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Institutions, Trade and Development: A Quantitative Analysis

Abstract

We propose and apply methods to quantify the impact of national institutions on international trade and development. We are able to identify the direct impact of country-specific institutions on international trade within the structural gravity framework. Our approach naturally addresses the prominent issue of endogenous institutions. The empirical analysis offers robust evidence that stronger institutions promote trade. A counterfactual analysis reveals that the changes in institutional quality in the poor countries in our sample between 1996 and 2006 have had, via their impact on imports from rich countries, significant and heterogeneous real GDP effects, varying between -5 and 5 percent. Our methods are readily applicable to identifying the impact of a wide range of country-specific variables on international trade.

JEL-Codes: F130, F140, F160.

Keywords: institutional quality, international trade, development, structural gravity.

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"[I]nstitutions [...] are the fundamental cause of economic growth and development differences across countries"

Acemoglu and Robinson, 2010

"Domestic institutions can have profound effects on international trade"

Nunn and Trefler, 2014

1 Introduction

What determines differences in real income across countries is one of the most fundamental questions in international economics. In this paper, we seek to contribute to the debate by quantifying the impact of institutional quality on development and cross-country real income differences through international trade.

The focus on trade and institutions is motivated by the abundant evidence that both are determinants of income levels and growth. On the one hand, the recent trade and growth literature overwhelmingly finds that trade has a positive causal effect on income levels and growth.[1] Among the mechanisms through which trade causes growth, several studies have found a positive role of knowledge spillovers, import of new varieties and cost-reducing innovation.[2] On the other hand, studies such as North (1981; 1990), La Porta et al. (1997), and Acemoglu et al. (2001) show that high-quality institutions are a primary determinant of

[1] The seminal paper in the trade and growth literature is Frankel and Romer (1999). For more recent contributions, see Feyrer (2009; 2011), Brueckner and Lederman (2015), and Donaldson (2015) for a review. Bernhofen and Brown (2005), Wacziarg and Horn Welch (2008) and Bühler et al. (2011) show that trade liberalization episodes cause economic growth.

[2] Building on the literature on knowledge spillovers, Buera and Oberfield (2016) construct a structural model in which trade affects the diffusion of ideas. The model explains over a third of the TFP growth in China, Chinese Taipei and the Republic of Korea between 1962 and 2000. Broda et al. (2017) show that new imported varieties account for 10-25 percent of countries' productivity growth. Impullitti and Licandro (2017) find that trade liberalization generates tougher firm selection. This increases firms' incentives to innovate, thereby leading to a higher aggregate productivity growth rate. Calibrating their model to match the US economy, they find that moving from autarky to a 8.6 percent import penetration ratio is associated with a 57 percent increase in aggregate productivity growth due to innovation by more productive firms (exporters).

economic performance.[3] Beyond their direct effects on economic growth, institutions are also moderators of the relationship between trade and growth, as emphasized by Pascali (2017) in a recent but already influential contribution.[4]

To estimate the impact that institutional quality has on countries' comparative development through international trade, we employ a structural gravity methodology. This methodology is based on identifying empirically the impact of domestic institutions on international trade flows (relative to intra-national trade flows). From a theoretical perspective, there are at least two reasons why institutions may have a direct effect on trade. First, they are a source of comparative advantage.[5] Second, low-quality institutions act as trade frictions in bilateral trade, raising the cost of international exchange.[6]

We make four contributions to the literature, two methodological and two empirical. The first methodological contribution is to propose a simple approach to identify the direct effects of *country-specific* national institutions on international trade within a structural gravity estimation framework. As famously argued by Anderson and van Wincoop (2003), failure to control for the (unobservable) multilateral resistance terms (MRTs) in gravity estimations leads to biased estimates of the coefficients of the determinants of trade flows. To control

[3] Nunn (2009) provides a review of this literature. North (1981) argues that both contracting institutions (which support private contracts) and property rights institutions (which protect against unlawful expropriation) affect economic growth. Subsequent work by Acemoglu and Johnson (2005) shows that property rights institutions are the ones that matter most for long-term growth.

[4] Pascali (2017) estimates the effects of an exogenous increase in international trade (given by the asymmetric changes in shipping costs that resulted from the introduction of the steamship) on per capita incomes in the second half of the XIX century. In a restricted sample of 37 countries, he finds that trade reduced per capita GDP growth rates by more than a third in countries characterized by an executive power with unlimited authority, while it increased per capita GDP growth rates by almost one-tenth in countries in which the executive power was obliged to respond to several accountability groups.

[5] In particular, contracting institutions shape comparative advantage in complex products that require relationship-specific investments, thereby giving rise to the hold-up problem (Nunn, 2007). Moreover, institutions associated with financial development shape comparative advantage in industries that require relatively more external finance (Manova, 2008). Finally, labor market-related institutions shape comparative advantage in settings with endogenous division of labor (Costinot, 2009), hiring and firing costs (Cuñat and Melitz, 2012), and search frictions in the labor market (Helpman and Itskhoki, 2010). For a review of the literature on institutions and comparative advantage, see Nunn and Trefler (2014).

[6] In a seminal paper, Anderson and Marcouiller (2002) show analytically that the quality of the importing country's institutions determines the amount of risk of insecurity, which operates as a mark-up on imported goods. In a model featuring heterogeneous firms, Crozet et al. (2008) show that insecurity decreases the volume of bilateral exports by reducing the number of exporters.

for the MRTs, the standard practice in the literature, following Hummels (2001) and Feenstra (2004), is to adopt an econometric treatment with exporter and importer fixed effects. Unfortunately, while very powerful and convenient from an econometric perspective, the country-specific fixed effects do not allow for identification of the impact of national institutions, since the latter are also country-specific and, therefore, they are perfectly collinear with the fixed effects.

To overcome this identification challenge, researchers have adopted two alternative approaches. Some studies, e.g. Anderson and Marcouiller (2002), Yu et al. (2015), and Álvarez et al. (2018), have constructed bilateral institution variables as a combination of the institutional indexes on the importer and on the exporter side. The advantage of this approach is that it respects the structural properties of the gravity model by allowing estimation with the proper set of exporter and importer fixed effects.[7] The disadvantage of this method is that it does not allow for direct identification of the impact of national institutions on international trade and, therefore, poses a challenge with the interpretation of the estimates of the impact of (bilateral) institutions on trade.

Other studies, e.g. de Groot et al. (2004), Dutt and Traca (2010), de Jong and Bogmans (2011), Francois and Manchin (2013), Gil-Pareja et al. (2017), and Álvarez et al. (2018) have been able to estimate the direct impact of national institutions on international trade, however, at the expense of not properly controlling for the multilateral resistance terms.[8] As a consequence, the estimates of institutional quality on trade in such studies are potentially biased, subject to the Anderson and van Wincoop (2003) MR critique.[9]

[7] In Table 3 of Álvarez et al. (2018), bilateral institution variables (constructed as the difference between importer and exporter in various measures of institutional quality) are used. However, only exporter fixed effect are included, while importer fixed effects are omitted.

[8] In Table 2 of Álvarez et al. (2018), institution variables for the importing country are used (rather than bilateral institutions as in their Table 3). Only exporter fixed effect are included, while importer fixed effects are omitted. Dutt and Traca (2010) and de Jong and Bogmans (2011) consider the effects of corruption on bilateral trade flows. In their aggregate analysis with an exporter-importer-time panel, Dutt and Traca (2010) include either importer and exporter non time-varying fixed effects, or bilateral country-pair dummies. They cannot, however, include importer-time and exporter-time dummies. Similarly, de Jong and Bogmans (2011), who estimate a cross-sectional gravity equation, cannot include importer and exporter fixed effects to identify the coefficients on importer's and exporter's corruption.

[9] de Jong and Bogmans (2011) and Francois and Manchin (2013) approximate multilateral resistance

Our methods simultaneously address the deficiencies of both of the above mentioned approaches by delivering estimates of the impact of country-specific institutional measures within a structural gravity framework with exporter and importer fixed effects. To achieve this goal, we extend on the identification strategy of Heid et al. (2017), who propose the addition of intra-national trade flows to gravity estimations in order to be able to identify the impact of non-discriminatory unilateral trade policies within the structural gravity framework. Similar to Heid et al. (2017), we show that the introduction of intra-national trade flows in gravity estimations allows for identification of the impact of country-specific national institutions. However, unlike Heid et al. (2017), who are able to identify the impact of unilateral trade policies separately on the importer and on the exporter side, we demonstrate that it is not possible to identify the impact of national institutions (as well as of any other country-specific variable of interest) separately on exports versus imports. Instead, we show that it is only possible to obtain estimates of the impact of national institutional quality (or any other country-specific variable) on international trade relative to internal trade.

Our second methodological contribution relates to the literature that accounts for endogeneity of institutions. A large body of historical evidence supports the idea that pivotal institutional changes can occur as a result of economic integration.[10] Moreover, a series of prominent studies, e.g. Hall and Jones (1999), Acemoglu et al. (2001) and, more recently, Auer (2013), recognize the fact that national institutions are, to some extent, determined by income levels. In the light of the link between trade and income, this endogenous link between institutions and income is another reason why the relationship between institutions

terms with the Baier and Bergstrand (2009)'s transformation. However, such transformation is an approximation centered around a world with symmetric and identical trade costs, which is not suited to the counterfactual experiments we implement. Moreover, this approximation only applies to a log-linearized model, and not to the PPML model that we use to estimate our gravity equation.

[10] See, among several others, Puga and Trefler (2014) for an analysis of merchants-led institutional change in Venice during the Commercial Revolution of the early XI century; Acemoglu et al. (2005) for a study on the establishment of strong property rights protections in XVI century Britain; Inikori (2003) and Nunn and Wantchekon (2011) for analyses of the adverse consequences on institutional development of the slave trade in Africa. A comprehensive review is provided by Nunn and Trefler (2014). The conclusion of their survey is that "the impact of international trade on domestic institutions is the single most important source of long-run gains from trade" (Nunn and Trefler, 2014, p. 309).

and international trade cannot be treated as exogenous.

Our approach to identify the effects of national institutional quality on international trade relative to internal trade offers an alternative to deal with the endogeneity issue. First, exporter and importer fixed effects absorb and control for all observable and, more importantly, unobservable country-specific links between trade and national institutions. Further, our variable of interest is the interaction term between an 'international trade' dummy (equal to one if the trade flow is international, zero if it is intra-national) and institutions. As shown in a recent paper by Nizalova and Murtazashvili (2016), we will obtain consistent estimates if our international trade dummy is not correlated with institutional quality or the potentially omitted variables. This is the case, first because the international trade dummy is independent of any country choice, as it is one for all international flows and zero else. Hence, it is exogenous and does not vary systematically with institutional quality; and second because, on top of the exogeneity and the fixed effects mentioned above, we include standard country pair gravity controls (in cross-section estimations) and pair fixed effects (in panel estimations) that greatly reduce the scope for omitting variables. Therefore, our methods should deliver proper estimates of the impact of national institutions on trade without the need to use instrumental variables.[11]

We also make two empirical contributions to the existing literature. First, we apply our methods to obtain estimates of the impact of national institutions on international trade. To that end, we employ (cross-section and panel) data sets that include consistently constructed international and intra-national manufacturing trade flows. We obtain positive, large and statistically significant estimates of the impact of national institutions on international trade across specifications that employ different samples, alternative estimators, and various measures of institutional quality. Thus, we contribute to the related literature by offering robust support for a positive causal relationship between institutional quality

[11] Despite this argument, in the empirical analysis we also employ IV estimators with leading instruments from the existing literature. Reassuringly, the IV estimates are not statistically different from the results that are obtained without instrumenting for potentially endogenous institutions.

and international trade. Prominent papers that also obtain positive estimates of the impact of institutions on trade include Anderson and Marcouiller (2002), de Groot et al. (2004), Francois and Manchin (2013), and Álvarez et al. (2018).[12] The main difference between the above mentioned papers and our approach is that we are able to identify the direct impact of country-specific institutions, while – as discussed above – the existing literature either employs bilateral institutional measures or does not control properly for the structural multilateral resistance terms.

The last main contribution of this paper is the specific focus on the impact of poor countries' institutions – which vary substantially more over time than rich countries' institutions in our sample. We find a significantly stronger impact of institutional quality on the imports of poor countries from rich countries than on their exports to rich countries. This reflects the comparative advantage of the industrialized countries in the production and exports of manufacturing goods, which are covered by our data. We use this result, in combination with the general equilibrium properties of the structural gravity model, to demonstrate the importance of institutional quality for economic development and for cross-country real income differences. To that end, we perform an ex-post counterfactual analysis of the impact of observed changes in institutional quality in the poor countries in our sample over the period 1996-2006. The main finding from the counterfactual experiment is that the changes in institutional quality in the poor countries in our sample have had significant and heterogeneous impact on their welfare, as measured by real GDP. For example, our estimates reveal that, via its impact on trade, improvement in institutional quality increased real GDP by almost 5 percent in the best performing country, while negative changes in institutional quality in other countries led to decreases in real GDP of up to 5.2 percent. Importantly,

[12] The empirical literature on corruption and trade obtains more ambiguous results. In Dutt and Traca (2010), corruption taxes trade in the majority of cases, but in high-tariff environments it is trade enhancing. In de Jong and Bogmans (2011), measures of corruption in general are negatively associated with international trade, while measures of corruption directly related to international trade, such as frequent payments to customs, are positively associated with trade. Gil-Pareja et al. (2017) argue that, when using subjective perception measures, corruption decreases bilateral trade flows, while the opposite is true when using an objective measurement of corruption such as the Structural Corruption Index (SCI).

our results reveal that the main driver of the changes in real GDP for the poor countries in our sample was the change in consumer prices.

Stimulated by the large and heterogeneous estimates of the GE impact of institutional quality on the welfare of the poor countries in our sample, we attempt to identify certain pre-existing economic conditions that would facilitate or hinder the positive impact of institutional quality improvements on development through trade. To achieve this goal, we undertake a second counterfactual analysis where we simulate a uniform increase in the quality of institutions of the poor countries in our sample and exploit the variation in the resulting real GDP changes to study their determinants. This analysis reveals that the initial level of institutional quality as well as the initial level of national output are not significant factors in determining the effectiveness of institutional quality improvements. We view this as an encouraging result because it suggests that not only countries that are richer or that have better institutional quality initially, but also poorer countries and countries with poor institutions can benefit from institutional improvements. We also find that trade openness promotes the impact of institutional improvements. The implication of this result is that there might be significant benefits from implementing a combination of trade liberalization and institutional improvements.

The rest of the paper is organized as follows. Section 2 offers a brief review of the structural gravity model (in Subsection 2.1) and presents our identification strategy (in Subsection 2.2). Section 3 describes our data set (in Subsection 3.1), obtains partial equilibrium estimates of the impact of institutions on international trade as well as differential estimates of the effects of institutions for poor versus rich countries (in Subsection 3.2), and presents general equilibrium welfare effects of institutional quality changes observed in poor countries between 1996 and 2006, as well as results from a counterfactual experiment which hypothetically improves the institutional quality in those countries (in Subsection 3.3). Section 4 concludes with a summary of our findings and with a brief discussion of possible directions for future research. Finally, an analytical exposition of our methodology and the results from

a series of robustness tests are respectively included in Appendices A and B.

2 Theoretical foundations and identification

We start, in Section 2.1, with a brief review of the structural gravity model as the workhorse framework for partial and general equilibrium analysis of the determinants of bilateral trade flows. Gravity theory will guide our estimation analysis and we will rely on it to perform the general equilibrium counterfactual experiments. Then, in Section 2.2, we present our strategy to identify the impact of country-specific national institutions on international trade.

2.1 Review of the structural gravity model

It is now well-established and understood that the following generic theory-founded structural gravity model can be derived from a very wide class of microeconomic foundations:[13]

$$X_{ij} = T_{ij} \frac{Y_i E_j}{\Pi_i P_j}. \tag{1}$$

Here, X_{ij} are bilateral trade flows from exporting country i to importing country j; T_{ij} denotes any determinants of trade between countries i and j, including bilateral trade barriers, such as geographic distance and regional trade agreements, as well as country-specific trade-related drivers, such as institutions. Y_i denotes the total value of production of country i, which can be calculated as total sales at home and abroad: $Y_i = X_{ii} + \sum_{j \neq i} X_{ij}$. E_j is the expenditure in country j, which can be calculated for each country as sum across all bilateral imports, including the domestic sales in country j: $E_j = X_{jj} + \sum_{i \neq j} X_{ij}$. Finally, Π_i and P_j denote the structural outward and inward multilateral resistance terms (MRTs) of Anderson

[13] For expositional simplicity, equation (1) is presented in a cross-section form for a generic sector. However, the same equation applies separately to sectoral data as well as to panel data. We refer the reader to Head and Mayer (2014), Costinot and Rodríguez-Clare (2014) and Yotov et al. (2016) for recent surveys of the empirical and the theoretical structural gravity literature.

and van Wincoop (2003):

$$\Pi_i = \sum_j \frac{T_{ij} E_j}{P_j}, \quad P_j = \sum_i \frac{T_{ij} Y_i}{\Pi_i}. \tag{2}$$

The multilateral resistances in equation (2) have several appealing properties. Intuitively, they capture the fact that bilateral trade between two countries depends not only on their sizes and on the bilateral trade costs between them, but also on how isolated/remote each country is from the rest of the world. All else equal, more multilaterally remote countries would trade more with each other, see Anderson and van Wincoop (2003). From a structural perspective, the MRTs are general equilibrium indexes, which decompose the incidence of trade costs on the producers and on the consumers in each country as if they sell to and/or buy from a unified world market, see Anderson and Yotov (2010) and Yotov et al. (2016).

As general equilibrium indexes, the MRTs capture the fact that a change in trade costs between any two countries in the world would affect all other countries in the world. With respect to decomposing the incidence of trade costs and their changes on producers and consumers, the outward multilateral resistances can be used in combination with the market clearing conditions to translate any changes in trade costs into changes in factory-gate prices and, consequently, into changes in the value of national output. At the same time, the inward multilateral resistances can be interpreted structurally as ideal consumer price indexes, see Anderson and Yotov (2010). Thus, in combination, the changes in the inward and in the outward multilateral resistance terms can be used to obtain the response of real GDP of each country to any change in bilateral trade costs in the world economic system.[14] We capitalize

[14] Assuming an endowment economy with CES preferences, we can write nominal output as $Y_i = \sum_j X_{ij} = \sum_j (\alpha_i p_i)^{1-\sigma} T_{ij} E_j / P_j$, where p_i denotes the price of the good in country i, α_i is a CES preference parameter, σ denotes the elasticity of substitution, and the replacement of X_{ij} uses the solution for expenditures on goods shipped from country i to country j of the consumer's optimization problem. Then we can solve for $\alpha_i p_i$: $(\alpha_i p_i)^{1-\sigma} = Y_i / [\sum_j T_{ij} E_j / P_j] = Y_i / \Omega_i$. Hence, $\alpha_i p_i = (Y_i/\Omega_i)^{1/(1-\sigma)}$ and the change in nominal output between the baseline (denoted by superscript b) and the counterfactual (denoted by superscript c) is given by $Y_i^c / Y_i^b = \alpha_i p_i^c / (\alpha_i p_i^b) = p_i^c / p_i^b = [(Y_i^c/\Omega_i^c)^{1/(1-\sigma)}] / [(Y_i^b/\Omega_i^b)^{1/(1-\sigma)}]$. Note that real gross domestic product can then be calculated as $Y_i^c / (P_i^c)^{1/(1-\sigma)}$. We refer the reader to Yotov et al. (2016) for a detailed discussion of the multilateral resistances, their properties and construction, as well as more detailed discussion about performing a counterfactual analysis. In addition, Head and Mayer (2014) and Costinot

on these properties in Section 3.3, where we study the general equilibrium implications of stronger institutions in the poor countries in our sample.

2.2 National institutions and trade: an identification strategy

We develop and present our identification strategy in three steps. First, we show why existing gravity studies are unable to obtain estimates of the effects of country-specific institutions on international trade. While the collinearity issue that we describe at this stage is obvious, we present this trivial step as an opportunity to introduce the design of our analysis as well as some notation. Second, we demonstrate that the introduction of intra-national trade flows in structural gravity estimations allows identification of the impact of *country-specific* national institutions. Finally, we show that it is not possible to identify separate effects of institutions on exports versus imports. All steps that we describe in this section extend directly to the sectoral level and to analysis with panel data.

Start with the following traditional gravity model:

$$\ln X_{ij} = \mathbf{GRAV}_{ij}\boldsymbol{\beta} + \beta_1 IQ_i + \beta_2 IQ_j + \eta_i + \mu_j + \varepsilon_{ij}, \qquad \forall\ i \neq j. \tag{3}$$

Equation (3) is obtained after log-linearizing equation (1) and two additional steps. First, we have replaced the bilateral trade costs variable T_{ij} from specification (1) with a vector of trade cost variables $\mathbf{GRAV}_{ij}$, which may include any determinant of bilateral trade (e.g. distance, trade agreements, etc.), and we have included explicitly the two variables of interest that measure institutional quality on the exporter side (IQ_i) and on the importer side (IQ_j). Second, we have introduced a set of exporter fixed effects (η_i), which will control for the value of output and for the outward multilateral resistance in the exporter country, and a set of importer fixed effects (μ_j), which will control for expenditure and for the inward multilateral resistance in the importer country. ε_{ij} is a remainder error term.

and Rodríguez-Clare (2014) offer very informative and insightful reviews of the cutting-edge approaches to perform general equilibrium analysis with the structural gravity model.

Heid et al. (2017) propose the addition of intra-national trade flows to gravity estimations in order to be able to identify the impact of country-specific variables within the structural gravity framework. While Heid et al. (2017) suggest how to identify and to interpret the trade impact of country-specific variables that apply *differently* on exports and imports, such as unilateral trade policies, we extend on their approach and show how to identify the impact of country-specific variables that apply *equally* on exports and imports, such as (but not only) domestic institutions. As shown in Appendix A with a specific data example, this is not a trivial extension due to a series of collinearity issues discussed therein.

In particular, in Appendix A we show three results that will guide the empirical analysis of Section 3. First, in a cross-section setting (data varying across importers and exporters), when including intra- and international trade flows, it is possible to obtain estimates of the impact of national institutional quality on international relative to internal trade, even in estimations with importer- and exporter-specific effects. Second, it is not possible to identify simultaneously the differential trade effects of importer versus exporter institutions. This is because, unlike unilateral trade policies that are potentially directional, i.e., specific for a country as importer or exporter, the institutional quality is the same for a country, independently of whether it acts as an exporter or importer. Third, if the analysis is conducted in a panel setting (data varying across importers, exporters and years), the identification of the impact of importer's (or exporter's) institutions is still possible after including importer-time, exporter-time and country-pair fixed effects.

In a panel gravity estimation, the use of country-pair fixed effects is desirable for two reasons. First, they would control comprehensively for all observable and unobservable bilateral trade frictions. Second, as demonstrated by Baier and Bergstrand (2007), the pair fixed effects would mitigate possible endogeneity concerns with respect to the bilateral policy covariates in gravity equations.

To identify the effect of national institutions on international trade in a gravity framework with intra- and international trade flows, we will therefore use the following identification

strategy. In cross-sectional estimations, we will add importer and exporter fixed effects, and we will estimate the effect of an interaction between national institutions (of the importing or of the exporting country) and an international trade dummy (equal to one when the trade flow is international, as opposed to intra-national). In panel estimations, we will add importer-time, exporter-time and (in some estimations) country-pair fixed effects, and still we will be able to identify the coefficient on the interaction term. In both cross-sectional and panel settings, the coefficient of interest identifies the impact of national institutional quality on international relative to internal trade.

Finally, we will also show results of IV estimations that use instruments for institutional quality from the literature on institutions and income.

3 Empirical analysis

This section has four objectives. First, we demonstrate the ability of our methods to identify the effects of country-specific institutions on international trade. Second, we quantify the direct, partial-equilibrium impact of national institutions on international trade. Third, we study the differential partial-equilibrium impact of institutions on trade of poor with rich countries. All partial equilibrium analyses are presented in Section 3.2. Finally, in Section 3.3, we perform general equilibrium counterfactual experiments, where we study the links between institutional quality and development through trade. Before we present and discuss our estimates of the partial and general equilibrium impact of institutional quality on international trade, in Section 3.1 we describe our data.

3.1 Data: description and sources

Following the existing literature, our main estimates are obtained with a cross-section data set. Data constraints predetermined 2006 as the year of our main sample. In the sensitivity analysis we also experiment with panel estimations, which, due to availability of data on

institutional quality, cover either the period 1996-2006 or the period 1988-2006, depending on the institutional index that we use. Availability of reliable data on intra-national trade flows, which are crucial for the implementation of our methods, led to the use of data on total manufacturing and, in combination with the rest of the data, we were able to obtain coverage for sixty-three countries.[15] The data that we use to obtain our results can be split into three categories, which include: (i) data on trade flows (international and intra-national); (ii) data on institutional quality and economic development; and (iii) data on standard gravity variables. Next, we offer details on the construction of the variables in each category and we describe our data sources in more detail.

International and intra-national trade flows. Two sources are used to obtain the data on international trade flows. The first source is the United Nations' Commodity Trade Statistics Database (COMTRADE), and the second source is CEPII's Trade, Production and Bilateral Protection (TradeProd) database.[16] COMTRADE is the primary data source and TradeProd is used for instances when it includes positive flows for observations when no trade flows are reported in COMTRADE. Most important for the implementation of our methods, our database includes consistently constructed intra-national trade flows observations, which are calculated as the difference between total manufacturing production and total manufacturing exports.[17] Importantly, we note that both of these variables are reported on a *gross basis*, which ensures consistency between intra-national and international trade. Three original

[15] The following is the list of the sixty-three countries in our sample (with their respective ISO country codes in parentheses): Argentina (ARG), Australia (AUS), Austria (AUT), Belgium (BEL), Bolivia (BOL), Brazil (BRA), Bulgaria (BGR), Cameroon (CMR), Canada (CAN), Chile (CHL), China (CHN), Colombia (COL), Costa Rica (CRI), Cyprus (CYP), Denmark (DNK), Ecuador (ECU), Egypt (EGY), Finland (FIN), France (FRA), Germany (DEU), Greece (GRC), Hungary (HUN), India (IND), Indonesia (IDN), Iran (IRN), Ireland (IRL), Israel (ISR), Italy (ITA), Japan (JPN), Jordan (JOR), Kenya (KEN), Republic of Korea (KOR), Kuwait (KWT), Malawi (MWI), Malaysia (MYS), Mauritius (MUS), Mexico (MEX), Morocco (MAR), Nepal (NPL), Netherlands (NLD), Niger (NER), Nigeria (NGA), Norway (NOR), Panama (PAN), Philippines (PHL), Poland (POL), Portugal (PRT), Romania (ROU), Senegal (SEN), Singapore (SGP), South Africa (ZAF), Spain (ESP), Sri Lanka (LKA), Sweden (SWE), Switzerland (CHE), Tanzania (TZA), Thailand (THA), Trinidad & Tobago (TTO), Tunisia (TUN), Turkey (TUR), United Kingdom (GBR), United States (USA), and Uruguay (URY).

[16] UN COMTRADE can be accessed at http://comtrade.un.org, while CEPII's TradeProd can be found at http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=5.

[17] These data were constructed and kindly provided to us by Thomas Zylkin.

data sources are used to construct the production data, which are needed for the calculation of intra-national trade. The main source is the United Nations' UNIDO Industrial Statistics database. In addition, the UNIDO data are complemented with data from the CEPII's TradeProd database and with data from the World Bank's Trade, Production and Protection (TPP) database.[18]

Institutional quality and development indexes. Our main data on institutional quality come from the World Bank's World Governance Indicators (WGI) database, which includes data on a series of indicators for institutional quality including Voice and Accountability, Political Stability and Absence of Violence, Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption.[19] To obtain the main results, we construct an aggregate institutional quality index, as the simple average of the six individual WGI categories. In the sensitivity experiments, we also confirm the robustness of our main findings with each of the individual WGI indexes. In addition to using alternative measures from the WGI database, we also experiment with two other measures of institutional quality. Specifically we employ (i) the Combined Polity Score index from the Polity IV project; as well as (ii) an average index that we construct from the Political Rights and Civil Liberties indicators of the Freedom House initiative.[20] An advantage of the Polity IV and the Freedom House indexes of institutional quality is that they are available for an extended period of time, which enables us to study the impact of institutions over the period 1988-2006 (while the WGI data only covers the period 1996-2006).

To obtain some of our results, we implement instrumental variable estimators. To do so, in the main analysis, we rely on the distance-from-the-equator instrument of Hall and Jones (1999). In addition, in the robustness experiments, we also employ the mortality-rate

[18] The INDSTAT database can be found at http://stat.unido.org. The TPP data set can be accessed at http://go.worldbank.org/4Z6UU7TO40. For further details on the construction of the intra-national trade flows data we refer the reader to Baier et al. (2016).

[19] We refer the reader to http://info.worldbank.org/governance/wgi/#doc for a detailed description of the World Bank's WGI database.

[20] More information about the original Polity IV data set and its description can be found at http://www.systemicpeace.org/polity/polity4.htm. For more information on the Freedom House indexes, we refer the reader to https://freedomhouse.org/report/freedom-world-2016/methodology.

instrument from Auer (2013), who expands on the original 'settler mortality' instrument of Acemoglu et al. (2001) to construct a hypothetical mortality rate for a larger sample of countries.

In addition to the data on institutional quality, we employ the World Bank's Country and Lending Groups classification in order to identify the poor and the rich countries in our sample.[21] The poor countries in our sample are defined as those that are classified as 'low-income' or 'lower-middle income' economies by the World Bank. The rich countries are those classified as 'upper-middle income' or 'high-income' economies. There are a total of twenty-two 'poor' countries and forty-one 'rich countries' in the sample.[22] In the main empirical analysis, we demonstrate that the impact of institutions is much stronger for poor countries.

Standard gravity variables. In addition to a very rich structure of fixed effects, which control for many observable and unobservable determinants of bilateral trade, in most of the estimations we rely on proxies for bilateral trade costs that have been used standardly in the gravity literature. Specifically, we employ data on bilateral distance, colonial relationships, common official language and contiguous borders. All of these gravity variables come from the CEPII's GeoDist database.[23] An important advantage of the distance variables from the GeoDist database, especially for our analysis with intra-national trade flows, is that the weighted-average methods that are used to construct distance ensure consistency between the measures of intra-national and international distance. Specifically, consistency is ensured because each method uses population-weighted distances across the major economic centers

[21] The World Bank's Country and Lending Groups data, along with a detailed description of the data set and information about the construction of the data, can be found at https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups.

[22] In 2006, the following eight countries belonging to our sample of sixty-three countries were classified as 'low-income' in the World Bank's Country and Lending Groups classification: India, Kenya, Malawi, Nepal, Niger, Nigeria, Senegal, and Tanzania. The following fourteen countries were classified as 'lower-middle income': Bolivia, Cameroon, China, Colombia, Ecuador, Egypt, Indonesia, Iran, Jordan, Morocco, Philippines, Sri Lanka, Thailand, and Tunisia. The remaining forty-one countries in the sample were either classified as 'upper-middle income' (fifteen countries) or 'high-income' (twenty-six countries).

[23] This database can be accessed at http://www.cepii.fr/cepii/en/bdd_modele/presentation.asp?id=6. We refer the reader to Mayer and Zignago (2011) for detailed description of these commonly used gravity covariates.

within or across countries, respectively. Finally, we also employ data on regional trade agreements (RTAs). The original data on RTAs, including information about the agreement name, status, date of notification and of signature, signatories countries and link to the text of documents, is the WTO Regional Trade Agreements Information System (RTA-IS). We use Mario Larch's Regional Trade Agreements Database from Egger and Larch (2008), which is based on the original RTA data from the WTO.[24]

3.2 The impact of national institutions on international trade

This section demonstrates the validity of our methods by obtaining partial equilibrium estimates of the impact of national institutions on international trade. In addition, we also obtain differential estimates of the direct impact of institutions on international trade between poor and rich countries. The econometric analysis relies on the identification strategy that we presented in Section 2.2. In order to most clearly demonstrate the effectiveness of our methods, we develop the analysis sequentially. We start with a standard gravity specification, which confirms the representativeness of our sample. Then, we show that we can identify the impact of country-specific institutions within a structural gravity estimation framework. We proceed by gradually introducing a series of adjustments from the related literature. Our main estimates are presented in Table 1.

The estimates from column (1) of Table 1 are obtained with the OLS estimator based on the following standard cross-section gravity specification that does not include a measure of institutional quality:[25]

$$\begin{aligned} \ln X_{ij} &= \beta_1 LN\_DIST_{ij} + \beta_2 CNTG_{ij} + \beta_3 LANG_{ij} + \beta_4 CLNY_{ij} + \beta_5 RTA_{ij} \\ &\quad + \beta_1 BRDR_{ij} + \eta_i + \mu_j + \varepsilon_{ij}, \end{aligned} \tag{4}$$

[24] The original RTA data of the WTO can be found at http://rtais.wto.org/UI/PublicMaintainRTAHome.aspx. Mario Larch's RTA database can be accessed at http://www.ewf.uni-bayreuth.de/en/research/RTA-data/index.html.

[25] We start with a cross-section OLS specification because this is the standard and most popular econometric approach to study the impact of institutions in the existing literature. Below we demonstrate that our cross-section OLS estimates are robust to the use of panel data and of the PPML estimator.

where we have used the standard series of observable variables to proxy for trade costs, including: the logarithm of bilateral distance (LN_DIST_{ij}), whether or not two trading partners share a common border ($CNTG_{ij}$), whether i and j speak the same official language ($LANG_{ij}$), if two countries share any colonial relationships ($CLNY_{ij}$), and whether they have an RTA in force (RTA_{ij}). In addition, we have introduced an indicator variable $BRDR_{ij}$, which takes a value of one for international trade, and it is equal to zero for intra-national trade. (See Appendix A for details on why this variable is introduced). Finally, we also include the sets of exporter fixed effects (η_i) and importer fixed effects (μ_j), which, amongst other things, control for the multilateral resistance terms, and add a remainder error term (ε_{ij}).

Without going into details, we note that the estimates from column (1) of Table 1 capture the fact that distance and international borders are significant impediments to international trade, while sharing a common official language, sharing colonial ties, and having a regional trade agreement promote bilateral trade flows, all else equal. This is indicated by the large and significant estimates on LN_DIST, $BRDR$, $LANG$, $CLNY$, and RTA, respectively. The estimate of the impact of contiguous borders ($CNTG$) on international trade is also positive, as expected, although not statistically significant. Overall, the gravity estimates from column (1) of Table 1 are readily comparable to the meta-analysis gravity indexes from Head and Mayer (2014) and, therefore, they establish the representativeness of our sample.[26]

The results from column (2) of Table 1 are obtained with the same cross-section OLS specification as in column (1). However, in addition to the standard gravity covariates we have introduced the additional regressor IQ_BRDR, which captures the impact of national institutions on international trade. As discussed in Appendix A, IQ_BRDR can be defined either on the exporter side ($IQ\_BRDR \equiv IQ_i \times BRDR_{ij}$), or on the importer side ($IQ\_BRDR \equiv IQ_j \times BRDR_{ij}$), without any quantitative implications for the correspond-

[26] Head and Mayer's results are based on more than 150 studies, including more than 2500 gravity estimates.

ing estimates.[27] In each case, by construction, the estimate on IQ_BRDR captures the differential impact of national institutions on international relative to internal trade. Importantly, since the institution interaction term is set to zero for domestic sales, the impact of institutions can be identified even in the presence of the exporter and the importer fixed effects (η_i and μ_j), which apply to both internal and international sales.

Three main findings stand out from the estimates in column (2) of Table 1. First, they demonstrate that we were able to obtain an estimate of the impact of national institutions in the presence of the full set of exporter and importer fixed effects and without facing any collinearity issues. This result is important from a methodological perspective because it validates our methods in the case of national institutions, and also because it opens a universe of opportunities to study the differential impact of any country-specific variable on international relative to internal trade.[28] Second, we obtain a large, positive and statistically significant estimate on IQ_BRDR, which reveals that stronger national institutions promote international trade. This result reinforces the argument for a positive relationship between institutional quality and international trade from existing studies that use bilateral institution variables (e.g. Anderson and Marcouiller, 2002) or do not appropriately control for the multilateral resistances (e.g. de Groot et al., 2004). Third, we note that the estimates of all gravity covariates, except for the estimate on $BRDR$, are virtually identical to the corresponding estimates from column (1). As expected (based on the positive estimate of the impact of institutions), the estimate on $BRDR$ in column (2) is larger in absolute value as compared to the $BRDR$ estimate from column (1). The natural explanation for this result is that the estimate of the border effects from column (1) combines the positive impact of institutions with the negative impact of some unobservable impediments to trade. In the robustness analysis that we present in Appendix B, we demonstrate that qualitatively identical results are obtained with a series of alternative measures of institutional quality.

[27] We refer the reader to Table B-1 from Appendix B, where we demonstrate empirically the equivalence of the estimates of the impact of national institutions obtained (i) on the exporter side; (ii) on the importer side; and (iii) for intra-national trade.

[28] For example, value-added taxes, sales taxes, etc.

One of the most prominent and difficult challenges with the identification of the impact of institutions on trade, growth, and development is to address properly potential endogeneity of the institution regressor. As a result, some of the most influential papers in the literature that study the growth impact of institutions, e.g. Hall and Jones (1999), Acemoglu et al. (2001) and, more recently, Auer (2013), have gained popularity due to the introduction of novel and successful instruments to control for endogenous institutions. We obtain estimates of the relative impact of national institutional quality on international trade *relative to* internal trade, controlling for exporter and importer specific effects. Hence, in our specifications, the fixed effects will absorb and control for all observable and, more importantly, unobservable country-specific links between trade and national institutions. In addition, Nizalova and Murtazashvili (2016) show that when interest lies in the estimation of the *differential* impact of a particular factor, consistent estimates can be obtained even when the particular factor of interest is correlated with omitted variables. This is the case as long as the treatment is uncorrelated with both the factor of interest as well as the omitted variables. This insight can be applied to our setting by viewing the international trade dummy as the treatment and the institutional quality as the factor of interest. Since the distinction of international trade versus internal trade (not their levels!) should neither be correlated with the institutional quality nor with the omitted variables (and therefore be exogenous), we will obtain consistent estimates of the interaction term, i.e. of the effects of institutional quality on international relative to internal trade.

Even tough, as we just discussed, our econometric approach should address the issue of endogeneity of institutions in our setting automatically, we follow the prominent related literature to also implement an instrumental variable strategy in our setting. Specifically, the estimates from column (3) of Table 1 are obtained after instrumenting for endogenous institutions with the distance-from-the-equator instrument of Hall and Jones (1999). Two main findings stand out from column (3). First, as expected based on existing studies, the Hall-Jones instrument is a strong predictor of institutional strength. The first stage estimate

of the coefficient on the Hall-Jones instrument is significant at any level. Furthermore, we obtain large under-identification canonical correlations χ^2 test statistic of 766.58, (see Anderson, 1951), and weak-identification *Wald F* estimates of 922.82 and 16.38 (constructed following Cragg and Donald, 1993 and Stock and Yogo, 2005, respectively).

Second, and more important for our purposes, the estimate of the impact of institutions in column (3) is large, positive, and statistically significant at any conventional level. Furthermore, we find that, while a bit smaller, the IV estimate from column (3) is not statistically different from the corresponding OLS estimate in column (2), thus, reinforcing the argument that the country-specific (exporter and importer) fixed effects and the focus on the interaction term avoid severe endogeneity issues. In the robustness analysis that we perform in Appendix B, we demonstrate that very similar results are obtained if, instead of the Hall-Jones instrument, we employ the instrument from Auer (2013), which expands on the original "settler mortality" instrument of Acemoglu et al. (2001) to construct a hypothetical mortality rate for a larger sample of countries. Finally, we also employ a combination of the Hall-Jones and the Auer instruments to, once again, confirm the robustness of our main results. See Appendix Table B-4 for further details.

To obtain the estimates in column (4) of Table 1 we use an IV Poisson-Pseudo Maximum Likelihood estimator (PPML). The PPML estimator has gained popularity for structural gravity estimations due to three attractive properties. First, as demonstrated by Santos Silva and Tenreyro (2006), the PPML estimator effectively addresses the issue of heteroskedasticity, which often plagues international trade flows data. Second, since PPML is a multiplicative estimator, it enables researchers to take into account the information that is contained in the zero trade flows, which appear often in bilateral trade data. Finally, owing to its additive property (see Arvis and Shepherd, 2013; Fally, 2015), the PPML estimator can be used to perform structural general equilibrium analysis directly in standard software packages (e.g. Stata), see Anderson et al. (2016). Similar to the IV-OLS analysis from column (3), we employ the Hall-Jones instrument to obtain the IV-PPML estimates from column

(4). As before, in Appendix B we also demonstrate that the results are robust to employing the instrument from Auer (2013) as well as a combination of the Hall-Jones and the Auer instruments. The IV-PPML estimates from column (4) are not statistically different from the results that we already obtained in columns (2) and (3) and, therefore, they reinforce the robustness of our findings.

The last two columns of Table 1 report panel estimates over the period 1996-2006. The panel treatment of the impact of institutions in international trade has at least three advantages as compared to the cross-section analysis that we employed thus far. First, from a pure econometric perspective, the panel setting will improve the efficiency of our estimates. Second, the panel setting will enable us to capture the impact of changing institutional quality over time. This is potentially important because, in principle, the cross-section estimates of institutional quality may be biased upwards due to endogeneity resulting from reverse causality: better institutions may lead to more trade, but more trade could also lead to better institutions. If this intuition is correct, then we would expect that the panel estimates of the impact of institutions would be smaller as compared to their cross-section counterparts. Third, the panel setting will enable us to control comprehensively for all time-invariant bilateral frictions as well as to further mitigate endogeneity concerns through the use of country-pair fixed effects. Due to data availability constraints imposed by the WGI database, the years included in our sample are 1996, 1998, 2000, and the period 2002-2006. Proper treatment of the structural multilateral resistance terms in panel settings requires the use of exporter-time and importer-time fixed effects. Accordingly, we do include such fixed effects in the estimations of the last two columns of Table 1, although omit their estimates for brevity in the table.[29]

The estimates from column (5) of Table 1 are obtained with the standard gravity variables, where we also introduced a series of time-varying border dummies, which are designed

[29] The panel estimates in Table 1 are obtained with the OLS estimator. PPML estimates, which confirm the robustness of our main results, are presented in Table B-5 of Appendix B.

to capture any globalization effects.[30] Two main results stand out from the estimates in column (5). First, we find that globalization has had a significant impact on international trade during the period 1996-2006. This is captured by the positive and increasing estimates on the time-varying border dummies, which should be interpreted as deviations from the average $BRDR$ estimate.[31] Second, and more important for our purposes, the panel estimate on IQ_BRDR is still large, positive, statistically significant at any conventional level, and it is not (statistically) different from the corresponding cross-section estimates from columns (2)-(4).

The estimates from the last column of Table 1 are also obtained with panel data. However, in addition to the exporter-time and importer-time fixed effects, in column (6) we also include a complete set of country-pair fixed effects. As summarized by Yotov et al. (2016), the motivation for the inclusion of the country-pair fixed effects in gravity estimations is twofold. First, as demonstrated by Baier and Bergstrand (2007), the country-pair fixed effects effectively control for potential endogeneity of any time-varying bilateral trade policy variables, e.g. regional trade agreements, as they control for any non-time-varying unobservable characteristics correlated with the trade policy variables. Second, the country-pair fixed effects control more thoroughly for bilateral trade costs by absorbing all observable and unobservable time-invariant bilateral determinants of trade. Accordingly, the results from column (6) do not include estimates of the effects of distance, contiguity, common language, colonial ties, and international borders, because these covariates have been absorbed by the country-pair fixed effects.

[30] There are at least two important reasons for the introduction of the time-varying border dummies in our setting. First, the variation in the estimates of the coefficients of time-varying border dummies will capture the impact of globalization on international trade, which, as noted by Coe et al. (2002), has been missing from structural gravity estimations. Our estimates on the time-varying border dummies will reveal that globalization is indeed present in gravity regressions. Second, Bergstrand et al. (2015) demonstrate that the estimates of the effects of economic integration agreements, international borders, and bilateral distance in recessions that do not explicitly control for globalization trends can be severely biased.

[31] Our time-varying border estimates are comparable to the results from Bergstrand et al. (2015) and confirm that structural gravity estimations can capture the impact of globalization, thus, offering evidence against the famous 'distance puzzle' (see Disdier and Head, 2008) and 'missing globalization puzzle' (see Coe et al., 2002) in international trade.

Importantly, once again, we obtain a large, positive and statistically significant estimate of the impact of institutions on international trade. We do note, however, that the estimate on IQ_BRDR from column (6) is smaller in magnitude and less precisely estimated as compared to the corresponding indexes from columns (2)-(5). The natural explanation for this result is that, in the presence of the country-pair fixed effects, identification of the effects of institutions is due to the time variation of this variable, which, given the short sample period and the nature of the institutional variable, is not very large. Further, the smaller magnitude could be a result of controlling for reverse causality concerns by the country-pair fixed effects. We find it quite encouraging that we obtain positive effects of institutional quality even in a very demanding panel setting with such a rich structure of fixed effects. Furthermore, as noted earlier, we think that it is important to be able to identify the impact of institutions due to changes in institutional quality over time. Therefore, we favor the panel estimates with country-pair fixed effects from column (6) over the rest of the specifications in Table 1.

Trade with rich economies may be an important driver of development and growth for poor countries (see for instance Amiti and Konings, 2007). However, trade with less developed nations is hampered by significant uncertainty, often due to poor institutional quality.[32] Intuitively, strong institutions should be viewed as an indicator for economic stability and reliability. At the same time, institutional quality in poor countries varies significantly more than in developed nations.[33] In combination, these arguments point to a potentially differential, and in particular stronger impact of institutional quality changes on trade between

[32] For example, in an interview with Jakob Svensson, which aimed to quantify the experience of domestic firms in an emerging economy with government regulations and corruption in the foreign trade sector, "the chief executive officer of a successful [...] manufacturing firm exclaimed: *'I hope to be reborn as a custom official'*. When a well-paid CEO wishes for a job with low official pay in the government sector, corruption is almost surely a problem!" (Svensson, 2005, p. 19).

[33] Inspection of the changes in institutional quality among the countries in our sample reveals that this is indeed the case. For example, the three countries that have experienced the largest decrease in institutional quality are countries in the low income and low-middle income group (worsening between -0.66 and -0.47). On the opposite side of the spectrum we find that the countries that experienced the biggest improvement in institutional quality in our sample are also countries from the low income and the low-middle income group, with improvements between 0.33 and 0.51. The change in the institutional quality in some of the major developed countries are small in comparison.

poor and rich countries. We test this hypothesis in Table 2, where we allow for and estimate a differential impact of institutional quality on the exports of poor to rich countries ($IQ_P\_BRDR_{PR} \equiv IQ_P \times BRDR_{PR}$) as well as on the imports of poor nations from rich countries ($IQ_P\_BRDR_{RP} \equiv IQ_P \times BRDR_{RP}$), where subscript P denotes poor and subscript R denotes rich.[34] In order to ease interpretation, we subtract the two new institution variables from IQ_BRDR. Thus, the estimates on each institution covariate should be interpreted independently (rather than as deviations).

The estimates in Table 2 are obtained with the OLS estimator and panel data.[35] As before, each specification includes the full set of exporter-time and importer-time fixed effects. In addition, we also include a rich set of time-varying bilateral border dummies that correspond to the newly-introduced institution variables, whose estimates are omitted for brevity. Panel A of Table 2 offers estimates with the standard gravity variables. To ease comparison, column (1) reproduces the estimates from column (5) of Table 1, while column (2) introduces the new institutional quality variables for trade of poor with rich nations.

Two main findings stand out from the results in column (2). First, we obtain positive estimates of the impact of institutional quality on the exports of poor nations to rich nations as well as on the imports of poor countries from rich nations. The estimates are large and statistically significant. Second, we document significant asymmetries in the impact of institutional quality on the exports vs. imports of poor nations with rich countries. Specifically, we find that the imports of poor countries from rich countries will be affected significantly more. We find this result intuitive and our interpretation is that it reflects the pronounced comparative advantage of the industrialized nations in the production and exports of manufacturing goods, which are covered by our data.

[34] Due to perfect multicollinearity, it is not possible to identify both the effect of the exports of poor countries (to any country) and the effect of the imports of poor countries (from any country).

[35] The main motivation for the use of panel data is that our estimates would reflect the time-variation in institutional quality in the poor nations in our sample over the period of investigation. OLS is used for consistency with the literature and with our main results from Table 1. Table B-5 from Appendix B offers corresponding estimates that are obtained with the PPML estimator, and which confirm the robustness of the estimates that we present in Table 2.

Panel B of Table 2 offers estimates that are obtained with country-pair fixed effects. Once again, to ease comparison, column (3) reproduces the estimates from column (6) of Table 1, while column (4) introduces the new institutional quality variables for trade of poor with rich nations. Two main findings stand out from the estimates in column (4). First, we see that the estimates on the new institutional variables are significantly smaller as compared to the corresponding numbers that are obtained with the standard gravity variables in column (2). A possible explanation of this result is that once the country-pair fixed effects are introduced, the impact of institutions is identified mostly of the time-variation in the institutional quality indexes. Second, we still find significant asymmetries between the impact of institutions on exports vs. imports of poor with rich nations. Consistent with our findings from column (2), the asymmetries are in favor of the imports of the poor from the rich countries. Finally, the estimates from column (4) of Table 2 reveal that, while still positive and relatively large in economic magnitude, our estimate of the impact of institutions on the exports of poor to rich nations is no longer statistically significant.

In sum, the empirical analysis that we presented in this section demonstrates the validity and effectiveness of our methods to identify the impact of country-specific institutions on international trade flows. To that end, we obtained large, positive, and statistically significant estimates of the impact of institutions across various specifications with alternative estimators, different samples, and different measures of institutional quality. (More sensitivity experiments that demonstrate the robustness of our main results can be found in Appendix B.) In addition, we found evidence that poor countries' institutions matter, particularly for their imports from rich countries. Stimulated by this partial equilibrium result, in the next section we quantify the general equilibrium impact of institutions in developing countries.

3.3 Institutions, trade, and development: a GE analysis

The objective of this section is twofold. First, it presents quantitative evidence for the importance of trade as a channel for transmission of the impact of changes in institutional

quality on development. To achieve this goal, we offer ex-post analysis of the impact of institutional quality changes observed in the poor countries in our sample over the period 1996-2006. Specifically, we capitalize on the significant partial equilibrium estimates from the previous section (showing that the direct impact of institutional quality on trade of poor with rich nations is driven by the poor countries' imports from the rich nations) in order to quantify the general equilibrium impact of changes in institutional quality for the poor countries in our sample due to their imports from rich nations. The second objective of this section is to identify certain pre-existing economic conditions that would facilitate or hinder the positive impact of institutional quality improvements on development through trade. To achieve this goal, we undertake a second counterfactual analysis where we simulate a uniform increase in the quality of institutions of the poor countries in our sample and exploit the variation in the resulting real GDP changes (due to increased poor countries' imports from rich countries) to study the determinants of such changes.

To perform the counterfactual analysis, we rely on our most demanding and most conservative partial equilibrium estimates from column (4) of Table 2. We only focus on the significant effect of institutions on imports of poor countries from rich countries, i.e., we use only the estimate on $IQ_P \times BRDR_{RP}$ in order to generate the initial trade cost shock to the GE gravity system. We treat the last year in our sample (2006) as the baseline year, and we change the institutional quality for the poor nations to the values from the initial year in the sample (1996).[36] Thus, in effect, our counterfactual experiment evaluates the impact of changes in institutional quality over the period 1996-2006 in the poor nations, through their imports from rich countries, on the welfare of the poor countries in our sample. As we perform an ex-post analysis, the real GDP results from our GE analysis are reported as percentage changes from the counterfactual to the baseline values:

$$\%\Delta rGDP = \frac{(Y_i/P_j^{1/(1-\sigma)})^b - (Y_i/P_j^{1/(1-\sigma)})^c}{(Y_i/P_j^{1/(1-\sigma)})^c} \times 100, \tag{5}$$

[36] Recall that the measure of institutional quality used in column (4) of Table 2 is the simple average of the six individual WGI categories (see Section 3.1).

where superscript b denotes *baseline* and superscript c denotes *counterfactual*.

The main results from our ex-post counterfactual analysis are presented in Panel A of Table 3. Column (2) of Table 3 lists the changes in institutional quality for the poor nations in our sample during the period of investigation (1996-2006). Real GDP percentage changes, which correspond to the institutional quality changes from column (2), are reported in column (3). The main finding from column (3) is that the changes in institutional quality in the poor countries in our sample have had significant and heterogeneous impact on their real GDPs. For example, our estimates reveal that, *ceteris paribus*, changes in real GDP due to changes institutional quality observed between 1996 and 2006 range between 4.7 percent for the best performer and -5.2 percent for the worst.

In order to better understand the channels through which changes in institutional quality impact real GDP, we capitalize on the structural properties of the gravity model to decompose the total real GDP change into an effect on producers, which is captured by the percentage change in factory gate prices ($\%\Delta p = 100 \times (p_j^b - p_j^c)/p_j^c$), reported in column (4) of Table 3; and into an effect on consumers, which is captured by the percentage changes in the inward multilateral resistances $\left(\%\Delta IMR = 100 \times \left(\left(P_j^{1/(1-\sigma)}\right)^b - \left(P_j^{1/(1-\sigma)}\right)^c\right) / \left(P_j^{1/(1-\sigma)}\right)^c\right)$, reported in column (5) of Table 3. Several findings are noteworthy concerning the price effects. First, increases in institutions typically decrease producer and consumer prices, but consumer prices decrease more than producer prices leading to an increase in real GDP. If the institutional quality decreases, consumer and producer prices both tend to increase, with a stronger increase of consumer prices leading to a decrease in real GDP.

We find these results intuitive. For example, the reason for the inverse relationship between improvements in institutional quality and consumer prices in the poor nations is that, according to our partial estimates, better institutions will attract more imports and, therefore, will result in lower consumer prices in the destination countries. Similar intuition explains the fall in producer prices in the poor nations, i.e., imports lead to more competitive pricing in destination countries. Finally, the fact that the positive impact of

lower consumer prices in response to trade liberalization outweighs the negative impact on producers is a manifestation of standard gains-from-grade argument from introductory international economics. The same logic, but in the opposite direction, applies to explain the inverse relationship between worsening in institutional quality and the changes in consumer and producer prices in the poor nations.

Even though, on average, most of the results from Panel A of Table 3 can be explained intuitively, there are also some instances in which our estimates are exactly the opposite to those that we just described and, therefore, they do not conform to the traditional intuitive explanations that we offered above. For some countries we observe an increase in consumer prices but a fall in producer prices in response to worsening institutional quality. For others, we observe both lower producer and lower consumer prices in response to worsening institutions. The reason for the heterogeneous response of prices, and therefore real GDPs, to changes in institutional quality is that we are investigating a complex general equilibrium counterfactual scenario with different institutional changes for many countries that may impact other countries directly and indirectly. Thus, in principle, the price effects can go in either direction.[37]

Another important and clear result that stands out from the real GDP estimates from column (3) in Table 3, in combination with the institutional changes that we report in column (2) of the same table, is the direct relationship between improvements in institutional quality and real GDP changes. Specifically, whenever institutions improved, poor countries gained in terms of real GDP, while real GDP decreased when institutional quality deteriorated between 1996 and 2006. We highlight this relationship with a visual representation in Figure 1, where we plot the percentage change in real GDP responses against the observed institutional quality changes in the poor countries in our sample between 1996 to 2006. As can be seen from the figure, there is a strong positive relationship between real GDP percentage changes

[37] Note however that the effects of institutional quality changes on third countries, i.e. on the rich countries that are considered not to change their institutional quality, are quite small. The natural explanation for this result is that the poor nations are small. Thus, even the direct impact on rich countries, through the increase in their exports to the poor nations, is small.

and the changes in institutional quality in the poor countries. However, in addition, Figure 1 also reveals that the relationship between the changes in institutional quality and the corresponding percentage changes in real GDP is not perfect.

As noted earlier, the heterogeneous response in prices and real GDP to changes in institutional quality is due to a complex system of direct and indirect (general equilibrium) relationships that cannot be characterized analytically. Nevertheless, in what follows, guided by our theory we attempt to shed some light on the determinants of the effectiveness of institutional quality changes on the welfare of poor nations. To isolate the impact of heterogeneous institutional quality changes (i.e., the fact that some countries experienced larger institutional quality changes than others), we complement our ex-post counterfactual analysis of the impact of actual institutional quality changes with a hypothetical experiment. In such experiment, once again we start from the values in 2006 but, differently from the previous analysis, we simulate the response in real GDP to a uniform change in institutional quality across all poor countries. In particular, we use as an initial shock the largest positive institutional quality change that we observe in our sample over the period 1996-2006 which is an improvement of 0.5 in the WGI index. Thus, our new experiment can be interpreted as one where all poor countries in the sample improved their institutional quality uniformly by 0.5 during the period of investigation.

Estimation results from the new counterfactual experiment are presented in columns (6)-(9) of Table 3. As expected, all real GDP percentage changes for the poor countries in our sample, which we report in column (7) of Table 3, are positive. This confirms the direct relationship between improvements in institutional quality and welfare. More importantly for the current purposes, we note that the real GDP effects for the poor countries are quite heterogeneous (varying between 6.36 and 0.33, despite the fact that in this scenario all real GDP changes for the poor countries are generated in response to same uniform initial institutional quality change (see column (6) of Table 3). In order to understand the driving forces underlying the heterogeneity in the response of real GDP to institutional quality

changes, we rely on theory and our intuition to identify several potential candidates that may affect the effectiveness of institutional quality improvements in increasing welfare. For clarity and expositional simplicity, and since this analysis is only suggestive, we use graphical presentation of our findings.

First, in Figure 2 we plot the real GDP changes for the poor countries that we obtained in column (7) of Table 3 against the initial level of the institutional quality in 2006. The figure does not seem to capture any significant relationship. Next, in Figure 3 we investigate the relationship between the real GDP changes of column (7) of Table 3 and the level of outputs in 2006. For the sake of better visualization, but without loss of generality, we exclude four outliers from this figure. Once again, this figure does not capture a clear pattern. Last, Figure 4 plots the real GDP changes of column (7) of Table 3 against the trade openness in 2006. Here, we see a positive relationship: countries that are more open profit more form institutional improvements.

Based on these reduced-form analyses, we conclude that the initial level of institutional quality as well as the initial level of national output are not significant factors in determining the effectiveness of institutional quality improvements. We view this as an encouraging result because it suggest that poorer countries and countries with poor institutions may benefit equally from institutional improvements as countries that are richer and with better institutional quality initially. In other words, the initial conditions across these two dimensions do not matter much. Our second main conclusion, which has possible important policy implications, is that trade openness promotes the impact of institutional improvements and, therefore, there might be significant benefits from implementing a combination of trade liberalization and institutional improvements.

4 Conclusions

Institutions are deep determinants of economic exchange, both within and across borders. Most of the literature on how institutions affect trade flows, however, has not satisfactorily dealt with endogeneity issues. We simply do not know for sure whether country-level institutional quality has a causal effect on trade flows.

We have proposed a novel methodology that allows to estimate the effects of institutional quality on international trade relative to intra-national trade in a structural gravity framework with the appropriate set of fixed effects: importer and exporter fixed effects in cross-section; importer-time, exporter-time and even country-pair fixed effects in panels. Since – consistently with theoretical gravity – we employ both international and intra-national trade flows, our approach allows to identify the effects of national institutional quality on international trade relative to internal trade. Beyond providing a natural and intuitive interpretation of the econometric coefficient of interest, there are two other invaluable advantages of our approach.

First, it also deals with endogeneity issues, allowing to obtain consistent estimates of the (relative) effects of national institutional quality. Second, it opens the ground to studies of the trade impact of any country-specific variable that is not directional, i.e., that takes the same value both for observations in which the country is an importer and for observations in which the country is an exporter. Future research could therefore apply our methodology, for instance, to behind-the-border measures such as value-added taxes or sales taxes, or to measures of infrastructure and trade facilitation.

The impact of national institutional quality on international trade flows (relative to domestic trade) that we estimate is positive, significant and economically relevant. Such impact is particularly strong for trade flows that represent imports of the poor countries from the rich countries in our sample. These results are robust to the use of alternative estimators, different samples, different measures of institutional quality, and to the use of instrumental variables for institutional quality that are standard in the institutions and

growth literature.

Endowed with consistent estimates of the effects of national institutional quality on international trade relative to internal trade, we have presented general equilibrium quantification of the welfare impact of counterfactual changes in institutional quality in the poor countries in our sample over the period 1996-2006, based on their imports from rich countries. In a first counterfactual, we have simply considered observed changes. We have shown that the welfare (measured by real GDP) of countries that significantly improved their institutional quality also increased significantly, generally (but not in all cases) through consumer prices falling more than producer prices. In a second counterfactual, we have considered hypothetical changes in which all poor countries experience the same improvement in institutional quality as the best performer over the period 1996-2006. We have shown that all real GDP effects are positive, but quite heterogeneous.

Encouragingly, neither the initial level of institutional quality nor the initial level of national output seem to explain the heterogeneity in counterfactual welfare changes. The factor that seems to matter most is the initial level of trade openness: countries that were more open to trade in the baseline year (2006) experienced the largest real GDP counterfactual changes. The important policy implication of this result is that poor countries stand to gain relatively more from a combination of institutional reform and trade liberalization, as opposed to any of these two policies in isolation.

References

Acemoglu, Daron and James A. Robinson, "The Role of Institutions in Growth and Development," *Review of Economics and Institutions*, 2010, *1* (2).

_ **and Simon Johnson**, "Unbundling Institutions," *Journal of Political Economy*, 2005, *113* (5), 949–995.

_ , _ , **and James A. Robinson**, "The Colonial Origins of Comparative Development: An Empirical Investigation," *American Economic Review*, 2001, *91* (5), 1369–1401.

_ , _ , **and** _ , "The Rise of Europe: Atlantic Trade, Institutional Change, and Economic Growth," *American Economic Review*, 2005, *95* (3), 546–579.

Álvarez, Inmaculada C., Javier Barbero, Andrés Rodríguez-Pose, and José L. Zofío, "Does Institutional Quality Matter for Trade? Institutional Conditions in a Sectoral Trade Framework," *World Development*, 2018, *103*, 72–87.

Amiti, Mary and Jozef Konings, "Trade liberalization, intermediate inputs, and productivity: Evidence from Indonesia," *American Economic Review*, 2007, *97* (5), 1611–1638.

Anderson, James E. and Douglas Marcouiller, "Insecurity and the Pattern of Trade: An Empirical Investigation," *Review of Economics and Statistics*, 2002, *84* (2), 342–352.

_ **and Eric van Wincoop**, "Gravity with Gravitas: A Solution to the Border Puzzle," *American Economic Review*, 2003, *93* (1), 170–192.

_ **and Yoto V. Yotov**, "The Changing Incidence of Geography," *American Economic Review*, 2010, *100* (5), 2157–2186.

_ , **Mario Larch, and Yoto V. Yotov**, "On the Growth Effects of the Transatlantic Trade and Investment Partnership," 2016. Unpublished manuscript, available for download at https://editorialexpress.com/cgi-bin/conference/download.cgi?db_name =EEAE-SEM2016&paper_id=2227, February.

Anderson, Theodore W., "Estimating Linear Restrictions on Regression Coefficients for Multivariate Normal Distributions," *Annals of Mathematical Statistics*, 1951, *22*, 327–351.

Arvis, Jean-Francois and Ben Shepherd, "The Poisson Quasi-Maximum Likelihood Estimator: A Solution to the "Adding Up" Problem in Gravity Models," *Applied Economics Letters*, 2013, *20* (6), 515–519.

Auer, Raphael A., "Geography, Institutions, and the Making of Comparative Development," *Journal of Economic Growth*, 2013, *18* (2), 179–215.

Baier, Scott L. and Jeffrey H. Bergstrand, "Do Free Trade Agreements Actually Increase Members' International Trade?," *Journal of International Economics*, 2007, *71* (1), 72–95.

_ **and** _ , "*Bonus Vetus* OLS: A Simple Method for Approximating International Trade-cost Effects using the Gravity Equation," *Journal of International Economics*, 2009, *77* (1), 77–85.

_ **, Yoto V. Yotov, and Thomas Zylkin**, "On the Widely Differing Effects of Free Trade Agreements: Lessons from Twenty Years of Trade Integration," 2016. Working Paper No. 2016-15, School of Economics Working Paper Series, LeBow College of Business, Drexel University, October.

Bergstrand, Jeffrey H., Mario Larch, and Yoto V. Yotov, "Economic Integration Agreements, Border Effects, and Distance Elasticities in the Gravity Equation," *European Economic Review*, 2015, *78*, 307–327.

Bernhofen, Daniel M. and John C. Brown, "An Empirical Assessment of the Comparative Advantage Gains from Trade: Evidence from Japan," *American Economic Review*, 2005, *95* (1), 208–225.

Broda, Christian, Joshua Greenfield, and David E. Weinstein, "From Groundnuts to Globalization: A Structural Estimate of Trade and Growth," *Research in Economics*, 2017, *71* (4), 759–783.

Brueckner, Markus and Daniel Lederman, "Trade Openness and Economic Growth: Panel Data Evidence from Sub-Saharan Africa," *Economica*, 2015, *82* (s1), 1302–1323.

Buera, Paco and Ezra Oberfield, "The Global Diffusion of Ideas," 2016. NBER Working Paper No. 21844, National Bureau of Economic Research, Cambridge, MA, January.

Bühler, Stefan, Marco Helm, and Michael Lechner, "Trade Liberalization and Growth: Plant-Level Evidence from Switzerland," 2011. Economics Working Paper No. 1133, School of Economics and Political Science, University of St. Gallen, August.

Coe, David T., Arvind Subramanian, Natalia T. Tamirisa, and Rikhil Bhavnani, "The Missing Globalization Puzzle," 2002. IMF Working Paper No. WP/02/171, International Monetary Fund, Washington, DC, October.

Costinot, Arnaud, "On the Origins of Comparative Advantage," *Journal of International Economics*, 2009, *77* (2), 255–264.

Costinot, Arnaud and Andrés Rodríguez-Clare, "Trade Theory with Numbers: Quantifying the Consequences of Globalization," Chapter 4 in the *Handbook of International Economics* Vol. 4, eds. Gita Gopinath, Elhanan Helpman, and Kenneth S. Rogoff, Oxford: Elsevier, 2014, pp. 197–261.

Cragg, John C. and Stephen G. Donald, "Testing Identifiability and Specification in Instrumental Variables Models," *Econometric Theory*, 1993, *9* (2), 222–240.

Crozet, Matthieu, Pamina Koenig, and Vincent Rebeyrol, "Exporting to Insecure Markets: A Firm-Level Analysis," 2008. CEPII Working Paper No. 2008-13, Centre d'Etudes Prospectives et d'Informations Internationales, Paris, September.

Cuñat, Alejandro and Marc J. Melitz, "Volatility, Labor Market Flexibility, and the Pattern of Comparative Advantage," *Journal of the European Economic Association*, 2012, *10* (2), 225–254.

de Groot, Henri L. F., Gert-Jan Linders, Piet Rietveld, and Uma Subramanian, "The Institutional Determinants of Bilateral Trade Patterns," *KYKLOS*, 2004, *57* (1), 103–123.

de Jong, Eelke and Christian Bogmans, "Does Corruption Discourage International Trade?," *European Journal of Political Economy*, 2011, *27* (2), 385–398.

Disdier, Anne-Célia and Keith Head, "The Puzzling Persistence of the Distance Effect on Bilateral Trade," *Review of Economics and Statistics*, 2008, *90* (1), 37–48.

Donaldson, Dave, "The Gains from Market Integration," *Annual Review of Economics*, 2015, *7* (1), 619–647.

Dutt, Pushan and Daniel Traca, "Corruption and Bilateral Trade Flows: Extortion or Evasion?," *Review of Economics and Statistics*, 2010, *92* (4), 843–860.

Egger, Peter and Mario Larch, "Interdependent Preferential Trade Agreement Memberships: An Empirical Analysis," *Journal of International Economics*, 2008, *76* (2), 384–399.

Fally, Thibault, "Structural Gravity and Fixed Effects," *Journal of International Economics*, 2015, *97* (1), 76–85.

Feenstra, Robert C., *Advanced International Trade: Theory and Evidence*, Princeton NJ: Princeton University Press, 2004.

Feyrer, James, "Trade and Income – Exploiting Time Series in Geography," 2009. Unpublished manuscript, available for download at http://www.dartmouth.edu/~jfeyrer/Feyrer_AirSea2009_10_21.pdf, October 2009.

_ , "Distance, Trade, and Income – The 1967 to 1975 Closing of the Suez Canal as a Natural Experiment," 2011. Unpublished manuscript, available for download at https://economicdynamics.org/meetpapers/2011/paper_1438.pdf, March 2011.

Francois, Joseph and Miriam Manchin, "Institutions, Infrastructure, and Trade," *World Development*, 2013, *46*, 165–175.

Frankel, Jeffrey A. and David H. Romer, "Does Trade Cause Growth?," *American Economic Review*, 1999, *89* (3), 379–399.

Gil-Pareja, Salvador, Rafael Llorca-Rivero, and José Antonio Martínez-Serrano, "Corruption and International Trade: A Comprehensive Analysis with Gravity," Working Paper WPAE-2017-05, University of Valencia, 2017.

Hall, Robert E. and Charles I. Jones, "Why do Some Countries Produce So Much More Output Per Worker than Others?," *Quarterly Journal of Economics*, 1999, *114* (1), 83–116.

Head, Keith and Thierry Mayer, "Gravity Equations: Workhorse, Toolkit, and Cookbook," Chapter 3 in the *Handbook of International Economics* Vol. 4, eds. Gita Gopinath, Elhanan Helpman, and Kenneth S. Rogoff, Oxford: Elsevier, 2014, pp. 131–195.

Heid, Benedikt, Mario Larch, and Yoto V. Yotov, "Estimating the Effects of Non-discriminatory Trade Policies within Structural Gravity Models," *CESifo Working Paper No. 6735*, 2017.

Helpman, Elhanan and Oleg Itskhoki, "Labor Market Rigidities, Trade and Unemployment," *Review of Economic Studies*, 2010, *77* (3), 1100–1137.

Hummels, David L., "Toward a Geography of Trade Costs," 2001. Unpublished manuscript, available for download at http://www.krannert.purdue.edu/faculty/ hummelsd/research/toward/tgtc.pdf, September.

Impullitti, Giammario and Omar Licandro, "Trade, Firm Selection, and Innovation: The Competition Channel," *Economic Journal*, 2017, *in press.*

Inikori, Joseph, "The Struggle Against the Atlantic Slave Trade: The Role of the State," Chapter 11 in *Fighting the Slave Trade: West African Strategies*, ed. Sylviane A. Diouf, Athens, OH: Ohio University Press, 2003, pp. 170–198.

La Porta, Rafael, Florencio Lopez-de-Silanes, Andrei Shleifer, and Robert W. Vishny, "Legal Determinants of External Finance," *Journal of Finance*, 1997, *52* (3), 1131–1150.

Larch, Mario, Joschka Wanner, Yoto V. Yotov, and Thomas Zylkin, "The Currency Union Effect: A PPML Re-assessment with High-Dimensional Fixed Effects," School of Economics Working Paper Series 2017-7, LeBow College of Business, Drexel University April 2017.

Manova, Kalina, "Credit Constraints, Equity Market Liberalizations and International Trade," *Journal of International Economics*, 2008, *76* (1), 33–47.

Mayer, Thierry and Soledad Zignago, "Notes on CEPII's Distances Measures: The GeoDist Database," 2011. CEPII Working Paper No. 2011-25, Centre d'Etudes Prospectives et d'Informations Internationales, Paris, December.

Nizalova, Olena Y. and Irina Murtazashvili, "Exogenous Treatment and Endogenous Factors: Vanishing of Omitted Variable Bias on the Interaction Term," *Journal of Econometric Methods*, 2016, *5* (1).

North, Douglass C., *Structure and Change in Economic History*, New York: W W Norton & Co. Inc., 1981.

_ , *Institutions, Institutional Change and Economic Performance*, Cambdridge (UK): Cambridge University Press, 1990.

Nunn, Nathan, "Relationship-Specificity, Incomplete Contracts, and the Pattern of Trade," *Quarterly Journal of Economics*, 2007, *122* (2), 569–600.

_ , "The Importance of History for Economic Development," *Annual Review of Economics*, 2009, *1* (1), 65–92.

_ **and Daniel Trefler**, "Domestic Institutions as a Source of Comparative Advantage," Chapter 5 in the *Handbook of International Economics* Vol. 4, eds. Gita Gopinath, Elhanan Helpman, and Kenneth S. Rogoff, Oxford: Elsevier, 2014, pp. 263–316.

_ **and Leonard Wantchekon**, "The Slave Trade and the Origins of Mistrust in Africa," *American Economic Review*, 2011, *101* (7), 3221–3252.

Pascali, Luigi, "The Wind of Change: Maritime Technology, Trade, and Economic Development," *American Economic Review*, 2017, *107* (9), 2821–2854.

Puga, Diego and Daniel Trefler, "International Trade and Institutional Change: Medieval Venice's Response to Globalization," *Quarterly Journal of Economics*, 2014, *129* (2), 753–821.

Santos Silva, João M. C. and Silvana Tenreyro, "The Log of Gravity," *Review of Economics and Statistics*, 2006, *88* (4), 641–658.

Stock, James H. and Motohiro Yogo, "Testing for Weak Instruments in Linear IV Regression," in Donald W. K. A Andrews and James H. Stock, eds., *Identification and Inference for Econometric Models: Essays in Honor of Thomas Rothenberg*, Cambridge (UK): Cambridge University Press, 2005, pp. 80–108.

Svensson, Jakob, "Eight Questions about Corruption," *Journal of Economic Perspectives*, 2005, *19* (3), 19–42.

Wacziarg, Romain and Karen Horn Welch, "Trade Liberalization and Growth: New Evidence," *World Bank Economic Review*, 2008, *22* (2), 187–231.

Yotov, Yoto V., Roberta Piermartini, José-Antonio Monteiro, and Mario Larch, *An Advanced Guide to Trade Policy Analysis: The Structural Gravity Model*, Geneva,

Switzerland: United Nations and World Trade Organization. Available for download at https://vi.unctad.org/tpa/web/vol2/vol2home.html, 2016.

Yu, Shu, Sjoerd Beugelsdijk, and Jakob de Haan, "Trade, Trust and the Rule of Law," *European Journal of Political Economy*, 2015, *37*, 102–115.

Tables and Figures

Table 1: National institutions and international trade

	(1) OLS	(2) IQ	(3) IV_OLS	(4) IV_PPML	(5) PNL_GRV	(6) PNL_FES
LN_DIST	-1.226	-1.223	-1.223	-1.224	-1.241	
	(0.061)**	(0.057)**	(0.043)**	(0.042)**	(0.049)**	
CNTG	0.196	0.195	0.195	0.474	0.169	
	(0.223)	(0.226)	(0.154)	(0.157)**	(0.217)	
LANG	0.718	0.731	0.730	0.614	0.720	
	(0.110)**	(0.109)**	(0.080)**	(0.084)**	(0.094)**	
CLNY	0.500	0.469	0.472	0.624	0.478	
	(0.158)**	(0.157)**	(0.154)**	(0.131)**	(0.145)**	
RTA	0.193	0.185	0.186	0.245	0.079	0.039
	(0.075)**	(0.073)*	(0.062)**	(0.063)**	(0.057)	(0.050)
BRDR	-3.466	-4.256	-4.197	-4.391	-4.638	
	(0.361)**	(0.345)**	(0.295)**	(0.275)**	(0.297)**	
IQ_BRDR		1.906	1.764	1.015	2.011	0.616
		(0.291)**	(0.443)**	(0.485)*	(0.277)**	(0.301)*
BRDR_1998					0.118	0.142
					(0.062)$^{+}$	(0.059)*
BRDR_2000					0.098	0.141
					(0.073)	(0.066)*
BRDR_2002					0.136	0.142
					(0.085)	(0.073)$^{+}$
BRDR_2003					0.251	0.241
					(0.088)**	(0.078)**
BRDR_2004					0.292	0.287
					(0.086)**	(0.078)**
BRDR_2005					0.361	0.341
					(0.093)**	(0.090)**
BRDR_2006					0.438	0.402
					(0.093)**	(0.089)**
N	3880	3880	3880	3969	30753	30753
R^2	0.864	0.868	0.868		0.869	0.932

Notes: This table reports estimation results from a series of econometric models that study the impact of national institutions on international trade. All estimates are obtained with exporter and importer fixed effects, which also vary over time in the panel specifications. Estimates of the fixed effects, including the constant term, are omitted for brevity. Column (1) reports standard gravity estimates that are obtained with the OLS estimator and data for 2006. Column (2) replicates the specification from column (1) after adding a measure of institutional quality. Column (3) employs an instrumental variable estimator to re-evaluate the results from column (2). Column (4) replicates the estimates from column (3) with an IV PPML estimator. Finally, columns (5) and (6) report OLS estimates that are obtained with panel data over the period 1996-2006 with standard gravity variables (in column 5) and with country-pair fixed effects (in column 6), respectively. Standard errors, clustered by country pair, are reported in parentheses. $^{+}$ $p < 0.10$, * $p < .05$, ** $p < .01$. See text for further details.

Table 2: Institutions and international trade of poor nations

	Panel A: Gravity Variables		Panel B: Fixed Effects	
	(1)	(2)	(3)	(4)
	MAIN	POOR_RICH	MAIN	POOR_RICH
LN_DIST	-1.241	-1.243		
	(0.049)**	(0.049)**		
CNTG	0.169	0.156		
	(0.217)	(0.216)		
LANG	0.720	0.724		
	(0.094)**	(0.093)**		
CLNY	0.478	0.477		
	(0.145)**	(0.146)**		
RTA	0.079	0.051	0.039	0.028
	(0.057)	(0.058)	(0.050)	(0.051)
BRDR	-4.638	-4.623		
	(0.297)**	(0.299)**		
IQ_BRDR	2.011	1.984	0.616	0.608
	(0.277)**	(0.277)**	(0.301)*	(0.308)*
$\text{IQ}_P\text{\_BRDR}_{PR}$		1.919		0.436
		(0.312)**		(0.314)
$\text{IQ}_P\text{\_BRDR}_{RP}$		2.277		0.813
		(0.306)**		(0.314)**
N	30753	30753	30753	30753
R^2	0.869	0.869	0.932	0.932

Notes: This table reports estimation results from econometric models that study the differential impact of national institutions on international trade of poor countries with rich countries. All estimates are obtained in panel settings with exporter-time and importer-time fixed effects. Estimates of the fixed effects, including the constant term, as well as estimates of all time-varying border variables, are omitted for brevity. Column (1) is a replication of column (5) from Table 1, which reports estimates of the effect of institutions on trade that are obtained with standard gravity variables, the OLS estimator, and panel data. Column (2) replicates the specification from column (1) after adding border and institution variables for exports and imports between the poor and the rich countries in our sample. The estimates in column (3) reproduce the results from column (6) of Table 1, which are obtained with country-pair fixed effects, the OLS estimator, and panel data. Finally, column (4) adds border and institution variables for exports and imports between the poor and the rich countries in our sample. Standard errors, clustered by country pair, are reported in parentheses. $^{+}$ $p < 0.10$, * $p < .05$, ** $p < .01$. See text for further details.

Table 3: Institutions, trade and development: GE analysis

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Panel A: Observed ΔIQ 1996-2006				Panel B: Uniform IQ Change			
Country	$\Delta Inst$	%ΔrGDP	%Δp	%ΔIMR	$\Delta Inst$	%ΔrGDP	%Δp	%ΔIMR
ARG	0.00	0.02	-0.28	-0.30	0.00	-0.04	0.68	0.72
AUS	0.00	0.01	-0.38	-0.39	0.00	-0.02	0.91	0.93
AUT	0.00	0.01	-0.17	-0.18	0.00	-0.02	0.40	0.42
BEL	0.00	0.01	-0.21	-0.22	0.00	-0.01	0.50	0.51
BGR	0.00	0.01	-0.20	-0.20	0.00	-0.01	0.48	0.49
BOL	-0.36	-1.68	0.59	2.31	0.50	2.52	-0.53	-2.98
BRA	0.00	0.01	-0.29	-0.30	0.00	-0.01	0.69	0.70
CAN	0.00	0.00	-0.34	-0.34	0.00	-0.01	0.81	0.83
CHE	0.00	0.00	-0.21	-0.21	0.00	-0.01	0.49	0.50
CHL	0.00	0.01	-0.31	-0.32	0.00	-0.03	0.72	0.75
CHN	-0.14	-0.42	-0.86	-0.45	0.50	1.75	2.71	0.94
CMR	0.27	1.60	-0.31	-1.87	0.50	4.06	1.24	-2.71
COL	0.18	0.62	-0.70	-1.31	0.50	2.19	-0.02	-2.17
CRI	0.00	0.00	-0.33	-0.33	0.00	-0.01	0.76	0.77
CYP	0.00	-0.00	-0.24	-0.24	0.00	-0.00	0.56	0.56
DEU	0.00	-0.12	-0.12	0.00	0.00	0.28	0.28	0.00
DNK	0.00	0.01	-0.21	-0.22	0.00	-0.01	0.51	0.52
ECU	-0.31	-1.33	0.59	1.94	0.50	2.25	-0.88	-3.07
EGY	-0.37	-1.93	-0.04	1.92	0.50	2.79	0.43	-2.30
ESP	0.00	0.01	-0.21	-0.22	0.00	-0.01	0.50	0.51
FIN	0.00	0.01	-0.23	-0.24	0.00	-0.02	0.56	0.58
FRA	0.00	0.00	-0.22	-0.22	0.00	-0.02	0.51	0.53
GBR	0.00	0.01	-0.24	-0.25	0.00	-0.01	0.57	0.58
GRC	0.00	0.01	-0.21	-0.22	0.00	-0.01	0.51	0.52
HUN	0.00	0.01	-0.17	-0.18	0.00	-0.02	0.42	0.44
IDN	-0.10	-0.56	-0.66	-0.09	0.50	3.37	2.58	-0.76
IND	0.02	0.06	-0.28	-0.34	0.50	1.42	1.12	-0.30
IRL	0.00	0.00	-0.25	-0.25	0.00	-0.00	0.60	0.60
IRN	-0.18	-0.27	0.75	1.02	0.50	0.88	-1.89	-2.75
ISR	0.00	0.00	-0.28	-0.28	0.00	-0.01	0.65	0.66
ITA	0.00	0.01	-0.21	-0.22	0.00	-0.02	0.50	0.52
JOR	-0.04	-0.05	-0.17	-0.12	0.50	1.07	-0.66	-1.71
JPN	0.00	0.02	-0.35	-0.37	0.00	-0.04	0.88	0.92
KEN	0.07	0.10	-0.88	-0.98	0.50	1.12	-2.62	-3.69
KOR	0.00	0.02	-0.36	-0.38	0.00	-0.05	0.89	0.94
KWT	0.00	0.02	-0.33	-0.35	0.00	-0.05	0.80	0.85
LKA	0.02	0.08	-0.29	-0.37	0.50	2.07	1.15	-0.90
MAR	-0.31	-2.23	-0.65	1.62	0.50	3.95	1.40	-2.45
MEX	0.00	-0.00	-0.34	-0.34	0.00	-0.00	0.80	0.80
MUS	0.00	-0.00	-0.26	-0.25	0.00	-0.02	0.56	0.58
MWI	-0.01	-0.05	-0.30	-0.24	0.50	2.43	0.01	-2.36

Continued on next page

Table 3 – *Continued from previous page*

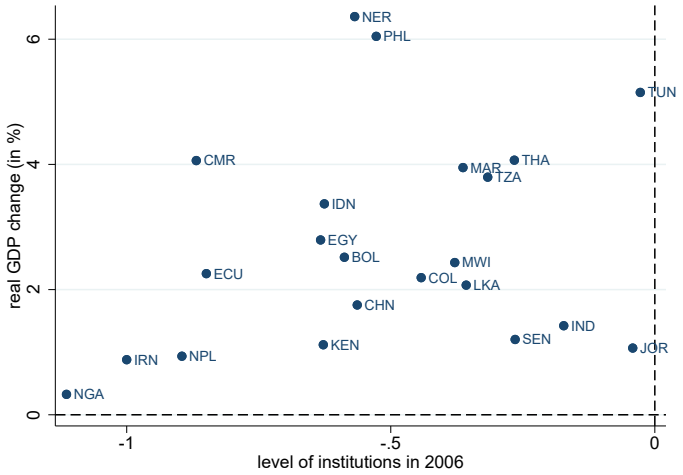
(1) Country	(2) $\Delta Inst$	(3) %ΔrGDP	(4) %Δp	(5) %ΔIMR	(6) $\Delta Inst$	(7) %ΔrGDP	(8) %Δp	(9) %ΔIMR
MYS	0.00	0.05	-0.34	-0.39	0.00	-0.09	0.83	0.92
NER	0.50	4.68	-0.43	-4.88	0.50	6.36	1.71	-4.37
NGA	0.06	0.03	-0.86	-0.89	0.50	0.33	-3.33	-3.64
NLD	0.00	0.02	-0.21	-0.23	0.00	-0.03	0.50	0.53
NOR	0.00	-0.00	-0.24	-0.24	0.00	-0.00	0.57	0.57
NPL	-0.66	-1.45	-0.10	1.37	0.50	0.94	0.43	-0.50
PAN	0.00	0.02	-0.32	-0.34	0.00	-0.04	0.77	0.82
PHL	-0.47	-5.23	-3.04	2.31	0.50	6.05	3.90	-2.02
POL	0.00	0.00	-0.18	-0.18	0.00	-0.01	0.42	0.43
PRT	0.00	0.01	-0.20	-0.21	0.00	-0.01	0.48	0.49
ROM	0.00	0.00	-0.20	-0.20	0.00	-0.01	0.47	0.48
SEN	-0.04	-0.07	0.03	0.10	0.50	1.20	-2.88	-4.03
SGP	0.00	0.08	-0.33	-0.41	0.00	-0.16	0.81	0.97
SWE	0.00	-0.00	-0.23	-0.23	0.00	-0.01	0.54	0.55
THA	-0.53	-4.16	-2.62	1.60	0.50	4.07	3.05	-0.98
TTO	0.00	-0.01	-0.33	-0.32	0.00	0.00	0.74	0.74
TUN	0.02	0.19	-0.14	-0.33	0.50	5.15	2.32	-2.69
TUR	0.00	0.01	-0.20	-0.21	0.00	-0.02	0.48	0.50
TZA	0.33	1.84	-1.22	-3.00	0.50	3.80	0.09	-3.57
URY	0.00	0.01	-0.29	-0.30	0.00	-0.01	0.74	0.75
USA	0.00	0.00	-0.34	-0.34	0.00	-0.01	0.81	0.82
ZAF	0.00	-0.00	-0.29	-0.29	0.00	-0.02	0.63	0.65

Notes: This table reports results from our counterfactual analyses. Column (1) lists the ISO country codes (in bold for poor countries). Columns (2) and (6) report the changes in institutional quality that are used to generate the corresponding general equilibrium effects. Columns (3) to (5) report the results from an ex-post evaluation of the impact of institutional quality in poor countries during the period (1996-2006), through changes in their imports from rich nations. Column (3) presents real GDP percentage changes, while columns (4) and (5) decompose their incidence on the consumers and on the producers in the world. Columns (7)-(9) report results that correspond to the estimates in columns (3)-(5), but this time in response to a uniform increase in the institutional quality in the poor nations in our sample, as depicted in column (6). See text for further details.

Figure 1: Impact of change in institutions on real GDP

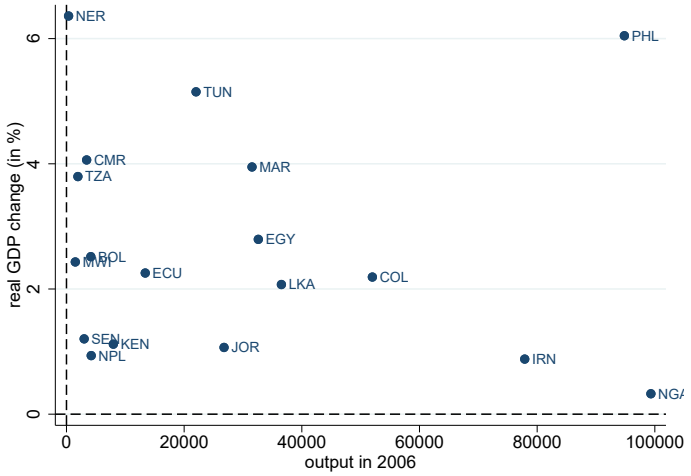
Notes: This figure plots, for the directly affected countries, the changes in real GDP obtained in column (3) of Table 3 against the observed changes from 1996 to 2006 of the institutions variable. The considered counterfactual scenario is the one of column (2) of Table 3, where the change in the institutions variable for imports of the poor countries from the rich countries is equal to the observed changes from 1996 to 2006. See text for further details.

Figure 2: Impact of initial level of institutions on real GDP



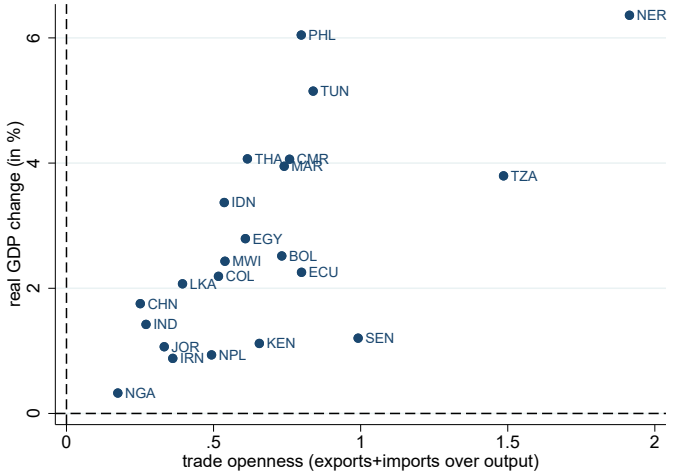
Notes: This figure plots, for the directly affected countries, the changes in real GDP obtained in column (7) of Table 3 against the observed level of the institutions variable in 2006. The considered counterfactual scenario is the one of column (6) of Table 3, where the change in the institutions variable for imports of the poor countries from the rich countries is uniform across poor countries and equal to the one of the best performer (0.50) from 1996 to 2006. See text for further details.

Figure 3: Impact of initial level of output on real GDP



Notes: This figure plots, for the directly affected countries, the changes in real GDP obtained in column (7) of Table 3 against the observed level of output in 2006. The considered counterfactual scenario is the one of column (6) of Table 3, where the change in the institutions variable for imports of the poor countries from the rich countries is uniform across poor countries and equal to the one of the best performer (0.50) from 1996 to 2006. See text for further details.

Figure 4: Impact of initial level of trade openness on real GDP



Notes: This figure plots, for the directly affected countries, the changes in real GDP obtained in column (7) of Table 3 against the observed level of trade openness in 2006. The considered counterfactual scenario is the one of column (6) of Table 3, where the change in the institutions variable for imports of the poor countries from the rich countries is uniform across poor countries and equal to the one of the best performer (0.50) from 1996 to 2006. See text for further details.

Appendices

A Identification of country-specific institutions in gravity

We present the identification challenges and the solutions that we propose with a specific data example. Assume availability of a cross-section bilateral trade data set with trade flows between three countries $\{A, B, C\}$, which, as traditionally used in the gravity literature, includes data on international trade flows but no data on intra-national trade flows. The goal is to show whether, and under what circumstances, one can identify the impact of country-specific national institutions and, ideally, to separate the impact on the importer and on the exporter side. The relevant part of estimation data set looks as follows:

$$\begin{array}{cccc} \# & i & j & \\ 1 & A & B & \\ 2 & A & C & \\ 3 & B & A & \\ 4 & B & C & \\ 5 & C & A & \\ 6 & C & B & \end{array} \begin{array}{c} \begin{array}{cccccc} \eta_1 & \eta_2 & \mu_1 & \mu_2 & \mu_3 & IQ_j \end{array} \\ \begin{bmatrix} 1 & 0 & 0 & 1 & 0 & IQ_B \\ 1 & 0 & 0 & 0 & 1 & IQ_C \\ 0 & 1 & 1 & 0 & 0 & IQ_A \\ 0 & 1 & 0 & 0 & 1 & IQ_C \\ 0 & 0 & 1 & 0 & 0 & IQ_A \\ 0 & 0 & 0 & 1 & 0 & IQ_B \end{bmatrix} \end{array} \tag{A-1}$$

Column (1) of matrix (A-1) numbers the observations. Columns i and j denote the generic exporting and importing country. Columns η's and μ's denote the exporter and the importer fixed effects, respectively. As with any dummy variable, we have to omit one category from the fixed effects and, without loss of generality, we drop the fixed effect η_3, i.e. the fixed effect for country C as an exporter. Finally, for expositional simplicity, at this stage, we only include one of the trade cost covariates, namely the institution variable on the importer side (IQ_j), which is of central interest to us. First, we demonstrate the obvious result that estimations with data sets which only include international trade flows and control for the structural MRTs with exporter and importer fixed effects are unable to deliver estimates of the effects of any country-specific determinant of trade. To see this formally in the case of national institutions, note that IQ_j can be expressed as a linear combination of the fixed effects in matrix (A-1):

$$IQ_j = \mu_1 IQ_A + \mu_2 IQ_B + \mu_3 IQ_C. \tag{A-2}$$

Equation (A-2) reveals that the importer institutions variable (IQ_j) is perfectly collinear with the importer fixed effects and, therefore, the coefficient of this variable cannot be identified

separately. Identical intuition and argumentation applies in the case of institutions on the exporter side.

Next, we follow the recommendation of Heid et al. (2017) to estimate gravity equations with *intra-national* as well as international trade flows. As we demonstrate next, similar to Heid et al. (2017), who target identification of the impact of non-discriminatory trade policies, we can show that the introduction of intra-national trade flows allows for identification of the impact of country-specific national institutions. However, unlike Heid et al. (2017), who are able to identify the impact of unilateral trade policies separately on the importer and on the exporter side, we also demonstrate that it is not possible to identify the impact of national institutions (and, in general, of any country-specific variable) separately on exports versus imports. The reason is that unilateral trade policies are potentially directional, i.e., specific for a country as importer or exporter, while the institutional quality is the same for a country, independently whether it acts as an exporter or importer.

Instead, we show that it is only possible to obtain estimates of the impact of national institutional quality on international relative to internal trade. To see these arguments, consider the following updated version of the data matrix (A-1):

$$
\begin{array}{cccc}
\# & i & j & \\
1 & A & B & \\
2 & A & C & \\
3 & B & A & \\
4 & B & C & \\
5 & C & A & \\
6 & C & B & \\
7 & A & A & \\
8 & B & B & \\
9 & C & C &
\end{array}
\begin{array}{c}
\begin{array}{ccccccc}
\eta_1 & \eta_2 & \mu_1 & \mu_2 & \mu_3 & BRDR_{ij} & IQ_j \times BRDR_{ij}
\end{array} \\
\begin{bmatrix}
1 & 0 & 0 & 1 & 0 & 1 & IQ_B \\
1 & 0 & 0 & 0 & 1 & 1 & IQ_C \\
0 & 1 & 1 & 0 & 0 & 1 & IQ_A \\
0 & 1 & 0 & 0 & 1 & 1 & IQ_C \\
0 & 0 & 1 & 0 & 0 & 1 & IQ_A \\
0 & 0 & 0 & 1 & 0 & 1 & IQ_B \\
1 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0
\end{bmatrix}
\end{array}
\tag{A-3}
$$

To obtain matrix (A-3), we added observations that correspond to intra-national trade. In addition, we introduced a dummy variable $BRDR_{ij}$, which takes a value of one for international trade, and it is equal to zero for intra-national trade. Finally, we re-defined the institutional variable as the product between the original institution variable and the border dummy, $IQ_j \times BRDR_{ij}$. Thus, by construction, the estimate of the coefficient on $IQ_j \times BRDR_{ij}$ should capture the differential impact of importer institutions on international

trade relative to domestic trade.

We demonstrate the linear independence of $IQ_j \times BRDR_{ij}$ from the country-specific fixed effects by contradiction. If $IQ_j \times BRDR_{ij}$ were perfectly collinear with the dummies, we should be able to express it as a linear combination of them:

$$IQ_j \times BRDR_{ij} = \alpha_1\eta_1 + \alpha_2\eta_2 + \alpha_3\mu_1 + \alpha_4\mu_2 + \alpha_5\mu_3 + \alpha_6 BRDR_{ij}, \tag{A-4}$$

where α_1 to α_6 denote coefficients to be estimated. Focus on specific rows. First, from observation 9 in matrix (A-3) it follows that α_5 has to be equal to zero. To fulfill equation (A-4) for observation 8, $\alpha_2 = -\alpha_4$ has to hold. From observation 7 it follows that $\alpha_1 = -\alpha_3$. Using these relationships, we can express equation (A-4) in matrix form as:

$$\begin{array}{ccc|ccccccccccccc}
\# & i & j & \alpha_1\eta_1 & + & \alpha_2\eta_2 & + & \alpha_3\mu_1 & + & \alpha_4\mu_2 & + & \alpha_5\mu_3 & + & \alpha_6 BRDR_{ij} & = & IQ_j \times BRDR_{ij} \\
1 & A & B & \alpha_1 & + & 0 & + & 0 & + & -\alpha_2 & + & 0 & + & \alpha_6 & = & IQ_B \\
2 & A & C & \alpha_1 & + & 0 & + & 0 & + & 0 & + & 0 & + & \alpha_6 & = & IQ_C \\
3 & B & A & 0 & + & \alpha_2 & + & -\alpha_1 & + & 0 & + & 0 & + & \alpha_6 & = & IQ_A \\
4 & B & C & 0 & + & \alpha_2 & + & 0 & + & 0 & + & 0 & + & \alpha_6 & = & IQ_C \\
5 & C & A & 0 & + & 0 & + & -\alpha_1 & + & 0 & + & 0 & + & \alpha_6 & = & IQ_A \\
6 & C & B & 0 & + & 0 & + & 0 & + & -\alpha_2 & + & 0 & + & \alpha_6 & = & IQ_B \\
7 & A & A & \alpha_1 & + & 0 & + & -\alpha_1 & + & 0 & + & 0 & + & 0 & = & 0 \\
8 & B & B & 0 & + & \alpha_2 & + & 0 & + & -\alpha_2 & + & 0 & + & 0 & = & 0 \\
9 & C & C & 0 & + & 0 & + & 0 & + & 0 & + & 0 & + & 0 & = & 0
\end{array} \tag{A-5}$$

It is obvious that equations corresponding to observations 7 to 9 in (A-5) fulfill the condition for perfect collinearity. Lines 1 and 6 can only simultaneously hold if $\alpha_1 = 0$. However, if $\alpha_1 = 0$, it follows that the equations given in lines 2 and 4 can only simultaneously hold if $\alpha_2 = 0$. Then, the only non-zero coefficient left is α_6. In order to satisfy equations 1 to 6, α_6 would have to take three different values. Hence, after ruling out trivial solutions for multicollinearity due to missing variation in $IQ_j \times BRDR_{ij}$, the only solution for the above system of equations is $\alpha_1 = ... = \alpha_6 = 0$. Thus, we have proven that the variable $IQ_j \times BRDR_{ij}$ is linearly independent from the set of exporter and importer dummies when intra-national trade flows observations are included in the estimating sample. Therefore, $IQ_j \times BRDR_{ij}$ can indeed be used to identify the effect of national institutions on international trade. Identical analysis can be used to demonstrate that, instead of identifying the impact of importer institutions on trade, we can identify the impact of exporter institutions on trade.

It is tempting to assume that similar intuition and analysis can be used to show that one can identify *simultaneously* the differential effects on trade of importer versus exporter institutions. Unfortunately, as we demonstrate next, this is not possible. To make this argument clear, we further extend our data matrix to include an interaction term $IQ_i \times BRDR_{ij}$ that would capture the impact of national institutions on exports:

$$
\begin{array}{ccc}
\# & i & j \\
1 & A & B \\
2 & A & C \\
3 & B & A \\
4 & B & C \\
5 & C & A \\
6 & C & B \\
7 & A & A \\
8 & B & B \\
9 & C & C
\end{array}
\begin{array}{c}
\begin{array}{ccccccccc}
\eta_1 & \eta_2 & \mu_1 & \mu_2 & \mu_3 & BRDR_{ij} & IQ_i \times BRDR_{ij} & IQ_j \times BRDR_{ij}
\end{array} \\
\begin{bmatrix}
1 & 0 & 0 & 1 & 0 & 1 & IQ_A & IQ_B \\
1 & 0 & 0 & 0 & 1 & 1 & IQ_A & IQ_C \\
0 & 1 & 1 & 0 & 0 & 1 & IQ_B & IQ_A \\
0 & 1 & 0 & 0 & 1 & 1 & IQ_B & IQ_C \\
0 & 0 & 1 & 0 & 0 & 1 & IQ_C & IQ_A \\
0 & 0 & 0 & 1 & 0 & 1 & IQ_C & IQ_B \\
1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0
\end{bmatrix}
\end{array}
\tag{A-6}
$$

Perfect collinearity would hamper identification if $IQ_j \times BRDR_{ij}$ can be expressed as a linear combination of the dummies and $IQ_i \times BRDR_{ij}$:

$$
IQ_j \times BRDR_{ij} = \alpha_1\eta_1 + \alpha_2\eta_2 + \alpha_3\mu_1 + \alpha_4\mu_2 + \alpha_5\mu_3 + \alpha_6 BRDR_{ij} + \alpha_7 IQ_i \times BRDR_{ij}. \tag{A-7}
$$

Focus on the observations in matrix (A-6). From observation 9 in matrix (A-6) it follows that α_5 has to be equal to zero. To fulfill equation (A-7) for observation 8, α_2 has to be equal to $-\alpha_4$, and from observation 7 it follows that $\alpha_1 = -\alpha_3$. Using these relationships, we can re-express equation (A-7) in matrix form as follows:

$$
\begin{array}{ccc|ccccccccccccccc}
1 & A & B & \begin{bmatrix}\alpha_1\end{bmatrix} & + & \begin{bmatrix}0\end{bmatrix} & + & \begin{bmatrix}0\end{bmatrix} & + & \begin{bmatrix}-\alpha_2\end{bmatrix} & + & \begin{bmatrix}0\end{bmatrix} & + & \begin{bmatrix}\alpha_6\end{bmatrix} & + & \begin{bmatrix}\alpha_7 IQ_A\end{bmatrix} & = & \begin{bmatrix}IQ_B\end{bmatrix} \\
2 & A & C & \begin{bmatrix}\alpha_1\end{bmatrix} & + & \begin{bmatrix}0\end{bmatrix} & + & \begin{bmatrix}0\end{bmatrix} & + & \begin{bmatrix}0\end{bmatrix} & + & \begin{bmatrix}0\end{bmatrix} & + & \begin{bmatrix}\alpha_6\end{bmatrix} & + & \begin{bmatrix}\alpha_7 IQ_A\end{bmatrix} & = & \begin{bmatrix}IQ_C\end{bmatrix} \\
3 & B & A & \begin{bmatrix}0\end{bmatrix} & + & \begin{bmatrix}\alpha_2\end{bmatrix} & + & \begin{bmatrix}-\alpha_1\end{bmatrix} & + & \begin{bmatrix}0\end{bmatrix} & + & \begin{bmatrix}0\end{bmatrix} & + & \begin{bmatrix}\alpha_6\end{bmatrix} & + & \begin{bmatrix}\alpha_7 IQ_B\end{bmatrix} & = & \begin{bmatrix}IQ_A\end{bmatrix} \\
4 & B & C & \begin{bmatrix}0\end{bmatrix} & + & \begin{bmatrix}\alpha_2\end{bmatrix} & + & \begin{bmatrix}0\end{bmatrix} & + & \begin{bmatrix}0\end{bmatrix} & + & \begin{bmatrix}0\end{bmatrix} & + & \begin{bmatrix}\alpha_6\end{bmatrix} & + & \begin{bmatrix}\alpha_7 IQ_B\end{bmatrix} & = & \begin{bmatrix}IQ_C\end{bmatrix} \\
5 & C & A & \begin{bmatrix}0\end{bmatrix} & + & \begin{bmatrix}0\end{bmatrix} & + & \begin{bmatrix}-\alpha_1\end{bmatrix} & + & \begin{bmatrix}0\end{bmatrix} & + & \begin{bmatrix}0\end{bmatrix} & + & \begin{bmatrix}\alpha_6\end{bmatrix} & + & \begin{bmatrix}\alpha_7 IQ_C\end{bmatrix} & = & \begin{bmatrix}IQ_A\end{bmatrix} \\
6 & C & B & \begin{bmatrix}0\end{bmatrix} & + & \begin{bmatrix}0\end{bmatrix} & + & \begin{bmatrix}0\end{bmatrix} & + & \begin{bmatrix}-\alpha_2\end{bmatrix} & + & \begin{bmatrix}0\end{bmatrix} & + & \begin{bmatrix}\alpha_6\end{bmatrix} & + & \begin{bmatrix}\alpha_7 IQ_C\end{bmatrix} & = & \begin{bmatrix}IQ_B\end{bmatrix} \\
7 & A & A & \begin{bmatrix}\alpha_1\end{bmatrix} & + & \begin{bmatrix}0\end{bmatrix} & + & \begin{bmatrix}-\alpha_1\end{bmatrix} & + & \begin{bmatrix}0\end{bmatrix} & + & \begin{bmatrix}0\end{bmatrix} & + & \begin{bmatrix}0\end{bmatrix} & + & \begin{bmatrix}0\end{bmatrix} & = & \begin{bmatrix}0\end{bmatrix} \\
8 & B & B & \begin{bmatrix}0\end{bmatrix} & + & \begin{bmatrix}\alpha_2\end{bmatrix} & + & \begin{bmatrix}0\end{bmatrix} & + & \begin{bmatrix}-\alpha_2\end{bmatrix} & + & \begin{bmatrix}0\end{bmatrix} & + & \begin{bmatrix}0\end{bmatrix} & + & \begin{bmatrix}0\end{bmatrix} & = & \begin{bmatrix}0\end{bmatrix} \\
9 & C & C & \begin{bmatrix}0\end{bmatrix} & + & \begin{bmatrix}0\end{bmatrix} & + & \begin{bmatrix}0\end{bmatrix} & + & \begin{bmatrix}0\end{bmatrix} & + & \begin{bmatrix}0\end{bmatrix} & + & \begin{bmatrix}0\end{bmatrix} & + & \begin{bmatrix}0\end{bmatrix} & = & \begin{bmatrix}0\end{bmatrix}
\end{array}
\tag{A-8}
$$

Subtract observation 6 from observation 1 in matrix (A-8) to obtain $\alpha_1 = \alpha_7(IQ_C - IQ_A)$. Subtract observation 5 from observation 3 to obtain $\alpha_2 = \alpha_7(IQ_C - IQ_B)$. These two

expressions for α_1 and α_2 along with setting $\alpha_7 = 1$ and $\alpha_6 = 0$ are enough to express $IQ_i \times BRDR_{ij}$ as function of the exporter and importer dummies and $IQ_j \times BRDR_{ij}$.[38] Hence, even with intra-national trade flows, one cannot simultaneously obtain separate effects of the impact of institutions for exports and for imports. Instead, one can only identify the impact of one of the two institution variables at a time. Importantly, however, since $IQ_i \times BRDR_{ij}$ and $IQ_j \times BRDR_{ij}$ are perfectly collinear, the corresponding estimates on the two institution variables from separate estimations will be identical and each of them should be interpreted as the sum of the effect of institutions on exports and imports (international trade) relative to intra-national trade. Therefore, in the subsequent empirical analysis we define the institutional regressor as $IQ \times BRDR_{ij}$, where IQ can either be the institution index on the importer side IQ_j or the institution index on the exporter side IQ_i.[39]

The analysis and discussion that we presented in this section naturally carry over to a setting with panel data. Intuitively, one can view the panel setting as sequence of cross-section data sets such as the one used in the presentation so far. More interesting from an econometric perspective, a panel setting would enable us to employ country-pair fixed effects. Importantly, the introduction of country-pair fixed effects would not lead to any additional collinearity challenges with the identification of the impact of national institutions. To see that this is indeed the case, one can consider a simple panel setting with two periods and then take first differences. The first differencing would wipe out the bilateral fixed effects while the remaining variables can be expressed as changes between the two periods. For identification purposes, the resulting system collapses to the cross-section setting that we presented earlier, where, instead of levels the system includes the changes of the variables. This however, has no impact and implications for any of our identification arguments.

[38] This can easily be checked by plugging in these expressions for α_1 and α_2 into equation (A-7).

[39] To gain further intuition for this result, assume that instead of defining $BRDR_{ij}$ as dummy taking value one for international trade, we defined a dummy $INTRA_{ii}$ that is equal to one for intra-national trade, i.e., $INTRA_{ii} = 1 - BRDR_{ij}$, and $BRDR$ and $INTRA$ both capture deviations between international and intra-national trade. They are merely differently defined dummies. However, using $INTRA$, it is obvious that we can not identify differential effects of institutions for importers and exporters.

B Robustness analysis

This Appendix reports the results from a series of sensitivity experiments that are designed to test the robustness of our methods and main findings.

Table B-1 reports estimates from three alternative specifications depending on the definition of the interaction between the institution quality index and the border dummy variable. The estimates from column (1) of Table B-1 reproduce our main results, which are obtained with an institution variable on the exporter side defined as $IQ_i \times BRDR_{ij}$, which we now explicitly label $WGI\_EXPORTER$. The estimates in column (2) of Table B-1 are obtained with an institutional variable defined on the importer side as $WGI\_IMPORTER \equiv IQ_j \times BRDR_{ij}$. Consistent with the analysis from Appendix A, the estimates from columns (1) and (2) of Table B-1 are identical. The estimates in column (3) of Table B-1 are obtained with an institutional variable defined as $WGI\_INTRANATL \equiv IQ_i \times INTRA_{ii}$, where $INTRA_{ii}$ is an indicator variable that is equal to one for intra-national trade, i.e., $INTRA_{ii} \equiv 1 - BRDR_{ij}$. As expected (see footnote 39), the estimates from column (3) are exactly the opposite as compared to those from columns (1) and (2). Thus, the results from Table B-1 support empirically our theoretical analysis from Appendix A.

Table B-2 reproduces our main estimates with alternative measures of institutional quality. For comparison purposes, the estimates in column (1) of Table B-2 replicate our main results from column (2) of Table 1. Then, in columns (2)-(7), we use the individual institutional quality indexes from the World Bank's World Governance Indicators database, which include Voice and Accountability (in column (2)), Political Stability and Absence of Violence (in column (3)), Government Effectiveness (in column (4)), Regulatory Quality (in column (5)), Rule of Law (in column (6)), and Control of Corruption (in column (7)). Without any exception, we obtain positive, large, and statistically significant estimates for each individual WGI indicator. The WGI estimates vary between 1.356 (std.err. 0.359) for Voice and Accountability and 2.003 (std.err. 0.277) for Regulatory Quality and, therefore, they confirm and support our main findings.

The estimates from columns (8) and (9) of Table B-2 are obtained with institution measures from two alternative databases. Specifically, we employ the Combined Polity Score index from the Polity IV project to obtain the estimates in column (8). The estimate on the new institution covariate $POLITY\_BRDR$ is positive, however, it is not statistically significant. We offer a possible explanation for this result when we discuss the findings from our next experiment, reported in Table B-3. The estimates from column (9) are obtained with an average institution index that is constructed from the Political Rights and Civil Liberties indicators of the Freedom House initiative. The estimate on $FRDMHS\_BRDR$ is positive, significant and comparable to the rest of the institution estimates from Table B-2.

An advantage of the Polity IV and the Freedom House indexes of institutional quality is that they are available for an extended period of time, which enables us to study the impact of institutions over the period 1988-2006. Table B-3 capitalizes on the longer time coverage of our sample when the institutional quality indexes are constructed based on the Polity IV and the Freedom House databases. Columns (1)-(3) obtain estimates with standard gravity variables. The estimates of the exporter-time and of the importer-time fixed effects, as well as the estimates of the border dummies are omitted for brevity. For comparison purposes, column (1) of Table B-3 replicates the panel results from column (5) of Table 1 with the main WGI institution variable. Columns (2) and (3) obtain estimates with the institution indexes from the Polity IV project and from the Freedom House database, respectively.

While the estimates on $POLITY\_BRDR$ (in column (2)) and $FRDMHS\_BRDR$ (in column (3)) are smaller in magnitude as compared to the main estimate on WGI_BRDR (column (1)), we find that the estimates on the new institution variables in Table B-3 are large, positive, and statistically significant. Columns (4)-(6) of Table B-3 confirm the results from columns (1)-(3) with country-pair fixed effects. As before, we find that the estimates on the institution variables are significantly smaller once bilateral fixed effects are added to the estimating specification. However, once again, we obtain positive and statistically significant

estimates on the two new institution variables. In fact, the estimates on $POLITY\_BRDR$ and $FRDMHS\_BRDR$ from Table B-3 are more precisely estimated as compared to the corresponding estimate on WGI_BRDR. Furthermore, we see that the insignificant cross-section estimate on $POLITY\_BRDR$ from column (8) of Table B-2 has become significant with the panel data in Table B-3. The larger time period, which allows for more variation in the institution indexes, is a natural explanation for the significant and more precisely estimated effects on $POLITY\_BRDR$ and $FRDMHS\_BRDR$.

The estimates in Table B-4 demonstrate the robustness of our main results to the use of alternative instrumental variables. Columns (1)-(3) of Table B-4 report IV-OLS estimates. For comparison purposes, column (1) of Table B-4 replicates the IV-OLS results from column (3) of Table 1, where we employed the distance-from-the-equator instrument of Hall and Jones (1999). The estimates from column (2) of Table B-4 are obtained with the instrument from Auer (2013), which expands on the original 'settler mortality' instrument of Acemoglu et al. (2001) to construct a hypothetical mortality rate for a larger sample of countries. Our results confirm the positive and significant relationship between institutional quality and international trade. The estimate on IQ_BRDR with the Auer instrument is a bit larger (2.412 std.err. 0.443) as compared to our main estimate of 1.906 (std.err. 0.291) from column (2) of Table 1. However, the two estimates are not statistically different from each other. Furthermore, with a highly statistically significant first-stage estimate and with an under-identification χ^2 test statistic of 768.37 (Anderson, 1951) and weak-identification *Wald F* estimates of 925.507 (Cragg and Donald, 1993) and 16.38 (Stock and Yogo, 2005), the mortality-rate instrument is performing well.

The estimates in column (3) of Table B-4 are obtained with the use of both the Hall and Jones and the Auer instruments. Once again, these estimates confirm the robustness of our main results. Estimates from the first-stage IV regression reveal that the instruments are strong predictors of the endogenous variable (Anderson $\chi^2 = 1560.52$, Cragg-Donald *Wald F* $= 1260.47$, and Stock-Yogo *Wald F* $= 19.93$). In addition, in combination, the instruments

jointly pass the overidentification test with a Sargan statistic $\chi^2 = 1.053$ (p-val. 0.3048). Columns (4)-(6) of Table B-4 report IV-PPML estimates, which, in terms of the definitions of the instrumental variables, correspond to the IV-OLS estimates from Columns (1)-(3) of Table B-4. The IV-PPML estimates are also in support of our main findings.

Finally, the specifications in Table B-5 use the PPML estimator to reproduce our main OLS results. Each PPML specification in Table B-5 corresponds directly to an OLS specification from the main text. Specifically, column (1) of Table B-5 reproduces the OLS estimates with gravity variables from column (5) of Table 1. Similar to our main OLS results, the PPML estimates from column (1) deliver a large, positive, and statistically significant estimate of the impact of institutional quality on international trade. We do note, however, that the PPML estimate is significantly smaller in magnitude as compared to the corresponding OLS estimate. Possible explanations for the difference between the PPML and the OLS estimates in gravity regressions include heteroskedasticity and the inclusion of zero trade flows, see Santos Silva and Tenreyro (2006), as well as the different estimation weights attached to nations with different size, see Larch et al. (2017).

Column (2) of Table B-5 reproduces the estimates of the impact of institutional quality on poor countries' trade with rich countries from column (2) of Table 2. Similar to our OLS findings, we obtain positive estimates of the effects of institutional quality on the exports and on the imports of poor countries with rich countries. However, only the estimate on the poor countries' imports is statistically significant. This confirms the significantly asymmetric impact of institutional quality on the exports vs. imports of the poor to and from the rich countries, respectively.

The estimates in columns (3) and (4) of Table B-5 reproduce the corresponding OLS estimates with country-pair fixed effects from column (6) of Table 1 and from column (4) of Table 2, respectively. The main difference between the PPML results and our OLS findings is that the average impact of institutions in columns (3) and (4) of Table B-5 is not significant. A possible explanation for this result is that, on average, the time variation in the

institutional quality changes over the period of investigation is not sufficient for identification purposes. This is confirmed in column (4), where we focus on the trade of poor countries, which experience significant variation in institutional quality. We obtain a large, positive and statistically significant estimate of the impact of institutions on the imports of poor countries from rich countries. This result is consistent with our OLS findings and reinforces the focus of our general equilibrium counterfactual analysis.

Based on the results from this Appendix, we view our main findings as robust and representative.

Table B-1: Institutions and trade: collinearity

	(1) IQ_EXP	(2) IQ_IMP	(3) IQ_INTRA
LN_DIST	-1.223	-1.223	-1.223
	(0.057)**	(0.057)**	(0.057)**
CNTG	0.195	0.195	0.195
	(0.226)	(0.226)	(0.226)
LANG	0.731	0.731	0.731
	(0.109)**	(0.109)**	(0.109)**
CLNY	0.469	0.469	0.469
	(0.157)**	(0.157)**	(0.157)**
RTA	0.185	0.185	0.185
	(0.073)*	(0.073)*	(0.073)*
BRDR	-4.256	-4.256	-4.256
	(0.345)**	(0.345)**	(0.345)**
WGI_EXPORTER	1.906		
	(0.291)**		
WGI_IMPORTER		1.906	
		(0.291)**	
WGI_INTRANATL			-1.906
			(0.291)**
N	3880	3880	3880
R^2	0.868	0.868	0.868

Notes: This table reports estimates from three alternative specifications depending on the definition of the interaction between the institution quality index and the border dummy variable. Column (1) reproduces the main results with an institution variable on the exporter side. The estimates in column (2) are obtained with an institution variable on the importer side. The estimates in column (3) are obtained with an institutional variable that interacts the country-specific institution index with an indicator variable for internal trade. All estimates are obtained with the OLS estimator and with exporter and importer fixed effects, which are omitted for brevity. $^{+}$ $p < 0.10$, * $p < .05$, ** $p < .01$. See text for further details.

Table B-2: Institutions and trade: alternative institutional quality indexes

	(1) WGI	(2) WGI_VA	(3) WGI_PV	(4) WGI_GE	(5) WGI_RQ	(6) WGI_RL	(7) WGI_CC	(8) POLITY	(9) FRDMHS
LN_DIST	-1.223	-1.217	-1.227	-1.226	-1.225	-1.224	-1.224	-1.221	-1.219
	(0.057)**	(0.063)**	(0.058)**	(0.056)**	(0.057)**	(0.057)**	(0.057)**	(0.062)**	(0.063)**
CNTG	0.195	0.201	0.189	0.193	0.196	0.196	0.193	0.198	0.198
	(0.226)	(0.226)	(0.224)	(0.226)	(0.226)	(0.226)	(0.225)	(0.224)	(0.225)
LANG	0.731	0.728	0.724	0.732	0.731	0.732	0.730	0.722	0.726
	(0.109)**	(0.110)**	(0.109)**	(0.109)**	(0.109)**	(0.109)**	(0.109)**	(0.110)**	(0.110)**
CLNY	0.469	0.479	0.491	0.467	0.462	0.466	0.472	0.494	0.484
	(0.157)**	(0.157)**	(0.158)**	(0.157)**	(0.157)**	(0.157)**	(0.157)**	(0.158)**	(0.158)**
RTA	0.185	0.196	0.191	0.177	0.179	0.184	0.184	0.198	0.198
	(0.073)*	(0.075)**	(0.073)**	(0.072)*	(0.072)*	(0.073)*	(0.072)*	(0.075)**	(0.076)**
BRDR	-4.256	-4.045	-3.520	-4.540	-4.525	-4.257	-4.176	-4.054	-2.036
	(0.345)**	(0.405)**	(0.325)**	(0.327)**	(0.355)**	(0.348)**	(0.354)**	(0.614)**	(0.521)**
WGI_BRDR	1.906								
	(0.291)**								
WGI_VA_BRDR		1.356							
		(0.359)**							
WGI_PV_BRDR			1.449						
			(0.305)**						
WGI_GE_BRDR				1.931					
				(0.253)**					
WGI_RQ_BRDR					2.003				
					(0.277)**				
WGI_RL_BRDR						1.715			
						(0.262)**			
WGI_CC_BRDR							1.489		
							(0.256)**		
POLITY_BRDR								0.442	
								(0.333)	
FRDMHS_BRDR									1.210
									(0.459)**
N	3880	3880	3880	3880	3880	3880	3880	3880	3880
R^2	0.868	0.866	0.867	0.868	0.868	0.868	0.867	0.865	0.866

Notes: This table reports estimation results with alternative measures of institutional quality. Column (1) replicates the main estimates from column (2) of Table 1. Columns (2)-(7), use the individual institutional quality indexes from WGI, including: Voice and Accountability (column 2), Political Stability and Absence of Violence (column 3), Government Effectiveness (column 4), Regulatory Quality (column 5), Rule of Law (column 6), and Control of Corruption (column 7). The estimates from columns (8) and (9) are obtained with the Combined Polity Score index from the Polity IV project, and with an average institution index that is constructed from the Political Rights and Civil Liberties indicators of the Freedom House initiative. All estimates are obtained with the OLS estimator and with exporter and importer fixed effects, which are omitted for brevity. $^{+}$ $p < 0.10$, * $p < .05$, ** $p < .01$. See text for further details.

Table B-3: Institutions and trade: long panel data

	Gravity Variables			Country-Pair Fixed Effects		
	WGI	POLITY	FRDMHS	WGI	POLITY	FRDMHS
	(1)	(2)	(3)	(4)	(5)	(6)
LN_DIST	-1.241	-1.204	-1.206			
	(0.049)**	(0.054)**	(0.055)**			
CNTG	0.169	0.198	0.196			
	(0.217)	(0.206)	(0.207)			
LANG	0.720	0.705	0.705			
	(0.094)**	(0.091)**	(0.091)**			
CLNY	0.478	0.601	0.598			
	(0.145)**	(0.146)**	(0.146)**			
RTA	0.079	0.036	0.032	0.039	0.222	0.222
	(0.057)	(0.057)	(0.057)	(0.050)	(0.044)**	(0.044)**
WGI_BRDR	2.011			0.616		
	(0.277)**			(0.301)*		
POLITY_BRDR		0.830			0.220	
		(0.234)**			(0.076)**	
FRDMHS_BRDR			1.408			0.374
			(0.310)**			(0.136)**
N	30753	76914	76914	30753	76914	76914
R^2	0.869	0.854	0.855	0.932	0.916	0.916

Notes: This table reports panel estimates of the impact of institutions on international trade. Column (1) replicates the panel results from column (5) of Table 1 with the main WGI institution variable. Columns (2) and (3) obtain estimates with the institution indexes from the Polity IV project and from the Freedom House database, respectively. Columns (4)-(6) replicate the estimations of columns (1)-(3) with the addition of country-pair fixed effects. All estimates are obtained with the OLS estimator and with exporter-time and importer-time fixed effects, which are omitted for brevity. $^{+}$ $p < 0.10$, * $p < .05$, ** $p < .01$. See text for further details.

Table B-4: Institutions and trade: alternative instruments

	IV-OLS			IV-PPML		
	MAIN	AUER	HJ_AUER	MAIN	AUER	HJ_AUER
	(1)	(2)	(3)	(4)	(5)	(6)
IQ_BRDR	1.764	2.412	2.088	1.015	0.902	0.945
	(0.443)**	(0.443)**	(0.310)**	(0.485)*	(0.434)*	(0.278)**
LN_DIST	-1.223	-1.222	-1.223	-1.224	-1.224	-1.224
	(0.043)**	(0.043)**	(0.043)**	(0.042)**	(0.042)**	(0.042)**
CNTG	0.195	0.194	0.195	0.474	0.470	0.472
	(0.154)	(0.154)	(0.154)	(0.157)**	(0.156)**	(0.156)**
LANG	0.730	0.735	0.733	0.614	0.613	0.613
	(0.080)**	(0.080)**	(0.080)**	(0.084)**	(0.084)**	(0.084)**
CLNY	0.472	0.461	0.466	0.624	0.627	0.626
	(0.154)**	(0.154)**	(0.154)**	(0.131)**	(0.131)**	(0.131)**
RTA	0.186	0.183	0.184	0.245	0.246	0.245
	(0.062)**	(0.062)**	(0.062)**	(0.063)**	(0.063)**	(0.063)**
BRDR	-4.197	-4.466	-4.332	-4.391	-4.395	-4.394
	(0.295)**	(0.295)**	(0.264)**	(0.275)**	(0.290)**	(0.283)**
N	3880	3880	3880	3969	3969	3969
R^2	0.868	0.867	0.868			

Notes: This table demonstrates the robustness of our main results to the use of alternative instrumental variables. Columns (1)-(3) of Table B-4 report IV-OLS estimates. Column (1) replicates the IV-OLS results from column (3) of Table 1 with the distance-from-the-equator instrument of Hall and Jones (1999). Column (2) uses the mortality-rate instrument from Auer (2013). Column (3) uses a combination of both the Hall and Jones and the Auer instruments. Columns (4)-(6) report IV-PPML estimates, which, in terms of the definitions of the instrumental variables, correspond to the IV-OLS estimates from columns (1)-(3). $^{+}$ $p < 0.10$, * $p < .05$, ** $p < .01$. See text for further details.

Table B-5: Institutions and trade: PPML estimates

	(1) PNL_GRV	(2) POOR	(3) PNL_FES	(4) POOR
LN_DIST	-0.723	-0.714		
	(0.082)**	(0.079)**		
CNTG	0.512	0.524		
	(0.157)**	(0.149)**		
LANG	0.197	0.185		
	(0.134)	(0.130)		
CLNY	-0.054	-0.038		
	(0.123)	(0.122)		
RTA	0.085	0.110	0.131	0.101
	(0.117)	(0.115)	(0.067)$^{+}$	(0.049)*
IQ_BRDR	0.650	0.694	0.129	0.128
	(0.102)**	(0.116)**	(0.100)	(0.092)
$\text{IQ}_P\text{\_BRDR}_{PR}$		0.369		0.084
		(0.258)		(0.146)
$\text{IQ}_P\text{\_BRDR}_{RP}$		0.892		0.393
		(0.244)**		(0.113)**
N	31752	31752	31752	31752

Notes: This table reports estimation results from econometric models that employ the PPML estimator. All estimates are obtained in panel settings with exporter-time and importer-time fixed effects. Estimates of the fixed effects, including the constant term, as well as estimates of all time-varying border variables (whenever applicable), are omitted for brevity. Each PPML specification in this table corresponds directly to an OLS specification from the main text. Specifically, column (1) reproduces the OLS estimates with gravity variables from column (5) of Table 1, while column (2) reproduces the estimates for poor countries' trade from column (2) of Table 2. Similarly, column (3) reproduces the OLS estimates with fixed effects from column (6) of Table 1, while column (4) reproduces the estimates for poor countries' trade from column (4) of Table 2. $^{+}$ $p < 0.10$, * $p < .05$, ** $p < .01$. See text for further details.