



Trade, democracy, and the gravity equation [☆]

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ABSTRACT

Does democracy affect trade? There are several channels by which democracy may affect trade, with differing implications. First, democratization in the exporting country can improve product quality and reduce trade costs, increasing bilateral trade. Second, democratization in the importing country may increase trade barriers and thus reduce imports. In this paper, I analyze the effect of democracy on trade by augmenting the gravity equation with democracy. Using a rich panel data set and controlling for the endogeneity of democracy, I find empirical evidence consistent with the hypothesis that democracy fosters trade. This finding is robust to various econometric methods and to the use of disaggregated specifications.

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1. Introduction

This paper investigates the influence of democracy on trade. Relatively little research has focused on this topic, despite being one of the most intriguing in international political economy.

Over the last four decades, global real imports have soared 534% while the world has concomitantly enjoyed historic political liberalization. About 36 countries established democratic regimes in this era (Papaioannou and Siourounis, 2008). As displayed in Fig. 1, the *Polity IV* indicator, which measures each regime's democracy with an incremental, institutionalized 22-point scale, also confirms that democracy has been on the march. This raises the question: Has the rise of democracy increased trade?

This paper addresses the issue by adding democracy to the gravity model to investigate effects of trading partners' democratization on trade, allowing derivation of structural estimation equations. There

are two main innovations in my theoretical model. First, importers value *quality*, which in turn depends on the level of democratization of the exporting country. In fact, I allow democracy to have heterogeneous effects of product quality across industries. Second, both trading partners' democracy levels affect their trade costs. For an importer, democracy affects trade costs via tariffs, whereas for an exporter, the effect of democracy works by improving institutions, product quality, and the level of trust the international community places in its products.

Based on the theoretical framework, I estimate the effects of democratization on trade, using a rich panel data set of 157 IMF-member countries over the years 1962–1998. I obtain robust empirical evidence that democracy significantly fosters trade, while controlling for the endogeneity of democracy. Overall, I estimate that democratization increased trade by about 23% over these years, which explains around 3–4% of the total 534% increase in the global directional imports during these four decades. Finally, I also examine income heterogeneity, consider sectoral regressions, and even look at decadal estimates.

This work adds to a growing literature on trade and democracy, including work done by, among others, Grofman and Gray (2000), Quinn (2001), and Fidrumc (2003). These studies differ in empirical methodology, channels of operation, country coverage, and time span, yet they all share the assumption that democracy is exogenous. Later researchers realized that omitting the potential endogeneity of democracy could lead to estimation bias. Giavazzi and Tabellini (2005) provide evidence that countries that liberalize and then democratize perform much better than do countries that do the reverse. Eichengreen and Leblang (2008) argue the existence of two-

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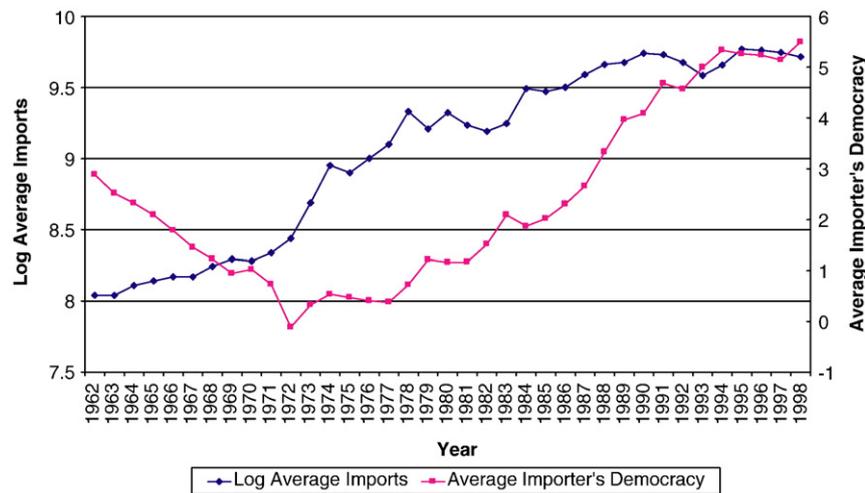


Fig. 1. World trade flow and democracy level. Sources: Directional nominal import data is from Feenstra et al. (2005), which is deflated by the American CPI (1995 = 100) to get real data as shown on this figure. Data on democracy indicators are from Polity IV by Marshall-Jagers (2002). Note that I leave raw materials like oil (SITC 2-digit code: 33) and gold (SITC 2-digit code: 97) out of the aggregation since they might not be influenced by institutional quality. Overall, trade and democracy display increasing trends over the years 1962–1998.

way positive causality between trade openness and democracy using historical data from 1870–2000. Yu (2007) presents evidence that democracy fosters trade, whereas trade hinders democracy in the post-Bretton-Woods era, using simultaneous equation methods to control for the estimation bias caused by the single-equation estimates.

By way of comparison, in this paper I perform estimation based on a theoretical gravity framework. I do not attempt *theoretically* to predict the sign of democracy's influence, but rather to use a micro-founded model to guide the empirical analysis. It turns out that the estimation results help us understand the magnitude of the effects through each channel of democracy on trade.

The remainder of the paper is organized as follows. Section 2 describes mechanisms by which democracy affects trade. Section 3 presents a theoretical gravity equation. Section 4 introduces the estimation methodology. Section 5 discusses estimation results and robustness checks. Finally, Section 6 concludes the paper.

2. Exploring the nexus between trade and democracy

Several mechanisms have been discussed in the literature. First, the extent to which a country is democratic has ramifications for product quality. Democracy and the rule of law are mutually reinforcing (Rigobon and Rodrik, 2004). In general, a highly democratic regime is associated with better maintenance of the rule of law and stronger property rights protection, which in turn helps it create a fair and competitive market (Barro, 1996, 1999). The freer is the market, the stronger is the regulation of a regime (Rodrik, 2000). Both effects help ensure high-quality products.

Second, the effects of an exporter's democracy on quality are differentiated across industries. A highly democratic regime tends to have stronger protection of intellectual property rights, which are associated with greater R&D expenditure (Clarke, 2001). Accordingly, the effect of democracy on quality will be stronger in industries with higher R&D expenditures.

Lastly, the more an exporter is endowed with strong democratic institutions, the more the international community will trust its products (Levchenko, 2007). For example, before signing a contract with a democratic exporter, importers have to have sufficient confidence to believe they will receive timely shipment of quality products with high probability (Berkowitz et al., 2006). In contrast, the insecurity that is associated with low-quality importers' institu-

tions acts as a hidden tax on imports (Anderson and Marcouiller, 2002).¹

Summarizing, the more democratic an exporter is, the better institutions it will tend to have regarding consumer rights, food and product regulations, and legal enforcement, and these will improve product quality and the reputation of a country's exports generally. Moreover, democratization and its associated quality institutions can potentially reduce trade costs associated with the risks of trading by improving the trust in an exporter.

Turning to *importers*, the degree of democratization in the importing country has ramifications for trade costs and hence imports as well. Consider first an importer that is a less-developed country (LDC). Since most developing countries are labor-abundant, comparative advantage suggests that LDCs should import relatively capital-intensive products. But, by the Stolper–Samuelson Theorem, a decrease in the import tariff of a capital-intensive good decreases the real return on capital, hence harming capital owners but benefiting labor. When such a country democratizes, political power generally shifts from non-elected elites to labor, which moves LDC governments to implement labor-friendly pro-trade policies (Milner and Kubota, 2005).² Hence, in LDCs, an implication of Heckscher–Ohlin is that democracy should *reduce* tariffs.

On the other hand, in rich countries, generally the opposite is thought to be true. Labor-friendly trade policies serve there as instruments for protectionism. O'Rourke and Taylor (2006) find evidence of a negative effect of democracy on trade in developed countries (DCs). Therefore, in rich countries, being more democratic could well raise trade costs by increasing tariffs and other non-tariff barriers meant to protect labor.

Furthermore, as discussed above, democracy could improve product quality, and thereby help exports. By the same token, one might expect that more democratic importers would have higher product quality, which may also dampen trade, as high-quality domestic goods could prove tough competition for foreign substitutes.

¹ In particular, authoritarian regimes tend to be more corrupt, usually resulting in relatively distorted markets and weak regulations (Lin, 2003). Anderson and Marcouiller (2002) argue that when law enforcement of an institution is impotent, its corrupt government and other predators are able to collect bribes and steal from traders which in turn reduce international trade. Therefore, an undemocratic regime tends to trade less, *ceteris paribus*.

² However, a labor-friendly policy can also increase wages and labor standards, which increase costs for labor-intensive industries. I thank a referee for pointing this out.

Finally, we may consider the effect of trade on democracy, which will be addressed in this paper because it raises the endogeneity issue, see Section 5.3 below. The main idea is that international trade could help sustain non-democratic regimes in land-abundant (e.g., Argentina and Chile) and capital-scarce (e.g., Vietnam) countries. As Acemoglu and Robinson (2006) have asserted, when such countries are open to trade, land (labor) owners get benefits from globalization. Yet, the land-owner (labor) elites are more likely to object to democracy out of fear of losing their assets in land (tax) reform. Therefore, trade could enrich the very powers-that-be enough that they have the power to prevent democratization, and so that they fear any changing of the status quo.³

Motivated by these observations, in the next section I develop a theoretical framework aimed at capturing the nexus between trading partners' trade and democracy.

3. Theoretical gravity framework

In short, my theoretical model augments the logic of the gravity equation by postulating two explicit roles for democratization: improvements in quality, and effects on trade costs.

The gravity equation, in its simplest form, suggests that trade is directly proportional to the trading partners' GDP. Based on this idea, Anderson (1979) provided a theoretical micro-foundation for the gravity equation based on a constant elasticity of substitution (CES) utility function, which has become a widely accepted setup in subsequent work. An innovation of the present paper is a modification of the CES utility function by embedding democracy into the gravity equation.

Suppose that each country produces unique product varieties. Country $i=1,\dots,I$ has K industries. Industry $k \in K$ produces N_{ik} commodities. Consider the CES utility function:

$$U_j = \sum_{i=1}^I \sum_{k=1}^K \sum_{h=1}^{N_{ik}} \left[f_k(z_i) C_{ijk}^h \right]^{\frac{\sigma-1}{\sigma}}, (\sigma > 1) \tag{1}$$

where C_{ijk}^h denotes the consumption in country j of variety h within industry k produced by country i , and z_i denotes exporter i 's degree of democratization. The elasticity of substitution s is assumed to be greater than one. The function $f_k(z_i)$ captures the quality of the products of industry k in country i , assumed to be an increasing function of the degree of exporter's democratization z_i .⁴ Here I adopt the exponential form $f_k(z_i) = \theta_{ik} \exp(z_i)$, where θ_{ik} is a parameter reflecting the responsiveness of the quality of the products in i 's industry k to the degree of democratization of exporter i .

My motivation is as follows. First, as discussed in Section 2, democracy improves the quality of other institutions, which in turn implies higher-quality products. In this sense, its products will be more desirable for other countries. Thus, I model the aggregate utility function of country j as a strictly increasing function of the democracy index z of exporter i . Second, the exponential functional form also allows one to control for the potential nonlinear relationship between product quality and the representative consumer's utility. Third, the quality of products in sector k also depends on the parameter $\theta_{ik} > 0$ which is used as a proxy for sector k 's R&D expenditure of exporter i . The idea is that, as stated in Section 2, a highly democratic regime and its associated stronger institutions encourage greater R&D expenditure, which would differ across sectors. Therefore, all else equal, industries with more R&D inputs are expected to have higher-quality

products.⁵ Finally, such a specification is also convenient for estimations.⁶

For brevity, and in line with previous studies (e.g., Anderson and van Wincoop, 2003), I assume that, given i and j , $p_{ijk}^h = p_{ijk}^{h'}$ for all h and h' in $\{1,\dots,N_{ik}\}$, i.e., all the varieties within an industry imported by country j from country i have the same price p_{ijk} . Then consumption in country j is also identical over the entire line of products within industry k sold by country i , i.e., $C_{ijk}^h = C_{ijk}^h = C_{ijk}^h, \forall h \in \{1,\dots,N_{ik}\}$. The utility function (1) can then be expressed as:

$$U_j = \sum_{i=1}^I \sum_{k=1}^K N_{ik} \left[\theta_{ik} \exp(z_i) C_{ijk} \right]^{\frac{\sigma-1}{\sigma}}. \tag{2}$$

The representative consumer in the importing country maximizes her utility (2) subject to the budget constraint:

$$Y_j = \sum_{i=1}^I \sum_{k=1}^K N_{ik} p_{ijk} C_{ijk}, \tag{3}$$

where Y_j is importer j 's GDP. Solving this maximization problem, I obtain the demand function for each product:

$$C_{ijk} = \left(p_{ijk} / P_j^k \right)^{-\sigma} \left(Y_j / P_j^k \right) \left(\theta_{ik} \exp(z_i) \right)^{\sigma-1}, \tag{4}$$

where the aggregate industrial price index P_j^k is defined as:

$$P_j^k = \left[\sum_{i=1}^I \sum_{k=1}^K N_{ik} \left(\frac{p_{ijk}}{\theta_{ik} \exp(z_i)} \right)^{1-\sigma} \right]^{\frac{1}{1-\sigma}}. \tag{5}$$

Here $p_{ijk}/(\theta_{ik} \exp(z_i))$ denotes the "quality-adjusted" price (Feenstra, 2003). Note that here prices for consumers p_{ijk} are presumed to be increasing with exporter i 's democracy index z_i : $\partial p_{ijk} / \partial z_i > 0$.⁷ Better quality goods produced by a highly democratic regime induce higher prices for (domestic and foreign) consumers due to their strong demand. Given each fixed "quality-adjusted" price, the higher is the quality of products, the higher are importer j 's prices. Finally, the exports in industry k from country i to country j are:

$$X_{ijk} = \sum_{h=1}^{N_{ik}} p_{ijk}^h C_{ijk}^h = N_{ik} p_{ijk} C_{ijk}, \tag{6}$$

where the first equality follows from the definition of exports, and the second is due to the equal price assumption across varieties within an industry. Combining Eqs. (4), (5), and (6), I obtain the export value of industry k from country i to country j :

$$X_{ijk} = N_{ik} Y_j \left(p_{ijk} / P_j^k \right)^{1-\sigma} \left[\theta_{ik} \exp(z_i) \right]^{\sigma-1}. \tag{7}$$

My second theoretical innovation is the explicit dependence of trade costs on the levels of democratization. I adopt Samuelson's (1952) suggestion of "iceberg" trade costs, denoted T_{ijk} . In order to have one unit of the product reach the destination country j , one

³ However, one may also have good reason to argue against this wisdom. For example, as Lipset (1960) pointed out, international trade could create a channel for trading countries' people to communicate ideas. An ideology that is dominant in rich countries may spillover to poor countries. Therefore, whether the reverse causality is positive or negative remains an empirical question.

⁴ The role of quality in utility was introduced by Anderson, Palma, and Thisse (1989).

⁵ For example, the stronger institution and better protection of intellectual property rights in democratic regimes would benefit industries such as the software industry more than it would the garment industry.

⁶ Note that data on the democracy index, *Polity IV*, is scaled from -10 to 10. Since I take the log form for estimations in the present paper, it is inappropriate to use a simple linear increasing function in order to have the well-defined domain of a logarithm function. Adding a constant number higher than 10 is helpful to solve the logarithm domain problem, but still cannot capture the non-linearity between democracy and trade.

⁷ Specification (8) sheds light on this point more explicitly.

needs $T_{ijk} \geq 1$ units of the product shipped from the departure country i . Hence, the industrial price on a c.i.f. (cost, insurance, freight) basis p_{ijk} equals the product of the “iceberg” trade costs and the industrial price on a f.o.b. (free on board) basis p_{ik} .

As a kind of artificial trade costs, import tariffs are a function of the importer's democracy index. As discussed in Section 2, democratic governments are more likely to choose labor-friendly commercial policies. Therefore, the iceberg trade costs depend on an importer's level of democratization z_j .

In addition, such iceberg trade costs are also affected by the exporter's democracy index z_i . As discussed above, an exporter's democratization and the associated high-quality institutions can influence the trust that consumers worldwide place in that country overall, reducing the perceived risk of trading with importers. This is also true for importers. Hence, I have:

$$p_{ijk} = T_{ijk}(z_i, z_j) p_{ik}(z_i). \quad (8)$$

Note that exporter i 's f.o.b. industrial prices p_{ik} are positively associated with goods' quality (denoted by a function of its democracy index z_i) due to strong demand.⁸ By combining this expression with Eq. (7), I have:

$$X_{ijk} = N_{ik} Y_j [T_{ijk}(z_i, z_j) / P_j^k]^{1-\sigma} p_{ik}^{1-\sigma} [\theta_{ik} \exp(z_i)]^{\sigma-1}. \quad (9)$$

Clearly, in the gravity Eq. (9), the industrial bilateral trade depends on the importing country's GDP, the aggregate industrial price index, the trading countries' democracy indices, industrial R&D expenditure, and the f.o.b. industrial price.

However, industrial bilateral trade is also affected by the number of varieties in each industry of the exporting country, N_{ik} , which is unfortunately unobservable. For estimation purposes, I consider the monopolistic competition *production-side* model presented originally by Krugman (1979), which helps us eliminate the number of varieties in the Eq. (9).

As in Krugman (1979), the representative firm of industry k in country i maximizes profits. Specifically, the production of goods (y_{ik})⁹ incurs a fixed cost (κ_{ik}) and constant marginal cost (ϕ_{ik}) given that labor (l_{ik}) is the firm's unique input:

$$l_{ik} = \kappa_{ik} + \phi_{ik} y_{ik}. \quad (10)$$

The monopolistic competitive equilibrium implies two conditions for the representative firm. First, the firm's maximization behavior requires that marginal revenue should equal marginal cost. Since the elasticity of demand equals the elasticity of substitution σ when the number of varieties N_{ik} is large, I obtain the first equilibrium condition:

$$p_{ik} = \left(\frac{\sigma}{\sigma-1} \right) \phi_{ik} w_i, \quad (11)$$

where the wage is denoted as w_i .

Second, the representative firm obtains zero profits due to free entry. Given that the firm's profit function of industry k in country i is

$\pi_{ik} = p_{ik} y_{ik} - w_i (\kappa_{ik} + \phi_{ik} y_{ik})$, the equilibrium production level \bar{y}_{ik} for such a representative firm of industry k in country i is:

$$\bar{y}_{ik} = (\sigma - 1) \kappa_{ik} / \phi_{ik},$$

where \bar{y}_{ik} is a constant number given that s , κ_{ik} , and ϕ_{ik} are all constant parameters. It is also noted that the GDP in country i is $Y_i = \frac{1}{s_{ik}} N_{ik} p_{ik} \bar{y}_{ik}$ where s_{ik} is output share of industry k in country i . By substituting this into Eq. (9), I have:

$$X_{ijk} = \frac{s_{ik} Y_i Y_j}{(p_{ik})^\sigma \bar{y}_{ik}} [T_{ijk}(z_i, z_j) / P_j^k]^{1-\sigma} [\theta_{ik} \exp(z_i)]^{\sigma-1}. \quad (12)$$

Therefore, industrial bilateral trade depends on the trading countries' GDP, exporter's industrial output share, exporter's industrial R&D expenditure, the iceberg trade costs, the trading countries' democracy levels, the exporting representative firms' fixed production, and various price indices.

4. Empirical methodology

To estimate the gravity Eq. (12), I specify the estimating equation by taking logs on both sides:

$$\ln X_{ijk} = \ln(Y_i Y_j) - \sigma \ln p_{ik} + (1 - \sigma) \ln T_{ijk} + (\sigma - 1) \ln P_j^k + (\sigma - 1) z_i + \ln s_{ik} + (\sigma - 1) \ln \theta_{ik} - \ln \bar{y}_{ik}. \quad (13)$$

The industrial bilateral iceberg cost T_{ijk} includes both artificial and natural trade costs. Aside from import tariffs, which are a function of an importer's democratization, the artificial category also includes dummies of regional trade agreements R_{ij} , General System of Preference (GSP) S_{ij} , and currency unions D_{ij} ¹⁰ This is because multilateral trade agreements could foster trade by reducing trade uncertainty, which in turn could be treated as a reduction of artificial trade costs (Rose, 2004).

Similarly, the natural trade costs include the following: (a) the bilateral distance cost g_{ij} ; (b) the indicator of a common land border B_{ij} : whether or not the trading countries share a common land border; and (c) the number of island countries I_{ij} . Following these suggestions, I consider a specification as follows:

$$\ln T_{ijkt} = \alpha_{ijk} + \rho_0 z_{it} + \rho_1 z_{jt} + \rho_2 \ln g_{ij} + \rho_3 B_{ij} + \rho_4 I_{ij} + \rho_5 R_{ijt} + \rho_6 S_{ijt} + \rho_7 D_{ijt} + \mu_{ijkt}, \quad (14)$$

where t denotes year, $B_{ij}(D_{ij})$ is a dummy variable which is unity if country i and country j share a common border (form a currency union) and zero otherwise. Note that tariffs are not included here since global tariff data is still currently unavailable. Thus, the effect of tariffs on the trade costs is partially absorbed by the exporter's democracy index z_i and importer's democracy index z_j , as discussed above. The coefficient ρ_0 is presumed negative since highly democratic institutions can lower trade costs as introduced above. In addition, ρ_1 is expected to be negative provided that the effect on tariffs of democratization in developing countries dominates that in developed countries. Finally, the constant term α_{ijk} captures any other border effects which are not specified in Eq. (14).

⁸ For brevity, the negative effect of institutional quality on industry-specific trade cost ($p_{ik} \partial T_{ijk} / \partial z_i$) is presumed to be dominated by the positive effect of institutional quality on goods' price ($T_{ijk} \partial p_{ik} / \partial z_i$). That is, $\partial p_{ijk} / \partial z_i > 0$. The economic rationale is that the impact on consumers' price of trading partners' mutual “trust” shall be much lower than that of products' quality.

⁹ Here the production of goods is defined as $y_{ik} = \sum_{h=1}^{N_{ik}} y_{ik}^h$, where y_{ik}^h is the amount of variety h produced in industry k in country i .

¹⁰ Such preferential trade agreements include the following: EEC/EC/EU, US–Israel Trade Agreement, CUTA/NAFTA, CARICOM, PATCRA, CACM, MERCOSUR, ASEAN, and SPARTECA.

Now I obtain the estimating equation for each period, substituting Eq. (14) into Eq. (13):

$$\begin{aligned} \ln X_{ijkt} = & \ln(Y_i Y_{jt}) + (\sigma - 1)(1 - \rho_0)z_{it} + (1 - \sigma)\rho_1 z_{jt} - \sigma \ln p_{ikt} \\ & + (1 - \sigma) [\rho_2 \ln g_{ij} + \rho_3 B_{ij} + \rho_4 I_{ij} + \rho_5 R_{ijt} + \rho_6 S_{ijt} + \rho_7 D_{ijt}] \\ & + [(1 - \sigma)\alpha_{ijk} + (\sigma - 1) \ln \theta_{ikt} + \ln s_{ikt} - \ln \bar{y}_{ikt} \\ & + (\sigma - 1) \ln P_{jt}^k + (1 - \sigma)\mu_{ijkt}]. \end{aligned} \tag{15}$$

In this specification, log industrial directional imports mainly depend on trading countries' GDP (Y_i, Y_j), trading partners' democracy levels (z_i, z_j), the exporter's industrial f.o.b. price index ($\ln p_{ikt}$), and the importer's log aggregate industrial price index ($\ln P_{jt}^k$). In addition, industrial directional imports are also affected by several indicators of trade costs ($\ln g_{ij}, B_{ij}, I_{ij}, D_{ij}, R_{ijt}$, and S_{ijt}).

However, in Eq. (15), in addition to the unspecified border effects (μ_{ijkt}), the exporter's industrial output share (s_{ikt}) and representative firm's production (y_{ikt}) are unobservable. Equally importantly, the importer's aggregate industrial price index P_{jt}^k in specification (15) is also unobservable since it depends on the unobservable exporter's industrial varieties number N_{ikt} according to Eq. (5). Finally, data on exporter's industrial R&D expenditure (θ_{ikt}) are also unavailable.¹¹ Hence, these terms are absorbed into the error term e_{ijkt} , which is as follows:

$$\begin{aligned} e_{ijkt} = & (1 - \sigma)\alpha_{ijk} + (\sigma - 1) \ln \theta_{ikt} + \ln s_{ikt} - \ln \bar{y}_{ikt} + (\sigma - 1) \ln P_{jt}^k \\ & + (1 - \sigma)\mu_{ijkt}. \end{aligned}$$

Accordingly, I have the following specification for estimations:

$$\begin{aligned} \ln X_{ijkt} = & \beta_0 + \beta_1 z_{it} + \beta_2 z_{jt} + \beta_3 \ln Y_{it} + \beta_4 \ln Y_{jt} + \beta_5 \ln q_{it} + \beta_6 \ln q_{jt} \\ & + \beta_7 \ln p_{ikt} + \beta_8 \ln g_{ij} + \beta_9 B_{ij} + \beta_{10} I_{ij} + \beta_{11} R_{ijt} + \beta_{12} S_{ijt} \\ & + \beta_{13} D_{ijt} + e_{ijkt}. \end{aligned} \tag{16}$$

Note that here I do not restrict the coefficient of trading countries' GDP as a unit. Instead, the coefficients β_3 and β_4 are allowed to absorb the effects of trading partners' income on trade in a flexible manner. I also include trading partners' GDP per capita, $\ln q_{it}$ for exporters and $\ln q_{jt}$ for importers, as these are standard in the recent gravity trade literature. My main interests are the signs of the coefficients of trading countries' democracy β_1 and β_2 .

5. Data, econometrics, and results

5.1. Data

The regressand of Eq. (16) is the log industrial directional import of country j from country i . As compared to other trade openness measures (e.g., the sum of industrial imports and exports relative to a country's GDP), using directional imports has two significant advantages. First, it can clearly describe the direction of trade that specifies the source and destination countries. Accordingly, trade data are more disaggregated and the samples are much larger, which in turn can reduce the possible multicollinearity problem among regressors and avoid an aggregation bias (Wooldridge, 2002). Equally importantly, directional imports can avoid the so-called "silver medal

error" of gravity model estimations coined by Baldwin and Taglioni (2006): the gravity theory merely mentions that the gravity equation explains one-way trade flows (e.g., Chinese exports to the U.S.) rather than the two-way bilateral trade (e.g., Chinese exports to the U.S. and the U.S. exports to China). Accordingly, ignoring this difference can create serious estimation bias.

The trading countries' democracy levels, the key variables in Specification (16), are taken from the *Polity IV* data set by Marshall and Jaggers (2002), which is a widely accepted data set to measure world democratization. Specifically, *Polity IV* includes annual composite indicators measuring the institutionalized autocracy and institutionalized democracy for just about every independent entity with a population over 500,000. The political liberalization index is defined as the difference between the democracy indicator and the authoritarian indicator. Each indicator is an additive 11-point scale (0–10). Accordingly, the political liberalization index is scaled between –10 and 10, with –10 representing the lowest level of political liberalization.

All data used in the present paper are publicly available. The nominal directional import data comes from the NBER-UN Trade data maintained by Feenstra et al. (2005). Since such nominal data are recorded in American dollars, I deflate them by the American CPI (1995 = 100) to obtain the real value following Rose (2004). Instead of using national level aggregated data, I first use mostly disaggregated country-industry trade data to obtain overall industry-level estimates to see the overall effect of democratization on trade. More essentially, I sort industries into labor-intensive and capital-intensive categories and estimate separate regressions for each sample given that my model is in line with the idea of comparative advantage.¹² In particular, I obtain 880,006 observations for 157 countries during the years 1962–1998 by choosing SITC 1-digit level directional import data for regressions.

Information related to GDP, GDP per capita data (in constant US dollars), and various geographic factors between trading countries are directly adopted from Rose (2004). Unfortunately, data on exporters' price levels are unavailable at the industrial level. Therefore, I have to use each exporter's consumer price index (CPI) to measure the exporter i 's price level p_i , following Baier and Bergstrand (2001). Such data can be accessed from the World Development Indicator (World Bank, 2002) of the World Bank, which specifies the base year of the CPI as 1995. Finally, my instrumental variable, the infant mortality rate, is also available from the World Bank, 2002.¹³

Panel A of Table 1 presents descriptive statistics for each variable, while Panel B describes several key variables' simple correlations. As one can observe, an exporter's democracy has almost no correlation with the importer's democracy ($corr. = 0.01$). In addition, the trading countries' democracy variables are not highly correlated with any other gravity variables. This implies that multicollinearity is not a problem for the coefficient of interest.

5.2. Econometric methods

As mentioned above, data on global directional bilateral tariffs are unavailable. Their impact on trade is partially absorbed by importer's democracy in my estimates. More importantly, both exporter and importer's democratization variables still influence their institutional quality, which in turn affects trade. To see this, I first compare simple OLS estimations *without* and *with* democracy variables shown in Columns (1) and (2) of Table 2. All trade-cost variables are insensitive between these two regressions in terms of magnitudes and signs,

¹¹ As one referee pointed out, higher expenditure on R&D may now be absorbed in the democratization variables. However, the possible omitted variable bias is mostly controlled by the fixed effects estimation as specified in Section 5.2.1.

¹² A more careful scrutiny on sorting industries will be offered in Section 5.5. I thank a referee for suggesting this point.

¹³ According to the definition of WDI, the infant mortality rate is the number of infants dying before reaching one year of age, per 1000 live births in a given year.

Table 1
Descriptive statistics of variables.

Panel A: basic statistics					
Variable	Mean	Std. Dev.	Minimum	Maximum	
Log industrial directional imports	2.55	2.97	−4.67	13.81	
Log GDP of exporters	18.22	2.15	11.56	22.83	
Log GDP of importers	17.56	2.35	11.56	22.83	
Log GDP per capita of exporters	1.63	1.54	−2.49	3.86	
Log GDP per capita of importers	1.32	1.61	−2.57	3.86	
Exporters democracy index	3.58	7.61	−10	10	
Importers democracy index	2.14	7.91	−10	10	
Log consumer price index	2.55	3.91	−23.02	10.14	
Log distance	8.07	0.84	4.02	9.42	
Land border	0.03	0.17	0	1	
Number of islands	0.27	0.49	0	2	
Exporters institutional quality	7.12	2.38	0	10	
Importers institutional quality	6.64	2.45	0	10	
Exporters infant mortality rate	0.05	0.04	0.00	0.22	
Importers infant mortality rate	0.06	0.05	0.00	0.22	
Panel B: key simple correlations					
Variable	(1)	(2)	(3)	(4)	(5)
(1) Log industrial directional imports	1.00				
(2) Exporters democracy index	0.23	1.00			
(3) Importers democracy index	0.22	0.01	1.00		
(4) Exporters infant mortality rate	−0.30	−0.57	−0.03	1.00	
(5) Importers infant mortality rate	−0.31	−0.03	−0.59	0.11	1.00
Panel C: distribution of importer's democracy level by income					
	Low Income	Lower-middle Income	Upper-middle Income	High income Non-OECD	High income OECD
1% percentile	−9	−10	−10	−10	−9
10% percentile	−9	−9	−10	−10	8
25% percentile	−7	−7	−7	−8	10
Median	−7	−3	4	−2	10
75% percentile	−1	7	8	10	10
90% percentile	7	9	9	10	10
99% percentile	9	10	10	10	10
Std. Dev.	5.719	7.132	7.648	8.197	4.184
Variance	32.703	50.869	58.499	67.184	17.507
Skewness	1.129	.324	−.120	.007	−3.597
# of Obs.	242,426	231,729	207,595	83,610	400,030

which imply that democratization does not pick up the effects from these trade-cost variables.

To precisely estimate the gravity model, Anderson and van Wincoop (2003) emphasized the importance of controlling for “multilateral resistance” among trading partners, which measures the implicit price indexes in the gravity model.¹⁴ The regular OLS estimates may be biased once researchers ignore such trade resistance particularly when the data set is a panel. To control for multilateral resistance among the trading partners, studies such as Rose and van Wincoop (2001) recommend using country-pair specific fixed effects to control for other unobservable features *between* each pair of trading countries. I therefore adopt their approach to check whether the positive effects of democracy on trade are robust to different econometric techniques.

5.2.1. Country-pair specific fixed-effect estimates

As introduced above, different trading country pairs could have unobserved specific country characteristics. The fixed effects estimation is one good way to handle this problem (Rose and van Wincoop, 2001). That is, the error term e_{ijkt} in Eq. (16) is decomposed into a

country-pair random variable ϕ_{ij} , an industry-specific effect λ_k , a year-specific effect ω_t , and an idiosyncratic effect ε_{ijkt} with normal distribution: $\varepsilon_{ijkt} \sim N(0, s_{ijkt}^2)$. This is represented by the following:

$$e_{ijkt} = \phi_{ij} + \lambda_k + \omega_t + \varepsilon_{ijkt}. \quad (17)$$

Column (3) of Table 2 presents the fixed-effect estimation results. Observations in the sample are clustered across different periods by the trading countries' pairs. Accordingly, time-invariant variables such as geographical factors ($\ln g_{ij}$, B_{ij} , and I_{ij}) are automatically dropped. I also include industry-specific and year-specific fixed effects to control industry-varying and time-varying unobserved specific characteristics. The Hausman (1978) test strongly rejects the null hypothesis that the random effect specification is appropriate (p -value = 0.00). Put another way, the country-pair random variable, ϕ_{ij} , is correlated with other regressors. Thus, the fixed-effect estimation is appropriate for my specification.

The most interesting finding from the country-pair specific fixed-effect estimate is that trading partners' democracy level, z_i for exporters and z_j for importers, are positively associated with their directional imports at a conventional statistical level. An importer's democratization, overall, reduces trade barriers such as tariffs and hence increases trade flows. Similarly, an increase in exporters' democracy leads to an increase in bilateral trade flow due to the quality upgrading of trading goods from more high democratic regimes and trade costs reduction.

¹⁴ Note that the importer j 's aggregate industrial price index P_j^k includes the unobservable number of varieties N_j^k according to Eq. (5), which will be controlled by fixed effects estimates shortly.

Table 2
Fixed effects estimates for multilateral resistance.

Regressand:	OLS		FE	FE + IV	PPML
Log directional Imports ($\lg X_{ijk}$)	(1)	(2)	(3)	(4)	(5)
Exporters democracy (Z_i)	–	.010** (23.08)	.004** (7.00)	.035** (7.28)	.008** (447.18)
Importers democracy (Z_j)	–	.001** (3.03)	.006** (9.60)	.025** (5.98)	.006** (356.14)
Log GDP of exporters	.663** (415.61)	.689** (378.31)	1.423** (54.90)	1.472** (38.23)	.308** (422.43)
Log GDP of importers	.564** (379.61)	.601** (341.81)	1.026** (44.98)	.911** (27.69)	.357** (673.79)
Log GDP per capita of exporters	.007** (3.26)	–.028** (–11.93)	–.570** (–20.11)	–.678** (–14.91)	.858** (1030.16)
Log GDP per capita of importers	.050** (23.70)	.007** (3.03)	–.163** (–7.48)	–.068** (–2.09)	.594** (1113.95)
Log CPI	.054** (81.07)	.046** (64.99)	.012** (10.34)	.001 (.33)	.005** (166.56)
Log distance	–.639** (–188.52)	–.680** (–184.94)			–.695** (–8684.82)
Land border	.632** (46.38)	.545** (38.11)			.544** (3195.64)
Number of islands	.084** (16.28)	.178** (30.84)			.315** (67.80)
Regional trade agreements	.845** (56.23)	.709** (44.14)	.295** (13.30)	.269** (10.61)	.364** (2304.93)
GSP	.059** (11.70)	.058** (10.79)	–.050** (–4.83)	.006 (.40)	.076** (625.50)
Currency unions	1.194** (50.33)	1.128** (37.96)	.784** (14.38)	.636** (8.16)	.033** (44.86)
Country-pair-specific fixed effects	No	No	Yes	Yes	No
Year (and sector)-specific fixed effects	No	No	Yes	Yes	Yes
F-statistics of first stage (Z_i)				2,409.97 [‡]	
F-statistics of first stage (Z_j)				1,979.91 [‡]	
Anderson likelihood-ratio statistic				16,429.87 [‡]	
Cragg–Donald F-statistics				16,716.54 [‡]	
Anderson–Rubin χ^2 statistic				74.89 [‡]	
R ²	.37	.37	.63	.14	.68
Number of observations	1,018,978	880,006	880,006	485,495	880,006

Notes: The regressand for the Poisson Pseudo Maximum Likelihood (PPML) is X_{ijk} . In contrast, all other regressands are log industrial directional imports $\log(X_{ijk})$. Numbers in parentheses are *t*-value. **(*) Indicates significance at 1(5) percent level. [‡] Indicates *p*-value of the statistic is less than 0.01.

5.2.2. An alternative econometric approach

Recent studies carried out by Santos Silva and Teneyro (2006), Westerlund and Wilhelmsson (2006), and Helpman et al. (2007) have argued that the OLS estimates can cause serious bias due to zero trade volume across trading partners. The log-linearization of directional imports, the regressand in the fixed-effect estimations, may cause some bias since the entire portion of the data with zero trade is dropped. Santos Silva and Teneyro (2006) proposed a truncated Poisson pseudo-maximum likelihood (PPML) estimation to address the zero trade problem. I therefore perform the PPML estimation and report its results in Column (5) of Table 2 as well by adopting the industrial directional import X_{ijk} directly as the regressand. After controlling for country-pair specific fixed effects, the key democracy variables, z_i and z_j , are again shown to be significantly positive.

5.3. Endogeneity issues

As discussed in the last paragraph of Section 2 above, democracy may not be exogenously given but rather affected by international trade. International trade could dampen democracy in land-abundant and capital-scarce countries. When such countries are open to trade, land (labor)-owner elites who get benefits from globalization have a strong incentive to resist democratization. Hence, trade may have a negative “reverse causality” on democracy.

The endogeneity problem can be observed from Eq. (16): the democracy indexes, z_i and z_j , are correlated with the error term ($\text{cov}(z_{it}, e_{ijkt}) \neq 0, \text{cov}(z_{jt}, e_{ijkt}) \neq 0$) since such variables are included into importer j 's aggregate industrial price index P_j^k which is absorbed into

the error term. One needs to control for the endogeneity of democracy in order to obtain the accurate estimated effects of democracy on trade. Otherwise, the related estimates would be suspect. The instrumental variables (IV) estimation is a powerful econometric method to address this problem (Wooldridge, 2002). However, to the best of my knowledge, few previous studies perform such estimations since finding a good instrument for democracy is difficult.

I therefore address this potential challenge by adopting a country's infant mortality rate as the instrumental variable. As a widely-used health indicator, a country's infant mortality rate is highly correlated with its democracy level. In my samples, the simple correlation between infant mortality rate and democracy is -0.57 for exporters and -0.59 for importers, as shown in Panel B of Table 1.¹⁵ The idea behind this observation is that the probability that a country attains and sustains democracy increases with the level of economic development (Przeworski, 2005). The data also reveal that high-income countries usually have a low infant mortality rate. Put another way, the good health status is helpful to increase the probability of a democratic regime's sustainable existence (Govindaraj and Rannan-Eliya, 1994). Barro (1999) also found robust evidence to confirm that a country's infant mortality is indeed a determinant of its democracy. Equally importantly, it is exogenous to the democracy index: as presented in Marshall and Jagers (2002), the construction of the democracy index in the *Polity IV* does not include the infant mortality rate.

¹⁵ These are much higher than the correlations between infant mortality rates and trade.

To fully justify its validity of the instrumental variable, more specification tests should be reported as well. I first check the estimation results from the first stages of IV estimates: the coefficient of country-specific infant mortality rate is highly significant in each country-specific democracy regression. The F -statistics of the first stage estimates for z_1 and z_2 are also high enough to pass the F -test. All of these serve as solid preliminary evidence that the infant mortality rate is an appropriate instrument.

Furthermore, estimates in the second stage offer more supporting evidence for the instrument's validity. The infant mortality rate is a good instrument if it affects the regressand (*i.e.*, log industrial directional imports) through and only through the instrumented variable (*i.e.*, democracy). To justify this, I perform several useful tests as follows.

First, I perform Anderson's (1984) canonical correlation likelihood-ratio test to check whether or not the excluded instrument (*i.e.*, country-specific infant mortality rate) is correlated with the endogenous regressor. The null hypothesis that the model is under-identified is rejected at the 1% level. Second, I check whether or not country-specific infant mortality rate is weakly correlated with its democracy. If so, then the estimates will perform poorly in this IV estimation. The Cragg and Donald (1993) F -statistics provide strong evidence to reject the null hypothesis that the first stage is weakly identified at a highly significant level. Third, the Anderson and Rubin (1949) χ^2 statistic rejects the null hypothesis that the coefficients of the endogenous regressors jointly equal zero. In short, such various statistical tests provide sufficient confidence that the instruments perform well, and therefore, that the specification is justified.

In Table 2, I report the country-pair specific fixed-effect IV estimates in Columns (4). Various statistical tests strongly supported the notion that country-specific infant mortality rate is an appropriate instrument for its democracy index. Both trading countries' democracies, again, lead to an increase in bilateral trade, respectively. ($\hat{\beta}_1^{FE+IV} = 0.035$; $\hat{\beta}_2^{FE+IV} = 0.025$).

5.4. Economic interpretation

Turning to the economic meaning of the estimated coefficients, we observe that the coefficients on trading countries' democracy are significantly positive. In particular, my estimates in Column (4) of Table 2 show that a one-scale increase in the importer's democracy leads to around a 3.5 percentage point increase in log directional imports. Analogously, the coefficient of the importer's democracy suggests that the semi-elasticity of the importer's democracy on trade is about 2.5 units.

Equally importantly, after controlling for the endogeneity of democracy, the effects of democracy on trade are amplified relative to the estimates obtained from the fixed-effect OLS. This finding is consistent with some previous works including Yu's (2007), which finds that democracy fosters trade whereas trade makes countries less democratic. In the fixed-effect OLS regressions, the positive effects of democracy on trade are under-estimated since they are undercut by the negative effects of trade on democracy. With the fixed-effect IV estimates, the accurate magnitudes are hence explicit after controlling for the endogeneity.

One interesting finding is that once the democracy indices are included (in Column (2) of Table 2), the signs and magnitudes of the coefficients of GDP per capita for both trading partners change dramatically. This observation is clearer once I control for the multilateral resistance and endogeneity. As shown in Columns (3) and (4) of Table 2, the coefficients of country-specific GDP per capita are significantly negatively associated with trade for the two fixed-effect estimates.¹⁶ At first glance, it is in sharp contrast to many other

studies in the literatures including Frankel et al. (1998) which find a positive effect of per capita income on trade. However, this is simply because the exclusion of institutional quality biased the typical gravity models (Anderson and Marcouiller, 2002). When the democracy variables, indicators of institutional quality, are dropped from regressions, part of the positive effect of democracy on trade is mis-attributed to per capita income.

Aside from this, the coefficients of exporters' and importers' GDP are positive and highly significant in all estimations shown in Table 2. These make good economic sense: all else equal, larger countries trade more, which is suggested by the standard gravity literature. As shown in Column (5) of Table 2, all geographic factors are economically and statistically significant. Regional trade agreements also help to increase trade flows ($\hat{\beta}_{11} = 0.36$). Countries that belong to a common currency union trade more ($\hat{\beta}_{13} = 0.03$). All of these results are consistent with previous related studies like Rose (2004).

My final step is to offer a more intuitive economic interpretation for these two key variables. To do so, I then aggregate all industrial data to the national level to examine the effect of democracy on directional trade at the country level. The aggregated estimation results are reported in Column (4) of Table 4. Comparing the data in 1962 with those in 1998, the world average exporter's democracy index increased by 1.31 points, which predicts around 4.7% of the bilateral trade growth since $1.31 \times 0.036 = 4.7\%$ given $\hat{\beta}_1 = 0.036$ in the country-pair-specific fixed-effect estimates. This contributes 0.9% to the 534% increase in bilateral trade during this period. Similarly, given that the average importer's level of democratization increased by about 2.61 points, it then explains 14.4% of the growth in bilateral trade, *ceteris paribus*, since $2.61 \times 0.055 = 14.4\%$.¹⁷ It contributes 2.7% to the bilateral trade as well. Adding up these two numbers, democracy, overall, contributes about 3.6% to bilateral trade growth.

Thus, all my results are robust using various econometric methods. Since the impact of democracy on trade is economically and statistically significant, I can safely conclude that global democratization fosters world trade.

5.5. Further sectoral estimates¹⁸

As introduced in Section 2, democratization from the importer's side leads to more labor-friendly trade policies. Democratization transfers power from non-elected elites to labor. Therefore, in developing countries, democratization benefits labor-intensive industries, leading to a reduction in tariffs on capital-intensive products there, thus fostering capital-intensive imports into those countries. In contrast, in developed countries, labor-intensive industries will seek for trade protection, and thus discourage labor-intensive imports.

To shed light on this point, I perform separate regressions for different industries and different income groups in line with the idea of comparative advantage. In particular, I sort all industries in the sample into two categories, namely labor-intensive industries and capital-intensive industries, and estimate them separately. Because it is technically challenging to find an exact cut-off line for labor-intensive and capital-intensive industries, I use only clear candidates for labor-intensive and capital-intensive products and drop hard-to-decide cases. The clear candidates for labor-intensive goods include five light-manufacturing industries whereas those for capital-

¹⁷ The average level of importers' democratization is different from that of exporters' democratization due to the directional import data adopted here. Sometimes I have trade data from country A to country B but no trade data from country B to country A, due to rounded-down accounting of the trade volume or data missing.

¹⁸ I am most grateful to a referee for her/his insightful suggestions on this subsection.

¹⁶ Note that the coefficients of per capita income are positive in the PPML estimate in Table 2 due, in large part, to its lack of controlling for endogeneity problem.

Table 3
Effects of democratization on industrial bilateral trade.

Regressand:	Capital-intensive imports			Labor-intensive imports		
	From DCs to LDCs			From LDCs to DCs		
	OLS	FE	FE+IV	OLS	FE	IV
Log directional imports	(1)	(2)	(3)	(4)	(5)	(6)
Exporters democracy (Z_i)	-.000 (-.30)	.009** (3.18)	.038** (6.40)	.039** (26.36)	-.002 (-1.05)	.388** (27.18)
Importers democracy (Z_j)	.009** (19.92)	.004* (1.66)	.229** (11.45)	-.032** (-16.20)	-.004 (-1.43)	-.090** (-7.36)
Log GDP of exporters	.950** (374.06)	1.363** (5.48)	1.960** (17.32)	.841** (119.68)	1.987** (14.29)	.512** (29.29)
Log GDP of importers	.694** (322.67)	.568** (3.09)	2.535** (12.34)	.564** (74.19)	-.659** (-5.86)	.517 (28.48)
Log GDP Per Capita of exporters	-.189** (-19.39)	.111 (.39)	-.585** (-4.22)	-.069** (-6.57)	-1.472** (-11.06)	-.211** (-10.35)
Log GDP per capita of importers	.038** (11.12)	.742** (4.23)	-1.059** (-5.58)	.254** (10.30)	.462** (4.61)	-.513** (-6.78)
Log CPI	.156** (37.48)	.104** (5.18)	.064** (5.98)	.107** (51.44)	-.009** (-2.53)	.008 (1.42)
Log distance	-.873** (-159.52)			-.696** (-47.08)		-.836** (-31.43)
Land border	-.096** (-2.36)			.178** (2.29)		.734** (5.35)
Number islands	.207** (28.87)			.137** (6.64)		-.374** (-7.97)
Regional trade agreements	2.248** (57.13)	.023 (.10)	.543** (4.31)	1.645** (13.00)	.282* (1.74)	.540* (1.80)
GSP	.084** (11.12)	-.049 (-1.15)	.147** (4.53)	.481** (20.76)	-.057* (-1.65)	1.348** (20.48)
Currency unions	1.695** (37.81)	.678** (6.08)	.297** (2.69)	2.945** (8.52)	.637** (3.40)	-.773** (-2.58)
Country-pair-specific fixed effects	No	Yes	Yes	No	Yes	No
Year-specific fixed effects	No	Yes	Yes	No	Yes	No
F-statistics of first stage (Z_i)			11295.60 [‡]			894.12 [‡]
F-statistics of first stage (Z_j)			3165.93 [‡]			1921.05 [‡]
Anderson likelihood-ratio statistic			6222.09 [‡]			1182.52 [‡]
Cragg-Donald F-statistics			6330.67 [‡]			1204.27 [‡]
Anderson-Rubin χ^2 statistic			356.22 [‡]			1664.89 [‡]
R ²	.46	.38	.32	.34	.27	.15
Number of observations	373,250	373,250	180,359	63,972	63,972	32,541

Notes: Numbers in parentheses are *t*-value. **(*)Indicates significance at 1(5) percent level. [‡]Indicates *p*-value of the statistic is less than 0.01.

intensive goods include twelve heavy-manufacturing industries at the SITC 2-digit level.¹⁹

Table 3 reports the estimation results for the effect of democratization on industrial bilateral trade. Columns (1)–(3) demonstrate the effects of democratization in LDCs on capital-intensive imports from DCs.²⁰ The OLS estimation results suggest that the more democratic a poor country is, the more capital-intensive imports it will have from rich countries, which is consistent with the story of comparative advantage introduced before. After controlling for the two-way fixed effects, the estimate in Column (2) also confirms the benchmark finding in Column (1). In Column (3), I perform a more rigorous estimation controlling for the endogeneity of importer democracy as well as for fixed effects. The significantly positive coefficient on

importer democracy suggests once more that democratization benefits labor-intensive industries in developing countries.

Turning to the effects of democratization in DCs on labor-intensive imports from LDCs, the benchmark OLS estimates shown in Column (4) of Table 3 suggest a significantly negative effect of importer's democratization on labor-intensive imports from LDCs. The two-way fixed effects estimations in Column (5) also yield a negative sign, though insignificant, for the coefficient on importers' democracy index. The insignificance of the coefficient is not surprising since, as shown in Panel C of Table 1, most of the DCs in the sample have stable, highly democratic governments, which renders fixed-effect estimations meaningless, since all of the time-invariance observations will be automatically dropped. To ameliorate this problem, I run the IV estimates without fixed effects in Column (6) and find that the coefficient on the importer democracy proxy turns out to be significantly negative. Therefore, all the findings here are broadly consistent with the story of comparative advantage presented above.

In addition, the effects of democratization from exporting LDCs on labor-intensive imports to DCs are expected to be positive for two reasons. First, democratization in LDCs benefits labor-intensive sectors which in turn encourages labor-intensive exports to DCs. Second, democracy in exporting LDCs fosters labor-intensive exports by improving product quality through the improvement in the quality of other institutions. In Column (4) of Table 3, the OLS benchmark estimate suggests that democratization from exporting LDCs is significantly positively associated with the labor-intensive imports to DCs. Turning to the fixed-effect estimations in Column (5), the unexpected (but

¹⁹ In particular, the labor-intensive industries at the SITC 2-digit level are leather manufactures and dressed fur skins (code: 61), rubber manufacturing (62), cork and wood manufactures other than furniture (63), paper and paperboard (64), and textile yarn and fabrics (65). The capital-intensive industries at the SITC 2-digit level include iron and steel (67), nonferrous metals (68), manufactures of metals (69), power generating machinery and equipment (71), machinery specialized for particular industries (72), metalworking machinery (73), general industrial machinery and equipment (74), office machine (75), telecommunication and equipment (76), electrical machinery (77), road vehicles (78), and transport equipment (79). Of course, not all of the selections of labor intensive industries above are labor intensive in some developed countries. However, dropping one or several listed categories in the estimation does not substantially change the results in Table 3.

²⁰ As introduced before, the LDCs include countries with low income, lower middle income, and upper middle income. In contrast, the DCs include high income non-OECD and high income OECD countries.

Table 4
Additional robustness checks.

Regressand:	FE		FE + IV			
	(1)	(2)	(3)	(4)	(5)	(6)
Log directional imports						
Exporters democracy (Z_i)	–	–.000 (–.14)	.120** (7.00)	.036** (5.24)	.035** (7.12)	.040** (7.30)
Importers democracy (Z_j)	–	.004** (3.48)	–.007 (–.62)	.055** (9.99)	.022** (5.54)	.030** (6.20)
$Z_i \times Z_j$	–	–	–	–	–	–.001** (– 6.75)
Exporters institutional quality	.060** (12.59)	.063** (12.31)	.010 (.95)	–	–	–
Importers institutional quality	–.008* (– 1.84)	–.007 (– 1.55)	.003 (.36)	–	–	–
Log GDP of exporters	1.057** (14.77)	1.110** (14.41)	.762** (6.64)	1.140** (25.35)	1.529** (38.21)	1.454** (38.07)
Log GDP of importers	.407** (25.90)	.285** (4.28)	.383** (4.14)	1.274** (30.83)	.836** (23.43)	.767** (19.69)
Log GDP per capita of exporters	–.435** (– 5.87)	–.524** (– 6.49)	–.196 (– 1.56)	.346** (7.04)	–.769** (– 16.40)	–.707** (– 15.99)
Log GDP per capita of importers	.551** (29.37)	.648** (10.29)	.503** (5.28)	.057 (1.42)	–.001 (.04)	.063* (1.69)
Log CPI	–.000 (–.03)	–.002 (–.74)	–.021** (– 4.79)	.038** (5.32)	.001 (.47)	.001 (.53)
Regional trade agreements (RTA)	.317** (15.40)	.197** (5.95)	.243** (6.07)	.395** (10.15)	–.070 (–.74)	–.089 (–.94)
RTA $\times Z_j$	–	–	–	–	.036** (3.64)	.039** (3.96)
GSP	–.057** (– 6.96)	.042 (.76)	.056 (.52)	.001 (.08)	.073** (3.74)	.067** (3.53)
GSP $\times Z_j$	–	–	–	–	–.019** (– 7.52)	–.016** (– 6.71)
Currency unions	–.009 (–.11)	.316 (1.17)	.071 (.15)	.562** (4.67)	.633** (8.03)	.647** (8.23)
R^2	.49	.50	.52	.25	.12	.12
Number of observations	382,782	337,778	205,444	88,518	485,495	485,495

Notes: Numbers in parentheses are *t*-value. **(*) Indicates significance at 1 (5) percent level. All columns include the country-pair specific and year-specific fixed effects. Observations in Column (4) are at the aggregated level.

insignificant) sign of the coefficient on exporter democracy, again, is due to the time-invariant observation of democratization in most developed countries. After controlling for the endogeneity, the IV estimate in Column (6) confirms that the more democratic a developing country is, the more its exports to developed countries will be labor-intensive.

In contrast, as shown in Columns (1)–(3) of Table 3, the more democratic a developed country is, the more its exports to less-developed countries will be capital-intensive. The economic rationale is as follows. Although democratization in DCs benefits workers, which in turn discourages capital-intensive exports to LDCs, democratization in DCs still encourages capital-intensive exports to LDCs by improving product quality. The estimation results in Columns (2)–(3) clearly suggest that the positive effect *dominates* the negative effect of the democratization in DCs on the capital-intensive exports to LDCs.

In short, all sectoral estimation results in Table 3 suggest that the effects of democratization on industrial trade are consistent with the idea of comparative advantage as introduced in the beginning of the paper.

5.6. Additional estimations with institutional quality

As recognized by previous studies such as by Levchenko (2007), high institutional quality, including solid maintenance of the rule of law, reliable contract enforcement, and better protection of property rights, can reduce the risks of the lack of fulfillment of the terms of contract for both international trading partners, which in turn foster trade.²¹

²¹ When dealing with a business partner in an undemocratic country, for example, one might be more inclined to require costly letters of credit at international banks in advance, which merely serves as an added trade cost.

Democracy can also make institutions and the rule of law more stable, which could also help trade (Rigobon and Rodrik, 2004).

Data from 1982 to 1997 also reveals that democracy and institutional quality tend to move in the same direction. Measured by the annual composite index of corruption in the government, rule of law, and bureaucratic quality from *International Country Risk Guide* (ICRG) constructed by Knack (1999),²² average global institutional quality has registered an 18.9% increase. During this same period, average global democracy also increased by 17.3%. In general, countries that experienced high institutional quality improvement and high-speed trade growth also enjoyed fast democratization. The simple correlation between democracy and institutional quality is also considerably high (*corr.* = 0.56). Hence, it is not surprising that institutional quality is found to be positively associated with trade, as demonstrated Anderson and Marcouiller (2002), Rodrik et al. (2004), and Berkowitz et al. (2006), given that democracy can foster trade.

Thus far, the empirical evidence presented above suggests that, on average, democracy fosters trade. However, without considering institutional quality, one has no idea about the additional explanatory power of democracy. Therefore, it should be a plus to identify the “residual” effect of democracy variables after controlling for pre-established channels of institutional quality.

²² The institutional quality index in the ICRG database covers 135 countries over the years 1982–1997. It is a composite indicator which covers corruption, the rule of law, and bureaucratic quality. Each of these three indices ranges in value from 0–6, with higher values indicating “better” ratings, e.g., less corruption, stronger rule of law, and less bureaucratic. Knack (1999) used an 18-point index of the “institutional quality” created by taking the simple sum of these three indices. Here I convert this 18-point index to a 10-point index (multiplying them by 5/9 and without taking logs) for estimation. The basic statistical information of this index can be found from Panel A of Table 1.

Table 4 includes institutional quality as additional regressors in the estimations. I first exclude the two democracy variables to see the effect of institutional quality on trade. The country-pair-specific fixed-effect estimate shown in Column (1) suggests that the institutional quality of an exporter increases trade whereas that of an importer decreases trade. The negative sign from importers, to some extent, suggests that democratization and its associated stronger institutional quality in the importing country improves its product quality, which in turn makes it more difficult for other countries to penetrate the market.

I then include the democracy variables in Columns (2) and (3) to perform fixed-effect estimations. In Column (2), after controlling for institutional quality, the impact of exporter's democratization on trade is negative but insignificant. I suspect that this is because of the endogeneity of democracy. I then perform the IV fixed-effect estimates to control for the endogeneity. As reported in Column (3), aside from the expected positive (though insignificant) signs of institutional quality, exporter's democracy is shown to be significantly positive. Compared to results without controlling for institutional quality, as shown in Column (4) of Table 2, its magnitude is relatively large. Yet, this is just because that my specification here is only post-1982, given data availability on institutional quality. In other words, the multilateral resistance in my specifications may be sensitive with a long time span with four decades (i.e., 1962–1998). I therefore address this concern now.

5.7. Additional robustness checks

To precisely estimate the gravity equation, it is important to control for the multilateral resistance effects involved in the gravity model, which is already controlled for by both country-pair specific and year-specific fixed effects. However, one might still worry that multilateral resistance could converge (or diverge) over the four-decade period of the panel. To address this concern, I therefore divide my full samples into four sub-samples to re-run decadal regressions.

Table 5 reports the exporters and importers' pooled OLS, fixed-effect OLS, IV, and PPML estimates.²³ I chose 1972 as the first cut-off year since democracy index reverses its trend before and after 1972 as described in Fig. 1: In the 1960s, international trade kept increasing whereas democracy was declining due, in large part, to the military coups (Huntington, 1991). After controlling for endogeneity, the fixed-effect IV estimates show that before 1972 the influence of democracy on trade is still positive, although the coefficient of exporter's democracy is insignificant.

Turning to other decadal estimates, those from the last two decades have similar findings with estimation results reported in Table 2. After controlling for the endogeneity of democracy and multilateral resistance, trading partners' democratization has a positive, though insignificant, effect on bilateral trade. One exception is the estimates from the period 1973–1979. Without controlling for the endogeneity, it is shown that the more democratic a country is, the more it will export and the less it will import. The negative impact of democracy on imports suggests that the increased democratization in the importing country improves their products' quality, which in turn makes it harder for the exporter to export high-quality products to this country. Such an effect even dominates the one from importer's trade liberalization due to its own democratization.²⁴ When controlling for endogeneity, both the importer and exporter's influences on trade turned out to be insignificant, which suggest that the reverse causality of trade on democracy is severe during this period.

One might also worry about the interaction effect of trading partners' democracy levels. The simple correlation reported in Panel B

Table 5
Decadal fixed-effect estimates for multilateral resistance.

Regressand:	OLS	FE	FE + IV	PPML
Log directional imports	$\log(X_{ijk})$	$\log(X_{ijk})$	$\log(X_{ijk})$	$X_{ijk} > 0$
<i>Period 1962–1972</i>				
Exporters democracy (Z_i)	.025** (24.69)	.005** (1.67)	.006 (.21)	.002** (16.99)
Importers democracy (Z_j)	.022** (22.47)	.003 (1.16)	.064* (1.89)	.007** (76.11)
R^2	.31	.27	.01	.64
Number of observations	172,182	172,182	86,797	172,182
<i>Period 1973–1979</i>				
Exporters democracy (Z_i)	.009** (9.62)	.005* (2.34)	.003 (.10)	.006** (116.26)
Importers democracy (Z_j)	-.008** (-8.77)	-.006** (-2.49)	-.027 (-.68)	-.009** (-159.59)
R^2	.33	.29	.26	.67
Number of observations	174,627	174,627	74,031	174,627
<i>Period 1980–1989</i>				
Exporters democracy (Z_i)	-.007** (-10.83)	.002 (1.27)	.058 (1.45)	.003** (72.59)
Importers democracy (Z_j)	-.010** (-17.83)	-.002 (-1.10)	.017 (.62)	-.001** (-18.46)
R^2	.38	.18	.02	.68
Number of observations	299,713	299,713	183,160	299,713
<i>Period 1990–1998</i>				
Exporters democracy (Z_i)	-.006** (-8.47)	.003* (1.77)	.042 (1.25)	.002** (64.48)
Importers democracy (Z_j)	-.009 (-15.99)	.000 (.04)	.024 (.89)	-.001** (-22.19)
R^2	.38	.05	.01	.68
Number of observations	277,322	277,322	177,293	277,322
Country-pair-specific fixed effects	No	Yes	Yes	No
Year-specific fixed effects	No	Yes	Yes	Yes

Notes: The regressand for the Poisson Pseudo Maximum Likelihood (PPML) is x_{ijk} . In contrast, all other regressands are log industrial directional imports $\log(X_{ijk})$. Numbers in parentheses are $t(z)$ -value. **(*)Indicates significance at 1(5) percent level. ‡Indicates p-value of the coefficient is less than 0.01.

of Table 1 suggests that they could be mutually exclusive. This is confirmed again by the exercise of including the interaction term of both countries' democracy levels into the estimations. I find that the coefficients of such an interaction term are highly close to nil, as shown in Column (6) of Table 4. Finally, it is worthwhile to include two interaction terms between preferential trade agreements (regional trade agreements and GSP, respectively) and importer's democracy into regressions to check whether the main coefficients of trading countries' democracy β_1 and β_2 are sensitive. As reported in last two columns of Table 4, the coefficients of trading partners' democracy are close to those in Column (4) of Table 2. In any case, my previous findings of the effect of democracy on trade are robust.

6. Concluding remarks

Democratization could affect trade in multiple ways. In this paper I estimate an augmented gravity equation with democracy based on a theoretical framework. I find robust evidence that democratization significantly increases trade. After controlling for the endogeneity of democracy, democratization contributes 3–4% overall to bilateral trade growth.

To the best of my knowledge, the present paper is the first one to include democracy in a theoretically-grounded gravity equation. Importer's democracy promotes trade via the removal of trade barriers. Simultaneously, a highly democratic country will be a favorable exporter in international trade due to better product quality and trust in trading. Hence, I am able to estimate the structural parameters based on a theoretical framework to investigate the impact of democratization on trade.

²³ In each decadal estimate, coefficients of trade-costs variables are not substantially different. To save space, I do not report them here, but they are available upon request.
²⁴ I thank a referee for suggesting this point.

My main findings are consistent with previous work and, more importantly, take a step forward in understanding the endogenous nexus between trade globalization and democratization. Previous works recognize that democracy fosters trade but find that trade has no impact on (or even dampens) democracy (Eichengreen and Leblang, 2008; Yu, 2007). In this paper I adopt appropriate instruments to control for potential reverse endogeneity directly. The instruments in both aggregated and disaggregated specifications performed well. Finally, I provide further empirical evidences by sector, by income, and by shorter time periods.

The paper also enriches the trade literature that analyzes trade growth. By examining the bilateral trade flows among 16 OECD countries, Baier and Bergstrand (2001, pp. 23) found that *approximately 67–69% of this (trade) growth could be explained by real GDP growth, 23–26% by tariff-rate reductions and preferential trade agreements, 8–9% by transport-cost declines, and virtually none by real GDP convergence.* In this study, I go further to identify that trading countries' democracies account for a total of 3–4% of trade flows within the 23–26% induced by trade liberalization and preferential trade agreements.

References

- Acemoglu, Daron, Robinson, James A., 2006. *Economic Origin of Dictatorship and Democracy*. Cambridge University Press.
- Anderson, James, 1979. A theoretical foundation for the gravity equation. *American Economic Review* 75 (1), 178–190.
- Anderson, T.W., 1984. *Introduction to Multivariate Statistical Analysis*, 2nd ed. John Wiley & Sons, New York.
- Anderson, T.W., Rubin, H., 1949. Estimation of the parameters of a single equation in a complete system of stochastic equations. *Annals of Mathematical Statistics* 20, 46–63.
- Anderson, James, Marcouiller, Douglas, 2002. Insecurity and the pattern of trade: an empirical investigation. *Review of Economics and Statistics* 84 (2), 342–352.
- Anderson, James, van Wincoop, Eric, 2003. Gravity with Gravitas: a solution to the border puzzle. *American Economic Review* 93 (1), 170–192.
- Anderson, Simon P., de Palma, Andre, Thisse, Jacques-Francois, 1989. Demand for differentiated products, discrete choice models, and the characteristics approach. *Review of Economic Studies* 56, 21–35.
- Baier, Scott L., Bergstrand, Jeffrey H., 2001. The growth of world trade: tariffs, transport costs, and income similarity. *Journal of International Economics* 53, 1–27.
- Baldwin, Richard, Taglioni, Daria, 2006. Gravity for dummies and dummies for gravity equations. NBER Working Papers, No. 12516.
- Barro, Robert J., 1996. Democracy and growth. *Journal of Economic Growth* 1 (1), 1–27.
- Barro, Robert J., 1999. Determinants of democracy. *Journal of Political Economy* 107 (S6), S158–S183.
- Berkowitz, Daniel, Moenius, Johannes, Pistor, Katharina, 2006. Trade, law, and product complexity. *Review of Economics and Statistics* 88 (2), 345–352.
- Clarke, George, 2001. How institutional quality and economic factors impact technological deepening in developing countries. *Journal of International Development* 13, 1097–1118.
- Cragg, J.G., Donald, S.G., 1993. Testing identifiability and specification in instrumental variables models. *Econometric Theory* 9, 222–240.
- Eichengreen, Barry, Leblang, David, 2008. Democracy and globalization. *Economics and Politics* 20 (3), 289–334.
- Feenstra, Robert C., 2003. *Advanced International Trade: Theory and Evidence*. Princeton University Press.
- Feenstra, Robert C., Lipsey, Robert E., Deng, Haiyan, Ma, Alyson, Mo, Hengyong, 2005. *World Trade Flow: 1962–2000*. NBER Working Papers, No. 11040.
- Fidrumc, Jan, 2003. Economic reform, democracy and growth during post-communist transition. *European Journal of Political Economy* 19 (3), 583–604.
- Frankel, Jeffrey, Stein, Ernesto, Wei, Shang-jin, 1998. Continental trading blocs: are they natural or supernatural? In: Frankel, Jeffrey A. (Ed.), *The Regionalization of the World Economy*. University of Chicago for the NBER, Chicago, pp. 91–113.
- Giavazzi, Francesco, Tabellini, Guido, 2005. Economic and political liberalizations. *Journal of Monetary Economics* 52, 1297–1340.
- Govindaraj, Ramesh and Rannan-Eliya, Ravindra (1994), "Democracy, Communism and Health Status: A Cross-National Study," Harvard University, School of Public Health, Data for Decision Making Project Working Papers, No. 7(2).
- Grofman, Bernard and Gray, Mark (2000), *Geopolitical Influences on Trade Openness in Thirty-One Long-Term Democracies, 1960–1995*, Unpublished Paper, University of California, Irvine.
- Hausman, Jerry A., 1978. Specification tests in econometrics. *Econometrica* 46, 1251–1271.
- Helpman, Elhanan, Melitz, Marc, Rubinstein, Yona, 2007. Estimating trade flows: trading partners and trading volumes. NBER Working Papers, No. 12927.
- Huntington, Samuel P., 1991. *The Third Wave: Democratization in the Late Twentieth Century*. University of Oklahoma Press, Norman.
- Lin, Justin Yifu, 2003. Development strategy, viability, and economic convergence. *Economic Development and Cultural Change* 51 (2), 277–308.
- Lipset, Seymour Martin, 1960. *Political Man—the Social Bases of Politics*. Doubleday & Company, Garden City.
- Levchenko, Andrei A., 2007. Institutional quality and international trade. *Review of Economic Studies* 74, 791–819.
- Knack, Stephen, 1999. Aid dependence and the quality of government. IRIS Center Working Paper. In University of Maryland.
- Krugman, Paul R., 1979. Increasing returns, monopolistic competition, and international trade. *Journal of International Economics* 9, 469–479.
- Marshall, Monty G., Jagers, Keith, 2002. Polity IV Project. (data set available at <http://www.cidcm.umd.edu/inscr/polity>).
- Milner, Helen, Kubota, Keiko, 2005. Why the move to free trade? Democracy and trade policy in the LDC. *International Organization* 59 (1), 157–193.
- O'Rourke, Kevin, Taylor, Alan M., 2006. Democracy and protectionism in the nineteenth century. NBER Working Papers, No. 12250.
- Papaioannou, Elias, Siourounis, Gregorios, 2008. Economic and social factors driving the third wave of democratization. *Journal of Comparative Economics* 36, 365–387.
- Przeworski, Adam, 2005. Democracy as an equilibrium. *Public Choice* 123 (3), 253–273.
- Quinn, Dennis (2001), *Democracy and International Financial Liberalization*, Unpublished Paper, Georgetown University.
- Rigobon, Roberto, Rodrik, Dani, 2004. Rule of law, democracy, openness, and income: estimating the interrelationships. NBER Working Papers, No. 10750.
- Rodrik, Dani, 2000. Institutions for high-quality growth: what they are and how to acquire them. CEPR Discussion Paper, No. 2370.
- Rodrik, Dani, Arvind, Subramanian, Trebbi, Francesco, 2004. Institutions rule: the primacy of institutions over geography and integration in economic development. *Journal of Economic Growth* 9 (2), 131–165.
- Rose, Andrew K., 2004. Do we really know that the WTO increases trade? *American Economic Review* 94 (1), 98–114.
- Rose, Andrew K., van Wincoop, Eric, 2001. National money as a barrier to international trade: the real case for currency union. *American Economic Review* 91 (2), 385–390.
- Samuelson, Paul, 1952. The transfer problem and transport costs: the terms of trade when impediments are absent. *Economic Journal* 62, 278–304.
- Silva, J.M.C. Santos, Tenreiro, Silvana, 2006. The Log of Gravity. *Review of Economics and Statistics* 88 (4), 641–658.
- Westerlund, Joakim, Wilhelmsson, Fredrik, 2006. "Estimating the Gravity Model without Gravity using Panel Data. (available via <http://www.nek.lu.se/NEKJWE/papers/poisson.pdf>).
- Wooldridge, Jeffrey M., 2002. *Econometric Analysis of Cross Section and Panel Data*. MIT Press.
- World Bank, 2002. *World Development Indicator (WDI) CD-Rom*.
- Yu, Miaojie (2007), *Trade Globalization and Political Liberalization: A Gravity Approach*, TIGER Working Papers, No. 104, available via <http://www.tiger.edu.pl/publikacje/twpono104.pdf>.