of malaria is particularly prevalent in Sub-Saharan Africa.

In order to control for a potential reverse causality from income to disease ecology, the variable malaria ecology (*maleco*) is used as an additional instrument. In addition to equation (4), we thus have the two first-stage regression equations:

$$INST_i = \lambda_{INST} + \gamma_{INST} Instrument_i^{INST} + \eta_{INST} maleco_i + \phi_{INST} SSA_i + \mu_i^{INST}$$
$$DIS_i = \lambda_{DIS} + \gamma_{DIS} Instrument_i^{DIS} + \eta_{DIS} maleco_i + \phi_{DIS} SSA_i + \mu_i^{DIS} \qquad (6)$$

The measure of malaria ecology was developed by Kiszewksi et al. (2004) and first used by Sachs (2003). As opposed to the actual prevalence of malaria, malaria ecology measures the biological potential for malaria transmission. It combines measures of temperature and vector conditions, such as breeding conditions for mosquitoes, their human biting behavior and daily survival rates, thereby creating a merely ecologically-based measure that is exogenous to the level of income and is predictive of malaria risk. The estimated F-test statistics of the first-stage regression confirm that *maleco* is not a weak instrument according to the rule of thumb by Stock and Staiger (1997).[12]

Table 4 and Table A3 present the results of the IV regression of income on institutions and malaria risk. When we include both the disease variable (*malrisk*

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[12] The first stage regression of *malrisk* (*mfalrisk*) on *maleco* and *lnmort* produces F-test statistics between 30.5 (53.2) and 35.2 (56.7) in the large sample and between 20.1 and 21.0 (around 41.8) in the small sample.

or *mfalrisk*) and the SAA-dummy as in equation (4), both coefficients turn out to be statistically insignificant.[13] This statistical insignificance may result from the apparent SSA-bias of the malaria variables. There is a high correlation between *malrisk/mfalrisk* and the SSA dummy, which creates a problem of multicollinearity.[14] Given the empirical model

$$\ln GDPW_i = c + \alpha \, INST_i - \delta \, DIS_i + \varepsilon_i \,,$$

the additional inclusion of the SSA dummy would add little orthogonal variation, which results in the insignificance of both variables. Hence we exclude the SSA dummy from the regression equation (5) in order to avoid the multicollinearity problem.

With the revised specification of equation (6) without the SSA dummy, the estimated coefficients of the disease variables become statistically significant. The results, as displayed in Table 5 (and in Table A4), indicate that the point estimates of the coefficient of the measure of malaria risk extend from about –1.2 to about –1.8. These estimates imply a quantitatively important negative effect of the measure of disease ecology on income per worker. For instance, countries with a 100 percent risk of malaria infection are estimated to have on average an income per worker that is lower by a factor in the range of 3.3-6.0 (exp(1.2)=3.3; exp(1.8)=6.0) as compared to countries with the same measure of institutional quality but zero malaria risk. Taking these results at face value it

[13] The same is true for the results of the small sample, which are available upon request.
[14] The correlation coefficient between *mfalrisk (malrisk)* and *SSA* amounts to 0.86 (0.71).

would follow that all other things being constant, a country with maximum malaria risk would only reach about 17-30 percent of the average income per worker of countries with no malaria risk.

However, these results must not be over interpreted, especially because in the large sample of countries some of the estimated coefficients of the measure of institutional quality turn out to be statistically insignificant. This outcome may result from the correlation of the instrumental variables. Especially in the large sample, the instruments *maleco* and *lnmort* show a relatively high correlation[15]. This correlation is likely to create problems of too little discriminatory power of the instruments, which in turn may result in the statistical insignificance of the coefficient of the measure of institutional quality.

Up to this point the results of the estimations including malaria risk suggest that there is some evidence that disease ecology directly affects income per worker and that it can mainly explain the statistical significance of the SSA dummy. However, as indicated above, a drawback of the application of IV estimation to the model is the difficulty to find independent instruments for institutions and malaria. In the case of correlated instruments no accurate interpretation of the results is possible. Therefore, we check the robustness of the previous results by using an alternative estimation approach. The estimation of conditional coefficients as presented in the following section eliminates the problem of cor-

[15] The correlation coefficient between *lnmort* and *maleco* is 0.59 in the small sample and 0.71 in the large sample.

related instruments at the cost of giving up on independent estimates of the coefficients of the measures of institutional quality and disease ecology.

5.2 Estimating Conditional Coefficients

Assuming that the quantitative effect of disease ecology on income per worker is known, our empirical model can be revised such that *malrisk/mfalrisk* is conditioned by the previously estimated parameters and enters the left-hand-side of the equation. On the right hand side remains only the institutional quality variable:

$$\ln GDPW_i - \delta \; DIS_i = c + \alpha \; INST_i + \varepsilon_i \tag{7}$$

The coefficient δ can be derived from the estimates in Table 5 and in Table A4. Our point estimates for the coefficient of *malrisk* vary between 1.5 and 1.8 while the point estimates for the coefficient of *mfalrisk* vary between 1.2 and 1.4. Therefore, we constrain the coefficients to 1.7 in the case of *malrisk* and to 1.3 in the case of *mfalrisk*. Imposing these restrictions and estimating equation (7) by using *lnmort* as instrumental variable yields the results presented in Table 6 (and in Table A5). The coefficients of *socinf*, *exprop2* and *kk96* are all statistically significant in both samples. In the second part of Table A5 the SSA dummy is added again to the conditional estimation. As expected, the coefficients of the institutional variables are unaffected by the inclusion of the SSA-dummy. In all cases, the coefficients of the SSA-dummy are statistically not different from zero. This result strongly indicates that the used measures of disease ecology adequately capture the effect that was initially identified by the SSA dummy.

Given the above results, it is possible to construct a normalized measure of institutional performance:

$$INST_i* = \frac{\ln GDPW_i - c - \delta\ DIS_i}{\alpha} \qquad (8)$$

We use this normalized measure to compare our results more directly with the findings by Radelet (2004). For a country where our measure is lower than the actual measure of institutional performance, we would conclude that it is governed better than could be expected on the basis of its income level and its disease ecology. Hence if SSA countries were systematically governed worse than could be expected after taking into account these economic and geographic constraints, we would expect to find that SSA countries on average display a negative difference between their actual and their normalized measure of institutional performance. Yet as already indicated by our regression results in Table A5, we do not observe a systematically lower score on normalized institutional performance of SSA countries relative to the other countries in our sample.

We present our results for the difference between the actual measure of institutional performance and our measure of normalized institutional performance in Figure 2. To calculate this difference, the first panel uses the measure of social infrastructure (*socinf*) by Hall and Jones (1999) and the second panel uses the indicator of average governance quality (*kk96*) by Kaufmann et al. (2003), in both cases by using *malrisk* as the measure of disease ecology. As both panels in Figure 2 show, there is no systematic tendency of SSA countries to display a negative difference between the actual and the normalized measure of institutional performance. According to our results for both panels, about 60 percent (17 out of 27) of the SSA countries have better actual institutional scores and about 40 percent have worse institutional scores as compared to their normalized institutional scores. Considering differences between the actual and the normalized institutional scores that are larger than one standard deviation, we find that Ethiopia, Tanzania and Congo (Zaire) have better institutional scores than could be expected on the basis of the sample averages for the level of income and disease ecology, whereas Gabon and Guinea have worse institutional scores than could be expected. These results reveal that once the level of income and the prevailing disease ecology are taken into account, SSA countries are on average not necessarily governed worse than other countries.

6 Conclusion

A majority of recent studies concludes that poor governance is the most important reason for being a poor country. While there can hardly be any doubt that good government matters for economic development, being a poor country may in itself also be an important reason for poor governance. Hence an absolute measure of institutional performance may prove to be a misleading indicator of the relative quality of governance, which in turn may depend on country-specific constraints. We find that once we take into account specific determinants of their low level of income, SSA countries on average do not appear to be governed worse than other countries. Our empirical result proves to be robust to using different measures of institutional quality, different samples of countries, and different instrumental variables.

Taken at face value, our result confirms the basic argument advanced by Sachs et al. (2004) and by a recent UN report (UN Millennium Project 2005). These studies are based on empirical evidence by Radelet (2004). However, we think that the findings by Radelet (2004) rely on an empirical specification that is in conflict with the basic argument of the studies it aims to support. Both Sachs et al. (2004) and the UN Millennium Project report (2005) claim that there are other factors besides the quality of institutions that can explain why some countries are much poorer than others. For instance, measures of disease ecology, which are especially relevant for SSA countries, may also affect the level of development independent from measures of institutions. This is not to deny that there is some debate in the literature about the empirical robustness of the direct development impact of geography-specific factors. But if such factors are in fact relevant for the level of development, they have to be taken into account when attempting to derive a normalized measure of the quality of governance. Ignoring the other factors beside institutional quality, as in the Radelet specification, implies an endorsement of the primacy of institutions hypothesis, which is in contrast to the arguments presented in Sachs et al. (2004) and the UN Millennium Project report (2005).

Nevertheless, it should be noted that a clear-cut quantitative assessment of the direct development effects of institutions versus disease ecology is restricted by the present lack of valid independent instrumental variables. Given the available data, we simply cannot identify whether the estimated coefficients correctly disentangle the web of causalities between institutions, disease ecology, and income. However, this limitation does not only apply to our paper but also to the other recent contributions to the literature on the development impact of institutions vs. geography. In this context, Albouy (2004) points out statistical weaknesses in the data on settler mortality in the early 19th century and shows that his revised measure of settler mortality would not pass the Stock-Staiger F-test for weak instruments, as opposed to the original mortality data. This suggests that the appropriateness of certain instruments for measures of institutional quality should be more closely considered in future work.

Even acknowledging the limitations to an accurate interpretation of our empirical results, some doubts arise on the supremacy of institutions hypothesis. We show that the statistical insignificance of geography-specific variables as claimed by the institutions supremacy literature is not robust. Our paper supports the view that good institutions alone are no guarantee for economic development. For instance, unfavorable disease ecology may hinder development even if countries are governed relatively well given the constraints they face. This does not mean that SSA countries are on average governed well, but when considering Sub-Saharan Africa’s development problem it seems inapt to blame weak institutional quality alone.

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Table 1: OLS Regression (large sample)

	Dependent variable: lngdpw95*					
Control variables	**1**	**2**	**3**	**4**	**5**	**6**
socinf	2.632 (0.364)					
gadp		3.731 (0.396)				
exprop			0.374 (0.052)			
rl96				0.683 (0.097)		
cc96					0.627 (0.097)	
kk96						0.882 (0.114)
SSA-dummy	-1.135 (0.161)	-1.308 (0.131)	-1.270 (0.158)	-1.132 (0.164)	-1.222 (0.172)	-0.956 (0.171)
Obs.	66	66	60	66	61	61

*Standard errors in parentheses. All regressions include a constant term (not reported).

Table 2: F-Statistics of First-stage Regression (large sample)

	socinf	**gadp**	**exprop**	**rl96**	**cc96**	**kk96**
lnmort	**18.40**	**26.84**	**11.83**	**32.22**	**14.39**	**22.41**
lat	0.75	9.55	4.09	9.73	**14.98**	**11.80**

Instruments that pass the Stock-Staiger test of weak instruments are highlighted by bold number.

Table 3: IV Estimation (large sample)

	1	2	3	4	5	6	7	8	9	10	11
socinf	4.188 (0.870)										
gadp		4.547 (0.748)	5.224 (1.604)								
exprop				0.610 (0.146)	0.679 (0.254)						
rl96						0.903 (0.174)	0.961 (0.283)				
cc96								1.139 (0.265)	0.748 (0.217)		
kk96										1.223 (0.233)	1.053 (0.283)
ssa	-0.822 (0.239)	-1.230 (0.148)	-1.165 (0.207)	-0.996 (0.240)	-0.916 (0.348)	-0.960 (0.203)	-0.915 (0.270)	-0.908 (0.254)	-1.148 (0.210)	-0.700 (0.234)	-0.830 (0.258)
Obs.	66	66	66	60	60	66	66	61	61	61	61
Instr.	ssa, lnmort	ssa, lnmort	ssa, lat	ssa, lnmort	ssa, lat	ssa, lnmort	ssa, lat	ssa, lnmort	ssa, lat	ssa, lnmort	ssa, lat

Table 4: IV Estimation with Disease Ecology Variable (malrisk) and SSA-Dummy (large sample)

	1	2	3	4	5	6	7	8	9
socinf	2.610 (1.231)								
gadp		3.331 (1.371)							
exprop			0.489 (0.265)						
rl96				0.700 (0.337)	0.664 (0.609)				
cc96						0.484 (0.271)	0.225 (0.293)		
kk96								0.610 (0.327)	0.362 (0.459)
malrisk	-0.939 (1.620)	-0.644 (0.906)	-0.444 (1.365)	-0.532 (1.108)	-0.553 (1.241)	-1.503 (0.799)	-1.366 (0.780)	-1.319 (0.844)	-1.290 (0.834)
ssa	0.088 (1.062)	-0.909 (0.489)	-0.817 (0.676)	-0.725 (0.501)	-0.740 (0.421)	-0.335 (0.418)	-0.579 (0.405)	-0.302 (0.390)	-0.500 (0.356)
Obs.	64	64	59	64	64	64	64	60	60
Instruments	ssa, lnmort, maleco	ssa, lnmort, maleco	ssa, lnmort, maleco	ssa, lnmort, maleco	ssa, lat, maleco	ssa, lnmort, maleco	ssa, lat, maleco	ssa, lnmort, maleco	ssa, lat, maleco

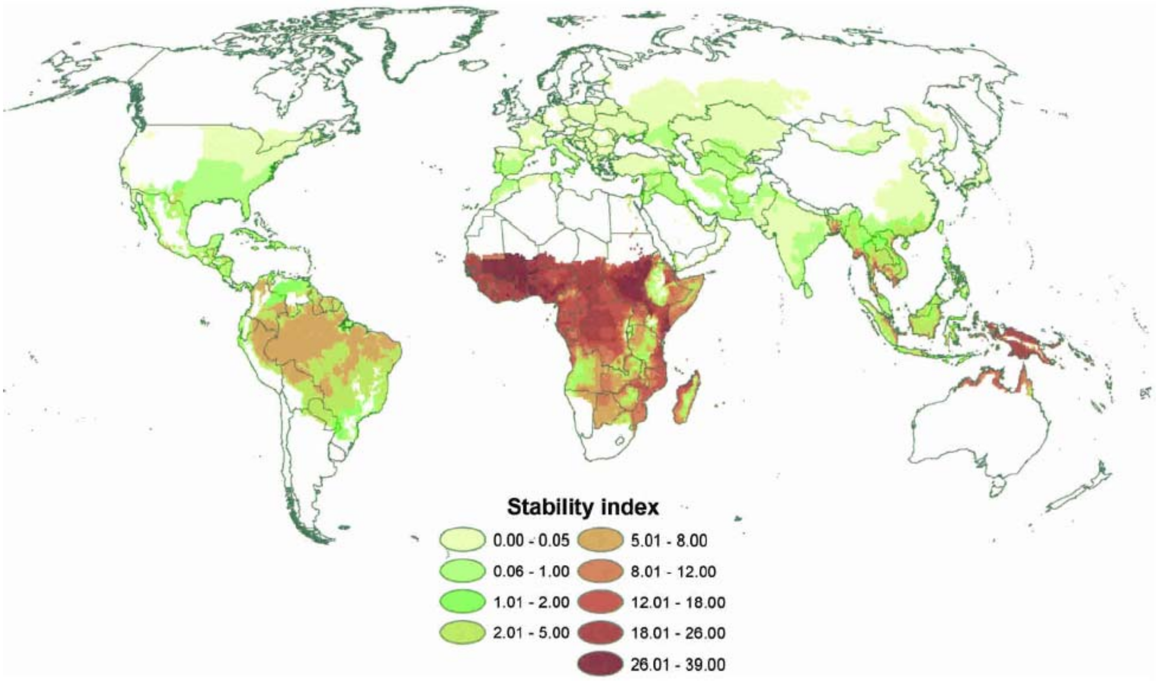
Table 5: IV Estimation with Disease Ecology Variable, without SSA-Dummy (large sample)

	1	**2**	**3**	**4**	**5**	**6**
socinf	1.801 (1.007)			2.653 (0.803)		
exprop		0.297 (0.178)			0.447 (0.137)	
kk96			0.465 (0.301)			0.726 (0.215)
malrisk	-1.813 (0.426)	-1.798 (0.453)	-1.841 (0.463)			
mfalrisk				-1.354 (0.304)	-1.315 (0.308)	-1.349 (0.296)
Obs.	64	59	60	64	59	60
Instruments	lnmort, maleco	lnmort, maleco	lnmort, maleco	lnmort, maleco	lnmort, maleco	lnmort, maleco

Table 6: Conditional Estimation (large sample)

	lngdpw95+1.7*malrisk			**lngdpw95+1.3*mfalrisk**		
socinf	2.069 (0.514)			2.790 (0.500)		
exprop		0.335 (0.091)			0.453 (0.085)	
kk96			0.557 (0.154)			0.760 (0.137)
Obs.	64	59	60	64	59	60

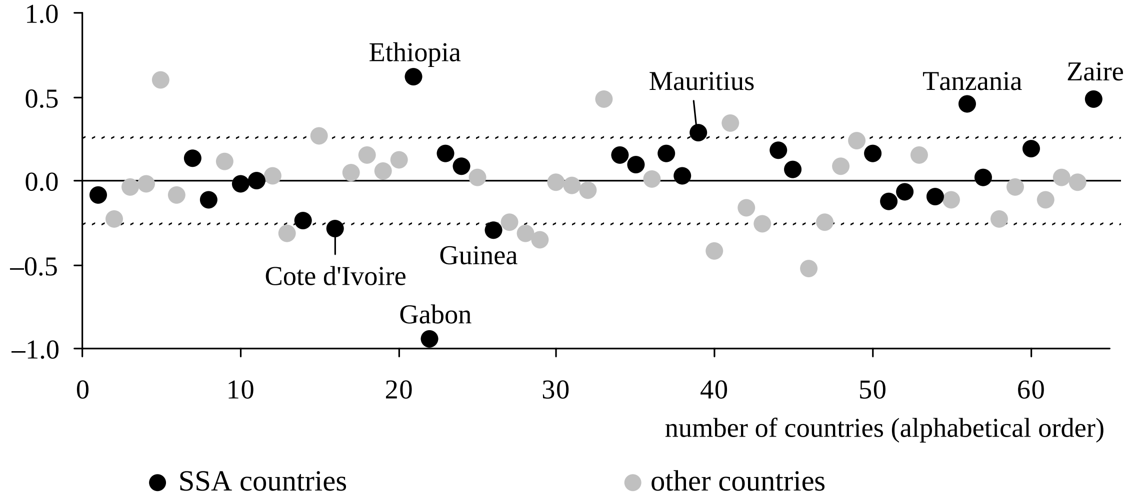
Figure 1: Malaria Stability Index



Source: Kiszewski et al. (2004)

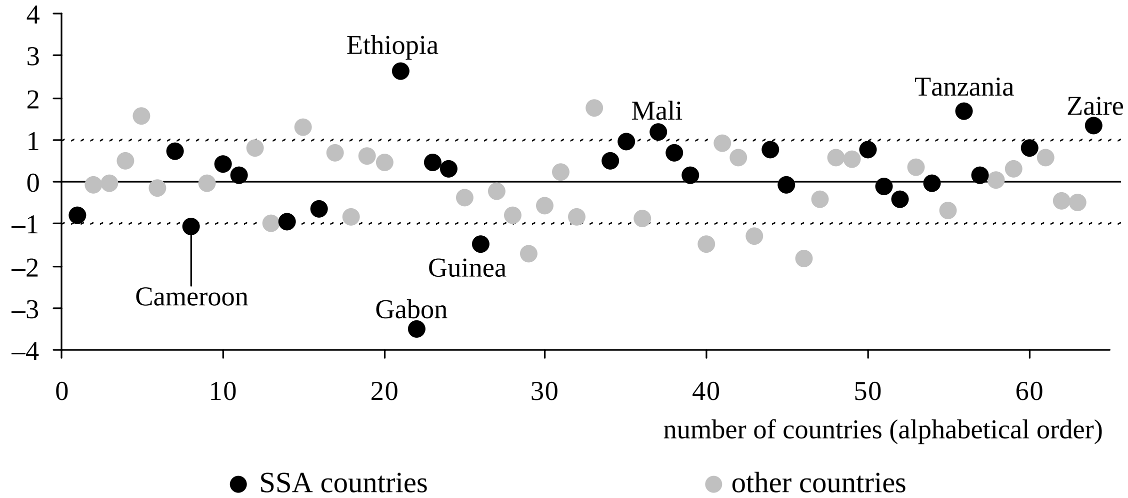
Figure 2: The Difference between the Actual and the Normalized Measure of Institutional Performance

1. Residuals based on a measure of social infrastructure (Hall and Jones 1999)



Calculation of SOCINF*: $SOCINF_i{*} = \dfrac{\ln GDPW95_i - 8.96 + 1.7\ \ malrisk_i}{2.07}$

2. Residuals based on a measure of average governance quality (Kaufman et al 2003)



Calculation of KK96*: $KK96_i{*} = \dfrac{\ln GDPW95_i - 9.873 + 1.7\ \ malrisk_i}{0.557}$

Appendix

I. Definitions and Sources of Variables:

cc96	Control of corruption, aggregate governance indicator based on country-specific survey data for 1996. Source: Kaufmann et al. (2003)
engfrac	Fraction of the population speaking English as mother tongue. Source: Hall and Jones (1999)
ethnoel	Average value of five different indices of ethnolinguistic fractionalization: probability of not belonging to the same ethnolinguistic group, probability of speaking different languages, probability of not speaking the same language, percent of population not speaking the official language. Source: Easterly and Levine (1997)
eurfrac	Fraction of the population speaking one of the major languages of Western Europe as mother tongue: English, French, German, Portuguese, or Spanish. Source: Hall and Jones (1999)
exprop	Index of protection against expropriation 1985-1995, measured on a [0, 10] scale. Source: Acemoglu et al. (2001)
frarom	Natural log of the Frankel and Romer (1999) predicted trade share of the economy. Source: Hall and Jones (1999)
gadp	Index of government antidiversion policies from Political Risk Services (average 1986-1995). GADP is one component of the index of social infrastructure. Source: Hall and Jones (1999)
GDPW95	Real GDP per worker in 1995. In the empirical analysis the logarithm of GDPW95 (lnGDPW95) is used. Source: Summers et al. (2002)
kk96	Average of 6 aggregate governance indicators for the year 1996: voice and accountability, political stability, political stability, government effectiveness, regulatory quality, rule of law and control of corruption. Source: Kaufmann et al. (2003)
lat	Distance from the equator as measured by the absolute value of country-specific latitude in degrees divided by 90 to place it on a

	[0,1] scale. Source: Hall and Jones (1999)
maleco	Malaria ecology is an ecologically-based variable that combines measures of temperature and vector conditions, such as breeding conditions for mosquitoes, their human biting behavior and daily survival rates. MALECO is predictive of the extent of malaria transmission risk. Source: Kiszewksi et al. (2004)
malrisk	MALRISK measures the proportion of each country's population that live with risk of malaria transmission, involving three largely non-fatal species of malaria (Plasmodium vivax, Plasmodium malariae, Plasmodium ovale) and the fatal species Plasmodium falciparum. Source: Sachs (2003)
mfalrisk	MFALRISK multiplies the MALRISK index by an estimate of the proportion of national malaria cases that involve the fatal species Plasmodium falciparum. Source: Sachs (2003)
mort	The variable MORT is an estimate of mortality rates of British soldiers and of other populations (e.g. bishops in Latin America) from disease in the European colonies in the early 19^{th} century. It is measured as the death rate among 1000 settlers. In the analysis the logarithm of settler mortality (lnmort) is used. Source: Acemoglu et al. (2001)
rl96	Rule of law, aggregate governance indicator based on country-specific survey data for 1996. Source: Kaufmann et al. (2003)
SSA	Sub-Saharan Africa dummy, variable equals 1 for Sub-Saharan countries and 0 otherwise.
socinf	Index of social infrastructure, defined as the average of an index of government antidiversion policies from Political Risk Services (average 1986-1995) and an index of trade openness. The index of trade openness is constructed by Sachs and Warner (1995) as a fraction of years in 1950-1994 that an economy has been open. Social infrastructure is measured on a [0,1] scale. Source: Hall and Jones (1999)

II. List of Countries

1. Large Sample (n=66)
Angola, Argentina, Australia, Bangladesh, Barbadosa [a) b) c)], Bolivia, Brazil, Burkina Faso, Cameroon, Canada, Cent. African Rep.[a) b)], Chad[a) b)], Chile, Colombia, Congo, Costa Rica, Dom. Rep., Ecuador, Egypt, El Salvador, Ethiopia, Gabon, Gambia, Ghana, Guatemala, Guinea, Guyana, Haiti, Honduras, Hong Kong, India, Indonesia, Cote d'Ivoire, Jamaica, Kenya, Madagascar, Malaysia, Mali, Malta[c)], Mauritania[a)], Mauritius[a)], Mexico, Morocco, New Zealand, Nicaragua, Niger, Nigeria, Pakistan, Panama, Paraguay, Peru, Rwanda[a) b)], Senegal, Sierra Leone, Singapore, South Africa, Sri Lanka, Tanzania, Togo, Trinidad and Tobago, Tunisia, Uganda, Uruguay, USA, Venezuela, Zaire

2. Small Sample (n=45)
Angola, Argentina, Australia, Bangladesh, Bolivia, Brazil, Burkina Faso, Cameroon, Canada, Chile, Colombia, Costa Rica, Dom. Rep., Ecuador, El Salvador, Guatemala, Guinea, Honduras, Hong Kong, India, Indonesia, Cote d'Ivoire, Jamaica, Kenya, Madagascar, Malaysia, Mauritania[a) b)], Mexico, Morocco, New Zealand, Nigeria, Pakistan, Panama, Paraguay, Peru, Senegal, Singapore, South Africa, Sri Lanka, Tanzania, Trinidad and Tobago, Tunisia, Uruguay, USA, Venezuela

[a)] Not included in regressions with *exprop* as institutional variable

[b)] Not included in regressions with *kk96* and *cc96* as institutional variables

[c)] Not included in regressions with disease ecology variables (*malrisk/ mfalrisk*)

III. Appendix Tables

Table A1: OLS Regression (small sample)

	Dependent variable: lngdpw95					
Control variables	**1**	**2**	**3**	**4**	**5**	**6**
socinf	2.228 (0.417)					
gadp		3.231 (0.416)				
exprop			0.358 (0.063)			
rl96				0.643 (0.091)		
cc96					0.596 (0.083)	
kk96						0 .777 (0.108)
SSA-Dummy	-1.149 (0.203)	-1.400 (0.154)	-1.180 (0.200)	-1.009 (0.183)	-1.313 (0.169)	-1.000 (0.184)
Obs.	45	45	44	45	44	44

Table A2: IV Estimation (small sample)

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
socinf	3.686 (0.797)										
gadp		3.702 (0.594)	4.348 (1.323)								
exprop				0.579 (0.124)	0.728 (0.323)						
rl96						0.757 (0.129)	0.795 (0.244)				
cc96								0.819 (0.147)	0.668 (0.196)		
kk96										0.994 (0.173)	0.940 (0.281)
ssa	-0.836 (0.268)	-1.367 (0.159)	-1.321 (0.188)	-0.913 (0.258)	-0.733 (0.463)	-0.898 (0.205)	-0.862 (0.287)	-1.201 (0.192)	-1.277 (0.192)	-0.830 (0.219)	-0.872 (0.278)
Obs.	45	45	45	44	44	45	45	44	44	44	44
Instr.	ssa, lnmort	ssa, lnmort	ssa, lat	ssa, lnmort	ssa, lat	ssa, lnmort	ssa, lat	ssa, lnmort	ssa, lat	ssa, lnmort	ssa, lat

Table A3: IV Estimation with Disease Ecology Variable (mfalrisk) and SSA-Dummy (large sample)

	1	2	3	4	5	6	7	8	9
socinf	2.930 (1.018)								
gadp		3.601 (1.071)							
exprop			0.520 (0.190)						
rl96				0.747 (0.257)	0.777 (0.403)				
cc96						0.604 (0.217)	0.392 (0.220)		
kk96								0.739 (0.251)	0.605 (0.327)
mfalrisk	-0.898 (0.917)	-0.593 (0.858)	-0.394 (1.259)	-0.483 (1.026)	-0.466 (1.087)	-1.498 (0.771)	-1.390 (0.762)	-1.277 (0.781)	-1.261 (0.774)
ssa	-0.368 (0.597)	-0.835 (0.607)	-0.760* 0.879	-0.652 (0.658)	-0.641 (0.643)	-0.057 (0.538)	-0.269 (0.546)	-0.057 (0.508)	-0.167 (0.507)
Obs.	64	64	59	64	64	60	60	60	60
Instruments	ssa, lnmort, maleco	ssa, lnmort, maleco	ssa, lnmort, maleco	ssa, lnmort, maleco	ssa, lat, maleco	ssa, lnmort, maleco	ssa, lat, maleco	ssa, lnmort, maleco	ssa, lat, maleco

Table A4: IV Estimation with Disease Ecology Variable, without SSA-Dummy (small sample)

	1	2	3	4	5	6
socinf	2.280 (0.792)			2.738 (0.668)		
exprop2		0.398 (0.138)			0.476 (0.115)	
kk96			0.648 (0.230)			0.777 (0.171)
malrisk	-1.609 (0.408)	-1.508 (0.427)	-1.523 (0.434)			
mfalrisk				-1.292 (0.311)	-1.190 (0.323)	-1.205 (0.292)
Obs.	45	45	44	45	45	44
Instruments	lnmort, maleco	lnmort, maleco	lnmort, maleco	lnmort, maleco	lnmort, maleco	lnmort, maleco

Table A5: Conditional Estimation (small sample)

	lngdpw95+1.7*malrisk			lngdpw95+1.3*mfalrisk		
socinf	2.112 (0.482)			2.723 (0.457)		
exprop2		0.341 (0.079)			0.442 (0.072)	
kk96			0.561 (0.137)			0.723 (0.112)
Obs.	45	44	44	45	44	44
socinf	2.112 (0.633)			2.770 (0.604)	0.435 (0.089)	
exprop2		0.332 (0.097)				
kk96			0.569 (0.177)			0.746 (0.146)
SSA	0.000 (0.213)	-0.032 (0.202)	0.016 (0.225)	0.026 (0.203)	-0.024 (0.185)	0.039 (0.185)
Obs.	45	44	44	45	44	44