Institutions and Economic Performance:
Endogeneity and Parameter Heterogeneity

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Abstract

The hallmark of the recent development and growth literature is the quest to identify institutions that explain significant portions of the observed differences in living standards. There are two drawbacks to the prominent approaches that focus either on the global sample, or on developing nations. First, it is unclear whether the identified institutions also hold explanatory power in advanced countries. Second, it is unclear whether the identified institutions matter to the same degree across all countries, or whether perhaps an altogether different set of institutions matters in advanced countries. To address these issues, we examine parameter heterogeneity in prominent approaches to institutions and economic performance. We find that parameter heterogeneity is so strong that it requires a new set of instruments to control for endogeneity. At the same time, however, we confirm that a common set of economically important institutions does exist among advanced and developing nations. The impact of these institutions is shown to vary substantially across subsamples; they are about three times more important in developing countries than in OECD countries.

Key words: Economic Institutions, Political Institutions, Parameter Heterogeneity

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1. Introduction

The hallmark of the recent development and growth literature is the quest to identify institutions that explain significant portions of the observed differences in living standards across countries. These differences are staggering, about 35 or 94 fold (depending on the dataset).[1] While the definitions of "institutions" may vary in previous studies, results are consistent and strong: institutions are consistently shown to explain economically and statistically significant differences in per capita incomes across countries.[2] The set of countries under observation is often dictated by data availability, but generally the literature examines either the global sample or developing countries. The "consensus institutions" that have been associated with economic performance relate to measures of government risk of expropriation, rule of law, bureaucratic quality, corruption, government repudiation of contracts, civil liberties, and openness to trade.

While it is certainly interesting to determine the institutions that are lacking in developing countries, there exists no comprehensive literature that analyzes the institutions that determine the economic fortunes in developed nations. One might expect, for example, that the above cited consensus institutions vary only marginally across OECD countries - too little, perhaps, to provide insights into how these nations achieve and maintain their status at the development frontier. We examine parameter heterogeneity as it relates to the influence of institutions on output in OECD and Non-OECD subsamples.[3] In the process we analyze whether a set of institutions exists that contains explanatory power and economic influence across subsamples.

While the growth literature provides ample guidance as to *which* institutions are commonly lacking in developing countries, there exists only rudimentary understanding to what degree these institutions actually matter in advanced countries. Research that focuses on relevant institutions in OECD usually abstracts from the rest of the world. As a result, such studies focus on completely different sets of institutions, such as labor market institutions (e.g., Nickell, Nun-

ziata and Ochel 2005, and Boeri, Nicoletti and Scarpetta, 2000), traditional factor markets such as human and physical capital (e.g., Bassanini, Hemmings and Scarpetta, 2001), or product regulations (e.g., Nicoletti and Sarpetta, 2003). Our focus is different, however. We seek to establish whether those institutions that have been shown to hold strong explanatory power in global regression analyses also exhibit explanatory power in the OECD subsample. The goal is to establish one set of institutions that matters in both advanced and developing countries.

Since we seek to investigate whether a set of institutions exists that matters across all countries, our point of departure is the Hall and Jones (1999) methodology. Their approach includes instruments that control for endogeneity in the global model. While their institutional quality measure is clearly correlated with per capita output in the global sample (see Figure 1), the simple OLS regression lines for the two subsamples seem to indicate a differential impact in OECD countries. OECD countries do seem to have a noticeably lower slope than Non-OECD countries. Conclusive statements to that effect require, however, rigorous empirical analysis.

[Figure 1 about here]

To address issues of parameter heterogeneity, we employ two approaches. First we split the sample, and second we employ the interaction methodology of Brock and Durlauf (2001), who used the approach to examine whether institutional indices can be expected to exhibit parameter homogeneity across "complex heterogeneous objects such as countries." Specifically, they cite the case of the US and Russia, where Civil Liberties data can hardly be seen to have a similar impact on economic performance. Previous evidence for parameter heterogeneity was offered by Brock and Durlauf (2001), and Masanjala and Papageorgiou (2003, 2004) for the case of Africa. Eicher, Roehn and Papgeorgiou (2007) document substantial parameter heterogeneity for the OECD, but do not examine institutions explicitly. Another key difference here is that we explicitly address endogeneity and also examine heterogeneity in the instruments.

Our results are not limited to a simple assessment of the impact of established institutions on output in global and OECD samples. As we examine parameter heterogeneity, we find that the established instruments are invalid when we split the sample into OECD and Non-OECD countries. This forces us to consider a new set of appropriate instruments in order to successfully control for endogeneity in all subsamples before we can examine the economic impact of institutions on output. Our new set of instruments is based on the *hierarchy of institutions hypotheses*. The hypothesis is laid out in detail in Acemoglu, Johnson and Robinson (2005) and similar approaches have provided empirical validation for such a hierarchy (see Persson 2004, 2005, and Eicher and Schreiber 2005). The basic argument is that the constitutional institutions/political rules set the stage for the economic institutions. We thus divide institutions into two dimensions: constitutional/political institutions that serve as instruments and economic institutions that are thought to exert direct influence on output.

Our robustness analysis confirms that the explanatory power of the established economic institutions is highly significant for OECD and Non-OECD countries, but the effect is about two-thirds smaller in OECD than in Non-OECD countries. We also highlight that the estimates obtained in the previous literature for the global sample are a weighted average of the impact of institutions on economic performance in advanced and developing countries. However, evidence for parameter heterogeneity is strong and the instruments established in the literature are weak and often overidentified. Our new set of political instruments performs strongly across subsamples. Most importantly, the instruments are robust to over-identification and weak instrument tests. The instruments are also robust to a number of alternative specifications and datasets. The coefficient estimates for the political instruments are highly significant in all subsamples indicating the important impact of such institutions on the fabric of economic institutions in both advanced and developing nations. In OECD countries, the impact of is generally shown to be

smaller than Non-OECD countries.

2. Parameter Heterogeneity in Instruments and Institutions

2.1 Established Instruments and Institutions

We approach parameter heterogeneity sequentially, first examining the possibility of heterogeneity in the instruments, and subsequently focusing on economic institutions. This progression is necessary to establish valid instruments across samples (Global, OECD and Non-OECD). In the absence of valid instruments, the impact of economic institutions on output is contaminated by endogeneity bias. Parameter heterogeneity would bias the global regressions even further. Among the established instruments for economic institutions, immediate candidates for parameter heterogeneity relate to the notion of *Western European historical influence*. Hall and Jones (1999) and Engerman and Sokoloff (1997) provide extensive motivation and historical analysis, respectively, that these instruments relate specifically to European influences. The thought is that the colonizers brought with them the basic prerequisites to establish economic institutions that are conducive to economic development.

For OECD countries, instruments relating to European origins can only be justified if they exhibit sufficient identifying variation and sufficient similar explanatory power. More importantly, however, the validity of the instruments in the OECD context is directly related to how well they can be motivated. Since most OECD countries were the *source* of the influence that the instruments are supposed to measure, the motivation is called into question. Specifically, measuring the positive influence of a country's own historical experience upon itself makes for weak instruments. A similar line of reasoning raises questions about Latitude (distance from the equator) as an appropriate instrument for OECD countries. Certainly the preference of European settlers to emigrate to similar Latitudes can be seen as a strong motivation for Latitude's influence on economic institutions in developing nations. However, one might argue that, by defini-

tion, Latitude holds little power in OECD countries – most of whom were the very source of the settlers. The last instrument Hall and Jones (1999) employ is the Frankel and Romer (1996, 1999) Implied Trade Share for a country. While deviations from the implied trade share can signal weak, or protectionist institutions, it is well known that trade barriers have been uniformly low across OECD countries.

We commence with simple diagnostics to ascertain the validity of instruments and economic institutions across OECD and Non-OECD subsamples. Certainly components of Hall and Jones' (1999) "social infrastructure" index (Rule of Law, Bureaucratic Quality, Corruption, Risk of Expropriation, Government Repudiation of Contracts, and Openness) are key traits for development, but one might be skeptical that these economic institutions explain income variation for *developed nations*. To establish a benchmark, we follow the methodology introduced by Hall and Jones (1999), who explore the effects of institutions on output by examining the structural model

$$\log Y / L = \alpha + \beta\, I + \varepsilon, \qquad (1)$$

where *Y/L* denotes income per worker and *I* is the measure of economic institutional quality.

Recognizing that economic institutions are potentially endogenous to income, perhaps being determined by a vector of exogenous factors, *X*, the regression identifying institutions is

$$I = \gamma + \delta \log Y / L + X\theta + \eta. \qquad (2)$$

Hall and Jones (1999) provide instruments to address endogeneity. We adopt their instrumental variable estimation strategy, without wanting to imply that other variables are irrelevant.

Valid instruments fulfill two criteria: they are *i)* uncorrelated with the error term in equation (1), and *ii)* strongly correlated with the endogenous regressor, *I*. The two stage least squares estimation can then be specified as

$$I^{\blacklozenge} = \tilde{\gamma} + \bar{X}\ \tilde{\theta} + \tilde{\eta} \qquad (3)$$

$$\log Y / L = \tilde{\alpha} + \beta I^{\blacklozenge} + \tilde{\varepsilon} \qquad (4)$$

where $\bar{X}$ is a subset of *X*. The 2SLS regression (I) in Table 1 replicates Hall and Jones (1999) results, where the instruments in the global sample are successful in that most first stage regressors are significant and adjusted R-squared is satisfactory. The Over ID χ^2 P-value is high and cannot reject the joint null hypothesis that the instruments are valid. The Cragg and Donald F-statistic, using Stock and Yogo (2005, Table 5.1) critical values surpass for 5% significance to reject weak instrument bias. Hall and Jones' (1999) compelling motivation of Latitude, Implied Trade Shares, and English Language Fraction is reflected in these instruments' strong performance in the global sample. Not only is the first stage strong, but instrumented institutions are highly significant and explain large differences in per capita income across countries.

[Table 1 here]

To explore parameter heterogeneity in instruments and institutions we add a OECD region dummy, *D*, to the 2SLS regression (I). This modifies the structural model to:

$$I^{\blacklozenge} = \tilde{\gamma} + \bar{X}\tilde{\theta} + \delta D + \tilde{\eta} \qquad (5)$$

$$\log Y / L = \tilde{\alpha} + \beta I^{\blacklozenge} + \zeta D + \tilde{\varepsilon} \qquad (6)$$

The 2SLS regression (II) in Table 1 reports that the OECD dummy is highly significant in the first stage.[4] In addition, the introduction of a regional dummy changes the explanatory power of instrumented institutions significantly. Having accounted for OECD specific effects, only two of the original four Hall and Jones instruments remain significant. The Implied Trade Share gains significance, moving from 10 to 1 percent levels, while the significance of European Languages and Latitude is greatly reduced. The explanatory power of Latitude changes dramatically. It

loses its 1 percent significance entirely. The fit of the first stage is greatly improved, but this is the only positive news. The Over-ID Test is rejected, and instruments are too weak for the Cragg and Donald F-statistic to surpass the Stock and Yogo (2005) 10.83 threshold. Overall, regression (II) raises serious doubts about the validity of these instruments across subsamples.

The second stage holds two additional surprises. First, the OECD dummy is not significant, which indicates the absence of OECD specific effects in the determination of income levels. Second, the measure of institutions remains highly significant with hardly a change in the point estimate, as compared to Hall and Jones' (1999) original specification. We must consider the second stage preliminary, however, since the estimates in equation (6) are contaminated by endogeneity bias and by weak instrument bias. With this caveat in mind, we do note that the regression indicates that economic institutions are important in accessing output in the global sample. Since the OECD dummy lacks explanatory power while economic institutions are highly significant, it is tempting to conclude that there exists little evidence for parameter heterogeneity in economic institutions. However, the OECD estimate is only valid to the degree that the instruments can be established as appropriate. The first stage of the 2SLS regression (II) highlights that the instruments lack not only a compelling intuitive motivation for OECD countries, but also explanatory power and introduce endogeneity and weak instrument bias. The first stage of regression (II) thus casts substantial doubt on the validity of the results obtained in the second stage regression; in addition, the presence of a highly significant OECD dummy in the first stage provides strong evidence of parameter heterogeneity in the instruments.

To explore the issue of instrument heterogeneity further, we split the sample and examine OECD and Non-OECD subsamples separately in the next columns of Table 1. The purpose is to isolate the impact of the established instruments and the explanatory power of economic institutions across the respective subsamples. Regression (III) provides further reason to doubt that the

established instruments are appropriate for the OECD. Only Latitude remains weakly significant at the 10% level in the first stage.[5] This is especially surprising since Latitude had lost explanatory power when we introduced the OECD dummy to the global sample in the 2SLS regression (II). The adjusted R-square drops sharply in the first stage, the Over-ID Test is rejected implying that we cannot rule out endogeneity, and there is strong evidence for weak instrument bias. All this is evidence against these instruments being inappropriate for OECD countries. The coefficient on economic institutions remains, however, highly significant in the second stage of regression (III), although its magnitude is reduced to about one third of the size observed in the global sample. After considering the caveat that the economic institutions estimate is contaminated by endogeneity bias, the second stage indicates that institutions do exert a positive effect on output in OECD countries, albeit a substantially smaller one. We expected the Non-OECD subsample results in 2SLS regression (IV) be similar to the original Hall and Jones results in regression (I). The sample is still large (about 100 countries), the instruments were well motivated for the developing world, and the sample now excludes OECD countries for which the instruments have been shown to lack statistical power as well as economic intuition. From this point of view, one could even hope to see that the explanatory power of the institutions for the subset of developing countries should be enhanced. However, the results in 2SLS regression (IV) disappoint. All instruments except the Implied Trade Share lose significance. The fit of the first stage approaches white noise, so the instruments perform even worse for Non-OECD countries than for the OECD subsample! The Over-ID Test is rejected and weak instrument bias is again a serious. Note that the coefficient on institutions in the Non-OECD sample rises slightly compared to the coefficient in the global sample (2SLS regression I). But given the weak performance of the first stage, it is unclear whether the magnitude of the coefficient on institutions is due to bias or due to higher economic impact.

As an additional robustness check we add the Engerman and Sokoloff (1997) instrument for institutions. The Wheat Sugar Ratio, as developed by Easterly (2006), measures the log of (1 + share of arable land suitable for wheat)/(1+ share of arable land suitable for sugarcane) as a proxy for the crop endowment of a country.[6] The Wheat Sugar Ratio is, not significant in either the OECD or Non-OECD first stage (regressions III' and IV'), and the first stage retains its overall weak performance where just about all instruments are insignificant, the Over-ID test is rejected (in the case of OECD) and instruments are weak (in OECD and Non-OECD).

In exploring whether the established instruments are valid for OECD countries, we therefore, quite inadvertently, uncover their weakness *in both* subsamples. Surprising is that the convincingly motivated instruments for the Non-OECD subsample are also ultimately rejected on the basis of the lack of significance, identification, and weak instrument bias. One might suspect that the result is an artifact of having picked an unfortunate division of the global dataset. In the working paper version of this paper (Eicher and Leukert 2006) we show that the results are robust to different sample splits (using the World Bank's definition of high/middle/low income countries).[7] In the next section we set out to find alternative instruments that are valid for OECD countries, and to test their explanatory power for the Non-OECD and global samples.

2.2 Instruments Derived from The Hierarchy of Institutions Hypothesis

In search of alternative instruments that control for endogeneity of economic institutions in both the global and the OECD samples, we turn to political institutions. The recent institutions literature has begun to draw a clear distinction between political and economic institutions. Williamson (2000), Acemoglu, Johnson and Robinson (2005), Acemoglu and Johnson (2005) and Roland (2004), all posit a *hierarchy of institutions* which we utilize below. While economic institutions determine economic performance, they are themselves influenced both directly and indirectly by political institutions. The direct effect of political institutions stems, for example, from

the concentration of political power in the hands of a malevolent dictator, who dismantles the economic institutions which ensure property rights and equal opportunity. Political institutions affect economic institutions indirectly, since they determine the distribution of *de jure* political power, which, in turn assigns the power to alter economic institutions.

While political institutions may not affect output directly, constitutions are not written in stone. They change slowly and exhibit great persistence over time, for example, as countries evolve from dictatorships to democracy (and vice versa). Acemoglu, Johnson and Robinson (2005) argue that political institutions are collective choices; hence the distribution of political power in society is the key determinant of their evolution. Persistence is introduced by those holding political power, who find it in their interest to maintain the status quo even at significant economic cost for society as a whole. Persson (2004, 2005) and Eicher and Schreiber (2005) provide empirical evidence for the hierarchy of institutions, by employing specific constitutional variables as instruments for economic institutions. Political institutions perform well as instruments because they are slow moving and because their direct impact on output is negligible. As a practical matter, this can be established in our regressions (see footnote 11). Glaeser et al (2004) also argue forcefully against a direct link between output and political institutions. Nonetheless, we are careful to examine our results in a robustness section below to confirm that they do not hinge on the assumption that political institutions are entirely exogenous. In this robustness analysis we allow for long term feedback from economic outcomes to constitutions in and examine alternative political and constitutional instruments.[8]

To examine whether the *hierarchy of institutions hypothesis* provides successful instruments, we augment the original Hall and Jones (1999) dataset with a number of political institutions provided by the Polity IV database, the World Bank, and the International Country Risk Guide. From Polity IV we select the *Constraints on the Chief Executive* ("Executive Constraints"

below) and *Chief Executive Recruitment Regulation* ("Executive Recruitment Regulations") for 1988, the year predating our data on income per worker. For robustness we also include additional Polity IV variables, *Legislative* and *Executive Indices of Electoral Competitiveness* in 1975 from the Database on Political Institutions (World Bank), *Voice and Accountability* from the "Government Matters" database (World Bank), *Type and Age of Democracies* (as derived by Persson, 2004 from Polity IV). The addition of political institutions reduces the size of our baseline dataset from 127 to 114.[9] Appendix Table A2 in Eicher and Leukert (2006) uses factor analysis to show that the economic institutions in Hall and Jones' (1999) social infrastructure variable and our proxies for political institutions are distinct. Specifically, factor analysis on the entire institutional dataset indicates that the variables span different dimensions of the dataspace and separate nicely into one economic factor (given by the social infrastructure variables) and two political factors.

In our working paper version (Eicher and Leukert 2006) we report the correlations among the political variables, which can be high. To avoid problems of multicollinearity, we choose Executive Constraints and Executive Recruitment Regulations as our baseline instruments, because these two variables have been used extensively in the literature.[10] In our robustness section we examine whether our results depend on a particular selection of political institutions. Table 2 reports the results when using our preferred political institutions as instruments in the global sample. 2SLS regression (V) shows that both instruments are highly significant and that their first stage fit is similar to the benchmark in Hall and Jones (1999) as reported in the 2SLS regression (I). The Over-ID Test is accepted and weak instrument identification is soundly rejected.[11] The political instruments perform strongly as previously shown in different contexts by Persson (2004, 2005) and Eicher and Schreiber (2005). The coefficient on economic institutions in the second stage of the global sample is similar to the one reported in Hall and Jones (1999).[12]

[Table 2 here]

For robustness we also pair our political institutions with Hall and Jones' (1999) instruments in the 2SLS regression (VI) to show that the political institutions retain their explanatory power once the additional regressors are included in the first stage. Over-ID and Weak Instrument tests remain strong and 2 of the 4 Hall and Jones instruments are significant in the first stage. In addition, the C Test (Difference-In-Sargan-Test) is also accepted. It tests a subset of the original orthogonality conditions to establish the exogeneity of our instruments against Hall and Jones'. Thus we can claim that in the global sample our new instruments perform at least as well as those in Hall and Jones (1999).

While we have found that political institutions are both strong and exogenous instruments for economic institutions, parameter heterogeneity may still be an issue. The fact that institutions matter in the global sample, as has been shown above, does not provide a guarantee that they work across subsamples. The 2SLS regression (VII) adds the OECD dummy and highlights that political institutions still do differ in the global sample. Nevertheless, in contrast to the 2SLS regression (II, in table 1), the new instruments do not lose their validity; they remain highly significant and pass Over-ID and weak instrument tests. The fact that the dummy retains its significance in the first stage does raise the question whether there is a systematic difference in the influence of political institutions in the OECD vs. Non-OECD samples. We explore such potential parameter heterogeneity more thoroughly in Table 3.

We examine parameter heterogeneity from three perspectives. First the global sample is split in regressions (VIIIa,c) and (IXa,c) into OECD and Non-OECD subsamples. Subsamples are, however, only a second best option to examine parameter heterogeneity, since information is lost when the dataset is reduced. To avoid the loss of information, we examine parameter heterogeneity by adding OECD/Non-OECD interaction terms to the global sample in regressions

(VIIIb) and (IXb) (see Brock and Durlauf, 2001). The interactions retain all information contained in the global dataset while representing the subsample specific effects of economic institutions on output.

$$I^{\blacklozenge} = \tilde{\gamma} + \bar{X}\ \tilde{\theta} + \delta\, D + \iota \bar{X} D + \tilde{\eta} \qquad (7)$$

$$\log Y / L = \tilde{\alpha} + \beta\, I^{\blacklozenge} + \zeta\, D + \nu\, I^{\blacklozenge} D + \tilde{\varepsilon} \qquad (8)$$

Following Brock and Durlauf (2001) the coefficients on institutions in regressions (VIIIb) and (IXb) are composite coefficient estimates and standard errors for $I^{\blacklozenge} + I^{\blacklozenge} D$.

[Table 3 here]

Table 3 highlights that parameter heterogeneity is confirmed to be of statistical and economic significance, no matter whether the sample is split (regressions VIIIa,c, IXa, c) or not (regressions VIIIb, IXb). In either case, the results are significant and stable across methods in the sense that the social infrastructure coefficients in the interacted, global sample are just about identical to the one obtained in the subsample estimation. The coefficients differ, however, in magnitude across the different groups of countries, which provides clear evidence for parameter heterogeneity. The coefficients are about three times larger for Non-OECD countries than for OECD countries (similar to Table 1 and Figure 1). The reduced coefficient for OECD countries suggests that economic institutions play a smaller economic, yet equally statistically significant role in determining output in OECD countries as compared to the global or Non-OECD samples. As expected, the magnitude of impact of economic institutions in the global sample (regression V, table 2) lies exactly between those of the OECD and Non-OECD samples (2SLS regressions VIIIa-c and IXa-c).

Table 3 also documents that political institutions perform well as instruments across all samples. The Over-ID Tests are accepted throughout, and evidence of weak instruments is re-

jected in all cases other than the Non-OECD subsample when we introduce the Wheat Sugar Ratio to the political institutions. In search of appropriate instruments that are valid across samples, we therefore uncovered important support for the hierarchy of institutions hypothesis in both subsamples and in the global dataset. In the process we come to the surprising conclusion that the type of social infrastructure identified by Hall and Jones (1999) does play a statistically significant (though economically muted) role, even in OECD economies.

Note that the step function approach of splitting the sample across OECD/Non-OECD may also imply decreasing returns to institutions (at least the ones featured in social infrastructure) in development. This hypothesis can be explored further in the quantile regressions of Figure 2.[13] Like OLS, the estimated coefficients in quantile regressions can be interpreted as marginal effects. Quantile regressions subdivide the population into quantile segments, each with equal proportions. The quantiles are then given by the data values that mark the boundaries between consecutive subsets. This approach provides richer information than ordinary least squares, which simply estimates the average effect of a regressor, without taking into account the potential heterogeneity of the effect of institutions in countries with different income levels. Quantiles are useful measures because they highlight the effects of institutions at each quantile income level (see Koenker and Hallock 2001).

[Figure 2 about here]

The inverted U relationship between social infrastructure and development is clearly visible in Figure 2. High and Low levels of income are identified with low marginal effects of institutions. Perhaps even more basic economic foundations are lacking in extremely poor countries; and, once a country reaches the 95% income quantile, factors other than social infrastructure better explain economic performance. At every quantile, the coefficient estimate for fitted institutions (not reported in a separate table) are estimated with greater than 1% significance lev-

els and the shaded area provides 90% confidence intervals.

3. Robustness

3.1 Alternative Instrument Specifications

Important to our investigation is the assumption that political institutions are exogenous with respect to output levels. However, the income level regressions capture long lasting effects of both political and economic institutional changes that may accumulate over time. While the hierarchy of institutions posits that there is no direct effect of economic outcomes in a particular year on political institutions and constitutions, it is certainly possible to imagine that there are feedback effects between economic outcomes and the distribution of power.

3.1.1. Alternative Time Periods: Early Political Institutions as Instruments

We cannot capture evidence for such feedback effects in our sample when we add the political institutions to the second stage (the coefficients on political institutions are insignificant in this case). An alternative method to establish that our instruments are largely exogenous to output in 1989 is to use political institutions that substantially predate 1989 income. In our case we can trace our political institutions back to 1900, 88 years prior to our political instruments above. If endogeneity did exist in the case of 1989 income levels and 1988 political institutions, it would arguably be a lot smaller for 1989 income levels and institutions in 1900.

[Table 4 here]

The results for both the OECD and global samples (regressions X and XI) are strong, even with the 89 year lag in political institutions. Both political institutions are highly significant in the global sample, which reduces to 46 countries due to data constraints and because a number of countries did not exist in 1900. The global estimate for the impact of economic institutions on output is again higher in the global than the estimate in the OECD sample, which in turn is

higher than the Non-OECD sample. The differences are minor, however, and within margin of errors. Therefore it seems that the long term effect of institutions was about similar across the two subsamples. The instruments do pass the Over-ID Test for all samples and the null of weak instrument bias is rejected for the global and the OECD sample. For Non-OECD samples we cannot rule out weak instrument bias (on the order of at least 3% see Stock and Yogo, 2005). Even quantile regressions (not reported here) show a constant effect of social infrastructure on output, however, the confidence bands increase as the level of development falls.

The Non-OECD regression (XII) is weak overall, with a low R squared in the first stage, and neither instrument is significant. While one might expect that the lack of power is due to small sample size, the result is equally weak if we use the Durlauf et al (2001) method of interacting institutions with region dummies to detect parameter heterogeneity while preserving the variation contained in the whole sample (not reported here). It is tempting to surmise that the results are due to the particular set of countries that is included in the 24 Non-OECD countries in 1900 for which we had data dating back that far. The noticeable difference across all samples as compared to Table 4 is the reduction of the impact of economic institutions on output. But again this may be related to the reduced number of countries in the dataset.

3.1.2 Alternative Political Instruments

Instead of examining different time periods, another robustness check with regard to our choice of political institutions is the examination of alternative political instruments. Above we used Executive Recruitment Regulation and Executive Constraints due to their prevalence in the institutions literature, and because the data can be traced back to 1900. Instead of selecting any number of variables among the universe of possible political institutions, the first part of Table 5 reports regressions based on the information contained in all 16 political institutions that we identified as potential candidates for instruments. Since the political data is highly correlated,

(see Eicher and Leukert 2006), we perform factor analysis on the global sample. We identify the two dominant factors (e.g., eigenvalues exceed unity) and report them along with their factor loadings in Table A1. The commonalities among the variables which play important roles in the two factors are such that we label factor 1 *Democratic Rules* and factor 2 *Participation/Stability*.

[Table 5 here]

The use of all possible political variables increases the power of the estimations significantly across all samples at the cost of providing exact policy prescriptions. In regressions (XIII) to (XV) the same pattern emerges as above, where the global sample indicates a significant impact of economic institutions on output which lies between the significant estimates for OECD and the Non-OECD countries. All estimates are highly significant, no matter which subsample or political factor we consider. The political instruments are again strong and uncorrelated with the error term in the global as well as the two subsamples and the null of weak instrument bias is soundly rejected in all specifications. The factor analysis also improves the first stage in terms of significance and fit. Aside from the fact that we are utilizing information contained in all 16 variables, rather than just two, the improved fit might also be a function of the fact that institutions are probably measured with error, which is mitigated by the factor analysis.

As an additional robustness experiment we also examine an alternative set of political institutions that have been featured prominently in the economic institutions analysis of Persson (2004): Forms of Democratic Government (whether an established democracy is a presidential or majoritarian system) and Age of Democracy. These two political institutions are employed as instruments in second part of table 5. The Persson (2004) instruments for political institutions perform well across all subsamples. The Over-ID Test is accepted, and there is no evidence of weak instrument bias. Note, however, that the estimates of the influence of economic institutions on output levels are reduced for the global and especially the Non-OECD samples. This adds the

additional insight that if democracies are established or more majoritarian, the impact of economic institutions is significantly muted in Non-OECD countries. Overall, however, the observed magnitudes across samples are strikingly similar to the ones obtained with our preferred instruments in Tables 2 and 3.

3.2 Alternative Economic Institutions

All of our results above have so far been conditional on the use of the Hall and Jones (1999) social infrastructure data as the proxy for economic institutions. The variable is not uncontroversial, because it consists of only a few institutions chosen from a large set of potential candidates. The literature on economic institutions and the empirical indicators that have been employed is surveyed in Acemoglu, Johnson and Robinson (2005). Now we examine whether our results are related to a specific choice of economic institutions. Following the publication of Hall and Jones (1999), Acemoglu, Johnson and Robinson (2001, 2002, 2005) established property rights and checks against government power as an important measure of economic institutions. We therefore examine whether Risk of Expropriation (International Country Risk Guide, averaged over 1985-1995) can also serve as a proxy for economic institutions in our global and OECD samples.[14] We use the McArthur and Sachs (2000) dataset to expand the original Acemoglu, Johnson and Robinson (2001) dataset from 69 to over 105 countries (including OECD members).

Table 6 shows that the hierarchy of institutions hypothesis, and the strength of political institutions as instruments for Risk of Expropriation perform well across all samples. Both of our political instruments are significant, the Over-ID Test is accepted in all subsamples, and weak instrument bias is rejected in all but the Non-OECD sample. Interestingly, different political institutions matter now for different subsamples. In the global sample, both Executive Constraint and Executive Recruitment matter. However in former colonies, only the Executive Constraints matters, while in OECD countries Executive Recruitment is significant. The fit of the

first stage is quite high across subsamples except for Non-OECD first stage. The second stage exhibits statistically significant coefficients for economic institutions in all subsamples.

[Table 6 here]

Again the OECD estimates regarding the impact of economic institutions lies below that of the Non-OECD sample, however within the margin of error. Two possibilities exist. The weak instrument bias in the Non-OECD instruments might be producing an artificially low Non-OECD coefficient for Risk of Expropriation. On the other hand, it may be possible that for the case of this type of economic institution, the impact is indeed identical across sub samples. This would indicate that some but not all institutions exhibit a step function effect in development. One could certainly hypothesize that those institutions which are central, always exert the same effect, while other institutions are more crucial at intermediate stages of development. We therefore conclude that the political instruments are strong not only across country samples, but also across different proxies for the economic institutions.

4. Conclusion

We examine the impact of economic institutions on economic performance across OECD and Non-OECD subsamples. While the relationship between economic institutions and economic outcomes has been established empirically for developing countries and for global datasets, it has not been analyzed for the countries that represent the gold standard of institutions today. Our goal was therefore to ascertain whether the results derived with global datasets readily translate to high-income, high-quality institution countries.

Analysis of institutions among high-income countries is inhibited by the absence of established instruments. Popular instruments in the institutions literature are shown to be relevant only for the global sample or for developing countries. We hypothesize that the notion of the *hi-*

erarchy of institutions may provide sufficiently strong instruments and utilize political/constitutional institutions to serve as instruments for economic institutions. To do so we show that they lead to very similar results when applied to the same groups of countries as the established instruments. The political institutions also pass all relevant statistical tests when they are employed only in the OECD (and Non-OECD) subsample.

Having established valid instruments that hold in the global sample as well as the high and low income subsets, we find substantial evidence of parameter heterogeneity for economic institutions: the impact of Hall and Jones' (1999) economic institutions on income in OECD countries is generally about one third of the effect that the same institutions exert in Non-OECD countries. Our results are robust to different specifications regarding time periods, different sets of political variables, and to a number of different samples splits. Most surprising is perhaps that the established instruments that perform strongly in the global sample (such as Latitude and European Languages) do not perform in neither the OECD nor the Non-OECD sample.

Endnotes

[1] See Hall and Jones (1999), or Caselli (2005).

[2] For prominent examples of definitions of "institutions," "economic institutions," "social infrastructure," or "structural policies" see Acemoglu, Johnson and Robinson (2001), Hall and Jones (1999) or Persson (2004), respectively.

[3] Alternatively, one could examine if institutions have different impacts in countries with high vs. low quality institutions. Instead of addressing the thorny question which institutions should be chosen to define a high quality institution country, we choose the exogenous OECD/Non-OECD split. We revisit this question in the empirics to show that our results do not depend on the particulars of the sample split.

[4] Instead of OECD and non-OECD we could have also used the top 20 or 30 countries with the best institutions (or fitted values of institutions from first stage). The results in all tables below would be just about identical.

[5] In the working paper version of this paper, Eicher and Leukert (2006) show that the results in this paper are not driven by the small sample when we divide the global dataset, nor are the results influenced by outliers (using bootstrapped standard errors and outlier robust estimation).

[6] Engerman and Sokoloff (1997) suggested that factor endowments affect structural inequality, which then affects institutions (Easterly 2006 reviews the literature). Engerman and Sokoloff link land endowments with crop types, some (sugar cane) being more conducive to the use of slave labor/inequality (sugar cane) than other crops (wheat) that promote family farms and a large middle class.

[7] That the Hall and Jones (1999) instruments are invalid for Non-OECD countries provides a deeper understanding of why they do not perform strongly in Acemoglu, et al (2001), whose sample is dominated by former colonies. Since Acemoglu, Johnson and Robinson (2001) focus

only on former colonies, their approach cannot be utilized here to solve the endogeneity and weak instruments for the OECD, which is comprised largely of the nations of origin of the settlers.

[8] Additional robustness analyses using alternative variables and estimation techniques (GMM, bootstrapped standard errors, outlier robust estimation etc) are reported in our working paper, Eicher and Leukert (2006).

[9] The excluded countries are Barbados, Cape Verde Islands, Hong Kong, Iceland, Luxembourg, Malta, Namibia, Puerto Rico, Reunion, Seychelles, Suriname, Yemen and Zaire.

[10] E.g, Persson, Tabellini and Trebbi (2003), Acemoglu and Johnson (2005) Acemoglu, Johnson and Robinson (2001, 2002), Acemoglu et al (2003), Gleaser et al (2004).

[11] Like Acemoglu, Johnson and Robinson (2001, 2002), we also used the cruder approach of identifying endogenous instruments by testing for their direct effect on output in a single regression. They are always insignificant.

[12] Reducing 2SLS regression (I) to the same 114 countries, yields a coefficient for economic institutions of 5.46.

[13] Quantiles are points chosen at regular intervals from cumulative distribution functions of random variables. For integers the *k*th *z*-quantile is the value *x* such that the probability that a point chosen is less than *x* is at most *k*/z.

[14] Risk of Expropriation measures differences in institutions due to different types of states and state policies.

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Table A1
Factor Analysis of Political Institutions
(Global Sample, Rotated Factor Loadings)

	Factors	
	"Democratic Rules"	***"Participation and Stability"***
Polity2 index	0.94	-0.04
Good Democracy	0.93	0.11
Executive Recruit. Competitiveness	0.91	-0.07
Political Competition	0.88	-0.08
Executive Constraints	0.87	0.04
Competitiveness of Exec. Recruit.	0.86	0.06
Competitiveness of Participation	0.84	0.05
Executive Recruitment Regulation	0.76	0.27
Democratic Accountability	0.56	0.19
Executive Electoral Competition	0.55	0.08
Voice and Accountability	0.49	0.19
Legislative Electoral Competition	0.35	0.13
Openness of Executive Recruitment	0.25	-0.08
Political Stability	0.24	0.20
Regime Durability	0.18	0.52
Regulation of Participation	-0.09	0.79

Note: based on 109 observations for which all data was available.

Figure 1
Institutions and Economic Performance: OECD and Non-OECD Countries

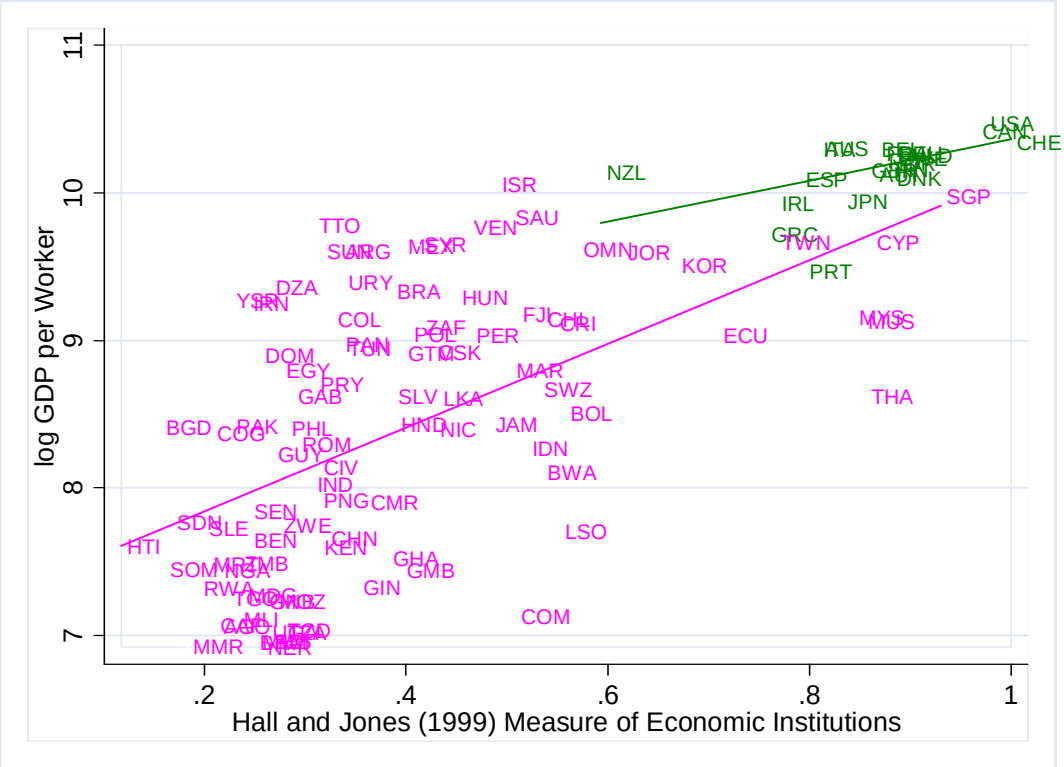


Table 1
Explanatory Power of Institutions and Instruments
Evidence for Parameter Heterogeneity and Weak Instruments in the Global Sample and Across Subsamples (2SLS)

	(I) Hall and Jones (1999)		(II) Global Sample		(III) OECD		(IV) Non-OECD		(III') OECD		(IV') Non-OECD	
	Institutions	**Y/L**	**Institutions**	**Y/L**	**Institutions**	**Y/L**	**Institutions**	**Y/L**	**Institutions**	**Y/L**	**Institutions**	**Y/L**
Institutions♦		5.085*** (0.545)		5.580*** (1.268)		1.845*** (0.456)		5.771*** (1.627)		1.826*** (0.456)		6.823*** (2.213)
OECD Dummy			0.340*** (0.052)	-0.583 (0.522)								
English Language Fraction	0.136 (0.092)		0.054 (0.080)		0.159 (0.125)		0.019 (0.117)		0.159 (0.125)		0.116 (0.140)	
European Language Fraction	0.170*** (0.056)		0.098** (0.049)		0.134 (0.089)		0.085 (0.059)		0.145 (0.135)		0.093* (0.058)	
Implied Trade Share	0.044* (0.025)		0.061*** (0.022)		0.046 (0.044)		0.066** (0.027)		0.025 (0.062)		0.035 (0.027)	
Latitude	0.004*** (0.001)		0.001 (0.001)		0.003* (0.002)		-0.000 (0.001)		0.004* (0.002)		-0.001 (0.001)	
Wheat Sugar Ratio									0.030 (0.252)		-0.122 (0.140)	
N	127	127	127	127	29	29	98	98	27	27	62	62
Adj. R-squared	0.30		0.48		0.26		0.09		0.25		0.09	
Over-ID (Sargan) Chi-sq P-value	0.243		0.044**		0.059*		0.003***		0.082*		0.144	
Weak Inst. Test F-stat (Cragg&Donald/Stock&Yogo)	12.84**		3.53		2.09		2.37		1.42		1.17	

Notes: The "♦"superscript indicates instrumented variables. Not reported: intercept; standard errors in parentheses. Significance at the 10, 5 and 1 percent levels are indicated by *, **, ***, respectively. The Over-ID Test is the P-value of the Hansen-Sargan test statistic of overidentifying restrictions of all but one instrument, the joint null being that the instruments are valid. The Cragg and Donald weak identification F-statistic significance levels are based on the 5% significance tables reported in Stock and Yogo (2005, Table 5.1).

Table 2
Institutions and New Instruments for the Global Sample: The Hierarchy of Institutions
(2SLS)

	(V) Global Sample		(VI) Global Sample		(VII) Global Sample	
	Institutions	**Y/L**	**Institutions**	**Y/L**	**Institutions**	**Y/L**
Institutions♦		4.870*** (0.503)		4.871*** (0.455)		5.789*** (1.020)
OECD Dummy					0.300*** (0.043)	-0.628 (0.441)
Executive Constraints	0.040*** (0.012)		0.036*** (0.012)		0.009 (0.011)	
Executive Recruitment Regulation	0.091** (0.042)		0.067 (0.041)		0.109*** (0.036)	
English Language Fraction			0.079 (0.086)			
European Language Fraction			0.047 (0.058)			
Implied Trade Share			0.053** (0.026)			
Latitude			0.002*** (0.001)			
N	114	114	114	114	114	114
Adjusted R-squared	0.37		0.45		0.57	
Over-ID Test (Sargan) Chi-sq P-value	0.355		0.125		0.831	
Over-ID C-Test for Political Institutions subset			0.104			
Weak Inst. Test F-stat (Cragg&Donald/Stock&Yogo)	32.5**		14.62**		13.96**	

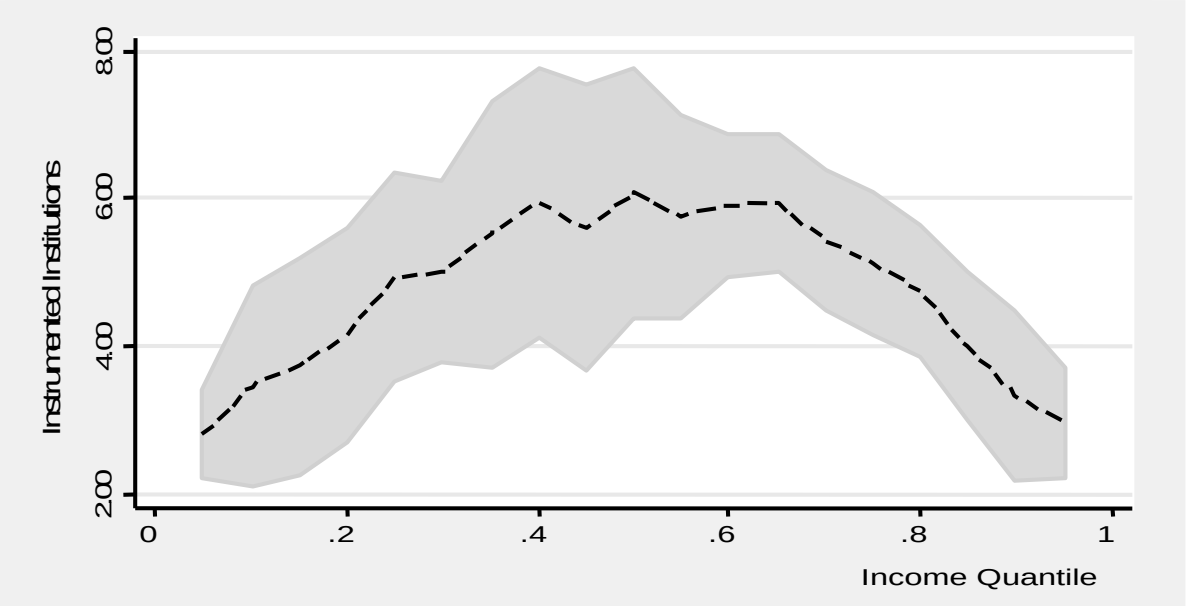
Notes: The "♦"superscript indicates instrumented variables. Not reported: intercept; standard errors in parentheses. Significance at the 10, 5 and 1 percent levels are indicated by *, **, ***, respectively. The Over-ID Test reports the P-value of the Hansen-Sargan test statistic of overidentifying restrictions of all but one instrument, the joint null being that the instruments are valid. Over-ID, C-Test is the P-value of the C-statistic when testing the over-identifying restriction for the two political instruments vis-à-vis the established ones. The Cragg and Donald weak identification F-statistic significance levels are based on the 5% significance tables reported in Stock and Yogo (2005, Table 5.1).

Table 3
Hierarchy of Institutions and Parameter Heterogeneity Across Subsamples (2SLS)
OECD vs Non-OECD

	(VIIIa) Split Sample		(VIIIb) Global Sample with Interaction Terms (eq 7,8)		(VIIIc) Split Sample		(IXa) Split Sample		(IXb) Global Sample with Interaction Terms (eq 7,8)		(IXc) Split Sample	
	OECD		OECD[a]		OECD		Non-OECD		Non-OECD[a]		Non-OECD	
	Institutions	Y/L	Institutions	Y/L	Institutions	Y/L	Institutions	Y/L	Institutions	Y/L	Institutions	Y/L
Institutions♦		2.317*** (0.257)		2.317*** (.806)		2.203*** (0.248)		7.529*** (1.849)		7.529*** (1.139)		8.785*** (2.921)
OECD Dummy			-0.473** (0.219)	2.66*** (0.762)								
Non - OECD Dummy									0.473** (0.219)	-2.66*** (0.762)		
Executive Constraints	0.027 (0.027)		0.005 (0.010)		0.045* (0.026)		0.005 (0.011)		0.027 (0.045)		0.003 (0.013)	
Exec. Recruitment Regulation	0.323*** (0.086)		0.085** (0.035)		0.273*** (0.083)		0.085** (0.038)		0.323** (0.144)		0.062 (0.041)	
Wheat Sugar Ratio					0.240** (0.110)						-0.046 (0.130)	
N	27	27	114	114	27	27	87	87	114	114	62	
Adj. R-squared	0.79		0.60		0.82		0.14		0.60		.11	
Over-ID (Sargan) Chi-sq P-value	0.584		NA		0.914		0.974		NA		0.476	
Weak Inst. Test F-stat (Cragg&Donald/Stock&Yogo)	44.48**		NA		35.8**		6.63**		NA		2.40	

[a] For columns (VIIIb) and (IXb) the specified dummy (OECD or Non-OECD) is included and interacted with Executive Constraints and Regulation of Chief Executive Recruitment in the first stage. The Second stage includes the predicted institutions, the subsample dummy, and predicted institutions interacted with the subsample dummy. The reported coefficients for institutions in the second stage are composite effects of (Institutions♦ + Institutions♦ Dummy). Standard errors for that effect are calculated with the delta method. Notes: The "♦"superscript indicates instrumented variables. Not reported: intercept; standard errors in parentheses. Significance at the 10, 5 and 1 percent levels are indicated by *, **, ***, respectively. The Over-ID Test is the P-value of the Hansen-Sargan test statistic of overidentifying restrictions of all but one instrument, the joint null being that the instruments are valid. The Cragg and Donald weak identification F-statistic significance levels are based on the 5% significance tables reported in Stock and Yogo (2005, Table 5.1).

Figure 2
The impact of Institutions on Income by Level of Development: Quantile Regressions



Quantile Regressions provide estimates for each quantile of the dependent variable, conditional on the values of the independent variable (instrumented economic institutions). The gray area provides 90% confidence intervals. Sample: 114 countries (Hall and Jones, 1999), institutions: Hall and Jones (1999) Social Infrastructure, instruments: hierarchy of institutions hypothesis, see text. All quintiles are significant at the 1 percent level.

Table 4:
Instrument Robustness: Political Institutions in 1900

	(X) Global		(XI) OECD		(XII) Non-OECD	
	Institutions$_{1989}$	**Y/L**	**Institutions$_{1989}$**	**Y/L**	**Institutions$_{1989}$**	**Y/L**
Institutions$_{1989}$$^{\blacklozenge}$		2.657*** (0.378)		1.790*** (0.41)		1.284 (2.607)
Executive Constraints$_{1900}$	0.057*** (0.011)		0.050*** (0.015)		0.013 (0.018)	
Executive Recruitment Regulation$_{1900}$	0.110** (0.043)		0.129 (0.108)		0.046 (0.042)	
N	46	46	22	22	24	24
Adjusted R-squared	0.52		0.43		0.08	
Over-ID Test (Sargan) Chi-sq P-value	0.528		0.116		0.540	
Weak Inst. Test F-stat (Cragg&Donald/Stock&Yogo)	23.43**		7.2**		0.88	

Notes: The "♦"superscript indicates instrumented variables. Not reported: intercept; standard errors in parentheses. Significance at the 10, 5 and 1 percent levels are indicated by *, **, ***, respectively. The First stage always includes Constraints on the Executive (Executive Constraints) and Regulation of Chief Executive Recruitment (Executive Recruitment) in 1900. Economic Institutions are the ones in 1989. Early political institutions data limitations reduce the sample size to 112 for the global sample. The Over-ID Test is the P-value of the Hansen-Sargan test statistic of overidentifying restrictions of all but one instrument, the joint null being that the instruments are valid. The Cragg and Donald weak identification F-statistic significance levels are based on the 5% significance tables reported in Stock and Yogo (2005, Table 5.1).

Table 5
Instrument Robustness
Factor Analysis: All Political Variables and Persson's (2004) Political Institutions

	(XIII) Factors of Political Institutions		(XIV) Factors of Political Institutions		(XV) Factors of Political Institutions		(XVI) Persson (2004) Political Institutions		(XVII) Persson (2004) Political Institutions		(XVIII) Persson (2004) Political Institutions	
	Global Institutions	Y/L	OECD Institutions	Y/L	Non OECD Institutions	Y/L	Global Institutions	Y/L	OECD Institutions	Y/L	Non OECD Institutions	Y/L
Institutions♦		3.754*** (0.368)		2.148*** (0.259)		4.016*** (1.078)		3.901*** (0.351)		2.627*** (0.385)		3.291*** (0.834)
Democratic Rules (factor)	0.130*** (0.016)		0.227*** (0.033)		0.073*** (0.019)							
Participation / Stability (Factot)	0.142*** (0.018)		0.163*** (0.045)		0.079*** (0.022)							
Form of Democratic Government (Persson 2004)							0.224*** (0.034)		0.050 (0.084)		0.209*** (0.042)	
Age of Democracy (Persson 2004)							0.541*** (0.077)		0.430*** (0.107)		0.280* (0.149)	
N	101	101	27	27	74	74	112	112	27	27	85	85
Adj. R-squared	0.57		0.74		0.23		0.58		0.40		0.29	
Over-ID (Sargan) Chi-sq P-value	0.862		0.432		0.244		0.265		0.664		0.029**	
Weak Inst. Test F-stat (Cragg&Donald/Stock&Yogo)	64.16**		34.91**		10.70**		76.08**		8.17**		17.01**	

Notes: The "♦"superscript indicates instrumented variables. Not reported: intercept; standard errors in parentheses. Significance at the 10, 5 and 1 percent levels are indicated by *, **, ***, respectively. In Regressions XIII-XV, Democratic Rules and Participation/Stability are the first two rotated factors from a factor analysis on all political variables (Good Democracy, Polity2, Regime Durability, Executive Recruitment Regulation, Competitiveness of Executive Recruitment, Openness of Executive Recruitment, Executive Constraints, Regulation of Participation, Competitiveness of Participation, Executive Recruitment, Political Competition, Democratic Accountability, Legislative Electoral Competition, Executive Electoral Competition, Voice and Accountability, Political Stability). In Regressions XVI-XVIII, the first stage always includes Parliamentary Democracy and Age of Democracy from Persson (2005). The instrumented institutions are Hall and Jones' (1999) social infrastructure. Adding the Persson (2004) data reduces the sample size to 112 for the global sample. The Over-ID Test is the P-value of the Hansen-Sargan test statistic of overidentifying restrictions of all but one instrument, the joint null being that the instruments are valid. The Cragg and Donald weak identification F-statistic significance levels are based on the 5% significance tables reported in Stock and Yogo (2005, Table 5.1).

Table 6
Hierarchy of Institutions in Alternative Datasets
Risk of Expropriation across Subsets

	(IXX) All Countries		(XX) Former Colonies		(XXI) OECD		(XXII) Non-OECD	
	Risk of Ex-propriation	**Y/L**	**Risk of Ex-propriation**	**Y/L**	**Risk of Ex-propriation**	**Y/L**	**Risk of Ex-propriation**	**Y/L**
Risk of Expropriation♦		0.647*** (0.064)		0.742*** (0.120)		0.662*** (0.100)		0.844*** (0.227)
Executive Constraints	0.341*** (0.079)		0.226*** (0.119)		-0.059 (0.210)		.521** (.261)	
Executive Recruit. Reg.	0.485* (0.269)		0.394 (0.383)		1.700*** (0.604)		.075* (.0829)	
N	105	105	60	60	26	26	79	79
Adj. R-sq	0.33		0.24		0.59		0.10	
Over-ID Test (Sargan) Chi-sq P-value	0.11		0.75		0.24		0.219	
Weak Inst. Test F-stat (Cragg&Donald/Stock&Yogo)	25.81**		8.87**		16.98**		4.14	

Notes: The "♦"superscript indicates instrumented variables. Not reported: intercept; robust standard errors in parentheses. Significance at the 10, 5 and 1 percent levels are indicated by *, **, ***, respectively. First stage always includes Constraints on the Executive (Executive Constraints) and Regulation of Chief Executive Recruitment (Executive Recruitment). The (instrumented) economic institutional variable now is Risk of Expropriation from McArthur and Sachs (2001). Over-ID Test is the P-value of the Hansen-Sargan test statistic of overidentifying restrictions of all but one instrument, the joint null being that the instruments are valid. The Cragg and Donald weak identification F-statistic significance levels are based on the 5% significance tables reported in Stock and Yogo (2005, Table 5.1).