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Legal environment, contract intensity, and export quality

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ABSTRACT

In this paper, we construct a simple game-theoretic model to illustrate that improvement in the legal environment can improve the quality of final products by improving the quality of intermediate products, especially in industries with higher contract intensity. Using Chinese Customs Database and Industrial Enterprise Database from 2000 to 2006, we measure the export quality at the firm-product-country level and examine the effect of the legal environment on the export quality. Our empirical study shows that the improvement in the legal environment can raise export quality, especially at firms with higher contract intensity. Further studies show that the legal environment and contract intensity affect the import decision of firms and thus have a significant impact on product quality of export firms.

1. Introduction

It is well known that product quality has significant impact on the living standard of society. However, it not until Grossman and Helpman (1991)'s construction of the quality ladder model, academics start to pay attention on the relationship between product quality and economic development. Within their theoretical framework, the ability to upgrade product quality plays a central role for economic development, and product quality upgrading is closely related to economic growth of an economy. As a result, many scholars put the overall product quality as one of the most important indices measuring the level of development of an economy (Khandelwal, 2010 ; Hallak & Schott, 2011 ; Xu, Tong, & Mao, 2015). Building on this theory, Hummels and Klenow (2005) conduct the relevant empirical analysis, and find that rich countries maintain a higher export price due to their product quality and level of development. Hallak and Schott (2011) study the quality evolution process for 43 countries and find the significant relationship between product quality and per capita GDP. It is also found that there is strong convergence of product quality across countries.

However, there are still exceptions to the above theory of the positive relationship between product quality and economic growth. For example, both Malaysia and Philipin enjoyed good increase in export quality but without enjoying the correspoinding economic growth as told by the theory. Some may think the reason might be the export quality increase in those two countries is mostly driven by the increase in the quality of imported intermediate inputs rather than increases in quality of their own domestic products. For the case of China, it is the other way around, China enjoys high growth for the past 40 years creating a growth miracle while the overall export quality does not show a significant increase as seen in the data. From Fig. 1, we can easily see this phenomenon. In Fig. 2 we use China's Custom Database from 2000 to 2006 to estimate the export quality of China. It shows a consistently higher quality as well as higher improvement in quality for precessing trade as compared to general trade. We might credit this increase in export quality to the import

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of better intermediate goods. The Chinese example might tell us China's economic growth miracle might be partially driven by engaging in price competition instead of quality competition.

Of course, China's overall economic growth also relies on vast domestic market, deepening market oriented reforms and policies that favor exports and FDIs. But as China's per capita GDP increases, the demand for high quality products also increases; the trade environment for export will also deteriorate, with more and more trade conflicts with foreign countries, the price competition trade policy comes to a dead end. Therefore, improving product quality becomes a key factor to achieve long run sustainable growth for the economy. Then, what are the factors hindering the improvement of product quality especially in export quality? Are there any systemic and institutional constraints for the improvement of export quality? If there are, can we indentifying the channels and mechamism through which those factors affecting the export quality? The answers to those question require both theoretical and empirical investigation.

In recent years, an increasing number of scholars have emphasized the relationship between institutional quality and long-term economic growth (e.g., Acemoglu, Antràs, & Helpman, 2007; Acemoglu, Gallego, & Robinson, 2014; Acemoglu, Johnson, & Robinson, 2005; Dixit, 2009; Helpman, 2009; La Porta, Lopez-de-Silanes, Shleifer, et al., 1998), writing that a good institution can promote long-term economic growth by promoting technological progress, increasing the accumulation of human capital and physical capital, deepening the division of labor, and so on. The institutional system, as an important external environment for economy, affects all aspects of an economy, and inevitably affects the quality of products. The effective implementation of a contract depends not only on whether there are laws to be followed but also on whether the laws can be effectively enforced. Although the laws promulgated by the government are implemented in China, its existing legal environment is not perfect. As a result, contract enforcement significantly differs between provinces and cities in China. As the World Bank (2008) report Doing Business in China 2008 points out, "The efficiency of the litigation system varies significantly across China. As with other indicators studied by Doing Business in China, coastal areas on average perform better than other areas. It takes an average of 230 days to enforce a contract in courts in the southeast. The same process takes 363 days in the northeast." Fan, Wang, and Zhu (2011) also pointed out in the NERI INDEX of Marketization of China's Provinces 2011 Report that, although the formulation and promulgation of laws are consistent across regions, law enforcement and government efficiency vary greatly among regions because of variation in the degree of reform, and together they caused great variation among regions in the development of the legal environment and intermediary organizations. If the legal environment improves the quality of export products, it means, on the one hand, that we can further deepen the supply-side reform by improving the legal environment and improve China's level of economic development and, on the other hand, that by improving the legal environment we can reduce differences in regional development.

The differentiation among regional legal environment provides us with good samples to study the relationship between legal environment and export quality. Provincial-level data has shown the following characteristics about the legal environment and export quality: (1) Fig. 3 shows that legal environment and export quality have a significant positive relationship. (2) Industry-level heterogeneity of the relationship of export quality and legal environment. We study this relationship based on the contract intensity of the industry. Fig. 4 shows that for high contract intensity industries the relationship is much stronger than that of low contract intensity industries. This means an improvement of legal environment might have bigger impact on average export quality for high contract intensity industries. (3) The relationship also exhibits heterogeneity across regions. Fig. 5 shows that a significant positive relationship exists in the eastern regions, while no significant relationship exists for the central and western regions.

Based on the above stylized facts, we study the effects of legal environment and contract intensity on export quality. This has

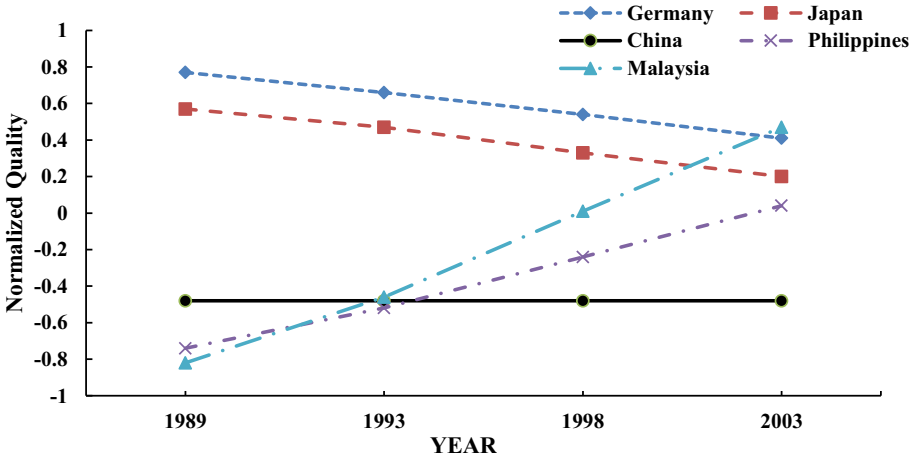

Fig. 1. Cross country difference in normalized quality (1989–2003).
Note: Data form Hallak and Schott (2011) Table IV. This Figure shows three types of economies with different slopes of quality curve among 43 countries. Type I, countries maintained stable and high export quality, such as Japan and Germny; Type II, countries with good improvement in export quality but not with impressive growth of the overall eonomy, such as Malaysia and Philippines. Type III, countries that enjoy high economic growth but without much export quality improvement, with China as a typical example.

important significance about construction of quality institutions. First, China has enjoyed high-speed growth without too much emphasis on the quality of growth. Export quality is an important indicator of the overall quality and level of development thus of interest of research. Second, legal environment quality helps to improve contract execution and enhance economic cooperation thus has significance on the quality of development and growth. On the one hand, the division of labor becomes more specialized in the economy as it develops and it demands more and more smooth cooperation among different entities, this requires good institutions to provide quality services. On the other hand, as specialization deepens in an economy, contract intensity will also increase, thus the study of legal environment and contract intensity on export quality has implications on industry upgrading to move along the ladder of development. It should be noted that there have been some existing studies on legal environment and contract intensity on export quality.

Essaji and Fujiwara (2012) and Yu, Cui, and Zhang (2016) are the closest studies on this topic, they both studied the relationship of legal environment and contract intensity on export quality. Our study is different from theirs in the following two major variations:

First, we study the problem in the framework of incomplete contracts by employing the theoretical framework developed by Lu, Ng, and Tao (2012) and constructed a game theoretical model to study the underlying mechanism of how legal environment can influence export quality. In our model, the final goods producer must purchase a specialized intermediate good to produce the final goods, the quality of the intermediate good is not publically verifiable by the court, and the contract is incomplete, thus the final good producer may be able to take advantage of this situation to hold up the intermediate good producer. With better legal environment, the intermediate input producer may be able to better protect itself. Hence, improving legal environment, intermediate good producers may have a stronger incentive to improve product quality thus improving the quality of the final goods. The more frequent usage of such intermediate goods, the bigger impact on the quality of the final goods.

Second, Essaji and Fujiwara (2012) and Yu et al. (2016) both use industry-level data. But we combine micro-level data and regional-level data to give us some certain advantages. The use of firm-level data allows us to address heteroskedasticity of the relationship across different types of firms, for example, the difference across types of exports, ownership structures, and regions respectively. In addition, firms may use import inputs substitute for local intermediate goods, this behavior is shown up in the input import volume and quality of firms, thus providing the possibility of studying the relationship of legal environment, contract intensity on export quality at a much deeper level to get a better picture. Also, the regional level data has given us an advantage over country-level data analysis. It is well known that there are significant differences in the level of development of legal institutions across different regions in China. The eastern part of China have much better legal institutions than the central and western part, thus provide a good sample studying the impact of high-quality legal institution on the economy. Furthermore, by using different regional data within the same country relieves us from the difficulty of controlling the effects of cultures and politics that exist naturally on the country-level data. Finally, micro-level data avoid the endogenous problem because micro firms are takers of the institutional environments and is difficult to affect the legal environment. Overall speaking, macro-level data tends to have significant impact on micro-level data not the vice versa.

Our main contributions to the literature are as follows. First, by constructing a game model under perfect information, this paper proves that improvement in the legal environment can raise the quality of intermediate products and then that of final products. The higher the contract intensity is, the more that the product quality will be improved. Second, most previous studies focus on the impact of the legal environment on the export volume. Essaji and Fujiwara (2012) and Yu et al. (2016) study the impact of the legal environment on the export quality of different contract-intensive industries using data on American industrial imports and global industrial exports respectively, but they reach different conclusions. This paper studies the impact of the legal environment on the export quality from the micro perspective of enterprises, finding that improvement in the legal environment can enhance the export quality of firms

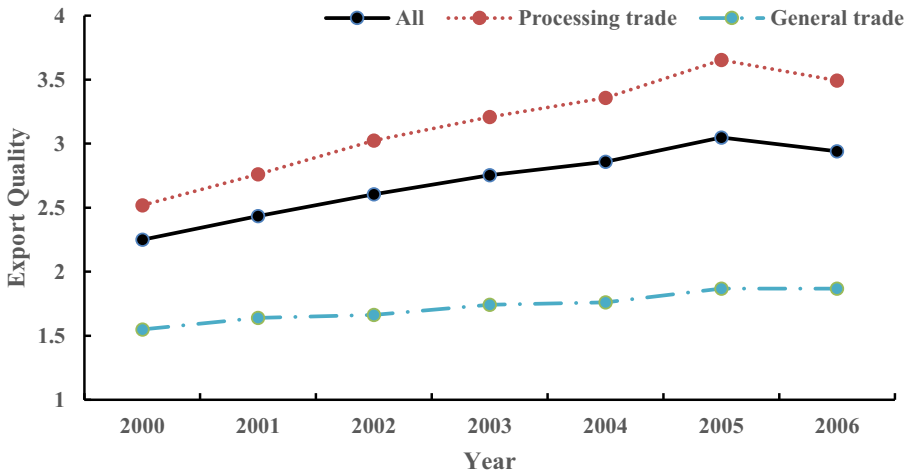

Fig. 2. Export quality in China(2000–2006).
Note: Export quality is calculated from data in the Chinese Custom Database weighted by export value. The details of the calculation method are shown in the paper.

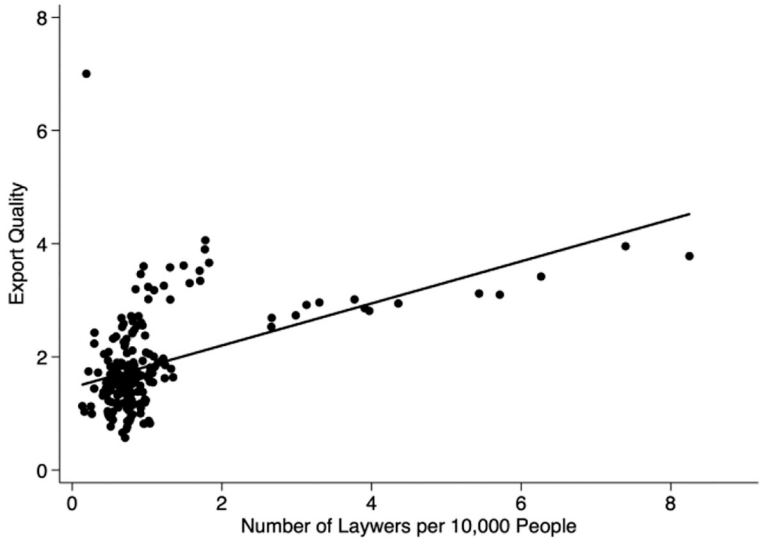

Fig. 3. Legal environment and export quality.
Note: (1) Number of lawyers per 10 k residents as the variable for legal environment, data from 2000 to 2006 *Statistical Year Book of Lawyers in China* and *Statistical Year Book of China*; (2) Export quality is calculated from data in the Chinese Custom Database weighted by export value. The details of the calculation method are shown in latter text.

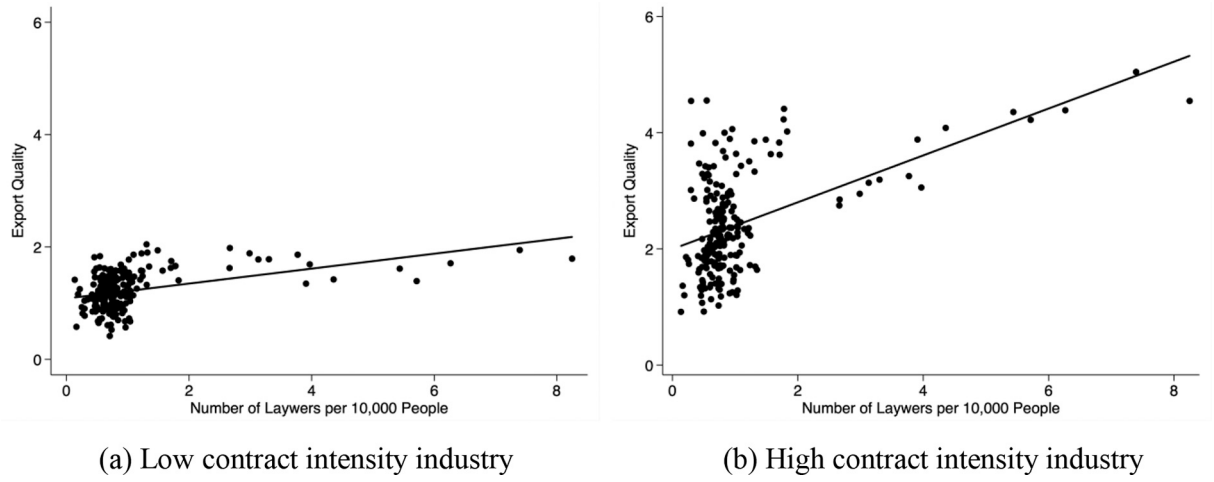

Fig. 4. Industry-level heterogeneity of the relationship of legal environment and export quality.
Note: (1) Number of lawyers per 10 k residents as the variable for legal environment, data from 2000 to 2006 *Statistical Year Book of Lawyers in China* and *Statistical Year Book of China*; (2) Export quality is calculated from data in the Chinese Custom Database weighted by export value. The details of the calculation method are shown in latter text.

with higher contract intensity, thus enriching the existing research. From the firms' micro point of view, we find that the impacts differ significantly for firms in different regions and ownership structure, we also find that they can also influence firms' import behavior thus further affect export quality.

The rest of the paper proceeds as follows. In Section 2, we summarize the literature, and Section 3 we describe the econometric model; then in Section 4 we describe the data, in Section 5 we analyze the regression results, Section 6 contains the study of the transition mechanisms of the influence of legal environment and contract intensity on import volume and quality and further on the export quality, with the conclusion in Section 7.

2. Literature review

Institutional quality, as an important external environment for economic activities, affects all aspects of an economy and inevitably affects the quality of products. However, the current researches about the impact of institutional quality on export are focused on the

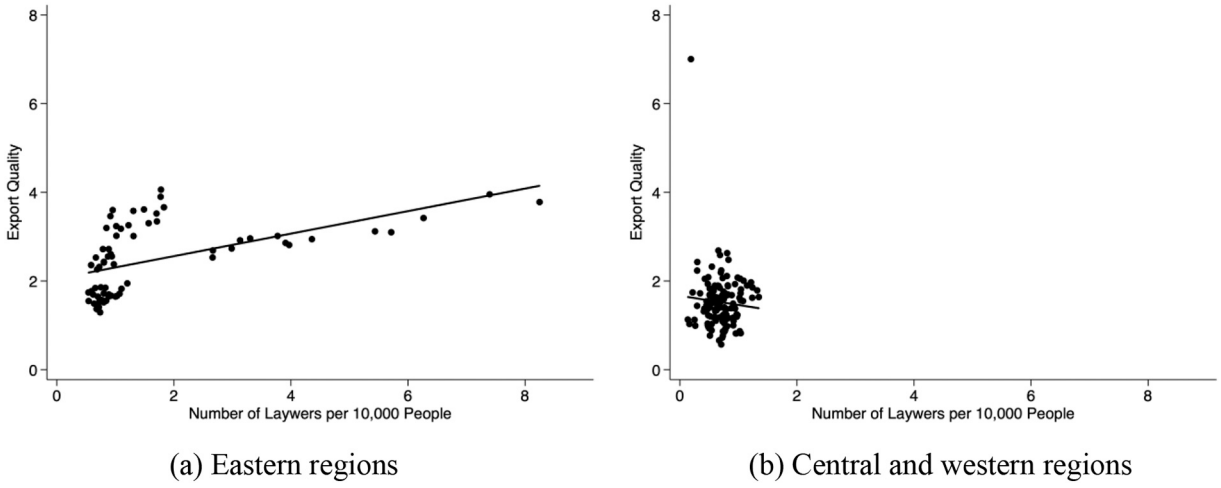

Fig. 5. Regional difference in the relationship of legal environment and export quality.
Note: (1) Number of lawyers per 10 k residents as the variable for legal environment, data from 2000 to 2006 *Statistical Year Book of Lawyers in China* and *Statistical Year Book of China*; (2) Export quality is calculated from data in the Chinese Custom Database weighted by export value. The details of the calculation method are shown in latter text.

impact of institutional quality on the export volume of a country or a region (e.g., Huang, Min, & Bao, 2013; Levchenko, 2007; Li & Wang, 2010; Nunn, 2007), viewing institutional quality as the source of comparative advantage of a country or region, and found that the influence of institutional quality on export has exceeded that of capital, human capital, and natural endowment (Nunn, 2007). The theoretical basis of this literature incomplete contract theory, developed by Williamson (1985), Grossman and Hart (1986), and Hart and Moore (1990). The theory of incomplete contracts points out that a contract is incomplete because of limited rationality, information asymmetry, or a contingent event. Because of the high sunk cost of relationship-specific investment and the incompleteness of the contract, investment cannot be written into the contract ex ante or be verified by a third party ex post. As a result, investors are exposed to the risk of hold-up in the course of subsequent negotiations. When the risk of hold-up is expected, the investor underinvests ex ante. When the relationship-specific investment is needed in the production of intermediate inputs, the incompleteness of contracts leads to insufficient investment, which raises the cost of final products. Because countries or regions with better contract enforcement faced with a smaller problem with underinvestment, these countries or regions have a comparative advantage in producing goods with high dependence on a specific investment. Levchenko (2007) first extended this view to international trade, expounding on the mechanism of the effect of contract enforcement on comparative advantage, and pointed out that different industries have different degrees of dependence on contract enforcement because of the different levels of contract intensity. The cost of producing goods with high contract intensity is lower in countries with higher efficiency of contract enforcement or higher institutional quality, and so contract enforcement or judicial quality can be regarded as a source of comparative advantage, thus affecting the trade structure of a country or region. Using the Herfindahl Index to measure the dependence on institutions or contracts of different industries, Levchenko (2007) found that countries with better contract enforcement or judicial quality export more contract-intensive products. Nunn (2007) constructed a contract intensity index for different industries and found that countries with better contract enforcement export more products with higher contract intensity. And he showed that the effect of contract enforcement exceeds the effect of human capital and physical capital. Li and Wang (2010), using data on 28 industries in various provinces and cities in China, concluded that regions with better judicial quality tend to specialize in producing and exporting products with higher contract intensity. Huang et al. (2013) also found that China's special economic zones have more comparative advantages in contract-intensive industries.

Does legal environment improve product quality? McMillan (1990), Bakos and Brynjolfsson (1993) consider stringent contract enforcement by Japanese *keiretsus* as the crucial determinant of superior Japanese quality. Lu et al. (2012), using data on 2400 manufacturing enterprises in China, showed that better contract enforcement can significantly improve the quality of final products, and firms located in provinces with better contract enforcement produce higher-quality products. However, these papers have not examined the impact of institutional quality on export quality in different industries. Kugler & Verhoogen, 2012 suggested that an improvement in final product quality requires the use of more sophisticated and higher-quality intermediate inputs. Essaji and Fujiwara (2012) argued that the production of sophisticated inputs requires greater collaboration between suppliers and final goods producers, with suppliers developing relationship-specific inputs and final goods producers customizing their production processes to incorporate them. In countries with poor legal institutions, relationship-specific investments are needed to achieve strong collaboration, and by extension more sophisticated inputs and higher-quality outputs, but will arguably be hard to achieve. They used import data from 1989 to 2006 and contract intensity to measure the reliance on customizable inputs to examine the impact of institutional quality on the export quality in different industries and found that for industries that use more customized inputs, countries with better contract enforcement produce a higher-quality final product. However, Yu et al. (2016) found that judicial quality is positively correlated with average export quality, but is unrelated to the contract intensity of industry.

By summarizing the literature, we can find that although the current research on the quality of export products has gradually become the leading edge in international trade theory, few studies have been conducted on the impact of legal institution on export quality. In particular, Essaji and Fujiwara (2012) and Yu et al. (2016) reached different conclusions in their respective research. In addition, as Melitz (2003) emphasizes, export trade is essentially a rational decision made by heterogeneous enterprises based on their own profit maximization goal, thus research on the export behavior of enterprises is more persuasive. Considering this, we make use of firm data from China to study the influence of institutional quality (legal environment) on export quality at enterprises with different contract intensities.

3. Theoretical model and hypotheses

Based on the theoretical model of Lu et al. (2012), this paper studies the impact of the legal environment on product quality in different industries. In the model, the final products producer orders high-quality intermediate inputs from the intermediate input supplier; because intermediate input is relationship specific, the government and other third parties have difficulty observing the quality of the input. Thus, intermediate input is contract dependent, and the contract is incomplete. Then there is a "hold-up" problem, the final products producer can easily "hold up" the supplier. When the final products producer and the supplier have disputes over the quality of intermediate inputs, given the exogenous legal environment, suppliers of high-quality input will be in a better situation. Therefore, the better the legal environment is the more motivated the supplier is to improve the quality of input; thus, improvement in the legal environment can improve the quality of intermediate products. Finally, a better legal environment will promote final product quality, especially in industries that need more contract-dependent inputs.

3.1. Theoretical model

3.1.1. Intermediate input quality

The final goods producer needs two kinds of intermediate inputs: the first is non-contract-dependent intermediate input, which can be purchased in the market freely and with no difference in quality; the second is contract-dependent intermediate input, which cannot be purchased in the market and needs to be customized by the intermediate input supplier, with heterogeneous quality. Assuming that the final goods producer in g industry needs 1-z_g non-contract-dependent intermediate input and z_g contract-dependent intermediate products, where $z_g \in [0,1]$ and measures the contract intensity of industry g.[1] For simplicity, assume that contract-dependent input has only two states: high quality H and low quality L. The probability that the input is high quality is π, and the probability of low quality is 1-π, where $\pi \in [0,1]$. So, π measures the quality of contract-dependent input. Because no difference is found in the quality of non-contract dependent input, the quality can be expressed as $\bar{\pi}$.

3.1.2. Production of contract-dependent input

It is assumed that the production cost of contract-dependent input is $c(\pi)$, which is continuous and differentiable, and satisfies $c(0) = 0$, $c(1) = \infty$, $c'(0) = 0$, $c'(1) = \infty$; $c'(\pi) > 0$ and $c''(\pi) > 0$ hold when $\pi > 0$. We assume that the value of high-quality input to the final product producer is 1, and that of low-quality input to the final product producer is 1-α, where $\alpha \in (0,1)$.

The production of contract-dependent input has two stages: first, in stage 0, the final products producer and the intermediate input supplier sign a contract, and the final products producer orders high-quality contract-dependent input from the supplier, promising to pay the supplier remuneration T, whereas it costs supplier c (π) to produce this input. After the input is produced, both the final products producer and the supplier can observe the quality of input, but the government and third-party organizations cannot. Therefore, the contract is incomplete.[2] Then, in stage 1, the supplier delivers the input to the final products producer, who pays the supplier T. But they may dispute the quality of the input and then resort to legal action or settle the dispute through negotiation. Without loss of generality, assume that the litigation cost for both of them is C. If the court rules that the input is of low quality, the supplier needs to compensate for the loss of the final product producer α. Because the court has difficulty in observing the quality of the input, the producer of final product still has an opportunity to bring a legal action to obtain compensation from the supplier. We assume that the probability of a trial rules right by the court is θ, where θ measures the local legal environment. The greater θ is, the higher the probability of a trial rules right by the court, where $\theta \in (0.5, 1]$. We assume that the cost of negotiation between the final products producer and the supplier is 0 and resolving disputes in the courts requires additional litigation fees. If both of them fully understand the outcomes of a trial, the optimal solution (equilibrium) for them is to solve the dispute through negotiation.

To reach equilibrium in this game, this paper uses the inverse inference method. First, consider the case in which the input is of low quality. The court has a probability θ of judging it as low in quality, and, if so, the supplier needs to compensate the final products producer for their loss α. In this case, the expected return of the supplier is $T - \theta\alpha - C$, and the expected return of the final products producer is $1 - \alpha - T + \theta\alpha + C$. If that the final products producer and the supplier negotiate at a cost of 0, and the final products producer and the supplier are aware of the expected return after the court decision, then the dispute between them does not need to

[1] For convenience, hereinafter we omit subscript g, in order to study the impact of quality changes in contract-dependent intermediate products on the final product quality in different industries.

[2] According to incomplete contract theory, in the real world contracts are incomplete for the following three reasons: (1) it is difficult to predict all possible states in the future; (2) it is difficult to describe all possible states in the future even if the future states can be predicted; (3) even if it is possible to describe the states in the future, they are still difficult for third parties to verify.

rely on the court. The final products producer and the supplier only need to negotiate to solve the dispute, by having the supplier pay the final products producer T^L. At this time, the supplier's profit is $T - T^L$, and the final products producer's profit is $1 - \alpha - T + T^L$. We assume that the negotiation between the final products producer and the supplier is a Nash negotiation, and the two sides have the same negotiating power, then T^L is determined by the following maximization problem (Nash product):

$$\max_{p^L}\left[\left(T - T^L\right) - (T - \theta\alpha - C)\right]\left[\left(1 - \alpha - T + T^L\right) - (1 - \alpha - T + \theta\alpha - C)\right] \tag{1}$$

Therefore, $T^L = \theta\alpha$.

If the input is of high quality, then the court judges the input as low quality by probability $1-\theta$, and the supplier needs to pay the final products producer α. In this case, the expected return of the supplier is $T - (1 - \theta)\alpha - C$, and the expected yield of the final products producer is $1 - T + (1 - \theta)\alpha - C$. Similarly, if negotiations take place between them, the dispute can be settled by the supplier paying T^H to the final products producer. At this time, the supplier's profit is $T - T^H$, and the profit of the final products producer is $1 - T + T^H$. Under the same assumptions, T^H is determined by the following maximization problem:

$$\max_{p^H}\left\{\left(T - T^H\right) - [T - (1 - \theta)\alpha - C]\right\}\left\{\left(1 - T + T^H\right) - [1 - T + (1 - \theta)\alpha - C]\right\} \tag{2}$$

$T^H = (1-\theta)\alpha$ can be obtained.

Realizing all these problems, the supplier produces an intermediate input with quality π and production cost $c(\pi)$ to maximize the expected profit. The maximization problem of the supplier is:

$$\max_{\pi}\Pi = T - \pi T^H - (1 - \pi)T^L - c(\pi) \tag{3}$$

The first-order condition for the maximization problem of the supplier is:

$$c'(\pi) = (2\theta - 1)\alpha \tag{4}$$

Eq. (4) shows that the quality of the input is a function of the legal environment and can be expressed as $\pi(\theta)$. In addition, it shows that when $\theta \leq 0.5$, the legal environment is inefficient. In this case, the supplier will not produce.

$c'(\pi) > 0$ and $\theta \in (0.5,1]$ indicate that improvement in the legal environment can improve the quality of intermediate input, that is, $\partial\pi(\theta)/\partial\theta > 0$. On one hand, $T - \pi T^H - (1-\pi)T^L$ represents the expected return for suppliers, which can be rearranged as $T - \theta\alpha + (2\theta - 1)\pi$. As $\theta \in (0.5,1]$, showing that the higher the product quality is, the higher is the expected return of the input. On the other hand, the higher the quality of the input is, the higher the production cost. The suppliers choose between the increasing expected return and the increasing production costs from improving the quality of input.

3.1.3. Quality of the final product

We assume that the quality of the final product is determined by both the quality and quantity of the inputs, the quality of the final product can be expressed as:

$$\begin{aligned}\lambda(z, \pi(\theta)) &\equiv \lambda(z, \theta) \\ &= \tau\int_0^z \pi(\theta)d\xi + (1 - \tau)\int_z^1 \bar{\pi}d\xi \\ &= \tau z\pi(\theta) + (1 - \tau)(1 - z)\bar{\pi}\end{aligned} \tag{5}$$

where ξ represents intermediate input. As the quality of different kinds of intermediate inputs may have different effects on the quality of the final product, the weight τ is introduced in Eq. (5), where $\tau \in (0,1)$.

Previous assumptions and Eq. (5) lead us to obtain the following propositions.

Proposition 1. A good legal environment can ameliorate the final products quality by improving the quality of contract-dependent intermediate input, namely:

$$\frac{\partial\lambda(z,\theta)}{\partial\theta} = \tau z\frac{\partial\pi(\theta)}{\partial\theta} \geq 0 \tag{6}$$

Proposition 2. A good legal environment can improve the final products quality, especially in industries that use more contract-dependent intermediate inputs, namely:

$$\frac{\partial^2\lambda(z,\theta)}{\partial\theta\partial z} = \tau\frac{\partial\pi(\theta)}{\partial\theta} > 0 \tag{7}$$

3.2. Hypothesis

From the above theoretical model under incomplete contracts, if the upstream firm produced a higher quality intermediate good, it can protect its interest better in case of a legal dispute under better legal environment. Thus, a better legal environment can encourage firms to improve intermediate good quality and enhance cooperation among intermediate good producer and final good producers. To the final good producer, the more frequent this happens the heavier reliance on a better legal environment.

Based on these propositions, it is not difficult to propose the following hypothesis:

Hypothesis 1. Improvement in the legal environment can improve the quality of export products of plants that use more contract-dependent intermediate input (much higher contract intensity).

Differences in the structure of ownership is a typical feature of the Chinese economy. The legal environment may be different for export products from plants under different types of ownership structure. China has not only imperfect contracts in the general sense but also contract discrimination based on ownership structure, where the contract implementation environment is significantly worse for private enterprises than state-owned enterprises (SOEs), HMT enterprises (Hong Kong, Macao and Taiwan) and foreign-funded enterprises (Brandt & Li, 2003). On the one hand, China's SOEs have a "natural connection" with the government, and the judicial system also relies on government appointments and budgets, thus creating a more favorable legal environment for SOEs (Gan, Zou, & Wang, 2015; Ma, Shi, & Luo, 2015). On the other hand, since the reform and opening up, local governments across China have adopted various ways to attract investment and foreign investors to invest in China. As a result, private enterprises are treated as second class entities as compared to SOEs, HMT and foreign funded firms. To correct this systemic bias, the state council issued in 2005 and 2010 relevant regulations to explicitly protect the legal rights of private firms, however, we have to wait to see the outcome of their implementation (Yang, 2012). In the 2003 World Bank *Investment Climate Surveys*, SOEs, HMT and foreign enterprises are more likely to believe they will be fairly treated by the court system as compared to private firms. Although the legal environment for private enterprises has improved somewhat it is still worse than that of HMT and foreign enterprises (Wang & Sheng, 2012). It also seen from the same survey that private enterprises are more likely to resort to out of court procedures (such as negotiation, arbitration) to resolve their disputes as compared SOEs, HMT and foreign enterprises, leading to insensitivity of private enterprises responding to the change of legal environment. Based on this analysis, this paper proposes the following hypothesis:

Hypothesis 2. Improving the legal environment may have a greater impact on the quality of export products of SOEs, HMT enterprises and foreign-funded enterprises than of products of collective enterprises and private enterprises.

The legisiative system is under the leadership of the central government, ie, people's congress, state council, laws are applied to all regions within the country. Local regions may have lacal laws, but only play a secondary role. Therefore, the set of laws in each region are very similar to each other. However, the implementation of laws in different regions could vary a great deal due to difference in the level of social and economic development, this is the major source of heterogeneity of legal environment across different regions. According to the *NERI Index of Marketization of China's Provinces 2011 Report*, the legal environment in China has improved, but the implementation of the same set of laws remains different in different regions. The legal environment is significantly better in eastern China than in central and western China. The World Bank report *Doing Business in China 2008* also shows that contract execution efficiency is significantly higher in the eastern coastal areas than in the central and western regions. The legal environment is much higher in the eastern region than in the central and western regions, including the efficiency of contract enforcement. As compared to western regions, the capital and labor markets in the eastern region is much bettter developed so that firms can find almost all the needed inputs in the market with reletively lower cost as compared to the west, this leads to a lower overall production cost in the east part. Without loss of generality, we assume the intermediate good producers cost function in the two regions are respectively,$c^e(\pi) = A^e c(\pi)$, $c^{cw}(\pi) = A^{cw} c(\pi)$ with $A^e < A^{cw}$, that is the east incurs a lower cost to produce the same intermediate good. From (4) we obtain:

$$A^e c^{'}(\pi) = (2\theta - 1)\alpha$$

$$A^{cw} c^{'}(\pi) = (2\theta - 1)\alpha$$

Differentiate with respect to θ to get:

$$\frac{\partial \pi^e}{\partial \theta} = \frac{2\alpha}{A^e c^{'}(\pi)}$$

$$\frac{\partial \pi^{cw}}{\partial \theta} = \frac{2\alpha}{A^{cw} c^{'}(\pi)}$$

Since $A^e < A^{cw}$and $c^{'}(\pi) > 0$, we know $\frac{\partial \pi^e}{\partial \theta} > \frac{\partial \pi^{cw}}{\partial \theta}$. Which means better legal environment produces a bigger impact in the eastern region than in the central and western region. As stated before, improving the legal environment provides intermediate good producers with better incentive to gain more by producing better quality output. It is in this process of improving output quality the east gained its access to better inputs and better tehnology as compared to the western region, therefore, the cost for improving quality is lower in the eastern region, inducing a faster improvemnet of quality.

Based on this analysis, this paper proposes the following hypothesis:

Hypothesis 3. Enterprises located in the eastern regions are more likely affected by the legal environment than enterprises in the

central and western regions of China.

4. Methodology and data

4.1. Methodology

This paper examines the quality of export products, with data for two dimensions (regions and industries), while the export quality is affected by the regional legal environment and industry contract intensity. This article follows Nunn (2007), which estimates using the interaction term of contract intensity and legal environment. The first to use this method were Rajan and Zingales (1998), who used this approach to study the relationship between financial development and industrial growth. Later, many scholars adopted this method to study the relationship between institutional quality and national comparative advantage. (Nunn & Trefler, 2014). The specific measurement model is as follows:

$$log\lambda_{ijct} = \alpha_0 + \alpha_1 \times z_g \times legal_{st} + \alpha X_{it} + \kappa_{st} + \chi_{jc} + \eta_{ct} + \varepsilon_{ijct} \tag{8}$$

where i, j, c, t are plant, product, destination country, and time, and g is the industry of product j. s is the region of plant i; $\log\lambda_{ijct}$ is the logarithmic export quality; z_g is contract intensity of the industry; $legal_{pt}$ is the proxy variable for the legal environment of the region; and X_{it} is the control variable for all other companies. Following Kugler & Verhoogen (2012), this paper adds to the regressions a fixed-effect η_{ct} at the country-time level to control for the influence of importing countries' income, exchange rate, and other factors and adds a product-country fixed effect χ_{jc} to control for the preferences of importing countries. Nunn (2007) and other papers use cross-sectional data to incorporate the national or regional fixed effects and control for the direct impact of the institutional system on the dependent variables. Because of significant improvement in the legal environment in various regions in China within the sample interval, simply adding regional control variables may result in deviation of the regressions. Based on this, this paper adds the province-time fixed effect κ_{st} to the regression to control for the direct impact of the legal environment in various regions of China. We expect the regression coefficient $\alpha_1>0$, as according to the data specification in this paper, $\alpha_1>0$ means that the improvement in the legal environment can improve the export quality in industries with higher contract intensity. This paper does not control for the fixed effects of plants. Kugler and Verhoogen (2012), Fan and Guo (2015), and Yu et al. (2016) did not control for individual fixed effects when studying the factors that affect the quality or price of export products. Fan and Guo (2015) pointed out that adding enterprise fixed effects may deviate from the focus of research.

4.2. Variables

4.2.1. Product quality

Following Khandelwal, Schott, and Wei (2013), Fan, Li, and Yeaple (2015), and Shi (2013), using ex post reasoning, we calculate the quality of export products of the enterprises by export prices and volumes. We assume the utility of a country's consumers is as follows:

$$U = \left(\int_{j\in\Omega} (\lambda_c(j) x_c(j))^{\frac{\sigma-1}{\sigma}} dj \right)^{\frac{\sigma}{\sigma-1}} \tag{9}$$

where c is the country, $\lambda(j)$ is the quality of product j, $x(j)$ is the consumption of product j, σ is the elasticity of substitution between products, and Ω is the overall product collection. Then demand for the product can be expressed as:

$$q_c(j) = \lambda_c^{\sigma-1}(j) p^{-\sigma}(j) P_c^{\sigma-1} Y \tag{10}$$

In this case, the export volume of a business can be expressed as:

$$q_{ijct} = \lambda_{ijct}^{\sigma-1} \frac{p_{ijct}^{-\sigma}}{P_{ct}^{1-\sigma}} Y_{ct} \tag{11}$$

where q is the quantity of export products, p is the price of the product, P is the price index of the destination country, and Y is the total consumption of the destination country. Taking the logarithm on both sides of the equation, we use ordinary least squares (OLS) regression to estimate the quality of export products:

$$logq_{ijct} + \sigma logp_{ijct} = \varphi_j + \psi_{ct} + \mu_{ijct} \tag{12}$$

where ψ_c is a fixed effect at the country-time level, which controls for the income and price level of the destination country; φ_j is the fixed effect of the product, which controls for the statistical difference of product price and sales volume in different countries; μ_{ijc} is the residual. The residuals contain quality information at the plant-product-country-time level. The economic meaning of Eq. (12) is: given the price of a product, the higher the quality of the product is, the greater the export volume will be and the greater the market share. The quality of the exported product can be expressed as:

$$log\widehat{\lambda}_{ijct} = \frac{\widehat{\mu}_{ijct}}{\sigma - 1} \tag{13}$$

According to Xu et al. (2015), Fan and Guo (2015) and Fan et al. (2015), in estimating Eq. (12), calculate the product elasticity of substitution value for each HS2 sub-division and estimate the quality of the export product at the HS6 sub-division.[3] Because the measurement units of some products under HS6 are different, the same products with different measurement units are incomparable. Therefore, the same products with different measurement units are defined as different products.[4] In addition, different from Xu et al. (2015), we considered the specialty of processing trade, we added a control variable of trade types to control nature of the firms engaging in international trade.

4.2.2. Legal Environment

Effective implementation of a contract depends not only on whether there are laws to rely on but also on whether the laws can be effectively enforced. The improvement in the legal environment can effectively enhance the efficiency of contract enforcement, but the legal environment is difficult to measure directly. Drawing on the research of Hasan, Wachtel, and Zhou (2009) and Chen, Wei, and Xiao (2013), we use the existence of legal professionals as a proxy variable for the quality of legal proceedings and legal content to measure the regional legal environment. Hasan et al. (2009) point out that the increased presence of legal professionals in a province is an indicator of the both the development of legal institutions and of the mechanisms for the law enforcement. We recognize the existence and number of legal professionals reflects the level of justice and contract execution and may represent the legal environment within the region. This variable is the number of lawyers (including full-time and part-time lawyers) per 10,000 people in each province and city. The data come from the statistical yearbooks of various provinces and cities in the country and the *Chinese Yearbook of Lawyers*.Table 1 provides descriptive statistics for the provinces and cities in China for 2000–2006. We can see for those years China's legal environment keeps improving, overall speaking, despite regional differences remain all the time. See details in Table A2 in the appendix. To ensure the robustness of results, we also tried the number of suits as the control variable, which is correlated with contract execution efficiency.

4.2.3. Contract intensity

Considering the availability of data, the measurement of contract intensity uses the data in Nunn (2007). According to Rauch (1999), Nunn (2007) divided production factors into three categories according to the degree of marketization of transactions: if the factor inputs are sold on an exchange, then the factor's trading market is thicker, this element is not specific, and the risk of being ripped off can be avoided; if the input is not traded on an exchange but is reference priced in trade publications, then the thickness and specificity of the market are at an intermediate level; if the intermediate input is neither traded on the exchange nor reference priced in trade publications, then that element is specific, and the use of the factor is susceptible to “hold-up.” The intermediate input types and usage ratios used in each industry's production are calculated with the US input-output table in 1997, and the contract dependence indicators are calculated using the following methods:

$$z_{1g} = \sum_h \theta_{gh} R_h^{neither} \tag{14}$$

$$z_{2g} = \sum_h \theta_{gh} \left(R_h^{neither} + R_h^{reference} \right) \tag{15}$$

Where $\theta_{gh} = u_{gh}/u_g$ indicates the ratio of the input amount of department h used by department g in total input, and $u_g = \sum_h u_{hg}$indicates the sum of the inputs of all the departments used by department g. $R_h^{neither}$indicates the proportion of products in which department h is traded neither on the exchange nor by reference price; $R_h^{reference}$indicates the proportion of products in department h that are not traded on the exchange but have reference prices. These two indicators reflect the contract intensity of the intermediate inputs of industry g. The higher the value is, the higher the contract intensity of the industry indicated is and therefore the more susceptible it is to an incomplete contract.

The contract intensity index across industries is shown in appendix table A1.

4.2.4. Control variables

To deal with the impact of the heterogeneity of plants on the quality of export products, this paper adds micro-variables that may affect the quality of export products. To prevent a possible causal relationship between control variables and dependent variables, some control variables are selected that lag one phase value. The specific control variables are as follows.

Total Factor Productivity (L.ln*TFP*): Johnson (2012) analyzed the relationship between the quality of export products and the productivity of plants. The analysis shows that high-productivity companies choose to produce high-quality products. Fan and Guo (2015) also found that the quality of export products is positively correlated to productivity.

Human Capital (L.ln*wage*): Because of the lack of statistics on the education level of employees at the plant level, we use wage payments. The human capital of the labor force is measured by the logarithm of the division of total wage payments by the average number of employees in a calendar year.

Capital intensity (L.ln*CI*): The capital intensity of a firm is measured by the logarithm of the ratio of the average annual net fixed

[3] The data used in this paper is at the HS6 level. In order to avoid the loss of sample size during data merging, the substitute elasticity at the HS2 level is used. Fan et al. (2015), and Fan and Guo (2015) used the same processing method for the substitute elasticity of Broda and Weinstein (2006).

[4] For the convenience of presentation, the same products of different units of measurement are regarded as different products hereinafter.

Table 1
Legal environment, number of layers per 10 k residents, descriptions.

year	Obs	Mean	Std.Dev.	Min	Max
2000	31	0.814	0.714	0.136	3.908
2001	31	0.865	0.783	0.163	4.358
2002	30	1.006	1.011	0.295	5.713
2003	30	1.021	0.973	0.298	5.437
2004	30	1.080	1.116	0.295	6.266
2005	31	1.140	1.311	0.189	7.395
2006	31	1.203	1.457	0.218	8.249

Note: Data from *Chinese Year Book of Lawyers*, and *Chinese Statistics Year Book*.

assets to the average number of employees.

Enterprise size (L.*size*): we use the logarithm of total industrial output value to characterize the size of the enterprise.

Age of establishment (age): The year of establishment is subtracted from the current year.

Differences in ownership structure are another influential factor closely related to Chinese enterprises' export decisions. Following Brandt, Van Biesebroeck, Wang, and Zhang (2017), we divide enterprises into SOEs (*states*), collective enterprises (*collective*), private enterprises (*private*), HMT enterprises (*HMT*) and foreign-invested enterprises (*foreign*).

At the same time, this paper makes control over trade types of products: processing and general, we also classify firms into three types: process only, general only and type three engaging in both.

4.3. Data

To study the impact of the legal environment and contract intensity on the quality of export products, this paper combines the Chinese Customs Database and the Industrial Enterprise Database from 2000 to 2006.

The Chinese Customs Database includes import and export data between 2000 and 2006, including import and export prices, quantity, source or destination, corporate information (e.g., company name, telephone number, zip code, contact), and the type of trade (e.g., general trade, processing and assembly trade). Because the existence of many trade intermediaries, there may be price adjustments in the trade intermediaries, so the prices of export products may not accurately reflect the product quality information of the production enterprise. Therefore, this article deletes enterprises whose name includes the words “import and export”, “trade”, “foreign trade”, “economics”, “foreign economics”, “industry and trade” and “technology and trade”. In addition, we also excluded data where the export price, quantity, measurement, and destination are 0 or missing.

The microdata on the plants comes from the 2000–2006 Industrial Enterprise Database, which includes all SOEs in China and non-SOEs with annual main business income totaling RMB 5 million or more. We deleted observations where the total industrial output value, industrial added value, total fixed assets, and total intermediate input values are less than or equal to 0; we also deleted observations with fewer than eight employees or total assets that are less than current assets, total assets are less than fixed assets, or the cumulative depreciation is less than the depreciation in the current year. At the same time, samples of enterprises established before 1949, samples with an age <0, or a profit rate <0 or $>100\%$ are also deleted.

To merge the Chinese Customs Database and the Industrial Enterprise Database, following Fan and Guo (2015) and Xu et al. (2015), we deleted samples without a company name, phone number, and zip code. First, we match the two databases according to the enterprise name and then retain the original samples with successful matching. Second, we use the last seven digits of the phone number and the zip code to match the samples which not matched in the first step. Then, combine the matched data together.

Finally, we convert the HS96 6-digit code into ISIC Rev2 3-digit code using the conversion code comes from WITS (World Integrated Trade Solution) to match the industry contract intensity data constructed by Nunn (2007). To avoid deviations caused by having fewer observations of certain products, we exclude data with <100 observations.

Table 2, descriptive statistics for export quality, constructed from Chinese Customs Database and the Industrial Enterprise Database of 2000–2006. Table 3 contains descriptive statistics for control variables.

Table 2
Descriptive statistics of export quality of matching samples.

Year	Obs	*quality*			
		Mean	Std.Dev.	Min	Max
2000	184,978	0.2145	1.6979	−17.0442	16.126
2001	220,279	0.3398	1.6724	−16.7293	16.3739
2002	272,757	0.3212	1.6531	−19.218	21.1771
2003	345,541	0.3025	1.6664	−17.0655	23.5596
2004	528,073	0.2834	1.6863	−19.8484	23.2019
2005	691,788	0.3855	1.6772	−16.7548	25.1577
2006	714,388	0.2264	1.7002	−21.2027	23.0006

Note: Data from 2000 to 2006 Chinese Customs Database and the Industrial Enterprise Database.

5. Empirical results

5.1. Baseline results

Table 4 reports the basic regression results obtained using the 2000–2006 unbalanced panel data, which controls for fixed effects at the product-destination level, the destination-time level, and the region-time level. The standard error is the robust standard deviation at the province-industry level. Table 4 shows that the interaction terms of contract intensity and the legal environment ($z_1 \times legal$ and $z_2 \times legal$) are significantly positive at the 1% significance level, indicating that the legal environment is better, the quality of export products from industrial enterprises with higher contract intensity is higher, and the improvement in the legal environment can raise the quality of export products from enterprises with high contract-intensity dependence, which is consistent with the expectations in our previous discussions.

The estimation results of the control variables are in line with the theory of Chinese export inspection. First, coefficients for enterprise productivity (L.ln*TFP*), capital intensity (L.ln*CI*), and human capital (L.ln*wage*) are all significantly positive, indicating that enterprise productivity, capital intensity, and enhancement of human capital can all effectively raise export quality. The coefficient for firm size (L.*size*) is significantly negative, while firm age (*age*) is not significant, which differ from related findings, as we use different samples and different control variables. From product trade types, there is not much difference between export quality of general trade and processing trade. From the firms' trade types, *general_only* types and *general* + *processing* types tend to have higher export quality, this fits the productivity paradox for export firms that is process firms are smaller in size and tends to have lower productivity. Compared to SOE's, the ownership effect tends to be negative for collective and HMT enterprises, but positive for foreign enterprises, a possible explanation is that collective enterprises does not have a clear ownership (Daokui Li, 1995) and HMT enterprises tend to be smaller in size which have lower tech and aim for speedy returns (Guo, 2005).

5.2. Robustness test

5.2.1. Substitute variable for legal environment

To ensure robustness of our results, we use a different proxy variable for legal environment, per capita legal suits of commerce contracts. Data taken from China Year Book of Lawyers 2004–2006, which can be viewed as a measure of the legal environments in different provinces and cities.

Table 5 shows the regression results using the number of per capita economic suits as a proxy variable for the legal environment. In the table, the coefficients of interaction terms for contract intensity and the number of per capita economic suits ($z_1 \times suits$ and $z_2 \times suits$) are all significantly positive at the 5% level, indicating that in provinces with more efficient contract enforcement, the higher the contract intensity is, the higher the quality of export products is; in other words, an improvement in contract intensity raises the quality of export products from industries in which contract intensity is greater. This is consistent with the baseline regression.

5.2.2. Robustness with elasticity of substitution

In the process of measuring export quality, we followed Fan et al. (2015) to use the exogenous elasiticity of substitution between products for HS 2-digit classification. To ensure robustness, we run our model based on differenct elasticity of substitution to see if the result is sensitive to the specific elasticity of substitution. Fan et al. (2015) consulted the existing literature and recommend that the reasonable elasticity of substitution should be in the interval [5,10]. Therefore we tried to use 5 and 10 respectiely first and then use 90% and 110% of the elasticity of substitution between products for HS 2-digit classification. Table 6 summarizes the results. It is seen that coefficient in front of the cross product term of legal environment and contract intensity are all significantly positive at 1% level, which is the same as the benchmark model.

5.2.3. Instrument variable estimation

The model is likely to have endogeneity problems because of factors such as measurement errors, omitted variables, and mutual causality—in particular, the legal environment itself is likely to be endogenous. Acemoglu et al. (2005), and Nunn (2008) found that international trade affects a country's institutional quality, and therefore, the legal environment in our model may be endogenous. Endogeneity may result in biased and inconsistent estimates. To reduce estimation bias from possible endogeneity, following Dong, Wei, and Tang (2012), He, Ma, Zhu, et al. (2016) and Li (2016) we tried to use the length of treaty port history for provinces opening for foreign trade in Qing dynasty. The longer foreign trade history, the deeper influence from foreign practices, thus the better legal

Table 3
Descriptive statistics for control variables.

Variables	Obs	Mean	Std.Dev.	Min	Max
L.lnTFP	132,751	2.5081	1.0960	−7.4428	10.1638
L.lnCI	132,751	3.7543	1.3088	−5.3705	9.6316
L.lnwage	132,614	2.4618	0.64160	−7.3715	6.6071
L.size	132,751	5.9785	1.3132	−3.5015	13.5913
age	164,460	8.4684	8.2529	0	56

Note: Data from 2000 to 2006 Chinese Customs Database and the Industrial Enterprise Database.

Table 4
Legal environment, contract intensity, and export quality (Baseline results).

VARIABLES	(1)	(2)	(3)	(4)
$z_1 \times$ *legal*	0.1845***		0.1938***	
	(0.0501)		(0.0412)	
$z_2 \times$ *legal*		0.3211***		0.3511***
		(0.0844)		(0.0770)
L.ln*TFP*			0.0366***	0.0366***
			(0.0078)	(0.0078)
L.ln*CI*			0.0541***	0.0539***
			(0.0103)	(0.0104)
L.ln*wage*			0.2105***	0.2100***
			(0.0265)	(0.0265)
L.*size*			0.1031***	0.1033***
			(0.0150)	(0.0150)
age			−0.0007	−0.0007
			(0.0010)	(0.0010)
General_product			0.0927*	0.0924*
			(0.0513)	(0.0514)
General_only_firm			0.5082***	0.5071***
			(0.0830)	(0.0831)
Process + General_firm			0.2960***	0.2961***
			(0.0584)	(0.0585)
collective			−0.0854**	−0.0836**
			(0.0346)	(0.0345)
private			−0.0457**	−0.0448*
			(0.0232)	(0.0231)
HMT			−0.1835***	−0.1835***
			(0.0340)	(0.0338)
foreign			0.0700***	0.0702***
			(0.0229)	(0.0229)
Product-Country	YES	YES	YES	YES
Country-Year	YES	YES	YES	YES
Province-Year	YES	YES	YES	YES
Constant	−1.5549***	−1.8198***	−1.6967***	−1.9884***
	(0.1965)	(0.2114)	(0.2217)	(0.2369)
Observations	2,468,641	2,468,641	2,468,641	2,468,641
R-squared	0.1452	0.1451	0.2464	0.2463

Note: Fixed effects at the product-destination country level, destination country-year level, and province-year level were added to the regression. The province-industry level robust standard errors are in parentheses. *, **, and *** represent 10%, 5% and 1% significance level respectively.

environment. Also, the chosen instrument is clearly independent of the error terms. We also use lagged values of number of lawyer per 10 k residents as instrument variable, it satisfies the conditions for instrumental variables.

Table 7 contains the regression result, in column (1) and (2) we use the one period lagged value of foreign trade starting time and legal environment. Column (3) and (4) incorporated the two periods lagged values in. First, we can see from Table 6 that it identification problem does not exist and the choice of instrumental variable is effective. After controlled of endogeneity, the cross term of legal environment and contract intensity has significant positive effect (at 1% level) same as the benchmark model.

5.3. Heterogeneity analysis

5.3.1. Regressions grouped by different ownership structure of enterprises

To study the impact of the legal environment on the export quality from enterprises with different ownership structure, we divide enterprises into groups of SOEs, collective enterprises, private enterprises, HMT enterprises and foreign enterprises, with the regression results in Table 8. The table shows that for SOEs, HMT enterprises, and foreign enterprises, the coefficients of interaction terms for contract intensity and legal environment ($z_1 \times$ *legal* and $z_2 \times$ *legal*) are significantly positive at the 5% level. For collective enterprises and private enterprises, the coefficients are not significant. This shows that, from the perspective of contract enforcement, the improvement in the legal environment has a greater impact on the export quality of SOEs and foreign-invested enterprises, but less impact on collective enterprises and private enterprises, which is basically consistent with our expectation.

5.3.2. Regressions grouped by different regions of enterprises

To study the impact of the legal environment on the export quality from different regions, we divide enterprises by their region—eastern, central and western China—with the results in Table 9. It shows that, for enterprises in eastern China, the coefficients of interaction terms for contract intensity and legal environment ($z_1 \times$ *legal* and $z_2 \times$ *legal*) are significantly positive at least the 1% level of significance. However, for enterprises in central and western China, the coefficients are not significant, and some are even negative. This shows that from the perspective of contract execution efficiency, improvement in the legal environment has a greater impact on export quality from enterprises in eastern China, whereas the impact in the central and western regions is not significant, which is in

Table 5
Legal environment, contract intensity, and export quality regression results (the number of per capita legal suits of commercial contracts).

VARIABLES	(1)	(2)	(3)	(4)
$z_1 \times suits$	0.1845***		0.0551**	
	(0.0501)		(0.0260)	
$z_2 \times suits$		0.3211***		0.1047**
		(0.0844)		(0.0441)
L.ln*TFP*			0.0323***	0.0323***
			(0.0086)	(0.0086)
L.ln*CI*			0.0502***	0.0503***
			(0.0114)	(0.0114)
L.ln*wage*			0.2482***	0.2478***
			(0.0342)	(0.0343)
L.*size*			0.1021***	0.1021***
			(0.0157)	(0.0156)
Age			−0.0008	−0.0008
			(0.0014)	(0.0014)
General_product			0.1396***	0.1397***
			(0.0528)	(0.0528)
General_only_firm			0.5594***	0.5596***
			(0.0859)	(0.0860)
Process + General_firm			0.3654***	0.3657***
			(0.0602)	(0.0603)
collective			−0.0237	−0.0234
			(0.0820)	(0.0818)
private			−0.0504**	−0.0503**
			(0.0249)	(0.0250)
HMT			−0.1844***	−0.1845***
			(0.0345)	(0.0345)
foreign			0.0267	0.0266
			(0.0247)	(0.0247)
Product-country	YES	YES	YES	YES
Country-year	YES	YES	YES	YES
Province-year	YES	YES	YES	YES
Constant	−1.7296***	−1.9453***	−1.8359***	−2.0802***
	(0.2296)	(0.2623)	(0.2617)	(0.2948)
Observations	1,591,867	1,591,867	1,591,867	1,591,867
R-squared	0.1695	0.1695	0.2635	0.2634

Note: Fixed effects at the product-destination country level, destination country-year level, and province-year level were added to the regression. The province-industry level robust standard errors are in parentheses. *, **, and *** represent 10%, 5% and 1% significance level respectively.

Table 6
Legal environment, contract intensity, and export quality regression results (robustness with elasticity of substitution).

Variables	$\sigma = 5$	$\sigma = 10$	$\sigma = 0.9\sigma_{HS2}$	$\sigma = 1.1\sigma_{HS2}$
Pannel A: Contract intensity (z_1)				
$z_1 \times legal$	0.1419***	0.1616***	0.1601***	0.1896***
	(0.0404)	(0.0394)	(0.0409)	(0.0406)
Control Variables	YES	YES	YES	YES
Pannel B: Contract intensity (z_2)				
$z_2 \times legal$	0.2823***	0.3078***	0.3264***	0.3481***
	(0.0746)	(0.0731)	(0.0772)	(0.0769)
Control Variables	YES	YES	YES	YES

Note: All the control variables and fixed effects at the product-destination country level, destination country-year level, and province-year level were added to the regression. The province-industry level robust standard errors are in parentheses. *, **, and *** represent 10%, 5% and 1% significance level respectively. Please see Fan et al. (2015) where σ is assumed to be 5 and 10 respectively, we also tried σ values for $0.9\sigma_{HS2}$ and $1.1\sigma_{HS2}$ in addition.

line with our expectation.

6. Further study: factor in imports of intermediate goods

There is still significant lag in legal justice and efficiency in China, compared to US and EU economies. To hedging against quality problems of domestic inputs, many firms use import substitutes. Aeberhardt, Buono, and Fadinger (2014)and Araujo, Mion, and Ornelas (2016) find that, under incomplete information, better institutional quality and legal environment can enhance cooperation

Table 7
Legal environment, contract intensity, and export quality regression results (IV estimation).

Variables	(1)	(2)	(3)	(4)
$z_1 \times legal$	0.1953***		0.1961***	
	(0.0430)		(0.0425)	
$z_2 \times legal$		0.3531***		0.3469***
		(0.0784)		(0.0780)
Control Variables	YES	YES	YES	YES
Underidentification Test	33.83	25.06	33.92	25.12
	[0.0000]	[0.0000]	[0.0000]	[0.0000]
Weak Identification Test	17,646	14,333	8529	6536
Overidentification Test	3.471	1.964	4.547	4.016
	[0.0625]	[0.161]	[0.103]	[0.134]

Note: All the control variables and fixed effects for the product-destination country level, destination country-time level, and province-time level were added to the regression. The province-industry level robust standard errors are in parentheses. *, **, and *** represent 10%, 5%, and 1% significance level respectively. The bracket is the *p*-value for the corresponding hypothesis tests. The specific regression results are shown in the appendix Table A3.

Table 8
Legal environment, contract intensity, and export quality (grouped by type of ownership structure).

Variables	SOEs	Collective	Private	HMT	Foreign
Panel A; Contract intensity (z_1)					
$z_1 \times legal$	0.1389**	−0.0019	0.1079	0.3430***	0.1296***
	(0.063)	(0.1016)	(0.0689)	(0.0791)	(0.0453)
Control variables	YES	YES	YES	YES	YES
Panel B; Contract intensity (z_2)					
$z_2 \times legal$	0.2817***	0.1615	0.1758	0.6573***	0.2135***
	(0.1008)	(0.1465)	(0.1483)	(0.2022)	(0.0811)
Control variables	YES	YES	YES	YES	YES

Note: All the control variables and fixed effects at the product-destination country level, destination country-year level, and province-year level were added to the regression. The province-industry level robust standard errors are in parentheses. *, **, and *** represent 10%, 5% and 1% significance level respectively. The specific regression results are shown in the appendix Table A4, A5 and A6.

Table 9
Legal environment, contract intensity, and export quality (by enterprise region).

	Eastern regions		Central and Western regions	
Variables	(1)	(2)	(3)	(4)
$z_1 \times legal$	0.2148***		−0.4200	
	(0.0409)		(0.2861)	
$z_2 \times legal$		0.3777***		0.1364
		(0.0787)		(0.3065)
Control variables	YES	YES	YES	YES

Note: All the control variables and fixed effects at the product-destination country level, destination country-year level, and province-year level were added to the regression. The province-industry level robust standard errors are in parentheses. *, **, and *** represent 10%, 5%, and 1% significance level respectively. The specific regression results are shown in the appendix Table A7.

among exporters and importers, specifically, they find the importers' institutional quality has positive effects on the duration and export volume of the country. Thus, we might think that improvement in legal environment could have an impact on the imports quality and volume of intermediate goods. To study this impact and its potential influence on export quality, we match Chinese Custom Database with Broad Economic Catalogue (BEC), and obtained the import data on intermediate goods, then use the same method to calculate the import quality, finally achieve the firm level data on import quality, which allow us to test the channel of legal environment affecting export quality through the import quality of intermediate goods. Specifically, we test this effect in the following manner:

First, for robustness, we test it for the overall firm level data to see the effect of legal environment and contract intensity on export quality, in the following econometric model:

$$log\bar{\lambda}_{it} = \alpha_0 + \alpha_1 \times z_g \times legal_{st} + \alpha X_{it} + process\_share_{it} + \kappa_{st} + ind + \varepsilon_{it}$$

Where, $log\bar{\lambda}$ is firm level export quality，*process_share* is the export share of the firm engaging in processing trade，*ind* is the fixed effect of the industry.

Second, we group the firms into non-import and import groups. Since non-import firms cannot use import substitution and thus may face a quality input problem, run the same model for them to see if it is similar to the benchmark model. This is closely related to the fundamental conclusion of our paper.

Third, we study the impact of legal environment and contract intensity on export quality through the channel of intermediate goods based on import volume and import quality. The behavior of an import firm lies in whether to import (extensive margin) and how much to import (intensive margin), therefore we use Heckman's self-selection model to deal with the relevant self-selection problem. We execute the following two steps:

(1) Use probit model to study the impact of legal environment and contract intensity on whether to import, and obtain Inverse Mills Ratio，(*IMR*):

$$Pr\left(dummy\_import_{it}\right) = \alpha_0 + \alpha_1 \times z_g \times legal_{st} + \alpha X_{it} + process\_share_{it} + dummy\_import_{it-1} + \kappa_{st} + ind + \varepsilon_{it}$$

Where，*dummy_import* is the import dummy。

(2) Examine the effect of legal environment and contract intensity on import volume and quality:

$$\log Z_{it} = \alpha_0 + \alpha_1 \times z_g \times legal_{st} + \alpha X_{it} + process\_share_{it} + IMR_{it} + \kappa_{st} + ind + \varepsilon_{it}$$

Where *Z* are respectively, log import volume (ln*import*), import input quality (*imp_quality_1* and *imp_quality_2*), and *IMR* is Inverse Mills Ratio.

Fourth, we incorporate the import volume and quality into the orginal model to see if our estimates are changed or not.

In the first step, Table 10 contain the results. One can easily see the cross term of legal environment and contract intensity ($z_1 \times legal$ and $z_2 \times legal$) remain significantly positive at 5% level, which are consistent with the benchmark results in Table 5. It should be noted that some firms don't import, therefore we use import dummy for the firms that import, and find that it is significant at 1% level, indicating firms using import input tends to have higher export quality.

In the second step (Table 11), among the non-import firms, the impact of the cross term of legal environment and contract intensity is also significant at 5% level, indicating improvement of legal environment has a positive impact on export quality for non-import firms. This impact is even higher for non-import firms compared to import firms because they don't enjoy the option of import substitution.

In step 3 (Table 12), in self-selection model of extensive margin, notice that the effect of the cross term of legal environment and contract is insignificant (negative), they don't have significant effect on firms' decision about whether to import. However, in intensive margin model, the effect is significant at 5% level, indicating legal environment and contract intensity indeed promotes firm's import volume and quality, this might be the due to that firms with higher contract intensity or a better legal environment tend to import more.

Step 4 (Table 13), it is seen that the import value (ln*import*) and quality (*imp_quality_1* and *imp_quality_2*) both are significant at 1% level; but the cross terms, $z_1 \times legal$ and $z_2 \times legal$, compared to Table 11, have reduced magnitude and significance. We may think improvement of legal environment promotes import quality and volume and enhance export quality of firms especially so for firms with high contract intensity.

Since the addition of import quality destroys the robustness of the cross terms $z_1 \times legal$ and $z_2 \times legal$, we further classify the firms into processing trade and general trade. Since, processing trade is more affect by import quality of intermediate inputs, and less dependent on domestic inputs, thus may not be very sensitive to legal environment and contract intensity. Table 14 contains the relevant results. It is seen that for processing trade, $z_1 \times legal$ and $z_2 \times legal$ are both not significant as expected, and both significant at 5% level for general trade. The results indicating for firms engaged in general trade, an improvement in legal environment not only affect input import thus improve export quality but also stimulates better quality of domestic factors, and further improves export quality. For processing firm, the effect of legal environment is mostly through input import.

Table 10
Legal environment, contract intensity, and export quality (aggregate regression).

VARIABLES	(1)	(2)	(3)	(4)
$z_1 \times legal$	0.0994**		0.1069**	
	(0.0432)		(0.0426)	
$z_2 \times legal$		0.1685**		0.1751**
		(0.0728)		(0.0724)
dummy_import			0.2531***	0.2527***
			(0.0206)	(0.0206)
Control Variables	YES	YES	YES	YES

Note: All the control variables and fixed effects at the province-year level and industry level were added to the regression. The province-industry level robust standard errors are in parentheses.*, **, and *** represent 10%, 5%, and 1% significance level respectively. The specific regression results are shown in the appendix Table A7.

Table 11
Legal environment, contract intensity, and export quality (aggregate regression).

VARIABLES	*Non-import enterprises*		*Import enterprises*	
$z_1 \times legal$	0.1067**		0.0929*	
	(0.0540)		(0.0512)	
$z_2 \times legal$		0.1604**		0.1454*
		(0.0740)		(0.0831)
Control Variables	YES	YES	YES	YES

Note: All the control variables and fixed effects at the province-year level and industry level were added to the regression. The province-industry level robust standard errors are in parentheses.*, **, and *** represent 10%, 5%, and 1% significance level respectively. The specific regression results are shown in the appendix Table A8.

Table 12
Legal environment, contract intensity, and import (Heckman Self-Selection Model).

	(1)	(2)	(3)	(4)
Variables	Extensive Margin	Intensive Margin	Extensive Margin	Intensive Margin
Pannel A: ln*impinput*				
$z_1 \times legal$	−0.0594*	0.2691***		
	(0.0355)	(0.0681)		
$z_2 \times legal$			−0.0550	0.3890**
			(0.0498)	(0.1587)
Control Variables	YES	YES	YES	YES
Pannel B: *imp_quality*				
$z_1 \times legal$	−0.0666*	0.0618**		
	(0.0371)	(0.0244)		
$z_2 \times legal$			−0.0622	0.1003**
			(0.0521)	(0.0451)
Control Variables	YES	YES	YES	YES

Note: All the control variables and fixed effects at the province-year level and industry level were added to the regression. The province-industry level robust standard errors are in parentheses. *, **, and *** represent 10%, 5%, and 1% significance level respectively. The specific regression results are shown in the appendix Table A9 and A10.

Table 13
Legal environment, contract intensity, import and export quality.

VARIABLES	(1)	(2)	(3)	(4)
$z_1 \times legal$	0.0800		0.0780	
	(0.0525)		(0.0528)	
$z_2 \times legal$		0.1275		0.1215
		(0.0859)		(0.0854)
ln*impinput*	0.0554***	0.0555***		
	(0.0090)	(0.0090)		
imp_quality			0.2848***	0.2849***
			(0.0219)	(0.0219)
Control Varibales	YES	YES	YES	YES

Note: All the control variables and fixed effects at the province-year level and industry level were added to the regression. The province-industry level robust standard errors are in parentheses.*, **, and *** represent 10%, 5%, and 1% significance level respectively. The specific regression results are shown in the appendix Table A11.

7. Conclusions

In this paper, we construct a simple game theory model under perfect information to illustrate that improvement in the legal environment can raise the quality of intermediate inputs, thereby raising the quality of final products, especially in industries with higher contract intensity. Empirically, using the Chinese Customs Database and the Industrial Enterprise Database from 2000 to 2006, following Khandelwal et al. (2013), Fan et al. (2015), and Shi (2013), we measure the export quality and examine the effect of the legal environment on the export quality, particularly enterprises with different contract intensity. The empirical study shows that an improvement in the legal environment can raise the export quality, especially at firms with higher contract intensity, which is consistent with the findings of Essaji and Fujiwara (2012). Second, through grouped regressions, we find that the impact of the legal environment is larger at SOEs, HMT enterprises and foreign enterprises, but smaller at collective enterprises and private enterprises. In addition, the legal environment has a stronger impact on enterprises that are in eastern China than on those in central and western China. Further studies show that legal environment and contract intensity affect the volume and import quality thus influence the

Table 14
Legal environment, contract intensity, import and export quality (General Trade and Process Trade).

VARIABLES	(1)	(2)	(3)	(4)
Pannel A: Processing Trade				
$z_1 \times legal$	0.0216		0.0226	
	(0.0660)		(0.0724)	
$z_2 \times legal$		0.2055		0.1741
		(0.1500)		(0.1553)
ln*imp_process*	0.1477***	0.1477***		
	(0.0127)	(0.0127)		
imp_quality_process			0.4595***	0.4593***
			(0.0225)	(0.0225)
Control Variables	YES	YES	YES	YES
Pannel B: General Trade				
$z_1 \times legal$	0.1062**		0.1077**	
	(0.0516)		(0.0520)	
$z_2 \times legal$		0.1674**		0.1649**
		(0.0789)		(0.0792)
ln*imp_general*	0.0178***	0.0179***		
	(0.0047)	(0.0047)		
imp_quality_general			0.1340***	0.1340***
			(0.0111)	(0.0111)
Control Variables	YES	YES	YES	YES

Note: All the control variables and fixed effects at the province-year level and industry level were added to the regression. The province-industry level robust standard errors are in parentheses. *, **, and *** represent 10%, 5%, and 1% significance level respectively. The specific regression results are shown in the appendix Table A12.

export product quality; especially for the general trade, even when we controlled the effects of import inputs, legal environment still promote the export product quality.

This paper has policy and practical significance. First, as China further integrates into the international division of labor, Chinese enterprises at the bottom of the global industrial chain have gradually improved, thereby higher product quality been required. Moreover, Chinese consumer demand for high-quality products has risen as economic development has become more sophisticated. All these factors are causing enterprises to depend more on the legal environment in the production process, where reforms should be further deepened in the judicial system so as to enhance the legal environment, accelerate improvement in product quality, boost enterprise competitiveness, and facilitate industrial restructuring and upgrading. Second, the study finds that the legal environment has a stronger impact on SOEs, HMT enterprises, foreign enterprises than on collective enterprises and private enterprises in China, which to some extent reveals discrimination by the type of ownership in the enforcement of laws there. Prosperity in the Chinese manufacturing sector is inseparable from the growth of private enterprises, so the elimination of this kind of discrimination is conducive to creating a better legal environment for collective enterprises and private enterprises, which will only help support manufacturing industry. Third, our study found that the legal environment has a stronger impact on export product quality at enterprises in eastern China, the location of most of the country's export enterprises. Therefore, we can improve the quality of export products in the country by various policy depended on different regions.

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Declaration of Competing Interest

None.

Appendix

Table A1
Industry contract intensity indes.

Industry code	Industry description	z_1	z_2
311	Food products	0.330636	0.557286
312	Misc. food products n.e.c	0.279307	0.630838

(*continued on next page*)

Table A1 (*continued*)

Industry code	Industry description	z_1	z_2
313	Beverages	0.712857	0.948596
314	Tobacco	0.316615	0.483153
321	Textiles	0.376078	0.820402
322	Wearing apparel, except footwear	0.745411	0.975405
323	Leather products	0.570608	0.847906
324	Footwear, except rubber or plastic	0.650408	0.933979
331	Wood products, except furniture	0.516188	0.669817
332	Furniture, except metal	0.56766	0.910021
341	Paper and products	0.348114	0.885098
342	Printing and publishing	0.712822	0.995253
351	Industrial chemicals	0.240284	0.883699
352	Other chemicals	0.489707	0.945846
353	Petroleum refineries	0.057654	0.759322
354	Misc. petroleum and coal products	0.39524	0.894579
355	Rubber products	0.407307	0.922965
356	Plastic products	0.407734	0.984789
361	Pottery, china, earthenware	0.328755	0.945808
362	Glass and products	0.557416	0.967179
369	Other non-metallic mineral products	0.376582	0.963428
371	Iron and steel	0.242224	0.816245
372	Non-ferrous metals	0.160398	0.460173
381	Fabricated metal products	0.434657	0.944649
382	Machinery, except electrical	0.763578	0.974796
383	Machinery, electric	0.740019	0.960169
384	Transport equipment	0.85874	0.984587
385	Professional and scientific equipment	0.784667	0.980761
390	Other manufactured products	0.546755	0.863411

Note: Industry Contract Intensity Index from Nunn (2007).

Table A2
The number of laywer per 10,000 people of provinces.

Province	2000	2001	2002	2003	2004	2005	2006
Anhui	0.485147	0.520235	0.611491	0.598085	0.601156	0.616177	0.638625
Beijing	3.908358	4.358123	5.713282	5.436813	6.265908	7.394669	8.248594
Chongqing	0.794314	0.970308	1.079602	1.019265	1.236663	1.320943	1.348647
Fujian	0.68827	0.724238	0.80351	0.873215	0.920941	0.940399	0.974059
Gansu	0.486282	0.476417	0.514026	0.542767	0.52499	0.543026	0.577935
Guangdong	0.803584	0.886751	1.01753	1.094276	1.224893	1.306939	1.488562
Guangxi	0.429383	0.417084	0.464745	0.472514	0.512375	0.557511	0.571943
Guizhou	0.249734	0.263227	0.294501	0.297933	0.295338	0.345308	0.408672
Hainan	0.718631	0.73995	0.779577	0.765721	0.801956	0.82971	0.843301
Hebei	0.543452	0.54023	0.620638	0.593441	0.656631	0.752445	0.702088
Heilongjiang	0.686105	0.699292	0.807501	0.817824	0.820802	0.823299	0.822129
Henan	0.426012	0.476818	0.509414	0.577532	0.560873	0.596375	0.60839
Hubei	0.506376	0.518911	0.563293	0.648549	0.662338	0.680736	0.730898
Hunan	0.595703	0.625076	0.675517	0.638001	0.67453	0.747392	0.761589
Jiangsu	0.585506	0.666803	0.787605	0.847144	0.915592	0.954534	1.015021
Jiangxi	0.616775	0.500956	0.473946	0.441937	0.453548	0.455347	0.465315
Jilin	0.68531	0.735043	0.752872	0.735207	0.767073	0.741164	0.782226
Liaoning	0.9424	0.987363	1.030216	1.089074	1.147498	1.216299	1.241161
Neimenggu	0.740304	0.758505	0.733222	0.826488	0.811116	0.830628	0.909731
Ningxia	0.916968	1.023091	1.04021	0.955172	0.913265	0.983222	0.97351
Qinghai	0.67118	0.736138	0.724008	0.773408	0.762523	0.779006	0.793796
Shaanxi	0.474753	0.594032	0.70071	0.753813	0.769356	0.753388	0.802379
Shandong	0.678373	0.636323	0.72462	0.791123	0.821024	0.888084	0.88495
Shanghai	2.66128	2.666067	2.987157	3.130804	3.302997	3.771958	3.96945
Shanxi	0.706806	0.735636	0.965088	0.808087	0.684558	0.877198	0.911407
Sichuan	0.545324	0.571288	0.658077	0.707314	0.722497	0.770945	0.803526
Tianjin	1.30969	1.568725	1.703079	1.710188	1.773438	1.779482	1.829767
Xinjiang	0.943753	0.795842	0.886614	1.043433	1.039226	1.038806	1.037561
Xizang	0.135659	0.162879	–	–	–	0.189286	0.217544
Yunnan	0.485735	0.547003	0.556427	0.603062	0.681314	0.743371	0.729645
Zhejiang	0.800214	0.92768	1.003141	1.027177	1.071675	1.104789	1.204062

Note: Data from *Chinese Year Book of Lawyers*, and *Chinese Statistics Year Book*.

Table A3
Legal environment, contract intensity, and export quality (IV estimation).

VARIABLES	(1)	(2)	(3)	(4)
$z_1\times$ *legal*	0.1953***		0.1961***	
	(0.0430)		(0.0425)	
$z_1\times$ *legal*		0.3531***		0.3469***
		(0.0784)		(0.0780)
L.ln*TFP*	0.0357***	0.0357***	0.0340***	0.0341***
	(0.0078)	(0.0077)	(0.0078)	(0.0077)
L.ln*CI*	0.0515***	0.0513***	0.0495***	0.0494***
	(0.0105)	(0.0106)	(0.0108)	(0.0108)
L.ln*wage*	0.2159***	0.2152***	0.2177***	0.2171***
	(0.0266)	(0.0267)	(0.0283)	(0.0284)
L.*size*	0.1031***	0.1033***	0.1031***	0.1032***
	(0.0149)	(0.0149)	(0.0153)	(0.0153)
age	−0.0007	−0.0006	−0.0007	−0.0006
	(0.0010)	(0.0011)	(0.0011)	(0.0011)
General_product	0.1058**	0.1055**	0.1193**	0.1191**
	(0.0518)	(0.0518)	(0.0521)	(0.0522)
General_only_firm	0.5234***	0.5222***	0.5379***	0.5367***
	(0.0852)	(0.0854)	(0.0839)	(0.0840)
Process + General_firm	0.3139***	0.3138***	0.3322***	0.3321***
	(0.0601)	(0.0602)	(0.0586)	(0.0587)
collective	−0.0730*	−0.0712*	−0.0607	−0.0590
	(0.0410)	(0.0409)	(0.0462)	(0.0461)
private	−0.0473**	−0.0463**	−0.0494**	−0.0485**
	(0.0233)	(0.0233)	(0.0239)	(0.0238)
HMT	−0.1784***	−0.1783***	−0.1771***	−0.1772***
	(0.0339)	(0.0338)	(0.0337)	(0.0336)
foreign	0.0663***	0.0664***	0.0589**	0.0589**
	(0.0238)	(0.0238)	(0.0242)	(0.0243)
Underidentification	33.83	25.06	33.92	25.12
	4.52e-08	3.62e-06	2.06e-07	1.46e-05
Weakindetification	17,646	14,333	8529	6536
Overidentification	3.471	1.964	4.547	4.016
	[0.0625]	[0.161]	[0.103]	[0.134]

Note: Fixed effects for the product-destination country level, destination country-time level, and province-time level were added to the regression. The province-industry level robust standard errors are in parentheses. *, **, and *** represent 10%, 5%, and 1% significance level respectively.

Table A4
Legal environment, contract intensity, and export quality (SOEs, collective and private firms).

VARIABLES	*SOEs*		*Collective*		*Private*	
$z_1\times$ *legal*	0.1389**		−0.0019		0.1079	
	(0.0630)		(0.1016)		(0.0689)	
$z_2\times$ *legal*		0.2817***		0.1615		0.1758
		(0.1008)		(0.1465)		(0.1483)
L.ln*TFP*	0.0291*	0.0295*	−0.0022	−0.0024	0.0117	0.0117
	(0.0151)	(0.0151)	(0.0216)	(0.0216)	(0.0151)	(0.0150)
L.ln*CI*	0.0286	0.0281	0.0416	0.0421	0.0491***	0.0487***
	(0.0196)	(0.0197)	(0.0266)	(0.0266)	(0.0155)	(0.0155)
L.ln*wage*	0.1510***	0.1505***	0.0812**	0.0811**	0.1197***	0.1192***
	(0.0286)	(0.0285)	(0.0389)	(0.0390)	(0.0362)	(0.0363)
L.*size*	0.0436**	0.0429*	0.1070***	0.1070***	0.0938***	0.0938***
	(0.0221)	(0.0222)	(0.0286)	(0.0286)	(0.0187)	(0.0187)
age	−0.0006	−0.0006	0.0006	0.0006	0.0008	0.0008
	(0.0012)	(0.0012)	(0.0013)	(0.0013)	(0.0012)	(0.0012)
General_product	0.2123***	0.2123***	0.2226**	0.2236**	0.3740***	0.3736***
	(0.0698)	(0.0700)	(0.1006)	(0.1009)	(0.0554)	(0.0555)
General_only_firm	0.2013	0.1978	0.0544	0.0545	0.2540	0.2528
	(0.1446)	(0.1446)	(0.1052)	(0.1052)	(0.1688)	(0.1688)
Process + General_firm	0.1136	0.1105	−0.0217	−0.0216	0.2369	0.2363
	(0.1414)	(0.1414)	(0.1000)	(0.0999)	(0.1687)	(0.1687)
Constant	−0.9032***	−1.1245***	−0.9267***	−1.1122***	−1.4415***	−1.5596***
	(0.2567)	(0.2797)	(0.2262)	(0.2772)	(0.2722)	(0.3074)
Observations	152,340	152,340	77,070	77,070	499,234	499,234
R-squared	0.4944	0.4943	0.5200	0.5200	0.3587	0.3586

Note: Fixed effects for the product-destination country level, destination country-time level, and province-time level were added to the regression. The province-industry level robust standard errors are in parentheses. *, **, and *** represent 10%, 5%, and 1% significance level respectively.

Table A5
Legal environment, contract intensity, and export quality (HMT and foreign enterprises).

VARIABLES	*HMT*		*Foreign*	
$z_1\times$ *legal*	0.3430***		0.1296***	
	(0.0791)		(0.0453)	
$z_2\times$ *legal*		0.6573***		0.2135***
		(0.2022)		(0.0811)
L.ln*TFP*	0.0217**	0.0215**	0.0495***	0.0496***
	(0.0106)	(0.0106)	(0.0134)	(0.0133)
L.ln*CI*	0.0302**	0.0300**	0.0622***	0.0622***
	(0.0117)	(0.0117)	(0.0122)	(0.0122)
L.ln*wage*	0.1736***	0.1738***	0.2287***	0.2283***
	(0.0172)	(0.0171)	(0.0323)	(0.0325)
L.*size*	0.1565***	0.1567***	0.0801***	0.0803***
	(0.0181)	(0.0181)	(0.0156)	(0.0156)
age	0.0014	0.0014	−0.0033	−0.0033
	(0.0024)	(0.0025)	(0.0032)	(0.0032)
General_product	0.2268***	0.2272***	−0.1538***	−0.1539***
	(0.0511)	(0.0512)	(0.0477)	(0.0477)
General_only_firm	0.5379***	0.5357***	0.3010***	0.3012***
	(0.0868)	(0.0870)	(0.1087)	(0.1088)
Process + General_firm	0.2413***	0.2411***	0.1141	0.1147
	(0.0773)	(0.0773)	(0.0869)	(0.0870)
Constant	−2.0975***	−2.6330***	−1.1906***	−1.3841***
	(0.1416)	(0.2762)	(0.2467)	(0.2666)
Observations	817,210	817,210	817,843	817,843
R-squared	0.3238	0.3237	0.2902	0.2901

Note: Fixed effects for the product-destination country level, destination country-time level, and province-time level were added to the regression. The province-industry level robust standard errors are in parentheses. *, **, and *** represent 10%, 5%, and 1% significance level respectively.

Table A6
Legal environment, contract intensity, and export quality (by regions).

VARIABLES	*Easten regions*		*Central and western regions*	
$z_1\times$ *legal*	0.2148***		−0.4200	
	(0.0409)		(0.2861)	
$z_2\times$ *legal*		0.3777***		0.1364
		(0.0787)		(0.3065)
L.ln*TFP*	0.0373***	0.0373***	0.0255**	0.0255**
	(0.0085)	(0.0084)	(0.0111)	(0.0111)
L.ln*CI*	0.0541***	0.0538***	0.0399***	0.0410***
	(0.0112)	(0.0113)	(0.0153)	(0.0153)
L.ln*wage*	0.2154***	0.2148***	0.0714***	0.0714***
	(0.0285)	(0.0285)	(0.0188)	(0.0190)
L.*size*	0.1064***	0.1066***	0.0839***	0.0835***
	(0.0160)	(0.0159)	(0.0165)	(0.0164)
age	−0.0009	−0.0008	−0.0006	−0.0006
	(0.0012)	(0.0012)	(0.0012)	(0.0011)
General_product	0.0957*	0.0954*	0.0456	0.0477
	(0.0545)	(0.0546)	(0.1173)	(0.1174)
General_only_firm	0.5256***	0.5245***	−0.2166**	−0.2185**
	(0.0850)	(0.0852)	(0.0854)	(0.0849)
Process + General_firm	0.3073***	0.3076***	−0.2983***	−0.2994***
	(0.0590)	(0.0591)	(0.0938)	(0.0937)
collective	−0.0824**	−0.0802**	−0.0674	−0.0662
	(0.0383)	(0.0382)	(0.0476)	(0.0477)
private	−0.0305	−0.0292	−0.1028***	−0.1042***
	(0.0268)	(0.0267)	(0.0381)	(0.0382)
HMT	−0.1763***	−0.1764***	−0.1013***	−0.0992***
	(0.0376)	(0.0374)	(0.0383)	(0.0383)
foreign	0.0801***	0.0802***	0.0541	0.0564
	(0.0258)	(0.0258)	(0.0477)	(0.0477)
Constant	−1.7769***	−2.0960***	−0.1370	−0.4312
	(0.2318)	(0.2483)	(0.2068)	(0.2974)
Observations	2,268,302	2,268,302	179,900	179,900
R-squared	0.2524	0.2522	0.4401	0.4400

Note: Fixed effects for the product-destination country level, destination country-time level, and province-time level were added to the regression. The province-industry level robust standard errors are in parentheses. *, **, and *** represent 10%, 5%, and 1% significance level respectively.

Table A7
Legal environment, contract intensity, and quality of export products (aggregate regression).

VARIABLES	(3)	(4)	(7)	(8)
$z_1 \times legal$	0.0994**		0.1069**	
	(0.0432)		(0.0426)	
$z_2 \times legal$		0.1685**		0.1751**
		(0.0728)		(0.0724)
L.ln*TFP*	0.0305*	0.0302*	0.0345**	0.0342**
	(0.0159)	(0.0159)	(0.0161)	(0.0161)
L.ln*CI*	−0.0094	−0.0095	−0.0153	−0.0154
	(0.0102)	(0.0102)	(0.0101)	(0.0101)
L.ln*wage*	0.1816***	0.1816***	0.1681***	0.1681***
	(0.0178)	(0.0178)	(0.0178)	(0.0179)
L.*size*	0.1412***	0.1415***	0.1276***	0.1280***
	(0.0181)	(0.0180)	(0.0190)	(0.0190)
age	−0.0010	−0.0010	−0.0010	−0.0010
	(0.0012)	(0.0012)	(0.0012)	(0.0012)
process_share	−0.0583	−0.0580	−0.1866***	−0.1860***
	(0.0592)	(0.0592)	(0.0574)	(0.0574)
dummy_import			0.2531***	0.2527***
			(0.0206)	(0.0206)
collective	−0.0624**	−0.0620**	−0.0457	−0.0453
	(0.0296)	(0.0296)	(0.0296)	(0.0296)
private	−0.0152	−0.0150	−0.0016	−0.0014
	(0.0236)	(0.0236)	(0.0235)	(0.0235)
HMT	0.1032***	0.1028***	0.0731**	0.0727**
	(0.0315)	(0.0315)	(0.0308)	(0.0308)
foreign	0.3102***	0.3099***	0.2705***	0.2703***
	(0.0311)	(0.0311)	(0.0311)	(0.0311)
Constant	−0.3005**	−0.4254***	−0.2638**	−0.3910**
	(0.1280)	(0.1523)	(0.1323)	(0.1555)
Observations	130,477	130,477	130,477	130,477
R-squared	0.1855	0.1855	0.1905	0.1904

Note: Fixed effects at the province-year level and industry level were added to the regression. The province-industry level robust standard errors are in parentheses.*, **, and *** represent 10%, 5%, and 1% significance level respectively.

Table A8
Legal environment, contract intensity, and export quality (Non-import and import firms).

VARIABLES	Non-import firms		Import firms	
$z_1 \times legal$	0.1067**		0.0929*	
	(0.0540)		(0.0512)	
$z_2 \times legal$		0.1604**		0.1454*
		(0.0740)		(0.0831)
L.ln*TFP*	0.0537***	0.0534***	0.0295	0.0294
	(0.0130)	(0.0130)	(0.0206)	(0.0206)
L.ln*CI*	−0.0097	−0.0098	−0.0239*	−0.0240*
	(0.0118)	(0.0118)	(0.0123)	(0.0123)
L.ln*wage*	0.1102***	0.1101***	0.1925***	0.1926***
	(0.0187)	(0.0187)	(0.0204)	(0.0204)
L.*size*	0.0559***	0.0561***	0.1597***	0.1600***
	(0.0100)	(0.0100)	(0.0246)	(0.0246)
age	0.0021**	0.0021**	−0.0034**	−0.0034**
	(0.0011)	(0.0011)	(0.0016)	(0.0016)
process_share	−0.7525***	−0.7512***	−0.0672	−0.0668
	(0.0762)	(0.0763)	(0.0499)	(0.0499)
collective	−0.0698*	−0.0699*	−0.0502	−0.0494
	(0.0360)	(0.0359)	(0.0419)	(0.0418)
private	−0.0258	−0.0257	−0.0083	−0.0081
	(0.0281)	(0.0281)	(0.0358)	(0.0359)
HMT	0.1265***	0.1263***	0.0461	0.0454
	(0.0359)	(0.0359)	(0.0408)	(0.0408)
foreign	0.1671***	0.1671***	0.2772***	0.2767***
	(0.0340)	(0.0340)	(0.0392)	(0.0392)
Constant	0.1955**	0.0999	−0.2251	−0.3380
	(0.0879)	(0.1106)	(0.1823)	(0.2102)
Observations	55,676	55,676	74,799	74,799
R-squared	0.1600	0.1600	0.1969	0.1968

Note: Fixed effects at the province-year level and industry level were added to the regression. The province-industry level robust standard errors are in parentheses.*, **, and *** represent 10%, 5%, and 1% significance level respectively.

Table A9
Legal environment, contract intensity, and import(ln*import*).

	(1)	(2)	(3)	(4)
VARIABLES	Intensive Margin	Extensive Margin	Intensive Margin	Extensive Margin
$z_1 \times legal$	−0.0594*	0.2691***		
	(0.0355)	(0.0681)		
$z_2 \times legal$			−0.0550	0.3890**
			(0.0498)	(0.1587)
L.ln*TFP*	−0.0327***	−0.1610***	−0.0329***	−0.1615***
	(0.0090)	(0.0205)	(0.0090)	(0.0205)
L.ln*CI*	0.0578***	0.1108***	0.0578***	0.1107***
	(0.0083)	(0.0190)	(0.0083)	(0.0189)
L.ln*wage*	0.1320***	0.2904***	0.1322***	0.2904***
	(0.0148)	(0.0271)	(0.0148)	(0.0271)
L.*size*	0.1408***	0.7665***	0.1407***	0.7674***
	(0.0066)	(0.0242)	(0.0066)	(0.0242)
age	−0.0036***	−0.0144***	−0.0036***	−0.0144***
	(0.0009)	(0.0023)	(0.0009)	(0.0024)
process_share	1.2471***	2.6118***	1.2467***	2.6135***
	(0.0634)	(0.0998)	(0.0634)	(0.1001)
L.*dummy_import*	1.8201***		1.8202***	
	(0.0371)		(0.0371)	
collective	−0.1137***	−0.0139	−0.1140***	−0.0122
	(0.0381)	(0.0960)	(0.0380)	(0.0957)
private	−0.0188	0.0749	−0.0190	0.0760
	(0.0284)	(0.0817)	(0.0283)	(0.0817)
HMT	0.1263***	0.4664***	0.1267***	0.4642***
	(0.0279)	(0.0833)	(0.0280)	(0.0834)
foreign	0.2641***	0.8036***	0.2644***	0.8019***
	(0.0299)	(0.0825)	(0.0299)	(0.0826)
Constant	−2.1321***	3.3283***	−2.0701***	2.5600***
	(0.1715)	(0.3139)	(0.2466)	(0.6393)
Observations	101,412	101,412	101,412	101,412

Note: Fixed effects at the province-year level and industry level were added to the regression. The province-industry level robust standard errors are in parentheses.*, **, and *** represent 10%, 5%, and 1% significance level respectively.

Table A10
Legal environment, contract intensity, and import quality(*imp_quality*).

	(1)	(2)	(3)	(4)
VARIABLES	Intensive Margin	Extensive Margin	Intensive Margin	Extensive Margin
$z_1 \times legal$	−0.0666*	0.0618**		
	(0.0371)	(0.0244)		
$z_2 \times legal$			−0.0622	0.1003**
			(0.0521)	(0.0451)
L.ln*TFP*	−0.0466***	−0.0291***	−0.0467***	−0.0292***
	(0.0091)	(0.0055)	(0.0091)	(0.0055)
L.ln*CI*	0.0531***	−0.0054	0.0530***	−0.0054
	(0.0088)	(0.0074)	(0.0088)	(0.0074)
L.ln*wage*	0.1453***	0.0729***	0.1454***	0.0729***
	(0.0160)	(0.0083)	(0.0160)	(0.0083)
L.*size*	0.1629***	0.1234***	0.1627***	0.1236***
	(0.0065)	(0.0050)	(0.0065)	(0.0050)
age	−0.0034***	−0.0015**	−0.0034***	−0.0015**
	(0.0009)	(0.0007)	(0.0009)	(0.0007)
process_share	1.3398***	0.4694***	1.3391***	0.4698***
	(0.0606)	(0.0204)	(0.0606)	(0.0204)
L.dummy_import	1.7427***		1.7428***	
	(0.0317)		(0.0317)	
collective	−0.1069***	−0.1245***	−0.1072***	−0.1243***
	(0.0374)	(0.0315)	(0.0373)	(0.0315)
private	−0.0011	−0.0394	−0.0012	−0.0392
	(0.0288)	(0.0250)	(0.0287)	(0.0250)
HMT	0.1780***	0.0490*	0.1783***	0.0485*
	(0.0276)	(0.0261)	(0.0276)	(0.0261)
foreign	0.3266***	0.0699***	0.3268***	0.0695***
	(0.0292)	(0.0242)	(0.0292)	(0.0242)
Constant	−2.2752***	−0.8525***	−2.2017***	−1.0679***
	(0.1841)	(0.1040)	(0.2609)	(0.1706)
Observations	101,412	101,412	101,412	101,412

Note: Fixed effects at the province-year level and industry level were added to the regression. The province-industry level robust standard errors are in parentheses.*, **, and *** represent 10%, 5%, and 1% significance level respectively.

Table A11
Legal environment, contract intensity, import and export quality.

VARIABLES	(1)	(2)	(3)	(4)
$z_1 \times legal$	0.0800		0.0780	
	(0.0525)		(0.0528)	
$z_2 \times legal$		0.1275		0.1215
		(0.0859)		(0.0854)
ln*impinput*	0.0554***	0.0555***		
	(0.0090)	(0.0090)		
imp_quality_2			0.2848***	0.2849***
			(0.0219)	(0.0219)
L.ln*TFP*	0.0393*	0.0392*	0.0378*	0.0377*
	(0.0202)	(0.0202)	(0.0200)	(0.0200)
L,ln*CI*	−0.0313***	−0.0314***	−0.0229**	−0.0230**
	(0.0117)	(0.0117)	(0.0115)	(0.0115)
L.ln*wage*	0.1737***	0.1737***	0.1699***	0.1699***
	(0.0190)	(0.0190)	(0.0193)	(0.0194)
L.*size*	0.1151***	0.1153***	0.1239***	0.1241***
	(0.0182)	(0.0182)	(0.0226)	(0.0226)
age	−0.0026*	−0.0026*	−0.0029*	−0.0029*
	(0.0015)	(0.0015)	(0.0015)	(0.0015)
process_share	−0.2346***	−0.2344***	−0.2150***	−0.2147***
	(0.0677)	(0.0677)	(0.0541)	(0.0541)
collective	−0.0428	−0.0421	−0.0113	−0.0106
	(0.0422)	(0.0422)	(0.0424)	(0.0423)
private	−0.0050	−0.0047	0.0081	0.0083
	(0.0362)	(0.0362)	(0.0360)	(0.0360)
HMT	0.0104	0.0098	0.0253	0.0247
	(0.0418)	(0.0419)	(0.0396)	(0.0396)
foreign	0.2205***	0.2200***	0.2475***	0.2470***
	(0.0390)	(0.0390)	(0.0382)	(0.0382)
Constant	−0.4557**	−0.5562**	0.0095	−0.0844
	(0.2133)	(0.2380)	(0.1700)	(0.2000)
Observations	74,799	74,799	74,799	74,799
R-squared	0.2030	0.2030	0.2158	0.2158

Note: Fixed effects at the province-year level and industry level were added to the regression. The province-industry level robust standard errors are in parentheses.*, **, and *** represent 10%, 5%, and 1% significance level respectively.

Table A12
Legal environment and, contract intensity, import and export quality (Processing Trade and General Trade).

	Processing Trade				*General Trade*			
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$z_1 \times legal$	0.0216		0.0226		0.1062**		0.1077**	
	(0.0660)		(0.0724)		(0.0516)		(0.0520)	
$z_2 \times legal$		0.2055		0.1741		0.1674**		0.1649**
		(0.1500)		(0.1553)		(0.0789)		(0.0792)
ln*impinput*	0.1477***	0.1477***			0.0178***	0.0179***		
	(0.0127)	(0.0127)			(0.0047)	(0.0047)		
imp_quality_p			0.4595***	0.4593***				
			(0.0225)	(0.0225)				
							0.1340***	0.1340***
							(0.0111)	(0.0111)
L.ln*TFP*	0.0488*	0.0487*	0.0250	0.0249	0.0528***	0.0524***	0.0549***	0.0545***
	(0.0252)	(0.0252)	(0.0258)	(0.0258)	(0.0167)	(0.0167)	(0.0166)	(0.0166)
L,ln*CI*	−0.0087	−0.0088	−0.0084	−0.0085	−0.0502***	−0.0504***	−0.0494***	−0.0495***
	(0.0155)	(0.0155)	(0.0148)	(0.0148)	(0.0116)	(0.0117)	(0.0116)	(0.0116)
L.ln*wage*	0.2007***	0.2011***	0.1919***	0.1922***	0.1527***	0.1529***	0.1468***	0.1471***
	(0.0218)	(0.0218)	(0.0204)	(0.0204)	(0.0177)	(0.0177)	(0.0181)	(0.0181)
L.*size*	0.1040***	0.1037***	0.1633***	0.1631***	0.0527***	0.0531***	0.0482***	0.0487***
	(0.0192)	(0.0192)	(0.0274)	(0.0274)	(0.0114)	(0.0114)	(0.0119)	(0.0119)
age	−0.0026	−0.0026	−0.0029	−0.0029	0.0002	0.0002	0.0001	0.0001
	(0.0020)	(0.0020)	(0.0019)	(0.0019)	(0.0013)	(0.0013)	(0.0013)	(0.0013)
process_share	0.5142***	0.5135***	0.7701***	0.7696***	−0.5805***	−0.5808***	−0.5738***	−0.5741***
	(0.0755)	(0.0755)	(0.0613)	(0.0613)	(0.0418)	(0.0418)	(0.0418)	(0.0418)
collective	−0.0171	−0.0186	0.0429	0.0417	−0.0888	−0.0880	−0.0683	−0.0674
	(0.0598)	(0.0598)	(0.0587)	(0.0588)	(0.0544)	(0.0544)	(0.0545)	(0.0545)
private	−0.0552	−0.0552	−0.0300	−0.0300	−0.0558	−0.0554	−0.0460	−0.0457

(*continued on next page*)

Table A12 (*continued*)

	Processing Trade				*General Trade*			
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	(0.0472)	(0.0472)	(0.0458)	(0.0458)	(0.0503)	(0.0503)	(0.0504)	(0.0504)
HMT	0.0153	0.0154	0.0679	0.0680	0.0103	0.0097	0.0146	0.0140
	(0.0489)	(0.0490)	(0.0452)	(0.0452)	(0.0477)	(0.0477)	(0.0470)	(0.0470)
foreign	0.2265***	0.2265***	0.3082***	0.3081***	0.1587***	0.1583***	0.1655***	0.1653***
	(0.0451)	(0.0451)	(0.0459)	(0.0459)	(0.0475)	(0.0474)	(0.0473)	(0.0472)
Constant	−2.4562***	−2.6975***	−1.3489***	−1.5500***	0.5462***	0.3981***	0.7635***	0.6204***
	(0.2500)	(0.3061)	(0.1995)	(0.2662)	(0.1095)	(0.1532)	(0.1080)	(0.1527)
Observations	53,752	53,752	53,705	53,705	40,055	40,055	40,026	40,026
R-squared	0.2761	0.2762	0.2886	0.2887	0.1616	0.1615	0.1658	0.1657

Note: Fixed effects at the province-year level and industry level were added to the regression. The province-industry level robust standard errors are in parentheses.*, **, and *** represent 10%, 5%, and 1% significance level respectively.

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