

Trade, Democracy and the Gravity Equation

Miaojie Yu¹

School of Economics and Finance

University of Hong Kong

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China Center for Economic Research

Peking University, China

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[Abstract]

Democracy has scale and selection effects on trade. Importer's democratization could change various trade barriers and hence affects trade flow (scale effect). Simultaneously, a democratic country would become a favorable exporter due to mutual ideological recognition and other concerns (selection effect). Thus, the net effect of democratization on trade remains an empirical issue. We present a theoretical gravity model with democracy. Using a rich panel dataset and clearly controlling for the endogeneity of democracy, we find robust empirical evidence that democracy fosters trade significantly. Overall, democratization accounts for 3% growing trade via scale effect and 8% via selection effect, *ceteris paribus*.

Keywords: Trade, Democracy, Gravity Equation, Transportation Costs

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¹ Corresponding address: Room 908, K.K. Leung Building, School of Economics and Finance, University of Hong Kong, Hong Kong. Tel: (+852)2857-8501. Email: mjyu@econ.hku.hk.

As Rodrik (1995) pointed out, “Theoretical and empirical work relating institutional contexts to trade policy outcomes is in its infancy but should be a promising area of research”. Relatively little research has concentrated effects of democratization on trade globalization—one of the most intriguing topics on international political economy. Over the last four decades trade has grown dramatically. As shown in Figure 1, the average bilateral log export increased from 14.37 in 1962 to 16.66 in 1998, which increases around 16%. Simultaneously, global political liberalization emerges during this period. The average democracy index increased from 4.53 in 1962 to 5.93 in 1998 according to reports from *Polity IV*—a widely accepted database on democracy. Thus, a question raised from such phenomenon is: does global democratization foster trade? More specifically, can importer’s democratization promote trade? Analogously, can exporter’s democratization encourage trade?

The effect of importer’s democratization on bilateral trade is ambiguous theoretically. Clearly, importer’s democracy could foster trade flow, which we call a positive “scale effect”. Such a positive effect emerges for at least two reasons. First, democracy guarantees the protection and enforcement of intellectual property rights in importing country. International trade and hence economic growth increases due to low uncertainty (Rodrik, 2000). Second, importer’s political liberalization restricts the ability of a government to use strategic trade policies in labor-abundant countries, such as a variety of trade barriers to earn political support (Milner and Kubota, 2005). As a consequence, politicians in labor abundant countries could foster trade liberalization and hence increase trade flow.

In contrast, democratization has a negative scale effect on trade too. The reasons that importer's democracy could discourage trade include: First, democratic countries typically enforce excessive redistribution programs, which could lower economic growth and then harm trade (Barro, 1996). Second, democratization implies transferring power from non-elected elites to the wider population group, most of whom will be workers. According to the Heckscher-Ohlin-Stolper-Samuelson theorem, O'Rourke and Taylor (2006) suggest that democratization would lead to more protectionism in capital-abundant countries in which workers will benefit from various high trade barriers. As a consequence, trade shrinks in those countries. Last but not least, the lengthy legal process may deter the process of trade liberalization. Such a phenomenon happens often in reality. One good example was whether the U.S. should grant China permanent normal trade relation in the year 2000. The debate wasted a lot of time and created "trade war" between the two countries though the U.S. Congress eventually passed the bill.

In addition, democratization could also have a "selection effect" on trade. A country would prefer to import goods from countries with high level democracy for two reasons: First, countries with high democracy level would prefer to trade with other democratic regimes, *ceteris paribus*, due to identical ideological recognition. For example, American people prefer to consume products from UK than those from China if products made in China don't have striking price advantages. Second, countries with low democracy level also prefer to import products from democratic countries. One possible reason is because of the attractive institutional stability in democratic countries. Hence, a democratic country would become a favorable exporter in global trade.

To summarize, since the scale effect of importer's democratization on trade is ambiguous, the net effect of democracy of trading countries on trade is uncertain and remains an empirical question for economists.

Some researchers have made significant contributions on this issue. Eichengreen and Leblang (2006) have an excellent survey for the related literature. As they pointed out, current promising literatures include, among others already mentioned, Grofman and Gray (2000), Quinn(2000), Fidrumc (2001), Giavazzi and Tabellini (2005) and Yu (2005). Particularly, Grofman and Gray (2000) suggest a negative effect of authoritarianism on trade by examining the impact on trade of the number of years a country was ruled by the authoritarian. Based on a larger country sample, Giavazzi and Tabellini (2005) obtain the similar result by using the widely accepted Polity IV dataset maintained by Marshall and Jagers (2004). Fidrumc (2001) instead finds a strongly positive effect of democracy on economic growth in 25 transition countries. In contrast, Quinn (2000) investigates the impact of democracy on international financial liberalization and concludes that democratization is more likely to remove various capital controls. All of these studies treat democracy as exogenous given. However, globalization could have impact on democratization. Based on this concern, Yu (2005) finds a striking positive effect of trade on democracy though the reverse effect is not always significant using a simultaneous equation method.

However, most of the previous studies are reduced-form estimation. The lack of a theoretical model could make estimation results volatile and bias. Hence, in this paper we perform a structural form estimation based on an augmented gravity model here, which are mainly drawn from Krugman (1980), Helpman (1987), Baier and Bergstrand (2001)

and Feenstra (2002). The reason for adopting the gravity equation here is that it is already shown to be powerful to explain world trade pattern.

To answer the question “why has trade grown so fast?” raised by Krugman (1995), Feenstra (1998) suggests three relatively obvious reasons: the growing GDP, trade liberalization and falling transportation cost. Baier and Bergstrand (2001) find evidence to confirm his idea using a gravity model. However, institutional context could also have significant effect on trade too (Rodrik, 1995) though it still remains unclear so far.

This question is challenging partly because of the endogeneity of democracy. Previous studies usually avoid discussing this issue since it is difficult to find appropriate instruments. Because of this drawback, existing results might have some estimation bias to some extent. Fortunately, in this paper we are able to clearly control for the endogeneity issue by adopting novel instruments for democracy.

In this paper we estimate the net effect of democratization on trade, using a structural specification derived from the gravity model with democracy. Our estimates are based on a rich panel data set for 132 IMF member countries over the last four decades. We find robust empirical evidence that democracy fosters trade significantly. Overall, democratization accounts for 5% growing trade via scale effect and 6% via selection effect, *ceteris paribus*.

The rest of the paper is organized as follows. Section I presents a theoretical gravity equation. The key innovation here is to express it in a form related to bilateral trade to country size, price level, various geographical factors and democracy level. Section II describes the procedure for estimating the theoretical gravity model. The main estimation

results and sensitivity analysis are discussed in Section III. The paper closes in Section IV with suggestions for future research.

I. Theoretical Gravity Model

Tinbergen (1962) is the first to use gravity equation to describe trade pattern. In its simplest form, the gravity equation suggests that bilateral trade is directly proportional to trading entities' GDP. Based on this motivation, Anderson (1979) provides a theoretical micro-foundation for the gravity equation based on a constant elasticity of substitution (CES) utility function, which becomes a standard setup for many successors. An innovation of this paper is our modification of the CES utility function by absorbing democracy index neatly into the model, which, in turn, is crucial to derive a simple operational gravity equation for estimation.

Suppose that each country produces unique product varieties, the export of good k from country i to country j is identical to the consumption of good k in country j . Democratization in country j affects its import and hence consumption via the change of tariffs and various non-tariff-barriers. For example, when country j increases tariffs due to the pressure from labor unions, the import from country i to country j would reduce, vice versa.

Assuming country $i=1, \dots, I$ produces N_i commodities, let us consider a CES utility form:

$$U_j = \sum_{i=1}^I \sum_{k=1}^{N_i} [\exp(z_i) \cdot C_{ijk}(z_j)]^{\frac{\sigma-1}{\sigma}}, \quad (\sigma > 1) \quad (1)$$

where C_{ijk} denotes the consumption in country j of good k produced by country i . The elasticity of substitution for each commodity σ is assumed to be higher than one. The bilateral scale effect of democracy on trade suggests that bilateral trade volume and hence consumption C_{ijk} is a function of importer's democracy index z_j . Here we don't restrict the partial effect of z_j on C_{ijk} since the scale effect on trade is ambiguous for reasons we mentioned before.

Furthermore, the selection effect implies that importer j 's aggregate welfare (utility) U_j also depends on exporter's democracy index z_i . The importer j would prefer to trade with a country with high democracy level. Thus, we model the aggregate utility function as a strictly increasing function of its democracy index z_i . For estimation concern, we specify an exponential function here².

For brevity, we assume equal price p_{ij} across variety following previous studies. Then consumption in country j is also identical over the entire product $k = 1 \dots N^i$ sold by country i . That is, $C_{ijk} = C_{ij}, \forall k$. The utility function (1) can be expressed as:

$$U_j = \sum_{i=1}^I N_i \cdot [\exp(z_i) \cdot C_{ij}(z_j)]^{\frac{\sigma-1}{\sigma}}. \quad (2)$$

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

$$Y_j = \sum_{i=1}^I N_i p_{ij} C_{ij}. \quad (3)$$

² Since data on democracy index is scale from -10 to 10, it is inappropriate to use a linear increasing function.

It is noted that democracy is not included in the budget constraint (3) since democracy is not a kind of commodity. Solving this maximization problem, we obtain the derived demand function for each product C_{ij} :

$$C_{ij} = (p_{ij} / P_j)^{-\sigma} (Y_j / P_j) \cdot (\exp(z_i))^{\sigma-1}, \quad (4)$$

where the aggregate price index P_j is defined as:

$$P_j = \left[\sum_{i=1}^I N_i (p_{ij} / \exp(z_i))^{1-\sigma} \right]^{\frac{1}{1-\sigma}}. \quad (5)$$

Finally, the total export X_{ij} from country i to country j is as follows:

$$X_{ij} \equiv \sum_{k=1}^{N_i} p_{ijk} C_{ijk} = N_i p_{ij} C_{ij}, \quad (6)$$

where the first equality follows the definition of export value whereas the second is due to equal price assumption across all varieties which we mentioned above. Combining (4), (5) and (6), we obtain the export value from country i to country j :

$$X_{ij} = N_i Y_j (p_{ij} / P_j)^{1-\sigma} [\exp(z_i)]^{\sigma-1}. \quad (7)$$

Samuelson (1952) illustrates that there exists an “iceberg” transport cost across borders. In order to have a one unit of the product to reach the destination country, we need $T_{ij} \geq 1$ units of the product shipped from the departure country. Hence, the price on a c.i.f. (cost, insurance, freight) base p_{ij} equals the product of “iceberg” transport cost T_{ij} and the price on a f.o.b. (free on board) base p_i . That is, $p_{ij} = T_{ij}(z_j)p_i$. Thus, (7) can be written as:

$$X_{ij} = N_i Y_j [T_{ij}(z_j) / P_j]^{1-\sigma} p_i^{1-\sigma} [\exp(z_i)]^{\sigma-1}. \quad (8)$$

Clearly, in the gravity equation (8), the bilateral trade depends on importing country's GDP and the aggregate price index, trading countries' democracy levels and price on a f.o.b. base.

However, the bilateral trade is also affected by the number of varieties in the exporting country N_i which is unfortunately unobservable. For the estimation concern, we then consider a monopolistic competition setup presented originally by Krugman (1979), which could help us eliminate the effect of the number of exporting varieties in our gravity equation (8).

According to Krugman (1979), Baier-Bergstrand (2001) and Feenstra (2003), the representative firm in country i maximizes its profit. Specifically, the production of goods (y_i) has fixed (κ) and constant marginal cost (ϕ) given that labor (l) is the firm's unique input:

$$l_i = \kappa + \phi \cdot y_i. \quad (9)$$

Monopolistic competition implies two equilibrium conditions for this representative firm. First, it requires that marginal revenue equals marginal cost due to the firm's maximization behavior. Since the elasticity of demand η equals the elasticity of substitution σ when country i 's number of varieties N_i is large, we obtain the first equilibrium condition:

$$p_i = \left(\frac{\sigma}{\sigma - 1} \right) \phi \cdot w, \quad (10)$$

where wage is denoted as w .

Second, the representative firm obtains zero profits due to free entry. Given that the firm's profit function in country i is $\pi_i = p_i y_i - w(\kappa + \phi y_i)$, we obtain fixed production level \bar{y} for such a representative firm:

$$\bar{y} = (\sigma - 1)\kappa / \phi. \quad (11)$$

It is also noted that GDP in country i is $Y_i = N_i p_i \bar{y}$, and substituting this into (8), we have:

$$X_{ij} = \frac{Y_i Y_j}{(p_i)^\sigma \bar{y}} \cdot \left[\frac{T_{ij}(z_j)}{P_j} \right]^{1-\sigma} \cdot [\exp(z_i)]^{\sigma-1}. \quad (12)$$

Therefore, the bilateral trade depends on trading countries' GDP, iceberg cost, trading countries' democracy level, exporting firms' fixed production and various price indexes. For the readers' convenience, we include the notation of the model in Table 1.

II. Empirical Methodology

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

$$\ln X_{ij} = \ln(Y_i Y_j) - \sigma \ln p_i + (1 - \sigma) \ln T_{ij} + (\sigma - 1) \ln P_j + (\sigma - 1) z_i - \ln \bar{y}_i. \quad (13)$$

Following Anderson and van Wincoop (2003), the bilateral iceberg cost T_{ij} can be broken into the bilateral distance cost g_{ij} and also any other border factors. Such factors could include: (1) exporter's democracy level; (2) indicator of common land boarder: whether trading countries share common land border is important to reduce transportation cost; (3)

the number of countries landlocked L_{ij} ; and (4) the number of island countries I_{ij} .

Intuitively, countries are far from sea trade less, countries which are farther apart trade less, while countries with many islands benefit from the convenient transportation and thus trade more. Hence, we have:

$$\ln T_{ij} = \alpha_{ij} + \rho_0 z_j + \rho_1 \ln g_{ij} + \rho_2 B_{ij} + \rho_3 L_{ij} + \rho_4 I_{ij} + \mu_{ij}, \quad (14)$$

where B_{ij} is a dummy variable which is unity if country i and country j share the common border and zero otherwise. The constant term α_{ij} captures any other border effects which are not specified in the specification (14). Then we obtain the estimating equation for each period t , moving the logarithm products of GDP to the left side and substituting (14) into (13):

$$\begin{aligned} \ln(X_{ijt} / Y_{it} Y_{jt}) = & (\sigma - 1)z_{it} + (1 - \sigma)\rho_0 z_{jt} - \sigma \ln p_{it} + (1 - \sigma)\rho_1 \ln g_{ij} + (1 - \sigma)\rho_2 B_{ij} \\ & + (1 - \sigma)\rho_3 L_{ij} + (1 - \sigma)\rho_4 I_{ij} + [(1 - \sigma)\alpha_{ijt} - \ln \bar{y}_{it} + (\sigma - 1) \ln P_{jt} + (1 - \sigma)\mu_{ij}]. \end{aligned} \quad (15)$$

In this specification, the bilateral trade openness—the logarithm of export value relative to trading countries' GDP—mainly depends on exporter's democracy level (z_i), importer's democracy level (z_j), bilateral log distance ($\ln g_{ij}$), exporter's f.o.b. price index ($\ln p_i$) and importer's log aggregate price index ($\ln P_j$). In addition to this, the bilateral openness is also affected by various borders' effects (α_{ij} , B_{ij} , L_{ij} and I_{ij}) and exporter's firm production \bar{y}_i .

However, the importer's aggregate price index is *unobservable* since it depends on the unobservable exporter's varieties number N_i according to (5). To address this

empirical challenge, Anderson and van Wincoop (2003) presents an *implicit* price index based on the market equilibrium condition. Feenstra (2002) instead recommends the fixed effects method to take account of this unobservable price index since it is relative simple. The idea is that the aggregate price index term, exporter's fixed production level and various unspecified border effects can be absorbed into the error term e_{ijt} . That is:

$$e_{ijt} = (1 - \sigma)\alpha_{ijt} - \ln \bar{y}_{it} + (\sigma - 1) \ln P_{jt} + (1 - \sigma)\mu_{ijt}.$$

This error term can be decomposed into a country-pair random variable φ_{ij} and an idiosyncratic effect ε_{ijt} with normal distribution: $\varepsilon_{ijt} \sim N(0, \sigma_{ijt}^2)$.

Assuming that φ_{ij} is uncorrelated with all regressors, we thus first process random effect estimations for the following specification:

$$\ln\left(\frac{X_{ijt}}{Y_{it}Y_{jt}}\right) = \beta_0 + \beta_1 z_{it} + \beta_2 z_{jt} + \beta_3 \ln p_{it} + \beta_4 \ln g_{ij} + \beta_5 B_{ij} + \beta_6 L_{ij} + \beta_7 I_{ij} + \varphi_{ij} + \varepsilon_{ijt}, \quad (16)$$

where $\beta_1 = \sigma - 1$, $\beta_2 = (1 - \sigma)\rho_0$, $\beta_3 = -\sigma$, $\beta_4 = (1 - \sigma)\rho_1$, $\beta_5 = (1 - \sigma)\rho_2$, $\beta_6 = (1 - \sigma)\rho_3$ and $\beta_7 = (1 - \sigma)\rho_4$ compared to expression (15). Our main interests are the signs of coefficient β_1 and β_2 . Since there is no guarantee that the random effect specification is a correct one, by way of contrast, we then also perform the fixed effect estimation. (Of course, the time-invariant geographical variables will be dropped out automatically in estimations.) Finally, we perform a Hausman test to see whether we can reject the null random effect hypothesis. If so, then the fixed effect estimation will be more favorable. This completes the description of our estimation specification.

III. Data, Econometrics and Results

In this section we first describe datasets used in the paper, followed by a discussion of econometric methods. We then address the possible endogeneity problem. Finally, we close the section with various robustness checks.

A. Data

The regressand of Specification (16) is the logarithm of bilateral aggregate openness—the ratio of export from country i to country j to the product of both countries' GDP. Note that our definition of trade openness is different the traditional one, which is the sum of export and import relative to a country's GDP. The nominal export data come from the NBER-UN Trade data maintained by Feenstra *et. al.*(2005). It covers bilateral merchandise trade volume between 132 countries for year 1962-2000. (Table A1 lists all countries used in the estimations.) Data of log product of real GDP data (in constant US dollars) between trading countries are directly from Rose (2004). Since his dataset ends in year 1998, we obtain 179,358 observations for our estimates during years 1962-1998.

We use exporter's consumer price index (CPI) to measure the exporter i 's price level p_i . Such data can be accessed from World Development Indicator (WDI, 2002) by World Bank, which specifies the base year of CPI as year 1995.

Trading countries' democracy level—the key variables in Specification (16)—is adopted by Polity IV dataset, which is a widely accepted dataset to measure world democratization. Many previous studies (Quinn, 2000, Milner and Kubota, 2005, Yu, 2005, and Eichengreen and Leblang, 2006) all use this dataset to measure the democracy

index. Precisely, Polity IV includes annual composite indicators measuring both “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. Since each indicator is an additive eleven-point scale (0-10), the index is scaled between -10 and 10 consequently. The higher the number is, the higher the political liberalization level is.

Traditional gravity equation suggests that the bilateral trade is also affected by various geographic factors. In particular, we include the great-circle bilateral distance, the number of islands that the trading countries have, dummy of common land boarder and the number of countries land-locked. All of this data again can be accessed directly from Rose (2004).

For our robustness checks, we also include data on death penalty and judicial independence for each country over the last four decades. The death penalty data are from Amnesty International (2005). Precisely, four different groups for the regulation of the death penalty are employed: (1) absolutely outlawed; (2) allowed in extreme case; (3) De Facto Ban on Death Penalty; (i.e., death penalty is sanctioned by law but has not been the practice for ten or more years.) and (4) death penalty permitted. Thus, death penalty variable is *zero* if the death penalty is allowed at a particular year in a country; and *one* otherwise.

Data on judicial independence for trading countries can be referred to the “Economic Freedom of the World” (Gwartney and Lawson, 2005). It is also an additive scale between 0 and 10 and spans every five years from year 1970 to 2000.

Panel A of Table 2 presents descriptive statistics for each variable while Panel B describe their partial correlations. As we can observe, trading countries' democracy variables are not highly correlated with all other gravity variables. This implies that the multicollinearity is not a problem for the coefficient of interest.

B. Estimates

We first perform a pooled ordinary least square (OLS) estimate to obtain benchmark results. Column (1) in Table 3 conveys very optimistic messages for this estimate.

Overall, these factors explain 21% of the growth of trade openness ($R^2 = 0.21$). All geographic factors are economically and statistically significant. Countries with long distance trade less ($\hat{\beta}_3 = -1.18$). Countries with common land border trade more ($\hat{\beta}_4 = 0.23$). Countries which have island endowments trade more ($\hat{\beta}_6 = 0.42$). In contrast, countries which are landlocked trade less ($\hat{\beta}_5 = -0.13$). All of these results are consistent with many previous related studies like Rose (2004) and Subramanian-Wei (2003).

The coefficient of exporter's democracy—one of the key variables of our interest—is $\hat{\beta}_1 = 0.03$ with a very high t-value. This means a one scale increase of exporter's democracy leads to around 3% percentage point increase of bilateral openness. The estimated constant elasticity of substitution is $\sigma = 1.03$ since $\hat{\beta}_1 = \sigma - 1$, which is also consistent with our theoretical assumption $\sigma > 1$. Analogously, the importer's democracy, another key variable, has an estimate of $\hat{\beta}_2 = 0.03$. This suggests that the semi-elasticity of importer's democracy on trade is about 0.03.

Let us turn to the price index. The pooled OLS estimate turns out that the coefficient is 0.06 and significant at 1% level. This makes sense intuitively. The rise of price of commodities is accompanied with the boom of the economy. Simultaneously, trade also grows when the economy is in good shape. As a consequence, the higher the CPI is, the higher the trade volume is. Since our estimation shows $\hat{\beta}_1 = 0.03$ and $\hat{\beta}_3 = 0.06$ which are inconsistent with the theoretical requirement $\hat{\beta}_3 \neq -(\hat{\beta}_1 + 1)$, one might worry about whether the estimated CPI coefficient $\hat{\beta}_3$ is economically significant. However, this should not be a surprise since there exists a measurement error for the exporter's price index ($\ln p_i$). As pointed out by Feenstra (2003), the published price index data are measured relatively to an arbitrary base period (we choose 1995 in our estimation), which usually undermine the accuracy of the estimates.

We then identify the coefficient in specification (14) based on our estimate results. For example, the coefficient of distance is $\hat{\rho}_1 = \hat{\beta}_4 / (1 - \hat{\sigma}) = -1.18 / -0.03 = 39.3$. We now obtain coefficients for other geographic variables using the same method, which are presented in column (1) of Table 4. All numbers have expected economic meanings. The rise of importer's democracy reduces the iceberg cost due to the removal of trade barriers. The semi-elasticity is a unit. Geographical distance significantly increases the iceberg transportation cost. Countries which are farther from sea suffer from the high iceberg cost too. Finally, countries with common land border reduce iceberg cost 7.67 times than those without common land border.

Since our dataset is a panel, we then perform the random effects estimates by assuming the error term in (17) is uncorrelated with other regressors. We find that we

obtain very similar results which are reported in Column (3) of Table 3. The coefficient of exporter's democracy is $\hat{\beta}_1 = 0.04$ while of importer's democracy is $\hat{\beta}_2 = 0.03$.

By way of comparison, we also perform the fixed-effect estimates by specifying the country-pair fixed effects. Of course, those time-invariant regressors such as log distance, land border, the number of landlocked and the number of island are dropped out.

However, we find that the effect of democracy on trade is identical with the one obtained from the random-effect estimates, which is again economically and statically significant.

Then it is very natural to ask: which specification is more appropriate statistically, the random effects or the fixed effect? To address this question, we perform the Hausman (1978) test, which assumes the random effect as the default correct specification. It turns out that the result from the Hausman test is against the random-effect hypothesis and favorable to the fixed effects.

C. Endogeneity Issues

We now go further to consider the endogeneity issues for the democracy index z_i .

The democracy index z_i is correlated with the error term: $\text{cov}(z_{it}, e_{ijt}) \neq 0$ for two reasons.

First, the endogeneity comes from the omitted variable problem (Wooldridge, 2002).

Note that the error term e_{ijt} includes the importer j 's aggregate price index P_j , which, in turn, include the *unobservable* number of varieties N_i according to (5). In addition to this, the *unobservable* exporter's fixed production \bar{y} is also absorbed into the error term e_{ijt} as well. These two omitted variables thus introduce the endogeneity of the democracy index.

Second, trading countries' democracy indexes z_i and z_j are also obviously correlated

with the error term since both variables are included into the importer j 's aggregate price index P_j .

Two-stage least squares (2SLS) estimation is a standard econometric method to address the endogeneity problem (Wooldridge, 2002). However, to my knowledge, rare previous works perform such an estimate since researchers immediately face a challenge of choosing good instruments for democracy—it is very difficult to find variables that affect only democracy but not trade.

Another contribution of this paper is that we present two novel instruments for the 2SLS estimations: dummy of exporter's death penalty abolition and exporter's judicial independence. Clearly, these two variables are important indicators to measure a country's democracy level. Yet the intriguing matter is that they are not necessarily related to a country's trade. It is possible that a country with high level of trade openness still maintains death penalty and is of high judicial dependence.

We then report the partial correlations for each variable, which are showed in Panel B of Table 2. The good news is that dummy of death penalty abolition is highly correlated with democracy level ($corr = 0.26$) but weakly correlated to trade openness ($corr = 0.11$). Similarly, the judicial independence variable is strongly correlated with democracy level ($corr = 0.49$) but relatively weakly correlated to trade openness ($corr = 0.22$) too.

The last two columns in Table 3 present various 2SLS estimates using both dummy of death penalty abolition and judicial independence as instruments. Our sample is reduced to 21,257 and only 123 countries included due to availability of such instruments data.

Column (4) is the fixed effects estimate while Column (5) is the random effects estimate. The corresponding Hausman test we performed again suggests that the fixed effect is a more appropriate specification. Compare Column (4) to Column (2), one can find that the coefficient of exporter's democracy in the 2SLS estimate is higher than that obtained by OLS. In contrast, the coefficient of importer's democracy in column (4) is less than that in column (2). In more details, the semi-elasticity of exporter's democracy with respect to bilateral trade is 0.05 while that of importer's democracy is 0.01. Both are significant at less than 1% at the conventional statistical sense.

The rest of Table 4 reports the calculated coefficients for Specification (14) using fixed effects and random effects. The size and sign of such coefficients are consistent with those calculated before using pooled OLS estimations.

Our final step is to deliver more economic explanation for these two key variables. We rely on coefficients obtained from 2SLS to perform this task since it is relatively reliable by controlling for the endogeneity. Using data of year 1962 to year 1998, the world average democracy index increase 1.65 points while average log bilateral openness increase 0.98 points. This means the exporter democracy explains around 8.41% of the growth of bilateral openness since we have $1.65 * 0.05 / 0.98 = 8.41\%$. Similarly, given that the average importer's democracy increases about 2.96 points, it thus accounts for about 3.02% of growing bilateral trade, *ceteris paribus*, since $2.96 * 0.03 / 0.98 = 3.02\%$.

In a nutshell, all the results are robust regardless of different econometric methods. Since the impacts of democracy on trade are economically and statistically significant, we are safe to conclude that global democracy fosters world trade.

D. Further Robustness Checks

Country's income varies. Is the effect of democratization on trade sensitive by income? Previous studies suggest an affirmative answer. Milner and Kubota (2005) finds evidence that democratization in developing countries leads to higher trade flow since politicians in those countries can not use the strategic trade policy to win the political support from the special interest groups like labor unions. In contrast, O'Rourke and Taylor (2006) suggest that democratization could discourage trade in capital-abundant countries. This is because workers, who get more political power from the democratization, prefer protectionism according to the Heckscher-Ohlin-Stolper-Samuelson theorem.

We thus perform estimations by dividing the sample by country groups according to their income *per capita* level. We don't restrict our scope into two groups (developing and developed countries); instead, we go more deeply to split all countries into five categories according to 2004's GNI per capita level reported by the World Bank: (a) low income countries (\$825 or less); (b) lower middle income countries (\$826 - \$3,255); (c) upper middle income countries(\$3,256 - \$10,065); (d) high income non-OECD countries(\$10,066 or more); and (e) high-income OECD countries (\$10,066 or more). Technically speaking, we don't use the dummy variables to capture the income difference. This is mainly because that our estimates are structural forms, which are based on a theoretical model, and hence can not add variables arbitrarily.

Table 5 and 6 present the results, separating exporters and importers into each income group and using OLS and 2SLS estimations. Within each table, we also report both fixed effects and random effects estimates. Only exporter's and importer's democracy variables

are reported here to save space. We then successively run the Hausman test and denote the appropriate method (fixed or random) in Table 5 and 6.

Briefly speaking, we find that exporter's democratization always fosters trade regardless of income groups. The coefficients of democracy are quite stable in the range between 0.03 and 0.05 for both fixed effects and random effects estimates. This confirms our previous global finding: a high democratic country will export more due to the mutual ideological recognition and intrinsic institutional stability. Put it another way, a high democratic entity will become the exporting source in global trade, regardless of their income level. Finally, the 2SLS estimates in Table 6 are also broadly consistent with the findings in Table 5 though the sizes for coefficients are a little smaller.

Now let us turn to the importers' side. We again find that a country with high democracy would import more from its trading partners no matter what income group it belongs to. Results obtains for low income countries are consistent with Milner and Kubota (2005). However, for developed countries (i.e., both high income non-OECD and high income OECD countries), we suspect that the positive effect of democratization is due to the endogeneity problem. We then find a significant negative effect for high income non-OECD countries and an insignificant positive effect for high income OECD countries, which are presented in Table 6. Hence, our estimates are broadly in line with O'Rourke and Taylor (2006).

Finally, we run the OLS and 2SLS estimates by different geographical regions. Our sample is separated into seven groups: (a) East Asian countries; (b) South Asian countries; (c) Mideast and North African countries; (d) Sub-Saharan countries; (e) European countries; (f) North American countries; and (g) Latin American and Caribbean countries.

As shown in Table 7 and 8, Most of the impacts of exporter's democratization on trade are statistically significant. Two exceptions remain here. One is the effect for South Asian countries, which is insignificant in both fixed effects and random effects estimates. However, this is because the severe endogeneity problem in such a region. We then use 2SLS to mitigate this problem and find that the effect shown in Table 8 is significant positive again. The other one is the European countries, which effect of democratization on export is negative by controlling for the endogeneity. This finding is counter with our intuition and worth to further explore in the future.

A note on caveats: one might worry about the missing data problem in our estimates. Usually, small countries have trade data but not GDP data. As a consequence, most of the missing data comes from the regressors' side and hence should not be a severe problem for our estimation (Rose, 2004).

IV. Concluding Remarks

Democratization could affect trade from different aspects. In this paper we present a theoretical gravity model to consider democratization's "scale effect" and "selection effect" on trade. Democracy could promote trade via various channels such as removal of various trade barriers and trade uncertainty reduction. Also, a country with high democracy level will be a favorable exporter in international trade. This could be because of ideological recognition among democratic countries, or because of the possible intrinsic attractive institutional stability from those democratic countries. In contrast, democratization could also have negative effect on trade due to excessive redistribution programs and lengthy legal process in democratic regimes. Thus, the net effect of democracy on trade remains an empirical question.

Since the “gravity” model is very successful to explain trade pattern in the literatures, we thus estimate a structural gravity equation with democracy based on a theoretical model. We find robust evidence that democratization fosters trade. Overall, importer’s democratization accounts for 3% growing trade via scale effect; and exporter’s democratization explains around 8.41% via selection effect, *ceteris paribus*.

These striking findings are in line with many studies on international political economy such as Milner and Kubota (2005) and Eichengreen and Leblang (2006). More importantly, there are consistent with trade literatures on explaining growing trade flow. For example, by examining the bilateral trade flows among 16 OECD countries, Baier and Bergstrand (2001) pointed out: “*We 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 converge.*” Here we go further to identify trading countries’ democratization could account for total 11%-12% of trade flows within the 23%-26% of trade liberalization and preferential trade agreements.

The main contributions of this paper have two folds: First, to our knowledge, we are the first to absorb democracy neatly into a gravity model. Thanks to this, we then are able to run a structural estimation to investigate the impact of democratization on trade. We believe this exercise would help us to reduce potential estimation bias in previous works caused by adopting reduced-form method.

Second, we present two novel instruments to mitigate the endogeneity of democracy, which is usually dodged by previous researchers due to the lack of good instruments. Luckily enough, we find that dummy of death penalty abolition and judicial

independence are good candidates since they are important indicators of democratization, yet are not highly correlated with trade volume.

A fruitful direction for future research might be to consider the reverse impact of growing trade on democratization. Several studies (Bussmann, 2001, Li and Reuveny, 2003, Lopez-Cordova and Meissner, 2005, Giavazzi and Tabellini, 2005, Rudra, 2005 and Yu, 2005) have done some pioneering works on that. However, a research like a complete empirical investigation with a well-developed micro-foundation model is called for in the future.

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Table 1: Main Notation for Models

Symbol	Definition
<i>Panel A: Theoretical Model</i>	
C_{ijk}	Good k produced in country i but consumed in country j
N_i	Number of varieties that produced in country i
z_i	Exporter i 's democracy level
z_j	Importer j 's democracy level
σ	Elasticity of substitution, $\sigma > 1$
Y_i, Y_j	Country i and country j 's GDP level , respectively
p_{ij}	Price on a c.i.f. (cost, insurance, freight) base
p_i	Price on a f.o.b. (free on board) base
T_{ij}	Bilateral iceberg transportation cost
X_{ij}	Value of export from country i to country j
P_j	Aggregate price index in importing country j
w	Wages
l_i	Labor input for the representative firm in country i
y_i	Output of country i 's representative firm, which is fixed in equilibrium: $y_i = \bar{y}$
κ	fixed cost for the representative firm in country i
ϕ	constant marginal cost for the representative firm in country i
<i>Panel B: Empirical Model</i>	
α_{ij}	Unspecified bilateral border effect
g_{ij}	bilateral distance cost
B_{ij}	Dummy variable which is unity if country i and country j share common border
L_{ij}	Number of countries landlocked
I_{ij}	Number of island countries
μ_{ijt}	Error term in Transport cost specification (14)
φ_{ij}	Country-pair random effect
ε_{ijt}	Idiosyncratic effect

Table 2: Descriptive Statistics of Variables

<i>Panel A: Basic Statistics</i>				
Variable List	Mean	Std. Dev.	Min	Max
Log Exports	15.54	3.08	6.91	25.91
Log product GDP	49.24	2.24	40.97	59.05
Log Openness	-33.70	2.23	-45.28	-25.41
Exporter's Democracy	3.48	7.49	-10	10
Importer's Democracy	1.73	3.47	-10	10
Log Consumer Price Index (1995:100)	2.42	3.98	-23.02	10.14
Log distance	8.20	0.79	4.02	9.42
Land Border	0.03	0.16	0	1
Number Landlocked	0.23	0.45	0	2
Number Islands	0.27	0.48	0	2
Exporter's Death Penalty Abolition	0.65	0.48	0	1
Exporter's Judicial Independence	6.04	1.92	1.67	9.63
Importer's Death Penalty Abolition	0.39	0.48	0	1
Importer's Judicial Independence	5.87	1.96	1.67	9.63

<i>Panel B: Key Correlations</i>								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) Log Openness	1.00							
(2) Exporter's Democracy	0.10	1.00						
(3) Importer's Democracy	0.08	-0.00	1.00					
(4) Log CPI	0.10	0.15	0.09	1.00				
(5) Exporter's Death Penalty Abolition	0.11	0.26	0.22	-0.00	1.00			
(6) Exporter's Judicial Independence	0.22	0.49	-0.06	-0.21	0.21	1.00		
(7) Importer's Death Penalty Abolition	0.11	0.23	0.27	0.00	0.06	0.10	1.00	
(8) Importer's Judicial Independence	0.16	-0.06	0.49	0.09	0.19	-0.12	0.13	1.00

Note: we obtain 171,294 observations for 157 IMF member countries from year 1962 to year 1998. We choose year 1995 as the base year to calculate CPI following WDI (2002). For data on dummy of death penalty abolition and judicial independence, we have 21,257 observations, spanning every 5 years between 1970 and 2000. Sources: Amnesty International (2005), Feenstra *et al.* (2005), Rose (2004) and WDI (2002).

Table 3: Net Effect of Democracy on Trade

Log Openness	Pooled	Fixed	Random	2SLS Estimate	
	OLS	Effects	Effects	Fixed Effect	Random Effect
	(1)	(2)	(3)	(4)	(5)
Exporter's Democracy	0.03** (48.98)	0.04** (54.50)	0.04** (56.30)	0.05** (10.32)	0.07** (18.01)
Importer's Democracy	0.03** (46.45)	0.03** (44.57)	0.03** (46.30)	0.01** (2.40)	0.03** (8.71)
Log CPI	0.06** (45.75)	0.04** (32.10)	0.04** (33.58)	0.01** (2.51)	0.00 (0.80)
Log distance	-1.16** (-176.61)		-1.25** (-43.15)		-1.21** (-28.37)
Land Border	0.24** (7.73)		0.40** (2.84)		0.28* (1.75)
Number Landlocked	-0.16** (-15.93)		-0.21** (-4.90)		-0.02 (-0.35)
Number Islands	0.42** (36.83)		0.25** (5.29)		0.39** (7.37)
# of Observations	179,358	179,358	179,358	21,257	21,257
# of Groups		5,904	5,904	3,494	3,494
R-square	0.21	0.04	0.20	0.01	0.23
Prob.>F or Prob.> χ^2	0.00	0.00	0.00	0.00	0.00

Notes: Regressand is log openness, which is defined as the difference between log bilateral trade and log product of GDP in both trading countries. Double stars and single star mean significance at 1% and 5% level for a two-tailed test, respectively. The z-statistics are in parenthesis and clustered by trading countries' pair-id for random effects and fixed effects. Hausman tests suggest that the fixed effects specifications are the correct ones.

Table 4: Calculated Coefficients for Iceberg Cost Specification

Iceberg Transport Cost	Pooled	Fixed	Random	2SLS Estimate	
	OLS	Effects	Effects	Fixed Effect	Random Effect
	(1)	(2)	(3)	(4)	(5)
Importer's Democracy (ρ_0)	-1.00	-1.00	-1.00	-0.33	-1.00
Log distance (ρ_1)	39.33		41.67		40.33
Land Border (ρ_2)	-7.67		-13.34		-9.33
Number Landlocked (ρ_3)	4.33		6.67		0.67
Number Islands (ρ_4)	-14.00		-8.67		-13.00

Notes: Numbers reported in this table are calculated from Table 3 using method discussed in the text.

Table 5: Estimates Varied by Income

Log Openness	Fixed Effects		Random Effects		# of Obs.
	Exporter's	Importer's	Exporter's	Importer's	
	Democracy	Democracy	Democracy	Democracy	
<i>Categories of Exporters</i>					
Low Income Countries	0.03** (9.23)	0.02** (7.75)	0.03** (9.73)	0.03** (8.70)	13,472
Lower Middle Income Countries	0.04** (16.31)	0.04** (15.16)	0.04** (16.43)	0.04** (15.39)	23,453
Upper Middle Income Countries	0.05** (25.13)	0.06** (28.59)	0.05** (23.77)	0.05** (27.18)	26,836
High Income Non-OECD Countries	0.05** (10.37)	0.04** (9.18)	0.04** (8.42)	0.03** (7.27)	9,622
High Income OECD Countries	0.03** (40.30)	0.02** (28.00)	0.03** (41.01)	0.02** (28.78)	97,911
<i>Categories of Importers</i>					
Low Income Countries	0.04** (27.23)	0.02** (19.02)	0.04** (27.69)	0.02** (19.50)	55,938
Lower Middle Income Countries	0.05** (34.73)	0.03** (27.23)	0.05** (35.29)	0.03** (27.70)	52,584
Upper Middle Income Countries	0.03** (18.41)	0.04** (27.48)	0.03** (18.92)	0.04** (28.20)	37,588
High Income Non-OECD Countries	0.05** (15.47)	0.02** (7.41)	0.05** (14.90)	0.02** (6.46)	12,599
High Income OECD Countries	-0.01** (-5.24)	0.01** (3.23)	-0.01** (-4.78)	0.01** (3.62)	10,229

Notes: Regressand is log openness, which is defined as the difference between log bilateral trade and log product of GDP in both trading countries. Double stars and single star mean significance at 1% and 5% level for a two-tailed test, respectively. The t-statistics are in parenthesis and clustered by trading countries' pair-id for random effects and fixed effects. Year effects are not reported here to save space. Hausman tests suggest that the fixed effects specifications are the correct ones.

Table 6: 2SLS Estimates Varied by Income

Log Openness	Fixed Effects		Random Effects		# of Obs.
	Exporter's	Importer's	Exporter's	Importer's	
	Democracy	Democracy	Democracy	Democracy	
<i>Categories of Exporters</i>					
Low Income Countries	0.13** (5.08)	0.05** (2.07)	0.10** (4.84)	0.04** (2.05)	1,588
Lower Middle Income Countries	0.20** (4.58)	-0.05 (-1.05)	0.20** (4.71)	-0.08* (-1.84)	3,052
Upper Middle Income Countries	0.16** (8.23)	-0.03 (-0.97)	0.15** (8.23)	-0.03 (-1.54)	3,730
High Income Non-OECD Countries	0.14** (4.05)	0.03 (0.93)	0.01 (0.50)	-0.08** (-5.24)	1,115
High Income OECD Countries	0.00 (0.43)	-0.02** (-5.05)	0.03** (5.77)	0.00 (0.56)	11,772
<i>Categories of Importers</i>					
Low Income Countries	0.02** (2.53)	0.01 (1.08)	0.04** (5.28)	0.03** (3.87)	5,965
Lower Middle Income Countries	0.08** (9.43)	0.02** (2.69)	0.09** (13.41)	0.03** (5.07)	6,953
Upper Middle Income Countries	0.04** (4.64)	0.01 (1.12)	0.05** (6.82)	0.02** (3.37)	4,980
High Income Non-OECD Countries	0.09* (1.82)	-0.25** (-4.04)	0.13** (3.86)	-0.19** (-6.04)	1,670
High Income OECD Countries	-0.69 (-1.30)	0.63 (1.16)	-0.54 (-1.16)	0.66 (1.39)	1,242

Notes: Regressand is log openness, which is defined as the difference between log bilateral trade and log product of GDP in both trading countries. Double stars and single star mean significance at 1% and 5% level for a two-tailed test, respectively. The z-statistics are in parenthesis and clustered by trading countries' pair-id for random effects and fixed effects. Year's coefficients are not reported here to save space. The instruments are death penalty abolition dummy and legal independence. Bold coefficients means the specific estimation is the correct specification due to the Hausman test.

Table 7: Estimates Varied by Region

Log Openness	Fixed Effects		Random Effects		# of Obs.
	Exporter's	Importer's	Exporter's	Importer's	
	Democracy	Democracy	Democracy	Democracy	
<i>Categories of Exporters</i>					
East Asian Countries	0.04** (15.91)	0.03** (11.90)	0.04** (15.48)	0.02** (11.46)	21,849
South Asian Countries	0.01 (1.50)	0.00 (0.10)	0.01 (1.47)	0.00 (0.21)	6,263
Mideast and North Africa Countries	0.03** (6.85)	0.02** (4.39)	0.03** (7.77)	0.02** (4.86)	11,201
Sub-Saharan Countries	0.02** (4.89)	0.05** (10.54)	0.02** (5.38)	0.05** (11.88)	7,951
European Countries	0.03** (35.87)	0.03** (32.38)	0.03** (36.77)	0.03** (33.40)	86,370
North American Countries	0.03** (8.85)	-0.00 (-0.27)	0.03** (9.45)	0.00 (0.55)	8,636
Latin American and Caribbean Countries	0.06** (28.63)	0.05** (26.53)	0.05** (27.93)	0.05** (25.81)	29,024
<i>Categories of Importers</i>					
East Asian Countries	0.04** (19.66)	0.07** (34.08)	0.04** (19.51)	0.07** (34.27)	25,434
South Asian Countries	0.05** (17.72)	0.03** (10.50)	0.05** (17.41)	0.03** (10.19)	10,998
Mideast and North Africa Countries	0.06** (22.74)	0.01** (2.64)	0.06** (23.96)	0.01** (3.05)	24,211
Sub-Saharan Countries	0.02** (15.46)	0.02** (10.99)	0.03** (16.86)	0.02** (12.57)	43,583
European Countries	0.04** (24.59)	0.03** (24.36)	0.04** (25.71)	0.04** (25.93)	26,055
North American Countries	-0.01* (1.77)	-0.02** (-2.95)	-0.01 (1.61)	-0.02** (-2.81)	670
Latin American and Caribbean Countries	0.03** (20.65)	0.04** (30.80)	0.03** (21.07)	0.04** (31.41)	37,987

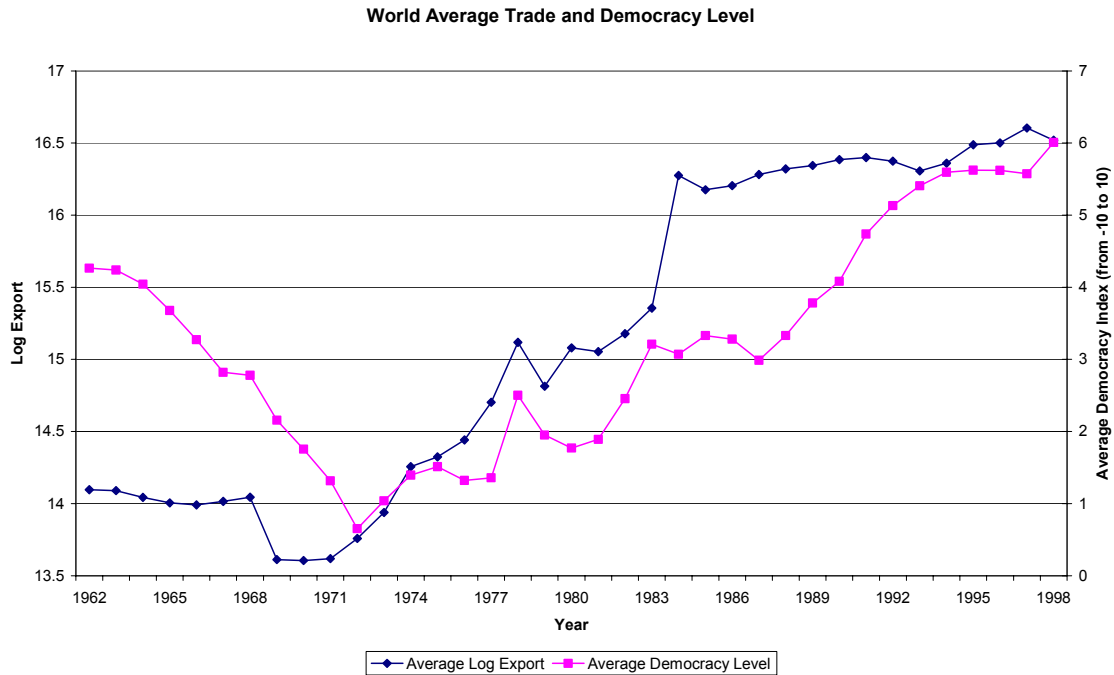
Notes: Regressand is log openness, which is defined as the difference between log bilateral trade and log product of GDP in both trading countries. Double stars and single star mean significance at 1% and 5% level for a two-tailed test, respectively. The z-statistics are in parenthesis and clustered by trading countries' pair-id for random effects and fixed effects. If not specified, the fixed effects are the appropriate specification due to the Hausman test. We use bold coefficients to denote the correct specification if the one is random-effect.

Table 8: 2SLS Estimates Varied by Region

Log Openness	Fixed Effects		Random Effects		# of Obs.
	Exporter's	Importer's	Exporter's	Importer's	
	Democracy	Democracy	Democracy	Democracy	
<i>Categories of Exporters</i>					
East Asian Countries	0.08** (4.61)	-0.01 (0.32)	0.07** (4.92)	-0.02 (1.41)	2,962
South Asian Countries	0.50** (2.39)	-0.24 (-1.41)	0.41** (2.39)	-0.21 (-1.54)	794
Mideast and North Africa Countries	0.16** (5.14)	0.02 (0.53)	0.13** (4.79)	-0.04 (1.42)	1,134
Sub-Saharan Countries	0.18** (5.75)	0.13** (4.01)	0.09** (4.66)	0.06** (3.02)	903
European Countries	-0.01** (-2.85)	-0.02** (-5.17)	0.02** (5.04)	0.01** (2.99)	10,624
North American Countries	0.05** (1.99)	0.03 (1.42)	0.05** (2.30)	0.03 (1.63)	723
Latin American and Caribbean Countries	0.23** (5.08)	-0.12** (-2.03)	0.17** (4.79)	-0.03 (-0.62)	4,117
<i>Categories of Importers</i>					
East Asian Countries	0.07** (4.98)	0.03* (1.91)	0.10** (8.40)	0.05** (4.20)	3,252
South Asian Countries	0.09** (5.43)	0.06** (4.41)	0.08** (5.61)	0.06** (4.30)	1,391
Mideast and North Africa Countries	0.08** (6.58)	0.00 (0.11)	0.10** (10.26)	0.02** (2.04)	2,680
Sub-Saharan Countries	-0.00 (-0.15)	-0.01 (-0.49)	0.03** (3.41)	0.03** (3.22)	4,330
European Countries	0.06** (5.40)	-0.01 (-0.91)	0.07** (6.82)	0.02** (2.11)	4,028
North American Countries	-0.25 (1.19)	0.21 (0.82)	-0.32 (-1.11)	0.32 (1.07)	82
Latin American and Caribbean Countries	0.04** (3.90)	-0.01 (-1.33)	0.06** (6.06)	0.01 (1.13)	5,047

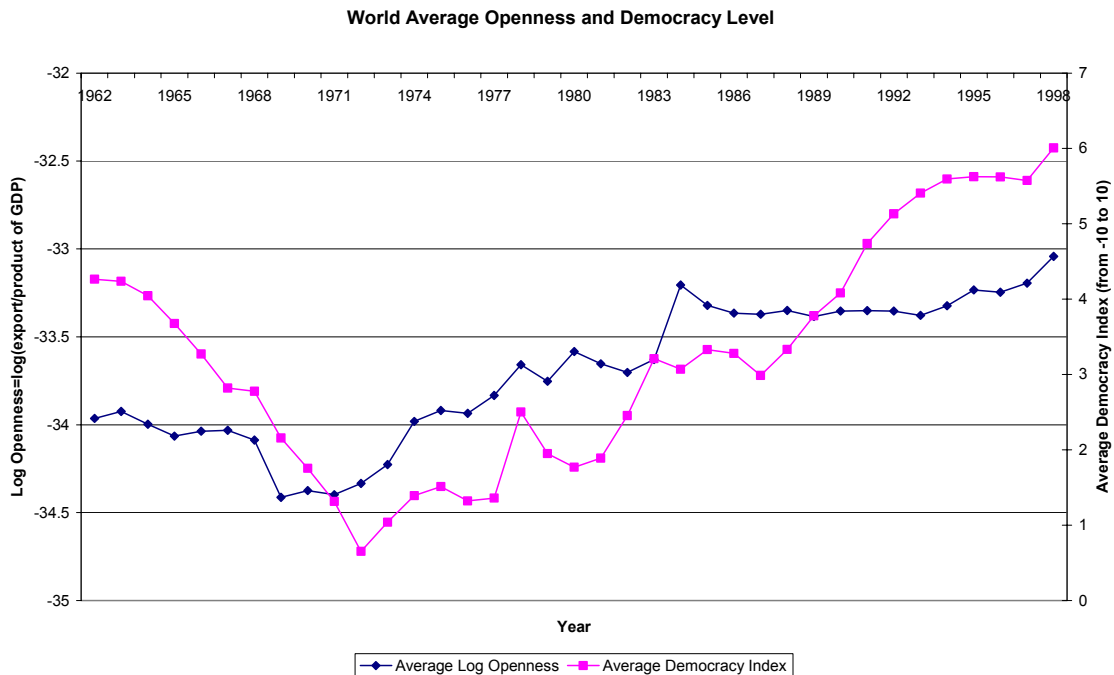
Notes: Regressand is log openness, which is defined as the difference between log bilateral trade and log product of GDP in both trading countries. Double stars and single star mean significance at 1% and 5% level for a two-tailed test, respectively. The z-statistics are in parenthesis and clustered by trading countries' pair-id for random effects and fixed effects. The instruments are death penalty abolition dummy and legal independence. If not specified, the fixed effects are the appropriate specification due to the Hausman test. We use bold coefficients to denote the correct specification if the one is random-effect.

Figure 1: World Trade Flow and Democracy Level



Sources: Export data is from Feenstra, *et. al.* (2005) and Democracy index is from Polity IV by Marshall-Jaggers (2004).

Figure 2: World Trade Openness and Democracy Level



Sources: Export data is from Feenstra, *et. al.* (2005), Real GDP data is from Rose (2004) and Democracy index is from Polity IV by Marshall-Jaggers (2004).