Relationship-Specificity, Incomplete Contracts and the Pattern of Trade

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Abstract

When relationship-specific investments are necessary for production, under-investment occurs if contracts cannot be enforced. The efficiency loss from under-investment will differ across industries depending on the importance of relationship-specific investments in the production process. As a consequence, a country's contracting environment may be an important determinant of comparative advantage. To test for this, I construct measures of the efficiency of contract enforcement across countries and the importance of relationship-specific investments across industries. I find that countries with better contract enforcement specialize in industries that rely heavily on relationship-specific investments. This is true even after controlling for traditional determinants of comparative advantage such as endowments of capital and skilled labor.

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1 Introduction

What determines a country's comparative advantage? Although this is one of the oldest, most fundamental questions in international trade, we still lack a full understanding of the primary determinants of comparative advantage and the resulting pattern of trade (Davis and Weinstein, 2001). In this paper, I consider a previously untested determinant of comparative advantage: the quality of a country's contracting environment. I test whether a country's ability to enforce written contracts is an important determinant of its comparative advantage.

The channel that I consider builds on a well-established insight from the theory of the firm: when investments are relationship-specific, under-investment will occur if contracts cannot be enforced. An investment is "relationship-specific" if its value within a buyer-seller relationship is significantly higher than outside the relationship. An example is an investment made by an input supplier to customize an input for a final good producer. When customization requires investments that are relationship-specific, the final good producer can hold-up the supplier if contracts are imperfectly enforced. After the relationship-specific investments have been made, the buyer can renege on the initially agreed upon price and pay the supplier the (significantly lower) value of the investments outside of the relationship, which is the lowest price the supplier will accept. The supplier, anticipating the ex post opportunistic behavior, will under-invest in the necessary relationship-specific investments. The under-investment will raise the costs of producing the intermediate inputs, as well as the costs of producing the final good that use the inputs. In countries with good contract enforcement, there is less under-investment and the costs of production are lower than in countries with poor contract enforcement. The more important are relationship-specific investments in the production process, the greater the cost advantages afforded to good contracting countries relative to poor contracting countries. In other words, countries with good contracting environments have a comparative advantage in the production of goods that require relationship-specific investments.

I test for this relationship by examining whether countries with better contracting environments export more in industries that use intensively relationship-specific investments. As a measure of the quality of a country's contracting environment I use a variable called the 'rule of law' from Kaufmann et al. (2003), which measures the effectiveness and predictability of the judiciary and the enforcement of contracts. To quantify the importance of relationship-specific investments across industries I construct a variable that measures, for each commodity, the proportion of its intermediate inputs that are relationship-specific. I use the United States input-output (I-O) tables to determine which intermediate inputs are used in the production of each final good. I identify inputs that are relationship-specific using data from Rauch (1999). I use whether or not an input is sold on an organized exchange as one indicator of whether it is relationship-specific. If an input is sold on an exchange, this indicates that the market for the input is thick, with many alternative buyers. Therefore, the value of the input outside of the relationship is close to the value inside the relationship, and by definition the input is not relationship-specific. If a good is not sold on an exchange, it may be reference priced in trade publications. This indicates an intermediate level of market thickness and relationship-specificity. Using this additional indicator, I construct a second measure of the proportion of a good's inputs that are relationship-specific. The measure is constructed in the same manner as the first measure, except that reference priced inputs are also categorized as not being relationship-specific.

I test for the influence of contract enforcement on comparative advantage by comparing how the export ratios of country pairs differ across industries. I find that countries with good contract enforcement export more in industries that rely heavily on relationship-specific investments. In addition, when I control for countries' endowments of capital and skilled labor, I find that the contracting environment is able to explain as much of the variation in trade flows as capital and skilled labor combined.

To correct for the possibility of omitted variables bias, I include a number of determinants of comparative advantage that if omitted may bias my results. I find that the results remain after controlling for a wide range of alternative determinants of comparative advantage. To estimate the causal effect of judicial quality on trade flows, I use instrumental variables (IV). As instruments I use each country's legal origin. Because legal origin may affect comparative advantage through channels other than the quality of a country's contracting environment, I also pursue a second strategy. I compare the relative exports of British common law and French civil law countries, but restrict my comparison to pairs of countries that are matched by important country characteristics that may affect comparative advantage and trade flows. I match country pairs using per capita income, financial development, factor endowments and trade openness. I find that the estimated effect of judicial quality on trade flows continues to be statistically significant.

1.1 Related Literature

This paper is most related to the literature on the organization of the multinational firm.[1] These studies also use the insight that the existence of relationship-specific investments creates a potential for hold-up, but they also exploit the additional insight, developed by Williamson (1975, 1985), Grossman and Hart (1986) and Hart and Moore (1990), that integration of the two parties is a possible solution to the help alleviate the hold-up problem. The literature incorporates these insights into general equilibrium trade models to understand the organization of multinational firms. One of the first papers in this literature is McLaren (2000), who models the effect that international openness can have on firm structure. In his model, increased openness helps alleviate the hold-up problem and leads to a decrease in vertical integration. Grossman and Helpman (2002) study the determinants of firms' make-or-buy decisions in a model where the organization of the firm is endogenous. Subsequent studies have more explicitly modelled the firm in an international environment, either looking at the firm's make-or-buy decision when inputs are obtained internationally (Grossman and Helpman, 2003; Antràs, 2003), the firm's decision of whether to outsource domestically or abroad (Grossman and Helpman, 2005), or the firm's simultaneous choice of location and ownership structure (Antràs and Helpman, 2004; Antràs, 2005). Most recently, Ornelas and Turner (2005) consider the effects of trade liberalization on the organization of production by multinational firms, and Puga and Trefler (2005) model how multinational firms' innovation decisions are affected by the quality of the contracting environment.

Although related, the focus of these papers is very different from mine. In all of these studies, the authors take comparative advantage as given and focus on the effect that the contracting environment has on the production decisions of multinational firms. In this paper, I take a step back and consider whether the contracting environment is also important for comparative advantage. The focus of this paper is closely related to Acemoglu, Antràs and Helpman (2005) and Costinot (2005), who model the effect that contract enforcement has on comparative advantage and the resulting pattern of trade. Both papers also develop models where comparative advantage is determined by the contracting environment, but neither paper tests the predictions of their models. The core contribution of this paper is testing whether a country's contracting environment is an important source of comparative advantage.

[1] For comprehensive surveys of this literature see Spencer (2005) and Trefler (2005).

The paper is related to studies that consider the relationship between institutions and trade. A number of papers have found that a country's institutional quality increases its volume of trade (Anderson, 2002; Berkowitz, Moenius and Pistor, 2004; de Groot et al., 2004; Ranjan and Lee, 2004). This paper is most closely related to Levchenko (2004), which is the first paper to test for the effect that institutional quality has on comparative advantage, rather than trade volumes. Levchenko tests whether countries with better institutions specialize in goods that are institutionally dependent, proxied for by a product's complexity. Levchenko measures the complexity of a product by quantifying the variety of inputs used to produce the good. The use of a wider range of inputs indicates that the good is more complex. Levchenko finds that countries with better institutions export more in industries that are institutionally dependent/complex.

Finally, the paper is related to two studies that focus on relationship-specific investments and their ability to explain the importance of the keiretsu system for production and trade in Japan's auto industry. Spencer and Qiu (2001) show how the increase in relationship-specific investments caused by the vertical structure of the keiretsu system may act as a barrier to trade, causing a fall in the range of imported auto parts. Head, Ries and Spencer (2004) test for this effect and find that U.S. exports to Japan are reduced for parts where keiretsu sourcing is most important.

The paper is organized as follows. In the next section, I develop a model that illustrates how differences in contract enforcement between countries can determine comparative advantage and the resulting pattern of trade. In Section 3, I describe the data and constructed variables. In Section 4, I use the model to develop my estimating equations and I report the basic empirical results. In Section 5, I correct for endogeneity and omitted variables bias, and test the robustness of my estimates. Section 6 concludes.

2 The Model

I develop a simple, stylized model that illustrates how contract enforcement can affect comparative advantage. I do not claim that the model is general. Rather, it is meant to provide one example of how differences in contract enforcement across countries can affect comparative advantage and the resulting pattern of trade.

I extend Dornbusch, Fischer and Samuelson (1977) by modelling the source of countries' Ricardian productivity differences as coming from differences in their contracting environments. As in their model, I assume that there is a continuum of final goods indexed by $z \in [0, 1]$. Unlike the original model, which assumes that the only factor of production is labor, I assume that production requires intermediate inputs, some of which require relationship-specific investments. I call inputs that do not require relationship-specific investments standardized inputs and those that do customized inputs. Each unit of a final good z requires one unit of a standardized input and $a(z)$ units of a customized input, where $a(z) > 0$ and $a'(z) > 0$. The production function for final good z is given by

$$\min \left\{ X^s(z), \frac{1}{a(z)} X^c(z) \right\}$$

where $X^s(z)$ and $X^c(z)$ denote the total usage of standardized inputs, s, and customized inputs, c.[2] Consumers' preferences are identical and Cobb-Douglas.

2.1 Customized Input Production

Production of customized inputs requires a principal and an agent. Each principal is endowed with the knowledge of how to produce an input for a specific final good producer. Each principal hires an agent to produce the inputs. Before production takes place, the principal and agent negotiate a split of the surplus of the relationship. I denote the agent's share of the surplus by s and therefore $1 - s$ is the principal's share.

When producing customized inputs the agent must choose the level of customization, which is given by $q \geq 0$. The surplus generated from inputs with customization equal to q is given by $f(q)$. I assume that the productivity of the input produced, and therefore the surplus of the relationship, is increasing at a decreasing rate in customization: $f'(q) > 0$ and $f''(q) \leq 0$. For simplicity, I assume that the production and customization of inputs occurs at zero cost.

After the inputs have been produced by the agent, the principal can attempt to renegotiate the contract. I assume that if successful, the principal pays the agent the value of the input outside of the relationship, which I assume for simplicity is zero.[3] The only protection the agent has against

[2] The results of the model do not depend on the specific production function chosen. For example, if $a^c(z)$ units of the customized input and $a^s(z)$ units of the standardized input are required to produce one unit of the final good, then all results of the model hold. As well, one could allow for substitutability between inputs, modelling the production function as Cobb-Douglas. Again, all results hold in this environment.

[3] The implicit assumption here is that the principal makes an offer to the agent, which

renegotiation is the judicial system. If the principal attempts to renegotiate the contract, the agent can take the case to court. I assume that with probability γ the judge is able to perfectly verify the surplus, and she rules for the agent. With probability $1 - \gamma$, the judge is unable to verify all of the surplus. The probability γ is thus a measure of how well contracts are enforced. I assume that when the surplus cannot be fully verified by the judge, she is only able to observe a proportion of the surplus given by $0 < g(q) < 1$. I assume that customization makes the surplus increasingly difficult to verify ($g'(q) < 0$) and that verifiability is decreasing at a constant rate ($g''(q) = 0$).[4] The court is able to enforce the ex ante contract for the proportion of the surplus that is verifiable. For the remainder the principal renegotiates the price and is able to pay the agent zero.

To summarize, the timing of events is as follows.

1. Contract Negotiation: The principal and agent match. They negotiate a split of the surplus, s.

2. Customization: The agent produces the input, choosing the amount of customization to undertake, q.

3. Litigation and Renegotiation: With probability γ the judge is able to perfectly observes the surplus and with probability $1 - \gamma$ the judge imperfectly observes the surplus.

I solve for the subgame perfect equilibrium, working backwards from period 3 to period 1.

2.1.1 Period 3: Litigation and Renegotiation

I assume that the cost of going to court is zero for both the principal and the agent. If the court rules in favor of the agent, then the principal is forced to uphold the contract and the principal does not face further penalty. If the court rules in for the principal, the principal is free to renegotiate the contract. Given these assumptions, in equilibrium, the principal always breaks the contract and the agent always takes the principal to court.

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the agent either accepts or rejects. In the subgame perfect equilibrium, the principal offers to pay the agent zero for the input and the agent accepts the principal's offer.

[4]The assumption that $g''(q) = 0$ is much stricter than necessary. It is made to simplify the exposition of the model. All of the results that follow hold as long as the second derivative of $g(q)$ is not too large. Specifically, all results hold as long as $g''(q)$ is less than $-g'(q)[2f'(q)^2 - f(q)f''(q)]$, which is greater than zero.

2.1.2 Period 2: Customization

The agent's payoff is as follows. With probability γ, the contract is enforced and the agent receives the fraction s of the surplus $f(q)p^c$. That is, she receives $sf(q)p^c$. With probability $1-\gamma$, the courts can only verify the proportion $g(q)$ of the surplus, and the agent receives $sf(q)p^c g(q)$. Thus, the agent's expected payoff is

$$\pi_{\text{A}}(p^c, \gamma, s, q) = sf(q)p^c[\gamma + (1-\gamma)g(q)] \tag{1}$$

The agent chooses q to maximize $\pi_{\text{A}}(p^c, \gamma, s, q)$. The agent's optimal level of customization, q^*, is given by

$$\frac{\gamma}{1-\gamma} + g(q^*) = -g'(q^*)\frac{f(q^*)}{f'(q^*)} \tag{2}$$

The agent's optimal level of customization is increasing in the quality of judicial system: $q^{*\prime}(\gamma) > 0$. This can be seen as follows. The LHS of (2) is decreasing in q. Because $g''(q) = 0$ and $f''(q) \leq 0$, the RHS of (2) is increasing in q. Therefore, an increase in γ increases the LHS of (2) and increases q^*.

The principal's payoff is equal to $f(q)p^c$ minus the payoff that the agent receives. The principal's payoff can be written

$$\pi_{\text{P}}(p^c, \gamma, s, q^*) = f(q^*)p^c[1 - \gamma s - (1-\gamma)g(q^*)s] \tag{3}$$

where q^* is given by (2).

2.1.3 Period 1: Contract Negotiation

The initial contract specifies the share s of the surplus that the agent receives. I model the determination of s as the outcome of Nash bargaining. If the principal and agent fail to come to an agreement, both receive zero. Therefore, the Nash bargaining solution is given by

$$\max_s \Pi(s) = \pi_{\text{A}}(p^c, \gamma, s, q^*) \cdot \pi_{\text{P}}(p^c, \gamma, s, q^*) \tag{4}$$

Substituting (1) and (3) into (4) and maximizing with respect to s yields

$$s(\gamma, q^*) = \frac{1}{2[\gamma + (1-\gamma)g(q^*)]} \tag{5}$$

For future use, I express the agent's payoff as a function of p^c and γ only by substituting (5) into (1):

$$\pi_{\text{A}}(p^c, \gamma) = \frac{p^c f(q^*(\gamma))}{2} \tag{6}$$

where $q^*(\gamma)$ is given by (2). I next consider the payoff of agents that produce standardized inputs.

2.2 Standardized Input Production

Production of standardized inputs occurs in the same manner as the production of customized inputs, except that inputs are not made for a specific final good producer. Because of this, there is no possibility of the principal holding-up the agent. I assume that each period, each agent can produce one input and that the principal and agent split the value of the input p^s according to the Nash bargaining solution. Thus, the principal and agent's payoffs are equal and given by

$$\pi_{\text{A}}(p^s) = \pi_{\text{P}}(p^s) = \frac{p^s}{2} \tag{7}$$

I assume that agents are free to produce either type of input. Therefore, in equilibrium agents must be indifferent between producing customized and standardized inputs: $\pi_{\text{A}}(p^c, \gamma) = \pi_{\text{P}}(p^s)$. Using (6) and (7) this condition can be written

$$p^c/p^s = \frac{1}{f(q^*(\gamma))} \tag{8}$$

Because $q^*(\gamma)$ is increasing in γ and $f(\cdot)$ is an increasing function, the price of customized inputs relative to standardized inputs p^c/p^s is decreasing in γ. In countries with poor contract enforcement (low γ), the price of customized inputs relative to standardized inputs is high. As I show in the next section, differences in countries' relative input prices affect their relative costs of producing in different industries, which determines comparative advantage.

2.3 Final Goods Production and the Pattern of Trade

The cost of producing one unit of good z is equal to

$$c(p^s, p^c, z) = p^s + p^c a(z)$$

Using (8) this can be rewritten

$$c(p^s, \gamma, z) = p^s[1 + a(z)/f(q^*(\gamma))]$$

Consider the model with two countries. Denote the country with the lower quality judicial system by a prime so that $\gamma > \gamma'$, and $c(p^s, \gamma, z)$ and $c(p^{s'}, \gamma', z)$ are the unit costs in the two countries. As the following lemma establishes, the unit cost of the country with the better judicial system relative to the unit cost of the country with the worse judicial system is decreasing in z. In other words, the country with the better judicial system has a comparative advantage in contract-intensive industries. All proofs are in the Appendix.

Lemma. *The ratio $c(p^s, \gamma, z)/c(p^{s'}, \gamma', z)$ is decreasing in z.*

The lemma can be seen from Figure 1, which displays unit costs as a function of z for both countries.[5] Both unit cost curves are upward sloping because as z increases more units of the customized input are required in production. Because the cost of producing customized inputs relative to standardized inputs is higher in the poor contracting environment country, as one increases z the unit cost of the poor contracting country increases faster than the unit cost of the good contracting country. As a result, as stated in the lemma, the unit cost of the good contracting country relative to the poor contracting country is decreasing in z.

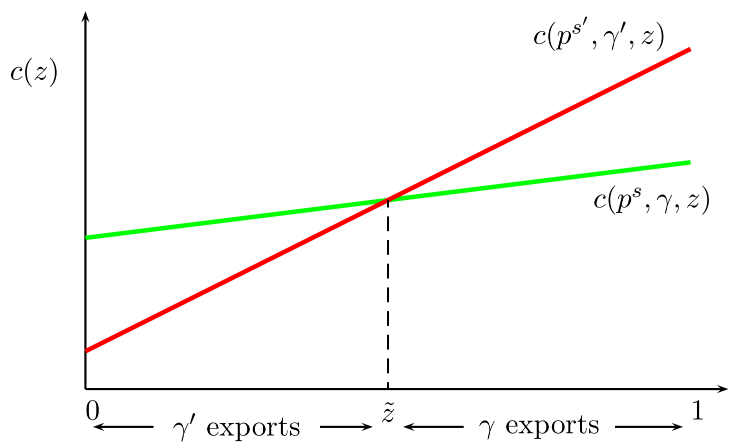

Figure 1: The pattern of trade with two countries.

The figure also illustrates the model's equilibrium when there is free trade. In equilibrium, the cost of producing some good, denoted $\tilde{z}$, is equal

[5]The cost curves are not restricted to be linear as drawn in the graph. This will only occur if $a'(z)$ is constant.

in both countries. Because goods produced in either countries are perfect substitutes and because transportation costs are zero, the country with the lower cost of producing a good will produce the good for both the domestic and foreign markets. Therefore, in equilibrium $z < \tilde{z}$ goods are exported by the poor judiciary country and $z > \tilde{z}$ goods are exported by the good judiciary country.

An equilibrium is defined as values of $p^s/p^{s'}$ and $\tilde{z}$ that satisfy two conditions: balanced trade and equal costs of producing good $\tilde{z}$ in each country. The following proposition states that for any two countries with different levels of judicial quality, there exists an unique equilibrium with trade.

Proposition. *For any two countries with $\gamma \neq \gamma'$ an equilibrium with trade exists and is unique.*

Conceptually, equilibrium is determined as follows. Because the slope of each country's cost curve is determined by γ and $a(z)$, changes in $p^s/p^{s'}$ shift the countries' cost curves vertically relative to each other. This adjusts $\tilde{z}$ and the range of goods produced by each country until trade is balanced in both countries.

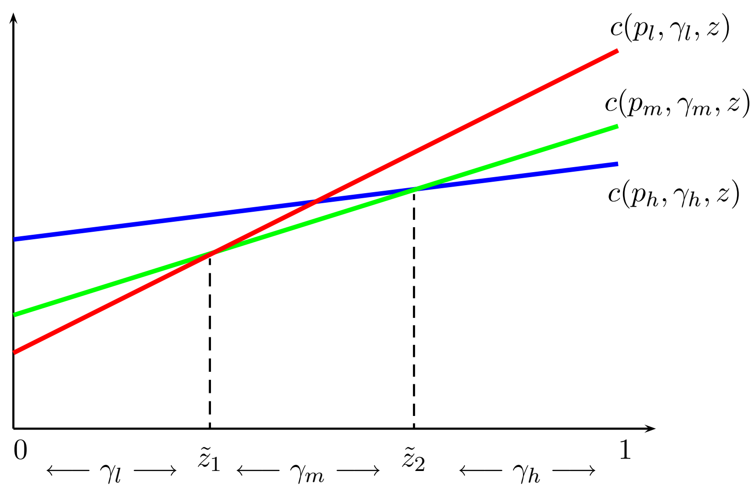

Figure 2: The pattern of trade with three countries.

When there are more than two countries, in equilibrium each country specializes in an interval of goods. Because $a(z)$ is the same for all countries, differences in γ between countries result in differences in the slope of their cost curves. The lower is a country's γ, the steeper is the slope of the country's cost curve. Differences in the slopes of countries' cost curves ensure that each country specializes in an interval of goods. If a country's cost curve does not lie below all other countries' cost curves over some range of z, then the price of inputs in that country p^s will decrease until the country becomes the lowest cost producer over some interval of goods. In equilibrium, the decrease in the price will ensure that the country's balanced trade condition is satisfied. Figure 2 shows an equilibrium with three countries. The country with the lowest γ specializes in the segment of the lowest z goods, $[0, \tilde{z}_1]$. The country with the intermediate level of γ specializes in the middle range of z goods, $[\tilde{z}_1, \tilde{z}_2]$. The high γ country specializes in the highest z goods, $[\tilde{z}_2, 1]$. The equilibrium with a general number of countries is described in the Appendix.

The model yields the stark prediction that in equilibrium goods are produced by only one country. This result follows from the assumption, originally made by Dornbusch, Fischer and Samuelson (1977), that goods produced in different countries are perfect substitutes. As Romalis (2004) shows, one can extend Dornbusch, Fishcher and Samuelson's model by assuming that countries produce different varieties of the same good and that the varieties are imperfect substitutes. This assumption along with transportation costs yields the prediction that all countries produce all goods, but countries with lower costs capture a larger share of the world market. What I take as most important from the model developed here is not its stark prediction about trade flows, but its prediction of how countries' relative costs change over z depending on their values of γ. In Section 4, I use these predictions to derive my estimating equations. Before doing this, I first describe the data that I use.

3 The Data

To test for contract enforcement as a source of comparative advantage I need measures for at least three variables: the volume of goods traded by each country in each industry, the quality of the contracting environment in each country (γ in the model), and the contract intensity of each industry (z in the model). I consider each measure below. All other variables used in the analysis are described in the Appendix.

I use trade data from 1997 taken from Feenstra (2000). I convert the original trade data, which are classified by 4-digit SITC codes, to the BEA's 1997 I-O industry classification. In the end, the trade data are classified into 222 industries. Full details of the conversion are provided in the Appendix.

As my primary measure of the quality of a country's contracting environment, I use a measure from Kaufmann et al. (2003) called the 'rule of law', which is a weighted average of a number of variables that measure individual's perceptions of the effectiveness and predictability of the judiciary and the enforcement of contracts in each country in 1997-1998. A list of the countries in the analysis ordered by rule of law is provided in Table 11. Although other measures of judicial quality exist, I have chosen Kaufmann et al.'s variable as my baseline measure because it is available for the largest number of countries.[6] In Section 5.3, I test the sensitivity of my results to the use of alternative measures of judicial quality taken from Gwartney and Lawson (2003) and Djankov et al. (2003). As I show, the results of the paper are robust to the use of these other measures.

3.1 Constructing Measures of Relationship-Specificity: z_i

The final variable needed to test the model is a measure of the importance of relationship-specific investments across industries. I construct a variable that directly measures the relationship-specificity of intermediate inputs used in the production process. I use the 1997 United States I-O Use Table to identify which intermediate inputs are used, and in what proportions, in the production of each final good.

Using data from Rauch (1999), I identify which inputs require relationship-specific investments. As an indicator of whether an intermediate input is relationship-specific, I use whether or not it is sold on an organized exchange and whether or not it is reference priced in a trade publication. If an input is sold on an organized exchange then the market for this good is thick, with many alternative buyers. If many buyers for an input exist, then the scope for hold-up is limited. If a buyer attempts to renegotiate a lower price, then the seller can simply take the input and sell it to another buyer.[7]

If a good is not sold on an exchange, it may be reference priced in trade publications. Because trade publications will only be printed if there are a sufficient number of purchasers, the existent of a trade publication indicates

[6] Of the 159 countries with trade data, Kaufmann et al. (2003) have data for 146 of them, while Gwartney and Lawson (2003) and Djankov et al. (2003) only have data for 112 and 116 of the countries.

[7] The setting that I describe is one where the seller must make relationship-specific investments. However, in many situations it is the buyer that must make relationship-specific investments. Whether an input is bought and sold on an exchange is still a good indicator of the relationship-specificity of an input in these situations. This is because inputs bought and sold on an exchange have many alternative sellers, and therefore the seller's ability to hold-up the buyer is limited.

that multiple buyers exist, even though the market for this product is not thick enough for it to be bought and sold on an exchange. Therefore, goods not sold on an exchange but referenced in trade publications can be thought of as having an intermediate level of relationship-specificity.

Rauch's original classification groups goods by the 4-digit SITC Rev. 2 system.[8] In Rauch's original data each industry is coded as being in one of the following three categories: bought and sold on an exchange, reference priced, or neither. I aggregate the indicators to the BEA's I-O industry classification system by first converting the 4-digit SITC to HS10 and HS10 to the I-O industry classification. I use the number of HS10 categories linking each SITC industry to each I-O industry as weights when aggregating. After aggregation, I have measures of the proportion of inputs in each I-O category that are bought and sold on an exchange, reference priced, or neither. Using this information, along with information from the United States Use Table on which inputs are used in the production of each final good, I construct for each final good two measures of the proportion of its intermediate inputs that are relationship-specific:

$$z_i^{rs1} = \sum_j \theta_{ij} \, R_j^{neither}$$

$$z_i^{rs2} = \sum_j \theta_{ij} \, \left(R_j^{neither} + R_j^{ref\ price} \right)$$

where $\theta_{ij} \equiv u_{ij}/u_i$ and u_{ij} is the value of input j used to produce goods in industry i and u_i is the total value of all inputs used in industry i; $R_j^{neither}$ is the proportion of inputs j that are neither sold on an organized exchange nor reference priced; and $R_j^{ref\ price}$ is the proportion of inputs j that are not sold on an organized exchange but are reference priced. I denote the two measures of z_i by $rs1$ and $rs2$, where 'rs' stands for 'relationship-specific'. Both measures classify inputs that are neither bought and sold on an exchange nor reference priced as being relationship-specific, but the second measure also includes reference priced inputs as being relationship-specific.

A list of the twenty least and twenty most contract intense industries using z_i^{rs1} is provided in Table 1. The ranking of industries appears sensible. For example, the least relationship-specific investment intense industry is poultry processing. The primary input in this industry is chickens, which are not relationship-specific because the market for chickens is thick. Other

[8]Rauch has both a liberal estimate and a conservative estimate. Throughout the paper, I use the liberal estimate. None of the results of the paper are affected by this decision.

Table 1: The least and most contract intense industries.

20 Least Contract Intense: lowest z_i^{rs1}		20 Most Contract Intense: highest z_i^{rs1}	
z_i^{rs1}	Industry Description	z_i^{rs1}	Industry Description
.023	Poultry processing	.801	Electromedical apparatus manuf.
.024	Flour milling	.801	Analytical laboratory instr. manuf.
.034	Petroleum refineries	.818	Air & gas compressor manuf.
.035	Wet corn milling	.819	Other electronic component manuf.
.050	Nitrogenous fertilizer manufacturing	.825	Other engine equipment manuf.
.053	Aluminum sheet, plate, & foil manuf.	.832	Packaging machinery manuf.
.056	Fiber, yarn, & thread mills	.839	Book publishers
.057	Primary aluminum production	.850	Breweries
.096	Rice milling	.854	Musical instrument manufacturing
.101	Coffee & tea manufacturing	.857	Electricity & signal testing instr.
.112	Prim. nonferrous metal, ex. copper & alum.	.875	Telephone apparatus manufacturing
.132	Tobacco stemming & redrying	.875	Aircraft engine & engine parts manuf.
.144	Other oilseed processing	.885	Search, detection, & navig. instr.
.150	Noncellulosic organic fiber manufacturing	.889	Broadcast & wireless comm. equip.
.150	Plastics packaging materials	.890	Aircraft manufacturing
.153	Nonwoven fabric mills	.894	Audio & video equipment manuf.
.157	Phosphatic fertilizer manufacturing	.895	Other computer peripheral equip. manuf.
.161	Resilient floor covering manufacturing	.956	Electronic computer manufacturing
.167	Carpet & rug mills	.974	Heavy duty truck manufacturing
.167	Synthetic dye & pigment manufacturing	.979	Automobile & light truck manuf.

Notes: The measures have been rounded from seven digits to three digits.

industries among the 20 least contract intensive industries have primary inputs that are widely bought and sold; for example, flour milling, petroleum refineries and oilseed processing. The industries listed as the most contract intense industries also seem sensible. The most contract intense industries listed are for various automobile, aircraft, computer, and electronic equipment manufacturing industries, all of which intensively use inputs requiring relationship-specific investments (see Monteverde and Teece, 1982; Masten, Meehan and Snyder, 1989; Masten, 1984).

4 Estimating Equation and Basic Results

The model developed in Section 2 is a Ricardian model where differences in production efficiencies arises because of differences in countries' contracting environments. Standard tests of Ricardian models take two countries and compare how their relative export volumes vary across industries. Tests of this nature have their origins with MacDougall (1951), Stern (1962) and

Balassa (1963), and have most recently been performed by Golub and Hsieh (2000). MacDougall compared exports from the United States and Britain in 1937. He found that across industries the ratio of U.S. exports relative to U.K. exports was positively correlated with the ratio of U.S. to U.K. labor productivity. That is, relative to the U.K., the U.S. exported more in industries where production was relatively more efficient.

I generalize these tests by comparing the relative export ratios of all possible country pairs from my sample. I test whether good judiciary countries have relatively higher exports of goods requiring greater relationship-specific investments. As the first step in deriving my baseline estimating equation, I begin by considering the following model, which follows the same logic as past tests of the Ricardian model

$$\ln\left(\frac{x_{ic}}{x_{ic'}}\right) = \alpha_{cc'} + \beta_1 z_i + \varepsilon_{icc'} \qquad (9)$$

where x_{ic} is total exports in industry i from country c to all other countries, z_i is the contract intensity of industry i, c denotes the country of the pair with the better legal system, c' denotes the country with the worse legal system, and $\alpha_{cc'}$ denotes country pair fixed effects.

Conceptually, I would like to compare every country pair using the 146 countries in my data set. However, including every country pair in a regression would involve a large amount of double counting. For example, once I compare the export ratios of Japan to Taiwan and Japan to Korea, then I have implicitly compared Taiwan to Korea. The observations of the third regression equation can be calculated from the observations of the first two regression equations so there is a linear dependence across observations. Ultimately, there are only 145 linearly independent country pairs. Because of this, I compare each country relative to the United States.[9] Because there are 145 countries (not including the United States) and 222 industries, the number of possible observations is $145 \times 222 = 32,190$. However, an observation is only included in the regression if both countries export a non-zero amount in that industry. The number of actual observations in each regression is 22,353.[10]

[9] An alternative strategy is to estimate a regression that includes every possible country pair, but to make the necessary adjustment to the standard errors. Doing this yields nearly identical results.

[10] Because I am only considering positive exports, the question that I am considering in my analysis is: conditional on a country exporting in an industry, how do differences in the contracting environment affect the volume of exports in that industry? The effect that the quality of a country's contracting environment has on its decision of whether or not to enter an industry is not captured in my estimates.

Table 2: Testing the model. Dependent variable is $\ln\left(\frac{x_{ic}}{x_{ic'}}\right)$.

	(1)	(2)	(3)
Contract intensity: z_i	.11	.01	
	(5.96)	(1.07)	
Judicial quality		.18	.18
interaction: $z_i(\gamma_c - \gamma_{c'})$		(19.7)	(21.9)
Country pair FE	Yes	Yes	Yes
Industry FE	No	No	Yes
R^2	.76	.77	.82
Number obs.	22,353	22,353	22,353

Notes: Beta coefficients are reported, with t-statistics in brackets. The contract intensity measure used is z_i^{rs1}. Standard errors in column 1 are adjusted for clustering within industries.

The model predicts that in (9), β_1 should be positive; across industries, the ratio of exports in the good judiciary country relative to those in the poor judiciary country should increase as one moves from the least contract intense industry to the most contract intense industry. The estimation results of (9) are reported in column 1 of Table 2. Consistent with the prediction of the model, the coefficient of z_i is positive and statistically significant.

In the model, the difference in the slopes of the cost functions increase the greater is the difference between γ and γ'. This can be seen in Figure 1. Holding constant γ, the more one decreases γ', the steeper is $c(z)$ and the greater the cost differences of the two curves as one moves along z. In equilibrium, $p^s/p^{s'}$ will adjust, shifting the cost curves vertically relative to one another to ensure that trade is balanced, but as one moves away from $\tilde{z}$ the difference in costs between the two countries is greater. This can also be seen in the multi-country version of the model shown in Figure 2. Compare the cost curves of country γ_h to γ_m, and country γ_h to γ_l. It is apparent that the cost differences of countries γ_h and γ_m vary more than the cost differences of countries γ_h and γ_m as one moves along z. Because countries with more dissimilar judicial qualities have costs that differ more over z, it is expected that exports will also vary more over z the more dissimilar the judicial qualities of the countries being compared. To capture this, I also include an interaction between the difference in judicial quality and the contract intensity of each industry: $z_i(\gamma_c - \gamma_{c'})$. My estimating equation becomes

$$\ln\left(\frac{x_{ic}}{x_{ic'}}\right) = \alpha_{cc'} + \beta_1 z_i + \beta_2\, z_i(\gamma_c - \gamma_{c'}) + \varepsilon_{icc'} \qquad (10)$$

Because γ_c is greater than $\gamma_{c'}$, β_2 is expected to be positive: the greater the difference in judicial quality between the two countries, the greater their cost differences and the more cross-industry differences in contract intensity influence the pattern of exports. When the interaction is included in the estimating equation, β_1 is expected to be zero. To see this consider the case of two countries with the same quality judicial systems. Because $\gamma_c = \gamma_{c'}$, the interaction term is equal to zero and the expected variation in the export ratio across industries is equal to $\beta_1 z_i$. Because the two countries have identical cost curves, the pattern of trade should be unrelated to z_i, with β_1 equal to zero. The estimation results, reported in column 2 of Table 2, support the model's predictions. The coefficient for the interaction term is positive and statistically significant, while the coefficient for z_i is not statistically different from zero.

Because the predicted coefficient for z_i is zero when the interaction term is included in the regression equation, in my baseline specification, instead of z_i, I include industry fixed effects, which capture the potential influence of z_i, as well as other industry specific characteristics. My baseline model is thus

$$\ln\left(\frac{x_{ic}}{x_{ic'}}\right) = \alpha_{cc'} + \alpha_i + \beta\, z_i(\gamma_c - \gamma_{c'}) + \varepsilon_{icc'} \qquad (11)$$

Estimates of (11) are reported in column 3 of Table 2. The estimated coefficient for the interaction term remains positive and statistically significant.

In addition to being statistically significant, the estimated effect of judicial quality on trade flows is also economically significant. The estimated coefficient in column 3 implies that if Thailand could improve its contract enforcement to equal Taiwan's, then its exports of "electronic computer manufacturing" commodities would increase from 2.8 to 8.1 billion U.S. dollars per year. Thailand's share of world production in these commodities would increase from 1.6 to 4.6%.[11]

[11] This is calculated as follows. Thailand's γ is .580 and Taiwan's is .734. Electronic computer manufacturing's z_i is .956. Thailand's value of exports in the industry is 2,830,776, measured in thousands of U.S. dollars. The beta coefficient of .18 for β_1 corresponds to a coefficient of 7.17. If Thailand's γ were improved to equal Taiwan's, then its exports of electronic computer manufacturing (call this x_{ic}) would be given by: $ln(x_{ic}) = \ln(2,830,776) + \beta_1 z_i \Delta\gamma_c = \ln(2,830,776) + 7.17 \cdot .956 \cdot (.734 - .580)$. Solving yields $x_{ic} = 8,121,293$ or 8.1 billion U.S. dollars. Because total world production of electronic computer manufacturing is 176 billion U.S. dollars, this represents and increase from 1.6 to 4.6% of global exports.

An alternative model to (11) that captures the same logic is: $x_{ic} = \alpha_i + \alpha_c + z_i\gamma_c + \varepsilon_{ic}$. The functional form of this estimating equation is the same as that used by Romalis (2004), when estimating the effects that countries' endowments of skill, capital and natural resources have on comparative advantage. Romalis estimates his equations using a Tobit model and he is, therefore, able to include zero export observations in his analysis. Using the same methodology with my data produces essentially identical results to what I report here. I prefer to use my estimating equation for two reasons. First, as I have shown, its is derived from the model developed in Section 2 and from past tests of Ricardian models. Second, as I show in Section 5.1.3, because of the functional form of my estimating equation, I am able to use propensity score matching techniques to correct for endogeneity and omitted variables bias. I would not be able to use these techniques if I used the same functional form as Romalis (2004).

4.1 The Role of Endowments

I control for standard factor endowment based determinants of comparative advantage, such as countries' stocks of capital and skilled labor. I do this by including country pair differences in endowments of capital and skilled labor interacted with the factor's intensity of production in each industry. These factor endowment interactions are given by $h_i(H_c - H_{c'})$ and $k_i(K_c - K_{c'})$, where H_c and K_c are country c's endowment of skilled labor and capital, and h_i and k_i are the skill and capital intensity of production industry i. The interactions test whether countries abundant in a particular factor export relatively more in industries that use the factor intensively. Endowments based models of comparative advantage predict a positive coefficient for the factor endowment interactions (see for example Dornbusch, Fischer and Samuelson, 1980; Romalis, 2004).

Data on factor endowments and production intensities are more limited than data on judicial quality and contract intensity. Factor endowment data are only available for 70 countries and factor intensity data are only available for 182 industries, resulting in a maximum of $69 \times 182 = 12{,}558$ observations. Because of zero export values, the actual number of observations in each regression is 10,792.

The results after controlling for factor endowments are reported in Table 3. In column 1, I re-estimate (11) using the smaller sample of countries and industries for which factor endowment and production intensity data exist. As shown, even within the smaller sample, judicial quality remains an important determinant of the pattern of trade. In column 2, I estimate the

Table 3: Controlling for factor endowments. Dependent variable is $\ln\left(\frac{x_{ic}}{x_{ic'}}\right)$.

	(1)	(2)	(3)
Judicial quality interaction: $z_i(\gamma_c - \gamma_{c'})$	.22		.21
	(20.7)		(17.7)
Skill interaction: $h_i(H_c - H_{c'})$		.19	.12
		(14.7)	(9.21)
Capital interaction: $k_i(K_c - K_{c'})$		.01	.09
		(.90)	(5.56)
Country pair FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
R^2	.84	.83	.84
Number obs.	10,792	10,792	10,792

Notes: Beta coefficients are reported, with t-statistics in brackets. The measure of contract intensity used is z_i^{rs1}.

model without the judicial quality interaction, but with capital and skill interactions. The results are roughly consistent with factor endowment based models of comparative advantage. The coefficients on both of the variables are positive as expected, although the coefficient for the capital interaction is not statistically significant. In column 3, I include both the factor endowment interactions and the judicial quality interaction together. The judicial quality interaction remains positive and statistically significant. The estimated coefficient for the skill interaction decreases significantly, but remains statistically significant, while the coefficient for the capital interaction increases significantly and becomes significant.

The relative magnitudes of the estimated coefficients suggest that the effect of judicial quality on specialization is approximately the same magnitude as the combined effects of capital and skilled labor. From the estimates of column 3, a one standard deviation increase in the judicial quality interaction, increases the dependent variable by .21 standard deviations, while a simultaneous one standard deviation increase in the capital and skilled labor interactions also increases the dependent variable by .21 standard deviations.[12]

[12] One may be concerned that the importance of judicial quality relative to skill and capital endowments is a result of my estimated skill and capital coefficients being unusually low. However, the estimated magnitudes of these coefficients are similar to what other

Overall, the results to this point provide preliminary evidence that support the prediction of the model that countries with better judicial systems specialize in goods that are contract-intensive. In the remainder of the paper I test the validity of these preliminary results by considering the econometric issues surrounding the OLS estimates reported to this point. In Section 5.1, I correct for the possibility of endogeneity and omitted variables bias in my estimates. In Section 5.2, I deal with the bias introduced by the existence of vertical integration and informal contract enforcement. Last, in Section 5.3, I perform a number of robustness and sensitivity checks.

5 Econometric Issues

5.1 Endogeneity and Omitted Variables Bias

There are a number of reasons why one cannot take the results presented thus far as conclusive evidence of the effect of contract enforcement on trade flows. One reason is that there may be determinants of trade flows that have been omitted from my OLS estimates. The true model may be

$$\ln\left(\frac{x_{ic}}{x_{ic'}}\right) = \alpha_{cc'} + \alpha_i + \beta z_i(\gamma_c - \gamma_{c'}) + \delta q_i(Q_c - Q_{c'}) + \varepsilon_{icc'} \qquad (12)$$

where Q_c is an additional determinant of comparative advantage, causing countries to specialize in certain industries according to q_i. If z_i and q_i or γ_c and Q_c are correlated, then OLS estimates of (11) will be biased. I correct for this possibility by controlling for a number of potential determinants of comparative advantage and trade flows. A second reason to be skeptical of the OLS estimates is that causality may run from trade flows to judicial quality. Countries that have exports focused in high contract intense industries may have a greater incentive to develop and maintain a good contracting environment. Therefore, part of the correlation between judicial quality and trade flows may be from the effect of trade flows on judicial quality. To estimate the causal influence of judicial quality on trade flows I estimate (11) using instrumental variables (IV). I use differences in countries' legal origins as instruments. Although a country's legal origin can be used to isolate exogenous variation in countries' legal quality, it may affect comparative advantage through channels other than the quality of a

studies have found. For example, Levchenko (2004) estimates a specification similar to my baseline equation with skill and capital factor endowment interactions included. The beta coefficients for his skill and capital interactions are .10 and .12, both of which are of the same magnitude as my estimate (see column 2 of Table 1).

country's contracting environment. Therefore, it may not satisfy the exclusion restrictions necessary in order for the instruments to be valid. Because of this, I pursue a second strategy. I compare the relative exports of British common law and French civil law countries, but restrict my comparison to pairs of countries that are matched by important country characteristics that may affect comparative advantage. I describe each of the procedures in detail below.

5.1.1 Controlling for Additional Determinants of Trade

I control for a number of alternative determinants of comparative advantage that may bias my results if omitted. The results of this are summarized in Table 4. In the first column, I include an interaction of the natural log of income and value added as a fraction of the total value of shipments in each industry in the United States.[13] The interaction allows for the possibility that high income countries specialize in high value added goods. Including this interaction changes the coefficient of the judicial quality interaction very little. In the second column, I interact log income with a measure of the amount of intra-industry trade in each industry, measured using the Grubel-Lloyd index for each industry. My results may be biased because high income countries tend to focus trade in these industries. The estimated coefficient for this interaction is large and statistically significant, but the estimated coefficient and significance of the judicial quality interaction changes little. In the third column, I control for the possibility that high income countries may have a comparative advantage in dynamic industries where technological progress is particularly rapid. I interact log income with each industry's total factor productivity growth between 1977 and 1997 in the United States. Again, the results remain robust to the inclusion of this variable. Next, I control for the possibility that countries that have better developed financial systems may have a comparative advantage in industries that require a large amount of external financing. I include an interaction between the log of each country's ratio of private credit to GDP and the capital intensity of each industry. Again, the judicial quality interaction coefficient remains robust to the inclusion of this variable.[14]

[13] The Appendix provides a full description of the data source and method of construction of the variables reported in the Table 4.

[14] I have also tested the robustness of my results using different measures of financial development. I have used private credit by deposit money banks and other financial institutions to GDP, stock market capitalization to GDP, and stock market total value traded to GDP. The results are robust to the use of each of these alternative measures.

Table 4: Controlling for other determinants. Dependent variable is $\ln\left(\frac{x_{ic}}{x_{ic'}}\right)$.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Judicial quality interaction: $z_i(\gamma_c - \gamma_{c'})$	.18	.18	.17	.18	.21	.16	.19	.20
	(21.9)	(19.6)	(20.6)	(20.5)	(20.8)	(18.4)	(18.8)	(16.3)
Log income, value added: $va_i(y_c - y_{c'})$		.01					$-.05$	$-.06$
		(.61)					(-3.00)	(-2.92)
Log income, intra-industry trade: $iit_i(y_c - y_{c'})$			.20				.21	.21
			(21.8)				(20.3)	(16.6)
Log income, TFP growth: $\Delta tfp_i(y_c - y_{c'})$				.00			$-.00$	$-.01$
				(.23)			($-.42$)	(-2.47)
Log Credit/GDP, capital: $k_i(cr_c - cr_{c'})$					.04		.02	.02
					(4.63)		(2.75)	(2.05)
Log income, input variety: $(1 - HI_i)(y_c - y_{c'})$						.34	.18	.18
						(11.5)	(4.31)	(3.41)
Factor endowment interactions	No	No	No	No	No	No	No	Yes
Country pair FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	.82	.84	.82	.84	.84	.82	.85	.84
Number obs.	22,353	17,966	21,526	17,966	15,864	21,526	15,542	10,632

Notes: Beta coefficients are reported, with t-statistics in brackets. The measure of contract intensity used is z_i^{rs1}.

The final variable that I include is motivated by the work of Clague (1991a, 1991b), Blanchard and Kremer (1997), and Levchenko (2004). I include an interaction between log income and one minus the Herfindahl index of input concentration in each industry. A small Herfindahl index indicates that an industry uses a wide variety of inputs. Therefore, one minus the Herfindahl index will be larger the wider the range of inputs that are used. The interpretation of what one minus the Herfindahl index measures differs slightly in the different studies. Clague (1991a, 1991b) views the variable as a measure of how 'self contained' the industry is. He argues that because developing countries have poorly developed transportation, communication and distribution infrastructures, they will specialize in production that is 'self contained'. Blanchard and Kremer (1997) and Levchenko (2004) interpret the variable as measuring a good's 'complexity'. Because complex goods rely more heavily on institutions than simple goods, high income countries, with superior institutions, should specialize in these more complex goods. Both interpretations of the measure predict a positive coefficient for the interaction term. High income countries should specialize in industries that use a wide variety of inputs. As reported in column 6, this is found in the data. As well, the coefficient of the judicial quality interaction remains robust to the inclusion of this variable.

In column 7, I include all control variables simultaneously. In column 8, I also add the skill and capital interactions. In both cases, the coefficient of interest remains positive and significant.

5.1.2 IV Estimates

To isolate the causal impact of judicial quality on trade patterns I use instrumental variables (IV). I use indicators of the legal origin of each country to construct interaction variables, which I use to instrument my judicial quality interaction. More precisely, I construct the following instruments: $z_i(B_c - B_{c'})$, $z_i(F_c - F_{c'})$, $z_i(G_c - G_{c'})$, $z_i(S_c - S_{c'})$, where B_c, F_c, G_c and S_c are indicator variables that equal one if country c has a legal origin that is British common law, French civil law, German civil law and Socialist. The omitted category is for Scandinavian civil law countries. Because each country's legal origin is predetermined and unaffected by trade flows in 1997, this can be used to isolate exogenous variation in judicial quality. Acemoglu and Johnson (2004), Djankov et al. (2003) and Lerner and Schoar (2005) have shown that legal origin is an important determinant of differences in judicial quality and contract enforcement between countries. Their findings, consistent with the work of legal historians, show that the quality of the judicial system is higher in British common law countries than in French civil law countries, and that German and Scandinavian civil law countries are found to lie between the French and British legal systems.

The IV estimates are reported in Table 5. The first stage is summarized in the bottom panel of the table. The coefficient for the interaction terms are statistically significantly and the F-statistics are high. The signs of the coefficients are as expected. The signs and magnitudes of the coefficients suggest that British legal origin countries have the best rule of law, followed in order by German, French, Scandinavian and Socialist. The second stage is summarized in the top panel of the table. In columns 1 and 3, I report the OLS results with and without factor endowment interactions included in the regression equation. In columns 2 and 4, I report the corresponding IV estimates. In both specifications, the IV coefficients are larger than the OLS estimates and are statistically significant. The Hausman test rejects the null hypothesis of consistency of OLS for both specifications, suggesting that judicial quality is endogenous. The results from tests of the over-identification restrictions are mixed. Without factor endowment interactions, the Chi-Squared test statistic is 13.7 and the null hypothesis of valid instruments can be rejected at the 1% significance level, but with factor endowment interactions, the test statistic is 3.34 and the null hypothesis cannot be rejected at any standard significance level. This shows that unless factor endowment interactions are included in the second stage, the instruments are correlated with the second stage error term. This result may be explained by La Porta et al.'s (1998) finding that legal origin affects investor protection. If a country's investor protection affects its accumulation of physical and human capital, then legal origin will affect trade flows through factor accumulation. Therefore, if factor endowments are not controlled for, legal origin may have an effect on trade flows through factor endowments. But once endowments are controlled for, legal origin does not appear to have any additional effect on trade flows.

5.1.3 Matching Estimates

Although I control for factor endowments in the second stage of the IV procedure, it is still possible that the instruments are correlated with the second stage residuals. This is especially a concern because the IV estimates of the effect of judicial quality on trade flows are larger than the OLS estimates. Given the nature of the potential reverse causality, the IV estimates are expected to be smaller than the OLS estimates, not larger. In addition, La Porta et al. (1997, 1998) and Acemoglu and Johnson (2003) find that

Table 5: IV estimates using legal origin as an instrument.

	OLS (1)	IV (2)	OLS (3)	IV (4)
Second Stage: Dep var is $\ln\left(\frac{x_{ic}}{x_{ic'}}\right)$				
Judicial quality interaction: $z_i(\gamma_c - \gamma_{c'})$	.18	.25	.21	.46
	(21.9)	(14.6)	(17.7)	(13.7)
Skill interaction: $h_i(H_c - H_{c'})$			.12	.04
			(9.21)	(2.46)
Capital interaction: $k_i(K_c - K_{c'})$			.09	.19
			(5.56)	(9.02)
Country pair FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
R^2	.82	.82	.84	.83
Number obs.	22,353	22,353	10,792	10,792
Hausman t-statistic		4.51		7.99
Over-id test: $nR^2 \sim \chi^2$		13.7		3.34
First Stage: Dep var is $z_i(\gamma_c - \gamma_{c'})$				
British interaction: $z_i(B_c - B_{c'})$		.18		.13
		(34.0)		(22.2)
French interaction: $z_i(F_c - F_{c'})$		.06		.05
		(9.54)		(6.93)
German interaction: $z_i(G_c - G_{c'})$		.17		.12
		(23.6)		(14.9)
Socialist interaction: $z_i(S_c - S_{c'})$		−.00		
		(−.36)		
R^2		.91		.90
F-statistic		594		385

Notes: For the second stage, beta coefficients are reported, with t-statistics in brackets. For the first stage, because the variables are indicator variables, I report regular coefficients. The omitted legal origin category in the first stage is Scandinavian. The measure of contract intensity used is z_i^{rs1}. Because factor endowment data are not available for any of the Socialist countries, the Socialist interaction term is not available as an instrument when factor endowments are controlled for in the second stage.

a country's legal origin also affects its financial development. If financial development affects trade through channels other than capital accumulation, then the exclusion restrictions may be violated and the IV estimates will be inconsistent. As well, Mahoney (2001) finds that legal origin affects economic growth. If a country's level of development affects its pattern of trade, the IV estimates will be inconsistent.

To correct for this possibility, I pursue the following strategy. I continue to use differences in legal origin as a measure of differences in judicial quality that are unaffected by trade flows in 1997, but I restrict my analysis to British common law and French civil law countries, and estimate the following equation[15]

$$\ln\left(\frac{x_{ib}}{x_{if}}\right) = \alpha_{bf} + \beta z_i + \varepsilon_{ibf} \tag{13}$$

where x_{ib} and x_{if} denotes total exports from a British and French legal origin country in industry i. Because, all else equal, British common law countries tend to have better legal systems than French civil law countries, β is expected to be positive.

Because British common law and French civil law countries are different in many ways other than the quality of their judicial systems, I restrict my comparison to pairs of countries with similar country characteristics that may affect comparative advantage and bias my estimates if not accounted for. I match countries based on per capita income, financial development, factor endowments and trade openness.[16] By restricting my sample to matched country pairs, I remove the bias that may exist in my estimates if these particular country characteristics were ignored.

An alternative strategy is to use IV, but include the same country characteristics interacted with industry characteristics as additional controls in the second stage. However, unlike IV, matching does not require that I know exactly how it is that country characteristics affect the pattern of trade in order to eliminate the bias from the country characteristics. That is, I do not need to specify the industry characteristics to be interacted with each country characteristic.[17]

[15] In the sample there are 16 socialist, 6 German and 5 Scandinavian legal origin countries. An additional strategy is to include German and Scandinavian civil law countries with the French civil law countries. This is not done because there are significant differences between the French, German and Scandinavian systems. Including all civil law systems together does not alter the results of the paper.

[16] I continue to use the same measures of income, financial development and factor endowments as before. Trade openness is the log of exports plus imports divided by GDP.

[17] To see this, assume that the true model is given by (12) and that legal origin is

To match British common law and French civil law countries I use propensity score matching (Rosenbaum and Rubin, 1983, 1984), which I perform as follows. Let L_c be an indicator variable that equals one if country c's legal origin is British common law and zero if country c's legal origin is French civil law. I first estimate the following probit model

$$P_c = \Pr\{L_c = 1 \,|\, \mathbf{X_c}\} = \Phi(\mathbf{X_c'}\beta)$$

where $\Phi(\cdot)$ is the normal CDF and $\mathbf{X_c'}$ is the vector of variables used to match countries. I calculate each country's predicted propensity score $\hat{P}_c$. Then, for each British common law country b, I choose the French civil law country f that minimizes the distance between their propensity scores. More precisely, for each b, the matched f satisfies

$$f(b) = \arg\min_f |\hat{P}_b - \hat{P}_f| \;\; \forall \;\; f \in \{F\}$$

where F denotes the set of French common law countries. This matching procedure is often referred to as nearest neighbor matching.

With the sample of matched country pairs, I estimate (13). The results of this are reported in Table 6. In the first column, for comparison I do not restrict my sample of matched country pairs. I match every British common law country with every French civil law country and estimate (13), adjusting the standard errors for clustering. The estimated coefficient of 1.07 is similar to the estimated effect of 1.22 implied by the IV estimates.[18] In columns 2 and 3, I restrict my sample of country pairs to those matched using log per capita GDP and financial development, respectively. In both cases, the estimated coefficients are positive and statistically significant, and the magnitude of the coefficients are slightly less than half the baseline estimate of 1.07 from column 1. This suggests that not controlling for differences in

correlated with Q_c, so that my instruments are correlated with the error term if I do not control for $q_i(Q_c - Q_{c'})$. In order for the exclusion restrictions to be satisfied, I must control for $q_i(Q_c - Q_{c'})$, which requires correctly identifying and measuring q_i. If instead I compare countries with different legal origins and match country pairs by Q_c, then among the pairs of countries that I am comparing $Q_c \approx Q_{c'}$ and the interaction in (12) is close to zero. Therefore, I do not have to know q_i in order to estimate the effect of judicial quality on growth.

[18]The effect from the IV estimates is calculated as follows. When comparing the export ratio of British and French legal origin countries, $B_c = 1$, $B_{c'} = 0$, $F_c = 0$, $F_{c'} = 1$, $G_c = 0$, $G_{c'} = 0$, $S_c = 0$, $S_{c'} = 0$, and the estimated difference in judicial quality between the two is: $z_i(\gamma_c - \gamma_{c'}) = .184\, z_i(1-0) + .061\, z_i(0-1) = .124\, z_i$. The second stage coefficient for $z_i(\gamma_c - \gamma_{c'})$ is 9.81. Therefore, the estimated change in relative exports across industries is: $9.81 \times .124\, z_i = 1.22\, z_i$.

Table 6: Comparing matched British common law and French civil law countries. Dependent variable is $\ln\left(\frac{x_{ib}}{x_{if}}\right)$.

	(1)	(2)	(3)	(4)	(5)	(6)
		Matched by				
	Not matched	Per-cap. GDP	Financial develop.	Factor endow.	Trade open.	All vars.
Contract intensity: z_i	1.07	.48	.43	2.01	1.16	.93
	(7.02)	(2.51)	(2.40)	(8.10)	(4.74)	(3.55)
Country pair FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2	.70	.57	.65	.54	.68	.68
Number obs.	348,042	5,223	4,898	4,328	3,614	4,138

Notes: Estimated coefficients are reported, with t-statistics in brackets. Standard errors have been adjusted for clustering within industries. The measure of contract intensity used is z_i^{rs1}.

income and financial development between British and French legal origin countries biases upwards the estimated effect of judicial quality on trade flows. In addition, it also shows that even controlling for these differences, legal origin continues to be an important determinant of comparative advantage.

In columns 4 and 5, I match countries by factor endowments and trade openness. In both cases the estimated coefficient remains positive and statistically significant. Unlike the results when countries are matched by income and financial development, here the estimated magnitudes are larger than the baseline estimate. In the final column, I match country pairs using all of the variables.[19] The estimated coefficient is .93, which is slightly smaller than the baseline estimate of 1.07, as well as the estimated effect of 1.22 implied by the IV estimates. This suggests that not accounting for these country characteristics does result in estimates that are biased upward. In addition, the coefficient is statistically significant, showing that British common law countries specialize in goods that rely most heavily on relationship-specific investments.

Overall, the matching estimates support the IV estimates. Although matching yields estimated effects that are slightly smaller than the effects implied by the IV estimates, the results continue to show that countries with

[19] I have also tried matching based on different subsets of variables. This yields similar results to what I report here.

good judicial systems tend to specialize in goods that are contract intense.

5.2 Measurement Error: Vertical Integration and Repeat Relationships

My analysis to this point has not accounted for the possibility that either vertical integration or informal forms of contract enforcement, such as repeat relationships, can be used to help reduce under-investment when contracts are imperfectly enforced. In this section, I examine how vertical integration and repeat relationships bias my results. I find that my estimates of the relationship between judicial quality and the pattern of trade are biased towards zero. I test for this bias by estimating my baseline equation (11) using a sample of countries for which repeat relationship are least likely to occur and using a sample of industries for which vertical integration is a less feasible option. Consistent with the nature of the bias, I find that the estimated effects of judicial quality on the pattern of trade are larger within these countries and industries.

I first consider the bias introduced by vertical integration. My ideal measure of the contract intensity of industries (call this z_i^*) would take into account each industry's ability to vertically integrate to help alleviate under-investment. Instead of this ideal measure, I am only able to quantify the proportion of inputs that are relationship-specific, z_i. Because my measure does not account for firms' ability to vertically integrate, it will tend to overstate the importance of contracts in each industry. That is, $z_i - z_i^* > 0$. In addition, this overstatement will likely be greater the higher is z_i. This is because the more important relationship-specific investments are in an industry, the greater the benefit to vertical integration (Klein, Crawford and Alchian, 1978), and all else equal the more likely it is that vertical integration will occur, causing z_i to differ from z_i^*. Following this logic, assume that measurement error from vertical integration takes the following form: $z_i - z_i^* = \rho z_i + v_i$, where $\rho \in (0,1)$ and v_i is i.i.d. drawn from a normal distribution. By including v_i, I also allow for the existence of random measurement error. Rearranging yields the following relationship between z_i and z_i^*

$$z_i = \frac{z_i^*}{\eta} + \frac{v_i}{\eta} \tag{14}$$

where $\eta \equiv 1 - \rho \in (0,1)$.

If a country has a poorly functioning judicial system, then informal forms of contract enforcement, such as repeat relationships, may develop as a substitute for formal contract enforcement. Let γ_c^* denote my ideal measure of the contracting environment that accounts for repeat relationships and γ_c my observed measure. Because γ_c does not account for the ability of repeat relationships to partially substitute for formal contract enforcement, it will tend to understate the quality of the contracting environment: $\gamma_c^* - \gamma_c > 0$. In addition, because repeat relationships develop as a substitute for formal contract enforcement, the difference between γ_c^* and γ_c is likely larger the worse is the quality of the judicial system. Based on this logic, I assume that measurement error takes the following form: $\gamma_c^* - \gamma_c = \psi(1 - \gamma_c) + w_c$, where $\psi \in (0, 1)$ and w_c is i.i.d. drawn from a normal distribution. Again, I have also allowed for random measurement error. Rearranging yields

$$\gamma_c = \frac{\gamma_c^*}{\phi} - \frac{1-\phi}{\phi} - \frac{w_c}{\phi} \tag{15}$$

where $\phi \equiv 1 - \psi \in (0, 1)$.

Expressing all variables as deviations from means, the true relationship between trade flows, the contracting environment and contract intensity is given by

$$\ln x_{ic} - \ln x_{ic'} = \beta\, z_i^* (\gamma_c^* - \gamma_{c'}^*) + \varepsilon_{icc'} \tag{16}$$

and the OLS estimate of β is

$$\hat{\beta} = \frac{\sum_{ic} z_i(\gamma_c - \gamma_c')(\ln x_{ic} - \ln x_{ic'})}{\sum_{ic} z_i^2 (\gamma_c - \gamma_{c'})^2} \tag{17}$$

Substituting (14), (15) and (16) into (17) and taking the probability limit of $\hat{\beta}$ gives

$$\text{plim}\,\hat{\beta} = \beta\,\eta\phi \left\{ \frac{\sigma_{z^*}^2 \sigma_{\gamma^*}^2}{\sigma_{z^*}^2 \sigma_{\gamma^*}^2 + \sigma_{z^*}^2 \sigma_w^2 + \sigma_{\gamma^*}^2 \sigma_v^2 + \sigma_v^2 \sigma_w^2} \right\}$$

Two sources of measurement error are apparent. One is attenuation bias from classic errors-in-variables. This is given by the expression inside the brackets, where the denominator is larger than the numerator. There is also a second bias that exists because of vertical integration and repeat relationships. To see this, assume that classical measurement error is absent with $\sigma_w^2 = \sigma_v^2 = 0$. Then, $\text{plim}\,\hat{\beta} = \beta\,\eta\phi$. Because η and ϕ are both between zero and one, the estimate of β is still biased towards zero.

Because of the two sources of measurement error, both of which bias OLS estimates towards zero, the OLS estimates reported may be a lower bound. The true relationship between contract enforcement and the pattern of trade

Table 7: Allowing the effect of judicial quality to differ. Dependent variable is $\ln\left(\frac{x_{ic}}{x_{ic'}}\right)$.

	(1)	(2)	(3)
Judicial quality interaction: $z_i(\gamma_c - \gamma_{c'})$	.18	.11	.20
	(21.9)	(11.7)	(22.6)
$z_i(\gamma_c - \gamma_{c'}) \times I_i^{n_i > \overline{n}}$		.10	
		(14.4)	
$z_i(\gamma_c - \gamma_{c'}) \times I_c^{\gamma_{c'} > \overline{\gamma}}$			.05
			(6.09)
Country pair FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
R^2	.82	.82	.82
Number obs.	22,353	22,353	22,353

Notes: Beta coefficients are reported, with t-statistics in brackets. The measure of contract intensity used is z_i^{rs1}.

may be larger than the estimates suggest. I explore this possibility by testing whether the estimated relationship between judicial quality and trade flows is stronger within industries where vertical integration is most difficult and most costly, and among countries where informal forms of contract enforcement are least likely to arise. As an indicator of the difficulty of vertical integration, I use the number of inputs used in the production process, calculated using the 1997 United States I-O Use Table. This assumes that vertical integration is more difficult in industries that requires many different inputs. For firms that use a small number of inputs, producing all inputs in-house is more feasible and less costly. I test whether the relationship between the contracting environment and trade flows is stronger in industries for which vertical integration is more difficult by constructing an indicator variable $I_i^{n_i > \overline{n}}$ that equals one if the number of inputs used in industry i is greater than the average number of inputs used in each industry, which is 75. I interact the indicator variable with $z_i(\gamma_c - \gamma_{c'})$ and include this in my baseline equation (11).

The estimation results are summarized in Table 7. Column 1 reproduces the baseline estimate for comparison. Column 2 includes the interaction term, which is positive and statistically significant. This indicates that the estimated relationship between the contracting environment and trade flows is stronger in industries that require many inputs. The estimated coefficient is .21 within industries requiring more inputs than average and .11 within industries requiring less inputs than average. This can be contrasted to the estimated coefficient for the sample as a whole reported in column 1, which is .18. These results support my calculations of the bias introduced by vertical integration. I find a stronger relationship between contract enforcement and trade flows in industries for which vertical integration is less likely to be a feasible alternative.

If countries with the worst judicial systems are the most likely to develop repeat relationships, then because of the bias introduced by repeat relationships, the estimated relationship between judicial quality and trade flows will be strongest among the countries with the best judicial systems. To test for this, I construct an indicator variable $I_c^{\gamma_{c'} > \overline{\gamma}}$ that equals one if the measured rule of law in country c' is greater than the average, which is .51. I interact this with $z_i(\gamma_c - \gamma_{c'})$ and include this interaction in my baseline estimate. The results, reported in column 3, show that the estimated relationship between judicial quality and trade flows is strongest among countries with the best judicial systems. The estimated coefficient for these countries is .25, which is significantly higher than the estimate of .18 for the sample as a whole. Again, these results are consistent with my calculations of the bias introduced from repeat relationships.

Overall, the results of this section suggest that the existence of repeat relationships and vertical integration bias OLS estimates towards zero. Therefore, my baseline estimates may represent a lower bound of the effect of contract enforcement on trade flows.

5.3 Sensitivity and Robustness

5.3.1 Using Alternative Measures of Judicial Quality and Contract Intensity

The first sensitivity check that I perform tests the robustness of my results to alternative measures of γ_c and z_i. I re-estimate (11) using four alternative measures of the contracting environment and both measures of contract intensity, z_i^{rs1} and z_i^{rs2}. The results are reported in Table 8. Each entry of the table reports the estimated coefficient and t-statistic for the interaction term $z_i(\gamma_c - \gamma_{c'})$ when different measures of γ_c and z_i are used. Columns 1 and 2 report the estimation results when I estimate (11) without capital and skill endowment interactions and columns 3 and 4 report the estimation results with capital and skill interactions. In columns 1 and 3, I use z_i^{rs1} as the measure of contract intensity, and in columns 2 and 4, I use z_i^{rs2}.

Each row of the table reports the results when different measures of contract

Table 8: Alternative measures of judicial quality and contract intensity. Dependent variable is $\ln\left(\frac{x_{ic}}{x_{ic'}}\right)$

	(1)	(2)	(3)	(4)
	Without factor endowment controls		With factor endowment controls	
Measure of judicial quality, γ_c	z_i^{rs1}	z_i^{rs2}	z_i^{rs1}	z_i^{rs2}
Rule of law	.18	.27	.21	.25
	(21.9)	(18.6)	(17.7)	(12.3)
Legal quality	.21	.25	.23	.23
	(22.3)	(15.6)	(19.2)	(10.7)
Number of procedures	.14	.18	.17	.17
	(18.5)	(12.5)	(16.1)	(8.98)
Official costs	.11	.23	.11	.18
	(12.7)	(14.4)	(9.41)	(8.43)
Time	.06	.05	.05	.04
	(8.00)	(4.05)	(5.22)	(2.41)

Notes: Each entry of the table reports the beta coefficient and t-statistic for $z_i(\gamma_c - \gamma_{c'})$. Each regression also includes country pair and industry fixed effects. Each regression has the following number of observations (with and without factor endowment controls): 18,839 and 10,641 when 'legal quality' is used; 19,232 and 10,601 when 'number of procedures' is used; 18,636 and 10,104 when 'official costs' is used; and 18,636 and 10,104 when 'time' is used.

enforcement are used. In the first row, for comparison I report the estimation results when the rule of law is used as my measure of γ_c. The second row reports the results when I use a subjective measure of legal quality in 1995 from Gwartney and Lawson (2003). The final three rows report results when I use three alternative measures of the quality of the legal system from the World Bank's Doing Business Database. In cooperation with Lex Mundi member law firms across the world, Djankov et al. (2003) have documented the exact procedures used by courts and litigants to evict a tenant for non-payment of rent and to collect a bounced check. Using this information, the World Bank has constructed three variables that can be used as measures of the quality of the judicial system and its ability to enforce contracts: the number of procedures involved, the official costs, and the total time

Table 9: Robustness of the results. Dependent variable is $\ln\left(\frac{x_{ic}}{x_{ic'}}\right)$.

	Contract intensity measure:	
	z_i^{rs1}	z_i^{rs2}
Baseline estimates		
Judicial quality interaction:	.18	.27
$z_i(\gamma_c - \gamma_{c'})$	(21.9)	(18.6)
Number obs.	22,353	22,353
R^2	.82	.82
Outliers omitted		
Judicial quality interaction:	.16	.28
$z_i(\gamma_c - \gamma_{c'})$	(22.9)	(22.5)
Number obs.	21,334	21,334
R^2	.88	.88
OECD countries only		
Judicial quality interaction:	.14	.27
$z_i(\gamma_c - \gamma_{c'})$	(10.2)	(12.2)
Number obs.	16,768	16,768
R^2	.72	.72
Data from 1963		
Judicial quality interaction:	.20	.33
$z_i(\gamma_c - \gamma_{c'})$	(9.80)	(7.90)
Number obs.	6,620	6,620
R^2	.68	.68

Notes: Beta coefficients are reported, with t-statistics in brackets. The measure of contract intensity used is z_i^{rs1}. Each regression includes industry and country pair fixed effects.

required. I scale each variable so that a higher number indicates a better judicial system. As Table 8 shows, no matter which measures of γ_c and z_i are used, the estimated coefficient of $z_i(\gamma_c - \gamma_{c'})$ is positive and statistically significant.

5.3.2 Sensitivity to Alternative Samples and Influential Observations

Next, I test the sensitivity of my results to alternative samples and to the removal of influential observations. The results are summarized in Table 9. In the top panel of the table, I report the baseline estimates for comparison. In the second panel, I omit observations with studentized residuals greater than

2.0 and re-estimate (11).[20] As shown, the results are robust to the removal of outlying observations. Next, I restrict my sample to countries that had joined the OECD by 1997. This serves as a check of whether the results are being driven by broad differences between developing and developed countries or whether the importance of judicial quality can also be seen among the group of most developed countries. In addition, because data from these countries are of good quality, I am also testing the sensitivity of my results to the omission of countries with lower quality data. As shown in the third panel, the results continue to hold when the equation is estimated using only OECD countries. As a final sensitivity check, I test whether my findings are robust to the time period being considered by re-estimating (11) using data from 1963.[21] The trade data are from the UN's Comtrade database. As a measure of contract enforcement I use a subjective measure of each country's legal quality in 1970 from Gwartney and Lawson (2003).[22] Using the 1963 U.S. I-O tables and Rauch's (1999) data, I construct measures of z_i^{rs1} and z_i^{rs2} for 1963. In the end, my 1963 sample includes 42 countries and 178 industries. As shown in the last panel of the table, the 1963 estimates support the findings for 1997. The estimated coefficients for the judicial quality interaction remain positive and statistically significant. In addition, they are approximately the same magnitudes as the 1997 coefficients.

5.3.3 Robustness to the use of United States Input-Output Tables

Because highly disaggregated I-O tables do not exist for all countries, when constructing my measures of z_i, I must use the U.S. I-O table for all countries, implicitly assuming that each country's intermediate input use is the same as in the United States. In this section, I test the sensitivity of my results to this assumption. I do this as follows. For 50 of the 146 countries

[20] An observations studentized residual is calculated from a regression with the observation in question excluded. This methodology allows one to recognize an outlier that strongly influences the estimated regression line, causing the observation to have a small residual. See Belsley, Kuh and Welsch (1980).

[21] I choose to report 1963 estimates because this is the earliest year for which data are available. I have also estimated the equations using data from 1967, 1972, 1977, 1982, 1987 and 1992, and the results are robust to each of these alternative samples. Unfortunately, one is unable to create a panel data set because the industry classification of the trade data and the production data are not consistent over time.

[22] I use this measure because Kaufmann et al.'s (2003) rule of law measure is not available for years before 1996 and Djankov et al.'s (2003) variables are not available for years prior to 2003. I have also used real per capita GDP in 1963 as a rough proxy for judicial quality. This produces estimates that are very similar to what I report here.

Table 10: Robustness to the reliance on U.S. I-O tables for all countries. Dependent variable is $\ln\left(\frac{x_{ic}}{x_{ic'}}\right)$.

	Beta coef	t-stat	R^2	Obs	Countries
All countries with GTAP I-O tables	.22	18.1	.79	9,873	50
Countries omitted if $\hat{\rho} < .5$	.24	17.7	.78	8,460	43
Countries omitted if $\hat{\rho} < .6$	.25	17.2	.78	7,391	38
Countries omitted if $\hat{\rho} < .7$	.25	15.6	.78	6,343	32
Countries omitted if $\hat{\rho} < .8$	.20	9.87	.73	4,984	24
Countries omitted if $\hat{\rho} < .9$	.16	4.58	.66	2,403	12

Notes: Each regression includes industry and country pair fixed effects. The measure of contract intensity used is z_i^{rs1}.

in my sample I-O tables for 1997 disaggregated into 57 sectors are available from the Global Trade Analysis Project (GTAP) Data Base. Using the GTAP tables, I construct measures of the similarity of each country's I-O table to the U.S. I-O table. To construct a measure of similarity to the U.S. I-O table, I follow Elmslie and Milberg (1992). I take the vector of final goods produced in the U.S. in 1997 (also from the GTAP Data Base) and, using the U.S. GTAP I-O table, I calculate the amount of each intermediate input that is needed to produced this output vector. For every other country for which a GTAP I-O table exists, I use the country's I-O table to calculate the amount of each intermediate input that is needed to produce the same output vector. I then compare each country's input vector with the U.S. input vector by calculating the pair wise correlation coefficient of the two vectors. I then re-estimate my baseline equation after restricting the sample to include only countries with I-O tables that are most similar to the U.S. I-O table.

The results of this procedure are reported in Table 10. Each row reports the results from one regression. In the first row, I restrict my sample to only include the 50 countries that have GTAP I-O tables. In the subsequent rows, I exclude countries with I-O tables that are dissimilar to the U.S. I-O table. I first omit countries with a correlation coefficient less than .5, then .6, and so forth. As shown, the results remain robust to the omission of countries that have input-output structures different from the U.S. In every subsample, the estimated coefficient remains positive, statistically significant and approximately the same magnitude as the estimate of .18 for the full sample.

6 Conclusions

I have tested whether a country's contracting environment is source of comparative advantage. I have found that countries with good contract enforcement specialize in industries where relationship-specific investments are important. My estimates suggest that contract enforcement explains more of the variation in trade flows than do endowments of capital or skilled labor. To correct for the possibility of endogeneity and omitted variables bias, I pursued a number of strategies. First, I controlled for a number of alternative determinants of comparative advantage. Second, I used instrumental variables to instrument for judicial quality, which is potentially endogenous to trade flows. As instruments I used each country's legal origin. Third, I used propensity score matching to compare matched British common law and French civil law countries. I matched countries by important country characteristics that may affect trade flows through channels other than contract enforcement. I found that the OLS results remain robust to these corrections. Overall, the results suggest that a nation's ability to enforce contracts is an important determinant of comparative advantage and the pattern of trade.

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A Proofs

Lemma. *The ratio* $c(p^s, \gamma, z)/c(p^{s'}, \gamma', z)$ *is decreasing in* z.

Proof. The ratio is given by

$$\frac{c(p^s, \gamma, z)}{c(p^{s'}, \gamma', z)} = \frac{p^s}{p^{s'}} \left[\frac{1 + a(z)/f(q^*(\gamma))}{1 + a(z)/f(q^*(\gamma'))} \right]$$

This can be rewritten

$$\frac{c(p^s, \gamma, z)}{c(p^{s'}, \gamma', z)} = \frac{p^s}{p^{s'}} \left[1 - \frac{f(q^*(\gamma'))^{-1} - f(q^*(\gamma))^{-1}}{a(z)^{-1} + f(q^*(\gamma'))^{-1}} \right]$$

Because $a(z)$ is increasing in z, $c(p^s, \gamma, z)/c(p^{s'}, \gamma', z)$ is decreasing in z. □

Proposition. *For any two countries with* $\gamma \neq \gamma'$ *an equilibrium with trade exists and is unique.*

Proof. Because consumers' preferences are Cobb-Douglas, the constant expenditure share $b(z)$ is given by

$$b(z) = \frac{P(z)C(z)}{Y + Y'} > 0$$

where $P(z)$ is the price of good z, $C(z)$ is the consumption of good z by both countries, and Y and Y' are the aggregate incomes in each country. The fraction of total income spent on goods produced by the country with the better judiciary is $\int_{\tilde{z}}^{1} b(z)\,\mathrm{d}z$ and the fraction spent on goods from the country with the poor judiciary is $\int_{0}^{\tilde{z}} b(z)\,\mathrm{d}z$.

Balanced trade requires that the amount spent by each country on the other's goods must be equal:

$$\int_0^{\tilde{z}} b(z)\,\mathrm{d}zY = \int_{\tilde{z}}^1 b(z)\,\mathrm{d}zY' \tag{18}$$

Total income is given by $Y = f(q^*(\gamma))p^c L^c + p^s L^s$. Using (8), this can be rewritten as $Y = p^s(L^c + L^s) = p^s L$, where L is the country's total endowment of labor. Analogously, income for the country with the poor judicial system is given by $Y' = p^{s'} L'$. Substituting the expressions for Y and Y' into (18) and rearranging yields

$$\frac{p^s}{p^{s'}} = \frac{\int_{\tilde{z}}^1 b(z)\,\mathrm{d}z}{\int_0^{\tilde{z}} b(z)\,\mathrm{d}z}\left(\frac{L'}{L}\right) \equiv B(\tilde{z}; L'/L)$$

$B(\tilde{z}; L'/L)$ is continuous and decreasing in z. We have $B(1; L'/L) = 0$, and $B(\tilde{z}; L'/L) \to \infty$ as $\tilde{z} \to 0$.

Equal costs of producing good $\tilde{z}$ requires $c(p^s, \gamma, \tilde{z}) = c(p^{s'}, \gamma', \tilde{z})$, which is equivalent to

$$\frac{p^s}{p^{s'}} = \frac{1 + a(\tilde{z})/f(q^*(\gamma'))}{1 + a(\tilde{z})/f(q^*(\gamma))} \equiv C(\tilde{z})$$

From the lemma, it follows that $C(\tilde{z})$ is increasing in $\tilde{z}$, and because $a(\tilde{z})$ is continuous, it follows that $C(\tilde{z})$ is also continuous.

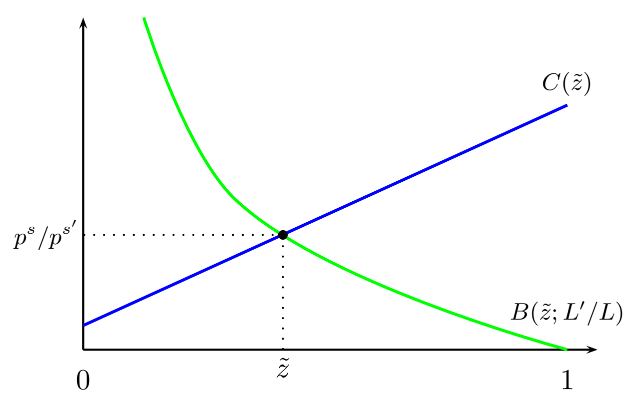

Figure 3: Existence and uniqueness of the equilibrium.

The determination of equilibrium is illustrated in Figure 3. The existence and uniqueness of equilibrium follows from $C(\tilde{z})$ being increasing and continuous in $\tilde{z}$, and from $B(\tilde{z}; L'/L)$ being continuous and decreasing in $\tilde{z}$, ranging from zero to infinity. □

B N Country Equilibrium

Consider the general case with N countries. I order these countries from 1 to N in increasing order of γ, such that $\gamma_1 < \gamma_2 < \ldots < \gamma_{N-1} < \gamma_N$.

For each country $i = 1, \ldots, N$, the following balance of trade condition must hold.

$$\sum_{j \neq i} p_j^s L_j \int_{\tilde{z}_{i-1}}^{\tilde{z}_i} b(z)\,\mathrm{d}z = p_i^s L_i \left(\int_0^{\tilde{z}_{i-1}} b(z)\,\mathrm{d}z + \int_{\tilde{z}_i}^1 b(z)\,\mathrm{d}z \right)$$

where $\tilde{z}_{i-1}$ and $\tilde{z}_i$ are the lower and upper cut-offs for country i, i.e. country i produces goods $z \in [\tilde{z}_{i-1}, \tilde{z}_i]$.

These conditions give $N-1$ independent equations. The balance of trade condition for the N^{th} country follows from the balance of trade condition of the other $N-1$ countries. In addition, $N-1$ equal cost conditions must be satisfied. For each $i = 1, \ldots, N-1$:

$$\frac{p_{i+1}^s}{p_i^s} = \frac{1 + a(\tilde{z}_i)/f(q^*(\gamma_i))}{1 + a(\tilde{z}_i)/f(q^*(\gamma_{i+1}))}$$

The balanced trade and equal cost conditions for each country provide $2N-2$ equations. Choosing any country's input price as the numéraire equal to one results in an additional equation so that there are $2N-1$ equations in total. There are $2N-1$ unknowns: $N-1$ cut-offs, $\tilde{z}_1, \ldots, \tilde{z}_{N-1}$, and N input prices rates, $p_1^s, \ldots, p_N^s$.

C Data

C.1 Country Data

Exports ($\mathbf{x_{ic}}$): The total value (in thousands of U.S. dollars) of exports by country c in industry i to all other countries in 1997. Source: World Trade Flows Database (Feenstra, 2000). The original data are classified by the 4-digit SITC Rev. 2 system. I concord the data to the BEA's 1997 I-O classification system, by first using the concordance from SITC to HS10, and then the concordance from HS10 to the I-O classification. The first concordance is from the NBER Trade Database, Disk 1. The second concordance is from the BEA. I use the number of HS10 categories linking each SITC and BEA category as an indicator of which BEA category to choose when an SITC category maps into multiple BEA categories. Data from 1963 are from the UN's Comtrade database. The original data are classified by the 4-digit SITC Rev. 1 system. I concord the trade data to BEA's 1963 I-O classification using a concordance from SITC Rev. 1 to SIC72, which the I-O system is based on. The concordance is from Feenstra (1996).

Log real per capita GDP ($\mathbf{y_c}$): The natural log of real GDP per capita in 1997. I use 'rgdpch' from the Penn World Tables (PWT) Mark 6.1 data set. Income data from Maddison (2001) are used for countries without 1997 PWT income data. I link the two measures based on the following cross country regression: rgdpch1997 = 288.1184 + 1.145986 maddison1997. For the regression $n = 100$, $R^2 = .9767$, the t-statistic for β_0 is 1.66, and the t-statistic for β_1 is 64.13.

Capital endowment ($\mathbf{K_c}$): The natural log of the average capital stock per worker in 1992. Source: Antweiler and Trefler (2002).

Human capital endowment ($\mathbf{H_c}$): The natural log of the fraction of workers that completed high school to those that did not complete high school in 1992. Source: Antweiler and Trefler (2002).

Rule of law ($\gamma_\mathbf{c}$): The rule of law in 1997/1998. The variable, which ranges from 0 to 1, measures the extent to which agents have confidence in and abide by the rules of society. These include perceptions of the incidence of crime, the effectiveness and predictability of the judiciary, and the enforceability of contracts. A higher number indicates a better rule of law. Source: Kaufmann et al. (2003).

Legal quality: A measure of the "legal structure and the security of property rights". The measure is an index from 1 to 10, which is comprised of five component indices also from 1 to 10. The component indices are from two sources: the *International Country Risk Guide* (ICRG) and the *Global Competitiveness Report* (GCR). The component indices measure: judicial independence (GCR), impartial courts (GCR), protection of intellectual property (GCR), military influence in the rule of law and political process (ICRG), and the integrity of the legal system (ICRG). Source: Gwartney and Lawson (2003).

Number of Procedures: The total number of procedures mandated by law or court regulation that demand interaction between the parties or between them and the judge (or administrator) or court officer. Because more procedures are associated with a lower judicial quality, I use 60 minus the total number of procedures as my measure. Therefore, a higher number indicates less necessary procedures and a more efficient judicial system. The measure ranges from 2 to 49. Source: World Bank's Doing Business Database. See Djankov et al. (2003).

Official costs: The sum of attorney fees and court fees during the litigation process, divided by the country's income per capita. The measure that I use is 6 minus the log of total official costs. Therefore, a higher number indicates lower costs of litigation and a better legal system. The measure ranges from .45 to 4.56. Source: World Bank's Doing Business Database. See Djankov et al. (2003).

Time: The total estimated time of the full legal procedure in calendar days. It equals the total time until completion of service of process, duration of trial, and duration of enforcement. I use 1,500 minus the total time. Therefore, a higher number indicates a shorter duration and a better legal system. The measure ranges from 41 to 1,473. Source: World Bank's Doing Business Database. See Djankov et al. (2003).

Legal origin: The legal origin of each country. Countries are classified as either: German, Scandinavian, British, French or Socialist. Source: La Porta et al. (1999).

Financial development (cr_c): The natural log of private credit by deposit money banks to GDP in 1997. Source: Financial Structure and Economic Development Database. See Beck, Demirgüç-Kunt and Levine (1999).

Trade openness: The natural log of aggregate exports plus imports divided by aggregate GDP. Source: Feenstra (2000) and PWT 6.1.

C.2 Industry Data

Contract intensity (z_i): This measures the importance of relationship-specific investments in each industry. Source: author's calculations. See the paper for a complete description of the measures that are constructed.

Capital intensity (k_i): Capital stock, calculated as the total real capital stock in industry i (in millions of dollars), divided by the value added (in millions of dollars) in industry i for the United States in 1996. Source: Bartelsman and Gray (1996). The original data are classified according to the SIC87 system. This is converted to the I-O classification by using the concordance from SIC87 to HS10, and then HS10 to the I-O classification.

Both concordances are provided by the BEA.

Skill intensity ($\mathbf{h_i}$): The ratio of non-production worker wages to total wages in industry i in the United States in 1996. Source: Bartelsman and Gray (1996).

Value added ($\boldsymbol{va}_\mathbf{i}$): Total value added divided by the total value of shipments in industry i in 1997.

Intra-industry trade ($\boldsymbol{iit}_\mathbf{i}$): The amount of intra-industry trade in each industry. I use the Grubel-Lloyd index for the United States in 1997. The index is equal to $1 - \frac{|x_i - m_i|}{x_i + m_i}$, where x_i and m_i are exports and imports in industry i.

TFP growth ($\boldsymbol{\Delta tfp}_\mathbf{i}$): Average growth rate in TFP in the United States between 1977 and 1997 in industry i. Source: Bartelsman and Gray (1996).

1 minus Herfindahl index ($\mathbf{1} - \boldsymbol{HI}_i$): The Herfindahl index for industry i is given by $\sum_j \theta_{ij}^2$, where θ_{ij} is the share of input j used in the production of final good i. The measure was constructed using the 1997 United States I-O Use Table.

Table 11: Countries in the sample, ordered by rule of law.

Country	Rule of law	Country	Rule of law	Country	Rule of law
Switzerland	.972	Thailand	.580	Venezuela	.375
Singapore	.948	Trin. & Tobago	.577	Ecuador	.375
Norway	.943	Argentina	.548	Maldives	.370
New Zealand	.935	India	.543	Kiribati	.369
Austria	.921	South Africa	.543	Solomon Islands	.369
Finland	.912	Turkey	.538	Colombia	.367
U.K.	.909	Egypt	.534	Yemen	.365
Netherlands	.904	Lebanon	.532	Niger	.360
Australia	.898	Guyana	.513	Guatemala	.359
Denmark	.897	Belize	.507	Pakistan	.357
Canada	.896	Mongolia	.505	Bangladesh	.356
Sweden	.890	Zimbabwe	.501	Sierra Leone	.356
Germany	.881	Panama	.495	Cambodia	.354
Iceland	.880	Philippines	.492	Suriname	.353
Ireland	.863	Ghana	.488	Russia	.345
U.S.A.	.854	Bhutan	.486	Paraguay	.344
Hong Kong	.846	Brazil	.482	Algeria	.342
Japan	.844	Sri Lanka	.479	Vietnam	.339
France	.789	Uganda	.477	Nicaragua	.337
Qatar	.779	El Salvador	.461	Togo	.335
Spain	.770	Bulgaria	.457	Burundi	.330
Portugal	.761	China	.456	Centr. Afr. Rep.	.326
Belgium	.758	Ethiopia	.453	Guinea	.322
Oman	.755	Jamaica	.452	Yugoslavia	.317
U.A.E.	.754	Romania	.451	Cameroon	.316
Chile	.752	Nepal	.450	Albania	.304
Taiwan	.734	Syria	.449	Comoros	.306
Kuwait	.731	Senegal	.447	Indonesia	.305
Israel	.717	Tanzania	.444	Chad	.304
Italy	.714	Gambia	.443	Haiti	.302
Bahrain	.706	Papua New Guin.	.436	Madagascar	.298
Bahamas	.698	Djibouti	.435	Mozambique	.297
Mauritius	.692	Bolivia	.434	Kenya	.296
Brunei Dar.	.683	St. Kitts	.433	Myanmar	.288
Saudi Arabia	.679	Seychelles	.433	Laos	.286
Costa Rica	.676	Zambia	.432	Libya	.278
Cyprus	.675	Mexico	.425	Afghanistan	.274
South Korea	.664	Benin	.424	Rwanda	.259
Malaysia	.663	Fiji	.420	North Korea	.258
Hungary	.656	Burkina Faso	.415	Congo	.254
Malta	.638	Peru	.412	Guinea-Bissau	.252
Greece	.633	Gabon	.404	Nigeria	.240
Czech Rep.	.623	Mauritania	.403	Angola	.211
Jordan	.620	Iran	.402	Iraq	.164
Poland	.615	Cuba	.400	Equatorial Guin.	.162
Barbados	.610	Malawi	.397	Liberia	.141
Morocco	.607	Ivory Coast	.396	Somalia	.139
Uruguay	.599	Mali	.386	Zaire	.106
Tunisia	.588	Honduras	.376		

Notes: The rule of law variables has been rounded from six digits to three digits.