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CONTRACTING INSTITUTIONS AND PRODUCT QUALITY

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Contracting Institutions and Product Quality [1]

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Abstract

For many goods, quality improvements involve the use of more sophisticated, higher quality inputs. The production of these sophisticated inputs requires greater collaboration between suppliers and final good producers, with suppliers developing relationship-specific inputs, and final good producers customizing their production processes to incorporate them. In countries with poor legal institutions, the relationship-specific investments needed to achieve strong collaboration, and by extension more sophisticated inputs and higher quality outputs, will arguably be hard to achieve. As the incomplete contracts literature suggests, doubts over contract enforcement will render the return on relationship-specific investments less certain, rendering both suppliers and final good producers less willing to undertake the customization necessary to improve quality. Employing a difference-in-difference methodology on highly disaggregated US import data , this paper studies the impact of legal institutions on product quality. It finds that poor contracting institutions substantially impede a country's ability to produce high quality final goods: in industries where the potential use of customizable inputs is extensive, countries with weaker contract enforcement regimes produce lower quality final goods.

JEL classification: F14; O17; D23; O11

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1 Introduction

The growing interest in the economic impact of institutions has fuelled close study of their effects on international trade. The quality of judicial institutions has been shown to significantly influence both the value and mix of trade. Weak property rights' protection and poor contract enforcement reduce overall trade flows (Anderson and Marcouiller (2002); De Groot et al. (2005)). Contracting enforcement also influences specialization: countries with weak institutions are less likely to export complex, differentiated goods; they also specialize away from goods that require many different inputs, or those that require relationship-specific investments (Ranjan and Lee (2007); Berkowitz, Möenuis, and Pistor (2006); Levchenko (2007); Nunn (2007)).

The existing work on the effect of contracting institutions on trade has focused on their impact on the overall value of trade. The dominant narrative in the existing papers focusses on how weak institutions increase production costs, and by extension reduces the quantities traded.[1] There is, however, good reason to believe that institutions matter for the quality of traded products. Improving the quality of many goods requires the use of more complex, sophisticated, better quality inputs (Kugler and Verhoogen 2011). For these goods, producing better quality products requires close collaboration between final good producers and input suppliers, with the suppliers developing customized inputs, and final good producers modifying their production processes to incorporate these customized inputs. In poor contracting environments, however, the customization needed to improve the quality of particular final goods will arguably be hard to achieve. Customization of inputs and production processes involves, by definition, relationship-specific investments. As the incomplete contracts' literature suggests, in poor contracting environments, input suppliers and final good producers will under-provide relationship-specific investments: doubts over contract enforcement will make the return on these investments more uncertain. This, in turn, will render both input suppliers and final good producers less willing to undertake

[1] All the papers consider the impact of institutions on the monetary value of trade; the narrative in these papers, though, centres on the effect of institutions on trade volumes.

the customization necessary to improve final good quality (Klein, Crawford, and Alchian (1978); Williamson (1979, 1985); Grossman and Hart (1986); Hart and Moore (1990)).

Our contention that contracting environments matter for final product quality is not novel. McMillan (1990) and Bakos and Brynjolfson (1993), for instance, credit the Japanese *keiretsus'* stringent contract enforcement mechanisms as being a crucial determinant of superior Japanese quality. They argue that in *keiretsu* systems, those who appropriate or under-provide relationship-specific investments face more than the loss of future business from their current contracting party. Thanks to the closed, long-term stable relationships facilitated by the *keiretsu*, contracting parties have fewer outside options if they appropriate or under-invest: a breakdown of their existing buyer-supplier relationship is more likely to mean exit from the market altogether. The more drastic consequences of reneging on contractual commitments, McMillan (1990) and Bakos and Brynjolfson (1993) argue, provide a strong incentive for suppliers to customize their inputs and final good producers to customize their production processes. The more stringent contract enforcement mechanism thus facilitates higher quality inputs, and ultimately higher quality final goods. Cusomano and Takeishi (1991) provide case study evidence to support McMillan (1990) and Bakos and Brynjolfson's (1993) view: they demonstrate that moving towards *keiretsu*- type arrangements has resulted in significant quality improvements in US automobile manufacturing. In a more recent study, Lu, Ng and Tao (2009) argue that the strength of legal institutions significantly influences final product quality. Using data on 2,400 Chinese manufacturing firms, they find that firms located in jurisdictions with better contract enforcement produce higher quality final goods; moreover, this effect of judicial institutions on product quality is more pronounced for goods that can potentially employ relationship-specific components more comprehensively.

Beyond the single-industry case studies and the recent analysis of a snapshot of Chinese firms, there is no evidence on the effect of contracting institutions on quality. In particular, there are no cross-industry, cross-country econometric studies examining this relationship. This paper fills this void. To isolate the effect of contracting environments on product quality, we build in the insight, reinforced by Lu, Ng, and Tao, that if contracting institutions matter, their effect should vary considerably across products. Specifically, the legal environment should matter mainly for final goods that can potentially make extensive use of customizable inputs. We thus employ a difference-in-difference approach to identify the impact of contracting environments on product quality. We discern the effect of contracting institutions by examining whether countries with good legal institutions produce *relatively* better quality goods in industries within which the prospective use of relationship specific components is greater. This methodology allows us to abstract away any country-specific differences in product quality.[2] Our analysis, which uses data on US imports from 123 countries spanning 17,677 highly detailed ten-digit HS classifications, supports the contention that legal institutions matter for product quality: final goods for which the potential use of relationship-specific inputs is greater are of higher quality in countries with better legal institutions.

This paper contributes to the nascent literature on legal institutions and trade, outlined above. It also adds to the burgeoning empirical literature on product quality and trade. This study fleshes out the details underlying the general trends documented in Schott (2004) and Hummels and Klenow (2005). By focusing on the supply side determinants of product quality, it complements Hallak (2006, 2010), Choi, Hummels and Xiang (2009). The latter show how demand side factors – income levels and distributions – influence quality patterns of imported goods. Finally, by demonstrating that contracting institutions matter for product quality, it provides and additional explanation for international vertical differentiation to that proffered by Flam and Helpman (1987) and Stokey (1991), viz., differences in technology and human capital endowments.

[2] It also purges the data of any industry-specific differences in product quality.

2 Data and Methods

2.1 Measuring Quality

Most studies of export goods' quality proxy for quality using average f.o.b. unit prices (See, e.g., Schott (2004); Hallak (2006); Choi, Hummels and Xiang (2009); Lugovskyy and Skiba (2010)). The use of f.o.b. prices data has been partly motivated by freely available US data, compiled by the Center for International Data: these data span the universe of US merchandise imports from 1989 to 2006, and are at the fine, ten-digit Harmonized System (HS) level of aggregation. F.o.b. unit prices are a problematic measure of product quality (Khandelwal (2010); Hallak and Schott (2011)). In the presence of horizontal differentiation, for instance, the mapping from unit prices to product quality is less than perfect.

To extract estimates of the quality of traded goods from disaggregated trade data, we adopt a procedure akin to Khandelwal (2010) and similar in flavour to Hallak and Schott (2011). The former borrows heavily from the industrial organization literature, as pioneered by Berry (1994). The intuition underlying both these approaches is simple: even in the presence of horizontal differentiation, goods that have higher prices than their quality warrants will have smaller market shares; using information on market shares, in concert with information on average unit prices, one can infer the average quality of a country's exports. We begin, as Hallak and Schott (2011) do, by assuming that each ten-digit unit price is approximately separable into a quality component and a "pure price" component:

$$ln(p_{ict}) = ln(\lambda_{1,ic}) + ln(\lambda_{2,t}) + ln(\lambda_{3,ict}) - ln(\widetilde{p}_{ict}),$$

where p_{ict} is the average unit price of goods exported to the US by firms from country c, in industry i, during year t. $\lambda_{1,ic}$ is the average quality of products sold by firms from country c, in industry i, during the sample time period. $\lambda_{2,t}$ represents the component of quality common to all goods sold year t, while $\widetilde{p}_{ict}$ is the element of each average unit price that is unrelated to the good's underlying quality.

Mirroring Khandelwal (2010) we model a consumer, n, as having preferences for each HS-10 digit product, i, produced by country c at time t. The consumer then selects the variety that gives her the highest indirect utility. The latter is given by:

$$V_{nict} = \gamma_{1,ic} + \gamma_{2,t} + \gamma_{3,ict} - \alpha ln(p_{ict}) + \mu_{nht} + (1-\sigma)\epsilon_{nict}.$$

The consumer's indirect utility is increasing in quality, as represented by $\gamma_{1,ic}$, $\gamma_{2,it}$ and$\gamma_{3,ict}$, where in turn $\gamma_{1,ic} = ln(\lambda_{1,ic})\alpha$, $\gamma_{2,it} = ln(\lambda_{2,it})\alpha$ and $\gamma_{3,ict} = ln(\lambda_{3,ict})\alpha$. Her indirect utility is decreasing in price paid. The μ_{nht} terms capture the common valuation the consumer attaches to goods in any sector h, where sectors are defined as a group of industries: these terms allow for correlation in the demand for goods in a given sector. In the empirical implementation, we treat HS-10 digit categories as industries, and HS-4 digit classifications as sectors. The term ϵ_{nict} is assumed to be a logit error, with a Type-I extreme value distribution.

To complete the logit demand system, one needs to specify an outside variety. Like Khadelwal (2010), we deem domestic output as the outside variety. The choice of the outside variety is not crucial for our purposes, as it only affects the absolute, not the relative, quality estimates. Under the logit demand system, the indirect utility generated by the outside variety is:

$$u_{ni0t} = \gamma_{1,i0} + \gamma_{2,it} + \gamma_{3,i0t} - \alpha ln(p_{i0t}) + \mu_{nht} + (1-\sigma)\epsilon_{ni0t}.$$

Given the distributional assumptions underlying ϵ_{nict}, the demand curve for any good i, in sector s, produced by country c in year t is:

$$ln(s_{ict}) - ln(s_{i0t}) = \gamma_{1,ic} + \gamma_{2,t} - \alpha ln(p_{ict}) + (1-\sigma) ln(s_{cht}) + \gamma_{3,ict}, \tag{1}$$

where s_{ict} is country c's share of sales in industry i, s_{i0t} is the share of domestic producers in industry i and s_{cht} is the share of country c in sector h in year t.

Estimating (1) and obtaining the quality parameters, $\gamma_{1,ic}$, $\gamma_{2,it}$ and$\gamma_{3,ict}$, is complicated by endogeniety concerns. Prices, p_{ict}, are correlated with quality. Similarly, depending on the size of the sector, and the correlation of quality-levels between industries in a sector, sectoral shares, s_{cht}, are potentially correlated with the quality parameters. To obtain accurate estimates of α, we use changes in a country's real exchange rate as an instrument. While real exchange rate movements undoubtedly influence f.o.b. prices, they are largely determined by macroeconomic factors, and are likely exogenous to quality levels in a single, highly-disaggregated industry. Following Khandelwal (2010), we employ the number of varieties exported by country c, in sector s, during year t, as an instrument for sectoral shares. This count measure is a valid instrument if entry or exit in an industry occurs prior to the specific quality choice: as Khandelwal (2010) notes, the latter is a standard assumption in the industrial organization literature.

Ultimately, we estimate (1) using the thirteen years of the aforementioned highly-detailed, HS-10 digit US import data. Restricting our analysis to data on manufacturing industries from 1989 to 2001, and trimming the data to reduce noise generated by idiosyncratic observations, our fixed-effects, two-stage least squares regression nonetheless contains over 1.5 million observations.[3]. The Appendix contains the results of the two-stage least squares' regression used to obtain the quality parameters, $\gamma_{1,ic}$, $\gamma_{2,it}$ and$\gamma_{3,ict}$. Altogether, the regression yields estimates of 341,115 $\gamma_{1,ic}$ parameters: these estimates span 17,677 HS-10 categories and 123 countries. We employ these as our measure of average product quality, by country, at the HS-10 digit level of disaggregation. To facilitate interpretation of results in subsequent sections, however, we transform our measures of average quality $\gamma_{1,ic}$, into their $\lambda_{1,ic}$ equivalents. That is, we convert each $\gamma_{1,ic}$, as follows:

$$ln(\lambda_{1,ic}) = \frac{\gamma_{1,ic}}{\alpha}.$$

[3]We trim the data as is Hallak (2006)

Using $\lambda_{1,ic}$ as our measure of product quality allows us to approximate the how differences in product quality, emanating from differences in contracting environments, manifest themselves in differences in unit prices.[4]

2.2 Measures of Legal Quality and Reliance on Customizable Inputs

Since we wish to evaluate the differential impact of contracting institutions on product quality, across products, we need a measure of a nation's legal quality. To this end, we use the "Rule of Law" variable from Kaufmann, Kraay, and Mastruzzi (2003). This metric combines data from surveys that measure perceptions of the predictability, competence and effectiveness of judicial systems. This is a commonly used measure for the quality of the contracting environment: Berkowitz, Möenius and Pistor (2006) and Nunn (2007) use it as their measure of legal quality.

In identifying the effect of legal institutions on product quality, we consider their differential effect on goods for which the potential use of customized inputs is extensive. To separate out these goods , we use Nunn's (2007) measure of the relationship-specificity of inputs. This metric computes the share of inputs that are differentiated, i.e., not traded on an organized exchange, or reference-priced in trade manuals. Since, by definition, only differentiated products may be customized, the extent to which a good depends on differentiated inputs is a reasonable proxy for the scope of quality improvement through customization. It also, thereby, provides a plausible proxy for the degree to which contracting institutions can influence product quality. Nunn's (2007) measure is calculated using US input-output tables and Rauch's (1999) classification of goods. The reliance on customizable inputs is therefore only available at the Input-Output code classification level, a degree of disaggregation slightly more restrictive than the six-digit North American Industrial Classification System (NAICS), or the four-digit Standard Industrial Classification (SIC). Full details on the construction of this variable are available in Nunn (2007).

[4] Hallak and Schott (2011) perform a similar transformation on their country-wide quality measures.

2.3 Estimating Framework

Having set out the primary data necessary to conduct this study, we now turn to the specification of the basic estimating framework. To uncover the relationship between contracting institutions and final product quality we estimate the following baseline model:

$$ln(\lambda_{1,ic}) = \psi_c + \phi_i + \beta z_i x_c + v_{ic}. \tag{2}$$

λ_{ic} is the quality of good i from country c, as derived above. ψ_c are country fixed effects, while ϕ_i are product fixed effects. z_i represents the degree to which customizable inputs can be employed in the production of a particular good i. x_c is the judicial quality in country c. The coefficient of interest is β: a positive, economically and statistically significant β would indicate that countries with better contract enforcement produce higher quality goods, and that this effect is increasing in a good's potential use on customizable inputs.

The identification strategy employed in (2) is very flexible. Specification (2) abstracts out all industry-specific and country-specific characteristics. This involves the estimation of 17,677 product fixed effects and 123 country fixed effects; this limits the degrees of freedom in the study and substantially limits the variation in product quality that can be attributed to judicial institutions.

3 Basic Results

Table 1 contains the results of estimating equation (2). The specifications contain a regressor – $z_i x_c$ – that varies at a more aggregate level than the dependent variable: $z_i x_c$ varies at the IO code-country level, while the dependent variable varies at the ten-digit HS code-country level. As such, following Moulton (1990), we cluster all standard errors at the IO code-country level.

Specification (1) in Table 1 suggests that contracting institutions play a significant role in determining final good quality. Besides being statistically significant, the effect of judicial quality

Table 1: Basic OLS and IV Results

	(1)	(2)	(3)	(4)	(5)
Estimation Method	OLS	IV	IV	IV	IV
Judicial quality interaction: $z_i x_c$	3.055**	3.011**	3.413**	3.120**	3.335**
	(0.674)	(1.138)	(1.107)	(1.130)	(1.089)
First Stage					
z_i × Log Settler Mortality		-0.118**	-0.112**	-0.116**	-0.113**
		(0.0039)	(0.0031)	(0.0020)	(0.0032)
z_i × Log Population Density 1500			-0.0129**		-0.0091**
			(0.0009)		(0.0015)
z_i × Urbanization Rate 1500				-0.0218**	-0.0092**
				(0.0199)	(0.0032)
F-statistic		906.40	820.38	656.72	682.77
Over-id [p-value]			0.95	0.80	0.29
Observations	341,115	177,264	177,264	177,264	177,264

Standard errors are clustered at the IO code-country level

** p<0.01, * p<0.05

is economically important. To see how large this effect on quality is, consider the following scenario. Suppose Nigeria's contracting institutions were bettered so that they became as good as China's.[5] The specification (1) findings imply that for goods that potentially employ customizable inputs extensively, such as motorcycles, the quality of Nigeria's exports would improve enough to support 52% higher price.[6]

3.1 Robustness Analysis

3.2 Endogeneity

The validity of the results presented in Column (1) of Table 1 rest crucially on the assumption that causality runs from contracting institution quality to product quality. This assumption is debatable. If the narrative presented in this paper is correct, countries that specialize in higher quality products have a strong incentive to invest in better contract enforcement institutions. The relationship between legal institutions and product quality may thus be characterized by bi-directional causality. If this is indeed so, the results in Table 1 will be biassed; in particular, the coefficients on the legal quality interaction term, $z_i x_c$ will be biassed upwards.

To mitigate the endogeneity bias, we use instrumental variable (IV) estimation. Selecting an instrument for judicial quality is not straightforward. Any instrument for judicial quality must not only be untainted by bi-directional causality, it must also satisfy the exclusion restriction. Specifically, to be a valid instrument for judicial quality, a variable must be related to product quality solely through its effect on judicial quality; it cannot have an independent relationship with product quality, nor can it be correlated with other variables that affect product quality. In particular, given the evidence on Linder effects, it is important that instrument have no direct relationship with income per capita; nor should it be correlated with determinants of income per capita, other than institutional quality. If such correlation exists, the IV estimates may be contaminated by Linder effects.

[5] This is equivalent to a one standard deviation improvement in judicial quality.

[6] In a ranking all goods by their reliance on customizable inputs, motorcycles are roughly at the 75th percentile.

To purge the legal quality variable of any effects of the product quality on legal institutions, we instrument for judicial quality using three instruments: a country's population density in 1500, its urbanization rate in 1500, and the mortality rates among European settlers in those countries. The choice of these instruments is motivated by findings in two seminal papers by Acemoglu, Johnson and Robinson (AJR) (2001, 2002). In those papers, they argue that for countries that were colonized by European powers – i.e., the majority of nations – the quality of institutions is still largely a function of the type of institutions set up by colonial administrators. In turn, the colonial powers choice of institutions was largely dictated by (i) the wealth that could be extracted from the colony and (ii) the colony's suitability for European settlement. In societies that had extensive resources to be exploited – human or otherwise – colonial powers set up weak institutions, with poor property rights protections and weak contract enforcement. These institutions allowed the Europeans to extract wealth from the colonies, without bothersome legalities. In colonies that attracted substantial European settlement, the colonists demanded legal protections akin to those they enjoyed in their home countries; this led colonial powers to establish effective institutions with strong property and contractual rights. As such, given that institutions are remarkably persistent, AJR claim that countries with weaker institutions today will be those that at the time of European conquest were: (i) wealthier, and hence more urbanized; (ii) more densely populated; or, (iii) had high mortality rates for European settlers. Wealthier, more urbanized societies had greater resources to plunder, which led to the establishment of poor legal protections. More densely populated societies offered fewer settlement opportunities; likewise, high mortality rates deterred European settlement. Without the pressures created by a European settler population, colonial powers set up weak legal protections.

AJR (2001, 2002) demonstrate convincingly that the population density in 1500, urbanization rates in 1500 and European settler mortality are good instruments for institutional quality. Significantly for our purposes, they show that these instruments are only correlated with income per capita through their effect on judicial quality. They thus plausibly satisfy the exclusion restriction for the product quality regression.

Columns (2) through (5) in Table 1 presents the results of the IV regressions. In specification (2), we instrument for judicial quality using settler mortality; in (3) we add the population density in 1500 to the instrument pool, while in (4), we add the urbanization rate in 1500. In (5) we include all three instruments. In each of the specifications, the instruments have the expected sign and the first stage F-statistics are large; moreover, in (3), (4) and (5) the over-identification test is satisfied. More importantly, though, all specifications suggest that judicial institutions influence product quality: echoing the column (1) results, one finds that for goods that potentially employ relationship-specific inputs more extensively, countries with better contracting institutions export higher quality goods.

3.3 Omitted Variable Bias

As noted above, in estimating (2) we adopt a highly restrictive identification strategy that it abstracts away all country-specific and industry-specific characteristics. Nonetheless, it is possible that other variables that vary at the industry-country level – other that the judicial quality-relationship specificity interaction ($z_i x_c$) – matter for product quality. If these other variables are correlated with $z_i x_c$, the results that we obtained above may be tainted.

To mitigate any potential omitted variable bias, we add a number of additional country and industry characteristic interactions to specification (2). In Table 2, column (1), we include the interaction of country c's human capital levels with the skill intensity of good i; in (2), we further include the interaction of country c's capital endowment per capita with industry i's capital intensity; (3) adds country c's financial sector development interacted with the good i's dependence on external finance.[7] Finally, in specification (5), we control for the possibility that developed

[7] Data on skill and capital endowments are from Hall and Jones (1999). Financial development is measured by natural log of credit by banks and other financial institutions to the private sector as a share of GDP in 1997. These data are from Beck, Demirgüc-Kunt, and Levine (1999). Skill intensity is defined as the share of non-production workers in total employment; capital intensity is the capital stock per worker. Data on total employment, the number of non-production workers and the capital stock are for 1995, and are from the NBER Productivity Database. The industry's reliance on external finance is from Rajan and Zingales (1998)

Table 2: OLS Regressions, with Additional Country-Industry Covariates

	(1)	(2)	(3)	(4)
$z_i x_c$	3.272**	2.385**	2.652**	2.649**
	(0.742)	(0.686)	(0.746)	(0.750)
Skill intensity$_i$ $\times$	1.442	1.148	1.570	1.576
Human capital endowment$_c$	(1.142)	(1.127)	(1.170)	(1.174)
Capital intensity$_i$ $\times$		-0.401**	-0.336*	-0.335*
Capital endowment$_c$		(0.160)	(0.168)	(0.168)
Financial intensity$_i$ $\times$			-0.0522	-0.0483
Financial development$_c$			(0.0792)	(0.0794)
Price coefficient of variation$_i$ $\times$				0.0239
Log GDP per capita$_c$				(0.0305)
Observations	306,870	306,870	284,877	283,862

Standard errors are clustered at the IO code-country level

** p<0.01, * p<0.05

countries have a comparative advantage in high-quality, differentiated goods: to this end, we interact the coefficient of variation of import prices in industry i with the log GDP per capita in country c.[8]

In Table 3, we repeat the regressions reported in Table 2, except that we instrument for judicial quality using using the country's population density in 1500 and its European settler mortality. The basic results reported in Table 1 prevail: for goods where the prosepctive use of relationship-specific inputs is more extensive, countries with superior contracting institutions export higher quality goods.

To further evaluate the robustness of our principal result, we control for other channels through which judicial institutions might affect product quality. Reflecting the insights in Levchenko

[8]GDP per capita data are from the Penn-World tables for 1995. The import price coefficient of variation is calculated from the Center for International Data's collection of import data. We obtain coefficients of variation for each industry for each year between 1989 and 2001, and then obtain the mean coefficient of variation for each industry. We use this mean coefficient of variation in the regressions.

Table 3: IV Regressions, with Additional Country-Industry Covariates

	(1)	(2)	(3)	(4)
$z_i x_c$	3.389**	2.642**	2.753**	2.654*
	(1.101)	(0.985)	(1.065)	(1.069)
Skill intensity$_i$ $\times$ Human capital endowment$_c$	0.634	0.376	0.451	0.453
	(1.617)	(1.608)	(1.718)	(1.722)
Capital intensity$_i$ $\times$ Capital endowment$_c$		-0.309	-0.249	-0.252
		(0.215)	(0.219)	(0.220)
Financial intensity$_i$ $\times$ Financial development$_c$			-0.287**	-0.276**
			(0.0973)	(0.974)
Price Coefficient of Variation$_i$ $\times$ Log GDP per capita$_c$				0.0448*
				(0.0191)
First Stage				
F-statistic	791.56	685.65	571.18	570.02
Over-id [p-value]	0.31	0.29	0.35	0.39
Observations	163,218	163,218	151,456	151,245

Standard errors are clustered at the IO code-country level
** p<0.01, * p<0.05

Table 4: OLS Regressions: Exploring the Effects of Judicial Quality through Alternative Pathways

	(1)	(2)	(3)	(4)
$z_i x_c$	2.669**	2.812**	2.639**	2.991**
	(0.812)	(0.741)	(0.762)	(0.819)
HI Input Concentration$_i$ $\times$ x_c	0.185			1.604
	(1.700)			(1.737)
No. of Inputs$_i$ $\times$ x_c		0.00906		0.0108
		(0.00509)		(0.00524)
Patent Intensity$_i$ $\times$ x_c			-0.545	0.950
			(0.808)	(0.800)
Additional Country-Industry Covariates	Yes	Yes	Yes	Yes
Observations	283,862	283,862	275,869	275,869

Standard errors are clustered at the IO code-country level
** p<0.01, * p<0.05

(2007), we incorporate interaction terms of judicial quality with measures of product "complexity", viz., the Herfindahl Index of input concentration, and the number of inputs. Columns (1) and (2) in Table 4 report the results of including these additional interaction terms. In specification (3), we add the interaction of the product's patent intensity with a country's judicial quality. The regressions in Table 5 mirror those in Table 4, but we instrument for judicial quality using the country's population density in 1500, its urbanization rate in 1500, and its European settler mortality. The results suggest that legal institutions do not affect product quality through any of these alternative pathways. Furthermore, our principal finding remains: for goods that potentially employ relationship-specific inputs more extensively, countries with better contracting institutions export higher quality goods.

The inclusion of additional interaction terms, and the persistence of the main result, suggest

Table 5: IV Regressions: Exploring the Effects of Judicial Quality through Alternative Pathways

	(1)	(2)	(3)	(4)
$z_i x_c$	2.476*	2.774**	2.603*	2.782*
	(1.186)	(1.070)	(1.095)	(1.157)
HI Input Concentration$_i \times x_c$	-1.357			-0.212
	(2.635)			(2.672)
No. of Inputs$_i \times x_c$		0.00945		0.0106
		(0.00809)		(0.00824)
Patent Intensity$_i \times x_c$			-0.433	-0.784
			(1.113)	(1.112)
Additional Country-Industry Covariates	Yes	Yes	Yes	Yes
First Stage				
F-statistic				
$z_i x_c$	370.47	272.22	271.53	187.47
HI Input Concentration$_i \times x_c$	362.07			200.08
No. of Inputs$_i \times x_c$		488.89		251.16
Patent Intensity$_i \times x_c$			129.17	68.34
Over-id [p-value]	0.49	0.28	0.17	0.25
Observations	147,312	147,312	147,312	147,312

Standard errors are clustered at the IO code-country level

** $p<0.01$, * $p<0.05$

that the latter is not compromised by omitted variable bias. In the OLS framework, the incorporation of additional covariates attenuates the coefficient of interest by 0.670; in the IV framework, it attenuates the estimates by 0.535. Based on methods developed by Altonji et al. (2005), and their subsequent embellishment in Bellows and Miguel (2009), we can use the observed attenuation to estimate how significantly the correlation of the judicial interaction term with additional, unaccounted for, regressors may be affecting our result. Specifically, Bellows and Miguel (2009) suggest computing the following measure to assess the potential attenuation due to omitted regressors:

$$\mu = \frac{\beta_c}{\beta_{nc} - \beta_c},$$

where β_c represents the estimate of our coefficient of interest with the incorporation of the additional covariates, while β_{nc} is the estimate of the coefficient of interest without. The larger the value of μ, the larger the covariance between the omitted variables and the variable of interest has to be in order to explain away the latter's estimated effect. More succinctly, the larger μ is, the less likely it is that our estimates of the effect of contracting institutions on product quality are tainted by omitted variable bias.

Computing μ from the results reported in Tables 2 and 3, one finds that there has to be considerable correlation between the judicial interaction and the omitted variables to compromise the main findings. In the OLS framework, the correlation between the judicial interaction term and omitted variables would have to be 3.6 times its correlation with the covariates already included in Table 2, specification (4). In the IV specifications, the correlation between the judicial interaction term and additional omitted variables would have to be 4.6 times its correlation with the covariates incorporated in specification (4) in Table 3. Given that even our baseline model is highly restrictive, such a high degree of correlation is unlikely; it especially implausible in the IV framework, since substantial correlation with the unaccounted for covariates would be inconsistent with the satisfaction of the over-identification tests. These findings thus suggest that omitted variable bias does not seriously compromise our result.

3.4 Alternate Measures of Legal Institution Quality

The Rule of Law measure employed in this paper is merely a proxy for the quality of contracting institutions. Obtained through responses to a myriad of surveys, it likely reflects the quality of a country's legal institutions with some error. Given that, it is important to check the results are not driven by idiosyncrasies in the Rule of Law metric. Accordingly, in Table 6, we replace the Rule of Law variable with other measures of institutional quality. To ensure comparability between these results and those reported in earlier tables, we scale the alternate measures so that their standard deviations match those of the Rule of Law measure. In columns (1) and (3), Gwartney and Lawson's (2003) (GL) Legal Quality measure proxies for the strength of contract enforcement. In columns (2) and (4) we use our own synthetic measure of the quality of contracting institutions. This metric is derived from the "Enforcing-a-Contract" indicators contained in the World Bank's (2004) Doing Business Database (DBD): this database reports the number of procedures involved in enforcing a contract, the number of days it takes to enforce it, and the cost of enforcing it. Using factor analysis, we combine the three indicators into a single measure of a country's contracting institutions' quality. As the results in Table 6 show, the finding that contracting institutions matter for quality persists, even under these alternate measures of institutional quality.

3.5 Sensitivity to Outliers

To bolster the findings *supra*, we verify that the results are not driven by outliers in the data. In all the regressions discussed in this section, we instrument for legal quality using the country's population density in 1500 and its European settler mortality. We also include all the additional regressors introduced in Section 3.3.[9]

As our first robustness check, we consider whether the results are determined by particular countries in the sample. We divide the countries up into thirty groups and randomly assign countries to each of the groups. We then run an IV regression, randomly omitting one of the

[9]The results are robust to the exclusion of these regressors. They hold, as well, if we do not instrument for judicial quality.

Table 6: Sensitivity to Alternate Measures of Legal Institution Quality

	(1)	(2)	(3)	(4)
Estimation Method	OLS	OLS	IV	IV
z_i × GL Legal Quality$_c$	2.868**		2.600*	
	(0.743)		(1.055)	
z_i × DBD Composite Contract Enforcement Measure		1.965*		4.494*
		(0.765)		(1.786)
Additional Country-Industry Covariates	Yes	Yes	Yes	Yes
First Stage				
F-statistic			993.58	82.90
Over-id [p-value]			0.89	0.38
Observations	282,474	276,412	151,144	150,911

Standard errors are clustered at the IO code-country level

** p<0.01, * p<0.05

groups. We repeat this random assignment and elimination process 1000 times. The results of these random country-group exclusions are not reported here; they indicate, however, that the findings of previous sections are not driven by just a few countries in the sample.

To verify that our results are not influenced by a few industries, we divide the six-digit NAICS groups into thirty categories, and randomly assign the NAICS groups to these thirty categories. We then run the IV regression, randomly eliminating one of these categories. Repeating the random assignment and omission process 1000 times reveals that the results are not driven by a handful of six-digit NAICS groupings.

As a final sensitivity test, we examine the effects of excluding larger groups of countries from the sample. Specification (1) in Table 7, deletes all the least-developed countries (LDC) from the sample; (2) omits all the lower-middle income countries (LMIC); (3) excludes all LDCs and LMICs from the sample. The findings in Table 7 indicate that the results presented so far are not a mere artefact of more fundamental differences between the traded goods of rich and poor countries.

4 Conclusion

The existing literature on the relationship between legal institutions and trade has concentrated on the effects legal quality on the volume of trade. Arguably, though, the quality of contracting institutions also determines of quality of goods traded. For many goods, improvements in product quality necessitate the use of higher quality or more sophisticated inputs. The production of these sophisticated inputs requires, in turn, greater collaboration between suppliers and final good producers, with suppliers developing relationship-specific inputs, and final good producers customizing their production processes to incorporate these higher quality inputs. In poor contracting environments, the relationship-specific investments needed to achieve strong collaboration, and by extension more sophisticated inputs and higher quality outputs, will be hard to achieve: uncertainty regarding the appropriability of the return on investment ensures that

Table 7: Sensitivity to Outliers

	(1)	(2)	(3)
$z_i x_c$	2.654*	3.658**	2.599*
	(1.078)	(1.183)	(1.256)
Additional Country-Industry Covariates	Yes	Yes	Yes
First Stage			
F-statistic	562.05	498.22	522.42
Over-id [p-value]	0.37	0.41	0.30
Less	LDC	LMIC	LDC+ LMIC
Observations	140.920	100,736	90,411

Standard errors are clustered at the IO code-country level

** p<0.01, * p<0.05

both suppliers and final good producers will underinvest in the relationships vital for product quality enhancement In many industries, therefore, countries with weak contracting institutions will arguably find it difficult to produce high quality goods.

Using highly disaggregated data on on US imports in from 1989 to 2001, this study examines the impact of legal institutions on the quality of traded goods It finds that for industries where the potential use of customized inputs in large, countries with stronger contracting institutions produce higher quality final goods. More importantly, the effect of contracting institutions is economically substantial.

5 Appendix

Table 8 presents the results of estimating Equation (1). Columns (1) and (2) contain the OLS and IV results, respectively. The industry-country fixed effects from the latter form the basis of our quality measure.

Table 8: Results of Quality Estimation Regressions

Dependent variable is log s_{ict}		
	(1)	(2)
Estimation Method	OLS	IV
Log prices: log p_{ict}	0.0297**	-0.253**
	(0.0020)	(0.0668)
Sectoral shares: log s_{hct}	579**	0.506**
	(0.001)	(0.0067)
First Stage: log p_{ict}		
z_i × Log real exchange rates		0.157**
		(0.0045)
z_i × Active HS categories per sector		-0.0012**
		(0.0001)
First Stage: log s_{hct}		
z_i × Log real exchange rates		-0.130**
		(0.0069)
z_i × Active HS categories per sector		0.0496**
		(0.0002)
Observations	1,637,254	1,553,374

** p<0.01, * p<0.05

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