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ABSTRACT

Inequality and Institutions*

This Paper presents theory and evidence on the relationship between inequality and institutional quality. We exhibit a model in which the two dynamically reinforce each other and set to test this relationship with a broad array of institutional measures. We establish the double causality between institutional strength and a more equal distribution of income and show its robustness to different data sources that cover various time-spans and to changes in specification.

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1. INTRODUCTION

While the importance of institutions for economic development has been well documented - see for example, Knack and Keefer, 1995, and the more recent Rodrik et al., 2002 - institutional quality varies significantly across countries. Consider, for example, the most recent report by Transparency International, an organization whose studies on corruption levels are typically published in the popular press around the world. It ranks countries such as Finland, Iceland, Denmark and New Zealand as those with the lowest levels of corruption, with a score of cleanliness of 9.5 out of 10 points. On the other hand, countries such as Bangladesh, Nigeria and Haiti are ranked at the highest levels of corruption, with typical scores of less than 1.5 points.[1] Moreover, this ranking tends to be fairly stable across time.[2]

Countries with bad institutions seem also more likely to have high inequality, a pattern that emerges by eyeballing contemporary data. For example, the cross-country data discussed more in detail below clearly shows the close link between the two. The correlation between income share of the middle-income quintile and various measures of institutional quality are in the range of 0.30 and 0.44; and the highest correlation is with the rule-of-law measure. Similarly, the correlation between many measures of institutional quality and the Gini coefficient ranges between 0.40 and 0.44, depending on the aggregate institutional measure employed. It is by no means clear, however, what the dynamics between these two variables are and, consequently, the resulting causal relationship between them. Some studies indicate that social polarization negatively

[1] As illustrated by the examples above, the higher the score, the less corruption in the country. See http://www.transparency.org/cpi/2003/cpi2003.en.html

[2] Cf., *http://www.transparency.org/cpi* for the data covering 1993-2003. Note, however, that country coverage in early years was quite incomplete. Other existing data sources commonly used in empirical studies also show this same relatively stable pattern –see the empirical section, below.

affects institutional quality, see Easterly (2001) and Keefer and Knack (2002), suggesting that institutional strength is endogenous, being determined, among other things, by political and economic conditions.

That the interaction of political and income inequality may play a part in blocking the adoption of good institutions is illustrated by the recent episode of Russia in transition. In the aftermath of the mass privatization in the early 1990s, a small group of entrepreneurs gained access to political power and then used it to promote their own interests, constantly subverting the emergence of institutions committed to the protection of smaller shareholders. As noted by an influential commentator, "…the state does not represent the interests of the society as a whole, but rather is deeply penetrated by Russia's emerging capitalist class. In a sense, the state has been privatized by these nouveaux riches and thereby operates in the interests of its new owners rather than society at large" (McFaul, 2002).

Likewise, in several Latin American countries the interests of ruling elites, the military, and large businesses often converged at the expense of smaller business interests, giving rise to a significant informal sector. Realizing that entry to a formal sector is likely to be costly whereas its benefits are uncertain at best, many smaller and medium size entrepreneurs gave up even contemplating the idea, see, for example, Kaufmann et al., 2003, for a discussion of the Bolivian case. This is also consistent with the recent work by Engerman and Sokoloff (1997, 2002), who contrast the colonial experiences in the Americas arguing that the initial differences in income inequality and political participation between North and South Americas affected the patterns of settlement in different manners. While starting at about a similar level of development, the former came to be dominated by the influx of immigrants who imported their own

institutions, whereas the latter established extractive colonial institutions, with a rigid hierarchical structure.

An emerging literature has generated analytical models where economic conditions affect institutional quality. In particular, some recent work, see Hoff and Stiglitz (2004) and Sonin (2003), suggests that an equal distribution is a more fertile ground for good institutions.[3] Whereas the former presents a static framework of institutional subversion, this paper's framework is more closely related to Sonin (2003) whose dynamic model suggests that low-quality institutions are associated with wasteful redistribution toward the rich. While similar, the mechanism proposed here identifies the intensity of rent seeking over a public asset – such as technological knowledge or natural resource - as a source of weak institutions.

Specifically, in this paper, we explore a possible double relationship between income inequality and institutional quality. It is suggested that while income inequality may cause subversion of institutions by the politically powerful rich elite, the reverse holds as well, namely, poor institutional quality renders a higher degree of inequality. This double causality relationship is exhibited in a simple dynamic model and is then tested in a cross-country panel framework. The model shows that when the political bias in favor of the rich is large, income inequality and poor institutional quality may reinforce each other, indicating a double feedback between the two. Thus, we formally exhibit a mechanism through which inequality and institutions reinforce each other. The empirical evidence provides support for these hypothesized relationships by using a panel of countries and a broad array of institutional measures commonly employed in the literature. We use an innovative panel *VAR* technique that, as predicted by the model,

allows measuring the statistical impact of each variable on the other, if any. In particular, with this method we are able to measure the contribution of the three different relationships that are explored, Granger causality from institutions to inequality, Granger causality from inequality to institutions, and instantaneous causality.[4]

The plan of the paper is as follows. The next section presents and Section 3 solves a simple model, which exhibits double causality between income inequality and institutional quality. Section 4 then contains the description of the empirical strategy; section 5 presents the data, and section 6 contains the empirical analysis. Finally, Section 7 concludes.

2. THE MODEL

Consider an economy populated by a measure one of households indexed by i, each consisting of a parent and child, operating in discrete time t. The initial level of household i's income is exogenously given at y_{io}, and the income level in period t, y_{it} is determined endogenously. The initial income distribution is assumed to be lognormal with the parameters μ_0 and σ_0^2, and the distributions in subsequent periods are endogenously determined. The assumptions below will imply that all future distributions are lognormal with the parameters, say, μ_t and σ_t^2. Each individual is also endowed with one unit of time in each period.

In each period, a certain amount of a productive resource is available in the

[3] See also Glaeser et al. (2003) for a more micro-based model and Gradstein (2004) where democracy is viewed as a commitment device to ensure high-quality institutions.

[4] This approach is consistent with a recent wave of empirical research that uses panel data in trying to assess causality in particular as the development of recent GMM-IV techniques have somewhat blurred the line between purely statistical precedence techniques that use internal instruments, and methods that control for endogeneity (Arellano and Bover, 1995). Recent research on causality includes Chong and Calderon (2000a), Beck et al. (2000), and others.

economy. This can be interpreted as a natural resource, or, alternatively, as appropriable technological knowledge. For simplicity, we assume that the amount of the resource is constant over time and let A denote its amount. The individuals allocate their income between consumption, c_{it}, and unproductive investment in rent seeking, r_{it+1}, to appropriate a larger share of the resource. Normalizing the prices to one, the budget constraint then is

$$y_{it} = c_{it} + r_{it+1} \tag{1}$$

so that the households are credit constrained.

In each period, the individuals also inelastically supply one unit of labor.

Rent seeking is used to appropriate a larger share of the available resource. The extent of the appropriated share by each individual depends on the amount of rent seeking and on institutional weakness, denoted w_{t+1}. Specifically, the amount appropriated by household i is

$$a_{it+1} = A \frac{r_{it+1}^{\,w_{t+1}}}{\int_0^1 r_{it+1}^{\,w_{t+1}} di} \tag{2}$$

For simplicity, we will focus on two polar cases, of *strong* institutions ($w_{t+1} = 0$) and *weak* institutions ($w_{t+1} = 1$): in the former case, the individual marginal value of rent seeking is zero, whereas in the latter case it is maximal.

Individual income is produced from the share of the appropriated resource and the individual ability; the production function is then given by:

$$y_{it} = \varepsilon_{it}\, a_{it} \tag{3}$$

where the ability, ε_{it} is assumed to be distributed in each period lognormally, say with the parameters 0 and γ^2, where the variance is assume to be relatively small.

Each parent's preferences are assumed to derive from consumption, as well as from the amount of income accrued to the child. This simple specification of the ”warm glow” altruistic motive implies that the parents need not take into account children actions when making their own decisions. Assuming for simplicity symmetric logarithmic preferences, we write the expected utility:

$$V(c_{it}, y_{it+1}) = \ln(c_{it}) + \ln(y_{it+1}) \quad (4)$$

In each period, all decisions in the economy are made by the parents. They first determine the level of institutional quality and then allocate their resources between consumption, productive investment, and rent seeking. The determination of institutional quality is done collectively, through a political process, which may generally be biased toward the rich in a manner specified below. The equilibrium consists of such mutually consistent decisions.

3. EQUILIBRIUM ANALYSIS

The analysis proceeds backwards. Given the level of institutional quality households solve their budget allocation problem, and then anticipating these decisions, political choice of institutional quality is made.

3.1. INDIVIDUAL DECISIONS

Maximization of the utility function (4) subject to the budget constraints (1)-(3) leads to the following individually optimal allocation decisions:

$$r_{it+1} = w_{t+1}\, y_{it} /(1 + w_{t+1}),\ c_{it+1} = y_{it} /(1 + w_{t+1}) \quad (5)$$

implying that next-period income is:

$$y_{it+1} = \varepsilon_{it} A\, y_{it}^{w_{t+1}} / \int_0^1 y_{it}^{w_{t+1}}\, di \qquad (6)$$

In particular, from (5), rent seeking decreases and current consumption increases with the level of institutional quality.

We observe, from (6), that when $w_{t+1} = 0$, next-period income inequality is only due to differences in abilities, whereas when $w_{t+1} = 1$, it increases over time. Thus, only when the institutions are weak is inequality expected to increase.

To sum up,

Proposition 1. Low institutional quality leads to higher income inequality in the next period.

3.2. POLITICAL DETERMINATION OF INSTITUTIONAL QUALITY

We assume that the choice of institutional quality is done via political process, which is biased toward the rich. The simplest way to capture this is to assume that the identity of the decisive voter, y_{dt}, is given by:

$$\ln (y_{dt}) = \mu_t + \beta\sigma_t^2 \qquad (7)$$

where β represents the extent of political bias in favor of the rich. For example, if $\beta = 0$, the median income voter is decisive; when $\beta = 1/2$, the average income voter is decisive; to make the analysis interesting we will assume that the political bias exists and that $\beta > 1/2$.

The individual utility functions corresponding to the two values of institutional quality respectively are:

$$U_{it}^{\text{strong}} = \ln (y_{it}) + \ln (\varepsilon_{it} A) \qquad (8)$$

and

$$U_{it}^{\text{weak}} = \ln (y_{it}/2) + \ln [\varepsilon_{it} A\, y_{it}/ E(y_{it})] \quad (9)$$

so that the utility differential is:

$$U_{it}^{\text{weak}} - U_{it}^{\text{strong}} = \ln (1/2) + \ln [y_{it}/ E(y_{it})] \quad (10)$$

As (10) decreases in income, the determination of institutional quality will be done by the decisive voter whose utility differential is

$$U_{dt}^{\text{weak}} - U_{dt}^{\text{strong}} = \ln (1/2) + \ln [y_{dt}/ E(y_{it})] = \ln (1/2) + (\mu_t + \phi\sigma_t^2) - (\mu_t + \sigma_t^2/2) =$$

$$\ln (1/2) + (\beta - 1/2)\, \sigma_t^2 \quad (11)$$

Clearly, when $\beta \leq 1/2$, (11) is negative indicating that a high level of institutional quality will emerge at equilibrium. If, however, the political bias is large as we have assumed, so that the individual with income above average is decisive, $\beta > 1/2$, then it is possible – when income inequality as measured by σ_t^2 is sufficiently large – that the minimal level of institutional quality will be chosen.

To sum up,

Proposition 2. When the political bias is large enough, the political choice of institutional strength hinges upon income inequality. If inequality is small, strong institutions will constitute the political choice; however, when it is large, then weak institutions will prevail.

3.3. INTERTEMPORAL EVOLUTION

The analysis of the economy's intertemporal evolution hinges on the initial degree of inequality, σ_0^2. If it is small, then, from (11), a high level of institutional quality will be chosen. From (6) this then will lead to a constant level of income inequality, which is determined by the variance in individual abilities. Because of our assumption that this

variance is small, it follows that in future periods strong institutions will also constitute a political choice.

In contrast, if income inequality is initially large, then weak institutions will prevail, $w_{t+1} = 1$. Next-period income inequality in this case, from (6), is

$$\sigma^2_{t+1} = \gamma^2 + \sigma^2_t \tag{12}$$

Thus, inequality increases over time strengthening the support by politically powerful coalition for weak institutions. We thus obtain multiple equilibria whose realization depends on initial conditions, while the dynamics indicates economic equality and institutional quality reinforcing each other.

Proposition 3. Income inequality and low institutional quality reinforce each other along the transition path. As a result, multiple equilibria could be realized, depending on initial conditions: with weak institutions and high inequality; and with high institutional quality and low income inequality.

4. EMPIRICAL STRATEGY

In this section we study the basic empirical implications of the theoretical model above. To do this we focus on the dynamic relationship between institutions and income inequality as well as on the direction of causality between these variables and their implied contribution to the possible correlation among these variables.[5] In particular, the first step is to analyze the dynamic relationship between inequality and institutions. Consistent with the propositions of the model above, the objective is to examine how the behavior of a given variable is related to the future behavior of the rest. In our empirical

[5] To our knowledge there are only two studies that focus on the link between institutions and income inequality (Chong and Calderon, 2000b; Gupta et al., 2002). Both use pure cross-section approaches with relatively small samples.

context, there are two issues to this, effect and predictability. The first deals with whether changes in a given variable have a lasting impact on another variable. The second examines whether the behavior of a given variable helps predict the behavior of the rest. Our methodology consists of estimating and testing vector autoregressions (*VAR*) in a panel setting that have the following form:

$$y_{i,t} = A(L)y_{i,t} + B(L)x_{i,t} + \eta_t + \mu_i + \varepsilon_{i,t} \tag{13}$$

$$x_{i,t} = C(L)y_{i,t} + D(L)x_{i,t} + \phi_t + \psi_i + \upsilon_{i,t} \tag{14}$$

where *y* and *x* represent the two variables of interest, inequality and institutions; *L* is the lag operator; *A, B, C,* and *D* are vectors of coefficients; η_t and ϕ_t are unobserved time effects; μ_i and ψ_i are unobserved country effects, and $\varepsilon_{i,t}$ and $\nu_{i,t}$ are regression residuals. Note that we also control for other determinants, *Z*, in particular the log of initial output, education, financial development, and the rate of inflation[6]. The subscripts *i* and *t* denote country and time, respectively.

As is standard in non-structural *VAR* analysis, no cross-equation parameter restrictions are imposed, we allow for a free cross-equation error covariance, and we interpret each equation as a reduced-form regression. We choose the optimal lag structure for the panel *VARs* through likelihood ratio tests[7]. As described above, by testing for the dynamic relationship between institutions and inequality, we are interested in the impact of changes in a variable, say *x (institutions),* on the other, say *y (inequality).* The direct impact of *x (institutions)* on *y (inequality)*, given the past history of *y (inequality)*, is

[6] The education variable is the percentage of primary enrollment as a percentage of school age individuals; the financial development variable is liquid liabilities as a percentage of gross domestic product. Country fixed level effects are included in all regressions. The variables were included based on the standard empirical literature (Li and Zou, 1998). The source for all the variables is World Bank (2003).

[7] They yield the use of one lag in the case of Kaufmann et al. (2003) and two lags in the case of all the other data sets.

given by the sum of the coefficients on all lagged *x (institutions)***.** Using the properties of the lag operator, this impact would be equal to *B(1)*. From estimation of the *VAR*, we can obtain the point estimate of *B(1)* and, for the purpose of statistical inference, its associated standard deviation.[8]

Also in the context of the theoretical propositions above, a second step is to examine whether a variable, say *x (institutions)*, helps forecast the other variable in the system, say *y (inequality)*, beyond what the past history of *y* predicts[9]. This is a test of Granger-causality, and, in the example above, it amounts to testing if the coefficients of the lag polynomial *B* are statistically significantly different from zero. Notice that the two issues of interest, impact and Granger-causality, are related but not identical. There may be cases when a variable has predictive power for another, yet its impact is zero because coefficients on different lags cancel each other. However, in the relationships we consider, it is usually the case that when the impact is statistically zero there is also no indication of Granger causality. In this context, and based on the work of Geweke (1982) we test a more complete approach than unidirectional Granger-causality tests by measuring the degree of linear dependence and feedback between two panel series *x (institutions)* and *y (inequality).* We do this by measuring the sum of linear feedback from *x (institutions)* to *y (inequality)*, linear feedback from *y (inequality)* to *x (institutions)*, and "instantaneous" linear feedback between *x (institutions)* and *y (inequality)*. Absence of a particular causal ordering implies that one of these feedback

[8] From the estimated coefficients we can also obtain the long-run effect of *x* on *y*. The long-run effect takes into account both the direct impact of *x* on *y* (given the past history of *y*) and the autoregressive properties of *y* (to account for own and cross feedback effects). Provided that *y* follows a stable process, the long-run effect of *x* on *y* is given by *B(1)/[1-A(1)]*.

[9] In Granger causality tests, if *x* causes *y*, *x* should help predict *y*. That is, in a regression of *y* against past values of *y*, the addition of past values of *x* as independent variables are expected to contribute to the explanatory power of the regression in an statistically significant manner. Furthermore, *y* is expected not to help predict *x*, as if this is the case and y helps predict *x*, then other variables are causing *x* and *y*. Also, see

measures is equal to zero.[10] In particular, let us denote $z_t = (y_t, x_t)'$ the vector with information on the variables *x (institutions)* and *y (inequality),* and the *VAR* representation for z_t is $\Gamma_0 z_t = \Gamma_1 L z_t + \xi_t$, with $\Gamma_1 L = \sum_{i=1}^{m} \Gamma_{1i} L^i$. The proposed decomposition test is based on likelihood ratios comparing the following three system representations, as shown in Table 1. From these systems, the objective is to test a specific set of measures of linear feedback. The proposed measures to be tested are shown in Table 2 (Geweke, 1982; Calderon and Liu, 2003).

In summary, in the empirical approach we focus on the dynamic relationship between institutions and inequality in order to test whether there is reinforcement between these two variables, as predicted by the model. More importantly, we also focus on causality issues as measured by statistical precedence. While the essential empirical methodology is to use Granger causality tests to study the direction of the link between institutions and inequality, the key emphasis is to decompose the contribution of each direction of causality between institutions and inequality by using a test of linear dependence and feedback[11].

5. DATA

We use Gini coefficients as a proxy for income inequality from Deininger and Squire (1997). These data have several advantages. First, the observations are based on household surveys. Second, the population and income coverage are comprehensive.

Table 1.

[10] This linear feedback and causality method has been recently applied to the case of institutional quality and economic performance by Chong and Calderon (2000a) and in the case of financial development and economic growth by Calderon and Liu (2003).

[11] While in this research we are assuming that the relationship between institutions and inequality are linear it is true that this may not necessarily be the case. We do not tackle potential non-linearities as this, we

Furthermore, different criteria from different sources are homogenized in order to avoid problems of definition (Chong and Calderon, 2000b)[12]. While the data from Deininger and Squire go from 1960 to 1995 we are able to augment our inequality series using household data from Milanovic (2002a, 2002b) and by generating information using the coefficient of variation of income and the income's linear correlation with ranks. For the sake of robustness, we also use alternative measures of income distribution such as the income share ratio of the top to the bottom quintile of the population as well as the income shares of the middle quintiles. The Gini coefficient ranges from 0 to 1, while the income shares for the top and bottom quintiles of the population are ratios that fluctuate between zero and one.

We use a broad array of measures of governance that cover different time periods, countries, and relatively different, but related definitions. First, we use the set of indicators developed by Kaufmann et al. (2003) for six dimensions of governance covering 199 countries for 1995, 1998, 2000 and 2002. These indicators are motivated by a broad definition of governance as the traditions and institutions by which authority in a country is exercised; and we also compute an average of the six dimensions for the specified periods[13]. For our purposes, the weakness of these data is the limited time-span it covers which, given the fact that both institutions and inequality tend to move slowly along time (Chong and Calderon, 2000a), may result in little variation.

For the sake of completeness and robustness, we also use data from the International Country Risk Guide (ICRG), originally used by Knack and Keefer (1995),

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believe, escape the scope of this research and prefer to leave it for a future contribution.

[12] Definitional problems include whether a category applies to household or individuals, whether income is measured gross or net of taxes, and whether expenditure or income is used to calculate the income share and Gini coefficient.

[13] See Kaufmann et al. (1999) for more details.

Hall and Jones (1999), and several other researchers. The ICRG risk rating system assigns a numerical value to a predetermined range of risk components for about 130 countries. In this paper we consider five of the most commonly used institutional dimensions used in the literature: (i) government stability, (ii) corruption, (iii) law and order, (iv) democratic accountability, and (v) bureaucracy quality; we also computed an average of these five dimensions for the 1984-2000 period. Additionally, we use a third set of institutional indices, an index of civil liberties and an index of political rights developed by Freedom House, which has published an annual assessment of the state of institutional freedom in each country since 1972. Their original scores range from 1 to 7, with lower scores denoting higher degrees of freedom. We rescaled these variables to 0-1, with higher scores implying higher more freedom and we also compute a Gastil Index, defined as the simple average of the civil liberties and political rights indices. The time-coverage for this variable goes from 1970 to 2000. Finally, we also use credit ratings from the magazine Institutional Investor, which provide country ratings on the institutional environment in what regards to investment. Similar to the Freedom House case, we re-scale our data from zero to one where higher scores represent a better institutional environment for investment. These data also go from 1970 to 2000[14].

In order to avoid potential country selection biases, we homogenize the number of countries to 121, which are the common countries in all four data sets[15]. In the case of ICRG, Freedom House, and Institutional Investor we assemble a panel data set of 121 industrial and developing countries, spanning the corresponding full time periods for each sample which are averaged over 5 years. In other words, we use panel data of at most six

[14] To further test the robustness of our results we also test for systematic changes in specification to our empirical benchmark regression, see Appendix 1.
[15] The list of countries is shown in Appendix 2.

non-overlapping 5-year period observations over the sample period ---which is the case of Freedom House and Institutional Investor as the periods these data cover are from 1970 to 2000[16]. This is done under the premise that institutional change occurs slowly through time and, thus, the observed variation from year to year may be rather small (Chong and Calderon, 2000a).[17] In short, we consider a very broad array of country-homogeneous data sets, which we arrange in terms time coverage. We first consider sources that are broadly used but have limited time span (Kaufmann et al, 2003) and also data that cover a much longer time-span but provide a somewhat broader definition of institutions (Freedom House, various years)[18]. Table 3 provides summary statistics of all the variables used in this research and Table 4 provides some basic correlation between all the institutional measures considered with the income inequality measures employed.

6. EMPIRICAL EVIDENCE

6.1. DYNAMIC RELATIONSHIP

Our main finding is that institutional quality and income inequality mutually reinforce each other, as predicted by our simple theoretical model. This appears to be true regardless of the data set and specific measured considered the time-span, and whether or not the sample focuses on industrial countries or developing countries, as is shown in Tables 5-7. From Table 5, we observe that a one-unit change in the index of aggregate governance for the sample of all countries helps reduce the Gini coefficient by 0.034.

[16] The number of observations is 684 in the case of both Freedom House and Institutional Investor, and of 430 observations in the case of ICRG.

[17] For the sake of completeness we also perform our analysis using different year groupings (ten years) as well as with annual data whenever possible. We find very similar results regardless of the sample size or data stacking.

[18] As shown by Knack and Keefer (1995) the correlation between Freedom House measures and other institutional measures (ICRG, in particular) are extremely high.

Among the several indicators of governance reported in this table, improvements in *political stability* have the largest impact on income distribution, as reflected in a reduction of 0.081 in the Gini coefficient. Interestingly, the measures of *rule of law* and *control of corruption* have the lowest impact on inequality as they yield a reduction in the Gini coefficient of 0.016 and 0.019, respectively.

On the other hand, we also find that a reduction in the Gini coefficient increases the different indices of aggregate governance. In general, the largest impact of lower inequality on institutions is attributed to *political stability* as a reduction of 0.1 in the Gini coefficient increases the coefficient of this measure by 0.072. Similarly, the lowest increase is experienced in the cases of the *rule of law* and *control of corruption* (with an increase of 0.038 and 0.039, respectively). These findings stand regardless of whether the focus is on developing countries or on industrial countries whereas the effect of better institutions on income distribution seems to be larger among industrial countries than among developing ones. For example, a one-unit increase in the aggregate governance index reduces the Gini coefficient by 0.16 among industrial countries, whereas an analogous change in this governance measure reduces the Gini coefficient by 0.01 among developing countries[19].

While an obvious weakness of the data from Kaufmann et al. (2003) is its relatively short time span, this does not appear to be critical for any of our findings. In fact, it is remarkable that, regardless of the data source we use (ICRG, Freedom House, or Institutional Investor) and whether the sample considered includes developing

[19] Among industrial countries, regulatory quality and rule of law are the dimensions that have the stronger impact on income inequality. For developing countries, government effectiveness has the largest impact on income inequality. Notice that there is no clear pattern on the reverse relationship as only in some cases (such as with voice and accountability, rule of law, and control of corruption.) is the impact of income inequality on governance larger among industrial than among developing countries.

countries, industrial countries, or both we obtain very similar results - see Tables 6 and 7.[20]

6.2. CAUSALITY AND FEEDBACK

The previous section has focused on the signs of the coefficients and their statistical significance in order to assess whether a dynamic relationship between institutions and inequality exists. In this section, we measure the extent of the contribution of each direction of causality possible between these variables in the observed overall correlation.

In Table 8, we first focus on the data from Kaufmann et al. (2003), finding that there is a significant causal relationship in both directions, from institutional quality to income inequality and vice versa[21]. It is also noteworthy that the causal direction from income inequality to institutional quality is the more significant one. For instance, when using the Gini coefficient as a measure for inequality, while the contribution of the *institutions to inequality* causality to the total linear dependence between these two variables in the entire sample is approximately 33 percent, the contribution of the *inequality to institutions* causality to the total linear dependence between these two variables is approximately 55 percent.[22] This finding also holds in the sub-samples of countries.[23]

[20] The only difference with the data displayed in Table 5 is that there is no obvious pattern of impact when comparing industrial countries and developing countries. In particular, it is not necessarily the case that the impact of institutional improvements on income inequality is larger among industrial countries than in developing countries. If anything, there appears to be an opposite pattern in which improvements in the distribution of income on institutions appear to be stronger on developing countries rather than among industrial countries.

[21] This, regardless of the income inequality indicator used, in particular, the Gini coefficient, the income share ratio of top to bottom quintiles of the population, and the income share of the middle quintile of the population. Because of space consideration the results using income shares are not reported but may be provided upon request.

[22] Notice that the instantaneous causality between these two variables is not statistically significant.

[23] The contribution of the institutions to inequality causality to the total linear dependence for the sub-sample of industrial countries is approximately 25 percent and the contribution of the inequality to institutions causality to the total linear dependence is approximately 64 percent; for developing countries, the contribution of the institutions to inequality causality to the total linear dependence is 33 percent and

In the case of the Gini coefficient and using the full sample, the largest contribution to the linear relationship between institutional quality and inequality is attributed to the *Inequality to Voice and Accountability* causal direction (64 percent). Notice that even the one component that provides the smallest contribution to this direction of causality, *regulatory quality* (46 percent), contributes a much larger percentage to the total linear dependence between these two variables than any of the variables that go on the opposite direction. A similar pattern is observed in the sub-samples of industrial and developing countries.[24] Overall, it appears that the direction of causality from inequality to institutions is more dominant for developing countries than for industrial countries.

In general, we find strong evidence of bi-directional causality for all the indicators, regardless of the sample, with the aggregate governance to inequality direction being always significant but having a smaller share in the total linear dependence relationship. Consistently, the instantaneous correlation between inequality and governance is not significant for any of the indicators regardless of the inequality measure used[25]. As before, the causal direction from income inequality to institutional quality dominates the linear relationship between these variables regardless of the institutional indicators, the sample of countries and the income distribution variable used[26]. Using the ICRG data, Freedom

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the contribution of the inequality to institutions causality to the total linear dependence is 58 percent – see Table 8.

[24] For the former, the causal relationship from income inequality to control of corruption explains nearly 73 percent of the total linear dependence. The one component that accounts for the smallest contribution to this direction of causality, regulatory quality (54 percent) contributes a much larger percentage to the total linear dependence than any of the contributions from institutions to inequality. For the latter sub-sample, the causal relationship from income inequality to rule of law explains 74 percent of the linear dependence between institutions and inequality which represents the largest contribution to the total linear dependence.

[25] Furthermore, robustness checks regarding the other measures of income inequality (i.e. income share ratio of top to bottom quintiles and the share of the middle income quintile) generate very similar results.

[26] We also used additional inequality measures, namely, the Theil and Atkinson indices. Our findings do not change. While we do not report these findings because of space considerations we would be happy to provide them upon request.

House and Institutional Investor data essentially confirms these results (see Tables 9 and 10).

7. CONCLUSIONS

The starting point of this paper is the observation that there is a significant correlation between income inequality and weakness of institutions. In theory, it stands to reason that weak institutions may be conducive to income inequality. Where the poor are not given the protection by an independent judicial system, for example, their ability to extract rents is inferior to that of the rich. It has also been suggested that high income inequality allows the rich to wield stronger political influence thereby subverting institutions.

This double feedback relationship is first exhibited in a simple formal model here and then tested empirically employing a comprehensive cross-country panel data set. The adopted approach enables us to directly establish causality links using Granger tests of statistical precedence. Unlike typical causality studies, however, we decompose the contribution of each type of causality on the observed total linear dependence between variables. Our panel *VAR* approach indicates that, consistent with the theory, institutions Granger-cause inequality as well as inequality Granger-causes institutions and provides strong empirical support to the mutually reinforcing mechanism between these variables. Furthermore, the direction of causality from inequality to institutions is shown to dominate the reverse causality. These findings hold for various institutional measures, as well as for different time-spans, year groupings, inequality measures, and changes in specification.

While our findings do not dispute the premise that better institutions may lead to a more equal distribution of income, the established reverse causality may help explain why countries with full awareness of the need to pursue dramatic institutional reforms have

failed to do so. Institutional reform may be an instrument to reduce inequality; political factors, however, may prevent its implementation.

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TABLE 1: FEEDBACK DECOMPOSITION TESTS

System	Representation of Parameter Matrices	Var-Cov Matrix of Residuals	Causality Tests
AR System	$\Gamma_0 = I_2$ $\Gamma_1 = \begin{bmatrix} \sum_{i=1}^{m} C_{1i} L^i & 0 \\ 0 & \sum_{i=1}^{m} E_{1i} L^i \end{bmatrix}$	$E(\xi_t^{(1)} \xi_t^{(1)}) =$ $\sum^{(1)} = \begin{bmatrix} \Sigma_{11}^{(1)} & \Sigma_{12}^{(1)} \\ \Sigma_{21}^{(1)} & \Sigma_{22}^{(1)} \end{bmatrix}$	Current values of y (x) are functions of m past values of y (x) only.
Granger System	$\Gamma_0 = I_2$ $\Gamma_1 = \begin{bmatrix} \sum_{i=1}^{m} C_{2i} L^i & \sum_{i=1}^{m} D_{2i} L^i \\ \sum_{i=1}^{m} F_{2i} L^i & \sum_{i=1}^{m} E_{2i} L^i \end{bmatrix}$	$E(\xi_t^{(2)} \xi_t^{(2)}) =$ $\sum^{(2)} = \begin{bmatrix} \Sigma_{11}^{(2)} & \Sigma_{12}^{(2)} \\ \Sigma_{21}^{(2)} & \Sigma_{22}^{(2)} \end{bmatrix}$	Granger Causality: y (x) does not Granger-cause x (y) iff $F_{2i} \equiv 0$ ($D_{2i} \equiv 0$), for all i.
Instantaneous System	$\Gamma_0 = \begin{bmatrix} 1 & -D_{30} \\ -F_{30} & 1 \end{bmatrix}$ $\Gamma_1 = \begin{bmatrix} \sum_{i=1}^{m} C_{3i} L^i & \sum_{i=1}^{m} D_{3i} L^i \\ \sum_{i=1}^{m} F_{3i} L^i & \sum_{i=1}^{m} E_{3i} L^i \end{bmatrix}$	$E(\xi_t^{(3)} \xi_t^{(3)}) =$ $\sum^{(3)} = \begin{bmatrix} \Sigma_{11}^{(3)} & \Sigma_{12}^{(3)} \\ \Sigma_{21}^{(3)} & \Sigma_{22}^{(3)} \end{bmatrix}$	Instantaneous causality between x and y if and only if $D_{30} \neq 0$ and $F_{30} \neq 0$.

Sources: Chong and Calderon (2000a), Calderon and Lui (2003).

TABLE 2: LINEAR FEEDBACK STATISTICS AND EMPIRICAL TESTS

Linear Feedback	Statistic	Null Hypothesis
From x to y ($F_{x \to y}$)	$\ln\left(\left\|\sum_{11}^{(1)}\right\| \Big/ \left\|\sum_{11}^{(2)}\right\| \right)$	H_0: $F_{x \to y} = 0$, i.e. "x does not Granger-cause y." That is, $\left\|\Sigma_{11}^{(1)}\right\| = \left\|\Sigma_{11}^{(2)}\right\|$
From y to x ($F_{y \to x}$)	$\ln\left(\left\|\sum_{22}^{(1)}\right\| \Big/ \left\|\sum_{22}^{(2)}\right\| \right)$	H_0: $F_{y \to x} = 0$, i.e. "y does not Granger-cause x." That is, $\left\|\Sigma_{22}^{(1)}\right\| = \left\|\Sigma_{22}^{(2)}\right\|$
Instantaneous ($F_{x \cdot y}$)	$\ln\left(\left\|\sum_{11}^{(2)}\right\| \Big/ \left\|\sum_{11}^{(3)}\right\| \right) = \ln\left(\left\|\sum_{22}^{(2)}\right\| \Big/ \left\|\sum_{22}^{(3)}\right\| \right)$	H_0: $F_{x \cdot y} = 0$, i.e. "no instantaneous causality between y and x."
Linear Dependence ($F_{x,y}$)	$(F_{x,y}) = F_{x \to y} + F_{y \to x} + F_{x \cdot y}$	H_0: $F_{x,y} = 0$, i.e. "no linear association between y and x."

Sources: Chong and Calderon (2000a), Calderon and Lui (2003).

TABLE 3
SUMMARY STATISTICS

Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
I. Inequality Measures						
Gini Coefficient	0.3909	0.10	0.3220	0.04	0.4121	0.10
Top to Bottom	9.2360	6.12	5.9311	1.69	10.3855	6.67
Middle	0.1554	0.04	0.1777	0.02	0.1476	0.04
II. Kaufmann et al. (2003) Governance Data						
Governance	0.2138	0.86	1.5145	0.31	-0.0797	0.65
Voice and Accountability	0.1269	0.92	1.3807	0.19	-0.1518	0.77
Political Stability	0.1503	0.89	1.2007	0.29	-0.0831	0.81
Government Effectiveness	0.2347	0.94	1.6700	0.40	-0.0842	0.70
Regulatory Quality	0.2793	0.86	1.3195	0.30	0.0481	0.77
Rule of Law	0.2425	0.97	1.7187	0.38	-0.0856	0.73
Control of Corruption	0.2093	1.00	1.7974	0.50	-0.1490	0.68
III. Freedom House Indicators						
Gastil Index of Liberties	0.5389	0.32	0.9536	0.10	0.4396	0.27
Civil Liberties	0.5346	0.30	0.9372	0.11	0.4382	0.25
Political Rights	0.5430	0.35	0.9701	0.10	0.4408	0.31
II Credit Ratings	0.4541	0.2506	0.8046	0.11	0.3669	0.19
IV. ICRG Indicators						
ICRG Index	4.0283	1.21	5.6895	0.58	3.5996	0.93
Government Stability	7.0606	2.00	8.2530	1.55	6.7529	1.99
Corruption	3.4412	1.33	5.1963	0.82	2.9909	1.03
Rule of Law	3.7025	1.50	5.5889	0.68	3.2185	1.26
Democratic Accountability	3.6942	1.51	5.6628	0.57	3.1891	1.23
Bureaucratic Quality	2.2413	1.18	3.7466	0.50	1.8551	0.98

TABLE 4
INSTITUTIONS AND INCOME INEQUALITY
SIMPLE CORRELATIONS

Variable	Gini Coefficient	Ratio of Top to Bottom Quintiles	Income Share of Middle Quintile
1. World Bank			
Governance	-0.4020	-0.2986	0.4238
	(0.00)	(0.00)	(0.00)
Voice and Accountability	-0.3202	-0.2094	0.3297
	(0.00)	(0.01)	(0.00)
Political Stability	-0.3629	-0.2506	0.3803
	(0.00)	(0.00)	(0.00)
Government Effectiveness	-0.4135	-0.3337	0.4339
	(0.00)	(0.00)	(0.00)
Regulatory Quality	-0.2735	-0.2065	0.2970
	(0.00)	(0.01)	(0.00)
Rule of Law	-0.4136	-0.3310	0.4360
	(0.00)	(0.00)	(0.00)
Control of Corruption	-0.3971	-0.2973	0.4221
	(0.00)	(0.00)	(0.00)
2. Gastil and Institutional Investor			
Gastil Index of Liberties	-0.1859	-0.1177	0.1815
	(0.00)	(0.01)	(0.00)
Civil Liberties	-0.1892	-0.1238	0.1845
	(0.00)	(0.01)	(0.00)
Political Rights	-0.1774	-0.1089	0.1734
	(0.00)	(0.02)	(0.00)
Credit Ratings	-0.3655	-0.2787	0.3654
	(0.00)	(0.00)	(0.00)
3. ICRG			
ICRG Index	-0.4393	-0.3718	0.4225
	(0.00)	(0.00)	(0.00)
Government Stability	-0.2769	-0.2172	0.2380
	(0.00)	(0.00)	(0.00)
Corruption	-0.3726	-0.3383	0.3783
	(0.00)	(0.00)	(0.00)
Rule of Law	-0.4336	-0.3553	0.4479
	(0.00)	(0.00)	(0.00)
Democratic Accountability	-0.3634	-0.3148	0.3501
	(0.00)	(0.00)	(0.00)
Bureaucratic Quality	-0.3545	-0.3195	0.3371
	(0.00)	(0.00)	(0.00)

Statistical significance is shown in parenthesis.

TABLE 5
DYNAMIC RELATIONSHIP BETWEEN INSTITUTIONS AND INEQUALITY
RESULTS USING DATA FROM KAUFMANN, KRAAY, AND MASTRUZZI FOR 1995-2000

		All Countries		Industrial Countries		Developing Countries	
		X -> Y	Y -> X	X -> Y	Y -> X	X -> Y	Y -> X
Aggregate Governance	Sum Coeff.	-0.0343	-0.1259	-0.1637	-0.4236	-0.0105	-0.6460
	[p-value]	(0.007)	(0.007)	(0.000)	(0.000)	(0.006)	(0.006)
Voice and Accountability	Sum Coeff.	-0.0415	-0.4175	-0.0596	-0.4455	-0.0155	-0.3315
	[p-value]	(0.009)	(0.038)	(0.010)	(0.031)	(0.200)	(0.051)
Political Stability	Sum Coeff.	-0.0805	-0.7202	-0.0645	-0.4984	-0.0050	-0.7635
	[p-value]	(0.045)	(0.030)	(0.008)	(0.008)	(0.006)	(0.027)
Government Effectiveness	Sum Coeff.	-0.0257	-0.6472	-0.0557	-0.4827	-0.0229	-0.6872
	[p-value]	(0.008)	(0.056)	(0.046)	(0.003)	(0.120)	(0.100)
Regulatory Quality	Sum Coeff.	-0.0707	-0.6533	-0.0790	-0.4154	-0.0123	-0.4405
	[p-value]	(0.059)	(0.029)	(0.000)	(0.003)	(0.037)	(0.051)
Rule of Law	Sum Coeff.	-0.0163	-0.3756	-0.0778	-0.5115	-0.0111	-0.3655
	[p-value]	(0.035)	(0.032)	(0.006)	(0.069)	(0.019)	(0.053)
Control of Corruption	Sum Coeff.	-0.0188	-0.3908	-0.0482	-0.7668	-0.0195	-0.6037
	[p-value]	(0.024)	(0.015)	(0.009)	(0.043)	(0.024)	(0.007)

Tests of dynamic relationship using institutional measures from Kaufmann, Kraay, and Zodio-Lobaton (1999) and Kaufmann, Kraay, and Mastruzzi (2003). The available data go from 1995 to 2000; *X* represents the corresponding institutional measure and *Y* represents the inequality measure as measured by the Gini coefficient. P-values are shown in parenthesis.

TABLE 6
DYNAMIC RELATIONSHIP BETWEEN INSTITUTIONS AND INEQUALITY
ROBUSTNESS TEST USING ICRG DATA FOR 1985-2000

		All Countries		Industrial Countries		Developing Countries	
		X -> Y	Y -> X	X -> Y	Y -> X	X -> Y	Y -> X
ICRG Aggregate Index	Sum Coeff.	-0.0514	-0.4302	-0.0241	-0.7247	-0.0592	-0.3536
	[p-value]	(0.009)	(0.041)	(0.008)	(0.049)	(0.008)	(0.052)
Government Stability	Sum Coeff.	-0.0923	-0.2701	-0.0415	-0.8334	-0.0271	-0.2708
	[p-value]	(0.009)	(0.043)	(0.008)	(0.021)	(0.009)	(0.006)
Corruption	Sum Coeff.	-0.0433	-0.3977	-0.0160	-0.8053	-0.0381	-0.4026
	[p-value]	(0.021)	(0.002)	(0.008)	(0.037)	(0.034)	(0.004)
Rule of Law	Sum Coeff.	-0.0343	-0.4668	-0.0219	-0.4803	-0.0465	-0.4698
	[p-value]	(0.013)	(0.009)	(0.009)	(0.057)	(0.008)	(0.019)
Democratic Accountability	Sum Coeff.	-0.0294	-0.4302	-0.0177	-0.5377	-0.0296	-0.4175
	[p-value]	(0.036)	(0.052)	(0.009)	(0.049)	(0.007)	(0.058)
Bureaucratic Quality	Sum Coeff.	-0.0177	-0.8536	-0.0368	-0.4594	-0.0175	-0.7833
	[p-value]	(0.008)	(0.050)	(0.008)	(0.071)	(0.009)	(0.010)

Tests of dynamic relationship using institutional measures from ICRG (Knack and Keefer, 1995). The available data go from 1985 to 2000. *X* represents the corresponding institutional measure and *Y* represents the inequality measure as measured by the Gini coefficient. P-values are shown in parenthesis.

TABLE 7
DYNAMIC RELATIONSHIP BETWEEN INSTITUTIONS AND INEQUALITY
ROBUSTNESS TEST USING DATA FROM FREEDOM HOUSE AND INSTITUTIONAL INVESTOR FOR 1970-2000

		All Countries		Industrial Countries		Developing Countries	
		X -> Y	Y -> X	X -> Y	Y -> X	X -> Y	Y -> X
Gastil Index	Sum Coeff.	-0.0121	-0.3335	-0.0278	-0.0521	-0.0104	-0.3241
	[p-value]	(0.020)	(0.014)	(0.007)	(0.007)	(0.028)	(0.019)
Civil Liberties	Sum Coeff.	-0.0106	-0.1133	-0.0290	-0.1313	-0.0712	-0.2756
	[p-value]	(0.009)	(0.058)	(0.041)	(0.037)	(0.049)	(0.007)
Political Rights	Sum Coeff.	-0.0133	-0.5624	-0.0122	-0.0216	-0.0309	-0.5805
	[p-value]	(0.001)	(0.039)	(0.009)	(0.009)	(0.048)	(0.052)
Institutional Investor Credit Ratings	Sum Coeff.	-0.0027	-0.7786	-0.0050	-0.5618	-0.0019	-0.7557
	[p-value]	(0.004)	(0.009)	(0.045)	(0.044)	(0.060)	(0.011)

Tests of dynamic relationship using institutional measures from Freedom House (1999) and Institutional Investor (various years). The available data go from 1970 to 2000. *X* represents the corresponding institutional measure and *Y* represents the inequality measure as measured by the Gini coefficient. P-values are shown in parenthesis.

TABLE 8
LINEAR FEEDBACK AND CAUSALITY MEASURES BETWEEN INSTITUTIONS AND INEQUALITY
RESULTS USING DATA FROM KAUFMANN, KRAAY, AND MASTRUZZI FOR 1995-2000

	I. Sample of All Countries				*II. Sample of Industrial Countries*				*III. Sample of Developing Countries*			
	x -> y	**y -> x**	**y . x**	**y , x**	**x -> y**	**y -> x**	**y . x**	**y , x**	**x -> y**	**y -> x**	**y . x**	**y , x**
Aggregate Governance	33.4	55.0	11.5	100.0	24.9	64.0	11.1	100.0	32.8	58.0	9.2	100.0
	(0.05)	(0.02)	(0.91)	(0.02)	(0.06)	(0.01)	(0.91)	(0.04)	(0.02)	(0.02)	(0.93)	(0.02)
Voice and Accountability	30.4	64.2	5.4	100.0	36.2	63.0	0.8	100.0	32.8	58.0	9.2	100.0
	(0.10)	(0.02)	(0.88)	(0.04)	(0.07)	(0.03)	(0.90)	(0.04)	(0.10)	(0.04)	(0.88)	(0.04)
Political Stability	26.5	63.5	10.0	100.0	27.5	61.9	10.6	100.0	25.6	72.9	1.4	100.0
	(0.04)	(0.01)	(0.79)	(0.03)	(0.06)	(0.05)	(0.96)	(0.05)	(0.09)	(0.03)	(0.93)	(0.04)
Government Effectiveness	39.2	56.9	3.9	100.0	34.3	56.4	9.3	100.0	32.8	64.5	2.7	100.0
	(0.00)	(0.00)	(0.42)	(0.00)	(0.08)	(0.04)	(0.98)	(0.05)	(0.05)	(0.02)	(0.93)	(0.05)
Regulatory Quality	35.2	46.0	18.8	100.0	39.1	54.2	6.8	100.0	38.5	56.8	4.6	100.0
	(0.10)	(0.03)	(0.64)	(0.04)	(0.09)	(0.03)	(0.85)	(0.02)	(0.00)	(0.00)	(0.85)	(0.01)
Rule of Law	34.6	52.6	12.8	100.0	36.5	62.4	1.0	100.0	24.4	74.1	1.5	100.0
	(0.10)	(0.06)	(0.88)	(0.06)	(0.08)	(0.02)	(0.68)	(0.06)	(0.05)	(0.02)	(0.97)	(0.05)
Control of Corruption	38.4	58.5	3.1	100.0	24.3	72.5	3.2	100.0	34.5	60.7	4.9	100.0
	(0.04)	(0.01)	(0.77)	(0.03)	(0.07)	(0.04)	(0.77)	(0.05)	(0.05)	(0.03)	(0.92)	(0.42)

The variable *x* represents the measure of institutional quality, whereas the variable *y* represents the measure of income inequality, as measured by the Gini coefficient. All feedback measures are expressed as a percentage of the total correlation or linear dependence between institutions and inequality *(F x,y)*. Hence, the causality from *institutions* to *inequality* is represented by $x \rightarrow y$. Similarly, the causality from *inequality* to *institutions* is represented by $y \rightarrow x$. Instantaneous causality is represented by $y \cdot x$ The statistical significance of each feedback measure is shown in parentheses (*p*-values for χ^2 tests).

TABLE 9
LINEAR FEEDBACK AND CAUSALITY MEASURES BETWEEN INSTITUTIONS AND INEQUALITY
ROBUSTNESS TEST USING ICRG DATA FOR 1985-2000

	I. Sample of All Countries				*II. Sample of Industrial Countries*				*III. Sample of Developing Countries*			
	x -> y	**y -> x**	**y . x**	**y , x**	**x -> y**	**y -> x**	**y . x**	**y , x**	**x -> y**	**y -> x**	**y . x**	**y , x**
ICRG Index	33.2	63.5	3.4	100.0	37.7	59.2	3.0	100.0	34.3	62.3	3.4	100.0
	(0.04)	(0.00)	(0.67)	(0.01)	(0.07)	(0.04)	(0.96)	(0.05)	(0.02)	(0.00)	(0.93)	(0.01)
Government Stability	35.0	60.7	4.3	100.0	39.1	59.0	2.0	100.0	31.8	63.2	5.0	100.0
	(0.03)	(0.00)	(0.53)	(0.01)	(0.05)	(0.01)	(0.91)	(0.02)	(0.01)	(0.00)	(0.51)	(0.01)
Corruption	32.2	66.2	1.7	100.0	34.9	58.9	6.2	100.0	33.3	62.6	4.1	100.0
	(0.02)	(0.00)	(0.78)	(0.00)	(0.02)	(0.01)	(0.93)	(0.01)	(0.02)	(0.00)	(0.54)	(0.01)
Rule of Law	31.5	65.3	3.2	100.0	33.3	51.8	14.9	100.0	32.4	60.0	7.6	100.0
	(0.01)	(0.00)	(0.71)	(0.00)	(0.09)	(0.03)	(0.94)	(0.05)	(0.03)	(0.00)	(0.89)	(0.01)
Democratic Accountability	32.9	64.5	2.5	100.0	31.4	60.0	8.6	100.0	29.5	67.4	3.1	100.0
	(0.01)	(0.00)	(0.52)	(0.01)	(0.06)	(0.01)	(0.75)	(0.02)	(0.02)	(0.00)	(0.66)	(0.01)
Bureaucratic Quality	36.5	60.6	2.9	100.0	28.6	54.0	17.5	100.0	38.6	58.3	3.1	100.0
	(0.02)	(0.00)	(0.84)	(0.00)	(0.10)	(0.04)	(0.74)	(0.09)	(0.00)	(0.00)	(0.60)	(0.00)

The variable *x* represents the measure of institutional quality, whereas the variable *y* represents the measure of income inequality, as measured by the Gini coefficient. All feedback measures are expressed as a percentage of the total correlation or linear dependence between institutions and inequality *(F x,y)*. Hence, the causality from *institutions* to *inequality* is represented by $x \rightarrow y$. Similarly, the causality from *inequality* to *institutions* is represented by $y \rightarrow x$. Instantaneous causality is represented by $y \cdot x$ The statistical significance of each feedback measure is shown in parentheses (*p*-values for χ^2 tests).

TABLE 10
LINEAR FEEDBACK AND CAUSALITY MEASURES BETWEEN INSTITUTIONS AND INEQUALITY
ROBUSTNESS TEST USING DATA FROM FREEDOM HOUSE AND INSTITUTIONAL INVESTOR FOR 1970-2000

	I. Sample of All Countries				*II. Sample of Industrial Countries*				*III. Sample of Developing Countries*			
	x -> y	**y -> x**	**y . x**	**y , x**	**x -> y**	**y -> x**	**y . x**	**y , x**	**x -> y**	**y -> x**	**y . x**	**y , x**
Gastil Index	36.5	59.0	4.5	100.0	37.7	54.3	8.0	100.0	38.4	57.9	3.7	100.0
	(0.06)	(0.02)	(0.96)	(0.03)	(0.09)	(0.03)	(0.89)	(0.49)	(0.08)	(0.03)	(0.92)	(0.04)
Civil Liberties	25.5	66.0	8.4	100.0	36.9	55.3	7.8	100.0	32.4	62.4	5.2	100.0
	(0.04)	(0.03)	(0.61)	(0.03)	(0.06)	(0.03)	(0.75)	(0.05)	(0.05)	(0.02)	(0.78)	(0.04)
Political Rights	24.5	73.7	1.8	100.0	32.9	64.5	2.7	100.0	31.9	58.5	9.6	100.0
	(0.09)	(0.00)	(0.84)	(0.02)	(0.09)	(0.02)	(0.97)	(0.05)	(0.08)	(0.01)	(0.69)	(0.02)
Institutional Investor	38.6	58.4	2.9	100.0	43.0	53.7	3.3	100.0	43.6	52.0	4.4	100.0
	(0.00)	(0.00)	(0.84)	(0.00)	(0.00)	(0.01)	(0.63)	(0.01)	(0.06)	(0.03)	(0.78)	(0.04)

The variable *x* represents the measure of institutional quality, whereas the variable *y* represents the measure of income inequality, as measured by the Gini coefficient. All feedback measures are expressed as a percentage of the total correlation or linear dependence between institutions and inequality *(F x,y)*. Hence, the causality from *institutions* to *inequality* is represented by $x \rightarrow y$. Similarly, the causality from *inequality* to *institutions* is represented by $y \rightarrow x$. Instantaneous causality is represented by $y \cdot x$ The statistical significance of each feedback measure is shown in parentheses (*p*-values for χ^2 tests).

APPENDIX 1: ROBUSTNESS TO CHANGES IN SPECIFICATION

In this appendix, we assess the robustness of our results with respect to the addition of regressors to the benchmark specifications in (13) and (14). As in Sala-i-Martín (1997), we consider the entire distribution of the estimator of the variable of interest by focusing on the fraction of the density function lying on each side of zero[27]. Given that zero divides the area under the density in two, the larger of the two areas is denoted *cdf(0),* regardless of whether it is above or below zero. Under the assumption that the distribution of the coefficient of interest is non-normal the *cdf(0)* is calculated as follows[28]. First, consider a group of variables classified as the dependent *variable,* the benchmark explanatory variables, and a set of ancillary variables $(X_{A,i})$, representing a group of related auxiliary variables identified as potentially related to the determinants of inequality and institutions. We augment the empirical specifications used in our benchmark specifications in (13) and (14) by using this pool of ancillary variables X_A. The idea is to choose up to two variables of this pool at a time, and perform regressions including all the possible combinations based on such pool of ancillary variables[29]. We test the benchmark specification for all possible combinations of ancillary variables and compute the coefficient estimates, their variance, the integrated likelihoods, and the individual *cdf(0)* for each regression; this is summarized in the vector $V=F\{\hat{\gamma}_{I,j}, \hat{\sigma}^2_{I,j}, L_{I,j}, \Phi_{I,j}(0/\hat{\gamma}_{I,j}, \hat{\sigma}^2_{I,j})\}$. We compute the aggregate *cdf(0)* of our coefficient of interest γ_1 as the weighted average of all individual *cdf(0)s*, $\Phi_I(0) = \sum_{j=1}^{M} \omega_{I,j} \Phi_{I,j}(0/\hat{\gamma}_{I,j}, \hat{\sigma}^2_{I,j})$ where the weights are the integrated likelihoods, $\omega_{I,j} = \frac{L_{I,j}}{\sum_{k=1}^{M} L_{I,k}}$.

[27] If 95 percent of the density function for the estimates of the coefficient of interest lies to the right of zero, one could say that this variable is more likely to be correlated with our dependent variable.

[28] Assuming normality yields essentially identical results.

[29] We use twelve ancillary variables: population growth rate, public-sector employment, participation of female workers in the labor force, the share of the agricultural sector in output, secondary schooling ratio, share of urban population, share of agriculture, rate of growth, external debt, rate of unemployment, membership to the World Trade Organization, membership and membership to the International Labor Organization. To a certain extent, these last two variables help us deal with some potential unobserved variables that may vary within countries across time for it may be claimed that both economic outcomes, inequality and institutions may be related to membership in international organizations.

The variable of interest is said to be strongly correlated (i.e., is robust) with the dependent variables if the weighted *cdf(0),* is greater than or equal to 0.90. Our findings are shown in Table 11. We present robustness measures for both the dynamic relationship between institutions and inequality (the ones that correspond to Tables 5-7) and the linear feedback and causality between these two variables (the ones that correspond to Tables 8-10). The results are generally quite robust for the data sources employed, which provides some additional credibility to our initial findings.

TABLE 11: ROBUSTNESS TO CHANGES IN SPECIFICATION

	Dynamic Relationship		Linear Feedback	
Mean	x -> y	y -> x	x -> y	y -> x
Aggregate Governance	-0.031	-0.101	37.51%	51.04%
Cumulative Distribution Function	0.936	0.945	0.952	0.971
ICRG Aggregate Index	-0.062	-0.405	39.17%	49.33%
Cumulative Distribution Function	0.952	0.912	0.971	0.954
Gastil Index	-0.009	-0.305	32.84%	53.89%
Cumulative Distribution Function	0.782	0.816	0.914	0.806
Institutional Investor Rating	-0.0019	-0.702	33.15%	62.40%
Cumulative Distribution Function	0.961	0.934	0.942	0.911

A variable whose weighted cumulative distribution function (cdf) is larger than 0.90 is significantly correlated with the dependent variable (i.e., is robust) at ten percent significance level or better. The cdf is computed assuming non-normality of the parameters estimated. In the normal case results obtained are similar. Findings are based on benchmark specification ---see equations (13) and (14) in text. Results using aggregate measures of each data base are presented in this table but robustness with sub-indices was also tested.

APPENDIX 2: LIST OF COUNTRIES

1	ARE	United Arab Emirates
2	ARG	Argentina
3	AUS	Australia
4	AUT	Austria
5	BEL	Belgium
6	BFA	Burkina Faso
7	BGD	Bangladesh
8	BGR	Bulgaria
9	BHR	Bahrein
10	BHS	Bahamas
11	BLR	Bielorussia
12	BOL	Bolivia
13	BRA	Brazil
14	BWA	Botswana
15	CAN	Canada
16	CHE	Switzerland
17	CHL	Chile
18	CHN	China
19	CIV	Cote d'Ivoire
20	COL	Colombia
21	CRI	Costa Rica
22	CYP	Cyprus
23	CZE	Czech Republic
24	DEU	Germany
25	DNK	Denmark
26	DOM	Dominican Republic
27	DZA	Algeria
28	ECU	Ecuador
29	EGY	Egypt
30	ESP	Spain
31	EST	Estonia
32	ETH	Ethiopia
33	FIN	Finland
34	FRA	France
35	GBR	United Kingdom
36	GHA	Ghana
37	GIN	Guinea
38	GNB	Guinea Bissau
39	GRC	Greece
40	GTM	Guatemala
41	HKG	Hong Kong
42	HND	Honduras
43	HRV	Croatia
44	HUN	Hungary
45	IDN	Indonesia
46	IND	India
47	IRL	Ireland
48	IRN	Iran
49	IRQ	Iraq
50	ISR	Israel
51	ITA	Italy
52	JAM	Jamaica
53	JOR	Jordan
54	JPN	Japan
55	KAZ	Kazhakstan
56	KEN	Kenya
57	KGZ	Kirgyz Rep.
58	KOR	Korea, Rep.
59	KWT	Kuwait
60	LBN	Lebanon
61	LBY	Libya
62	LKA	Sri Lanka
63	LSO	Lesotho
64	LTU	Lithuania
65	LUX	Luxembourg
66	LVA	Latvia
67	MAR	Morocco
68	MDG	Madagascar
69	MEX	Mexico
70	MLI	Mali
71	MLT	Malta
72	MNG	Mongolia
73	MRT	Mauritania
74	MUS	Mauritius
75	MYS	Malaysia
76	NER	Niger
77	NGA	Nigeria
78	NIC	Nicaragua
79	NLD	Netherlands
80	NOR	Norway
81	NPL	Nepal
82	NZL	New Zealand
83	OMN	Oman
84	PAK	Pakistan
85	PAN	Panama
86	PER	Peru
87	PHL	Philippines
88	PNG	Papua New Guinea
89	POL	Poland
90	PRT	Portugal
91	PRY	Paraguay
92	QAT	Qatar
93	ROM	Romania
94	RUS	Russia
95	RWA	Rwanda
96	SAU	Saudi Arabia
97	SEN	Senegal
98	SGP	Singapore
99	SLE	Sierra Leone
100	SLV	El Salvador
101	SVK	Slovak Rep.
102	SVN	Slovenia
103	SWE	Sweden
104	SYR	Syria
105	THA	Thailand
106	TTO	Trinidad and Tobago
107	TUN	Tunisia
108	TUR	Turkey
109	TWN	Taiwan
110	TZA	Tanzania
111	UGA	Uganda
112	UKR	Ukraine
113	URY	Uruguay
114	USA	United States
115	VEN	Venezuela
116	VNM	Vietnam
117	YEM	Yemen
118	YSR	Yugoslavia
119	ZAF	South Africa
120	ZMB	Zambia
121	ZWE	Zimbabwe