Contractual versus non-contractual trade: The role of institutions in China

Robert C. Feenstra [a,b,*], Chang Hong [c], Hong Ma [d], Barbara J. Spencer [b,e]

[a] University of California at Davis, United States
[b] National Bureau of Economic Research, United States
[c] Clark University, United States
[d] Tsinghua University, China
[e] University of British Columbia, Canada

ARTICLE INFO

ABSTRACT

Recent research has demonstrated the importance of institutional quality at the country level for both the volume of trade and the ability to trade in differentiated goods that rely on contract enforcement. This paper takes advantage of cross-provincial variation in institutional quality in China, and export data that distinguishes between foreign and domestic exporters and processing versus ordinary trade, to show that institutional quality is a significant factor in determining Chinese provincial export patterns. Institutions matter more for processing trade and more for foreign firms, just as we would expect from a greater reliance on contracts in these cases.

© 2013 Elsevier B.V. All rights reserved.

1. Introduction

The importance of institutional quality in determining the volume of trade has been established by several recent papers (Levchenko, 2007; Nunn, 2007; Ranjan and Lee, 2007).[1] Beyond its influence on the volume of trade, however, institutional quality can also have an impact on the organization of trade and production. Levchenko (2007) shows that countries with better institutions specialize in goods that are institutionally dependent, as measured by the Herfindahl index of intermediate inputs, while Ranjan and Lee (2007) investigate the different effects of contract enforcement on homogeneous goods versus differentiated goods. Combining these two approaches, Nunn (2007) measures the extent of differentiation in intermediate inputs, arguing that goods that rely on more differentiated inputs will be more subject to "hold up" problems with suppliers, and therefore benefit more from good institutions. The index he constructs is a measure of the *contract intensity* of exports.

The above papers all focus on either U.S. imports or world trade data, and do not distinguish regions within countries. But institutions certainly differ a great deal within countries (Acemoglu and Dell, 2009, 2010). In the current paper, we take advantage of the cross-province variation in institutional quality in a large developing country, namely China, to examine the significance of institutional quality for Chinese export patterns. The tremendous growth in exports from China, especially since it joined the WTO in 2001, is reason enough to direct attention to that country. But in addition, provincial imports and exports from China are separated into categories not typically available. Consequently, we are able to address the limitation

---

* Corresponding author. Tel.: +1 530 752 7022; fax: +1 530 752 9382.
 E-mail address: rcfeenstra@ucdavis.edu (R.C. Feenstra).

[1] The importance of institutions has also been particularly emphasized by the empirical work by La Porta et al. (1997, 1998), and Acemoglu et al. (2001, 2002). In our working paper (Feenstra and Spencer, 2005), we also argue that local institutional differences play a significant role in the pattern of exports depending on their contractual relations.

of previous research that it uses only indirect measures, such as the Herfindahl index of intermediate inputs or the Nunn (2007) index, to characterize the extent to which traded goods rely on contracts. We also take advantage of special features of the Chinese input–output table to refine our construction of the Nunn (2007) indexes of *contract intensity* for China based on whether an input used by an exporting industry is domestic or imported.

Chinese trade data is separated into "ordinary" exports and a special customs designation, called "processing" exports. As their name suggests, processing exports are goods that rely on inputs that are imported duty free, then processed in China, with the finished good exported. Such relationships are contractual in the sense that the buyer specifies the characteristics of the good and makes payment accordingly. In contrast, "ordinary" imports and exports have no special customs treatment and we treat them as closer to arms-length transactions. Due to the need to enforce contracts, we hypothesize that higher quality judicial institutions would have more effect in increasing processing exports than ordinary exports. Moreover, the Chinese trade data also categorize the ownership of importing and exporting firms as domestic, joint venture or foreign and we also hypothesize that foreign firms are more dependent on contracts and therefore on institutions. We discuss features of the Chinese judicial system supporting this hypothesis in the next section. So the trade data are broken down into categories that arguably are related to the use of contracts. To reflect this idea, we refer to the categories of ownership and the choice between processing and ordinary exports as the *contractual modes* of exports.

For institutional quality, we use measures of the effectiveness of the judicial system in enforcing contracts for 30 provincial capital cities in China from the World Bank (2008). It is no accident that institutional authority differs across provinces. The old Chinese proverb, "The mountains are high and the emperor is far away," is suggestive of a neglect of authority in regions far away from Beijing, and differences were exacerbated by colonial rule that differed across regions. Since colonial rule is exogenous, it provides a useful instrument for our court-based measures of institutional quality. As a second instrument, we use enrollment in Christian missionary lower primary schools in China in 1919, as suggested by Fang and Zhao (2009).[2] Combining this institutional variation across provinces with the contractual relations in the trade data makes China an excellent testing ground for the impact of institutions on trade.

In the empirical analysis, we initially abstract from differences in contractual modes so as to focus on the more basic question of whether higher quality institutions are associated with greater exports of more contract dependent goods in our Chinese data. We first distinguish exports based on the Rauch (1999) classification of differentiated, reference-priced and homogeneous goods and then on contract intensity based on the Nunn (2007) index. Using our instrumental variables (colonial status and enrollment in Christian missionary schools in 1919), we find that the hypothesis is supported by positive and significant interactions between institutional quality (based on our measures of the quality of the court system) and goods that exhibit higher contract dependence. The results hold quite strongly for contract dependence measured by the Nunn contract intensity index, but only weakly for the Rauch classification of export goods.

Next, examining the effects of contractual mode determined by the nature of ownership and type of trade (processing versus ordinary), we interact contractual mode with our (instrumented) court measures of institutional quality. In most cases, we can explain the signs of these interactions based on our hypotheses, but we are concerned that there may be bias from the potential role of geography as an omitted factor. For example, some contractual modes, such as those that divide ownership and control, are more common in coastal cities, where institutional quality is also higher. We address this potential problem by adding a three-way interaction term that combines the Nunn index of contract intensity with contractual mode and institutional quality. For each of our court measures (instrumented by colonial status and enrollment in Christian missionary schools) and contractual modes, this three-way interaction is statistically and economically significant in explaining the volume of exports. Admittedly, the variation in province-industry-year export values that is explained by this triple interaction is not that large: about 3–5% of the total variation, but this is very similar to what Nunn (2007) finds for the explanatory power of his index when applied across countries. Here, we find similar results *within* a country. Furthermore, we find a very systematic pattern to the impact of institutional quality: institutions matter more for processing trade than ordinary trade, and more for foreign firms, just as we would expect from a greater reliance on contracts in both cases.

In the next section, we describe the Chinese trade and institutional data and our construction of the Nunn (2007) index of contract intensity. In Section 3, we provide an initial analysis of the effects of institutions for our overall Chinese data, prior to addressing the implications of different contractual modes in Sections 4 and 5. Section 4 develops the regression specification incorporating contractual modes and also examines the effects of institutional quality interacted with the various contractual modes. Section 5 adds the three-way interaction of the Nunn (2007) index with institutional quality and contractual mode, and Section 6 concludes.

2. Chinese trade and institutional data

Data for Chinese exports and imports are available at the Harmonized System (HS) of product classification, broken down by source or destination countries, city of origin or destination, customs regime (including both ordinary and processing

---

Table 1
Export processing, foreign ownership and trade in China.

Year	Processing exports/total exports (1)	Exports by foreign firms/total exports (2)	Share in total processing exports of	
			Exports by foreign firms (3)	Import-and-assembly (4)
1997	0.545	0.361	0.561	0.704
1998	0.568	0.393	0.587	0.705
1999	0.568	0.413	0.609	0.677
2000	0.552	0.439	0.646	0.701
2001	0.554	0.462	0.669	0.714
2002	0.553	0.486	0.699	0.736
2003	0.552	0.518	0.747	0.775
2004	0.553	0.546	0.780	0.791
2005	0.547	0.562	0.806	0.798
2006	0.527	0.564	0.820	0.815
2007	0.507	0.556	0.825	0.812
2008	0.473	0.541	0.831	0.836

Source: The Customs General Administration of the People's Republic of China.
Notes: Columns (1) and (2) show processing exports and exports by foreign firms, respectively, as a share of total China exports; columns (3) and (4) show as a share of total China processing exports, processing exports by foreign firms, and processing exports under the import-and-assembly regime.

trade), and ownership of firm.[3] Table 1 shows a simple decomposition of different types of exports. Processing exports play a major role, accounting for over one-half of China's total exports through the sample period from 1997, except in the final year 2008 (column 1). The share of foreign firms[4] in exports increases substantially from around one-third in 1997 to over 54% of the total value of exports in 2008 (column 2). These firms are especially important in processing trade, as shown in column (3).

Processing trade has been further broken into two types, as follows:[5]

The pure-assembly regime: In this arrangement, a foreign firm supplies a factory in China, which can be foreign-owned or domestic, with materials from abroad (Naughton, 1996). While the factory takes possession of the imported materials during processing, the foreign firm retains ownership over them. The foreign firm pays the factory in China a fee for its processing services. To obtain clearance from Chinese customs to import materials and to export processed goods, the terms of the transaction between the Chinese factory and the foreign firm must be stipulated in a written contract and presented in advance to Chinese customs officials for approval. Legally, the processing factory may use imported materials for the sole purpose of meeting its obligations to the foreign client.[6]

The import-and-assembly regime: In this arrangement, the processing factory in China (foreign or domestic) plays a more active role: it can control where to source the materials and to whom it ultimately exports the processed goods. When selling the processed goods to a foreign buyer, the destination can differ from the source country. The factory takes ownership of imported materials during processing and may process goods for multiple foreign firms (World Bank, 1994). The factory would still require export contracts to obtain the "processing" designation that authorizes the duty-free import of materials. Column (4) of Table 1 shows that import-and-assembly is the most common form of export processing. Its share of total processing exports increased to over 80% in 2008, from 70% in 1997.

Table 1 also shows that exports by foreign firms have risen over time as a share of both total and processing exports. We hypothesize that the quality of the court system will be more important for foreign firms than domestic, Chinese firms. The legal scholar Jerome Alan Cohen has written extensively on the importance of Chinese legal institutions for attracting and maintaining foreign direct investment into China. In *Contract Laws of the People's Republic of China* (Cohen et al., 1988), he first describes the traditional Chinese system: "Of course, the Chinese have traditionally preferred to resolve their disputes informally. If the disputants cannot negotiate a solution by themselves, they often seek the assistance of third parties who, rather than make a binding decision, try to help them reach a conciliated, mutually agreeable settlement. This is even true of matters that reach the courts. About two-thirds of the economic cases brought to the courts and a very large number of those brought to other dispute resolution institution in the PRC are disposed of by mediation . . . through the efforts of local authority figures . . . such as the precinct policeman, the factory manager or the village Party secretary" (pp. 5–6).

Cohen then contrasts this traditional system with the laws developed to support foreign direct investment: "China's momentous 1978 decision to accept foreign investment, which had been anathema to the PRC's nationalistic first-generation

---

[3] These data are purchased from Mr. George Chen, China Customs Statistics Information Center, Economics Information Agency, Hong Kong; EIAET@PACIFIC.NET.HK. Several researchers are now using Chinese firm-level import and export data (see Ahn et al., 2010; Manova and Zhang, 2009) obtained from the same source.

[4] Two types of foreign firms are recognized by the Chinese government: wholly foreign-owned enterprises and equity joint ventures in which a foreign interest has at least a 25% ownership stake. We include both these categories in our measure of foreign firms' exports.

[5] In Chinese trade statistics, pure-assembly is called "processing and assembling" or "processing with supplied materials," and the import-and-assembly arrangement is called "processing with imported materials." The following description of these types draws on Feenstra and Hanson (2005).

[6] If firms sell some of their final products in the domestic market, then the imported intermediate inputs used are not eligible for customs duty rebate.

Table 2
Summary statistics for institutional variables.

Area	Variable	Obs.	Mean	Std. dev.	Min	Max
Southeast Coastal Provinces	Rank	6	25.5	4.8	19	30
	Time	6	356.5	100.7	258	488
	Cost	6	38.1	2.3	35.5	41
Interior and Northern Provinces	Rank	24	13.2	7.9	1	26
	Time	24	262.0	77.4	60	390
	Cost	24	25.8	8.4	8.2	40.4

Notes: We report three measures of court efficiency as indicators of institutional quality: rank, time and cost (see main text for description). All together there are 30 provinces. Provinces of the Southeast coastal area (top panel) include Fujian, Guangdong, Hainan, Jiangsu, Shanghai, and Zhejiang; with the rest being interior and northern provinces. Here we report the summary statistics for rescaled data, so a higher number means higher efficiency (to be concrete, we define rank as 31 minus the original rank, time as 600 minus the original time, and cost as 50 minus the original cost).

leaders, confirmed the need for a stable, articulated legal environment... Other forms of business co-operation new to the PRC, such as the processing of material and assembly of components supplied by foreign companies . . . plainly required the support of a legal system" (p. 7). Reading between the lines, we can identify two main reasons why foreign investors would rely more on the court system. First, foreign firms would be engaged in new activities as compared to Chinese firms: the repatriation of profits is but one example (p. 13). The more informal traditional system would not be equipped to handle these new issues. Second, we believe that because foreign firms are less familiar with local customs and have weaker ties to their suppliers, they would find it more difficult to take advantage of *alternative* methods for resolving disputes outside the court system.[7] That is, the "precinct policeman, the factory manager or the village Party secretary" could not be relied upon to resolve legal disputes involving foreign firms. Indeed, Cohen reports that: "in the 'special economic zones', 'economic and technological development zones' and other special regimes that the PRC has established in its coastal areas, large numbers of officials have had to absorb what the Chinese call 'international economic law'" (p. 8).

While Cohen's writings come in the early years of China's opening to trade and foreign investment, recent events such as China's accession to the World Trade Organization (WTO) in 2001 have brought a clarification of the laws pertaining to foreign firms. In particular, China committed to the "Non-discrimination" provision[8] as well as the "Uniform Administration of the Trade Regime" provision[9] of the WTO, which specify equal treatment for foreign and domestic enterprises with respect to production conditions, the availability of goods and services supplied by government or public enterprises and laws and regulations. With this clarification of the laws, foreign firms would potentially have stronger recourse to the court system to settle disputes.

While these arguments lend support to our hypothesis that foreign firm will rely more on a high-quality court system, they also raise concerns about the potential *endogeneity* of the system of trade laws and of its institutions more generally: the example of China's accession to the WTO shows how the trade laws were tightened over time, and this also might happen more in provinces where trade is higher. Such endogeneity can lead to exports influencing the quality of institutions rather than the reverse, so we will need to control for the endogeneity using (arguably) exogenous factors influencing institutions.

For our main measures of institutional quality, we use indexes of judicial quality from the World Bank (2008). These indexes are based on the methodology developed in Djankov et al. (2002), and measure the quality of the judicial system in enforcing contracts for 30 provincial capitals in China. There are three indicators of institutional quality: (i) a ranking of the efficiency of the court system in each provincial capital city, or "court rank"; (ii) the number of days from the time the plaintiff files the lawsuit until the time of payment, or "court time"; (iii) the official cost of going through court procedure, or "court cost".[10] Summary statistics for the institutional quality variables for southeastern coastal provinces and for interior and northern provinces are show in Table 2. Overall, institutions in the inland and northern provinces are not as efficient as the coastal counterparts.

---

[7] This line of reasoning is also found in Allen et al. (2005), who argue that institutions are less important in the private (domestic) sector in China.

[8] The provision states that: "Except as otherwise provided for in this Protocol, foreign individuals and enterprises and foreign-funded enterprises shall be accorded treatment no less favorable than that accorded to other individuals and enterprises in respect of: (a) the procurement of inputs and goods and services necessary for production and the conditions under which their goods are produced, marked or sold, in the domestic market and for export; and (b) the prices and availability of goods and services supplied by national and sub-national authorities and public or state enterprises, in areas including transportation, energy, basic telecommunications, other utilities and factors of production". *Source*: "The Legal Instruments on China's Accession to the World Trade Organization", 2001, China Legal Publishing House, p. 7. Compiled by the Legislative Affairs Office of the State Council.

[9] The provision states that: "China shall apply and administer in a uniform, impartial and reasonable manner all its laws, regulations and other measures of the central government as well as local regulations, rules and other measures issued or applied at the sub-national level (collectively referred to as "laws, regulations and other measures") pertaining to or affecting trade in goods, services, trade-related aspects of intellectual property rights ("TRIPS") or the control of foreign exchange". *Source*: "The Legal Instruments on China's Accession to the World Trade Organization", 2001, China Legal Publishing House, p. 6. Compiled by the Legislative Affairs Office of the State Council.

[10] We make a simple adjustment to the scale of these variables so that a higher value indicates better institutional quality; see the notes to Table 2.

Table 3
Summary statistics for Nunn (2007) contract intensity measure (for 23 IO industries included in the regressions).

	Variable	Obs.	Mean	Std. dev.	Range	Median
Domestic input for	Processing export, Nunn narrow (z_i^1)	23	0.21	0.15	0–0.77	0.17
	Processing export, Nunn broad (z_i^2)	23	0.44	0.17	0–0.82	0.42
	Ordinary export, Nunn narrow (z_i^1)	23	0.38	0.16	0.16–0.81	0.35
	Ordinary export, Nunn broad (z_i^2)	23	0.68	0.09	0.56–0.88	0.67
Imported input for	Processing export, Nunn narrow (z_i^1)	23	0.55	0.21	0–0.92	0.60
	Processing export, Nunn broad (z_i^2)	23	0.83	0.20	0–0.99	0.90
	Ordinary export, Nunn narrow (z_i^1)	23	0.60	0.15	0.32–0.88	0.60
	Ordinary export, Nunn broad (z_i^2)	23	0.84	0.08	0.64–0.96	0.84

Notes: The contract intensity index z_i^n is between 0 and 1, the larger the index, the more contract dependent is that industry i. z_i^1 is narrowly defined since it only includes inputs that are differentiated based on the Rauch classification. z_i^2 is more broadly defined as it also includes reference-priced inputs as being relationship-specific.

To control for potential endogeneity of the court system to the amount of trade, we follow Lu et al. (2013) in using former colonial rule – by Britain, France, Russia, or several of these countries as instruments.[11] We expect that former colonies will have a better judicial system. Of course, there are many other ways that the institutions of former colonies will be influenced, including through their educational system as with schools established by missionaries, for example. We use data on enrollment (per 100,000) persons in Christian missionary lower primary schools in 1919 as a second instrument, taken from Fang and Zhao (2009). They use this variable as an instrument for the influence of institutional quality on economic performance in China, as measured by GDP per capita across Chinese cities.

To explain why missionary school enrollment does not have an impact on economic performance today *except through* its influence on institutions, Fang and Zhao (2009) argue that: (i) this variable is uncorrelated with geography, and in particular the distance to the coast; (ii) the number of missionary schools were only about 4% of the government-run primary schools at that time, so they are too small to have a general impact on human capital and hence performance today; (iii) since the Communist Revolution of 1949 and the subsequent Cultural Revolution, Christianity has been sufficiently suppressed that any economic influence of current-day resurgence is unlikely to be correlated with its historical legacy. These arguments are used to justify the *exclusion restriction* whereby Christian missionary schools in 1919 do not have a direct impact on economic performance today, which, for our purposes, would include today's patterns of exports. Of course, we recognize that colonial status and missionary schools can influence the quality of institutions beyond the judicial system. For example, Fang and Zhao (2009) use Christian missionary school enrollment as an instrument for the quality of property-rights protection. But consideration of other variables to measure the quality of institutions, beyond our court variables, is beyond the scope of this paper.

Following Nunn (2007), we construct indexes of the "contract intensity' of goods or the *relationship-specificity of a good's intermediate inputs*, which is based on the differentiation of intermediate inputs as in Rauch (1999).[12] Two measures of contract intensity are constructed as:

$$z_i^1 = \sum_j \theta_{ij} R_j^{diff} \quad \text{and} \quad z_i^2 = \sum_j \theta_{ij}(R_j^{diff} + R_j^{refprice}), \tag{1}$$

where θ_{ij} is the share of input j used in industry i; R_j^{diff} is the proportion of input j that is differentiated; and $R_j^{refprice}$ is the proportion of input j that is not sold on an exchange but is reference priced. Both contract intensity measures classify the proportion of inputs that is relationship-specific, but the second measure z_i^2 is more broadly defined as it also includes reference-priced inputs as being relationship-specific. We refer to z_i^1 and z_i^2 as the narrow and broad Nunn measures. In general, z_i^n index ranges between 0 and 1 and the larger the index value, the more contract dependent that industry is.

Table 3 gives the summary statistics for the Nunn indexes for contract intensity, for both z_i^1 and z_i^2. One feature of the contract intensity variable that distinguishes it from Nunn (2007) is that the Chinese input–output table provides several sets of weights to use for θ_{ij}: those obtained from domestic or imported inputs going to either domestic output, ordinary exports, or processing exports.[13] In Table 3, the top panel presents the contract intensity constructed using *domestic* inputs for both processing and ordinary exports, while the bottom panel presents the contract intensity constructed using *imported* intermediate inputs for both processing and ordinary exports. Because processing exports usually use a smaller share of domestic inputs, the Nunn indexes using domestic inputs for processing exports are smaller than the ones for ordinary

---

[11] Britain colonies are: Guizhou, Sichuan, Hubei, Hunan, Jiangxi, Anhui, Jiangsu, Henan, Zhejiang, Chongqing; French colonies are: Yunnan, Hainan, Guangxi, Guangdong; Russian colonies are: Xinjiang, Neimenggu, Heilongjiang, Liaoning, Jilin; and multi-occupancy colonies are: Shanghai, Tianjin. No foreign occupancy consists of Gansu, Beijing, Hebei, Ningxia, Qinghai, Shan'xi, and Shanxi.

[12] The Rauch (1999) index has both a liberal and a conservative estimate for product classification, which differ in the criterion used to classify goods as reference priced or differentiated. We used both estimates for our estimation and obtained similar results, but here report estimates using the conservative classification.

[13] We thank Zhi Wang for providing us the 2000 trade expanded input–output table from Chen et al. (2004).

Table 4
Export regressions using Rauch classification.

Independent variables	Institutional variable			Institutional variable		
	(1) rank	(2) time	(3) cost	(4) rank	(5) time	(6) cost
2nd stage regressions: dependent variable, log(export value)						
Institutions × Differentiated goods	0.112***	0.009***	0.080**	0.176***	0.024***	0.144***
	(0.020)	(0.002)	(0.033)	(0.050)	(0.011)	(0.043)
Institutions × Reference-priced goods	0.046***	0.004***	0.033*	0.053*	0.009*	0.039
	(0.012)	(0.001)	(0.017)	(0.032)	(0.005)	(0.029)
Differentiated goods	0.298	−0.547	−0.214	−0.713	−4.75	−2.01
	(0.386)	(0.670)	(1.022)	(0.77)	(3.23)	(1.26)
Reference-priced goods	0.341*	−0.012	0.126	0.232	−1.57	−0.045
	(0.194)	(0.383)	(0.469)	(0.48)	(1.50)	(0.78)
Province-year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
First stage F-test				4.27	0.4	6.8
1st stage regressions: dependent variable, Institutions × Rauch indicator						
Britain × Rauch indicator				1.28	53.2	−1.79
				(5.04)	(47.76)	(4.92)
France × Rauch indicator				1.38	47.8	2.95
				(6.59)	(69.56)	(6.38)
Russia × Rauch indicator				−0.899	−3.72	−0.081
				(4.62)	(68.6)	(3.86)
Multi × Rauch indicator				9.53*	29.9	10.2***
				(3.46)	(37.70)	(2.12)
Enrollment × Rauch indicator				0.089	0.684	0.070*
				(0.05)	(0.59)	(0.03)
Rauch indicator				11.3*	230***	25.2***
				(4.36)	(46.74)	(2.87)
Province-year fixed effect				Yes	Yes	Yes
Observations				990	990	990
Within R-squared				0.27	0.16	0.25

Notes: Dependent variable is log(export value). The panel covers 30 provinces over 1997–2007. We classify exports by differentiated goods as well as reference-priced goods, according to Rauch (1999). There are three proxies for institutional quality: the rank of court efficiency, the average time used to solve a dispute, and the official costs associated with going through court procedure. The first three columns are OLS regression, while the last three columns are using instruments which include the interaction terms of Rauch product categories with the occupancy of foreign powers (Britain, France, Russia, and multiple powers) in each province, as well as with the enrollment at the Christian missionary lower primary school. Robust clustered standard errors, by province, are in parentheses.

For the 1st stage regressions there are two endogenous variables, Institutions × Differentiated goods and Institutions × Reference-priced goods, and the results are identical whichever endogenous variable is used.

* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

exports. However, the two measures for ordinary and processing exports are quite close if we look at the Nunn indexes using imported inputs. In practice, we use the weights most appropriate to the trade flow in question, so for processing trade we use the weights for imported intermediate inputs rather than domestic inputs.[14]

The Chinese input–output table distinguishes 23 traded industries that are used to measure exports, and also provides the labor and capital used per yuan value of exports, which we denote by l_i and k_i, the labor and capital intensity of each industry i.[15] These factor intensities differ between processing and ordinary exports. We supplemented the factor intensities with measures of skilled labor and capital endowments by province r in year t, or L_t^r and K_t^r. The variable L_t^r measures the educational attainment of the provincial workforce.[16] The provincial capital endowments K_t^r are obtained from Bai et al. (2006).[17] We follow Nunn (2007) in using $L_t^r l_i$ and $K_t^r k_i$ as interactions between skilled labor, capital endowments and industry factor intensities, which we refer to as "skill × labor intensity" and "capital × capital intensity."

3. The effect of institutions: initial regressions

This section deals with the basic question as to whether higher quality institutions have a greater effect in raising the exports of more contract-dependent goods in our Chinese data. Our initial regressions of Table 4 measure contract dependency based on Rauch (1999) and pool exports with respect to contractual modes, so that the data is not distinguished

---

[14] We also experimented with using domestic inputs for both ordinary and processing exports, and the results turned out to be qualitatively similar.

[15] There are 40 sectors in China's input–output table including both tradable and non-tradable goods. We keep 23 tradable sectors for the estimation.

[16] Using data from various years of China Statistical Yearbook, we ran a preliminary regression of provincial average manufacturing wages on the fraction of the population with primary, junior, senior and university education. The predicted wage from this regression is used as the skilled labor endowment.

[17] We are grateful to Chong-En Bai for generously providing us the data on Chinese provincial capital stock.

by customs regime or ownership. Specifically, in Table 4 province-year exports are distinguished according to the Rauch (1999) classification of differentiated, reference-priced, and homogeneous goods, with the last category omitted. The value of exports is summed within these three categories across 30 provinces and 11 years, giving 990 observations.[18] Indicator variables for differentiated and reference-priced exports are interacted with institutional quality.

The first three columns in Table 4 are run with OLS, and the next three use colonial rule as well as the Christian missionary lower primary school enrollment in 1919 as instrumental variables for institutional quality. According to all our measures, better institutional quality is significant in raising the exports of differentiated goods. Better institutional quality also raises the exports of reference-priced goods, but with coefficients that are about one-third as large and at best significant at the 10% level for the IV regressions.

The lower panel of Table 4 presents the first stage regression results, which regress the endogenous variables Institutions × Differentiated goods and Institutions × Referenced-priced goods on the instruments and other exogenous variables.[19] Only the multi-occupancy colonies (Shanghai and Tianjin) are significant in the court rank and cost regressions, and the Christian missionary school enrollment is also weakly significant in the latter. The within R^2 values are quite low, ranging from 0.16 to 0.27. We test for weak instruments using an F-test on the instruments in the first-stage regression, as recommend by Stock et al. (2002). The first-stage regressions have quite low Stock-Yogo F-statistics for the colonial status and enrollment variables, indicating that the strength of identification is weak. The court ranking and court cost regressions have F-statistics of 4.27 and 6.8, respectively, and court time has an F-statistic of only 0.4, so we conclude that the instruments are weak and there is a potential for bias.[20] One reason that court time might be an especially weak instrument is that either a very short amount of time or a very long amount of time might both be indicators of an inefficient court system, so there is no monotonic relationship between court time and institutional quality.[21]

Stronger results are obtained when we use of the Nunn contract intensity measure in Table 5, rather than the Rauch classification of goods applied to exports. Because contract intensity differs for ordinary and processing trade, we distinguish exports by these two types of trade, as well as by 23 industries from the IO table and 30 provinces. We test for the effect of institutional quality interacted with the Nunn contract intensity measure, using our instruments and controlling for factor intensity (interacted with factor endowments). This regression provides baseline estimates that are comparable to Nunn (2007) Eq. (1). The coefficients for institutional quality interacted with contract intensity are strongly significant in Table 5, and positive for all three measures of judicial quality, and for both broad and narrow measure of contractibility. The largest quantitative impact of institutional quality is obtained from the court rank and cost measures, with court time again playing a weaker (but still significant) role. The results indicate that provinces with better institutions have greater exports in industries that rely more on contracts. In the lower part of Table 5 we report the first stage regressions. Both foreign colonial presence and enrollment in Christian missionary schools have a significant impact on institution interactions, and the first-stage F-statistics all exceed 10 by substantial margins.

4. Regression specification with contractual mode

We hypothesize that processing exporters as well as foreign firms are more dependent on contracts and therefore on institutions. So we distinguish contractual mode (i.e. ownership and custom regimes) in our next regressions. To develop the regression specification, we denote our dependent variable by $\ln Y_{ijrt}$, which is the log value of exports in industry i, contractual mode j (i.e. type of trade and ownership), province r, and time t.[22] Indicator variables for contractual mode are denoted by the (9×1) vector $X_{irt} = (X_{i1rt}, \ldots, X_{i9rt})$, where there are three types of trade (ordinary, pure assembly, and import-and-assembly) interacted with three types of ownership (domestic, joint venture, and foreign). We treat ordinary trade by domestic firms as the omitted category, so without any further interactions there are only 8 types of contractual mode. We interact X_{irt} with each institutional quality variable, denoted Q_r, which differ across provinces, and also with the Nunn narrow and broad measures of contract intensity, z_i^n, $n = 1, 2$, which differ across industries, obtaining the regression:

$$\ln Y_{ijrt} = \beta_1' X_{irt} + \beta_2' X_{irt} Q_r + \beta_3' X_{irt} Q_r z_i^n + \gamma_1 L_{rt} l_i + \gamma_2 K_{rt} k_i + \delta_i + \delta_{rt} + \varepsilon_{ijrt}, \tag{2}$$

where β_n, $n = 1, 2, 3$, are (8×1) or (9×1) vectors of coefficients on the contractual mode indicator variables, interacted with institutional quality and also with contract intensity.[23] Following Romalis (2004) as well as Nunn (2007), this regression

---

[18] In later regressions we are missing provincial endowment data for 2008, so for consistency, we have omitted that year from all regressions reported.

[19] The first-stage regression results are identical whether the Rauch product category is differentiated goods or reference-priced goods, since either of these select 330 of the 990 observations. So the coefficients in these first-stage regressions are identical to those found from running OLS of rank, time, or cost on the colonial indicators and enrollment; the within R^2 values are computed from these simple OLS regressions.

[20] The Stock and Yogo critical value to limit the bias to 30% of OLS for two endogenous variables and ten instruments is 4.66. Stock and Yogo (2005), http://ws1.ad.economics.harvard.edu/faculty/stock/files/rfa_6.pdf.

[21] We thank Nathan Nunn for this suggestion.

[22] More than one-half of the possible observations for exports Y_{ijrt} are zero and were omitted from the regression. This means that we are examining the impact of institutional quality on the intensive margin of trade and not the extensive margin. The extensive margin of exports across types of trade and ownership will be influenced by factors such as the availability of export processing zones in a province, for example. We view the formation of such zones as a very interesting research topic that we are exploring, but that is beyond the scope of this paper.

[23] The vector β_1 is (8×1) because ordinary trade by domestic firms is the omitted category. When contractual mode is interacted with only institutions, then it is also necessary to omit one category, because the contractual modes sum to unity and the remaining institutional variable is perfectly correlated

Table 5
Export regressions with Nunn contractual intensity, but without distinguishing contractual mode (trade type or ownership).

	Nunn narrow measure			Nunn broad measure		
	(1) rank	(2) time	(3) cost	(4) rank	(5) time	(6) cost
2nd stage regressions: dependent variable, log(export value)						
Institutions × Contract intensity	0.378***	0.032***	0.292***	0.567***	0.039***	0.400***
	(0.04)	(0.004)	(0.03)	(0.07)	(0.01)	(0.05)
Skill × Skill intensity	0.625***	0.544***	0.578***	0.867***	0.846***	0.903***
	(0.22)	(0.20)	(0.21)	(0.21)	(0.20)	(0.21)
Capital × Capital intensity	−3.462**	−2.391	−3.012*	−1.081	−1.408	−1.170
	(1.61)	(1.56)	(1.55)	(1.48)	(1.48)	(1.50)
Province-year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
First stage F-test	87.4	31.4	91.5	117	51.6	116
1st stage regressions: dependent variable, Institutions × Contract intensity						
Britain × Contract intensity	4.10**	122***	4.85**	5.27***	146***	7.48***
	(1.25)	(13.41)	(1.48)	(1.15)	(12.6)	(1.43)
France × Contract intensity	4.36**	112.093***	9.697***	5.37***	134.1***	12.1***
	(1.66)	(17.17)	(1.81)	(1.48)	(15.41)	(1.71)
Russia contract intensity	2.52*	70.6***	7.37***	3.64***	95.1***	10.2***
	(1.10)	(18.98)	(1.30)	(0.95)	(17.28)	(1.21)
Multi × Contract intensity	11.3***	73.2***	14.7***	12.1***	89.2***	16.5***
	(1.08)	(14.58)	(1.07)	(0.99)	(14.05)	(1.15)
Enrollment × Contract intensity	0.117***	1.316***	0.139***	0.128***	1.529***	0.165***
	(0.01)	(0.19)	(0.01)	(0.01)	(0.16)	(0.01)
Skill × Skill intensity	0.058	1.797	0.201	−0.139	−2.144	−0.301
	(0.20)	(2.94)	(0.30)	(0.16)	(2.33)	(0.24)
Capital × Capital intensity	2.25***	13.8	1.76*	−0.154	−0.455	−0.192
	(0.64)	(7.11)	(0.72)	(0.29)	(3.41)	(0.40)
Province-year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12,038	12,038	12,038	12,038	12,038	12,038
Within R-squared	0.81	0.89	0.89	0.80	0.88	0.88

Notes: Dependent variable is log(export value). The panel covers 30 provinces and 23 sectors over 1997–2007. There are three proxies for institutional quality: the rank of court efficiency, the average time used to solve a dispute, and the official costs associated with going through court procedure. All estimation is performed with instruments, which include the interaction terms of contract intensity with the occupancy of foreign powers (Britain, France, Russia, and multiple powers) in each province, as well as with the Christian missionary lower primary school enrollment. All regressions have province-year and industry fixed effects, and also include an ordinary-versus-processing trade indicator. Robust clustered standard errors, by province × industry, are in parentheses.

* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

includes the factor endowment variables L_t^r and K_t^r interacted with the industry-specific factor intensities l_i and k_i. We also add indicator variables for industry δ_i and for province-year δ_{rt}.

To analyze the data, we begin with a simple specification in Table 6 that includes the contractual mode in (2), but excludes the Nunn measures of contract intensity, z_i^n, involved in the three-way interactions in (2). We do not report β_1, which are the coefficients of indicator variables for contractual mode and are of little interest in themselves.[24] We report the coefficients β_2, which indicate the impact of institutional quality on exports by each contractual mode. The first three rows of estimates in Table 6 refer to pure-assembly processing trade, distinguished by the three ownership types; the next three rows refer to import-and-assembly; and the next two rows refer to ordinary trade. We find that relative to ordinary trade by domestic firms (the omitted category), the interactions of our institutional variables, court rank and court cost (instrumented for colonial rule and Christian missionary school enrollment) have a significant effect in raising exports for all contractual modes except for pure assembly combined with joint ventures. A number of the results for court time are not significant or have the wrong sign, but as shown by the F-tests for weak instruments at the bottom of Table 6, court time is again a weak instrument. As

---

with the provincial indicators. So we again omit ordinary trade by domestic firms so the vector β_2 is (8×1). When further interacting with the relationship-specificity of each industry, the vector β_3 is (9×1).

[24] The contractual mode indicators are still included in the regressions in Table 6 as well as in Table 7. In general, we are careful to include all variables that appear within any interaction terms, though sometimes those coefficients are not reported or the variables are dropped due to perfect multicollinearity. For example, when using the double-interaction $X_{irt}Q_r$ in Table 6, we include X_{irt} (but do not report those coefficients) and should also include Q_r. But since Q_r is endogenous it needs to be instrumented using the colonial indicators and Christian missionary school enrollment. Since these instruments are perfectly collinear with the provincial fixed effects, so is $\hat{Q}_r$, and hence that variable is dropped.

Table 6
Export regressions without Nunn contractual intensity, but distinguishing contractual mode (trade type and ownership).

Independent variables	Institutional variable			Institutional variable		
	(1) rank	(2) time	(3) cost	(4) rank	(5) time	(6) cost
Institutions × Pure assembly × Domestic	0.136***	0.010***	0.140***	0.149***	0.010***	0.156***
	(0.02)	(0.003)	(0.02)	(0.02)	(0.003)	(0.02)
Institutions × Pure assembly × Joint venture	0.000	−0.005	0.024	0.014	−0.005*	0.041**
	(0.03)	(0.003)	(0.02)	(0.03)	(0.003)	(0.02)
Institutions × Pure assembly × Foreign	0.091***	0.000	0.105***	0.104***	−0.001	0.122***
	(0.03)	(0.003)	(0.02)	(0.03)	(0.003)	(0.02)
Institutions × Import and assembly × Domestic	0.040**	0.001	0.045***	0.053**	0.000	0.063***
	(0.02)	(0.003)	(0.02)	(0.02)	(0.003)	(0.02)
Institutions × Import and assembly × Joint venture	0.110***	0.005*	0.100***	0.123***	0.004	0.117***
	(0.02)	(0.003)	(0.02)	(0.02)	(0.003)	(0.02)
Institutions × Import and assembly × Foreign	0.199***	0.012***	0.165***	0.212***	0.011***	0.182***
	(0.03)	(0.003)	(0.02)	(0.03)	(0.003)	(0.02)
Institutions × Ordinary × Joint venture	0.067***	0.004	0.041***	0.069***	0.004	0.044***
	(0.02)	(0.003)	(0.015)	(0.02)	(0.003)	(0.02)
Institutions × Ordinary × Foreign	0.129***	0.010***	0.096***	0.131***	0.010***	0.100***
	(0.02)	(0.003)	(0.02)	(0.02)	(0.003)	(0.02)
Skill × Labor intensity				0.623***	0.568***	0.660***
				(0.14)	(0.14)	(0.14)
Capital × Capital intensity				2.663**	−0.077	3.612***
				(1.30)	(1.12)	(1.29)
Province-year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Trade type and ownership interactions	Yes	Yes	Yes	Yes	Yes	Yes
Observations	38,638	38,638	38,638	38,638	38,638	38,638
First stage *F*-test	*F* > 26	3.9 < *F* < 6.6	*F* > 32	*F* > 23	3.9 < *F* < 6.7	*F* > 30

Notes: Dependent variable is log(export value). The panel covers 30 provinces over 1997–2007. We categorize exports by industry, by trade type (pure-assembly, import-and-assembly, and ordinary exports) and by ownership of the exporter (domestic, equity joint venture, and wholly foreign owned). There are three proxies for institutional quality: the rank of court efficiency, the average time used to solve a dispute, and the official costs associated with going through court procedure. All estimation is performed with instruments, which include the interaction terms of export categories with the occupancy of foreign powers (Britain, France, Russia, and multiple powers) in each province, as well as with the Christian missionary lower primary school enrollment. All regressions have province-year and industry fixed effects and also trade-type-ownership interactions. Robust clustered standard errors, by province × industry, are in parentheses.

* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

discussed with respect to Table 4 in Section 3, court time may not reflect true judicial efficiency. The first-stage regressions for the court variables rank and cost each have much stronger first-stage *F*-statistics.[25]

For each mode of trade, we have highlighted the ownership type that gives the largest coefficients. Thus, for pure assembly we find that *domestic* firms have the largest coefficient – an improvement in institutions increases exports by domestic firms the most – while for import-and-assembly and ordinary trade, institutions have the greatest impact on exports by *foreign* firms. These results continue to hold when controlling for provincial factor endowments, in regressions (4)–(6).

The differing impact of institutional quality on exports by domestic and foreign firms is puzzling at first glance, but we offer an explanation drawing on Feenstra and Hanson (2005). They argue that the case of (a) pure assembly (meaning a foreign firm located abroad chooses the inputs sent to China) combined with domestic ownership of firms, or (b) import-and-assembly (meaning the local Chinese manager has control over the inputs) combined with foreign ownership of the firm in China, are both examples of *separated ownership and control*. In a property-rights model, such separation of ownership and control maintains the incentives for both Chinese and foreign parties to work hard, but the potential cost of noncompliance is higher than if a single owner was fully in control. Having a strong court system can offset this cost of breaching the contract, so by this argument it is not surprising that institutional quality has the greatest marginal impact on exports in these cases of separated ownership and control. In contrast, when there is ownership and control by the same party, then the court system is less essential. While this provides one plausible rationale for the results in Table 6, we offer a different interpretation in the following section, suggesting that those results might be influenced by geography.

---

[25] There are multiple first-stage regressions in Tables 6 and 7 because the court variables are interacted with other (exogenous) variables. The first-stage regressions for Tables 6 and 7 and A1–A3 are included in on-line Appendix.

Table 7
Export regressions with Nunn contractual intensity, and distinguishing contractual mode (trade type and ownership).

	Nunn narrow measure			Nunn broad measure		
	(1) rank	(2) time	(3) cost	(4) rank	(5) time	(6) cost
Institutions × Contract intensity × Pure assembly × Domestic	0.289***	0.022***	0.202***	0.327***	0.022***	0.222***
	(0.04)	(0.003)	(0.03)	(0.07)	(0.005)	(0.05)
Institutions × Contract intensity × Pure assembly × Joint Venture	0.339***	0.026***	0.238***	0.497***	0.034***	0.337***
	(0.04)	(0.003)	(0.03)	(0.07)	(0.005)	(0.04)
Institutions × Contract intensity × Pure assembly × Foreign	0.442***	0.032***	0.296***	0.645***	0.042***	0.418***
	(0.04)	(0.003)	(0.03)	(0.07)	(0.005)	(0.05)
Institutions × Contract intensity × Import assembly × Domestic	0.322***	0.023***	0.216***	0.408***	0.027***	0.262***
	(0.04)	(0.003)	(0.03)	(0.07)	(0.005)	(0.05)
Institutions × Contract intensity × Import assembly × Joint venture	0.436***	0.031***	0.293***	0.616***	0.040***	0.397***
	(0.04)	(0.003)	(0.03)	(0.07)	(0.005)	(0.05)
Institutions × Contract intensity × Import assembly × Foreign	0.445***	0.032***	0.300***	0.697***	0.045***	0.447***
	(0.04)	(0.003)	(0.03)	(0.07)	(0.005)	(0.05)
Institutions × Contract intensity × Ordinary × Domestic	0.268***	0.021***	0.185***	0.327***	0.022***	0.216***
	(0.04)	(0.004)	(0.03)	(0.07)	(0.005)	(0.05)
Institutions × Contract intensity × Ordinary × Joint venture	0.299***	0.022***	0.206***	0.326***	0.022***	0.217***
	(0.04)	(0.004)	(0.03)	(0.07)	(0.005)	(0.05)
Institutions × Contract intensity × Ordinary × Foreign	0.337***	0.024***	0.231***	0.374***	0.025***	0.246***
	(0.04)	(0.004)	(0.03)	(0.08)	(0.005)	(0.06)
Skill × Skill intensity	0.486***	0.400**	0.494***	0.439**	0.402**	0.483***
	(0.17)	(0.18)	(0.16)	(0.18)	(0.20)	(0.18)
Capital × Capital intensity	−1.060	−1.561	1.002	0.970	−1.002	2.297
	(1.46)	(1.31)	(1.40)	(1.49)	(1.32)	(1.48)
Province-year and industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Institutions, trade type and ownership interactions	Yes	Yes	Yes	Yes	Yes	Yes
Observations	38,638	38,638	38,638	38,638	38,638	38,638
First stage *F*-test	*F* > 30	*F* > 14	*F* > 53	*F* > 22	*F* > 8.9	*F* > 44

Notes: Dependent variable: log(export value). The first three columns use the narrow definition of contract intensity, which measures the share of intermediate inputs that are differentiated, while the following three columns use the share of intermediate inputs that are differentiated or reference-priced. The panel covers 30 provinces over 1997–2007. We categorize exports by industry, by trade type (pure-assembly, import-and-assembly, and ordinary exports) and by ownership of the exporter (domestic, equity joint venture, and wholly foreign owned). There are three proxies for institutional quality: the rank of court efficiency, the average time used to solve a dispute, and the official costs associated with going through court procedure. All estimation is performed with instruments, including the interaction terms of trade type, ownership and contract intensity with the occupancy of foreign powers (Britain, France, Russia, and multiple powers) in each province, as well as with the Christian missionary lower primary school enrollment. All regressions have province-year and industry fixed effects and also interactions between trade type, ownership and institutions. Robust clustered standard errors, by province × industry, are in parentheses.

 * Significant at 10%.
 ** Significant at 5%.
 *** Significant at 1%.

5. Contractual mode and the Nunn index of contract intensity

The findings in Table 6 do not establish causality, and an alternative possibility is that a third factor – namely, geography – can account for the results shown. For example, Feenstra and Hanson (2005) find that cases of separated ownership and control are more common in coastal areas, and from Table 2, this is also where institutional quality is stronger. The proximity of Hong Kong, Taiwan, Japan and South Korea to the coastal areas of China, or some other factor, might influence the choice of divided ownership and control while being correlated with institutional quality by virtue of geography. For this reason, we view the results in Table 6 as suggestive but hardly conclusive on the importance of institutions.

To attempt to establish a causal link between institutions and trade, we add both the narrow and broad contract intensity measures, z_i^1 and z_i^2 of Nunn (2007). We run regressions in Table 7 that include $\beta_1' X_{irt}$ and $\beta_2' X_{irt} Q_r$ as in Table 6, and now also include the interactions $\beta_3' X_{irt} Q_r z_i^n$, while only reporting the latter coefficients for brevity.[26]

In Table 7, the first three rows of estimates again refer to pure assembly, distinguishing the three ownership types; the next three rows refer to import-and-assembly; and the next three rows refer to ordinary trade, all interacted with

---

[26] As mentioned in a previous footnote, we attempt to include all variables that appear within any interaction terms, although sometimes those coefficients are not reported or the variables are dropped due to perfect multicollinearity. For example, when using the triple-interaction, $X_{irt} Q_r z_i^n$, in Table 7, we also include X_{irt} and $X_{irt} Q_r$ (but do not report those coefficients) and should also include z_i^n, $Q_r z_i^n$ and $X_{irt} z_i^n$. But the contract intensity variable z_i^n is perfectly multicollinear with the industry fixed effects, while $Q_r z_i^n$ can be constructed from the triple-interaction by summing across contractual mode j in the vector X_{irt} to obtain unity. In Table 7 we do not explicitly include $X_{irt} z_i^n$, but that variable is handled when running regression (2) across the nine different contractual modes, as in Appendix Tables A1–A3.

Table 8
Proportion of variance explained by institutional and other variables.

	Institutional variable		
	Rank	Time	Cost
Regression specification			
Without endowments or contract intensity	0.0143	0.0066	0.0148
With endowments, without contract intensity	0.0172	0.0092	0.0183
With narrow contract intensity z_i^1	0.0554	0.0443	0.0528
With broad contract intensity z_i^2	0.0422	0.0314	0.0413

Notes: This table reports the variance of the value of trade accounted for by the regression variables without fixed effects. These variances are measured by the Frisch–Waugh–Lovell (FWL) theorem, as follows: First, we regress the predicted value for institutional interactions from the first stage regression on the indicator variables and the trade–ownership interactions, and likewise for the trade values themselves (as well as interactions of factor endowment and intensity when used), and then report the R^2 of the regression of the export value residual on other residuals.

institutional quality *and* the Nunn variables. We highlight in bold the ownership type for each mode of trade that gives the high coefficients. Now we see that cases involving *foreign ownership* benefit the most from higher-quality courts, followed by joint ventures, and followed by domestic firms. The relative importance of institutional quality to foreign-owned firms is consistent across the three measures of quality (rank, time and cost), and across the Nunn narrow and broad measures. By interacting with these measures of contract intensity we are controlling for the impact of geography that influenced the results in Table 6 since identification of the coefficients via the triple-interactions in Table 7 relies on variation in contract intensity across industries *within* a province. Thus, we view these results in Table 7 as more reliable, indicating the positive impact of institutions on trade by all types of firms, and especially so for foreign firms. These findings are consistent with our argument in Section 2 that the court system in China is most important for foreign firms.

The specification in Table 7 can be generalized by running the regressions separately over the nine types of contractual mode, i.e. three types of trade regimes and three types of ownership. These regressions are shown in Appendix. Similar to Table 5, we test for the effect of institutional quality interacted with the Nunn contract intensity measure, using our instruments and controlling for factor intensity (interacted with factor endowments). The results are not quite as strong as those shown in Table 7: in Table A1, for the court variable rank, we find that foreign firms generally benefit the most from strong institutions; but the results for court time in Table A2 have weak instruments and are therefore not reliable; while the results for court cost in Table A3 show benefits for most firms, and not necessarily the greatest benefits for foreign firms.

5.1. Variance explained by institutional and other variables

With the results in Tables 6 and 7, we calculate how much of the variation in trade is explained by institutional and other variables. This is done by applying the technique described as the Frisch–Waugh–Lovell (FWL) theorem in Davidson and MacKinnon (1993, pp. 19–24), and used by Nunn (2007, p. 583). This procedure regresses the predicted value for institutional interactions from the first stage regression on the province-time and industry indicator variables and the trade-type-ownership interactions, and likewise for the trade values themselves (as well as interactions of factor endowment and intensity when used), and then reports the R^2 of the regression of the export value residual on other residuals. That will give the amount of trade that cannot be explained by the indicator variables, the trade-type-ownership interactions, and factor endowments. This residual is deemed as being "explained" by the institutional variables.

In the first row of Table 8, we find that 1.43% (i.e. about one and one-half percent) of the variance in export value is explained by court rank, in the specification reported in column (1) of Table 6. Adding the two endowment variables in column (4) of Table 6 explains a further 0.29%, or 1.72% in total. Then adding the narrow measure of the Nunn contractual intensity, in column (1) of Table 7, adds 3.82 percentage points, so that 5.54% is explained in total. If instead we use the broad measure of the Nunn contractual intensity, in column (4) of Table 7, then it adds 2.5 percentage points, so that 4.22% is explained in total.

Thus, the interaction terms between court rank with contract intensity and contractual mode (i.e. type of trade and ownership), explain 4–5% of the total variation in export values, as shown in the first column and last two rows of Table 8. Slightly lower magnitudes are obtained for the other two institutional variables we have used, court time and court cost, in the remaining columns of Table 8. Their interaction with contractual intensity and mode explains 3–5% of the total variation in exports. While not large, that estimate is very similar to what Nunn (2007) finds for the explanatory power of his index when applied across developing countries. Here, we find similar results within a country – China – using the variation in institutional quality across provinces.

6. Conclusions

Several recent papers (Levchenko, 2007; Nunn, 2007; Ranjan and Lee, 2007) provide evidence that institutional quality is important for both the volume of trade and the ability to trade in differentiated goods that rely on contract enforcement. But the limitations of the country-level data used by these authors (either U.S. imports or world trade data) means that only

indirect measures are used to identify those imports or exports that are more institutionally dependent due to their greater need for contract enforcement. In this paper, we depart from this literature by using province-level variation in institutional quality within China to identify the effects of better institutions on Chinese exports. A major advantage is that the Chinese trade data distinguishes between categories of exports (processing or ordinary) and categories of ownership (foreign or domestic) that differ in the importance of contract enforcement. We refer to these categories as "contractual modes" of exports.

Since obtaining the custom's designation for duty-free import typically requires proof of an export contract, it is natural to suppose that contract enforcement is more important for processing trade than for ordinary trade, for which no special customs declaration is required. We also hypothesize that foreign firms producing in China would be more institutionally dependent than domestic firms. We are able to calculate the Nunn index of contractual intensity with industry weights that vary appropriately depending on whether the index applies to processing or ordinary trade.

Initial regressions in Tables 4 and 5 show that the provincial data exhibits the expected relationship between institutional quality and the volume of exports: better institutional quality tends to increase the exports of more contract dependent goods based on both the Rauch (1999) classification in Table 4 and contract intensity based on the Nunn (2007) indexes in Table 5. The results for the Rauch classification are quite weak, however, compared to those for contract intensity.

Our main analysis incorporates the various contractual modes of exports. In addition to ordinary trade, we distinguish two types of processing trade: pure-assembly in which a foreign firm controls (and owns) the materials supplied to the factory in China and import-and-assembly in which the factory in China controls the purchase of materials from abroad. We also distinguish three types of ownership: domestic, joint venture and foreign.

Table 6 is estimated using a simple interaction of the various contractual modes of exports and our measures of institutional quality. We find that relative to ordinary trade by domestic firms (the omitted category), the interactions of our institutional variables, court rank and court cost (instrumented for colonial rule and enrollment in Christian missionary schools) have a significant effect in raising exports for almost all contractual modes. For import and assembly and ordinary trade, institutions have the greatest impact on exports by foreign firms, but for pure assembly we find, somewhat surprisingly, that institutions affect domestic firms the most. We provide an explanation based on the possibility that institutions are more important when there is separation of ownership and control, but our primary possibility is that the results may be affected due to an omitted factor, namely the importance of location at the coast.

We address this problem by adding a three-way interaction in which the Nunn measure of contract intensity is combined with institutional quality and contractual mode. As shown in Table 7, this three-way interaction term is positive and significant for all our measures of institutional quality and all contractual modes. Moreover, for every type of trade, including pure assembly, exports by foreign firms are most affected by the quality of institutions. Joint ventures are next most affected, followed by domestic firms. Thus, our results confirm the importance of the court system for enhancing exports of foreign firms, particularly in industries that are most reliant on contracts. The fact that variation in the quality of institutions within a country can have a significant effect on the pattern of trade underscores the general importance of institutions for trade.

Acknowledgments

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.jebo.2013.08.009.

Appendix.

See Tables A1–A3.

Table A1

Export regression with Nunn contractual intensity, 9 separate export regimes. Institutional variable: rank.

	Ordinary			Pure assembly			Import and assembly		
	Domestic (1)	JV (2)	Foreign (3)	Domestic (4)	JV (5)	Foreign (6)	Domestic (7)	JV (8)	Foreign (9)
Contract intensity: Nunn narrow measure									
Institutions × Contract intensity	0.243***	0.300***	**0.359***	0.304***	−0.002	**0.466***	**0.368***	0.287***	0.321***
	(0.06)	(0.07)	**(0.08)**	(0.10)	(0.12)	**(0.10)**	**(0.08)**	(0.08)	(0.09)
Skill × Skill intensity	2.49	1.910	−0.902	1.475	−1.759	5.920***	4.101	1.612	1.068
	(1.54)	(2.43)	(2.19)	(1.83)	(1.41)	(1.84)	(2.839)	(2.85)	(2.94)
Capital × Capital intensity	−0.752	−5.89*	−8.184***	12.691*	1.510	−23.123***	−5.154	−8.126	−16.137***
	(1.80)	(3.26)	(2.32)	(6.77)	(6.33)	(7.41)	(5.25)	(5.48)	(4.97)
First stage F-test	100	65.3	55.7	40.0	22.0	33.5	47.3	37.5	33.4
Contract intensity: Nunn broad measure									
Institutions × Contract intensity	0.153	0.261	**0.304*	0.743***	0.449*	**0.944***	0.603***	0.627***	**0.695***
	(0.12)	(0.17)	**(0.18)**	(0.20)	(0.26)	**(0.205)**	(0.18)	(0.18)	**(0.17)**
Skill × Skill intensity	2.67*	2.28	−0.61	2.53	−1.13	6.27***	4.75*	2.105	1.31
	(1.56)	(2.40)	(2.16)	(1.56)	(1.71)		(2.83)	(2.78)	(3.01)
Capital × Capital intensity	0.429	−2.54	−4.72**	13.1**	−2.40	−20.8***	−0.402	−6.32	−14.8***
	(1.69)	(3.11)	(2.20)	(6.54)	(6.32)	(7.0)	(5.27)	(5.86)	(5.16)
First stage F-test	95.1	56.5	51.8	31.4	17.2	27.1	41.4	31.2	29.3
Observations	6892	5546	5086	3511	2861	3161	4332	3807	3442
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province × Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster (Province × Industry)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Dependent variable is log(export value) by nine separate export modes. We categorize exports by industry, by trade type (pure-assembly, import-and-assembly, and ordinary exports) and by ownership of the exporter (domestic, equity joint venture, and wholly foreign owned). The panel covers 30 provinces over 1997–2007. There are three proxies for institutional quality: the rank of court efficiency, the average time used to solve a dispute, and the official costs associated with going through court procedure. All estimation is performed with instruments, which include the interaction terms of export categories with the occupancy of foreign powers (Britain, France, Russia, and multiple powers) in each province, as well as with the Christian missionary lower primary school enrollment. All regressions have province-year and industry fixed effects and also trade-type-ownership interactions. Robust clustered standard errors, by province × industry, are in parentheses. The largest, significant coefficients for Institutions × Contract intensity are in **bold**.

 * Significant at 10%.
 ** Significant at 5%.
 *** Significant at 1%.

Table A2

Export regression with Nunn contractual intensity, 9 separate export regimes. Institutional variable: time.

	Ordinary			Pure assembly			Import and assembly		
	Domestic (1)	JV (2)	Foreign (3)	Domestic (4)	JV (5)	Foreign (6)	Domestic (7)	JV (8)	Foreign (9)
Contract intensity: Nunn narrow measure									
Institutions × Contract intensity	0.042***	0.034**	**0.043***	0.019	0.000	0.006	**0.048***	0.035***	0.015
	(0.011)	(0.014)	**(0.016)**	(0.012)	(0.010)	(0.009)	**(0.015)**	(0.012)	(0.012)
Skill × Skill intensity	2.30	1.59	−1.285	0.341	−1.76	5.28***	2.48	0.669	0.615
	(1.56)	(2.44)	(2.159)	(1.90)	(1.43)	(1.84)	(3.24)	(3.37)	(2.95)
Capital × Capital intensity	−0.641	−3.97	−6.45***	16.1**	1.47	−12.8*	−1.18	−4.41	−11.0**
	(1.78)	(3.28)	(2.36)	(6.38)	(6.11)	(7.02)	(5.64)	(6.67)	(5.48)
First stage F-test	9.26	5.67	4.06	3.55	4.44	4.08	3.85	3.31	3.69
Contract intensity: Nunn broad measure									
Institutions × Contract intensity	0.035*	0.045*	**0.078**	0.074***	0.012	0.001	**0.095***	0.052***	0.047**
	(0.02)	(0.025)	**(0.03)**	(0.027)	(0.02)	(0.02)	**(0.034)**	(0.02)	(0.023)
Skill × Skill Intensity	2.28	1.43	−1.85	−0.348	−2.052	5.33***	1.85	0.347	0.128
	(1.54)	(2.35)	(2.17)	(2.17)	(1.546)	(1.87)	(3.37)	(3.21)	(2.99)
Capital × Capital intensity	0.381	−2.70	−5.28**	15.3**	0.971	−12.1*	0.331	−2.47	−12.2**
	(1.69)	(3.08)	(2.16)	(6.16)	(6.05)	(7.04)	(5.68)	(6.19)	(5.47)
First stage F-test	9.02	6.05	4.52	3.37	3.61	3.68	3.29	3.16	2.84
Observations	6892	5546	5086	3511	2861	3161	4332	3807	3442
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province × Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster (Province × Industry)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: see Appendix Table A1.

 * Significant at 10%.
 ** Significant at 5%.
 *** Significant at 1%.

Table A3
Export regression with Nunn contractual intensity, 9 separate export regimes. Institutional variable: cost.

	Ordinary			Pure assembly			Import and assembly		
	Domestic (1)	JV (2)	Foreign (3)	Domestic (4)	JV (5)	Foreign (6)	Domestic (7)	JV (8)	Foreign (9)
Contract intensity: Nunn narrow measure									
Institutions × Contract intensity	0.145[***]	**0.214[***]**	0.206[***]	0.189[***]	−0.050	**0.351[***]**	**0.262[***]**	0.132[**]	0.179[**]
	(0.05)	**(0.06)**	(0.067)	(0.07)	(0.08)	**(0.08)**	**(0.07)**	(0.06)	(0.07)
Skill × Skill intensity	2.53	2.13	−0.779	1.92	−1.99	6.42[***]	4.98[*]	1.92	1.14
	(1.54)	(2.42)	(2.23)	(1.80)	(1.47)	(1.85)	(2.62)	(2.62)	(2.92)
Capital × Capital intensity	−0.251	−4.60	−6.39[***]	14.2[**]	2.65	−19.9[***]	−0.645	−2.91	−13.2[**]
	(1.77)	(3.21)	(2.28)	(6.37)	(6.16)	(7.22)	(5.10)	(5.40)	(5.14)
First stage F-test	158	96.6	83.9	**71.4**	62.5	44.6	82.0	60.5	51.3
Contract intensity: Nunn broad measure									
Institutions × Contract intensity	0.044	0.143	0.111	0.522[***]	0.239	**0.707[***]**	**0.436[***]**	0.355[**]	0.428[***]
	(0.11)	(0.15)	(0.15)	(0.15)	(0.164)	**(0.19)**	**(0.15)**	(0.14)	(0.16)
Skill × Skill intensity	2.54	2.38	−0.674	3.59[*]	−0.753	7.34[***]	5.83[**]	2.86	1.67
	(1.57)	(2.44)	(2.19)	(1.89)	(1.72)	(1.72)	(2.67)	(2.57)	(2.99)
Capital × Capital intensity	0.454	−2.02	−4.14[*]	14.6[**]	−0.912	−18.0[***]	2.46	−2.67	−12.1[**]
	(1.69)	(3.10)	(2.21)	(6.26)	(6.10)	(6.85)	(5.24)	(5.68)	(5.25)
First stage F-test	136.3	79.4	91.3	46.3	38.4	37.6	57.6	42.3	40.3
Observations	6892	5546	5086	3511	2861	3161	4332	3807	3442
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province × Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster (Province × Industry)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: see Appendix Table A1.
[*] Significant at 10%.
[**] Significant at 5%.
[***] Significant at 1%.

References

Acemoglu, D., Dell, M., 2009. Beyond Neoclassical Growth: Technology, Human Capital, Institutions and Within Country Difference. NBER Working Paper No. 15155.

Acemoglu, D., Dell, M., 2010. Productivity differences between and within countries. American Economic Journal: Macroeconomics 2 (1), 169–188.

Acemoglu, D., Johnson, S., Robinson, J., 2001. The colonial origins of comparative development: an empirical investigation. American Economic Review 91, 1369–1401.

Acemoglu, D., Johnson, S., Robinson, J., 2002. Reversal of fortune: geography and institutions in the making of the modern world income distribution. Quarterly Journal of Economics 117, 1231–1294.

Ahn, J.B., Khandelwal, A., Wei, S.-J., 2010. The Role of Intermediaries in Facilitating Trade. Columbia University.

Allen, F., Qian, J., Qian, M., 2005. Law, finance, and economic growth in China. Journal of Financial Economics 77, 57–116.

Bai, C.-E., Hsieh, C.-T., Qian, Y., 2006. The return to capital in China. Brookings Papers on Economic Activity II.

Chen, X., Cheng, L.K., Fung, K.C., Lau, L.J., 2004. The Estimation of Domestic Value-Added and Employment Induced by Exports: An Application to Chinese Exports to the United States. Stanford University.

Cohen, J.A., Chan, Y.Y.F., Ho, Y.M., 1988. Contract Laws of the People's Republic of China. Longman, Hong Kong, Chicago.

Davidson, R., MacKinnon, J.G., 1993. Estimation and Inference in Econometrics. Oxford University Press, New York.

Djankov, S., La Porta, R., Lopez-de-Silanes, F., Shleifer, A., 2002. Courts: The Lex Mundi Project. NBER Working Paper No. 8890.

Fang, Y., Zhao, Y., 2009. Do Institutions Matter? Estimating the Effect of Institutions on Economic Performance in China. Bank of Finland Institute for Economics in Transition (BOFIT) Discussion Papers 9/2009, Available from: http://www.suomenpankki.fi/bofit_en/tutkimus/tutkimusjulkaisut/dp/Pages/dp0909.aspx (downloaded 04.06.12).

Feenstra, R.C., Hanson, G.H., 2005. Ownership and control in outsourcing to China: estimating the property-rights theory of the firm. Quarterly Journal of Economics 120 (May (2)), 729–762.

Feenstra, R.C., Spencer, B., 2005. Contractual Versus Generic Outsourcing: The Role of Proximity. NBER Working Paper No. 11885.

La Porta, R., Lopez-de-Silanes, F., Shleifer, A., Vishny, R., 1997. Legal determinants of external finance. Journal of Finance 52, 1131–1150.

La Porta, R., Lopez-de-Silanes, F., Shleifer, A., Vishny, R., 1998. Law and finance. Journal of Political Economy 106, 1113–1155.

Legislative Affairs Office of the State Council, 2001. The Legal Instruments on China's Accession to the World Trade Organization. China Legal Publishing House.

Levchenko, A.A., 2007. Institutional quality and international trade. Review of Economic Studies 74, 791–819.

Lu, Y., Png, I., Tao, Z., 2013. Do institutions not matter in China? Evidence from manufacturing enterprises. Journal of Comparative Economics 41, 74–90.

Manova, K., Zhang, Z., 2009. Export Prices and Heterogeneous Firm Models. NBER Working Paper No. 15342.

Naughton, B., 1996. China's emergence and prospects as a trading nation. Brookings Papers on Economic Activity II, 273–343.

Nunn, N., 2007. Relationship-specificity, incomplete contracts, and the pattern of trade. Quarterly Journal of Economics May, 569–600.

Ranjan, P., Lee, J.Y., 2007. Contract enforcement and international trade. Economics and Politics 19 (July (2)), 191–218.

Rauch, J.E., 1999. Networks versus markets in international trade. Journal of International Economics 48, 7–35.

Romalis, J., 2004. Factor proportions and the structure of commodity trade. American Economic Review 94, 67–97.

Stock, J.H., Wright, J.H., Yogo, M., 2002. A survey of weak instruments and weak identification in generalized method of moments. Journal of Business and Economic Statistics 20 (October (4)), 518–529.

Stock, J.H., Yogo, M., 2005. Testing for weak instruments in linear IV regression. In: Stock, J.H., Andrews, D.W.K. (Eds.), Identification and Inference for Econometric Models: Essays in Honor of Thomas J. Rothenberg. Cambridge University Press, New York (Chapter 5).

World Bank, 1994. China: Foreign Trade Reform. The World Bank, Washington, DC.

World Bank, 2008. Doing Business in China 2008, Available from: http://www.doingbusiness.org/china