International Trade and Institutional Change

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Abstract

This paper analyzes the impact of international trade on the quality of institutions, such as contract enforcement, property rights, or investor protection. It presents a model in which institutional differences play two roles: they create rents for some parties within the economy, and they are a source of comparative advantage in trade. Institutional quality is determined in a Grossman-Helpman type lobbying game. When countries share the same technology, there is a "race to the top" in institutional quality: irrespective of country characteristics, both trade partners are forced to improve institutions after opening. On the other hand, domestic institutions will not improve in either trading partner when one of the countries has a strong enough technological comparative advantage in the good that relies on institutions. We test these predictions in a sample of 141 countries, by extending the geography-based methodology of Frankel and Romer (1999). Countries whose exogenous geographical characteristics predispose them to exporting in institutionally intensive sectors enjoy significantly higher institutional quality.

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1 Introduction

Recent literature on the economics of institutions has established a set of important results. First, institutions matter a great deal for economic performance (La Porta, Lopez-de-Silanes, Shleifer and Vishny, e.g. 1997, 1998, Acemoglu, Johnson and Robinson, e.g. 2001, 2005a, Rodrik, e.g. 2007). Second, in spite of the obvious overall benefits to institutional improvement, institutions are in fact very persistent (Acemoglu and Robinson, 2006). Relatedly, episodes of institutional change are rare, and they are typically associated with large and abrupt changes in the economic environment. Finally, institutions are a source of comparative advantage in trade, and the welfare consequences of institutional comparative advantage are often ambiguous (Levchenko, 2007, Nunn, 2007, Costinot, 2006).

This paper analyzes the effect of international trade on economic institutions. It builds a model in which institutions play two key roles. First, they generate rents for some parties within the economy. Second, they are a source of comparative advantage in trade. Then, it endogenizes institutional quality using a simple version of the lobbying framework of Grossman and Helpman (1994, 1995). When countries share the same technology, trade leads to a "race to the top" in institutional quality. Trading partners improve institutions up to the best attainable level after opening, as they compete to capture the sectors that generate rents. By contrast, when one of the trading partners has a sufficiently strong technological comparative advantage in the rent-bearing good, institutions do not improve after trade opening in either country. When other sources of comparative advantage are strong enough, changing institutions will not affect trade patterns, and thus trade does not create an incentive to improve them. The paper then tests these predictions in a sample of 141 countries, and demonstrates that countries whose geographic characteristics predispose them to develop comparative advantage in the institutionally intensive sectors exhibit significantly higher institutional quality.

Why study the effects of trade on institutions? Acemoglu, Johnson, and Robinson (2005a) emphasize the idea that institutions are inherently persistent. The reason for this persistence is that agents in command of political power install the kinds of economic institutions that redistribute resources in the economy to themselves. In turn, the distribution of resources that favors those agents also endows them with political power. The two-way dependence between the distribution of resources in the economy and political power proves difficult to break. This kind of framework suggests that one way institutional change could occur is through large and discrete changes in either the distribution of resources, or the distribution of power in the economy. Trade opening is a natural place to look for a source

of such changes, as it affects the structure of the economy in fundamental, and often abrupt, ways. Indeed, it is widely hoped that greater openness will improve institutional quality through a variety of channels, including reducing rents, creating constituencies for reform, and inducing specialization in sectors that demand good institutions (IMF, 2005; Johnson, Ostry, and Subramanian, 2007). Rodrik (2000) argues that the greatest growth benefits of trade liberalization may well come not from the conventional channels, but from the institutional reform that trade liberalization can engender. However, no well-accepted theoretical framework or a set of basic results on this question currently exist. This paper is an attempt to fill this gap.

To analyze the effect of trade on institutional quality, we must first build a model of institutions. To do so, this paper uses the insights from the incomplete contracts literature exemplified by Williamson (1985) and Grossman and Hart (1986). The quality of contract enforcement and property rights are important because they allow agents to overcome the well-known holdup problem. This modeling approach is advantageous because it leads to a concrete interpretation of what constitutes institutional quality, suggested by Caballero and Hammour (1998): in countries with worse institutions contracts are more incomplete. This framework can be adapted seamlessly and tractably to both trade openness and the political economy of institutions.

An important aspect of the incomplete contracts setup is that some parties to production earn rents. If endowed with political power, those parties will install imperfect institutions in order to capture those rents. This feature lends itself naturally to endogenizing institutions. In order to do so, we adopt a political economy model following Grossman and Helpman (1994).[1] As shown by Caballero and Hammour (1998), the parties earning rents benefit from making institutions worse, up to a certain point. This paper uses Caballero and Hammour's insight in a fully specified lobbying model in order to derive equilibrium institutional outcomes. We show that in autarky, institutions can be sub-optimal, precisely for this reason. Thus, one of the contributions of this paper is to introduce a parsimonious and tractable model of endogenous institutions, which combines the insights from the literatures on both incomplete contracts and political economy.

When it comes to international trade, it is immediate that institutional differences are also a source of comparative advantage: when countries open to trade, only the country with better institutions produces the institutionally intensive good, which is characterized

[1] An innovative aspect of this paper is that while the large majority of papers employing the Grossman-Helpman framework apply it to fiscal instruments – be it tariffs, taxes, or subsidies – we use it to model the determination of institutions instead.

by rents. Thus, the rents disappear as a result of trade opening in the country with inferior institutions.[2] Under trade, we assume that both countries set institutions non-cooperatively as in the two-country model of Grossman and Helpman (1995). When countries share the same technology, the resulting equilibrium is a "race to the top" in institutional quality: both countries improve institutions up to the best attainable level. This is because rents – the very reason to lobby for bad institutions – disappear, unless institutions improve to at least the level slightly better than the trading partner's. When both countries set their institutional quality simultaneously and non-cooperatively, equilibrium is characterized by the best attainable institutions, a Bertrand-like outcome.[3]

What is remarkable about this result is that it does not depend on country characteristics. The country may have such features that its equilibrium institutions are very bad in autarky. However, under trade those features no longer matter. Note also that the "race to the top" result is completely due to the changing preferences of the lobby groups regarding the optimality of institutions. That is, the political power of lobby groups does not change as a result of trade opening. Nonetheless, institutions improve.[4]

Though quite basic, this framework also reveals the circumstances under which this logic would fail. Note that the driving force behind institutional improvement in this model is that rents disappear as a result of trade opening in the country with inferior institutions. If instead the rents do not disappear, trade no longer creates the incentive to improve institutions. One way this could occur is due to differences in technology. If one of the trading partners has a sufficiently strong comparative advantage in the institutionally intensive good, changing institutions in either country will not affect the specialization patterns. Thus, if technologies in the two countries are sufficiently different, the race to the top will not occur. In fact, in this case trade opening may actually increase rents rather than decrease them, and institutions will deteriorate as a result of trade opening in the country

[2]See Levchenko (2007) for a detailed analysis of this result.

[3]Note that we do not attempt to endogenize trade opening. Endogenous trade policy has been the subject of a large literature, and remains beyond the scope of this paper (see e.g. Rodrik, 1995, and Grossman and Helpman, 2002). Nonetheless, we believe that our exercise is still well worth pursuing. First, in many instances changes in trade openness have indeed been exogenous, driven by technological shocks or changes in colonial regimes. Second, many other factors besides ensuing institutional change contribute to the formation of trade policy. Thus, it could be that even when trade openness is endogenous, it is driven by factors unrelated to those we are modeling. The policy initiatives promoting unconditional trade liberalization in developing countries are an important example. Finally, in order to analyze trade opening and endogenous institutions simultaneously, it is important to first understand how the former affects the latter. This paper studies that question, and thus can be used as a building block for a more complete analysis. Indeed, our approach can be viewed as complementary to the trade policy literature, which endogenizes openness but assumes that institutions are exogenous and do not change with trade opening.

[4]Thus, in order to observe institutional improvement, trade need not necessarily empower the "right" groups, as in Acemoglu, Johnson, and Robinson (2005b).

that exports the institutionally intensive good.

Having developed the main intuition regarding the effect of trade opening on institutions, the paper takes it to the data. The key prediction is that countries improve institutions as a result of trade opening if doing so allows them to retain or attract the institutionally dependent sectors. When it comes to actual country experiences, however, it is clear that some countries do not have much hope of attracting those sectors. This would be the case if they have a sufficiently strong comparative disadvantage in the institutionally intensive goods, so that even if they improve institutions, they would not be able to attract those sectors. In this case, the incentive to improve institutions is lost, and trade does not have a positive effect.

These predictions imply that in order to empirically test for the effect of trade on institutions, we must first establish which countries would be the most able to attract the institutionally dependent sectors under trade. We would then expect to see a positive impact of trade on institutions especially in those countries. In order to develop a measure of predicted comparative (dis)advantage in institutionally intensive sectors, the paper follows a strategy similar to Do and Levchenko (2007a). The key idea is to use exogenous geographic variables to predict each country's export pattern, by expanding the methodology of Frankel and Romer (1999). These authors use the gravity model to predict bilateral trade volumes between each pair of countries based on a set of geographical variables, such as bilateral distance, common border, area, and population. Summing up across trading partners then yields, for each country, its "natural openness:" the overall trade to GDP as predicted by its geography. In order to get a measure of predicted trade patterns rather than total trade volumes, Do and Levchenko's (2007a) point of departure is to estimate the Frankel and Romer gravity regressions for each industry. This makes it possible to obtain the predicted trade volume not just in each country, but also in each sector within each country. Combining these with an index of "institutional intensity" at industry level from Nunn (2007) yields a measure of *predicted institutional intensity of exports*. In essence, this approach uses exogenous geographical variables, together with information on how those geographical variables affect industries differentially, to construct a measure of how institutionally intensive a country's export pattern is expected to be.

A country's predicted institutional intensity of exports is indeed a robust determinant of institutions in a cross-section of 141 countries. Countries that, due to their geography, have the potential to export in institutionally intensive sectors have better institutions, all else equal. This result is robust to the inclusion of a variety controls, use of alternative

predicted institutional intensity of exports measures, and subsamples.

This paper is part of a growing literature on the impact of trade openness on domestic institutions. Using different theoretical frameworks, Segura-Cayuela (2006), Stefanadis (2006), and Dal Bó and Dal Bó (2004) demonstrate that economic institutions and policies can deteriorate as a result of trade opening in countries with weak political institutions. Acemoglu, Johnson, and Robinson (2005a) argue that in some West European countries, Atlantic trade during the period 1500-1850 engendered good institutions by creating a merchant class, that became a powerful lobby for institutional improvement. Do and Levchenko (2007b) develop a model in which trade opening creates incentives to improve institutions, but may also lead to strengthening of elites. This paper is the first to model the effect of trade on institutions using a framework in which institutions matter for trade patterns themselves. Doing so allows us to study this question in a model that features two-way interactions between institutions and trade, and therefore use the insights from the literature on institutional comparative advantage. In addition, this framework has the advantage of tractability while at the same time generating a rich set of comparative statics.

Empirical studies by Ades and di Tella (1997), Rodrik, Subramanian and Trebbi (2004), and Rigobon and Rodrik (2005) find that overall trade openness has a positive effect on institutional quality in a cross-section of countries, though this result is not always robust. Giavazzi and Tabellini (2005) demonstrate that institutional quality rises following trade liberalization episodes. This paper focuses on predicted institutional intensity of trade patterns, and shows that it matters more than the overall trade openness.

The rest of the paper is organized as follows. Section 2 lays out the production and trade side of the model, deriving the autarky and trade equilibria at each exogenously given level of institutional quality of the trading partners. Section 3 endogenizes institutions in a political economy framework of lobbying, and presents the main analytical results in the paper. Section 4 describes the empirical strategy and results. Section 5 concludes. Proofs of Propositions are collected in the Appendix.

2 A Model of Institutions, Production, and Trade

2.1 The Environment

The model of production and trade is based on Levchenko (2007). Consider an economy with two factors, capital (K) and entrepreneurs (H), and three goods. Two of the goods are produced using only one factor, and thus we call them the K-good and the H-good. The mixed good, M, is produced with both factors.

Production technology of the K-good and the H-good is linear in K and H. Suppose that one unit of capital produces a units of the K-good, and one unit of H produces b units of the H-good. Then profit maximization in the two industries implies that

$$p_K a = r \qquad \text{and} \qquad p_H b = w, \tag{1}$$

where r and w are the returns to capital and entrepreneurs respectively.

The M-good is produced with a Leontief technology that combines one unit of H and x units of K to produce y units of the M-good. This paper takes the view that institutions matter because they facilitate transactions between distinct self-interested economic parties. The M-good is the only one that requires joining of two distinct factors of production, and thus it is natural to think of the M-good as being dependent on institutions. We now describe how we use the incomplete contracts framework to model imperfect institutions, and how this approach creates a source of comparative advantage: institutional differences.

To model a setting in which the quality of contract enforcement and property rights matter, we adopt the approach developed by Williamson (1985), Grossman and Hart (1986), and Hart and Moore (1990). The strategy is to posit a friction that can be alleviated by appropriately designed contracts and property rights. Following Klein, Crawford and Alchian (1978) and Williamson (1985), we assume that when two distinct parties invest in joint production, some fraction of their investment becomes specific to the production relationship. Investment irreversibility makes the parties more reluctant to enter, introducing inefficiency – the well-known holdup problem. This argument has been used to analyze many kinds of relationships: between producers within a supply chain, between managers and outside investors, between firms and workers, and others. One way to reduce the inefficiency is to write binding long-term contracts. Another is to assign property rights in a way that distributes the residual rights of control to moderate the holdup problem – this is the key idea of Grossman-Hart-Moore. Institutions – quality of contract enforcement, security of property rights, and the like – will matter a great deal for both of these solutions.

Our modeling approach follows Caballero and Hammour (1998). We focus on the case in which the parties to production are K and H. For concreteness, H can be thought of as managers or inside capital, while K would be the outside, or unorganized capital. This interpretation would be in line with the La Porta et al.'s (1998) emphasis of the role of institutions in the market for external finance. However, it is important to emphasize that these arguments are more general and apply to many kinds of production relationships.

Relationship-specific investments occur in production of the M-good. In particular, a fraction ϕ of K's investment in the M-good sector becomes specific to the relationship. The

parameter ϕ is meant to capture quality of contract enforcement and property rights, and its value will differ across countries. Better institutions thus correspond to lower values of ϕ. In other words, if contracts and property rights are well-enforced, each agent will be able to recoup its *ex ante* investment to a greater degree. This way of formalizing institutional differences is appealing because it leads to a concrete interpretation of what constitutes institutional quality: countries with better institutions are the ones in which contracts are less incomplete. In the limiting case when $\phi = 0$, institutions are perfect and we are back to the standard frictionless setting.

What are the consequences of imperfect institutions? Recall that one unit of H and x units of K are required to produce y units of M. After the production unit is formed, K can only recover a fraction $(1-\phi)$ of the investment. In order to induce K to form the production unit, it must be compensated with a share of the surplus, which is given by the revenue minus the *ex post* opportunity costs of the factors:

$$s = p_M y - w - r(1-\phi)x.$$

We adopt the assumption that *ex post* the parties reach a Nash bargaining solution and each receive one half of the surplus. Thus, K will only enter the M-good production if its individual rationality constraint

$$r(1-\phi)x + \frac{1}{2}s \geq rx$$

is satisfied. This can be rearranged to yield:

$$p_M y \geq w + (1+\phi)rx. \tag{2}$$

To complete the description of the setup, it remains to specify the demand for the three goods. For simplicity, we assume that agents have identical Cobb-Douglas utility functions, $U(C_K, C_H, C_M) = C_K^{\alpha} C_H^{\beta} C_M^{\gamma}$, where α, β, and γ are positive and $\alpha + \beta + \gamma = 1$. Given the goods prices p_K, p_H, and p_M, we let the numeraire be the ideal price index associated with Cobb–Douglas utility. Consumer utility maximization then leads to the familiar first-order conditions:

$$p_K = \alpha \frac{C_K^{\alpha} C_H^{\beta} C_M^{\gamma}}{C_K}, \quad p_H = \beta \frac{C_K^{\alpha} C_H^{\beta} C_M^{\gamma}}{C_H}, \quad \text{and} \quad p_M = \gamma \frac{C_K^{\alpha} C_H^{\beta} C_M^{\gamma}}{C_M}. \tag{3}$$

2.2 Autarky Equilibrium

This approach to modeling institutions is easily embedded in the general equilibrium model of this section, in which prices and resource allocations are endogenously determined. Notice

that in general equilibrium, condition (2) can be interpreted as a joint restriction on w, r, and p_M, and will hold with equality.

The only remaining ingredient of the closed-economy equilibrium is market clearing. It is useful to define the following notation. Let E be the share of entrepreneurs (H) employed in the M-sector. This is convenient because the value of E completely characterizes the resource allocation in the economy. Given E and the relevant endowments K and H, production of the M-, H-, and K-goods is yEH, $b(1-E)H$, and $a\left(\frac{K}{H} - xE\right)H$, respectively. Goods market clearing then requires:

$$C_K = a\left(\frac{K}{H} - xE\right)H, \quad C_H = b(1-E)H, \quad \text{and} \quad C_M = yEH. \tag{4}$$

The equilibrium in an economy endowed with K units of capital and H entrepreneurs is a set of prices and the resource allocation $\{p_K, p_H, p_M, r, w, E\}$ characterized by equations (1) through (4).

Institutional imperfections modeled here have two key consequences. First, in general equilibrium one of the factors – H in our case – is segmented: its rewards differ across sectors. Equation (2) makes it possible to calculate the reward to a unit of H employed in the M-sector:

$$w + \frac{1}{2}\left[p_M y - w - (1-\phi)rx\right] = w + \phi rx. \tag{5}$$

It is clear from this expression that each unit of H employed in the M-sector earns rents of size ϕrx.

Second, contracting imperfections imply that the outcome is inefficient. There is underinvestment in the M-good production, and w and r are lower than in the efficient case. This result is intuitive. Imperfect institutions imply that it is harder to induce capital to enter the M-sector. Compared to the frictionless case, w and r must be pushed down, and p_M pushed up to satisfy the individual rationality condition for capital (2). This is achieved by reducing the size of the M-sector, which simultaneously pushes the factors into the K- and the H-sectors, lowering w and r and raising p_M. The effect is monotonic in ϕ: higher values of ϕ lead to lower E, w, and r. Notice also that for a given level of ϕ, increasing the size of the M-sector will raise both w and r, thereby raising welfare of all factors employed in all sectors.

2.3 Trade Equilibrium and Institutional Comparative Advantage

The model is easily adapted to an international trade setting in the presence of both factor endowment and institutional differences. Suppose that there are two countries, A and B,

that can trade costlessly with each other. Following the standard notation, let $\overline{V} = (\overline{K}, \overline{H})$ be the vector of the world factor endowments, and let $(V^A, V^B) = \left[(K^A, H^A), (K^B, H^B)\right]$ be a partition of world factor endowments into the two countries, so that $\overline{K} = K^A + K^B$ and $\overline{H} = H^A + H^B$.

In order to endogenize institutions in the next section, we must first understand what happens in this model at any given level of institutional differences. Suppose, without loss of generality, that country A has better institutions: $\phi^A < \phi^B$. In A a lower fraction of K becomes specific to the M-sector production unit, or, equivalently, contracts are less incomplete there. The description of the trade equilibrium proceeds in two steps. In the first step, we assume that technology is the same in the two countries, and show how institutional differences act as a source of comparative advantage. In the second step, we introduce technological differences, and describe how they can affect trade patterns.

Suppose first that technology is the same in the two countries, but institutions differ. How can we determine the pattern of production and trade? Differences in institutional quality act in a way similar to a Ricardian productivity difference in the M-sector to generate comparative advantage and trade. It turns out that the trade equilibrium can be analyzed using an approach akin to the Davis (1995) Heckscher-Ohlin-Ricardo model. The starting point of the analysis is the integrated equilibrium, which is the resource allocation that results under perfect factor mobility. It is obtained by solving for the equilibrium of a closed economy characterized by the world factor endowment $\overline{V}$. Denote by $\overline{V}(i) = \left[\overline{H}(i), \overline{K}(i)\right]$ the integrated equilibrium factor allocations in industry $i = K, H, M$.

The key insight of the Davis model is that if one country can produce one of the goods more cheaply than the other at a common set of factor prices, in the integrated equilibrium only that country's production process will be used to produce that particular good. In the Davis model, the difference between countries is in Ricardian productivity. Here, it arises instead because country A's less incomplete contracts allow it to sell the M-good at a strictly lower price. This is immediate from equation (2): the price at which the M-good can be produced under country A's institutions is strictly less than the price when country B's institutions are used:

$$p_M y = w + (1 + \phi^A) rx < w + (1 + \phi^B) rx, \tag{6}$$

as $\phi^A < \phi^B$. Therefore, in the integrated equilibrium, only A's institutions will be used to produce the M-good.

From the integrated equilibrium production pattern we can construct a set of partitions

of world factor endowments into countries called the Factor Price Equalization (FPE) set. Following Helpman and Krugman (1985) and Davis (1995), define the FPE set as follows:

Definition 1 *Let η_{ic} denote the share of the integrated equilibrium production of good i that comes from country c. Then, the* ***Factor Price Equalization (FPE) set*** *is a set of partitions of the world factor endowments into countries defined by:*

$$\begin{aligned} FPE \;=\; & \{\left(V^A, V^B\right) \mid \exists \eta_{K,A}, \eta_{H,A}, \eta_{K,B}, \eta_{H,B} \geq 0, \textit{ such that} \\ & \eta_{K,A} + \eta_{K,B} = 1,\ \eta_{H,A} + \eta_{H,B} = 1,\ \eta_{M,A} = 1, \eta_{M,B} = 0, \\ & V^c = \sum_i \overline{V}(i) \textit{ for } c = A, B\}. \end{aligned}$$

This definition states that the two countries' factor endowments belong to the FPE set when i) country A has enough of both factors to produce the entire integrated equilibrium world quantity of the M-good; and ii) the integrated equilibrium production of the K- and H-goods can be allocated between the two countries while keeping all factors fully employed. The FPE set is important because when country endowments belong to it, the integrated equilibrium world resource allocations and prices are replicated purely through trade, as stated formally in the proposition below.[5]

Proposition 1 *When $\phi^A < \phi^B$, and $\left(V^A, V^B\right) \in FPE$, the trade equilibrium world resource allocation, factor prices, and goods prices replicate those of the integrated equilibrium. Therefore, in the trade equilibrium, only country A produces the M-good.*

This result implies that in order to analyze the trade outcomes, we need to do little more than solve for the integrated equilibrium. Figure 1 illustrates the analysis. The sides of the box represent the world factor endowments. Any point in the diagram can represent a division of the world factor endowments into countries, where country A's endowments are measured from O^A, and country B's from O^B. The shaded area represents the FPE set. Since in the integrated equilibrium only A's institutional setting will be used in production of the M-good, country endowments can only belong to the FPE set if the entire integrated equilibrium production of the M-good can be accommodated in A. This is the case, for example, at point P.

[5] We must use the term FPE with caution here. Factor rewards are equalized across countries in each sector, but in this model they differ across sectors. Thus, relative factor rewards across countries will be determined by which sectors operate in which countries. Nevertheless, the FPE set still has the useful feature that for appropriate factor endowments it allows us to analyze the trade outcomes by first constructing the integrated equilibrium.

Let $V^c(i) = [H^c(i), K^c(i)]$ be the trade equilibrium use of factors in industry i and country c. The pattern of production is graphically illustrated in Figure 2 for the factor endowments at point R. While in autarky the M-good was produced in both countries, under trade country B stops producing M altogether, and now its entire factor endowment is dedicated to production of the K-good and the H-good. In country A the M-sector increases to accommodate the entire world demand.

For the purposes of endogenizing institutions, the most important result is that the M-sector disappears following trade opening in the country with inferior institutions. That implies that the rents H was earning in the M-sector disappear upon trade opening. Returns to H in country B in autarky can be expressed as:

$$w^B H^B + \phi^B r^B x E^B H^B,$$

while under trade they are:

$$w^T H^B.$$

Note that this does not have unambiguous implications for aggregate welfare, or even overall returns to H in country B: though H formerly employed in the M-sector loses rents, the base return to H, w^T, goes up as a result of trade: $w^T > w^B$. The same can be said of the return to K: $r^T > r^B$. What matters for the purposes of this paper is that the behavior of rents in autarky and under trade has an important impact on the lobbying game.

The key to the political economy analysis in the following section is that when countries open to trade and institutional differences are the source of comparative advantage, the country with inferior institutions loses the M-sector, and therefore the rents associated with it. In order to anticipate some of the results that follow, it is important to also discuss the effect of technology differences on trade patterns in this model. Suppose that in the M-sector, countries also have different productivities, y_A and y_B. How will these differences affect the conclusions above?

It turns out that the logic of the analysis is largely unchanged. In order to construct the integrated equilibrium, all we need to examine is which country can deliver the M-good more cheaply at common factor prices. Facing the same factor prices w and r, country A can produce the M-good at a price of $p_M = \frac{w+(1+\phi^A)rx}{y_A}$ (see also equation 6). Country B can deliver the M-good at the price equal to $\frac{w+(1+\phi^B)rx}{y_B}$. Thus, in the integrated equilibrium, only the country in which this value is lowest will produce the M-good.

There are two possibilities to consider. First, suppose that country A – which already has better institutions – is also more productive in the M-good: $y_A > y_B$. Then, the analysis is

exactly the same as above: there is simply an extra reason why A ends up with the M-sector under trade. The M-sector still expands in A, and disappears in B, along with the rents. By contrast, suppose that country B is better: $y_A < y_B$. Then, institutional comparative advantage and Ricardian comparative advantage go in the opposite directions, and we must compare $\frac{w+(1+\phi^A)rx}{y_A}$ to $\frac{w+(1+\phi^B)rx}{y_B}$. It could be that A's institutional comparative advantage is still strong enough that it is better at producing M under a common set of factor prices. In that case, the analysis is still unchanged. However, if B has a much better technology, it may end up producing the M-good under trade in spite of its inferior institutions. In that case, the FPE set is the set of all endowments such that the entire integrated equilibrium quantity of the M-good can be produced in B, and institutional differences are not the salient source of trade. The outcome can be analyzed as a special case of the Davis (1995) model.

To summarize, in the presence of Ricardian technology differences, institutional quality may not affect trade patterns. Countries with better institutions will not necessarily specialize in institutionally intensive goods under trade, if they have sufficiently inferior technology for producing it compared to its trading partner. As the next section demonstrates, this can affect countries' incentives to improve institutions after trade opening.

3 Political Economy of Institutions

This section asks the central question of this paper: how does opening to trade affect institutional quality? We adopt a simple political economy model of institutional choice, and analyze outcomes before and after trade. To do this, we combine the model of production and trade developed in the previous section with the political economy of special interest groups framework of Grossman and Helpman (1995, 2001, ch. 7-8). We first consider equilibrium institutions in autarky, and then describe how these change when two trading countries set domestic institutions taking into account those of the trade partner.

3.1 Institutions in Autarky

Suppose there is one policymaker and one interest group representing H – the factor that earns rents when institutions are imperfect.[6] The policymaker receives a nonnegative con-

[6]This could be because the ownership of H is more concentrated than the ownership of K, and thus H is the only factor that is able to solve the collective action problem associated with forming a lobby group. If all agents in the economy lobbied the policymaker, it is well known that the equilibrium policy maximizes aggregate welfare. In this model, that corresponds to always setting up perfect institutions. Notice that for this reason, some asymmetry in lobby participation is typically assumed. In our case, it is actually not important whether H or K can lobby. As will become clear below, if K were the lobby instead of H,

tribution of size θ from the interest group, and sets institutional quality ϕ to maximize its political objective function $G(\phi, \theta)$. We adopt the standard assumption that the policymaker maximizes a weighted sum of the aggregate welfare in the economy, $S(\phi)$, and the political contribution θ:

$$G(\phi, \theta) = \lambda S(\phi) + (1 - \lambda)\theta,$$

where $\lambda \in [0, 1]$. In this formulation, λ can be thought of as parameterizing corruption, and shows the extent to which the policymaker is captive to the interest group. At one extreme, when $\lambda = 1$, the policymaker is the benevolent social planner. At the other, when $\lambda = 0$, it cares only about its political contributions, and in effect sets the policy to serve exclusively the special interest.

The interest group influences the policymaker by making its contribution contingent on the government's choice of ϕ. In particular, the interest group confronts the government with a schedule, $\theta = \Theta(\phi)$, which specifies the contribution the policymaker will receive for each level of ϕ that it might set. The objective function of the interest group is simply H's total welfare, $S_H(\phi)$, net of the contribution:

$$V(\phi, \theta) = S_H(\phi) - \theta.$$

The timing of the game can be thought of as follows: first, the interest group makes its contribution schedule known to the policymaker. Then the policymaker sets institutional quality ϕ. Given this ϕ, agents make their production and consumption decisions. This last stage is simply the equilibrium outcome of the model in the preceding section. Thus, under the assumptions put on preferences, aggregate welfare equals aggregate real income:

$$S(\phi) = r(\phi)K + [w(\phi) + \phi x r(\phi) E(\phi)]\, H.$$

$S(\phi)$ is maximized when institutions are perfect ($\phi = 0$), and decreases as institutions deteriorate ($\frac{dS}{d\phi} < 0$). This is intuitive because imperfect institutions introduce a distortion in an otherwise frictionless setting. As discussed in the previous section, the reward to capital, $r(\phi)$, decreases unambiguously in ϕ, as does $w(\phi)$.

Imperfect institutions can arise because the agents extracting rents can lobby the policymaker. The interest group's objective function is entrepreneurs' real income net of the contribution:

$$V(\phi, \theta) = [w(\phi) + \phi x r(\phi) E(\phi)]\, H - \theta.$$

the problem would be symmetric: K would lobby the policymaker to set up institutions such that some of H becomes relationship-specific. In this sense, the assumption in the previous section that some fraction ϕ of K's investment becomes specific to the relationship is not the primitive assumption. The primitive assumption is that H can organize into a lobby, while K cannot.

This function makes it apparent why H will lobby for positive ϕ: imperfect institutions allow H to earn rents equal to $\phi x r(\phi) E(\phi) H$. The interest group bribes the policymaker to increase ϕ above the socially optimal value of zero.[7] The contribution must be large enough to compensate the government for the disutility it suffers from the resulting decrease in aggregate welfare. We now provide the basic definitions and state the main result.

Definition 2 *The policymaker's* ***best-response set*** *to a contribution function $\Theta(\phi)$ consists of all feasible policies ϕ that maximize $G(\phi, \theta)$.*

Definition 3 *A policy ϕ^* and a contribution schedule $\Theta(\phi)$ constitute* ***an equilibrium*** *in the lobbying game with a single policymaker and a single interest group if i) ϕ^* belongs to the policymaker's best-response set to $\Theta(\phi)$; and ii) there exists no other feasible contribution function $\Theta'(\phi)$ and policy ϕ' such that ϕ' is in the policymaker's best response set to $\Theta'(\phi)$ and $V(\phi', \Theta'(\phi)) > V(\phi^*, \Theta(\phi))$.*

Proposition 2 *The autarky equilibrium institutional quality ϕ^* is given by:*

$$\phi^* = \arg \max_{\phi \in [0,1]} \left\{ \left[w(\phi) + \phi x r(\phi) E(\phi) \right] H + \lambda r(\phi) K \right\}. \tag{7}$$

There exist values of $\lambda \in [0, 1)$ for which the autarky equilibrium institutions are imperfect: $\phi^* > 0$.

This Proposition states that the equilibrium value of institutional quality maximizes a weighted sum of all agents' welfare levels, with higher weight given to those belonging to the interest group. Furthermore, for any set of parameters that characterize the production side of the model, if the power of the interest group is sufficiently high, equilibrium institutions will be imperfect. This results captures the notion that in autarky institutions are a function of the country's characteristics, and bad institutions may arise as an equilibrium outcome.

[7] Strictly speaking, of course, only entrepreneurs in the M-sector earn rents, thus in some sense it would be more natural to take only this subset of H to be the interest group. The problem with this choice is that the fraction of entrepreneurs employed in the M-sector is itself a function of institutions in our model, so the boundaries of the interest group change with the policy choice. To avoid this problem, we assume that the interest group represents the entire population of entrepreneurs, and choose to ignore disagreements between its different subsets.

An alternative would be to assume that the interest group represents only "inside entrepreneurs" H^I, which is the part of H that is employed in the M-sector no matter what the value of ϕ. In that case, we must put a restriction ensuring that $H^I < E_{\min} H$, where $E_{\min}$ is the smallest possible equilibrium size of the M-sector. The analysis under this alternative modeling assumption is qualitatively the same as the one presented in this section. Note that the inside entrepreneurs always prefer higher ϕ than an interest group which maximizes the welfare of overall H. This is because higher ϕ unambiguously hurts the entrepreneurs in the H-sector, which the inside entrepreneurs do not care about.

3.2 Institutions under Trade

We can now contrast these conclusions with the outcome under trade. Suppose that, just as in autarky, each country has one interest group representing H, and the policymaker's objective function is unchanged. The timing of events is similar to the autarky case. First, the countries play the contribution game simultaneously and noncooperatively. Then, production and trade take place. Under trade, the interest group in each country must take into account institutional quality of the trading partner. We now state the definitions for the trade game.

Definition 4 *Let ϕ^{-c} be an arbitrary institutional quality value of country c's trading partner. Then a feasible contribution schedule $\Theta(\phi;\phi^{-c})$ and an institutional quality ϕ^c are an **equilibrium response** to ϕ^{-c} if i) ϕ^c is the policymaker's best response to the contribution schedule $\Theta(\phi;\phi^{-c})$; and ii) there does not exist a feasible contribution schedule $\Theta'(\phi;\phi^{-c})$ and a level of institutions $\phi^{c\prime}$ such that a) $\phi^{c\prime}$ is in the policymaker's best response set to $\Theta'(\phi;\phi^{-c})$ and b) $V(\phi^{c\prime},\Theta'(\phi;\phi^{-c}))>V(\phi^c,\Theta'(\phi;\phi^{-c}))$.*

Definition 5 *A **noncooperative equilibrium** consists of political contribution functions $\Theta(\phi;\phi^{-c})$ for $c=A,B$ and a pair of institutional quality values ϕ^A and ϕ^B, such that $\left[\Theta(\phi;\phi^B),\phi^A\right]$ is an equilibrium response to ϕ^B and $\left[\Theta(\phi;\phi^A),\phi^B\right]$ is an equilibrium response to ϕ^A.*

The following Proposition describes the features of equilibrium.

Proposition 3 *The equilibrium institutions in the two countries under trade, ϕ^A and ϕ^B, solve two equations in two unknowns given by*

$$\phi^c(\phi^{-c})=\arg\max_{\phi^c\in[0,1]}\left\{w(\phi^c,\phi^{-c})H^c+\phi^c x r(\phi^c,\phi^{-c})E^c(\phi^c,\phi^{-c})\overline{H}+\lambda^c r(\phi^c,\phi^{-c})K^c\right\}, \quad (8)$$

$c=A,B$. In equilibrium, when the technology for producing the M-good does not differ between countries, at least one country is characterized by perfect institutions, $\phi^c=0$, and thus the world as a whole reaches the first best allocation.

This Proposition states that institutions under trade are obtained by simultaneously solving the equilibrium response functions of the two countries. In the equilibrium without Ricardian productivity differences between countries, one of following is the outcome: i) institutions are perfect in both countries, $\phi^A=\phi^B=0$; or, ii) institutions are perfect in one of the countries, $\phi^c=0$, while the other country is indifferent between all of the possible

qualities of domestic institutions. In both cases, the world as a whole reaches the first best allocation, as the M-good is produced only using perfect institutions.

Figure 3 illustrates this Proposition. It gives the equilibrium best responses for the two countries as a function of the trading partner's institutions. Up to a certain level of ϕ, the best response is to set domestic ϕ at a level just below the trading partner's. This allows the country to retain the M-sector, and earn rents. Beyond a certain level of ϕ, it is no longer optimal to raise it further, and thus as long as a country's institutions are better than the trading partner's, they do not depend on its ϕ. This diagram is reminiscent of the best response functions associated with the Bertrand oligopoly model. Just as in the Bertrand oligopoly, the equilibrium is to set both ϕ's to zero.

Recalling the analysis of the trade equilibrium, it is easy to see why the outcome is perfect institutional quality. The M-sector can only be located in the institutionally superior country, and only that country's institutions matter in determining the factor prices. If ever $\phi^c \geq \phi^{-c} \geq 0$ with at least one strict inequality, all parties in country c strictly prefer to improve domestic institutions to a level just below ϕ^{-c}. Not only do $w(\phi^c, \phi^{-c})$ and $r(\phi^c, \phi^{-c})$ increase as a result, but country c also captures the worldwide rents associated with locating the M-sector at home.

The mechanisms that made it possible to observe imperfect equilibrium institutions in autarky no longer work in the presence of a trade partner. Notice that the only reason H lobbies to increase ϕ above the socially optimal level of zero is because it can earn rents in the M-sector. But under trade, H will only capture those rents so long as it is the institutionally superior country. In the institutionally inferior country, H will actually have an incentive to lobby for institutional improvement, up to a point at which it has at least slightly better institutions than its trade partner. In effect, competition to capture the rent-bearing M-sector results in a "race to the top" in institutional quality between countries.

What is remarkable about this Proposition is that under trade, the first best institutional quality outcome occurs irrespective of any country characteristics. Both countries can be entirely corrupt ($\lambda^c = 0$), so that the policymakers are completely captive to the special interest group. In autarky, these countries can have very bad institutions. Nevertheless, trade will force institutional improvement even in the most corrupt country.

3.3 Technological Differences

This paper establishes the result that when trade reduces rents, it also changes the nature of the political economy game that gives rise to those rents. In the symmetric case, this leads to institutional improvement in both countries. What are the crucial assumptions behind this result? Economically, the most important assumption is that trade opening reduces rents in the institutionally inferior country. We can use the framework in this paper to also think about what happens when trade increases rents instead. The simplest way to model such a case is to introduce productivity differences between countries. For instance, suppose that country A is more productive in the M-sector: $y_A > y_B$. Furthermore, suppose for simplicity that the technological advantage is substantial, in the sense that even if country B's institutions were the best possible, $\phi_B = 0$, country A would still have a cost advantage at producing the M-good at the common world factor prices and its autarky level of institutional quality:

$$\frac{w + (1 + \phi^A)rx}{y_A} < \frac{w + rx}{y_B}.$$

How do institutions change in response to trade opening in the two countries? Note that the logic behind the analysis of the trade patterns remains unchanged here. As discussed at the end of the previous section, as long as country A can produce the entire integrated equilibrium world quantity of good M, it is the only country which will produce it under trade. This is because its Ricardian comparative advantage in good M is strong enough to overcome its inferior institutions.

What happens to the institutional lobbying game in this case? Since the situation is no longer symmetric, it is helpful to write out the equilibrium best responses for the two countries:

$$\phi^A(\phi^B) = \arg \max_{\phi^A \in [0,1]} \left\{ w(\phi^A)H^A + \phi^A xr(\phi^A)E^A(\phi^A)\overline{H} + \lambda^A r(\phi^A)K^A \right\}, \tag{9}$$

$$\phi^B(\phi^A) = \arg \max_{\phi^B \in [0,1]} \left\{ w(\phi^A)H^B + \lambda^B r(\phi^A)K^B \right\}. \tag{10}$$

For both countries, the equilibrium best response expression no longer depends on ϕ^B, since A will produce in the rent-bearing M-sector no matter what country B does with its institutions. Therefore, the "race to the top" result disappears. Country A no longer has an incentive to improve institutions, because it will not lose the rents to country B. Furthermore, it is easy to demonstrate that institutions actually deteriorate in country A after trade opening under these circumstances. Comparing the expressions that define the

autarky and trade institutions in country A, (7) and (9), we can see that the only difference between them is the rents term, which increases from $\phi^A xr(\phi^A)E^A(\phi^A)H^A$ in autarky to $\phi^A xr(\phi^A)E^A(\phi^A)\overline{H}$ under trade. Thus, the level of ϕ^A that maximizes (9) is greater under trade than in autarky. Figure 4 illustrates this outcome. Here, country B's equilibrium best response is irrelevant, while country A's equilibrium best response is defined by a value ϕ^A_{trade}. Institutions deteriorate in country A: $\phi^A_{trade} > \phi^A_{aut}$.

3.4 Limits to Institutional Improvement

The model can be modified to capture the notion that some countries cannot improve their institutions as efficiently as others. This could be due to inherent geographical or historical differences across countries, for instance. What happens when the best attainable level of institutional quality – let us call it $\underline{\phi}^c$ – is different between countries? The logic of the model remains unchanged, and the equilibrium is still given by equations (8), with only one modification: the arg max is over a range of $\phi^c \in \left[\underline{\phi}^c, 1\right]$ for both countries $c = A, B$. The outcomes then depend on the magnitude of the difference between $\underline{\phi}^A$ and $\underline{\phi}^B$. Suppose, without loss of generality, that $\underline{\phi}^A < \underline{\phi}^B$: country A can attain better institutions than country B. For $\underline{\phi}^B$ low enough, the outcome is depicted in Figure 5. Intuitively, if one could think of the symmetric equilibrium as a Bertrand outcome, this case is something akin to limit pricing: country A will improve institutions to a level just better than $\underline{\phi}^B$. Having worse institutions than $\underline{\phi}^B$ implies that country A loses the M-sector. For low enough $\underline{\phi}^B$, having much better institutions than that does not maximize rents in A. As depicted in the Figure, trade does result in institutional improvement in country A, but to a lesser extent than in the baseline case, as A does not need to go all the way to the best attainable level of institutional quality to retain the M-sector.

It is also clear that if $\underline{\phi}^B$ is high enough, there is no institutional improvement in country A at all, in fact institutions in A may deteriorate as a result of trade opening. This is the case when $\underline{\phi}^B > \phi^A_{aut}$. Under autarky institutions in A, trade opening can never result in the loss of the M-sector, and thus there is no impetus for institutional improvement. In fact, the "limit pricing" logic implies that institutions will actually deteriorate, as under trade country A can capture more rents, an intuition similar to that in the previous subsection.

4 Empirical Evidence

Existing empirical results on the impact of international trade on institutions estimate the simple non-conditional relationship between institutional quality and measures of overall

trade openness. The main theoretical result of the paper is that opening to trade will have a tendency to improve institutions, suggesting that the overall trade openness should indeed play a positive role. However, this effect is also highly conditional on country characteristics, as we just demonstrated with two simple examples. In particular, countries that for some reason cannot capture the institutionally intensive sectors simply by improving their institutions have no incentive to do so. The empirical evidence presented in this section is based on this intuition.

In particular, this paper builds a measure that combines the role of overall openness with how likely the country is to export in institutionally intensive sectors, and analyzes how it affects institutions. We thus estimate the following equation in the cross-section of countries:

$$INST_c = \alpha + \beta IIX_c + \gamma \mathbf{Z}_c + \varepsilon_c. \tag{11}$$

The left-hand side variable, $INST_c$, is a measure of a country's quality of institutions, and $\mathbf{Z}_c$ is a vector of controls. The right-hand side variable of interest, IIX_c, is a measure of *predicted institutional intensity of exports:* how easy it is for the country to export in the institutionally intensive sectors under trade. Or course, this variable is constructed without regard for the country's actual institutional quality or actual trade patterns, as explained below. The main hypothesis is that the effect of IIX_c on institutions is positive ($\beta > 0$).[8]

Before carrying out the empirical analysis, it is worth making an additional remark. In the model, the country that has a very strong technological comparative advantage in the institutionally intensive sector may actually experience a deterioration of institutions as a result of trade opening. In the world comprised of hundreds of countries, however, it is unlikely that any single country will have such a strong comparative advantage in institutionally intensive sectors that it will be able to export in those sectors even if it had bad institutions. That is, in the presence of some 15 or 20 countries with a very high insititutional quality (i.e. the OECD), it is unlikely that any individual country will have such a high value of IIX that is would actually find it optimal to *reduce* its quality of institutions after trade opening. We confirmed this intuition by examining whether the

[8]Note that the results in this paper exploit variation in institutions in the cross-section of countries. This choice is dictated primarily by lack of data availability: there are no reliable datasets on institutional quality with sufficiently long time series to capture enough episodes on institutional change. (For instance, the International Country Risk Guide has observations for several dozen countries going back to 1984, but the data do not exhibit enough time variation within countries to enable reliable panel inference.) Relatedly, it is well known that institutions are formed over the long run and are very persistent. The empirical strategy in the paper is therefore consistent with the view that today's institutions are the result of a long period of evolution and subject to influence by countries' comparative advantage and trade. Finally, the empirical strategy in the paper exploits the variation in predicted comparative advantage as dictated by the countries' exogenous geographical characteristics. It would not be feasible in a panel setting with country effects.

relationship between $INST$ and IIX is nonlinear: positive at lower values of IIX, then turning negative for higher IIX. There appears to be no evidence of such nonlinearity, suggesting that equation (11) is an accurate description of the actual country experiences.

4.1 Predicted Institutional Intensity of Exports

To carry out the analysis, the first step is to construct the predicted institutional intensity of exports, IIX_c, for each country. The strategy in this paper is based on the approach of Do and Levchenko (2007a), which expands the geography-based methodology of Frankel and Romer (1999, henceforth FR). FR construct predicted trade as a share of GDP by first estimating a gravity regression on bilateral trade volumes between countries using only exogenous geographical explanatory variables, such as bilateral distance, land areas, and populations. From the estimated gravity equation, FR predict bilateral trade between countries based solely on geographical variables. Then for each country they sum over trade partners to obtain the predicted total trade to GDP, or "natural openness."

Do and Levchenko's (2007a) goal is to build a measure of export patterns, not aggregate trade volumes, that is based on exogenous geographical variables. To do this, they extend the FR methodology to industry level. Their procedure, described in Appendix A.2, generates predicted exports to GDP in each industry i and country c, $\widehat{X}_{ic}$. Armed with those, it is straightforward to construct the predicted institutional intensity of exports. This measure weights predicted exports $\widehat{X}_{ic}$ by a sector-level index of institutional intensity, and sums across sectors $i = 1, .., I$:

$$IIX_c = \sum_{i=1}^{I} \widehat{X}_{ic} * Institutional\_Intensity_i. \tag{12}$$

Institutional intensity of each sector is sourced from Nunn (2007). It is defined as the fraction of each industry's inputs not sold on organized exchanges or reference priced, and is constructed based on US Input-Output Tables. The idea behind this measure is that inputs sold in spot markets – those that can be obtained on organized exchanges, for instance – do not require contracts and thus good institutions. However, inputs that cannot be bought this way require relationship-specific investments and thus rely on good contracting institutions being in place. The higher the fraction of such inputs in an industry, the higher is its "institutional intensity."

To summarize, the measure used in the analysis, IIX_c, captures the institutional intensity of exports of each country, as predicted exclusively by its exogenous geographic characteristics. It be high in a country whose geographical characteristics imply that it is

expected to export especially in sectors that rely on institutions. By contrast, countries expected to export in industries that do not rely on institutions will exhibit lower values of IIX. It is important to stress that IIX does not use any actual data on exports or institutional quality of countries. It is instead constructed using only the exogenous geographical features of countries and their trading partners, and the same sector-level gravity coefficients applied to all countries. The empirical analysis below demonstrates that this geographic predisposition to export in institutionally intensive sectors is strongly positively correlated with actual institutional quality.

4.2 Data Description

The dependent variable, institutional quality, is proxied by the rule of law index from the Governance Matters database of Kaufmann, Kraay, and Mastruzzi (2005). The index is normalized to have a mean of zero and a standard deviation of 1. It therefore ranges from about -2.5 (worst) to 2.5 (best). Observations come at biyearly frequency, and we take the average across 1996-2000. The model in this paper is about institutions that govern economic relationships between private parties, such as enforcement of contracts and property rights. This, the rule of law subcomponent of the Governance Matters database is the most appropriate index to use.

The main right-hand side variable, IIX_c, is constructed using the estimates of predicted exports as a share of GDP for each industry i in country c, $\widehat{X}_{ic}$, sourced from Do and Levchenko (2007a) and described in Appendix A.2. The construction of $\widehat{X}_{ic}$ is carried out at the 3-digit ISIC revision 2 level for manufacturing trade, yielding 28 sectors. The estimates of $\widehat{X}_{ic}$ are then combined with data on institutional intensity from Nunn (2007), to produce our measures of IIX_c. The list of sectors along with their institutional intensity is presented in Appendix Table A1. The mean share of intermediate inputs not bought on organized exchanges is 0.487, with a standard deviation across sectors of 0.206. According to this measure, the least institutionally intensive sector is Petroleum Refineries, with only 6% of all inputs not bought on organized exchanges. The most institutionally dependent sector is Transport Equipment, with 86% of inputs that are differentiated.

The main controls in estimation include overall trade openness (imports plus exports as a share of GDP) and PPP-adjusted GDP per capita, both of which come from the Penn World Tables (Heston, Summers and Aten, 2002). We also use information on countries' legal origin as defined by La Porta et al. (1998), extended to include the socialist legal system. The final sample is a cross-section of 141 countries and, unless otherwise indicated,

the variables are averaged over 30 years, 1970-1999.

Appendix Table A2 presents the data on institutional quality, predicted institutional intensity of exports, and overall trade openness for the countries in the sample, along with basic summary statistics. Figure 6 plots institutional quality against the overall trade openness. There is some positive association between institutions and overall trade openness, but it is not strong, with the simple correlation of 0.16 and the Spearman correlation of 0.18. Figure 7 plots institutions against the predicted institutional intensity of exports instead. There appears to be a closer positive relationship between these two variables, with both simple and Spearman correlation coefficients of around 0.48. We now turn to a regression analysis of the relationship between these two variables.

4.3 Results

Table 1 presents the baseline results of estimating equation (11). The first column regresses institutional quality on simple trade openness. There is a positive and significant relationship, but it is not strong, with an R^2 of 0.03. When instead in column 2 we regress institutions on IIX_c, the R^2 is 0.23, and the variable of interest is significant at the 1% level, with a t-statistic of 6.3. Column 3 includes both the trade openness and the external finance need of exports. The coefficient on IIX is actually increased, while the coefficient on trade is of the "wrong" sign. Columns 4 and 5 attempt to control for other determinants of institutions. We first include the legal origin dummies from La Porta et al. (1998), and then per capita income. The latter is meant to capture a country's overall level of development. While in both of these specifications the coefficient on IIX_c is somewhat smaller, it nonetheless remains significant at the 1% level. Finally, column 6 includes both the legal origin dummies and per capita income on the right-hand side. The coefficient on the variable of interest is further reduced somewhat, but preserves its significance at the 1% level. The magnitude of the effect is sizeable but not implausibly large. The most conservative coefficient estimates imply that a one standard deviation change in IIX_c is associated with a change in institutional quality equivalent to 0.19 of its standard deviation.

Examining the definition of IIX, (12), it is clear that this variable will have high values either because predicted overall trade $\widehat{X}_{ic}$ is high across all sectors – "natural openness" –, or because the country is predicted to export *relatively* more in the institutionally intensive sectors. As evident from Figure 7, a lot of the variation in IIX is in fact driven by differences in overall "natural openness." Conceptually, the main index of IIX, which combines both of these, is correct: what should matter is the combination of how strong is the disciplining

effect of trade – the operall openness – and how easily the country can start exporting in the advantageous sectors if it were to improve institutions. Clearly, in the absence of the former, the latter matters little for the incentive to improve institutions. Nonetheless, we would still like to demonstrate that the results are not driven exclusively by overall openness.

We do this in several ways. As a preliminary point, note that the overall openness is already controlled for in all specifications.[9] Thus, any effect of IIX is already obtained while netting out the impact of aggregate openness. Following Frankel and Romer (1999), we control for land area and population, since those authors find that natural openness is highly correlated with country size. The results are reported in Column 7 of Table 1. Clearly, controlling for area and population does not affect the coefficient of interest, in fact neither of these two variables is significant. As a second exercise, we construct an alternative index of IIX that is purged of the influence of overall predicted openness:

$$IIX\_SHARES_c = \sum_{i=1}^{I} \widehat{\omega}_{ic}^{X} * Institutional\_Intensity_i.$$

Here, $\widehat{\omega}_{ic}^{X}$ is the predicted share of total exports in industry i in country c, constructed from the predicted exports to GDP ratios $\widehat{X}_{ic}$ in a straightforward manner: $\widehat{\omega}_{ic}^{X} = \frac{\widehat{X}_{ic}}{\sum_{i=1}^{I} \widehat{X}_{ic}}$. This index is driven solely by the predicted differences in sectoral export *shares* across sectors. Column 8 of Table 1 uses it instead of the baseline measure. The results are robust to purging the effects of "natural openness:" the coefficient is significant with a p-value of 5.6%, even with income, trade openness, and legal origins as controls.

To further establish that natural openness is not the predominant driving force behind our results, Table 2 determines whether they are driven by outliers and entrepot countries. Column 1 removes the outliers, defined as countries in the top 5 and bottom 5 percent of the IIX distribution, and shows that the results are robust. Some of the countries with the highest values of IIX are also entrepot countries, for which the values of trade openness are high, but much of it is due to re-exports.[10] Column 2 of Table 2 drops these countries, and shows that the coefficient estimates are actually larger and more significant than in the full sample. To summarize, the variety of exercises we perform all support the conclusion that the variation in IIX, and therefore our results, are not driven exclusively by natural openness.

We also check the robustness of the results in several other ways. Table 2 further

[9] Controlling for natural openness instead of actual openness leaves the results unchanged. The results are available upon request.

[10] These economies are Bahrain, China-Hong Kong, Guyana, Malta, and Singapore. The 1970-99 average trade as a share of GDP in these countries ranges from 156 to 340 percent.

establishes that the results are not driven by particular subsamples. Column 3 drops the OECD countries.[11] The next column drops the sub-Saharan African countries. The results are not sensitive to the exclusion of this region. The economies sometimes called "Asian tigers" experienced some of the fastest growth of trade and institutional improvement over the postwar period. Column 5 excludes the Asian tigers, to check that the results are not driven by these particular countries.[12] We next drop Latin America and the Caribbean, and the Middle East and North Africa regions. The results are robust to excluding these country groups. Finally, Column 7 drops countries that have more than 60% of their exports in Mining and Quarrying, a sector that includes crude petroleum.[13] The results are robust to the exclusion of these countries.

Table 3 determines whether the results are sensitive to the inclusion of additional explanatory variables. All of the columns include the most stringent set of controls – trade openness, per capita income, and legal origin dummies – but do not report their coefficients to conserve space. The first column controls for the level of human capital by including the average years of secondary schooling in the population from the Barro and Lee (2000) database. The second column includes distance to the equator.[14] Next, we control for the fraction of the population speaking English as the first language, sourced from Hall and Jones (1999).[15] The fourth column adds the Polity2 index, which is meant to capture the strength of democratic institutions within a country. This index is sourced from the Polity IV database.[16] Column 5 includes an indicator of ethnic fractionalization, based on Easterly and Levine (1997).[17] Column 6 controls for inequality, by including the Gini coefficient of the income distribution sourced from the World Bank's World Development Indicators. Finally, the last column controls for the proportion of the population that is Catholic, Muslim, and Protestant, obtained from La Porta et al. (1999). It is clear that the results are robust to the inclusion of all of these additional controls.

[11] OECD countries in the sample are: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom, and the United States. We thus exclude the newer members of the OECD, such as Korea and Mexico.

[12] In our sample, we consider Asian tigers to be: Indonesia, Korea, Malaysia, Philippines, and Thailand.

[13] There countries are Algeria, Angola, Republic of Congo, Gabon, Islamic Republic of Iran, Kuwait, Nigeria, Oman, Qatar, Saudi Arabia, and Syrian Arab Republic.

[14] Alternatively, we included a tropics indicator, the average number of days with frost, and the mean temperature. The results were robust.

[15] Alternatively, we also controlled for the share of the population speaking a European language, and the indicator for "neo-Europe." The results were robust.

[16] We also used Polity IV's constraint on the executive variable, which is meant to capture the checks placed on the power of the executive branch of government. The results were unchanged.

[17] We also controlled for the ethnic, religious, and linguistic fractionalization using the variables developed by Alesina et al. (2003). The results were unchanged.

5 Conclusion

Recent literature has highlighted the role of the quality of institutions in various aspects of countries' economic performance, including international trade. Given the emerging consensus regarding their primary importance, the crucial question is what are the forces that could drive institutional change. The main goal of this paper is to provide a simple framework for modeling the effect of trade on the political economy of institutions. The building blocks of the analysis are the model of institutional comparative advantage of Levchenko (2007), and the lobbying framework of Grossman and Helpman (1994, 1995).

What are the main conclusions from this exercise? The key consequence of bad institutions is the presence of rents that are captured by some parties inside the country. Lobbying can give rise to imperfect institutions because the agents capturing those rents have an incentive to lobby in order to retain them. Under trade, however, those very rents disappear in the institutionally inferior country. In order to regain those rents, the country must improve its institutions vis-à-vis its trading partner. In equilibrium, there is a "race to the top": both countries adopt the best attainable level of institutional quality. This simple framework captures the key idea that bad institutions are more costly in an open world. However, it is also flexible enough to investigate cases in which institutional improvement does not occur. In particular, if one of the trading partners has a sufficiently strong technological comparative advantage in the institutionally intensive good, institutions will not improve in either country. This extension is telling about the kinds of circumstances under which trade brings institutional deterioration – namely, when trade increases, rather than decreases rents.

Is it the case empirically that trade improves institutions? We argued that in order to take this question to the data, it is necessary to refine the model's predictions as follows: institutions will improve as a result of trade in countries that can expect to capture the institutionally intensive sectors after trade opening. The empirical strategy relies on the notion that a country's geographical characteristics will affect its expected export patterns. Extending the approach of Frankel and Romer (1999), we constructed for each country its predicted institutional intensity of exports, based solely on its geographical characteristics. The estimates show that countries that are expected to specialize in institutionally intensive sectors do in fact exhibit better institutions.

A Appendix

A.1 Proofs of Propositions

Proof of Proposition 1: The proof follows the treatment in Helpman and Krugman (1985, pp. 13-14). The FPE set is defined as a partition of the world factor endowments into countries such that every country can fully employ all of its factors using the integrated equilibrium techniques of production. To prove that trade replicates the integrated equilibrium factor prices, we observe that given the integrated equilibrium factor prices, every firm employs the integrated equilibrium techniques of production. Thus, by definition of the FPE set, under the integrated equilibrium factor prices, full employment prevails in each country without movements of factors across countries. Thus, under trade in goods but not factors, the world economy can produce the integrated equilibrium quantities of all the goods. Since, under the integrated equilibrium factor prices, the aggregate world income is also equal to the integrated equilibrium world income, and consumption shares are also the same, there is goods market clearing. Thus, such a resource allocation and set of factor and goods prices under trade are an equilibrium, which by construction replicates the factor prices of the integrated equilibrium.■

Proof of Proposition 2: Grossman and Helpman (2001, ch. 7) show that the equilibrium policy is jointly efficient, that is, it maximizes the joint welfare of the policymaker and the interest group. The policymaker's outside option is not to deal with the interest group at all. Thus, the interest group must provide the policymaker with a utility level at least as great as what it would achieve without dealing with the interest group, $\overline{G}$, obtained by:

$$\overline{G} = \max_{\phi \in [0,1]} \{\lambda S(\phi)\}$$

Thus, the interest group solves

$$\max_{\phi \in [0,1]} \{[w(\phi) + \phi x r(\phi) E(\phi)] H - \theta\}$$

subject to

$$\lambda S(\phi) + (1-\lambda)\theta \geq \overline{G}.$$

Because the interest group has no reason to give the policymaker a utility level higher than $\overline{G}$, the constraint will bind with equality and the political contribution can be backed out:

$$\theta = \frac{1}{1-\lambda}\left[\overline{G} - \lambda S(\phi)\right]$$

Therefore, the interest group in effect chooses ϕ to maximize a weighted sum of the its own welfare gross of the contribution and the aggregate welfare:

$$\max_{\phi \in [0,1]} \{[w(\phi) + \phi x r(\phi) E(\phi)] H + \lambda S(\phi)\},$$

which is the same as equation (7). Note that in general, there are many possible contribution schedules $\Theta(\phi)$ which can be designed to achieve this outcome.

It remains to show that for high enough values of λ, institutions are imperfect in the autarky equilibrium. We can use the autarky equilibrium conditions (1) through (4) to establish the following result (see also Levchenko, 2007):

$$\frac{d}{d\phi}\left[w(\phi)+\phi xr(\phi)E(\phi)\right]\Big|_{\phi=0}>0.$$

That is, H's welfare is strictly increasing in ϕ when institutions are perfect ($\phi=0$). This is because while $w(\phi)$ does decrease in ϕ, raising ϕ allows H to earn rents in equilibrium, and for low enough ϕ the second effect dominates. Thus, the derivative of the first term of the maximand in the expression defining ϕ^*, (7), is positive. The derivative of the second term is negative, but can be made arbitrarily small as $\lambda\to 0$. Thus, there is a value of $\lambda\in[0,1)$, such that the derivative of the maximand is positive in ϕ at $\phi=0$. This immediately leads to the conclusion that for those parameter values, $\phi^*>0$.■

Proof of Proposition 3: The equilibrium responses $[\Theta(\phi^c;\phi^{-c}),\phi^c]$ at each possible value of ϕ^{-c} are constructed in a manner similar to the equilibrium in Proposition 4. In particular, Grossman and Helpman (1995) show that the equilibrium response policy vector in this game must maximize the joint welfare of the lobby group and the policy maker. The equilibrium response value of ϕ^c at each level of ϕ^{-c} is then given by:

$$\phi^c(\phi^{-c})=\arg\max_{\phi^c\in[0,1]}\left\{w(\phi^c,\phi^{-c})H^c+\phi^c xr(\phi^c,\phi^{-c})E^c(\phi^c,\phi^{-c})\overline{H}+\lambda^c r(\phi^c,\phi^{-c})K^c\right\}, \tag{A.1}$$

for $c=A,B$. Once again, there are many contribution schedules $\Theta(\phi;\phi^{-c})$ that generate this outcome.

We must show that the equilibrium is characterized by $\phi^c=0$ for at least one country c. From the expression for the equilibrium response institutions, it is clear that $\phi^c(\phi^{-c})<\phi^{-c}$ for all $\phi^{-c}>0$. This is because when a country's institutions are inferior to its trading partner's, every term in equation (A.1) will increase as a result of moving ϕ^c below ϕ^{-c}. Thus, it must necessarily be the case that the equilibrium response to any level of the trade partner's institutions is to set better institutions than the trade partner. This implies that there is no equilibrium for which both ϕ^A and ϕ^B are strictly positive.■

A.2 Predicted Industry-Level Exports

This Appendix describes the steps followed by Do and Levchenko (2007a) to extend the FR approach to obtain the industry-level predicted exports. For each industry i, Do and Levchenko (2007a) run the FR regression:

$$\begin{aligned} LogX_{icd} \;=\; & \alpha+\eta_i^1 ldist_{cd}+\eta_i^2 lpop_c+\eta_i^3 larea_c+\eta_i^4 lpop_d+\eta_i^5 larea_d+ \\ & \eta_i^6 landlocked_{cd}+\eta_i^7 border_{cd}+\eta_i^8 border_{cd}*ldist_{cd}+ \\ & \eta_i^9 border_{cd}*pop_c+\eta_i^{10} border_{cd}*area_c+\eta_i^{11} border_{cd}*pop_d+ \\ & \eta_i^{12} border_{cd}*area_d+\eta_i^{13} border_{cd}*landlocked_{cd}+\varepsilon_{cd}, \end{aligned} \tag{A.2}$$

where $LogX_{icd}$ is the log of exports as a share of GDP in industry i, from country c to country d. The right-hand side consists of the geographical variables. In particular, $ldist_{cd}$

is the log of distance between the two countries, defined as distance between the major cities in the two countries, $lpop_c$ is the log of population of country c, $larea_c$ log of land area, $landlocked_{cd}$ takes the value of 0, 1, or 2 depending on whether none, one, or both of the trading countries are landlocked, and $border_{cd}$ is the dummy variable for common border. The right-hand side of the specification is identical to the one FR use.

Do and Levchenko (2007a) use trade flows from the World Trade Database described in Feenstra et al. (2005). The database contains bilateral trade flows between more than 150 countries, accounting for 98% of world trade, for the period 1962-2000. Trade flows are broken into sectors according to the 3-digit ISIC revision 2 classification, yielding 28 manufacturing sectors. To estimate the gravity equation, the bilateral trade flows X_{icd} are averaged over the period 1970-1999. This allows to smooth out any short-run variation in trade shares across sectors, and reduce the impact of zero observations.

Having estimated equation (A.2) for each industry, Do and Levchenko (2007a) then obtain the predicted logarithm of industry i exports to GDP from country c to each of its trading partners indexed by d, $\widehat{LogX}_{icd}$. In order to construct the predicted overall industry i exports as a share of GDP from country c, they take the exponential of the predicted bilateral log of trade, and sum over the trading partner countries $d = 1, ..., C$, exactly as in FR:

$$\hat{X}_{ic} = \sum_{\substack{d=1 \\ d \neq c}}^{C} e^{\widehat{LogX}_{icd}}. \tag{A.3}$$

That is, predicted total trade as a share of GDP for each industry and country is the sum of the predicted bilateral trade to GDP over all trading partners. This exercise extends and modifies the FR methodology in two respects. First, and most importantly, it constructs the FR predicted trade measures by industry. And second, rather than looking at total trade, it looks solely at exports.

Do and Levchenko (2007a) discuss and justify this strategy at length. As mentioned above, the objective is to predict trade patterns, not trade volumes. How can this procedure yield different predictions for $\widehat{X}_{ic}$ across sectors if all of the geographical characteristics on the right-hand side of equation (A.2) do not vary by sector? Note that the procedure estimates an individual gravity equation for each sector. Thus, crucially for this strategy, if the vector of estimated gravity coefficients η_i differs across sectors, so will the predicted total exports $\widehat{X}_{ic}$ across sectors i within the same country. Indeed, Do and Levchenko (2007a) show that the variation in these coefficients across sectors is indeed substantial, generating variation in predicted trade patterns across countries.

There is another potentially important issue, namely the zero trade observations. In Do and Levchenko's gravity sample, only about two-thirds of the possible exporter-importer pairs record positive exports, in any sector. At the level of individual industry, on average only a third of possible country-pairs have strictly positive exports, in spite of the coarse level of aggregation (28 sectors).[18] Do and Levchenko's (2007a) procedure deals with zero observations in two ways. First, following the large majority of gravity studies, they take logs of trade values, and thus their baseline gravity estimation procedure ignores zeros.

[18]These two calculations make the common assumption that missing trade observations represent zeros (see Helpman, Melitz, and Rubinstein, 2007).

However, instead of predicting in-sample, they use the estimated gravity model to predict out-of-sample. Thus, for those observations that are zero or missing and are not used in the actual estimation, they still predict trade.[19] In the second approach, they instead estimate the gravity regression in levels using the Poisson pseudo-maximum likelihood estimator suggested by Santos Silva and Tenreyro (2006). The advantage of this procedure is that it actually includes zero observations in the estimation, and can predict both zero and non-zero trade values in-sample from the same estimated equation. Its disadvantage is that it assumes a particular likelihood function, and is not (yet) a standard way of estimating gravity equations found in the literature. It turns out that the two are quite close to each other, an indication that the zeros problem is not an important one for this empirical strategy. This paper only reports the results of implementing the first approach. The results of using the second one are available upon request.

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[19] More precisely, for a given exporter-importer pair, they predict bilateral exports out-of-sample for all 28 sectors as long as there is any bilateral exports for that country pair in at least one of the 28 sectors.

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Figure 1: The World Economy and the Factor Price Equalization Set

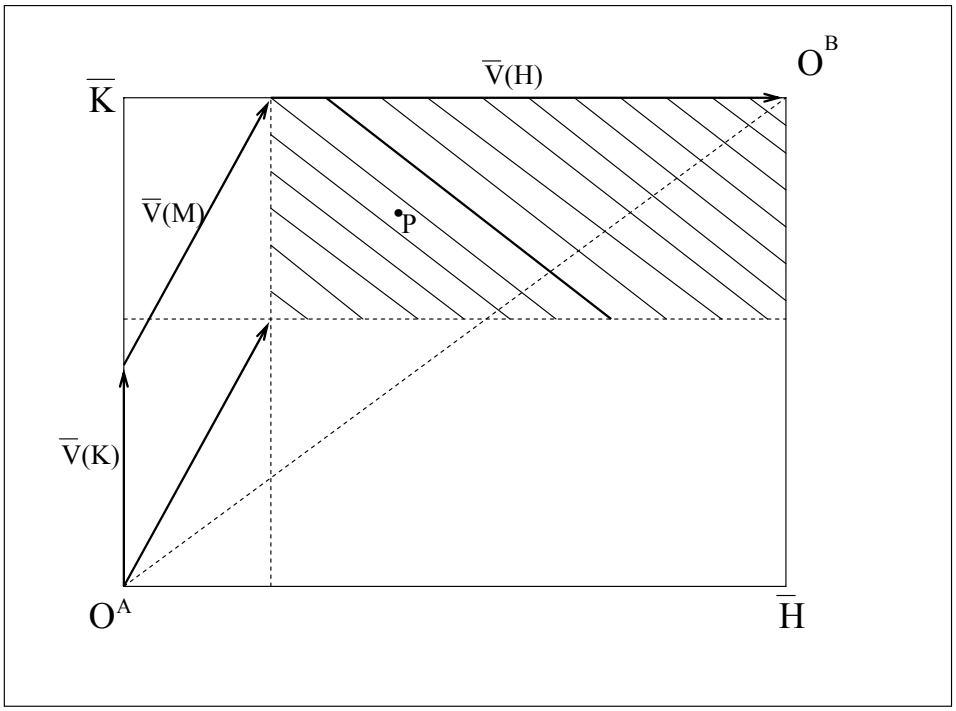


Figure 2: The Pattern of Production

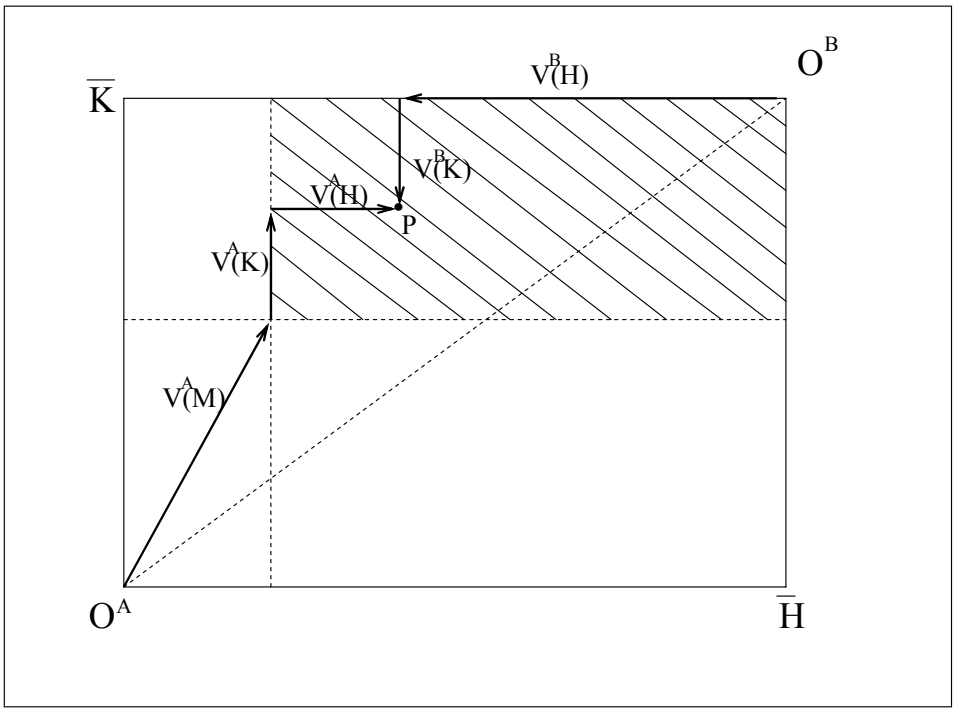


Figure 3: Equilibrium Best Responses and Equilibrium Institutions, Symmetric Case

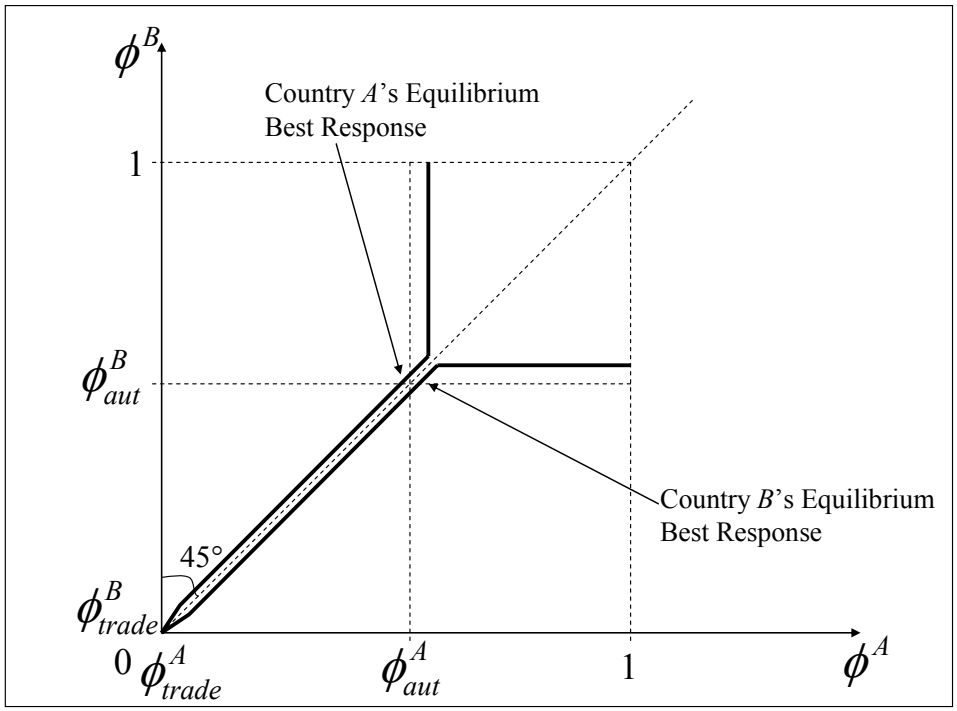


Figure 4: Equilibrium Best Responses and Equilibrium Institutions, Country *A* has a Technological Advantage in the *M*-good

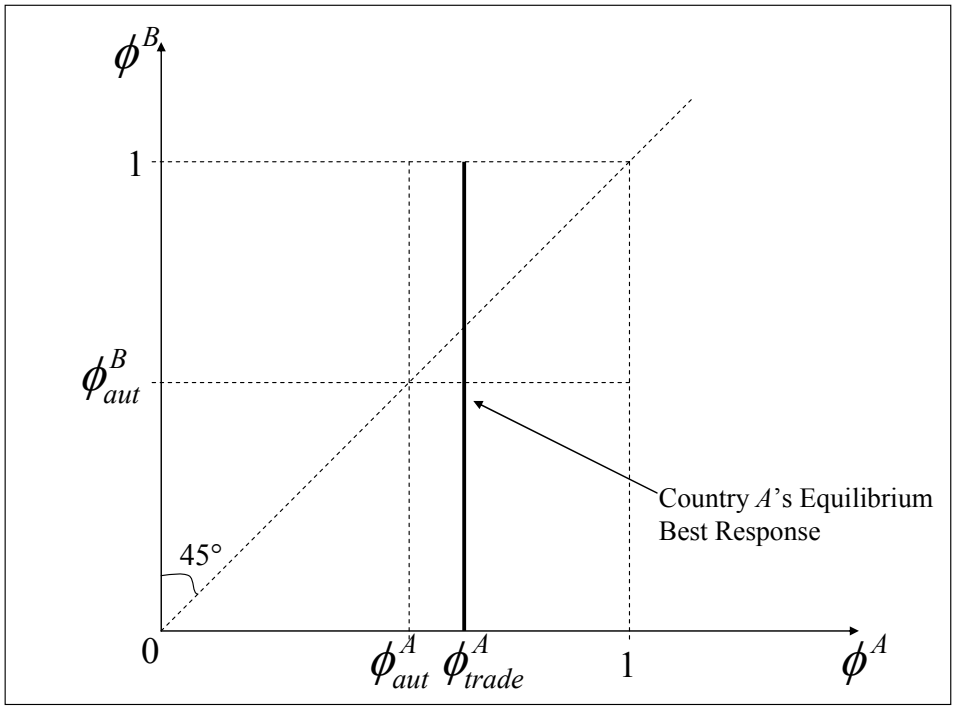


Figure 5: Institutional Choice: Limits to Institutional Improvement in Country *B*

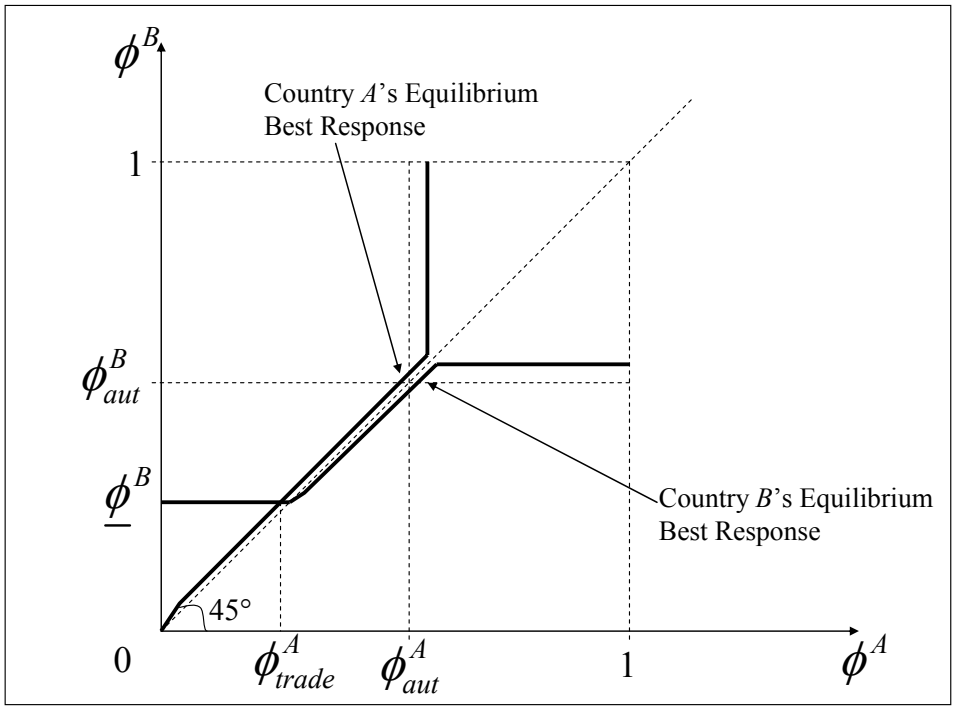
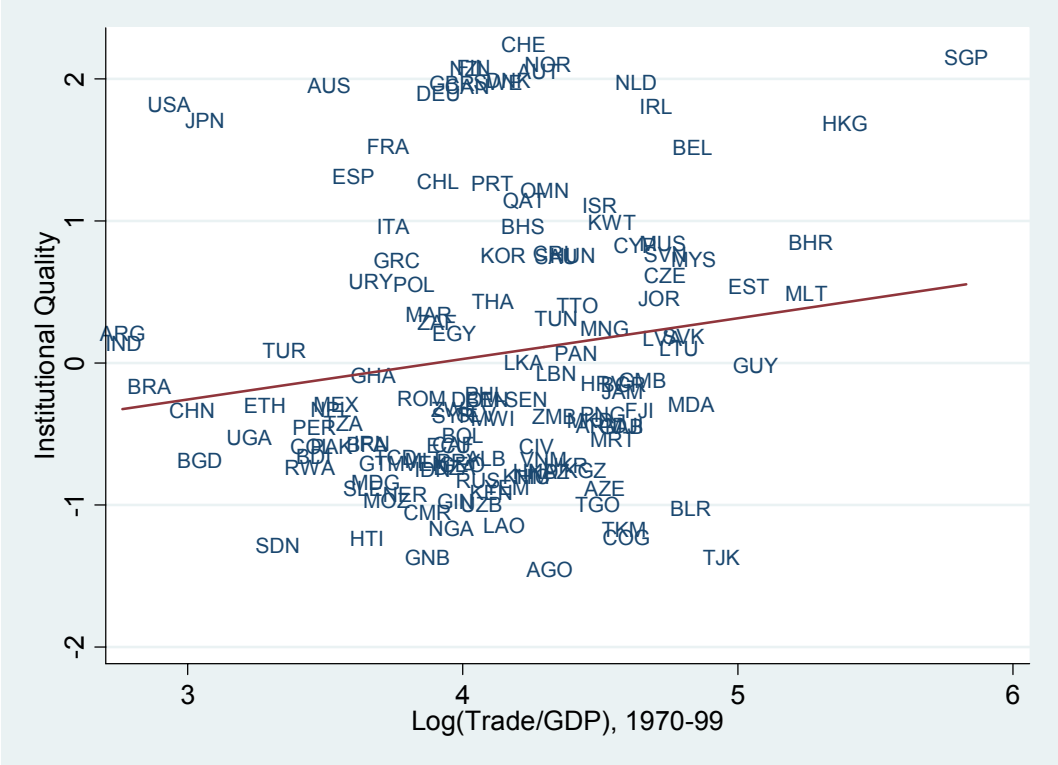
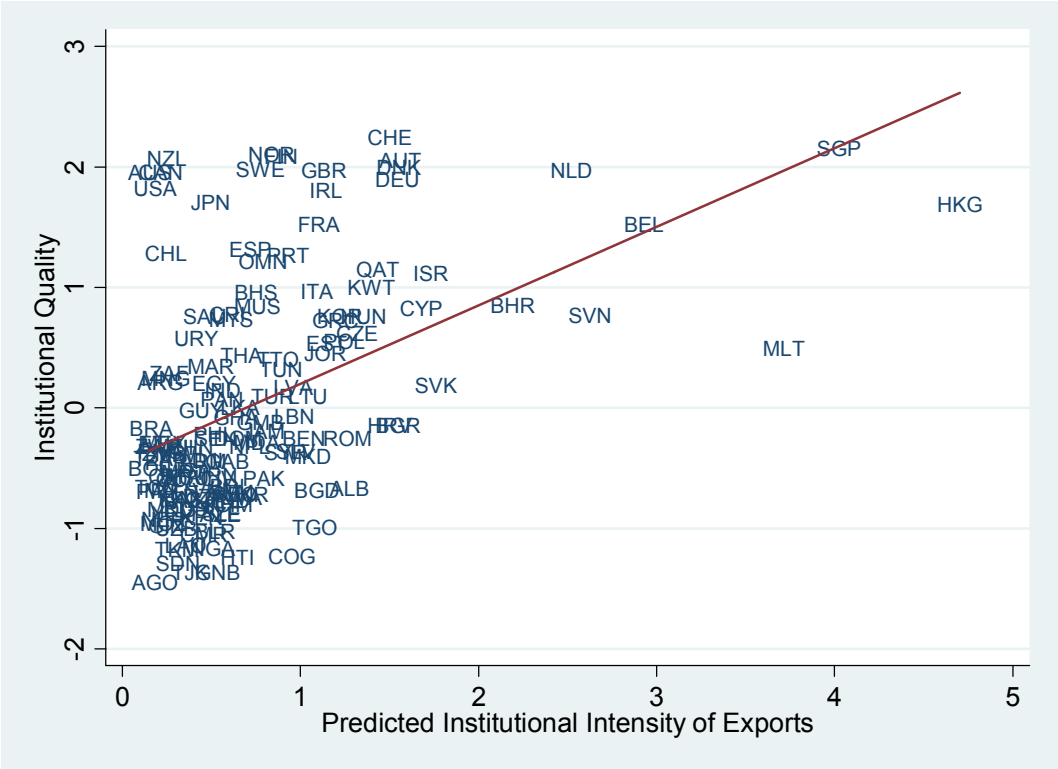


Figure 6: Institutional Quality and Trade Openness



Notes: This figure presents the scatter plot of the quality of institutions, proxied by the Rule of Law index from the Governance Matters database of Kaufmann, Kraay, and Mastruzzi (2005), against the log of exports plus imports as a share of GDP from the Penn World Tables.

Figure 7: Institutional Quality and Predicted Institutional Intensity of Exports



Notes: This figure presents the scatter plot of the quality of institutions, proxied by the Rule of Law index from the Governance Matters database of Kaufmann, Kraay, and Mastruzzi (2005), against the predicted institutional intensity of exports, *IIX*, constructed as described in the main text.

Table 1: Main Estimation Results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dep. Var.: Institutional Quality								
Predicted IIX		0.652***	0.756***	0.617***	0.294***	0.262***	0.276**	
		(0.104)	(0.123)	(0.110)	(0.094)	(0.083)	(0.119)	
Predicted IIX: Shares Based								2.058*
								(1.070)
Log(Trade/GDP)	0.297*		-0.259*	-0.087	-0.271***	-0.142	-0.132	0.065
	(0.154)		(0.152)	(0.153)	(0.102)	(0.097)	(0.123)	(0.089)
Log(Income)					0.693***	0.610***	0.607***	0.659***
					(0.058)	(0.054)	(0.057)	(0.048)
French Legal Origin				-0.389**		-0.373***	-0.373***	-0.353***
				(0.194)		(0.106)	(0.112)	(0.106)
German Legal Origin				1.121***		0.411**	0.415**	0.380**
				(0.294)		(0.177)	(0.183)	(0.190)
Scandinavian Legal Origin				1.603***		0.720***	0.718***	0.747***
				(0.196)		(0.144)	(0.147)	(0.143)
Socialist Legal Origin				-0.654***		-0.663***	-0.668***	-0.716***
				(0.167)		(0.122)	(0.123)	(0.130)
Log(Area)							0.009	
							(0.056)	
Log(Population)							-0.002	
							(0.062)	
Constant	-1.159*	-0.454***	0.534	0.172	-4.815***	-4.343***	-4.449***	-6.233***
	(0.641)	(0.109)	(0.601)	(0.679)	(0.585)	(0.567)	(1.113)	(0.672)
Observations	143	141	141	139	141	139	139	139
R-squared	0.03	0.23	0.24	0.48	0.67	0.76	0.76	0.75

Notes: Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%. Dependent variable, *Institutional Quality* is the index of Rule of Law sourced from Kaufmann, Kraay, and Mastruzzi (2005); *Predicted IIX* is the predicted instititional intensity of exports; *Log(Trade/GDP)* is log of exports and imports as a share of GDP; *Log(Income)* is log of PPP-adjusted real per capita income from Penn World Tables; these two variables are average values over 1970-99. *French, German, Scandinavian, and Socialist Legal Origin* dummies are as defined originally by La Porta et al. (1998); Log(Area) is log of the land area of the country; Log(Population) is the log of avreage population over the 1970-99 period. Variable definitions and sources are described in detail in the text.

Table 2: Robustness, Outliers and Subsamples

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Sample	No outliers	No Entrepot Countries	No OECD	No Sub-Saharan Africa	No Asian Tigers	No Latin America/ Caribbean	No Mining Exporters
Dep. Var.: Institutional Quality							
Predicted IIX	0.316**	0.366***	0.322***	0.210**	0.265***	0.243***	0.233***
	(0.134)	(0.104)	(0.084)	(0.087)	(0.084)	(0.086)	(0.084)
Log(Trade/GDP)	-0.092	-0.142	-0.031	-0.099	-0.148	-0.218**	-0.091
	(0.102)	(0.103)	(0.098)	(0.108)	(0.099)	(0.108)	(0.096)
Log(Income)	0.576***	0.600***	0.429***	0.688***	0.603***	0.644***	0.607***
	(0.063)	(0.056)	(0.055)	(0.069)	(0.054)	(0.054)	(0.058)
French Legal Origin	-0.283**	-0.370***	-0.234**	-0.409***	-0.381***	-0.305***	-0.326***
	(0.112)	(0.109)	(0.097)	(0.126)	(0.110)	(0.112)	(0.110)
German Legal Origin	0.499**	0.351*	0.219***	0.337*	0.538***	0.327*	0.417**
	(0.191)	(0.178)	(0.078)	(0.174)	(0.146)	(0.179)	(0.182)
Scandinavian Legal Origin	0.814***	0.687***		0.609***	0.724***	0.643***	0.706***
	(0.160)	(0.156)		(0.148)	(0.148)	(0.146)	(0.149)
Socialist Legal Origin	-0.620***	-0.693***	-0.480***	-0.675***	-0.668***	-0.672***	-0.699***
	(0.129)	(0.131)	(0.106)	(0.130)	(0.125)	(0.128)	(0.124)
Constant	-4.372***	-4.321***	-3.570***	-5.131***	-4.259***	-4.267***	-4.488***
	(0.581)	(0.591)	(0.547)	(0.735)	(0.575)	(0.579)	(0.599)
Observations	127	134	118	105	134	116	128
R-squared	0.75	0.76	0.62	0.77	0.77	0.8	0.77

Notes: Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%. Dependent variable, *Institutional Quality* is the index of Rule of Law sourced from Kaufmann, Kraay, and Mastruzzi (2005); *Predicted IIX* is the predicted instititional intensity of exports; *Log(Trade/GDP)* is log of exports and imports as a share of GDP; *Log(Income)* is log of PPP-adjusted real per capita income from Penn World Tables; these two variables are average values over 1970-99. *French, German, Scandinavian, and Socialist Legal Origin* dummies are as defined originally by La Porta et al. (1998). Variable definitions and sources are described in detail in the text.

Table 3: Robustness, Additional Controls

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dep. Var.: Institutional Quality							
Predicted IIX	0.201**	0.228**	0.327***	0.348***	0.219*	0.279***	0.303***
	(0.093)	(0.089)	(0.084)	(0.087)	(0.118)	(0.096)	(0.097)
Secondary Schooling	0.221***						
	(0.082)						
Distance to Equator		0.016***					
		(0.005)					
Fraction English-Speaking			0.659**				
			(0.264)				
Polity2 Index				0.019***			
				(0.007)			
Ethnic Fractionalization					-0.247		
					(0.194)		
Gini Coefficient						-1.540**	
						(0.599)	
Proportion Catholic							-0.360**
							(0.178)
Proportion Muslim							-0.287*
							(0.155)
Proportion Protestant							0.074
							(0.321)
Constant	-4.387***	-3.884***	-3.933***	-4.019***	-4.488***	-4.050***	-4.321***
	(0.699)	(0.594)	(0.545)	(0.576)	(0.697)	(0.694)	(0.542)
Other Controls	Log(Trade/GDP), Log(Income), Legal Origin Dummies						
Observations	96	139	138	136	110	105	136
R-squared	0.82	0.79	0.78	0.78	0.78	0.77	0.77

Notes: Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%. Dependent variable, *Institutional Quality* is the index of Rule of Law sourced from Kaufmann, Kraay, and Mastruzzi (2005); *Predicted IIX* is the predicted instititional intensity of exports; *Log(Trade/GDP)* is log of exports and imports as a share of GDP; *Log(Income)* is log of PPP-adjusted real per capita income from Penn World Tables; these two variables are average values over 1970-99. *French, German, Scandinavian, and Socialist Legal Origin* dummies are as defined originally by La Porta et al. (1998). *Secondary Schooling* is the average years of secondary schooling in the total population from Barro and Lee (2000); *Polity2 Index* is an indicator of strength of democratic institutions from the PolityIV database; *Ethnic Fractionalization* is sourced from Easterly and Levine (1997); the *Gini coefficient* of the income distribution is a measure of income inequality, and is sourced from the World Bank's World Development Indicators. Variable definitions and sources are described in detail in the text.

Appendix Table A1: The Institutional Intensity Measure

ISIC	Industry Name	Institutional Intensity
311	Food products	0.331
313	Beverages	0.713
314	Tobacco	0.317
321	Textiles	0.376
322	Wearing apparel, except footwear	0.745
323	Leather products	0.571
324	Footwear, except rubber or plastic	0.650
331	Wood products, except furniture	0.516
332	Furniture, except metal	0.568
341	Paper and products	0.348
342	Printing and publishing	0.713
351	Industrial chemicals	0.240
352	Other chemicals	0.490
353	Petroleum refineries	0.058
354	Misc. petroleum and coal products	0.395
355	Rubber products	0.407
356	Plastic products	0.408
361	Pottery, china, earthenware	0.329
362	Glass and products	0.557
369	Other non-metallic mineral products	0.377
371	Iron and steel	0.242
372	Non-ferrous metals	0.160
381	Fabricated metal products	0.435
382	Machinery, except electrical	0.764
383	Machinery, electric	0.740
384	Transport equipment	0.859
385	Professional & scientific equipment	0.785
390	Other manufactured products	0.547
	Mean	0.487
	Standard Deviation	0.206

Notes: Institutional Intensity is the share of intermediate inputs that cannot be bought on organized exchanges and is not reference-priced. Source: Nunn (2007).

Appendix Table A2: Countries and Main Variables

Country	IIX	Trade/GDP	Rule of Law	Country	IIX	Trade/GDP	Rule of Law
Algeria	0.46	53.05	-0.74	Ecuador	0.36	51.94	-0.58
Angola	0.18	75.00	-1.45	Egypt	0.52	52.83	0.21
Argentina	0.21	15.85	0.21	El Salvador	0.97	57.31	-0.36
Armenia	0.45	89.61	-0.44	Estonia	1.15	154.56	0.53
Australia	0.15	33.57	1.95	Ethiopia	0.21	26.64	-0.30
Austria	1.56	71.91	2.06	Fiji	0.32	103.78	-0.33
Azerbaijan	0.55	91.53	-0.89	Finland	0.89	56.78	2.08
Bahamas, The	0.75	67.96	0.96	France	1.10	41.58	1.52
Bahrain, Kingdom of	2.19	193.62	0.85	Gabon	0.59	97.26	-0.45
Bangladesh	1.09	20.98	-0.69	Gambia, The	0.78	105.09	-0.13
Belarus	0.52	125.13	-1.03	Georgia	0.63	54.54	-0.72
Belgium	2.93	125.80	1.52	Germany	1.54	50.03	1.90
Benin	1.02	59.69	-0.26	Ghana	0.64	39.43	-0.09
Bolivia	0.15	54.61	-0.51	Greece	1.20	43.02	0.73
Brazil	0.16	17.46	-0.17	Guatemala	0.61	40.72	-0.71
Bulgaria	1.55	97.85	-0.15	Guinea	0.25	53.21	-0.98
Burkina Faso	0.32	38.50	-0.57	Guinea-Bissau	0.54	48.08	-1.37
Burundi	0.59	31.79	-0.66	Guyana	0.44	158.04	-0.02
Cambodia	0.60	68.73	-0.80	Haiti	0.65	38.49	-1.24
Cameroon	0.46	48.05	-1.05	Honduras	0.59	71.26	-0.77
Canada	0.22	55.47	1.95	Hungary	1.36	81.54	0.76
Central African Rep.	0.26	52.74	-0.57	India	0.57	15.94	0.14
Chad	0.19	42.84	-0.66	Indonesia	0.30	49.03	-0.75
Chile	0.24	49.91	1.28	Iran, I.R. of	0.55	39.29	-0.57
China,P.R.: Mainland	0.38	20.44	-0.34	Ireland	1.14	110.18	1.81
China,P.R.:Hong Kong	4.70	218.94	1.69	Israel	1.73	89.91	1.11
Colombia	0.31	31.55	-0.59	Italy	1.09	42.44	0.96
Congo, Republic of	0.95	99.17	-1.23	Jamaica	0.80	97.66	-0.20
Costa Rica	0.59	75.22	0.77	Japan	0.50	21.37	1.71
Croatia	1.50	90.82	-0.14	Jordan	1.14	111.52	0.45
Cyprus	1.68	102.07	0.83	Kazakhstan	0.32	74.79	-0.77
Czech Republic	1.32	113.83	0.62	Kenya	0.45	60.63	-0.91
Côte d'Ivoire	0.53	71.42	-0.59	Korea	1.22	63.22	0.76
Denmark	1.55	64.47	1.99	Kuwait	1.40	93.87	0.99
Djibouti	0.48	99.44	-0.44	Kyrgyz Republic	0.39	85.19	-0.76
Dominican Republic	0.65	57.17	-0.26	Lao People's Dem.Rep	0.36	63.60	-1.14

(cont'd)

Notes: IIX is the predicted institutional intensity of exports, constructed as described in the text. Trade/GDP is exports plus imports as a share of GDP from the Penn World Tables, averaged over 1970-99. Rule of Law index is from the Governance Matters database of Kaufmann, Kraay, and Mastruzzi (2005).

Appendix Table A2: Countries and Main Variables (cont'd)

Country	IIX	Trade/GDP	Rule of Law	Country	IIX	Trade/GDP	Rule of Law
Latvia	0.96	112.91	0.17	Senegal	0.52	68.85	-0.26
Lithuania	1.04	119.94	0.10	Sierra Leone	0.56	38.00	-0.88
Macedonia, FYR	1.04	86.73	-0.40	Singapore	4.03	340.44	2.15
Madagascar	0.28	39.83	-0.84	Slovak Republic	1.76	121.77	0.19
Malawi	0.33	60.97	-0.39	Slovenia	2.63	114.30	0.77
Malaysia	0.61	126.54	0.73	South Africa	0.26	49.77	0.28
Mali	0.22	47.23	-0.68	Spain	0.72	36.67	1.31
Malta	3.72	190.45	0.49	Sri Lanka	0.66	68.18	0.00
Mauritania	0.34	94.48	-0.54	Sudan	0.31	27.88	-1.29
Mauritius	0.76	113.19	0.84	Sweden	0.78	62.02	1.98
Mexico	0.23	34.45	-0.29	Switzerland	1.50	68.10	2.24
Moldova	0.75	125.21	-0.29	Syrian Arab Republic	0.92	52.72	-0.37
Mongolia	0.25	91.45	0.24	Tajikistan	0.38	139.78	-1.37
Morocco	0.50	48.28	0.34	Tanzania	0.17	35.32	-0.42
Mozambique	0.23	41.44	-0.97	Thailand	0.67	60.98	0.43
Nepal	0.71	33.84	-0.32	Togo	1.08	89.22	-1.00
Netherlands	2.52	102.64	1.97	Trinidad and Tobago	0.87	82.78	0.40
New Zealand	0.25	55.96	2.07	Tunisia	0.89	76.75	0.32
Nicaragua	0.51	70.19	-0.80	Turkey	0.84	28.51	0.09
Niger	0.23	44.29	-0.93	Turkmenistan	0.30	98.18	-1.17
Nigeria	0.51	52.37	-1.17	Uganda	0.37	25.14	-0.52
Norway	0.84	74.51	2.10	Ukraine	0.70	79.41	-0.72
Oman	0.79	73.54	1.21	United Kingdom	1.13	52.47	1.97
Pakistan	0.79	33.91	-0.59	United States	0.18	18.79	1.82
Panama	0.56	82.55	0.06	Uruguay	0.41	39.04	0.57
Papua New Guinea	0.21	90.82	-0.36	Uzbekistan	0.30	58.44	-1.00
Paraguay	0.20	53.70	-0.69	Venezuela, Rep. Bol.	0.31	47.79	-0.71
Peru	0.25	31.84	-0.46	Vietnam	0.53	73.20	-0.68
Philippines	0.51	59.31	-0.22	Yemen, Republic of	0.29	64.18	-0.87
Poland	1.24	45.73	0.55	Zambia	0.23	76.20	-0.37
Portugal	0.93	60.76	1.27	Zimbabwe	0.21	53.17	-0.32
Qatar	1.43	68.31	1.15				
Romania	1.26	47.06	-0.25	Mean	0.79	71.22	0.07
Russia	0.35	57.75	-0.83	Standard Deviation	0.72	42.55	0.98
Rwanda	0.64	31.35	-0.74				
Saudi Arabia	0.46	76.68	0.75				

Notes: IIX is the predicted institutional intensity of exports, constructed as described in the text. Trade/GDP is exports plus imports as a share of GDP from the Penn World Tables, averaged over 1970-99. Rule of Law index is from the Governance Matters database of Kaufmann, Kraay, and Mastruzzi (2005).