Institutional Causes of Output Volatility

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The authors investigate the relationship between the quality of institutions and output volatility. Using instrumental variable regressions, they address whether higher entry barriers and lower property rights protection lead to higher volatility. They find that a 1-standard-deviation increase in entry costs increases the standard deviation of output growth by roughly 40 percent of its average value in the sample. In contrast, property rights protection has no statistically significant effect on volatility. (JEL O11, O17, O43)

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Poor macroeconomic policies in less-developed countries have been blamed for the negative relationship between growth and macroeconomic volatility as measured by the volatility of the growth rate of output per worker. Acemoglu et al. (2003) offer a different explanation: Volatility is related to institutional quality; once institutions are controlled for, macroeconomic policies (i.e., fiscal, monetary, and exchange rate policy) have only a minor effect on volatility. This finding raises the question of how institutions affect output volatility—more precisely, which institutional features are most responsible for the relationship documented by Acemoglu et al. (2003). We use instrumental variable (IV) regressions to disentangle the effect of two distinct types of institutions: entry barriers and property rights protection. We find that higher entry barriers lead to higher output volatility. In contrast, property rights protection appears to have no effect on output volatility.

Entry barriers and property rights protection are correlated in the data, although their economic effects, both empirically and theoretically, are quite different. Barseghyan (2008) shows that worse property rights protection leads to lower educational attainment and a lower capital-to-output ratio: A lack of property rights enforcement discourages investment in all types of capital. The effect of property rights on total factor productivity (TFP) is much weaker and is mostly statistically insignificant. On the other hand, entry costs have no effect on the capital-to-output ratio but do have a strong effect on TFP. According to prevalent theories of industry structure (e.g., Hopenhayn, 1992), this is exactly what should be expected: Higher entry barriers reduce entry, protect incumbent firms, and allow those with lower productivity to survive. Thus, the results of our paper suggest that differences in output volatility are driven by industry structure, which, in turn, is significantly affected by entry barriers. This is consistent with the findings of Acemoglu et al. (2003) that a significant part of the effect of institutions on economic outcomes occurs through microeconomic channels.

In a related paper, we explore the link between entry costs and cross-country output and TFP differences through the lenses of general equilib-

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rium models. Barseghyan and DiCecio (2010) construct a model with endogenous entry and operation decisions by firms and calibrate it to match the U.S. distribution of firms by size. Higher entry costs lead to greater misallocation of productive factors and lower steady-state TFP and output. As in the data, higher entry costs are associated with a larger informal sector and overall number of operating firms, a smaller number of legally registered firms, and a higher concentration of employment in the smallest and largest firms.

In our investigation, we use a measure of entry costs originally constructed by Djankov et al. (2002) and later expanded by the World Bank (2007). Unlike most measures of institutional quality, this is a continuous variable that captures the precise quantitative value of the object of interest. We control for property rights by considering five proxies for property rights institutions: the rate of debt recovery from a "going-out-of-business" borrower, three indices of property rights protection, and a social infrastructure measure. Sources of exogenous variation in entry costs and the property rights measures are given by the following instruments: geographic latitude, fraction of the population speaking a major European language, the country's legal origin, European settler mortality in early stages of colonization, and indigenous population density in the early sixteenth century, the use of which is further explained below.

The IV regressions reveal that entry costs have a statistically significant effect on output volatility. The economic effect of entry costs is worth emphasizing. A 1-standard-deviation (SD) increase in entry costs is estimated to increase the SD of the growth rate of output per worker by 41 percent of its average value in our sample. Also, a 1-SD increase in entry costs increases the magnitude of the worst output drop by 60 percent of its sample average. We perform a variety of checks to ensure that the estimated strong effect of entry costs on volatility is robust. Notably, we entertain the possibility raised by Glaeser et al. (2004) that the defining characteristic of a successful European settlement was an increase in human capital. We include human capital as an endogenous variable in the IV regressions. The robustness exercises confirm that entry costs are an important determinant of output volatility. Moreover, the magnitude of this effect is close to the one estimated in the benchmark regressions. The effect of property rights on volatility remains insignificant throughout robustness analysis.

This paper belongs to the empirical literature on institutions and growth, such as Hall and Jones (1999); Acemoglu, Johnson, and Robinson (2002); Acemoglu et al. (2003); Dollar and Kraay (2003); Easterly and Levine (2003); Rodrik, Subramanian, and Trebbi (2004); and earlier contributions by Knack and Keefer (1995) and Mauro (1995). The empirical strategy used in the paper is closest to that of Acemoglu and Johnson (2005) and Barseghyan (2008). As in these papers, our analysis hinges on the availability of a set of instruments that affect current economic outcomes only through institutions and are capable of separating the effects of various institutional features.

Our findings suggest that entry costs, by affecting the composition of the pool of firms, have an impact on volatility. Comparably, Koren and Tenreyro (2007) highlight the importance of the sectorial composition in understanding the relationship between development and volatility. Kraay and Ventura (2007) argue that comparative advantage determines differences in the composition of firms between rich and poor countries, making least-developed countries more volatile.

In the next section, we present the data and methodology used in the empirical investigation. We present the results of the empirical investigation in the following section and discuss their robustness in the final section. The appendix provides data sources and definitions.

DATA AND METHODOLOGY

Output Volatility

The benchmark measure of volatility is constructed using purchasing power–adjusted gross domestic product (GDP) per worker annual data from the Penn World Table 6.2 constructed by Heston, Summers, and Aten (2006). We consider only countries for which (i) the data for output per worker are available for at least 20 years and

(ii) entry costs data are available.[1] Our benchmark measure of volatility is the SD of the growth rate of output per worker. To assess the robustness of our results, we also consider the worst output drop (i.e., the minimum growth rate of output per worker). For comparison, we also construct the average growth rate for each country and report descriptive statistics for it.

ENTRY COSTS, PROPERTY RIGHTS, AND SOCIAL INFRASTRUCTURE

Entry costs are from the World Bank's *Doing Business* dataset and are available for 132 countries.[2] They include all official fees and dues that an entrepreneur must pay in the process of completing legal procedures for starting a new firm. They are constructed for a "standardized" firm. Although this standardized firm is relatively small, it is quite representative of a typical firm because smaller production units have a large share of aggregate employment.[3]

In most developed countries, entry costs are not a significant burden on entrepreneurs: For example, in Canada entrepreneurs pay less than 1 percent of gross national income (GNI) per capita in entry costs, whereas the cross-country average is 79 percent of GNI per capita. Higher entry costs are associated with worse macroeconomic conditions along several dimensions, as shown in Table 1 and Figures 1 through 3. Entry costs are positively correlated with volatility and negatively correlated with average growth. Also, higher entry costs are associated with more severe economic crises, measured by the worst output drop.

Finding a suitable proxy for property rights protection is more challenging. The first variable we use is the rate of debt recovery from a "going-out-of-business" borrower. This is, to our knowledge, the only available quantitative measure that can proxy property rights protection. The second variable, "constraint on executive power," refers to "the extent of institutionalized constraints on the decision-making powers of chief executives, whether individuals or collectivities" (Jaggers and Marshall, 2000). It can be used as a proxy for the protection of private citizens and businesses against government expropriation. However, it may ignore the risk of expropriation by other agents. The third variable is the property rights protection index constructed by the Heritage Foundation (2006). The fourth variable is the "expropriation risk" constructed by the Political Risk Services (1999). It measures the risk of expropriation of private foreign investment by the government.[4] Finally, we consider the social infrastructure measure proposed by Hall and Jones (1999). It was constructed as the average between the government anti-diversion policy index and the openness to international trade measure of Sachs and Warner (1995). All property rights measures and social infrastructure are strongly positively correlated with each other and are negatively correlated with output growth volatility and entry costs (see Table 1).

ECONOMETRIC MODEL

The target is to identify and estimate the following relationship:

$$Y_i = \gamma_0 + \gamma_E E_i + \gamma_0 O_i + Z_i' \gamma_Z + \varepsilon_i,$$

where Y_i is the volatility of output growth for country i, E_i is the measure of entry costs, O_i is the proxy for other institutions, Z_i is the vector

[1] Notice that for different countries the volatility, average growth, and worst output drop are computed for different time periods. Our results are robust to the use of the same sample for all countries (e.g., 1961-2003).

[2] We consider only countries for which both volatility and entry costs data are available.

[3] In a sample of countries in the Organisation for Economic Co-operation and Development, for which harmonized firm-level data are available, the employment share of the firms with fewer than 50 workers is substantial—about one-third of the total. In less-developed and developing countries, which constitute a large part of our sample, the employment share of smaller establishments is much larger than in developed countries—typically more than 60 percent of the total (see Tybout, 2000).

[4] Acemoglu and Johnson (2005) use constraint on executive power, the Heritage Foundation index, and expropriation risk to proxy for property rights. Their preferred measure is constraint on executive power because it conceptually refers to constraints directly imposed on government actions. The other variables are equilibrium outcomes driven by policies that may result from such constraints.

Table 1

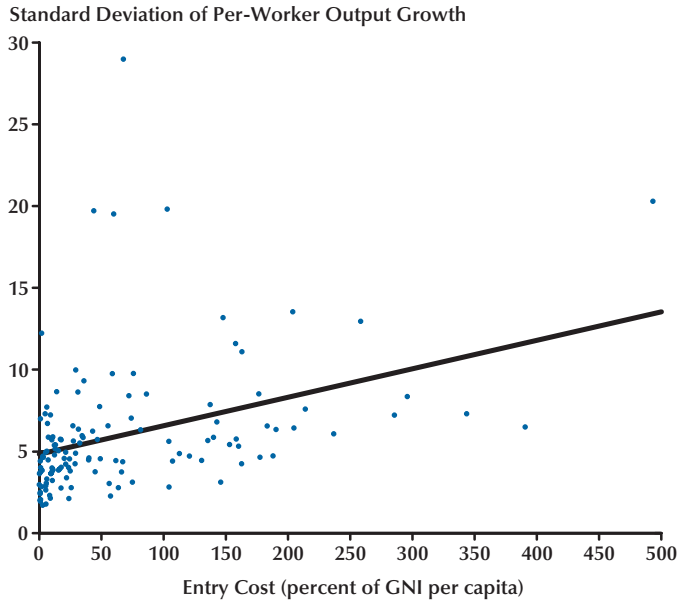
Descriptive Statistics and Correlations of Macro Variables, Institutions, and Moments of the Distribution of Firms

				Correlations										
Variables	Observations	Sample average	SD	SD growth rate	Worst output drop	Average growth rate	Entry costs	Debt recovery rate	Constraint on executive power	Heritage Foundation index	Expropriation risk	Social infrastructure	Average firm size	Variance of firm size
SD of growth rate	132	6.02	4.01	1.00										
Worst output drop	132	–13.23	9.64	–0.90	1.00									
Average growth rate	132	1.58	1.85	–0.30	0.43	1.00								
Entry costs	132	79.45	133.51	0.26	–0.32	–0.48	1.00							
Debt recovery rate	132	31.97	26.59	–0.44	0.45	0.34	–0.41	1.00						
Constraint on executive power	132	4.83	1.99	–0.52	0.51	0.35	–0.40	0.51	1.00					
Heritage Foundation index	112	3.20	1.11	–0.30	0.41	0.38	–0.46	0.79	0.58	1.00				
Expropriation risk	59	6.52	1.51	–0.22	0.33	0.50	–0.32	0.59	0.36	0.73	1.00			
Social infrastructure	117	0.51	0.49	–0.16	0.20	0.15	–0.22	0.37	0.36	0.85	0.73	1.00		
Average firm size	79	3.07	1.38	0.42	–0.39	–0.30	0.23	–0.73	–0.53	–0.75	–0.64	–0.79	1.00	
Variance of firm size	79	2.47	1.17	0.41	–0.41	–0.26	0.14	–0.61	–0.56	–0.65	–0.39	–0.68	0.84	1.00

NOTE: See the appendix for data sources and definitions.

Figure 1

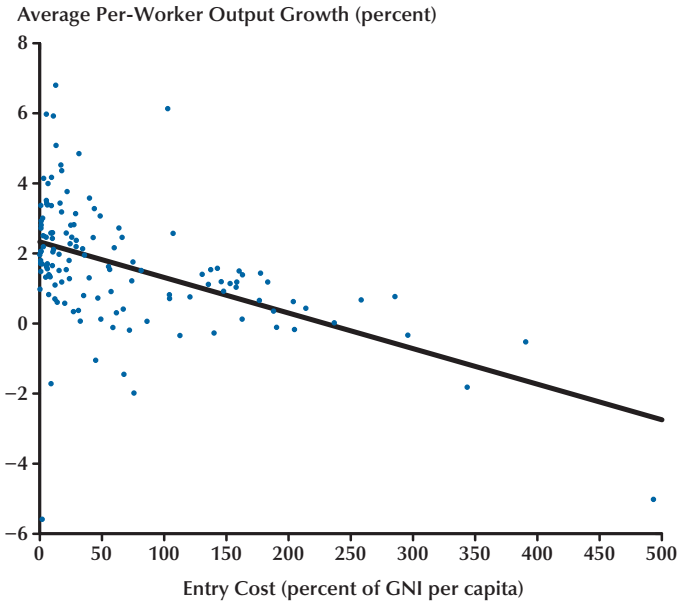
Volatility and Entry Costs: Data and Linear Fit Line (slope 1.74, *p*-value 0.000)



NOTE: Two outliers (entry costs > 500 percent of GNI) excluded.

Figure 2

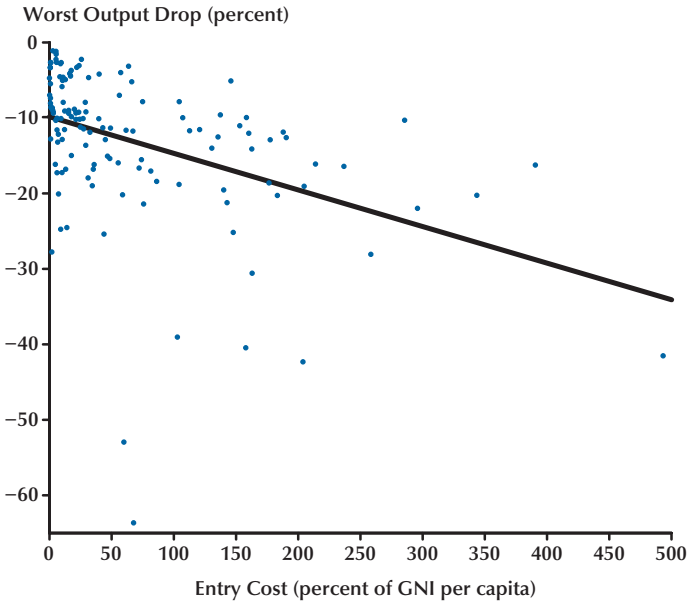
Growth and Entry Costs: Data and Linear Fit Line (slope –1.01, *p*-value 0.000)



NOTE: Two outliers (entry costs > 500 percent of GNI) excluded.

Figure 3

Crises and Entry Costs: Data and Linear Fit Line (slope –4.85, *p*-value 0.000)



NOTE: Two outliers (entry costs > 500 percent of GNI) excluded.

of additional controls, and ε_i is the error term. An IV procedure is implemented because of potential endogeneity, omitted variable bias, and measurement error. The following two assumptions must be satisfied for an IV regression to be valid:

(A1) The instruments must satisfy the rank condition

$$rank\ \mathbb{E}\left(\left[1\ I\ Z\right]' \left[1\ E\ O\ Z\right] \right) = (3+z),$$

where I denotes the vector of instruments and z is the number of additional controls.

(A2) The instruments must be uncorrelated with the error term, ε_i.

As discussed in our results below, we test whether these two assumptions are satisfied in the data to corroborate our IV regression analysis.

INSTRUMENTS

From the set of instruments available in the literature, we use geographic latitude, the fraction of the population speaking a major European language, legal origin, and, for a subsample of former colonies, European settler mortality and indigenous population density.

The first two instruments are those used by Hall and Jones (1999), who argued that geographic characteristics and the extent to which major European languages have been adopted in a country are correlated with the quality of the country's institutions. This is true because (i) Europeans were more likely to settle and establish Western institutions where the geographic characteristics were more similar to those in their countries of origin and (ii) the extent to which European culture and, consequently, European institutions have spread in a country is likely to be correlated with the adoption of European languages.

Legal origin (La Porta et al., 1999) has a strong effect on various institutional features related to property rights, most notably on the degree of legal formalism, which is associated with judicial transparency and fairness, safeguards against corruption, and enforceability of contracts.

Settler mortality and population density, introduced by Acemoglu, Johnson, and Robinson (2002) and Acemoglu et al. (2003), can be used as instruments because of their lasting effects on countries' institutional development. Early European settlements were negatively affected by high mortality rates. In places where Europeans were settling in large numbers, it was in their interest to promote free entrepreneurship, provide property rights protection, and so on. Higher indigenous population density, on the other hand, provided Europeans with an opportunity to capture and exploit local labor, giving rise to extractive institutions and, therefore, poor property rights protection. Higher population density should not necessarily lead to higher entry barriers. In fact, as shown in the next section, the data reveal the opposite: Population density has a negative effect on entry costs.

We do not use the fraction of population speaking English or the predicted measure of trade shares (Frankel and Romer, 1999), which have been used by Hall and Jones (1999). Once the five instruments previously described are controlled for, these instruments have no predictive power for entry costs or property rights measures. Therefore, they are not relevant to our analysis.

Because of data availability, our regressions rely on samples of different sizes. The largest sample consists of 123 countries.

MOMENTS OF THE DISTRIBUTION OF FIRMS BY SIZE

In Table 1, we also report statistics for the mean and the variance of the distribution of firms by size, based on Alfaro, Charlton, and Kanczuk (2009). Higher volatility is associated with a lower density of firms (i.e., a larger average firm size) and more heterogeneity in firm size (i.e., a higher variance of the distribution of firms by size). The first two moments of the distribution of firms by size are negatively related to measures of institutional quality and positively correlated with entry costs (Figures 4 and 5).

RESULTS

Endogenous Regressors and Instruments

As a starting point, we identify the minimum number of instruments that allow us to separately identify the effect of entry costs and the effect of property rights on output volatility. Table 2 presents the results of the ordinary least squares regressions of the endogenous regressors on all available instruments. In column 1, entry costs is the dependent variable. The regressors in columns 2 through 5 are the proxies for property rights protection. In column 6, social infrastructure is the dependent variable.

The table shows the correlation patterns of institutional variables with instruments; the differences guide our initial choice of instruments. The European languages variable has an effect on entry costs, but no statistically significant effect on the debt recovery rate, the Heritage Foundation index, expropriation risk, or social infrastructure. Legal origin has no effect on entry costs, but has an effect on the debt recovery rate, the Heritage Foundation index, expropriation risk, and social infrastructure. This suggests that IV regressions that use only the legal origin and European languages variables as instruments might achieve identification. A natural advantage of these regressions is that they do not involve population density or settler mortality and therefore can be implemented on the full sample rather than the subsample of former colonies.

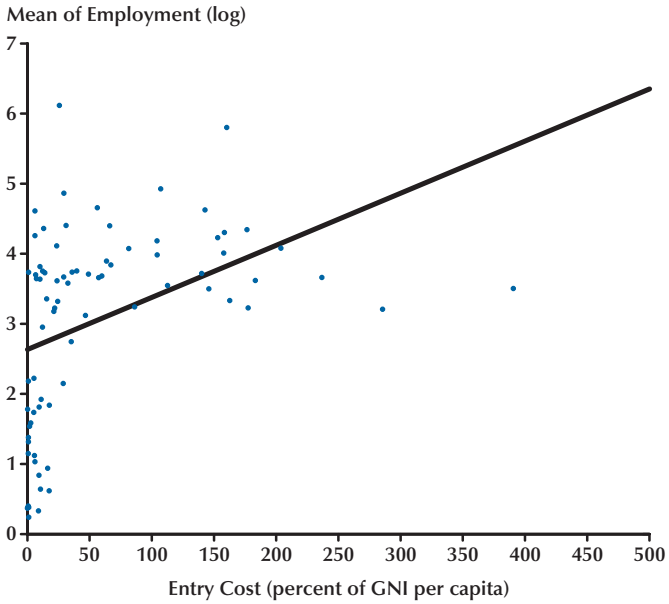
Population density has the expected negative effect on property rights measures and social infrastructure, but its effect on entry costs has the wrong sign.[5] Settler mortality has the expected negative effect on all endogenous regressors. Neither of these variables has a statistically significant effect on constraint on executive power. Because the latter is correlated with the European languages variable and latitude, we consider IV regressions that use population density, settler mortality, and the European languages variables (or latitude) as instruments.

In each of the following IV regressions, we formally test whether the rank condition (A1) is

[5] That is, higher population density implies lower entry barriers.

Figure 4

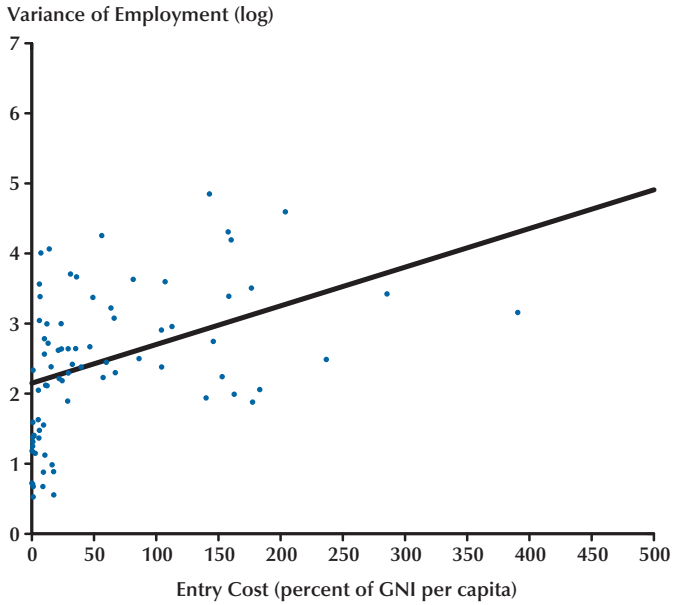
Average Firm Size and Entry Costs: Data and Linear Fit Line (slope 0.74, *p*-value 0.001)



NOTE: Two outliers (entry costs > 500 percent of GNI) excluded.

Figure 5

Variance of Firm Size and Entry Costs: Data and Linear Fit Line (slope 0.55, *p*-value 0.001)



NOTE: Two outliers (entry costs > 500 percent of GNI) excluded.

Table 2

Assessing Instruments: Ordinary Least Squares Regressions of Endogenous Regressors on Instruments

	Endogenous regressors					
Instruments	Entry costs (2)	Debt recovery rate (2)	Constraint on executive power (3)	Heritage Foundation index (4)	Expropriation risk (5)	Social infrastructure (6)
Latitude	–126.13	31.03	2.77	1.74	1.71	0.02
	(99.63)	(20.03)	(1.19)	(0.70)	(1.20)	(0.21)
	0.21	0.13	0.02	0.02	0.16	0.93
European languages	–115.55	–2.20	2.55	0.29	0.42	0.00
	(40.97)	(9.43)	(0.50)	(0.28)	(0.38)	(0.06)
	0.01	0.82	0.00	0.31	0.27	0.96
British legal origin	0.43	11.59	0.31	0.63	0.77	0.07
	(65.94)	(5.14)	(0.35)	(0.18)	(0.34)	(0.04)
	0.99	0.03	0.38	0.00	0.03	0.10
Log population density	–19.44	–2.81	–0.05	–0.18	–0.19	–0.05
	(9.12)	(1.99)	(0.14)	(0.07)	(0.11)	(0.01)
	0.04	0.16	0.74	0.02	0.09	0.00
Log settler mortality	53.19	–6.69	–0.11	–0.15	–0.30	–0.06
	(26.92)	(2.07)	(0.17)	(0.08)	(0.16)	(0.02)
	–0.05	0.00	0.54	0.08	0.07	0.00
Observations	61	61	60	58	61	61
R^2	0.25	0.46	0.56	0.60	0.41	0.52

NOTE: Robust standard errors are reported in parentheses with corresponding *p*-values listed below. See the appendix for data sources and definitions.

satisfied. In addition, when the number of instruments exceeds the number of endogenous regressors, we perform a test for overidentifying restrictions.

RESULTS

Our preliminary regressions are carried out with two instruments: the legal origin and European languages variables. The results of these regressions are reported in columns 1 through 3 of Table 3. In the regressions reported in column 1, property rights are proxied by the debt recovery rate, in column 2 by the Heritage Foundation index, and in column 3 by social infrastructure.

We report three numbers for each instrumented variable: the coefficient, the heteroskedasticity robust standard error (SE), and the corresponding *p*-value. (To save space, the intercept is not reported.) We also report the *p*-value of the Cragg-Donald insufficient rank test (see Cragg and Donald, 1993). The null of this test is that the rank is insufficient. The rejection of the test provides confidence that the rank condition (A1) is satisfied. The number of observations is reported last.

As columns 1 through 3 show, entry costs have a statistically significant adverse effect on volatility. However, the null of the Cragg-Donald

Table 3

Instrumental Variable Regressions of Standard Deviation of Growth Rate of Output Per Worker on Entry Costs and a Measure of Property Rights

	Dependent variable: Standard deviation of growth rate					
	Instruments: Legal origin and European languages			Instruments: Legal origin and latitude		
Independent variable	Debt recovery rate (1)	Heritage Foundation index (2)	Social infrastructure (3)	Debt recovery rate (4)	Heritage Foundation index (5)	Social infrastructure (6)
Entry costs	1.64	1.68	1.53	1.56	1.10	1.14
	(0.58)	(0.77)	(1.53)	(0.94)	(1.00)	(0.62)
	0.00	0.03	0.01	0.10	0.27	0.07
Measure of property rights	–0.03	–0.56	–2.95	–0.03	–0.59	–3.56
	(0.01)	(0.40)	(1.33)	(0.02)	(0.54)	1.33
	0.05	0.16	0.03	0.19	0.28	0.01
Insufficient rank	0.07	0.20	0.23	0.36	0.35	0.29
Observations	121	110	113	123	111	113

NOTE: Heteroskedastic robust standard errors are reported in parentheses with corresponding *p*-values listed below. See the appendix for data sources and definitions.

test is rejected in only one regression,[6] implying that the instruments are not well suited to separately identify the effect of entry costs and property rights. For robustness, we also report the results of these regressions when latitude is used as an instrument instead of European languages (columns 4 through 6). While the results are similar to those reported in columns 1 through 3, the *p*-values of the entry costs coefficient and of the Cragg-Donald test are larger. This is expected given that neither legal origin nor latitude is strongly correlated with entry costs.

Our benchmark regressions use three instruments: settler mortality, population density, and European languages. Columns 1 through 5 of Table 4 show the results for all five proxies of property rights protection. The effect of entry costs in all these regressions is negative and statistically significant. Its magnitude is close to that reported in Table 3. Neither property rights nor social infrastructure has a statistically significant effect in any of these regressions. The null of the Cragg-Donald test is rejected once at the 1 percent level, twice at the 5 percent level, and twice at the 10 percent level. The null of the Hansen-Sargan overidentification test,[7] which is that the exclusion restriction (A2) holds, is not rejected in any of these regressions. This lends credibility to the validity of the instruments. Columns 6 through 10 of Table 4 repeat these regressions but use latitude rather than European languages as an instrument. The results of these regressions are similar to those in columns 1 through 5, but as indicated by the *p*-values of the Cragg-Donald test, this set of instruments is weaker.

[6] The regressions with constraint on executive power and expropriation risk are not reported, because their *p*-values of Cragg and Donald's test are very high.

[7] The Economic Significance of Entry Barriers. See Sargan (1958) and Hansen (1982); see Hayashi (2000) for a textbook treatment.

Table 4

Instrumental Variable Regressions of Standard Deviation of Growth Rate of Output Per Worker on Entry Costs and a Measure of Property Rights

	Dependent variable: Standard deviation of growth rate									
	Instruments: Settler mortality, population density, and European languages					Instruments: Settler mortality, population density, and latitude				
	Debt recovery rate (1)	Constraint on executive power (2)	Heritage Foundation index (3)	Expropriation risk (4)	Social infrastructure (5)	Debt recovery rate (6)	Constraint on executive power (7)	Heritage Foundation index (8)	Expropriation risk (9)	Social infrastructure (10)
Entry costs	1.47	2.03	1.64	1.62	1.61	2.17	1.93	1.91	2.07	2.04
	(0.62)	(0.85)	(0.71)	(0.66)	(0.63)	(0.94)	(0.79)	(0.89)	(0.85)	(0.78)
	0.02	0.02	0.02	0.01	0.01	0.02	0.01	0.03	0.02	0.01
Measure of property rights	–0.01	0.29	–0.02	–0.04	–0.30	0.02	0.07	0.21	0.25	1.51
	(0.03)	(0.28)	(0.45)	(0.40)	(1.89)	(0.04)	(0.26)	(0.47)	(0.46)	(2.29)
	0.60	0.29	0.96	0.92	0.87	0.60	0.80	0.66	0.60	0.51
Insufficient rank	0.04	0.06	0.03	0.10	0.01	0.43	0.08	0.11	0.24	0.05
Overidentification	0.25	0.57	0.85	0.23	0.23	0.62	0.61	0.98	0.61	0.72
Observations	59	58	56	59	59	59	58	56	59	59

NOTE: Heteroskedastic robust standard errors are reported in parentheses with corresponding *p*-values listed below. See the appendix for data sources and definitions.

THE ECONOMIC SIGNIFICANCE OF ENTRY BARRIERS

The results previously described suggest that entry barriers have a significant effect on output volatility. The average value of the entry costs coefficient in the 10 regressions in Table 4 is 1.85. This implies that a 1-SD increase in entry costs in our sample results in a 2.5-percentage-point increase in the SD of the growth rate of output, which is roughly 41 percent of its mean value in our sample.

Entry Costs and Industry Structure

A structural interpretation of our results relies on the seminal work of Hopenhayn (1992). Costlier entry leads to less competition and a lower number of operating firms. With the protection from potential entrants afforded by high entry costs, low-productivity firms can survive and operate. This implies that operating firms are more heterogeneous—that is, a higher dispersion of firm productivity.[8] This mechanism magnifies the volatility stemming from aggregate uncertainty. In the data, the lower density of operating firms and the higher heterogeneity in firm size are associated with higher macroeconomic volatility (Figures 4 and 5). Unfortunately, the paucity of data prevents us from analyzing directly the empirical relationship between entry costs and industry structure in this paper. We leave this task for future research.

Robustness

The effect of entry costs on output volatility is statistically and economically significant, and this result is not driven by an omission of human capital, corruption, or business regulation from the regressions. Moreover, the instruments do not have an independent effect on output volatility, especially those correlated with entry costs. Once entry costs are controlled for, property rights appear to have no effect on output volatility.[9]

While we found no indication that an omitted endogenous regressor biases the results, it is possible that entry costs and property rights capture the effect of other institutions that are correlated with the instruments and affect output volatility. If this were the case, our results should be interpreted as strong evidence for the existence of a set of institutions that are distinct from those related to property rights and that affect output volatility. Entry costs should be viewed as a good proxy for this set of institutions.

Other Volatility Measures

We also investigate whether entry costs affect the magnitude of economic downturns.[10] In Table 5, we perform regressions identical to those in Table 4, except the outcome of interest is the worst drop in output, which is computed as the minimum growth rate of output per worker.

The results of these regressions are in accord with our previous findings: Entry costs have a strong effect on the severity of economic crises in all regressions; property rights protection does not have a significant effect in any regression. The null of the Cragg-Donald test is not rejected (at the 10 percent level) in 7 of the 10 regressions. The null of the overidentification test is not rejected in any regression.

The magnitude of the effect of entry costs on the severity of an economic crisis is very large. The average value of the entry costs coefficient in the 10 regressions in Table 5 is 5.93. This implies that a 1-SD increase in entry costs increases the magnitude of the worst output drop by about 60 percent of its mean value in our sample.

CONCLUSION

Understanding the reasons behind cross-country differences in economic outcomes remains a primary goal of economics. Although recent advances in the literature have identified institutions as major determinants of economic outcomes, little is known about the role and relative

[8] See Barseghyan and DiCecio (2010) for a derivation of this result in a general equilibrium setting.

[9] Barseghyan and DiCecio (2009) report the regression tables (Tables 3C-3E and 4-7B) of these robustness checks.

[10] Our results are also robust to the use of the range of the growth rate of output per worker as a measure of volatility. The corresponding regression table is available from the authors upon request.

Table 5

Instrumental Variable Regressions of Largest Drop of Output Per Worker on Entry Costs and a Measure of Property Rights

	Dependent variable: Standard deviation of growth rate									
	Instruments: Settler mortality, population density, and European languages					Instruments: Settler mortality, population density, and latitude				
	Debt recovery rate (1)	Constraint on executive power (2)	Heritage Foundation index (3)	Expropriation risk (4)	Social infrastructure (5)	Debt recovery rate (6)	Constraint on executive power (7)	Heritage Foundation index (8)	Expropriation risk (9)	Social infrastructure (10)
Entry costs	–4.21	–6.57	–5.08	–4.89	–4.82	–7.35	–6.23	–6.76	–6.82	–6.59
	(1.94)	(2.78)	(2.29)	(2.16)	(2.01)	(3.42)	(2.63)	(3.04)	(3.08)	(2.64)
	0.03	0.02	0.03	0.02	0.02	0.03	0.02	0.03	0.03	0.01
Measure of property rights	0.05	–1.30	0.15	0.01	0.56	–0.10	–0.54	–1.31	–1.24	–6.86
	(0.08)	(1.02)	(1.56)	(1.31)	(6.14)	(0.14)	(1.01)	(1.82)	(1.79)	(8.23)
	0.51	0.20	0.93	1.00	0.93	0.47	0.59	0.47	0.49	0.40
Insufficient rank	0.04	0.06	0.03	0.10	0.01	0.43	0.08	0.11	0.24	0.05
Overidentification	0.18	0.44	0.10	0.13	0.13	0.66	0.56	0.97	0.65	0.80
Observations	59	58	56	59	59	59	58	56	59	59

NOTE: Heteroskedastic robust standard errors are reported in parentheses with corresponding *p*-values listed below. See the appendix for data sources and definitions.

importance of specific institutions. We find that entry regulation is an important determinant of output volatility, while property rights protection is not. These results strengthen the view that entry costs are an important institutional feature and that the effect of institutions on the economy occurs through their impact on industry structure (see, e.g., Nickell, 1996; Acemoglu et al., 2003; Nicoletti and Scarpetta, 2003; Bastos and Nasir, 2004; Sivadasan, 2009; Alesina et al., 2005; Bruhn, 2008; Djankov, Ganser et al., 2010; Barseghyan, 2008).

For policymakers seeking well-defined strategies to stabilize the economies of less-developed countries, our paper provides an additional argument for the elimination of entry barriers: The estimated effect of such a policy is a sizable decrease in output volatility.

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APPENDIX: DATA SOURCES AND DEFINITIONS

Entry Costs (The World Bank, 2004, 2005, 2006a,b, 2007)[11]

Entry costs are constructed for "a 'standardized' firm which has the following characteristics: (1) it performs general industrial or commercial activities, it operates in the largest city (by population), (2) it is exempt from industry-specific requirements (including environmental ones), it does not participate in foreign trade and does not trade in goods that are subject to excise taxes (e.g., liquor, tobacco, gas), it is a domestically-owned limited liability company, (3) its capital is subscribed in cash (not in-kind contributions) and is the higher of (i) 10 times GDP per capita in 1999 or (ii) the minimum capital requirement for the particular type of business entity, it rents (i.e., does not own) land and business premises, it has between 5 and 50 employees one month after the commencement of operations, all of whom are nationals, it has turnover of up to 10 times its start-up capital, and it does not qualify for investment incentives."

Debt Recovery Rate (The World Bank, 2004, 2005, 2006a,b, 2007)

The recovery rate is recorded as cents on the dollar recovered by claimants' creditors, tax authorities, and employees through the bankruptcy proceedings. The calculation takes into account whether the business is kept as a going concern during the proceedings, as well as bankruptcy costs and the loss in value due to the time spent closing down.

Purchasing Power Parity–Adjusted GDP Per Worker (Center for International Comparisons of Production, Income and Prices, University of Pennsylvania—Penn World Table 6.2)[12]

Constraint on Executive Power (*Polity IV Project*, Jaggers and Marshall, 2000)[13]

This variable "refers to the extent of institutionalized constraints on the decision-making powers of chief executives, whether individuals or collectivities," and takes values from 1 to 7, where 1 = unlimited authority; 3 = slight to moderate limitations; 5 = substantial limitations; and 7 = executive parity (between the executive(s) and accountability groups) or subordination. For more details, see the *Polity IV Project* manual.

Property Rights Protection Index (Based on the Heritage Foundation's 2006 Index of Economic Freedom dataset)[14]

From 1 to 5 (in the regressions, the scale is reversed, e.g., 5 = 1 and 1 = 5):

1. Private property guaranteed by government; court system efficiently enforces contracts; justice system punishes those who unlawfully confiscate private property; corruption nearly nonexistent, and expropriation highly unlikely.
2. Private property guaranteed by government; court system suffers delays and is lax in enforcing contracts; corruption possible but rare; expropriation unlikely.
3. Court system inefficient and subject to delays; corruption may be present; judiciary may be influenced by other branches of government; expropriation possible but rare.

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[11] Available at www.doingbusiness.org/.

[12] Available at http://pwt.econ.upenn.edu/.

[13] Available at www.systemicpeace.org/polity/polity4.htm.

[14] Available at www.heritage.org/Index/.

4. Property ownership weakly protected; court system inefficient; corruption present; judiciary influenced by other branches of government; expropriation possible.
5. Private property outlawed or not protected; almost all property belongs to the state; country in such chaos (for example, because of ongoing war) that property protection nonexistent; judiciary so corrupt that property not effectively protected; expropriation frequent.

The index is constructed based on the following factors: (i) freedom from government influence over the judicial system; (ii) commercial code defining contracts; (iii) sanctioning of foreign arbitration of contract disputes; (iv) government expropriation of property; (v) corruption within the judiciary; (vi) delays in receiving judicial decisions and/or enforcement; and (vii) legally granted and protected private property.

Protection Against Expropriation Risk (Acemoglu, Johnson, and Robinson, 2001)

Risk of expropriation of private foreign investment, from 0 to 10. Higher score means less risk. Original source: Political Risk Services (September 1999).

Social Infrastructure (Hall and Jones, 1999)

Hall and Jones constructed this measure as an average of the openness to trade index and the Government Anti-Diversion Policies (GADP) index. The openness to trade index was taken from Sachs and Warner (1995). The GADP index is an equal-weighted average of five indices: (i) law and order, (ii) bureaucratic quality, (iii) corruption, (iv) risk of expropriation, and (v) government repudiation of contracts. All of these were taken from Political Risk Services.

European Settler Mortality (Acemoglu, Johnson, and Robinson, 2001)

Estimated mortality for European settlers during the early period of European colonization (before 1850).

Population Density in 1500 (Acemoglu, Johnson, and Robinson, 2002)

Indigenous population density in 1500, indicated as inhabitants per square kilometer.

Fraction of Population Speaking a Major European Language (Hall and Jones, 1999, based on Gunnemark, 1991, and Hunter, 1992)

Latitude (La Porta et al., 1999)

The absolute value of the latitude of the country, scaled to values between 0 and 1. Original source: *CIA World Factbook*.

Government Corruption Variable (La Porta et al., 1999)

"Low ratings indicate 'high government officials are likely to demand special payments' and 'illegal payments are generally expected through lower levels of government' in the form of bribes connected with import and export licenses, exchange controls, tax assessment, policy protection, or loans." Scale 0 to 10. Average value over 1972-95. Original source: *International Country Risk Guide*, produced by Political Risk Services; www.prsgroup.com/icrg.aspx.

Business Regulation (La Porta et al., 1999)

This index ranges from 1 to 5. The index is constructed based on the following factors: (i) licensing requirements to operate a business; (ii) ease of obtaining a business license; (iii) corruption within the

bureaucracy; (iv) labor regulations, such as established workweeks, paid vacations, and parental leave, as well as selected labor regulations; (v) environmental, consumer safety, and worker health regulations; and (vi) regulations that impose a burden on business. Original source: The Heritage Foundation's Index of Economic Freedom dataset (2006).

Moments of the Distribution of Employment by Size Class Across Countries (Alfaro, Charlton, and Kanczuk, 2009)

These data are constructed from microdata collected in Dun & Bradstreet's *WorldBase*. The unit of observation is the plant.

For our cross-sectional study, only one observation is needed for each of the variables above. For entry costs and the debt recovery rate, we take the average over the five years (2004-08) for which data are available. For the constraint on executive power variable and the property rights index, we average over the last 10 years in which they were reported: 1994-2003 and 1996-2005, respectively. For the expropriation risk variable, we use the average over 1985-1995.

Ideally, the averages over the same period of time for all variables would be used. Unfortunately, this is not possible because of data limitations. For some countries data for one or more years might be missing. We ignore these years when constructing averages.[15]

[15] When constructing the averages for constraint on executive power, interregnum and transitional periods are ignored, except for the Democratic Republic of the Congo (Kinshasa). Because all years between 1994 and 2003 were classified as interregnum or transitional for this country, we use the value for year 1991, the last year for which constraint on executive power was recorded.