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Original Paper

Do Democracy Measures Matter in International Trade?

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Abstract

Gravity models of international trade usually focus on variables such as economic size of the partner nations (often gross domestic product), physical distance between the trading nations and other variables such as free trade agreements and common language. This work shows that additional measures of distance, *political distance,* are easily incorporated in gravity models. Two measures of political distance, based on published democracy indexes from the *Economic Intelligence Unit* of *The Economist* Magazine are separately incorporated into models of trade between the United States and its 10 leading partners over 16 years. The results indicate a crucial role for political distance in explaining this trade.

JEL codes: F10, F15

1. Introduction

This study attempts to estimate the effects of various trade determinants on the level of trade that occurs between the United States and a subset of its foreign trading partners. For purposes of this work, annual data in panel format were collected for the leading 10 trading partners over the period 2010-2025: Canada, China, the United Kingdom, Korea, India, Japan, Germany, Mexico, Vietnam, and Taiwan. The trade determinants examined in this study include the following: the US imports and exports with each trade partner, GDP of both the United States and the trade partners, the physical distance between the partners and the US, whether the US shares a common language and/or a free trade agreement with the partner, and finally the level of democracy for the US and its trade partners. This paper differs in two ways from others in literature. First, US total trade in goods and services (the sum of exports and imports) serves as the dependent variable. Second, this work includes two variables indicating political distance based on measures of democracy published by The Economist magazine.

2. The General Model and Previous Research

2.1 The Gravity Model

The term "gravity model of trade" derives from the similarity of the model to Newtonian physics, specifically Newton's law of universal gravitation. Newton's theory states that the force attracting two masses is proportional to the product of the measure of two masses and inversely proportional to the distance between the two masses. The gravity model of trade, first introduced by Jan Tinbergen in 1962, posits that trade between two nations will be proportional to the product of the size of the two nations (as measured by GDP, population, or some other indicator of size) and inversely proportional to the distance between the two nations. For example:

$$T_{ij} = A\frac{M_i^{\beta_1} M_j^{\beta_2}}{D_{ij}^{\beta_3}}$$

Where:

T_{ij} = some measure of trade flows between nations i and j,

M_i = a measure of the size of nation i (here GDP),

M_j = a measure of the size of nation j (here GDP),

D_{ij} = the distance between nations i and j, and

A = a constant

The multiplicative nature of the model leads to a specification in natural logs that allows for linear estimation techniques. That general form is:

$$log\ T_{ij} = log\ A + \beta_1\ log\ M_i + \beta_2\ log\ M_j - \beta_3\ log\ D_{ij} + \varepsilon_{ij}$$

Where log stands for the natural logarithm, the variables are defined as above, and ε_{ij} represents the error term. This model can (of course) be augmented to include other effects not represented in this simple formulation. The β_i represent elasticities of trade with respect to the explanatory variables. Suppose, for example, β_3 is estimated to be -1, then a 1% increase in distance would be associated with 1% less trade with the various trade partners.[1]

2.2 Previous Research

According to Srivastava and Green (1986), "Perhaps the most widely quoted study on the determinants of trade was conducted by Linneman (1966)." Linneman used gross national product, population, distance, and a preferential trade factor (which was essentially a dummy variable correlated to a particular "sphere of influence") as his independent variables in a gravity model specification. In this study Linneman found that all of these variables were of statistical significance with gross national product and distance having greatest explanatory value and the others having very little.

Srivastava and Green (1986) used Linneman's study as a starting point in their research using gross domestic product and distance while adding "political instability, membership in specific economic unions, and such cultural factors as religion and language," as independent variables. The study reported that 30.95% of the variance in trade was explained by these 6 variables, with distance accounting for about half. Similar to Linneman (1966), this study found that distance was the most important determinant of bilateral trade. Linneman also reported that, apart from distance, "only the GDP of the exporting country and the population of the importing country have additional significant effects on the dependent variable." The cultural and political variables included were found to be statistically significant yet not highly explanatory.

Other variables utilized in studies of the determinants of trade include free trade agreements and exchange rate volatility. A study by Baier and Bergstrand (2004) attempted to answer the question "Do Free Trade Agreements Actually Increase Members' International Trade?" Previous studies provided contradictory evidence on the statistical significance of free trade agreements, most giving it very little weight. Baier and Bergstrand (2004) attribute much of this to bias caused by using cross-sectional data. They suggest that "the best method to estimate the effect of FTAs on bilateral trade flows employs a theoretically motivated gravity equation using differenced panel data." With this method, Baier and Bergstrand estimate that a free trade agreement will "on average increase two member countries' trade about 86 percent after 15 years."

Much of the literature finds that distance between trading partners is robust and relatively constant over time (see Disdier and Head, 2008). However, a recent paper by Bergstrand, et al., (2015) suggests that the effect of distance has declined over time.

For more recent works, see Lohani (2020) and Narayan and Nguyen (2016). For an example of a currently estimated gravity model see the NYU Stern globalization explorer. Much of the rest of the more recent literature on gravity models focuses on modelling issues and is not summarized here.

3. Data

Data for the following variables were collected based on their importance and inclusion in the gravity model shown in previous research.

[1] An estimate of -1 for distance is common is these types of estimation.

M + X = US Imports plus Exports with a given country

GDPUS = Total GDP of the United States for a given year

GDPF = Total GDP of the trading partner for a given year

LANG = Dummy variable for common language (1=Yes 0=No)

FTA = Dummy variable for free trade agreement (1=Yes 0=No)

DIST_P = Physical distance between US and the trade partner

DEM = *The Economist* measure of the US democracy index

DEMF = *The Economist* measure of the US trade partner democracy index

The data for this exercise were collected primarily from traditional sources. The International Monetary Fund, World Economic Outlook Database, 2026 was the source for the GDP data. The trade data are from the US Bureau of Economic Analysis. The physical distance was collected from the NYU Stern globalization explorer, and the democracy indexes are from *The Economist*.

The democracy index measures from *The Economist* were available from 2010 to 2025 and that is the basis for the time frame for the data set.[2]

3.1 More on the Democracy Indices

The Economist measures of democracy are based on 60 indicators for 167 countries. The indices are computed by the *Economist Intelligence Unit* within the company that publishes the magazine and other materials. Each year data are gathered on the indicators in five categories: the election process and pluralism, functioning of government, political participation, political culture, and civil liberties. An annual index is computed for each nation, varying (theoretically) from 0 to 10, with higher scores representing greater democracy. Nations are also categorized by score as full democracies, flawed democracies, hybrid regimes, and authoritarian regimes. Herein the numerical scores are the basis for the two measures of political distance employed in the regressions as described below.

3.2 A Quick Look at the Trade Levels

Figures 1 and 2 provide one method of visualizing the data. Notice that US exports plus imports measured in goods and services is currently largest with Mexico as Mexico has recently surpassed China as the US number one trade partner. China's GDP is far larger than that of Mexico and the other US partners in this sample. The reader will know that relations between the US and China have deteriorated in recent years—post pandemic and associated supply chain issues. Additionally, the problematic political climate of trade policy, including tariffs, has also affected trade with US partners. Specifically, note the steep drop in trade associated with the pandemic period (2019-2020) for all US partners, followed by recovery thorough 2022 for these 5 nations. Post 2022, trade with China fell precipitously and fell more mildly with Canada, with both declines generally ascribed to US trade policy.

In Figure 2 trade fell in the pandemic year 2020 for Germany, Korea and India in the second quintile of partners, with trade increasing in the same year for Vietnam and Korea. Post pandemic trade with the U.S. generally grew with Taiwan's rapid ascent supplanting Germany as the leader of the nations in this second tier.

[2] Prior to 2010 *The Economist* published the democracy indexes, but the years were not consecutive.

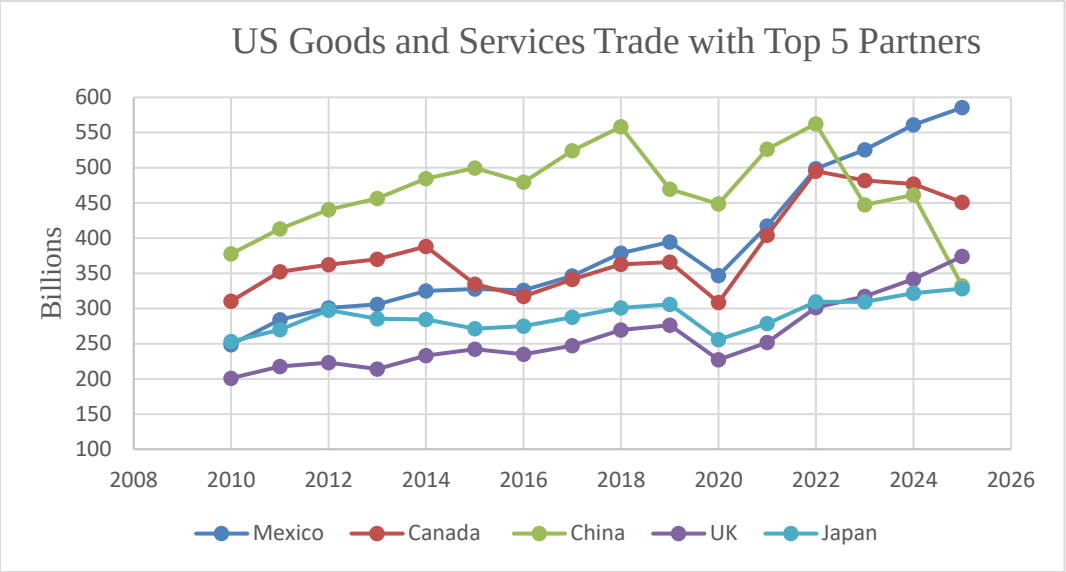

Figure 1. Trade in Goods and Services, 2010-2025 (Top 5 Partners)

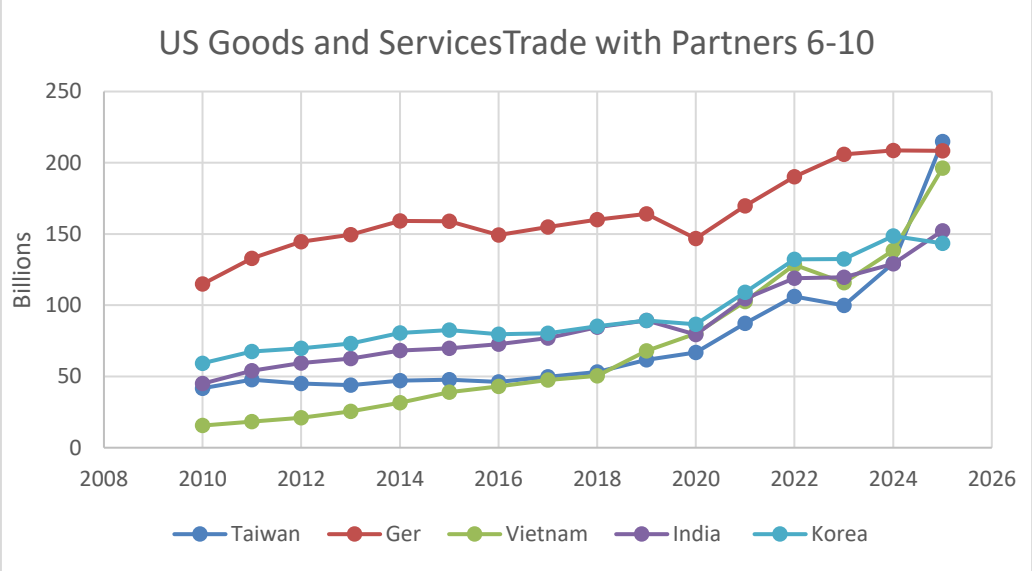

Figure 2. Trade in Goods and Services, 2010-2025 (Partners, 6-10)

4. Methodology

Panel regression analysis is employed in this study since the data have both a cross-section characteristic (different nations) and a time dimension (the years from 2010-2025). Four different regression methods were used: ordinary least squares (OLS), first differences (FD), fixed effects (FE), and random effects (RE). The following general estimation model was used for the regressions:

$$\log(TRADE_{it}) = \beta_0 + \beta_1\log(GDPUS_{it}) + \beta_2\log(GDPF_{it}) + \beta_3\log(DIST_i) + \beta_4\log(DIST\_dem_{it}) + \beta_5\log(OTHER) + \varepsilon_{it}, \quad (1)$$

where the variables are defined as above, i indicates the trade partners and t represents the year of the observation (t = 2010 – 2025). The variable DIST_dem represents political distance based on measures from the *Economist Intelligence Unit.*

The dependent variable takes two forms: one is total trade (TRADE) which is simply US imports plus exports of goods and services (M + X) by trade partner, and the other is merchandise trade—that is only exports plus imports of goods. These models differ from much of the literature in that for the dependent variable we measure the *sum* of exports and imports for the US, rather than bilateral exports between a group of nations. The first two independent variables are total GDP of the US (GDPUS) and that of the foreign trading partner (GDPF). The variables for common language and FTA may be included in the OTHER category.

As for the political distance variables, one variable was created as the ratio of the US measure of democracy to the measure of democracy for the trade partner, that is, DEM/FDEM. After the log operation that variable represents *political distance* between the US and the nations in the sample. Such a variable in log form will take on both positive and negative values, the negative values arise for nations with greater democracy measures than the US. It follows that the absolute value operation will produce the desired political distance for those cases. This is designated Political Distance (1). The second variable employed as a measure of political distance is simply a measure of the partner's difference (distance) from perfect democracy, that is, 10 minus the variable DEMF. Recall that DEMF has a theoretical maximum of 10. This variable is designated Political Distance (2) in natural log form

To be clear:

$$Political\ distance\ (1)\ = abs[log\left(\frac{DEM}{DEMF}\right)] \quad (2)$$

Where:

DEM = *The Economist's* measure of US democracy

DEMF = *The Economist's* measure of US trade partner democracy

log = natural log operator

abs = absolute value operator

and

$$Political\ Distance\ (2)\ = log(10/DEMF) \quad (3)$$

Unlike the first differences and fixed effects methods, RE allows the effects of variables that remain constant over the given time series to be estimated, and therefore variables like physical distance, FTAs, and common language may be included.

5. Results for Trade in Goods and Services[3]

5.1 Physical Distance

Table 1 contains the results of the estimations for each of three methods of estimation, after determining that Ordinary Least Squares is inappropriate.

5.1.1 Ordinary Least Squares

First consider ordinary least squares estimation (OLS). The measures of GDPF and the distance variable (here political distance) are statistically significant. There are, however, very good reasons that this regression should not be taken seriously. First, the coefficient for GDPUS is statistically insignificant and practically zero, counter to economic theory.[4] Second, in a panel setting such as the one employed here, the application of OLS assumes that coefficients (including intercepts) are constant across individuals (countries here) and over time. Varying intercepts would mean that unobserved effects are present across countries, meaning that some effects on trade are not (and maybe cannot) be included in the explanatory variable set. Fortunately, a simple test can be employed that will indicate whether such individual effects are in fact present and thus determine the appropriateness of ordinary

[3] The results for Merchandise Trade are very similar to Tables 1, 2, and 3. Those results are available from the author.

[4] The OLS regression is available from the author.

least squares. This test augments equation 1 by adding i – 1 dummy variables (D_1, D_2, … D_9) in order to test for individual effects as follows[5]:

$$\log(TRADE_{it}) = \beta_0 + \beta_1\log(GDPUS_t) + \beta_2\log(GDPF_{it}) + \beta_3\log(DIST_i) + \alpha_1D_1 + \alpha_2D_2 + \ldots + \alpha_9D_9 + \varepsilon_{it} \quad (1')$$

From 1′ we test that the α_i coefficients are jointly zero, i.e.,

H_0: $\alpha_1 = \alpha_2 \ldots = \alpha_9 = 0$ (there are no country effects)

H_1: some $\alpha_i \neq 0$ (one or more country effects are present)

The results of the regression specified in (1′) yield highly significant dummy variable coefficients, indicating important country (individual) effects, such that OLS is deemed inappropriate.[6]

5.1.2 First Differences

Given that OLS has been determined to be an inappropriate technique for this panel data, three other estimations are performed. The second column in Table 1 contains the estimated coefficients for the first differences method. Here US and foreign GDP are found to be statistically significant in explaining total US trade. Physical Distance drops out of First Differences and Fixed Effects estimations as it is invariant over the time frame and is, therefore, differenced or de-meaned out. The results for first differences have less explanatory power (as expected) than fixed effects or random effects.

5.1.3 Fixed Effects

The fixed effects method[7] finds highly significant effects for US and foreign GDP on US trade. The explanatory power of this regression is quite high ($\bar{R}^2$=.9587). The implied elasticity of trade with respect to US GDP is 0.5 and that of the trade partner is approximately 0.76.

5.1.4 Random Effects

Random effects panel regression methods have the advantage that variables which are constant over time (here distance between countries and common language) can be included in the regression's explanatory variable set. The classical test for the appropriateness of random effects methods is a Hausman test. This test involves comparing the covariance matrix of the least squares dummy variable model with that of the random effects model. The test is for correlation between the unobserved country specific random effects and the regressors. If such correlation exists, the random effects model is not chosen and the first differences or the fixed effects model is appropriate. If the correlation is insignificant, then random effects methods can be applied. This is a Wald type test distributed as χ^2 with degrees of freedom equal to k-1 (where k = number of regressors). The value of χ^2 is 1.54, with p-value of .214. Thus, the null hypothesis of no correlation cannot be rejected, and therefore, on this basis the random effects method is to be considered appropriate.

[5] This regression will return the same coefficient estimates as the "fixed effects" model for β_1, β_2, and β_3. It is sometimes called the least squares dummy variable technique (LSDV).

[6] The results of this regression are available from the author on request.

[7] The first differences method is actually one type of a "fixed effects" panel model. The model referred to here as fixed effects de-means the data prior to regression.

Table 1. Alternative Gravity Model Estimations, Dependent Variable Trade of Goods and Services (with Physical Distance in RE)

Explanatory Variable	**First Differences**	**Fixed Effects**	**Random Effects**
Constant	----	----	2.695 (3.17)
Total US GDP	0.9360* (6.43)	0.4950* (5.42)	0.5273* (6.02)
Total Foreign GDP	0.5349* (5.39)	0.7628* (8.25)	0.7183* (8.42)
Physical Distance	----	----	-0.8827* (-2.54)
$\bar{R}^2$	0.3620	0.9587	-----
SEE	0.0809	0.1710	0.1667

(t-scores in parentheses, * represents statistical significance at α < .01, ** represents statistical significance at α < .05, and *** represents statistical significance at α < .10)

Note further that the random effects method yields estimates for the coefficients of variables that are in keeping with economic theory and similar to the corresponding coefficients for the fixed effects results. For the additional variable included in the RE estimation, significant effects of physical distance are indicated, and the implied elasticity is in keeping with other research. Common Language and Free Trade Agreements had essentially no effects in the RE estimation and are therefore excluded from the regression.[8]

5.2 Political Distance 1 (and Physical Distance)

Table 2 presents the results of the regressions with Political Distance as defined as the ratio of the US democracy index to the trade partner's democracy index, i.e., DEM/FDEM modified as defined in section 4, Methodology. As stated above, that variable *does* vary with time and therefore *can* be included in all three estimations.

5.2.1 First Differences

In Table 2 both *US GDP* and *Foreign GDP* are statistically important determinants of trade in goods and services, whereas *Political Distance* is signed negatively in accord with expectations but is not significant statistically. These 3 variables explain approximately 36% of the variation in the differences in trade with the US and these 10 trade partners.

5.2.2 Fixed Effects

All three variables in the fixed effects regression are "correctly" signed in accord with theory and highly statistically significant. The estimated equation explains 96.31% of the variation of trade ($\bar{R}^2$= 0.9627). Importantly, the estimation indicates that *Political Distance* (1) is important to trade with this subset of trade partners.

[8] It would not follow that FTAs and common language have no effect on trade—only there seems to be no statistical evidence for this small sample.

Table 2. Alternative Gravity Model Estimations, Dependent Variable Trade of Goods and Services, with Political Distance (1) (and Physical Distance)

Explanatory Variable	**First Differences**	**Fixed Effects**	**Random Effects (a)**	**Random Effects (b)**
Constant	----	----	-6.447 (-9.03)	0.4761 (0.13)
Total US GDP	0.9585* (6.58)	0.6110* (6.71)	0.6247* (7.04)	0.6215* (7.01)
Total Foreign GDP	0.5357* (5.55)	0.8247* (9.27)	0.7838* (9.32)	0.7808* (9.28)
Physical Distance	----	----	----	-0.7685** (-1.90)
Political Distance (1) *abs[log(DEM/FDEM)]*	-0.2313 (-1.55)	-0.8977* (-4.13)	-0.7985* (-3.87)	-0.7686* (-3.71)
$\bar{R}^2$	0.3680	0.9627	-----	-----
SEE	0.0805	0.1625	0.1579	0.1585

(t-scores in parentheses, * represents statistical significance at α < .01, ** represents statistical significance at α < .05, and *** represents statistical significance at α < .10)

5.2.3 Random Effects

In Table 2, the *Random Effects (a)* column estimations are similar to those from the *Fixed Effects* for US and partner GDP including coefficients and t-scores. However, the estimate of elasticity for Political Distance is somewhat smaller versus fixed effects. This *Random Effects* equation has a slightly lower standard error of the estimate when compared to the Fixed Effects estimations Recall that in fixed effects estimation that variables are demeaned, and in random effects the variables are quasi-demeaned. *Random Effects (b)* includes both the physical and political distance variables. The physical distance is correctly signed, marginally significant, and reasonably close to common results from other works of this type. There is almost no change in the other coefficient estimates or their level of significance.

Compared to the *Randon Effects* estimation in Table 1, the estimated elasticity for Physical Distance is reduced in absolute value (-0.7686 versus -0.8827). This result is likely due to the presence of the measure of Political Distance in the estimation.

5.3 Political Distance 2 (and Physical Distance)

Table 3 presents the results of the regressions with Political Distance (2) as defined as the ratio of the US trade partner's level of democracy to the theoretical maximum of 10. That is ln(10/DEMF). This variable also varies with time and therefore *can* be included in all three estimations.

5.3.1 First Differences

In Table 3 both *US GDP* and *Foreign GDP* are statistically important determinants of trade in goods and services, whereas *Political Distance* is signed negatively in accord with expectations but is not significant statistically. These 3 variables explain approximately 36% of the variation in the differences in trade with the US and these 10 trade partners.

5.3.2 Fixed Effects

The Fixed Effects column of results in Table 3 indicates that the three explanatory variables are statistically significant determinants of trade with this subset of US trade partners. This measure of political distance is also an important determinant of trade. The adjusted R^2 and the standard error of the estimate are very similar to those of the corresponding values of Table 2.

5.3.3 Random Effects

The Random Effects (a) estimations in Table 3, with the alternative measure of political distance, show significant coefficients for US and partner GDP measures and an elasticity of approximately -0.71 for the second measure of political distance—somewhat smaller than the corresponding estimate from Table 2. The last column in Table 3, Random Effects (b), includes the second measure of Political Distance along with Physical Distance. The coefficient for Physical Distance is estimated to be -0.73 versus the -0.88 estimate from Table 1, a similar result as is evident in Table 2. Based on t-scores the Political Distance 2 variable estimate is highly significant. Physical Distance, though weakly significant, still suggests important effects.

Table 3. Alternative Gravity Model Estimations, Dependent Variable Trade of Goods and Services, with Political Distance (2) (and Physical Distance)

Explanatory Variable	**First Differences**	**Fixed Effects**	**Random Effects (a)**	**Random Effects (b)**
Constant	----	----	-5.77 (-8.66)	0.8221 (0.22)
Total US GDP	0.9508* (6.54)	0.4851* (5.63)	0.5165* (6.17)	0.5071* (6.18)
Total Foreign GDP	0.5354* (5.55)	0.9040* (9.72)	0.8475* (9.71)	0.7808* (9.28)
Physical Distance	----	----	----	-0.7346*** (-1.78)
Political Distance (2) *log(10/FDEM)*	-0.1742 (-1.17)	-0.7910* (-4.39)	-0.7084* (-4.12)	-0.6805* (-3.94)
$\bar{R}^2$	0.3636	0.9632	-----	-----
SEE	0.0808	0.1614	0.1569	0.1575

(t-scores in parentheses, * represents statistical significance at $\alpha < .01$, ** represents statistical significance at $\alpha < .05$, and *** represents statistical significance at $\alpha < .10$)

6. Summary of Findings and Discussion

6.1 Summary

This section offers a concise summary of the findings of the prior section. First (and unsurprisingly), the ordinary least squares method is found not to be an appropriate technique for analysis of this panel data set. Second, several robust results are found from estimations with three other methods: first differences, fixed effects, and random effects. That is, the results indicate that total foreign GDP and US GDP are important determinants of trade with the selected partners. Third, since the Hausman test suggests that the random effects model is an appropriate method of analysis for this data, it is possible to test for the effects of distance between the ten nations and the US. Common language and free trade

agreements can also be included in random effects models, though incorporating these two variables showed no significance and are not included in the presented estimates. The measured effect of distance is weakly significant in the random effects results, though the coefficient supports important effects.

6.2 Discussion

Though many of these results are congruent with prior research on the determinants of trade, there are some differences. As for the random effects results that show physical distance as being marginally significant, recent research has found that distance is becoming a less important factor in determining trade flows due to improved communications and transportation methods, including decreased transportation costs (see Bergstrom, et al., 2015). It is also likely that the widespread use of computers in the ordering process has reduced the effects of differing languages.

Several caveats are also in order. Baier and Bergstrand suggest that several of the explanatory variables in most gravity models are not exogenous. They focus in particular on FTAs, suggesting that the formation of an FTA is influenced by the level of trade (along with other variables). Most observers would agree that nations with large amounts of bi-lateral trade and in close proximity are more likely to form free trade agreements. Without disagreeing with this general line of reasoning, it is nonetheless true that the US has had free trade agreements with nations very far away and with relatively little trade with the US, at least from the US perspective. The finding of the effects of political distance on trade may be the most important result of this study. As a final possible limitation of this study, other than the first differences model, we have not accounted for any potential time series effects such as autocorrelation or conditional heteroskedasticity. Even with annual data for a relatively short timeframe, such effects are at least potential problems.

7. Conclusions

This project succeeded in producing results in line with previous gravity model studies of international trade. With total trade (the sum of US exports and imports) serving as the dependent variable with partner nations: Canada, China, Germany, India, Korea, Mexico, Japan, Taiwan, the United Kingdom, and Vietnam, results are given from estimated models for a panel data set. This work finds that the GDP of the trade partner, US GDP and *political distance* to be important determinants of US trade across these ten nations for annual data from 2010 to 2025. We also find that the random effects method is appropriate for this particular panel, and in that model, contrasting with early studies but consistent with more recent research, somewhat more weak statistical effects for the *physical distance* from the US to the trade partner are found. Finally, the effects of a common language and FTAs in the random effects model are estimated to be essentially zero.

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