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Abstract

Gravity variables such as distance, adjacency, colony, free trade agreements or language are used to capture the effects of trade costs in empirical studies. By using actual data on trade costs, this paper decomposes the overall effects of such variables on trade into those through three gravity channels: duties/tariffs (DC), transportation-costs (TC), and dyadic-preferences (PC). As opposed to the existing literature where gravity variables act like supply shifters (through DC and TC), this paper empirically shows that they act like demand shifters (through PC). Regarding policy, it is implied that welfare-improving globalization cannot be achieved only through reductions in direct costs such as duties/tariffs or transportation costs; it is rather the globalization itself that should be promoted in order to shift the preferences of destination countries toward international products and thus reduce indirect trade costs. The results are further connected to several existing discussions in the literature, such as welfare gains from trade and the distance puzzle.

JEL Classification: F12, F14

Key Words: Gravity Variables; Dyadic Preferences; U.S. Imports

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Abstract

Gravity variables such as distance, adjacency, colony, free trade agreements or language are used to capture the effects of trade costs in empirical studies. By using actual data on trade costs, this paper decomposes the overall effects of such variables on trade into those through three gravity channels: duties/tariffs (DC), transportation-costs (TC), and dyadic-preferences (PC). As opposed to the existing literature where gravity variables act like supply shifters (through DC and TC), this paper empirically shows that they act like demand shifters (through PC). Regarding policy, it is implied that welfare-improving globalization cannot be achieved only through reductions in direct costs such as duties/tariffs or transportation costs; it is rather the globalization itself that should be promoted in order to shift the preferences of destination countries toward international products and thus reduce indirect trade costs. The results are further connected to several existing discussions in the literature, such as welfare gains from trade and the distance puzzle.

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1 Introduction

Ever since the studies of migration flows by Ravenstein (1889) and of trade flows by Tinbergen (1962), gravity models have been employed to connect trade flows to masses of economic activity at source and destination countries together with dyadic/gravity variables such as distance, common language, border, colonial relationship, and free trade agreements. These initial empirical studies have been later supported by economic theory in studies such as by Anderson (1979), Anderson and van Wincoop (2003) in the context of homogeneous firms as well as Chaney (2008) and Arkolakis et al. (2012, 2015) in the context of heterogenous firms. The latter authors have also shown that, independent of the microfoundations, the estimated gravity equation model can be expressed in a log-linear format where log trade enters as the dependent variable, while source and destination effects together with dyadic variables representing trade costs enter as independent variables.[1]

Within this picture, dyadic/gravity variables have been shown to be the main focus of estimations, since they are directly linked to any policy investigation due to their representation of trade costs as surveyed in studies such as by Anderson and van Wincoop (2004) or Head and Mayer (2014). Although economic models in these surveys imply that dyadic/gravity variables capture such trade costs, mostly corresponding to the difference between source and destination prices, it is understood in the background that these dyadic/gravity variables may also be capturing preferences in the destination country. In particular, as nicely put by Anderson (2011):

> "In practice it is very difficult to distinguish demand-side home bias from the effect of trade costs, since the proxies used in the literature (common language, former colonial ties, or internal trade dummies, etc.) plausibly pick up both demand and cost differences. Henceforth trade cost is used without qualification but is understood to potentially reflect demand-side home bias."

where he mainly emphasizes the difficulty of distinguishing between the effects of preferences and trade costs on international trade when dyadic/gravity variables are employed in gravity regressions. Following studies such as by Balistreri and Hillberry (2006) who conclude that

[1] Also see Head and Mayer (2014) for an excellent survey based on other recent studies.

quantitative measures of trade costs or welfare effects cannot be made without direct data on trade costs, we believe that the difficulty in the literature mentioned by Anderson (2011) is mostly due to the lack of actual data on trade costs.

Accordingly, based on a simple model in this paper, we achieve to differentiate between the effects of dyadic/gravity variables on preferences and trade costs by using actual data on trade costs of U.S. imports. In particular, trade costs are defined as the difference between source and destination prices, including both duties/tariffs and transportation costs while excluding local distribution costs. Having data on trade costs (together with the standard data of trade and unit prices) directly allows us calculating the effects of dyadic/gravity variables on the measured data we have.[2]

In order to show the contribution of this paper in a clear way, we consider two types of preferences. The first type of preferences is random (as we call it the case of "random preferences"), which is mostly the case in the literature as we show in details. When these "random preferences" are considered, the effects of gravity variables are only through *direct* trade costs that are embedded in destination prices. Hence, gravity variables act like supply shifters in this case (as is standard in the literature), because they are parts of the marginal costs of delivering the product to the destination country.

The second type of preferences we consider is the one that depends on dyadic/gravity variables (as we call it the case of "dyadic preferences"). These preferences constitute the main contribution of this paper. When these "dyadic preferences" are considered, the effects of gravity variables are not only through *direct* trade costs that are embedded in destination prices but also through preferences of individuals at the destination country (that represent *indirect* trade costs). Hence, in this case, gravity variables not only act like supply shifters (as is standard in the literature) but also act like demand shifters (that are new in this

[2] Such an empirical approach is also in line with studies such as by Hillberry, Anderson, Balistreri and Fox (2005) who find that taste parameters are correlated with bilateral trade costs or by Head and Mayer (2013) who suggest that preference differences have the potential to explain some of the large distance and border effects that have been found in the literature. For instance, based on the estimates of indirect trade costs in Allen (2012) and Feyrer (2009), Head and Mayer (2013) show that between 50% to 85% of the distance effects on trade flows are due to indirect trade costs (that are called *dark* trade costs). In addition to these studies, this paper can directly identify the role of direct versus indirect trade costs through each and every gravity variable (rather than only distance) using actual data on trade costs.

paper). It is implied that "dyadic preferences" in this paper represent a more general case than "random preferences" in the literature.

The simple model introduced in this paper is estimated separately for each type of preferences. These estimations are essential to figure out the channels through which gravity variables affect international trade. In particular, we would like to know whether gravity variables act like supply shifters or demand shifters. The estimation results show that when "random preferences" are considered, about one third of the effects of gravity variables on international trade are due to the channel of duties/tariffs, while the rest is due to the channel of transportation costs; hence, gravity variables act like supply shifters by construction in this case. In order to show the contribution of this paper, when the more general case of "dyadic preferences" is considered, virtually all the effects of dyadic/gravity variables on U.S. imports are due to preferences, while the effects through duties/tariffs and transportation costs are very small. It is implied that when the overall effects of gravity variables on international trade are considered, they are mostly through dyadic preferences, and thus gravity variables act like demand shifters (rather than supply shifters as implied by the literature).

These results have important policy implications for having a welfare-improving globalization. In particular, policy tools acting like supply shifters such as duties/tariffs or investment on transportation technologies are simply implied as not having enough impact on trade as advocated in studies such as by Harley (1988) or Irwin and ORourke (2011); it is rather the globalization itself that should be promoted in order to shift the demand preferences of destination countries toward international products. Such a policy suggestion is also in line with Head and Mayer (2013) who suggest that the absence of globalization cannot be reduced to conventional explanations, such as tariffs and freight costs.

As a supplementary exercise, we also investigate the contribution of each gravity variable to each gravity channel. In the case of both random and dyadic preferences, distance is shown to be the dominant gravity variable for the channels of duties/tariffs and transportation costs. However, for the channel of dyadic preferences that captures virtually all the effects of gravity variables on U.S. imports, the tables turn as having a common border contributes about 45.12%, followed by distance about 32.23%, colony about 13.98%, free trade agreement (FTA) about 6.91%, and language about 1.76%. As an additional supplementary exercise, we finally investigate the contribution of each given gravity variable through alternative gravity channels. In the case of random variables, the effects of distance, common border, colonial relationship, and common language are shown to be mostly through transportation costs, whereas the effects of FTAs are through duties/tariffs. In the case of dyadic preferences though, all gravity variables are shown to be effective through the channel of dyadic-preferences rather than duties/tariffs or transportation costs.

The rest of the paper is organized as follows. The next section connects our investigation to the existing discussions and puzzles in the literature. Section 3 introduces a simple trade model. Section 4 shows the implications of the model for trade in the case of random taste parameters, while Section 5 shows the same implications in the case of dyadic preferences. Section 6 introduces the data and the corresponding descriptive statistics. Section 7 depicts the estimation results by carefully connecting the estimates to several existing discussions in the literature, such as welfare gains from trade or the distance puzzle. Section 8 achieves several variance decomposition analyses. Section 9 concludes.

2 Existing Discussions and Puzzles

In the related literature, the gravity variables are popularly used as proxies for both direct and indirect trade costs; while the former refer to measurable costs such as transportation costs and duties/tariffs, the latter correspond to abstract costs such as information/language barriers or search costs. Although the existing literature has used these gravity variables extensively, to our knowledge, there has not been enough attempt to decompose the overall gravity effects on trade (across time and space) into those through direct versus indirect trade costs. This has been mostly due to data limitations on trade costs, especially indirect ones; one exception is a survey study by Anderson and van Wincoop (2004) who have put together the implications of several studies based on the effects of gravity variables on trade. According to their investigation, the tax equivalent of international trade costs is about 74%, including transportation costs of about 12%, language barrier of about 7%, and duties/tariffs of about 3% (for the U.S.), among others such as information or security barriers. Although our data on trade costs are line with these numbers, different from Anderson and van Wincoop (2004) who take these components as independent from each other (e.g., duties/tariffs or transportation costs do not depend on language) since these effects are collected from different studies in the literature, in this paper, by having a complete investigation that capture all of these mentioned components, we show that the effects of gravity variables can be both through measured trade costs (of duties/tariffs or transportation costs) as well as dyadic preferences. Accordingly, when dyadic preferences are ignored as in the existing literature, we show that the effects of gravity variables on trade are mostly through transportation costs, except for the effects of FTAs that are through duties/tariffs (as one would expect). When we consider dyadic preferences, though, we show that the effects of gravity variables on trade are now through these preferences that dominate the other channels of duties/tariffs and transportation costs. Since all destination-price effects (i.e., supply shifters or movements along the demand curve) are already captured by the available data in this paper, it is implied that gravity variables mostly work as demand shifters rather than supply shifters as implied by the existing literature. This is important from a policy perspective, because policy tools such as duties/tariffs or investment on transportation technologies are implied as simply not enough to have any impact on trade; it is rather the globalization itself that should be promoted in order to shift the preferences of destination countries toward partner country products. Therefore, the consideration of dyadic preferences is essential to understand the contribution of gravity effects on trade.

This paper is also connected to several discussions and puzzles in the existing literature, where individual gravity variables play important roles. Within this picture, distance has been one of the key variables, since it is used as a proxy for many components of trade costs such as transportation costs, policy barriers, information costs, contract enforcement costs, costs associated with the use of different currencies, legal and regulatory costs and local distribution costs (e.g., see Anderson and van Wincoop, 2004). This practice has come at the cost of unrealistically high/overloaded estimated ad-valorem tax equivalents of distance effects, considered under the title of "distance puzzle" due to lower expected distance effects based on the magnitude of transportation costs and duties/tariffs (e.g., see Disdier and Head, 2008; Yilmazkuday, 2014). Besides this *magnitude* dimension of the distance puzzle, the persistence of the distance coefficients over time constitutes the *time* dimension of the puzzle that mostly exists due to the expectation for decreasing effects of distance over time because of the improvements in transportation technology and the reductions in duties/tariffs (e.g., see Carrere and Schiff, 2005; Hummels, 2007; Berthelon and Freund, 2008; Yilmazkuday, 2017). Compared to the existing literature, by using actual data on measured trade costs, this paper shows that both *magnitude* and *time* dimensions of the distance puzzle can be solved when the effects of distance are decomposed into those due to measured trade costs and preferences.

Adjacency has been another standard (dummy) variable used in gravity studies (e.g., see Anderson and van Wincoop, 2004). The main idea is to investigate whether having a common border affects the trade flows between neighbor countries. However, we do not know through which channels adjacency affects trade. For example, after the effects of distance are controlled, can we still talk about the effects of adjacency on transportation costs? The answer is yes in studies such as by Woudsma (1999) or Hesse and Rodrigue (2004) who have shown that transportation networks may improve between countries that trade more with each other, which can result in lower transportation costs. The game-theory based models of trade also show how increasing trade pushes countries that trade more to have free trade agreements between each other in order to maximize their welfare (e.g., see Bagwell and Staiger, 1998, for a theoretical discussion; see Yilmazkuday and Yilmazkuday, 2014, for the corresponding empirical evidence); since adjacent countries trade more with each other, having a common border may also result in lower duties/tariffs. Then the question is, which one of these effects contribute more to trade flows? Unlike the existing literature that is silent on this question, this paper shows that adjacency is more effective through transportation costs rather than duties/tariffs. On top of these channels, when dyadic preferences are introduced in this paper, it is also shown that preferences dominate both transportation costs and duties/tariffs regarding the effects of adjacency on trade.

Existing studies also have similar discussions based on having FTAs, historical colonial relationships, and sharing a language (among others), all of which are shown to have significant effects on international trade through gravity regressions. Among these variables, though, having an FTA has a special importance due to its connection to international trade policy. For instance, Baier and Bergstrand (2004) empirically show that the potential welfare gains and likelihood of a bilateral FTA are economically and significantly higher: (i) the closer in distance are two trading partners; (ii) the more remote a natural pair is from the rest of the world (ROW); (iii) the larger and more similar economically are two trading partners; (iv) the greater the difference in comparative advantages; and (v) the less is the difference in comparative advantages of the member countries relative to that of the ROW. However, we do not know the contribution of each gravity channel through which FTAs are more effective, after controlling for all economic conditions (also mentioned by Baier and Bergstrand, 2004) that are standard in the literature. This paper achieves several decompositions within this context and shows that FTAs are effective mostly through duties/tariffs rather than transportation costs; however, when dyadic preferences are introduced, they dominate all other channels by big margins.

In sum, in this paper, overall effects of gravity variables on trade are mostly shown to be through dyadic preferences rather than the measured trade costs of transportation costs or duties/tariffs. This additional channel of dyadic preferences has not been given enough importance in the existing literature, mostly due to the lack of available data on the subject.[3] Thanks to the detailed data on U.S. imports and the corresponding measured trade costs, this paper has achieved to identify the effects of each gravity channel by using the implications of a simple model, which is introduced next.

3 The Model

We model the imports of the U.S. at the good level considering the optimization problems of individuals in the U.S. and the firms in the source countries.

3.1 Individuals and Firms

The individual in the U.S. maximizes utility of a composite index of goods at time t given by:

$$C_t \equiv \prod_j \left(C_t^j\right)^{\gamma_t^j} \quad (1)$$

[3] Withn this context, this paper complements the growing literature which separate trade costs and preference-related drivers of bilateral trade flows (e.g., see Atkin, 2013; Atkin and Donaldson, 2015; Cosar et al., 2018). For example, Cosar et al. (2018) argue that the preference-based differences are the most important drivers of home market advantage compared to the supply-side frictions, such as tariffs and transportation costs.

where C_t^j represents the composite index of varieties of good j at time t given by:

$$C_t^j \equiv \left(\sum_i \left(\theta_{t,i}^j\right)^{\frac{1}{\eta_t}} \left(C_{t,i}^j\right)^{\frac{\eta_t-1}{\eta_t}} \right)^{\frac{\eta_t}{\eta_t-1}} \tag{2}$$

where $C_{t,i}^j$ is the variety i of good j imported from source country i; $\eta_t > 1$ is the time-varying elasticity of substitution across varieties; γ_t^j and $\theta_{t,i}^j$ are taste parameters.[4]

The optimal allocation of any given expenditure within each variety of goods yields the following demand functions:

$$C_{t,i}^j = \theta_{t,i}^j \left(\frac{P_{t,i}^j}{P_t^j} \right)^{-\eta_t} C_t^j \tag{3}$$

and

$$P_t^j C_t^j = \gamma_t^j P_t C_t \tag{4}$$

where

$$P_t^j \equiv \left(\sum_i \theta_{t,i}^j \left(P_{t,i}^j\right)^{1-\eta_t} \right)^{\frac{1}{1-\eta_t}} \tag{5}$$

is the price index of good j (which is composed of the prices of different varieties), and

$$P_t \equiv \prod_j \left(\frac{P_t^j}{\gamma_t^j} \right)^{\gamma_t^j} \tag{6}$$

is the cost of living index (which is composed of the prices of different goods) at time t. Last four equations imply that the total value of imports of at time t in terms of good j can be written as follows:

$$P_t^j C_t^j = \sum_i P_{t,i}^j C_{t,i}^j \tag{7}$$

and that the total expenditure at time t for all goods can be written as follows:

$$P_t C_t = \sum_j P_t^j C_t^j \tag{8}$$

The unique firm in source country i specialized in the production of good j maximizes its profits out of producing variety i of good j to be exported to the U.S. according to the

[4]Studies such as by Giri et al. (2021) show that having a common trade elasticity (that can be represented by $\eta_t - 1$ in this paper) across goods would result in similar (welfare) implications compared to having good-specific trade elasticity as long as these elasticities are estimated in a model-consistent way, which is the methodology followed in this paper.

following profit maximization problem using its pricing to market strategy:

$$\max_{P^j_{t,i}} Y^j_{t,i}\left[P^j_{t,i} - Z^j_{t,i}\right] \tag{9}$$

subject to

$$Y^j_{t,i} = C^j_{t,i} \tag{10}$$

where $Y^j_{t,i}$ is the level of output, and $Z^j_{t,i}$ is the marginal cost that is given by:

$$Z^j_{t,i} = \frac{W_{t,i}\tau^j_{t,i}}{A^j_t} \tag{11}$$

where $W_{t,i}$ represents the time and source-country specific input costs, A^j_t is the productivity that is time and good specific, and $\tau^j_{t,i}$ represents trade costs between the source country i and the U.S. for good j at time t that is further given by:

$$\tau^j_{t,i} = \tau^{j,D}_{t,i}\tau^{j,T}_{t,i} \tag{12}$$

where $\tau^{j,D}_{t,i}$ represent trade costs of duties/tariffs, and $\tau^{j,T}_{t,i}$ represents transportation costs.

The first order condition for the profit maximization problem implies that:

$$P^j_{t,i} = \left(\frac{\eta_t}{\eta_t - 1}\right) Z^j_{t,i} \tag{13}$$

where $\frac{\eta_t}{\eta_t-1}$ represents (gross) markups. The source prices (excluding trade costs) $P^{j*}_{t,i}$ are implied as follows:

$$P^{j*}_{t,i} = \frac{P^j_{t,i}}{\tau^j_{t,i}} = \left(\frac{\eta_t}{\eta_t - 1}\right)\frac{W_{t,i}}{A^j_t} \tag{14}$$

4 Implications for Trade: The Case of Random Taste Parameters

According to Equation 3, the values of U.S. imports are implied as follows:

$$M^j_{t,i} = P^j_{t,i}C^j_{t,i} = P^j_{t,i}\theta^j_{t,i}\left(\frac{P^j_{t,i}}{P^j_t}\right)^{-\eta_t} C^j_t \tag{15}$$

which can be estimated in its log format according to:

$$\underbrace{\log M^j_{t,i}}_{\text{Trade Data}} = (1-\eta_t) \underbrace{\left(\log P^j_{t,i}\right)}_{\text{Destination-Price Data}} + \underbrace{\log\left(C^j_t\left(P^j_t\right)^{\eta_t}\right)}_{\text{Time and Good Fixed Effects}} + \underbrace{\log\theta^j_{t,i}}_{\text{Taste Parameters as Residuals}} \tag{16}$$

where (log) taste parameters $\log \theta_{t,i}^{j}$ are assumed to be i.i.d. random variables, and thus they are considered as the residuals. Considering the definition of destination prices $P_{t,i}^{j} = P_{t,i}^{j*}\tau_{t,i}^{j,D}\tau_{t,i}^{j,T}$ due to Equations 12 and 14, this expression can be rewritten as follows:

$$\underbrace{\log M_{t,i}^{j}}_{\text{Trade Data}} = (1-\eta_t)\underbrace{\left(\log P_{t,i}^{j*} + \log \tau_{t,i}^{j,D} + \log \tau_{t,i}^{j,T}\right)}_{\text{Destination Prices}} + \underbrace{\log\left(C_t^j \left(P_t^j\right)^{\eta_t}\right)}_{\text{Time and Good Fixed Effects}} + \underbrace{\log \theta_{t,i}^{j}}_{\text{Taste Parameters as Residuals}} \tag{17}$$

where source prices $P_{t,i}^{j*}$, together with trade costs of $\tau_{t,i}^{j,D}$ and $\tau_{t,i}^{j,T}$, are simultaneously determined in equilibrium. Accordingly, following Zellner and Theil (1962), we employ the estimation methodology of Three-Stage Least Squares (3SLS) that simultaneously estimates Equation 17 (under the restriction that $\log P_{t,i}^{j*}$, $\log \tau_{t,i}^{j,D}$ and $\log \tau_{t,i}^{j,T}$ have the same coefficient of $1-\eta_t$ representing the negative of *trade elasticity*) together with the following three expressions representing source prices $P_{t,i}^{j*}$, trade costs due to duties/tariffs $\tau_{t,i}^{j,D}$, and transportation costs $\tau_{t,i}^{j,T}$, respectively:

$$\log P_{t,i}^{j*} = \underbrace{\log\left(\frac{\eta_t}{\eta_t - 1}\right)}_{\text{Time Fixed Effects}} + \underbrace{\log W_{t,i}}_{\text{Time and Source-Country Fixed Effects}} - \underbrace{\log A_t^j}_{\text{Time and Good Fixed Effects}} + \underbrace{v_{t,i}^{j}}_{\text{Residuals}} \tag{18}$$

and

$$\log \tau_{t,i}^{j,D} = \delta_t^{j,D} + G_{t,i}^{D} + v_{t,i}^{j,D} \tag{19}$$

and

$$\log \tau_{t,i}^{j,T} = \delta_t^{j,T} + G_{t,i}^{T} + v_{t,i}^{j,T} \tag{20}$$

where $\delta_t^{j,A}$ (for $A \in \{D, T\}$) represents time and good fixed effects; $v_{t,i}^{j}$, $v_{t,i}^{j,D}$ and $v_{t,i}^{j,T}$ represent the random components (as residuals), and $G_{t,i}^{A}$ (for $A \in \{D, T\}$) represents the effects of basic gravity variables according to the following specification:

$$G_{t,i}^{A} = d_{t,i} + bo_{t,i} + la_{t,i} + co_{t,i} + fta_{t,i} \tag{21}$$

where $d_{t,i}$ is the effect of (log) distance between the source country i and the U.S., $bo_{t,i}$ is the effect of sharing a land border (i.e., adjacency), $la_{t,i}$ is the effect of sharing a language, $co_{t,i}$ is the effect of any colonial relationship, and $fta_{t,i}$ is the effect of country i and the U.S. having a free trade agreement. It is important to emphasize that the gravity variables that we consider have time-varying effects as suggested by Bergstrand et al. (2015) who have shown that ignoring the changes in gravity variables over time may lead into biased estimates.

In order to see the effects of gravity variables on trade in a better way, once the estimation is achieved, we can rewrite the fitted value of Equation 17 as follows:

$$\log \widehat{M}_{t,i}^{j} = \widehat{G}_{t,i} + (1-\eta_t)\left(\log \widehat{P}_{t,i}^{j*} + \widehat{\delta}_t^{j,D} + \widehat{\delta}_t^{j,T}\right) + \log\left(\widehat{C_t^j\left(P_t^j\right)^{\eta_t}}\right) + \widehat{u}_{t,i}^{j} \tag{22}$$

where $u_{t,i}^{j} = \log \theta_{t,i}^{j} + v_{t,i}^{j} + v_{t,i}^{j,D} + v_{t,i}^{j,T}$, and $\widehat{G}_{t,i}$ represents the combined fitted effects of gravity variables according to:

$$\widehat{G}_{t,i} = (1-\eta_t)\left(\widehat{G}_{t,i}^{D} + \widehat{G}_{t,i}^{T}\right) \tag{23}$$

which can easily be decomposed into effects due to duties/tariffs and transportation costs, as we will achieve below.

5 Implications for Trade: The Case of Dyadic Taste Parameters

If (log) taste parameters are not just i.i.d. random variables (as in Equation 17) but also functions of gravity variables (i.e., if they are dyadic), they can be rewritten as follows:

$$\log \theta_{t,i}^{j} = \delta_t^{j,P} + G_{t,i}^{P} + v_{t,i}^{j,P} \tag{24}$$

where $\delta_t^{j,P}$ represents time and good fixed effects, $G_{t,i}^{P}$ represents the effects of very same gravity variables (as described in Equation 21) on taste parameters, and $v_{t,i}^{j,P}$ represents the i.i.d. random component of taste parameters. Therefore, the only difference between having random taste parameters and dyadic taste parameters is that the taste parameters only act like residuals in the former case, whereas they are split into two, representing (i) the effects of gravity variables and (ii) residuals, in the latter case.

When Equation 24 is substituted into Equation 17, we can obtain:

$$\begin{aligned} \log M_{t,i}^{j} &= (1-\eta_t)\underbrace{\left(\log P_{t,i}^{j*} + \log \tau_{t,i}^{j,D} + \log \tau_{t,i}^{j,T}\right)}_{\text{Destination Prices}} + \underbrace{\log\left(C_t^j\left(P_t^j\right)^{\eta_t}\right) + \delta_t^{j,P}}_{\text{Time and Good Fixed Effects}} \\ &\quad + \underbrace{G_{t,i}^{P}}_{\text{Taste Parameters as Gravity Variables}} + \underbrace{v_{t,i}^{j,P}}_{\text{Residuals}} \end{aligned} \tag{25}$$

which can be estimated with the same methodology introduced above. Compared to Equation 17 that considers gravity variables affecting trade through duties/tariffs $\tau_{t,i}^{j,D}$'s and transportation costs $\tau_{t,i}^{j,T}$'s, Equation 25 is a more general framework, where gravity variables can affect trade also through taste parameters $\theta_{t,i}^{j}$'s. Therefore, it is very useful to investigate the channels through which gravity variables affect trade.

In order to see the effects of gravity variables on trade in a better way, we can rewrite the fitted value of this expression as follows:

$$\log \widehat{M}_{t,i}^{j} = \widehat{G}_{t,i} + (1-\eta_t)\left(\log \widehat{P}_{t,i}^{j*} + \widehat{\delta}_t^{j,D} + \widehat{\delta}_t^{j,T}\right) + \log\left(\widehat{C_t^j \left(P_t^j\right)^{\eta_t}}\right) + \delta_t^{j,P} + \widehat{u}_{t,i}^{j,P} \tag{26}$$

where $u_{t,i}^{j,P} = v_{t,i}^{j,P} + v_{t,i}^{j} + v_{t,i}^{j,D} + v_{t,i}^{j,T}$, and $\widehat{G}_{t,i}$ again represents the combined fitted effects of gravity variables, this time according to:

$$\widehat{G}_{t,i} = (1-\eta_t)\left(\widehat{G}_{t,i}^{D} + \widehat{G}_{t,i}^{T}\right) + \widehat{G}_{t,i}^{P} \tag{27}$$

which can also be decomposed into effects due to duties/tariffs, transportation costs, and taste parameters, as we show in details, below.

6 Data

The U.S. imports data are from the U.S. International Trade Commission.[5] These data cover 224 countries at the SITC 4-digit good level over the period from 1996 to 2013. The data set includes: (1) customs value (defined as the total price actually paid or payable for merchandise, excluding U.S. import duties, freight, insurance, and other charges), (2) unit of quantity, (3) calculated duties in values (i.e., the estimated duties are calculated based on the applicable rates of duty as shown in the Harmonized Tariff Schedule), (4) import Charges (i.e., the aggregate cost of all freight, insurance, and other charges incurred, excluding U.S. import duties).

Total trade costs are decomposed into duty costs and transportation costs; ad valorem duties/tariffs are calculated by dividing the calculated duties by the customs value, while ad valorem transportation costs are calculated by dividing the general import charges by the customs value. Import prices (measured at the source) are calculated by dividing the

[5] *https://dataweb.usitc.gov/*

customs value by the quantity traded.[6] After ignoring missing observations, we are left with 425,812 observations, consisting of 822 goods and 177 countries between 1996 and 2013.

We combine the trade data set with the dyadic data borrowed from Glick and Rose (2016) that include the gravity variables introduced above between the U.S. and its trade partners. In particular, Glick and Rose (2016) obtain the data on distance, common border, colonial relationship and common language from the CIA's World Factbook, while they obtain the data on regional/free trade agreements (FTAs) from the World Trade Organization. It is important to emphasize that the data on FTAs change across years as well; e.g., the dummy variable of FTA takes a value of one after the U.S. starts having an FTA with Australia in 2005, while the same dummy takes a value of zero before 2005.

Before continuing with the estimation results, we would like to provide some descriptive statistics about the combined version of our data sets; the corresponding figures are in the Appendix. The effects of distance are given in Figure A.1, where we distinguish between distant and nearby countries. As is evident, the shares of U.S. imports are pretty much the same and they are stable over time. However, the duties/tariffs have significantly been reduced over time, for both nearby and distant countries. Although transportation costs have also been steady up until 2010 or so, they have been decreasing in recent years, for both nearby and distant countries.

The effects of having a border are shown in Figure A.2, where they also represent the North American Free Trade Agreement (NAFTA) countries (i.e., Canada and Mexico) for the U.S.. Although the shares of trade are stable over time, both duties and transportation costs have been reduced, for both NAFTA countries (for which such trade costs were already low back in 1996) and other trade partners (for which reduction in percentage terms has been higher).

Having a colonial relationship does not seem to have a big impact on U.S. imports due to the low trade shares as shown in Figure A.3, where both duties/tariffs and transportation costs follow similar patterns across trade partners over time.

FTAs of the U.S. correspond to higher shares of trade over time in Figure A.4, where both duties/tariffs and transportation costs have increased between the U.S. and its FTA

[6] Since we estimate the implications of our model for these unit prices in a separate equation, potential measurement errors are captured by the corresponding residuals.

partner countries. Although such trends may seem puzzling, there is nothing interesting about them, since they are mostly due to new FTAs achieved in early 2000s. Since the new FTA partner countries are either far away (e.g., Singapore or Australia) or initially have high duties/tariffs, we observe such increasing trends in trade costs starting from early 2000s.

Finally, as shown in Figure A.5, the U.S. has imported relatively less over time from the countries with which it shares a language. Although there is evidence for decreasing duties/tariffs, independent of having a common language, duties/tariffs have always been lower in magnitude for the countries that share a language with the U.S. during our sample period. There is no significant effects of sharing a language on transportation costs though.

7 Estimation Results

This section depicts the estimation results of 3SLS regressions by individually focusing on the effects of trade elasticity as well as those of each gravity variable, for the case of both random and dyadic preferences. While we depict the estimation results in figures in order to show their pattern over time, the full set of estimation results can be found in Appendix tables. We also carefully connect the estimation results to the relevant discussions in the existing literature.

7.1 Welfare Gains: Trade Elasticity

Trade elasticity (denoted by $\eta_t - 1$ in this paper) is the key parameter for connecting the movements in prices to quantities and thus consumer welfare. In the existing literature, Arkolakis et al. (2012) have shown the importance of this parameter in the determination of welfare gains from trade in a large and important class of structural gravity models, where there is a negative relationship between trade elasticity and welfare gains.

We follow Arkolakis et al. (2012) to confirm that our model also implies the same expression for welfare gains from trade, this time at the good level. As we show its technical details in the Appendix, the welfare gains from trade (which is defined as the welfare costs of autarky) in this paper corresponds to the following expression at the good j level:

$$\log WGT_t^j = -\frac{1}{\eta_t - 1} \log \left(X_{t,H}^j \right) \tag{28}$$

where $X_{t,H}^j$ $\left(= P_{t,H}^j C_{t,H}^j / \sum_i P_{t,i}^j C_{t,i}^j\right)$ is the current expenditure share of good j that is produced at home (in the U.S.). It is implied that there is an inverse relationship between trade elasticity $(\eta_t - 1)$ welfare gains from trade WGT_t^j. Under the light of this theoretical discussion, year-specific estimation results for the coefficient in front of destination prices, $1 - \eta_t$, of which absolute value corresponds to the trade elasticity of $\eta_t - 1$, are given in Figure 1, where we distinguish between random and dyadic preferences; full details of the estimation for each year are given in the Appendix tables.

As is evident, when random preferences are considered, the trade elasticity estimates range between 1.38 and 2.23; they are all significant at the 0.1% level. These numbers are close to the lower bound of the estimates in similar recent studies such as by Simonovska and Waugh (2014) who have estimated trade elasticities between 2.79 and 4.46 using alternative data sets.[7] Therefore, for given home expenditure shares of $X_{t,H}^j$'s, welfare gains from trade based on random preferences are relatively higher compared to the existing literature.

When dyadic preferences are considered, the trade elasticity estimates range between 0.89 and 1.94; they are all significant at the 0.1% level. These estimates are lower compared to the trade elasticity estimates based on random preferences. This result is due to taste parameters captured by gravity variables (in the case of dyadic preferences) accounting for more trade barriers. In other words, gravity variables act like demand shifters when dyadic preferences are considered and thus the effects of gravity variables as supply shifters are reduced compared to the case with random preferences. This makes home products less substitutable to foreign products (as reflected in lower estimates of $\eta_t - 1$ in the case of dyadic preferences), which results in having higher welfare gains from trade in the case of dyadic preferences (for any given home expenditure share).

It is also evident in Figure 1 that the estimates of the trade elasticity $(\eta_t - 1)$ have been increasing over time, suggesting that welfare gains from trade are getting smaller over time for any given home expenditure share, for both random and dyadic preferences.

[7] In earlier studies, after using the connection between the elasticity of substitution η and the trade elasticity $\eta - 1$, Hummels' (2001) trade-elasticity estimates range between 3.79 and 7.26, the estimates of Head and Ries (2001) range between 6.9 and 10.4, the estimate of Baier and Bergstrand (2001) is about 5.4, Harrigan's (1996) estimates range from 4 to 9, Feenstra's (1994) estimates range from 2 to 7.4, the estimate by Eaton and Kortum (2002) is about 8.28, the estimates by Romalis (2007) range between 5.2 and 9.9, the (mean) estimates of Broda and Weinstein (2006) range between 3 and 16.3.

7.2 Distance Puzzle Solved: Distance Elasticity

As discussed above, distance elasticity has been another key parameter in gravity studies, since distance is used as a proxy for many components of trade costs, leading into "distance puzzle" through both *magnitude* and *time* dimensions. Under the light of this discussion, our estimates for the coefficient of log distance are available for the regressions based on log duties/tariffs (as shown in Equation 19) and log transportation costs (as shown in Equation 20) for the case of random variables, while they are available for also the regressions based on preferences (as shown in Equation 24) for the case of dyadic preferences. The coefficient estimates over the years are given in Figure 2, with the corresponding details in the Appendix tables. It is important to emphasize that due to the way that we achieve our estimations, the estimates based on trade-costs regressions should be compared to the absolute value of the distance-elasticity measures in the literature, since they have another (and negative) coefficient of trade elasticity ($\eta_t - 1$) in front of them in Equations 17 and 25.

As is evident, for both cases of random and dyadic preferences, the effects of distance on transportation costs and duties/tariffs are consistent with the expectations based on their positive sign (since trade costs are expected to increase with distance) and magnitude; e.g., the average distance elasticity of observed trade costs, which is about 0.005, corresponds to an *ad-valorem* distance effects on trade of about 7% ($\approx 1000^{0.005\times 2}$) for a distance of about a thousand miles (when multiplied by a trade elasticity of about 2), which is consistent with our expectations based on the actual data on duties/tariffs and transportation costs. Therefore, our results based on the distance elasticity provide a simple and an alternative solution to the *magnitude* dimension of the distance puzzle. Moreover, the effects of distance on transportation costs and duties/tariffs have also decreased over time, suggesting another simple and alternative solution to the *time* dimension of the distance puzzle.

The contribution of this paper is more clear when we consider the estimates for the distance elasticity of dyadic preferences in Figure 2. As is evident, after controlling for distance effects due to duties/tariffs and transportation costs (and thus solving the distance puzzle), the effects of distance on trade due to preferences is positive during 1990s, which is against most of the studies in the literature using distance as a proxy for such observed trade costs. Nevertheless, this result is consistent with some other studies in the literature such as by Yilmazkuday (2016) who also focus on the effects of distance through the preference of consumers toward exotic products coming from distant countries. The distance elasticity estimates become mostly insignificant over time (starting from 2005), partly due to free trade agreements such as NAFTA showing its effects (gradually starting from 1994) when the U.S. might have started importing more products from nearby NAFTA countries. In particular, as trade between the U.S., Canada and Mexico has increased over time, the U.S. might have demanded more products coming from these countries due to having more information about them; we will discuss more about this below while focusing on the effects of a common border. Nevertheless, it is important to emphasize that such effects are relative to the average effects captured by the other gravity variable of having a free trade agreement, which covers other free trade agreements of the U.S. as well (as we will discuss in more details, below).

Overall, the results based on distance effects have implications from a broader perspective. Specifically, while the effects of distance on measured trade costs (of duties/tariffs and transportation costs) can be considered as supply shifters due to the marginal costs of delivering the product to the destination country (including both production costs and trade costs), the effects of distance on dyadic preferences can be considered as demand shifters. Since the literature has mostly focused on the effects of distance as a supply shifter due to focusing mostly on duties/tariffs and transportation costs (which corresponds to a movement along the demand curve), such studies have apparently missed a big part of the picture that is about distance effects contributing as demand shifters (which is newly introduced in this paper).

7.3 NAFTA: Effects of Having a Common Border

Since we have international data on U.S. imports, we consider the effects of having a common border in our regressions; these effects should not be confused with the border effects discussed in studies such as by McCallum (1995) or Anderson and van Wincoop (2003) who focus on trade costs of passing through a border (e.g., between the U.S. and Canada). Accordingly, the idea in this paper is to show whether the U.S. has involved in higher amount of trade with Canada and Mexico (with whom the U.S. has a free trade agreement of NAFTA), after controlling for all other factors (proxied by gravity variables) as discussed in the model section, above. Within this context, for the U.S., the effects of having a common border can also be considered as investigating the pure effects of NAFTA over time.

The coefficient estimates of having a common border are given in Figure 3, where we again distinguish between the two cases of preferences. Independent of the preference type, as is evident, the effects of having a common border on transportation costs are significant and negative starting from early 2000s, suggesting that transportation costs have become cheaper over the years, potentially due to the introduction of NAFTA back in 1994 after which transportation networks might have improved (as consistent with studies such as by Woudsma, 1999, or Hesse and Rodrigue, 2004). In terms of the magnitude, since we have log transportation costs on the estimated Equation of 20, the average coefficient of about -0.05 corresponds to the U.S. having about 5% lower transportation costs with NAFTA countries compared to other trade partners, after controlling for all other factors.

The effects of having a border on duties/tariffs are also shown in Figure 3, where there is evidence for decreasing common-border effects on duties/tariffs with NAFTA countries until 2004 (after which the effects become insignificant). This is exactly what one would expect due to the details of NAFTA that eliminate duties/tariffs starting in 1994 and continuing for ten years (with a few tariffs continuing to 15 years) as discussed by many studies (e.g., Romalis, 2007, or Hakobyan and McLaren, 2016). Regarding the magnitude of the effects, NAFTA has reduced duties/tariffs from about 3% to nothing during our sample period.

The effects through dyadic preferences dominate one more time in terms of its magnitude (compared to the effects on observed trade costs) in Figure 3. As is evident, the U.S. has increased their already existing preference toward NAFTA products over time, even after controlling for all other factors (captured by other gravity variables). In particular, back in 1996, the U.S. used to have a preference toward NAFTA products by about 2, which has increased to about 2.5 over the years. Regarding the intuition of these numbers, they suggest that the U.S. has imported about double the amount of products coming from NAFTA countries compared to other trade partners, after controlling for all other factors. This result, which can be called *adjacency bias* or *common-border bias*, acts just like the *home-bias* in trade as discussed in several studies such as by Obstfeld and Rogoff (2001) as a puzzle and is shown to be solved by considering the existence of trade costs. Compared to these studies, this paper shows that such trade costs mostly show up through dyadic preferences (rather than transportation costs or duties/tariffs) when one considers the broader definition of trade costs by Anderson and van Wincoop (2004) as we introduced above.

7.4 Historical Effects: Having a Colonial Relationship

Strong historical trade ties are important to understand the reasons behind certain trade patterns (see Anderson and van Wincoop, 2004). The empirical literature based on gravity studies has attempted to capture such effects partly by considering the historical colonial relationships between countries; e.g., Head, Mayer, and Rise (2010) find that the observed erosion in colonial trade can be explained by higher trade costs due to the deterioration of trade networks.

Within this context, as we show in Figure 4, the effects of having a colonial relationship on transportation costs and duties/tariffs are pretty stable over time, although there is some evidence for increasing trade costs. It is implied that trade costs between the U.S. and the countries that it has historical ties with have increased relative to the trade costs between the U.S. and other trade partners.

Nevertheless, the big part of the picture shows up itself when the effects of having a colonial relationship are investigated on dyadic preferences. In particular, such effects were captured by a coefficient of about 1.98 back in 1996, and this coefficient has reduced all to way down to 1.24 in 2012, suggesting that, after controlling for other factors, the U.S. has preferred importing goods many times more from countries that it has historical colonial relationships with, but these effects have been reduced significantly in recent years. In other words, after controlling for all other factors, historical ties have lost some of their importance for U.S. imports.

7.5 Trade Policy: Effects of Free Trade Agreements

Although we have covered the effects of NAFTA above, the U.S. has regional/free trade agreements (FTAs) with 20 different countries in total. From a policy perspective, it is essential to understand the pure effects of these FTAs in order to shape the future global trade policy of the U.S.. Since we have only one dummy variable for FTAs in our regressions (as standard in empirical gravity studies), the results here should be considered as the effects of FTAs on average across trade partners of the U.S..

The estimation results given in Figure 5 for transportation costs and duties/tariffs mostly reflect the descriptive statistics on FTAs (in Figure A.4). In particular, since the U.S. started having FTAs in early 2000s with either distant countries (e.g., Singapore or Australia) or FTA partner countries that initially have high duties/tariffs, the effects of having an FTA on both transportation costs and duties/tariffs have started increasing in early 2000s.

Our results in Figure 5 also show that the effects of FTAs on transportation costs and duties/tariffs are almost entirely the mirror image of the results on common-border (NAFTA) effects (in Figure 3) along the horizontal axis. Therefore, while transportation costs and duties/tariffs have decreased over time between the U.S., Canada and Mexico in relative terms, the same measured trade costs have increased over time between the U.S. and other trade partners with FTAs, again in relative terms. It is implied that NAFTA has dominated all other FTAs due to its reducing impact on both transportation costs and duties/tariffs by a large margin.

When we consider the dyadic preferences of the U.S. toward products coming from FTA partner countries, it is evident in Figure 5 that such preferences have been reduced dramatically during our sample period. This is one more time the mirror image of the results on NAFTA effects along the horizontal axis, suggesting that NAFTA has dominated all other FTAs not only due to its reducing impact on measured trade costs but also due to the shifts that it has created in the U.S. imports demand through preferences (i.e., *adjacency bias* or *common-border bias*).

7.6 Communication: Effects of Having a Common Language

Having a common language can facilitate communication between trade partners by reducing language barriers for trade. Our corresponding results are given in Figure 6, where the effects of language are pretty stable over time. While having a common language coincides with slightly positive (and sometimes insignificant) effects on transportation costs, it coincides with negative and significant effects on duties/tariffs. Therefore, having a common language reduces trade costs mostly through duties/tariffs rather than transportation costs, where negotiation of tariff rates might have been affected historically or recently through FTAs. In terms of the magnitude, though, the higher effects of having a common language show up again when we consider them on dyadic preferences of the U.S.. In particular, after controlling for all other factors, the U.S. has preferred importing relatively fewer products from the countries that it shares a language with, and these effects are pretty stable over time as also shown in Figure 6.

8 Decomposition of Gravity Channels

Although we covered the magnitude of the effects through each gravity variable in the previous section, we did not discuss the sources of variation across countries. In particular, among the three gravity channels, namely *duties/tariffs* (DC), *transportation-costs* (TC), and *dyadic-preferences* (PC), which gravity channel contributes more to the overall effects of gravity variables on trade? What is the contribution of each gravity variable to a given gravity channel? What is the contribution of each gravity channel for a given gravity variable? We attempt to answer these questions in this section by employing variance decomposition analyses across time and space (i.e., by pooling all source countries and years), also by distinguishing between the cases of random and dyadic preferences.

8.1 Random Preferences

In the case of random preferences, we start with investigating the contribution of each gravity channel to the overall effects of gravity variables on trade. We achieve this through a variance decomposition analysis by taking the covariance of both sides in Equation 23 (i.e., the fitted values of estimated gravity effects) with respect to the left hand side variable of $\widehat{G}_{t,i}$ as follows:

$$cov\left(\widehat{G}_{t,i}, \widehat{G}_{t,i}\right) = cov\left(\left(1-\eta_t\right)\widehat{G}^{D}_{t,i}, \widehat{G}_{t,i}\right) + cov\left(\left(1-\eta_t\right)\widehat{G}^{T}_{t,i}, \widehat{G}_{t,i}\right) \tag{29}$$

which can be rewritten in percentage terms as follows by using $cov\left(\widehat{G}_{t,i}, \widehat{G}_{t,i}\right) = var\left(\widehat{G}_{t,i}\right)$:

$$100\% = \underbrace{\frac{cov\left(\left(1-\eta_t\right)\widehat{G}^{D}_{t,i}, \widehat{G}_{t,i}\right)}{var\left(\widehat{G}_{t,i}\right)}}_{\text{Gravity Effects (\%) through Duties/Tariffs (DC)}} + \underbrace{\frac{cov\left(\left(1-\eta_t\right)\widehat{G}^{T}_{t,i}, \widehat{G}_{t,i}\right)}{var\left(\widehat{G}_{t,i}\right)}}_{\text{Gravity Effects (\%) through Transportation Costs (TC)}} \tag{30}$$

where $cov(\cdot)$ and $var(\cdot)$ are the operators of covariance and variance, respectively, and all variables are pooled across source countries i and time t. The corresponding results are given in Table 1, where duties/tariffs contribute about 46.85%, whereas transportation costs contribute about 53.15% to the overall effects of gravity variables on trade. Therefore, when we ignore dyadic preferences, gravity variables are mostly effective through transportation costs rather than duties/tariffs. For robustness, we also replicate this decomposition on a year-by-year basis in Figure 7, where we show that the contribution of each gravity channel is pretty stable over time.

In order to investigate the goods that are responsible for the contribution of each gravity channel when random preferences are considered, we also consider exclusion tests. For these exclusion tests, we exclude one 2-digit SITC good at a time (after converting 4-digit SITC codes into 2-digit SITC codes). The corresponding results are given in Figure 8, where the contribution of each gravity channel is very similar when alternative 2-digit SITC goods are excluded; the only exception is "Articles of apparel and clothing accessories" with the 2-digit SITC code of 84, for which the contribution of duties/tariffs is slightly lower (of about 34.88%) and the contribution of transportation costs is slightly higher (of about 65.12%). It is implied that this particular 2-digit good is relatively more responsible (compared to other goods) for the benchmark results given in Table 1 in regard to the contribution of each gravity channel.

We continue with investigating the contribution of each gravity variable to these gravity channels (in the absence of dyadic preferences). This is achieved by using the very same methodology summarized in Equations 29 and 30, except for replacing the right hand side variables (representing the fitted values of all gravity variables) with the fitted values of individual gravity variables. The corresponding results are given in Table 1, where distance is the dominant gravity variable for both duties/tariffs and transportation costs (with a contribution of 97% in total). The contribution of other variables are pretty insignificant, except for the (expected) contribution of FTAs to duties/tariffs that is about 7.19%.

In the case of random variables, we also investigate the contribution of each gravity variable through alternative gravity channels. This is achieved by using the very same methodology summarized in Equations 29 and 30, except for replacing the left hand side of Equation 29 with the fitted value of an individual gravity variable. The corresponding results are given in Table 2. As is evident, the effects of distance, common border, colonial relationship, and common language are mostly through transportation costs, whereas only the effects of FTAs are through duties/tariffs.

Next, we investigate whether these results hold under the case of dyadic preferences as well.

8.2 Dyadic Preferences

In the case of dyadic preferences, regarding the investigation of the contribution of each gravity channel to the overall effects of gravity variables on trade, we achieve a variance decomposition analysis by using the very same methodology as above in order to obtain:

$$100\% = \underbrace{\frac{cov\left(\left(1-\eta_t\right)\widehat{G}^{D}_{t,i},\widehat{G}_{t,i}\right)}{var\left(\widehat{G}_{t,i}\right)}}_{\text{Gravity Effects (\%) through Duties/Tariffs}} + \underbrace{\frac{cov\left(\left(1-\eta_t\right)\widehat{G}^{T}_{t,i},\widehat{G}_{t,i}\right)}{var\left(\widehat{G}_{t,i}\right)}}_{\text{Gravity Effects (\%) through Transportation Costs}} + \underbrace{\frac{cov\left(G^{P}_{t,i},\widehat{G}_{t,i}\right)}{var\left(\widehat{G}_{t,i}\right)}}_{\text{Gravity Effects (\%) through Preferences}} \tag{31}$$

The corresponding results are given in Table 1, where the channel of *dyadic-preferences* dominate the other two channels by a big margin. Therefore, we can safely claim that almost all gravity effects on trade are through the channel of *dyadic-preferences* that are newly introduced in this paper, rather than the standard channels of duties/tariffs or transportation costs. For robustness, we also replicate this decomposition on a year-by-year basis in Figure 7, where we show that the contribution of each gravity channel is pretty stable over time.

In order to investigate the goods that are responsible for the contribution of each gravity channel when dyadic preferences are consisted, we again consider exclusion tests. For these exclusion tests, we again exclude one 2-digit SITC good at a time (after converting 4-digit SITC codes into 2-digit SITC codes). The corresponding results are given in Figure 8, where the contribution of each gravity channel is very similar when alternative 2-digit SITC goods are excluded. It is implied that the benchmark results are highly common across goods when dyadic preferences are considered

When we investigate the contribution of each gravity variable to each of these gravity channels, we observe that distance is again the dominant gravity variable due to its contribution to duties/tariffs and transportation costs. When we consider the additional channel of *dyadic-preferences*, having a common border contributes the most to dyadic preferences with about 42.57%, which is reflected as a total contribution of about 45.12% when all gravity channels are considered. It is implied that the channel of *dyadic-preferences* is the dominant gravity channel on trade with (a common) border contributing the most to it.

When we investigate the contribution of each given gravity variable through alternative gravity channels, the corresponding results are given in Table 2. As is evident, all gravity variables are effective through the channel of *dyadic-preferences*, which is opposed to the case with random preferences, where gravity variables are effective through duties/tariffs or transportation costs. Compared to Head and Mayer (2013) who show that between 50% to 85% of the distance effects on trade flows are due to indirect trade costs (that they call as *dark* trade costs), our results show that the contribution of distance effects through dyadic preferences (corresponding to dark trade costs in Head and Mayer, 2013) are much higher, about 96%.

In sum, if one would ignore the existence of dyadic preferences, s/he may easily think that the effects of gravity variables are through the measured trade costs; however, as we show in this paper, their consideration dramatically changes the decomposition of gravity effects into their components.

9 Conclusions

Gravity variables such as distance, adjacency, colony, free trade agreements or language have been extensively used in empirical studies to capture the effects of trade costs. By using actual data on transportation costs and duties/tariffs obtained from U.S. imports, this paper has decomposed the overall effects of such variables on trade into those through three gravity channels: duties/tariffs (DC), transportation-costs (TC), and dyadic-preferences (PC). When PC is ignored as is typical in existing studies in the literature, we show that nearly all gravity effects are due to distance (with a contribution of about 97%). The tables turn as the additional channel of PC is introduced and shown to dominate other channels, with common border contributing about 45%, distance about 32%, colony about 14%, free trade agreements about 7%, and language about 2%.

The results are further connected to several existing discussions in the literature, such as the distance puzzle or welfare gains from trade. In particular, we show that the distance puzzle can easily be solved by decomposing the effects of distance into those due to transportation costs, duties/tariffs and dyadic preferences. Moreover, welfare gains from trade are estimated to be relatively higher in the case of dyadic preferences, which is ignored in the existing literature.

The results are robust to the specification of trade costs (e.g., multiplicative versus additive trade costs), since we use actual data on transportation costs and duties/tariffs to construct multiplicative trade costs. The results are also robust to the consideration of any local distribution costs (that are shown to account for about half of overall trade costs in Anderson and van Wincoop, 2004), since we already use trade data measured at both source and destination docks. Accordingly, whenever we proxy dyadic preferences by gravity variables in our regressions, it is implied that they capture all other indirect costs of trade, such as time to ship (as in Hummels and Schaur, 2013), search costs (as in Rauch, 1999), or information barriers (as in Portes and Rey, 2005), although the source-country related costs (such as contracting costs as in Evans, 2001, or insecurity as in Anderson and Marcouiller, 2002) are supposedly captured through data on source prices.

Significant policy implications follow. In particular, policy tools such as duties/tariffs or investment on transportation technologies are simply implied as not having enough impact on trade as advocated in studies such as by Harley (1988) or Irwin and ORourke (2011); it is rather the globalization itself that should be promoted in order to shift the preferences of destination countries toward partner country products. Such a policy suggestion is also in line with Head and Mayer (2013) who suggest that the absence of globalization cannot be reduced to conventional explanations, such as tariffs and freight costs. At the end of the day, consumers determine their preferences based on their perception of the products, rather than pure evidence of quality; e.g., as nicely put by the U.S. trade representative Odell (1911) more than a century ago:

> "Any existing preference for foreign goods would seem to be founded on prejudice and a feeling that articles from abroad possess a particular excellence rather than on any real difference in quality."

where, as shown in this paper, such prejudice and feelings toward the perception of quality can be captured by standard gravity variables.

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10 Appendix: Derivation of Welfare Gains

Given income $P_tC_t = \sum_j P_t^j C_t^j$, we attempt to measure the welfare costs of autarky by which the aggregate price index P_t^j for each good j would have to adjust to keep the consumer utility the same between the current openness to trade and a hypothetical autarky:

$$\prod_j \left(C_t^j\right)^{\gamma_t^j} = \prod_j \left(C_t^{j,A}\right)^{\gamma_t^j}$$

where the expenditure on each good remains the same due to the functional form of C_t as follows:

$$P_t^j C_t^j = \gamma_t^j P_t C_t = \gamma_t^j P_t^A C_t^A = P_t^{j,A} C_t^{j,A}$$

where superscript A stands for autarky. This expression shows that the expenditure on each composite good j is the same between the two cases (i.e., $P_t^j C_t^j = P_t^{j,A} C_t^{j,A}$). It is implied that the welfare costs of autarky for good j are given by:

$$WGT_t^j = \frac{P_t^{j,A}}{P_t^j} = \frac{C_t^j}{C_t^{j,A}}$$

which can be connected to expenditure shares, as we achieve next.

Using the relationship between C_t^j and $C_{t,i}^j$, the following expressions can be written for expenditure share of good j coming from country i:

$$P_{t,i}^j C_{t,i}^j = \theta_{t,i}^j \left(\frac{P_{t,i}^{j*} \tau_{t,i}^j}{P_t^j} \right)^{1-\eta_t} P_t^j C_t^j \tag{32}$$

and

$$P_{t,i}^{j,A} C_{t,i}^{j,A} = \theta_{t,i}^j \left(\frac{P_{t,i}^{j*,A} \tau_{t,i}^{j,A}}{P_t^{j,A}} \right)^{1-\eta_t} P_t^{j,A} C_t^{j,A} \tag{33}$$

which imply that the expenditure shares of good j produced at home (in the U.S.) is given by:

$$P_{t,H}^j C_{t,H}^j = \theta_{t,H}^j \left(\frac{P_{t,H}^{j*} \tau_{t,H}^j}{P_t^j} \right)^{1-\eta_t} P_t^j C_t^j \tag{34}$$

and

$$P_{t,H}^{j,A} C_{t,H}^{j,A} = \theta_{t,H}^j \left(\frac{P_{t,H}^{j*,A} \tau_{t,H}^{j,A}}{P_t^{j,A}} \right)^{1-\eta_t} P_t^{j,A} C_t^{j,A} \tag{35}$$

which can be combined in order to get an expression for WGT_t^j as follows:

$$WGT_t^j = \left(X_{t,H}^j \right)^{-\frac{1}{\eta_t - 1}}$$

where

$$X_{t,H}^j = \frac{P_{t,H}^j C_{t,H}^j}{P_t^j C_t^j} = \frac{P_{t,H}^j C_{t,H}^j}{\sum_i P_{t,i}^j C_{t,i}^j}$$

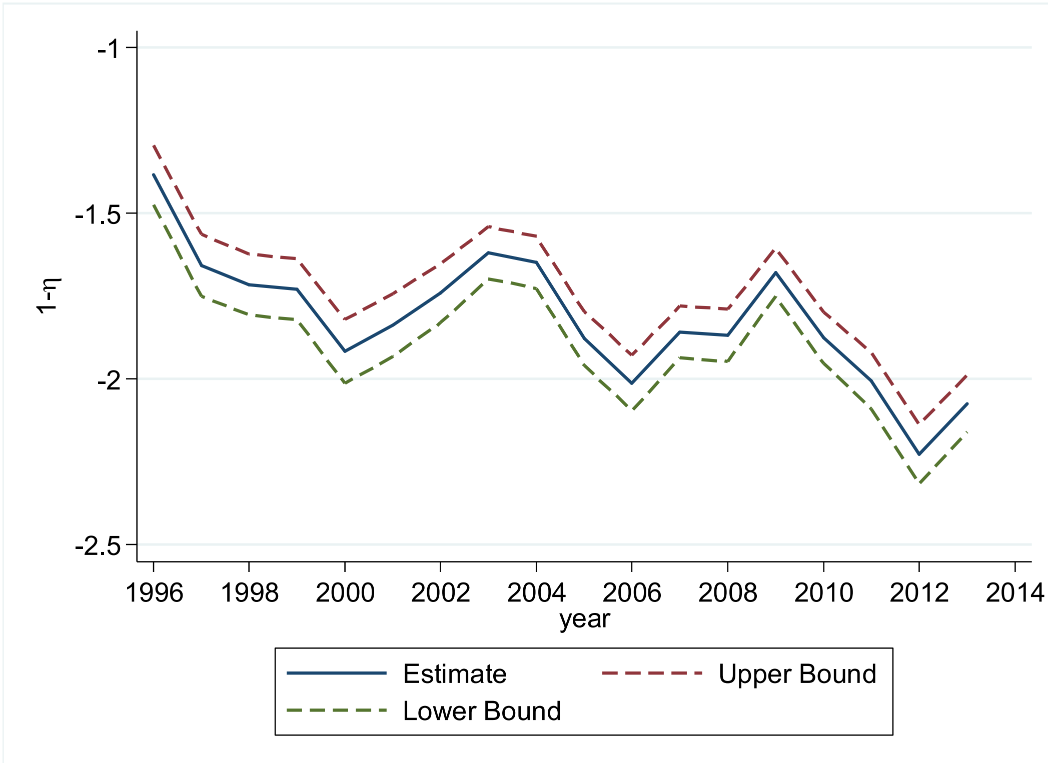
and time and source-country specific input costs, productivity, and internal trade costs are assumed to be the same between the two cases $\left(\text{i.e., } W_{t,i}^A = W_{t,i},\ A_t^{j,A} = A_t^j, \text{ and } \tau_{t,H}^{j,A} = \tau_{t,H}^j\right)$. We can rewrite WGT_t^j in log form as follows:

$$\log WGT_t^j = -\frac{1}{\eta_t - 1} \log \left(X_{t,H}^j \right)$$

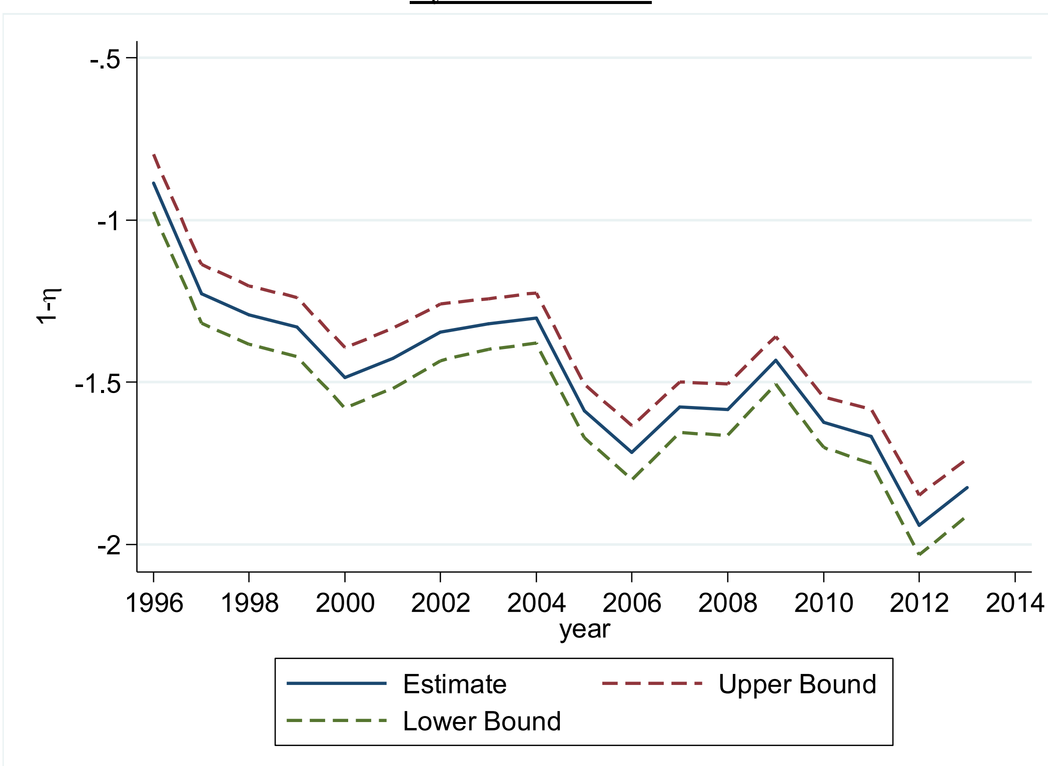
where gains from trade are directly connected to the inverse of trade elasticity defined by $\eta_t - 1$.

Figure 1 - Estimates of Trade Elasticity between 1996-2013

Random Preferences



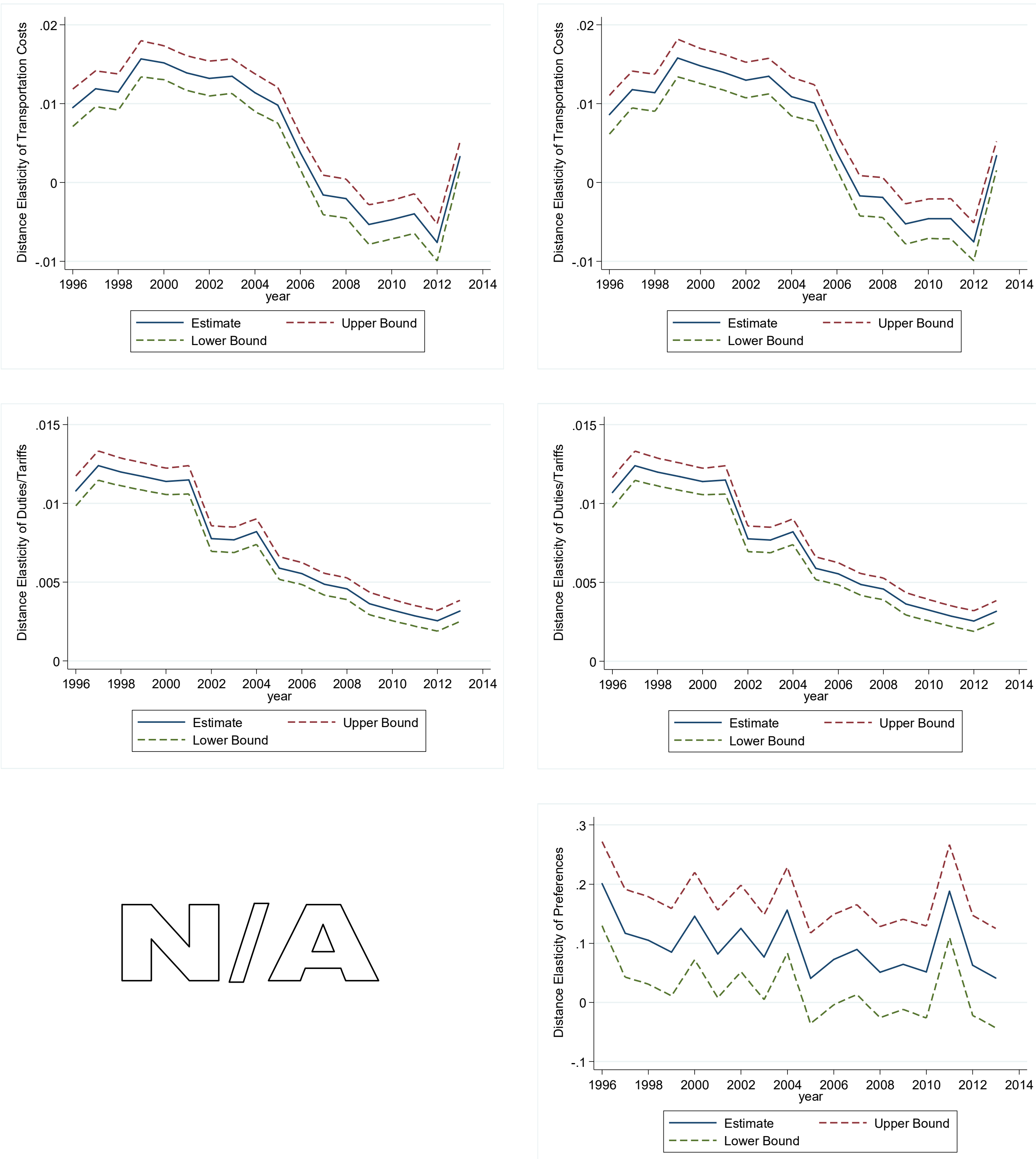
Dyadic Preferences



Notes: Upper and lower bounds represent the 90% confidence interval.

Figure 2 - Estimates of Distance Elasticity between 1996-2013

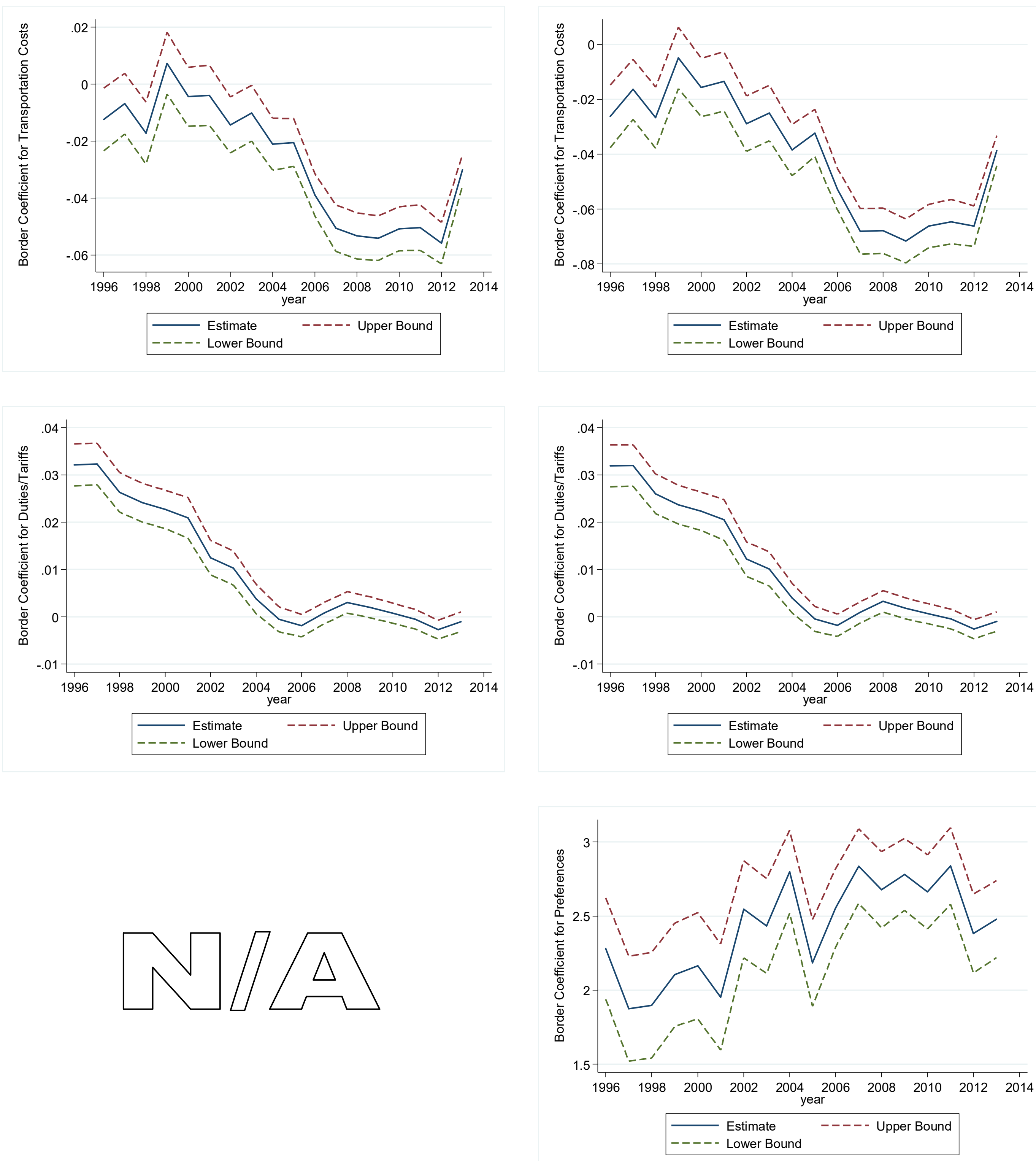
Random Preferences | **Dyadic Preferences**



Notes: Upper and lower bounds represent the 90% confidence interval.

Figure 3 – Common-Border Coefficient Estimates between 1996-2013

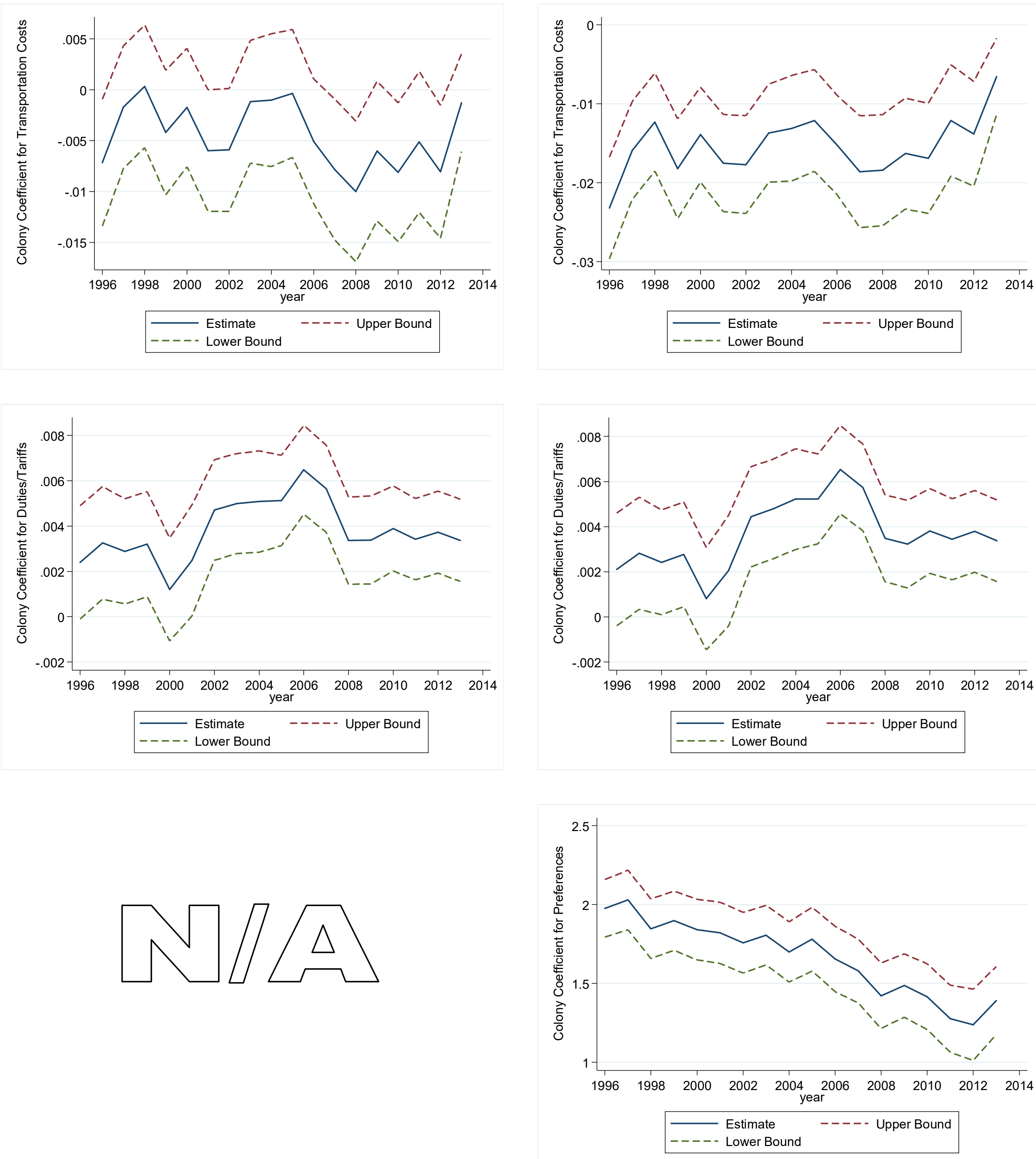
Random Preferences | **Dyadic Preferences**



Notes: Upper and lower bounds represent the 90% confidence interval.

Figure 4 – Colonial-Relationship Coefficient Estimates between 1996-2013

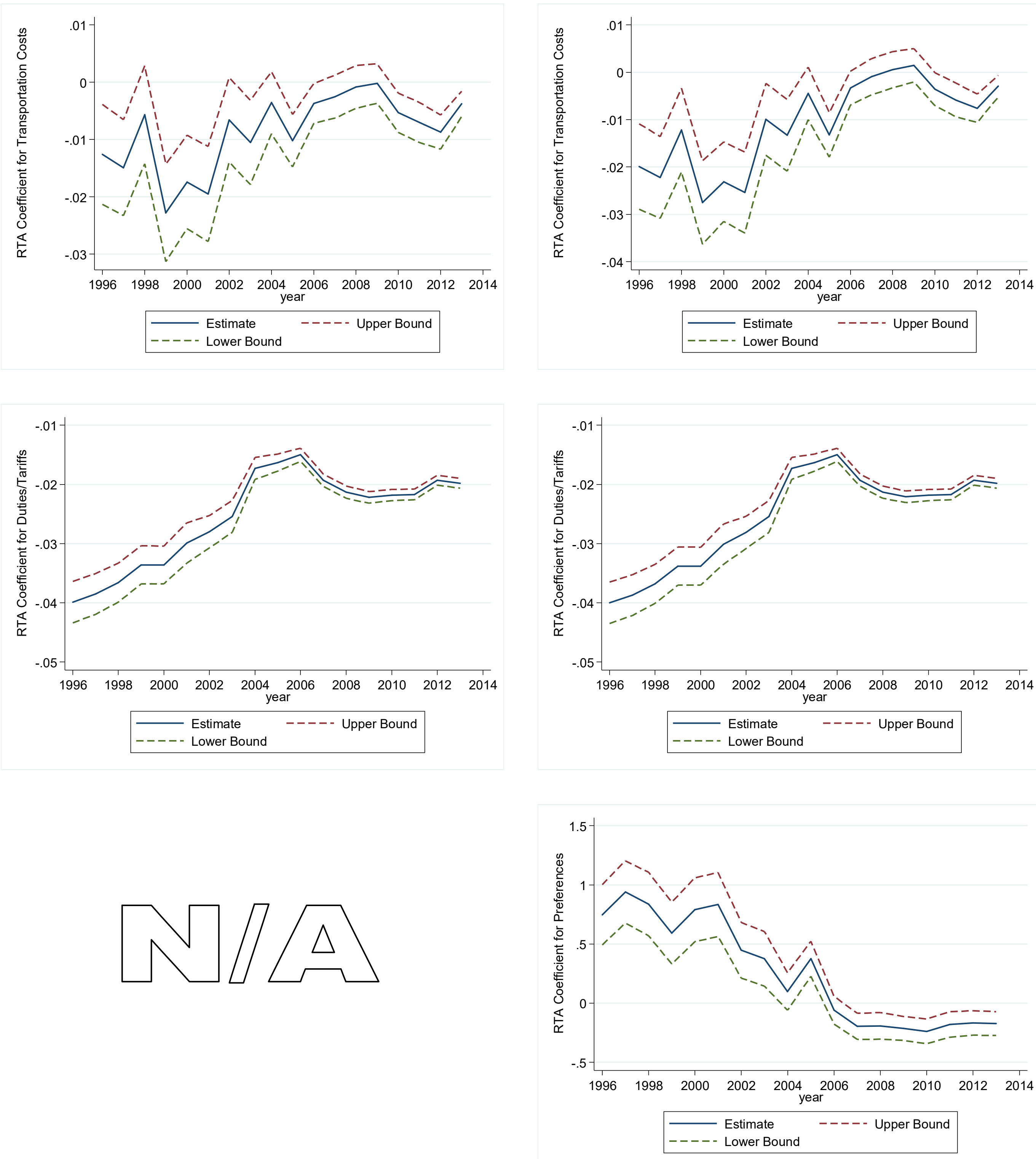
Random Preferences | **Dyadic Preferences**



Notes: Upper and lower bounds represent the 90% confidence interval.

Figure 5 – Regional/Free-Trade-Agreement Coefficient Estimates between 1996-2013

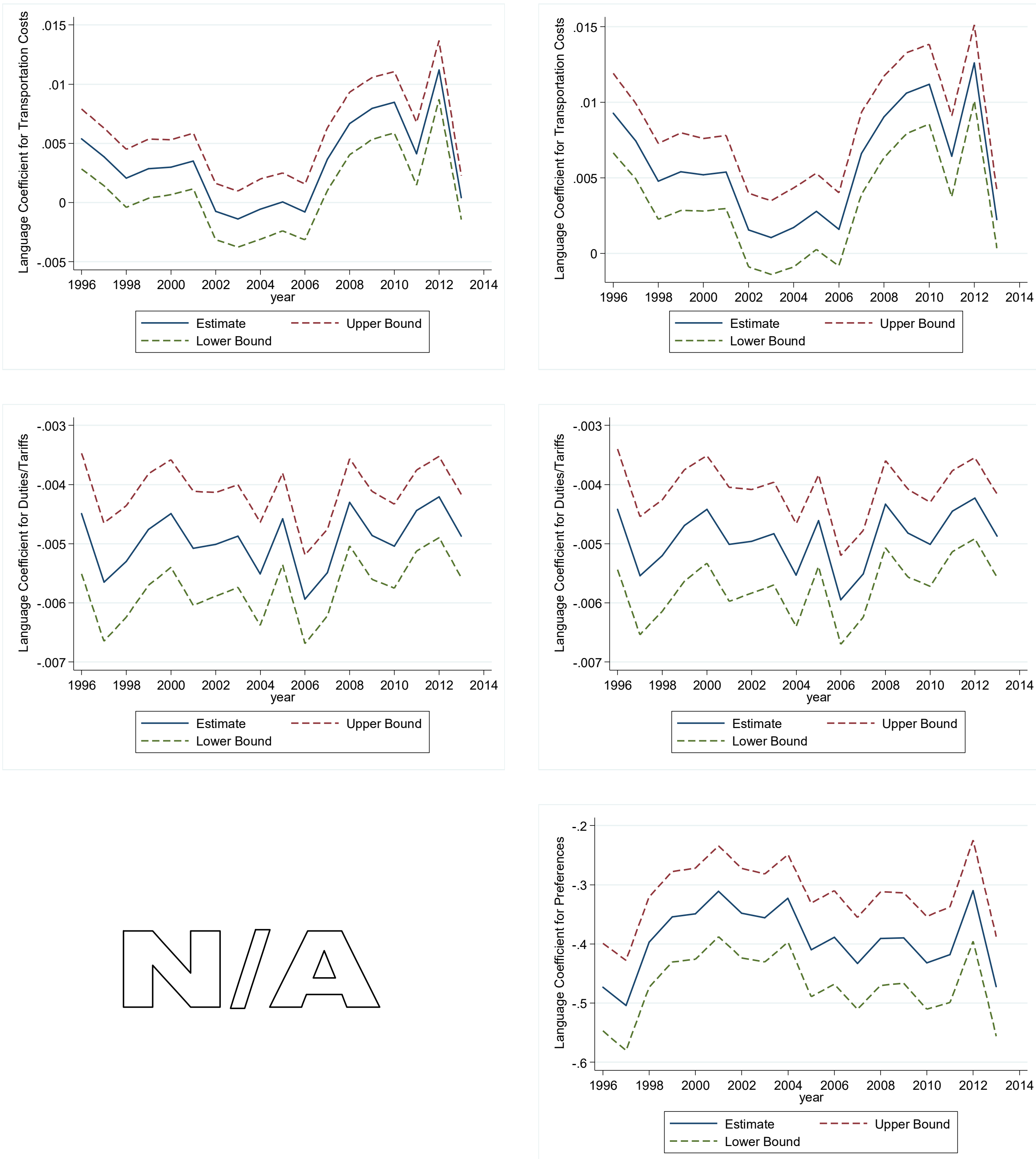
<u>**Random Preferences**</u> <u>**Dyadic Preferences**</u>



Notes: Upper and lower bounds represent the 90% confidence interval.

Figure 6 - Common-Language Coefficient Estimates between 1996-2013

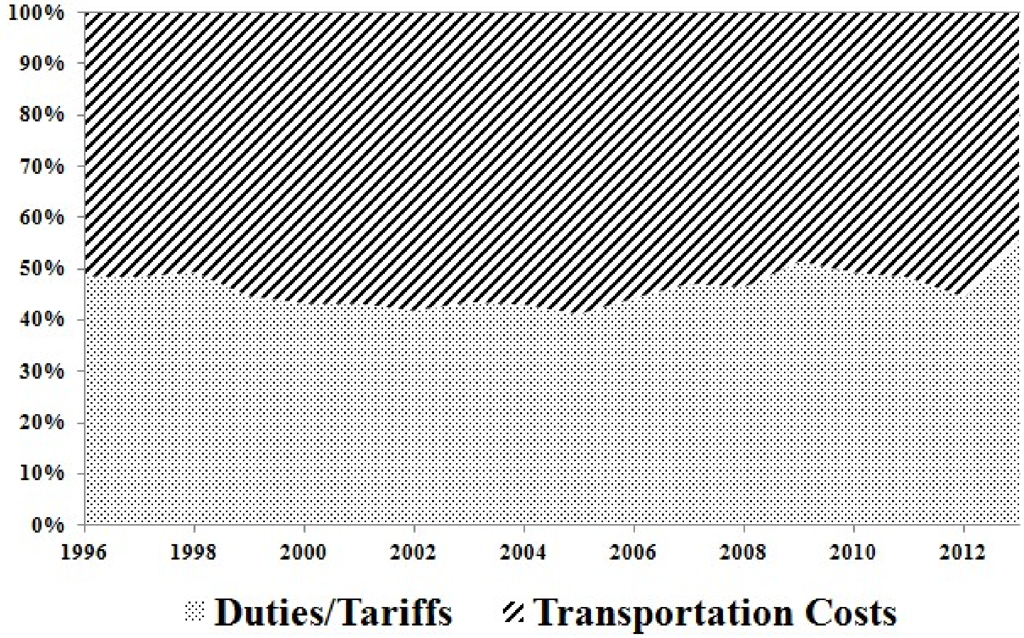
Random Preferences | **Dyadic Preferences**



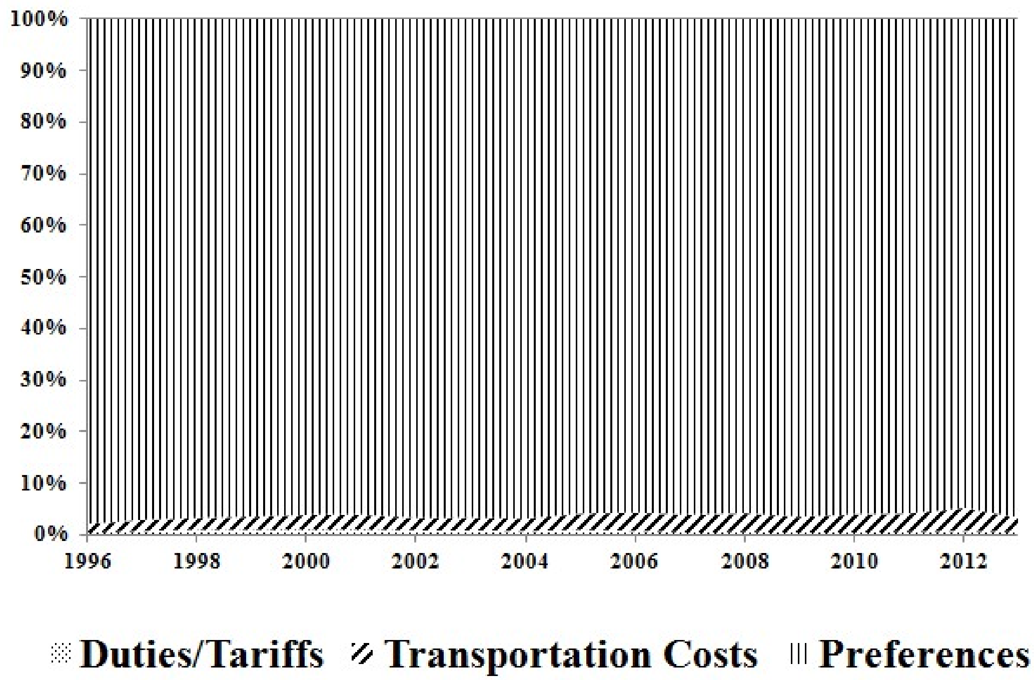
Notes: Upper and lower bounds represent the 90% confidence interval.

Figure 7 - Decomposition of Gravity Channels between 1996-2013

Random Preferences



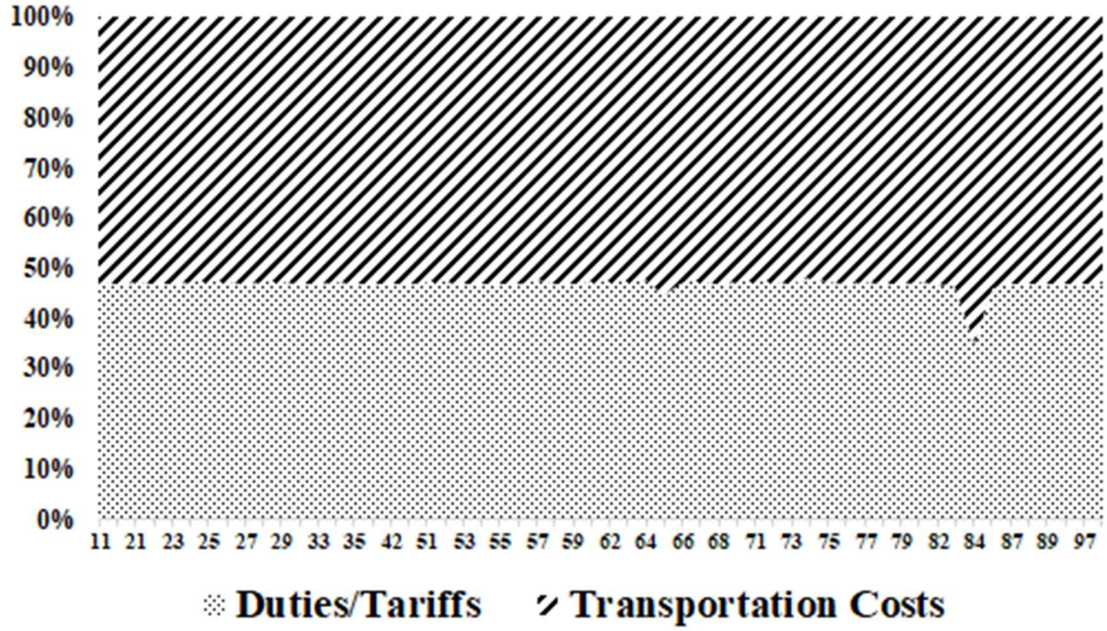
Dyadic Preferences



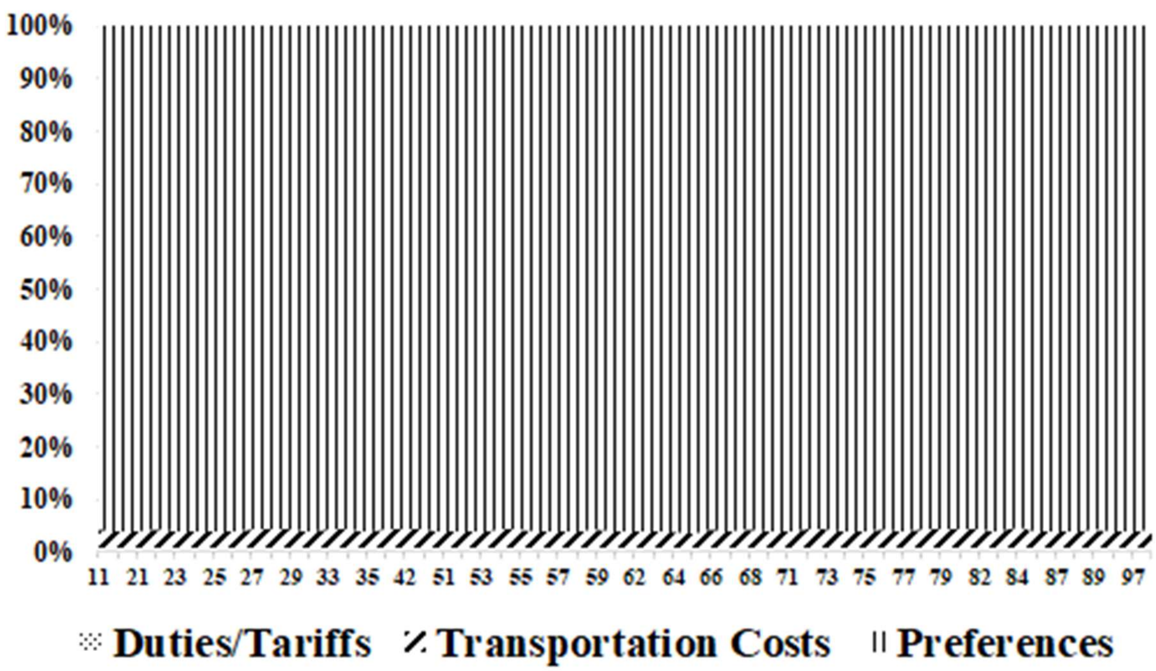
Notes: The horizontal axes represent different years in the sample.

Figure 8 – Exclusion Tests for Decomposition of Gravity Channels

Random Preferences



Dyadic Preferences



Notes: The horizontal axes represent the 2-digit SITC good that is excluded in the exclusion test.

Table 1 - Contribution of Each Gravity Channel to Overall Gravity Effects

	Random Preferences			Dyadic Preferences			
	Duties/ Tariffs (DC)	Transportation Costs (TC)	Total	Duties/ Tariffs (DC)	Transportation Costs (TC)	Dyadic Preferences (PC)	Total
% Contribution of Gravity Channels	46.85%	53.15%	100.00%	0.98%	3.19%	95.83%	100.00%
% Contribution of Individual Variables to Each Gravity Channel:							
Distance	92.16 %	98.61 %	97.00 %	92.15 %	97.74 %	34.34 %	32.23 %
Border	0.30 %	1.96 %	1.54 %	0.29 %	2.82 %	42.57 %	45.12 %
Colony	0.01 %	0.08 %	0.04 %	-0.04 %	0.06 %	14.28 %	13.98 %
FTA	7.19 %	0.31 %	2.07 %	7.22 %	0.18 %	6.90 %	6.91 %
Language	0.34 %	-0.96 %	-0.65 %	0.38 %	-0.80 %	1.91 %	1.76 %
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Notes: This table shows the contribution of each gravity channel to the overall gravity effects. The effects due to each gravity channel is further decomposed into the effects due to individual variables.

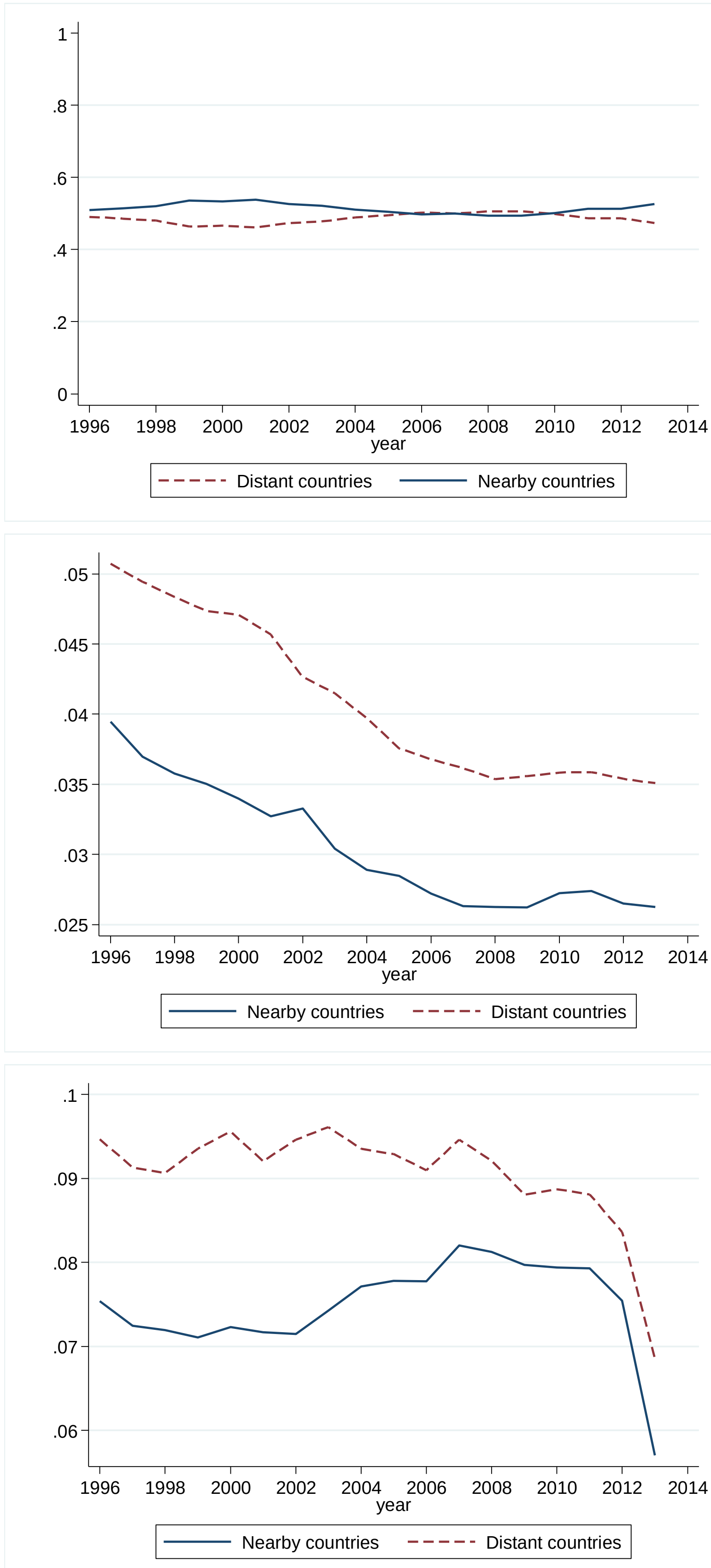
Table 2 - Contribution of Individual Variables to Overall Gravity Effects

% Contribution of Individual Variables to Overall Gravity Effects	Random Preferences			Dyadic Preferences			
	Duties/ Tariffs (DC)	Transportation Costs (TC)	Total	Duties/ Tariffs (DC)	Transportation Costs (TC)	Dyadic Preferences (PC)	Total
Distance	29.43 %	70.57 %	100.00%	0.40 %	3.40 %	96.20 %	100.00%
Border	13.54 %	86.46 %	100.00%	-0.41 %	2.71 %	97.70 %	100.00%
Colony	-7.30 %	107.30 %	100.00%	-0.31 %	1.28 %	99.03 %	100.00%
FTA	75.00 %	25.00 %	100.00%	2.55 %	2.63 %	94.82 %	100.00%
Language	39.22 %	60.78 %	100.00%	-1.80 %	2.15 %	99.65 %	100.00%

Notes: This table shows the contribution of each gravity variable to the overall gravity effects.

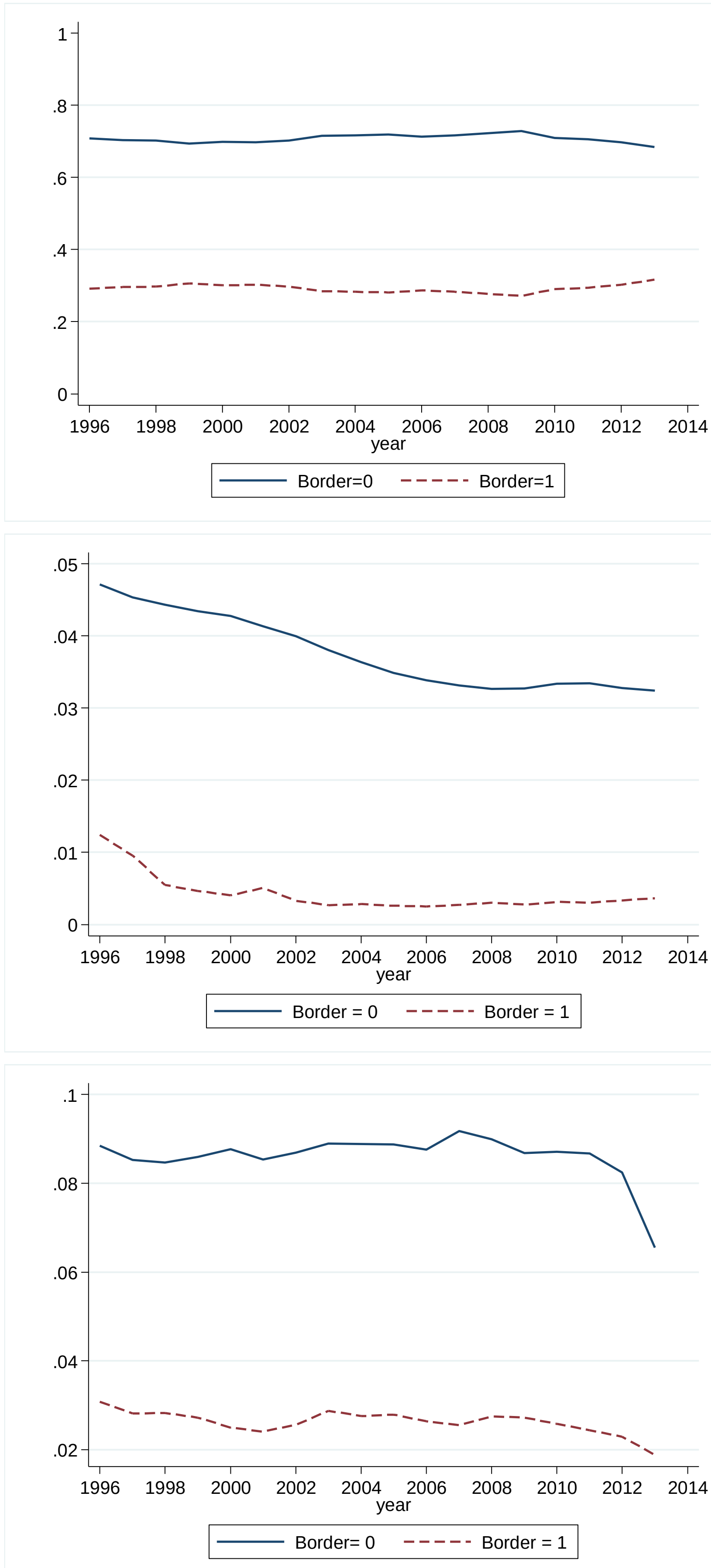
ONLINE APPENDIX

Figure A.1 - Descriptive Statistics: Effects of Distance



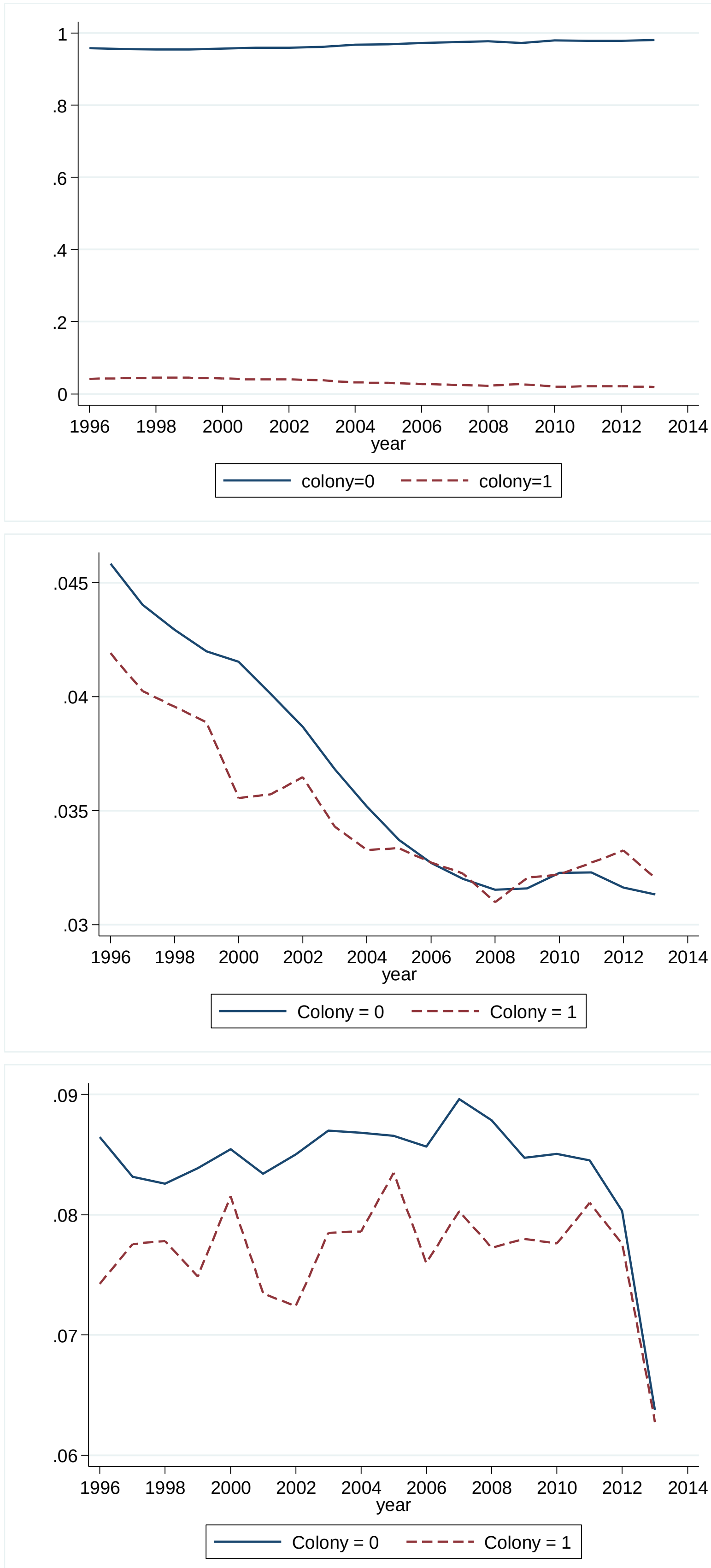
Notes: The distance between the U.S. and nearby (distant) countries is below (above) the median distance.

Figure A.2 - Descriptive Statistics: Effects of Having a Common Border (NAFTA)



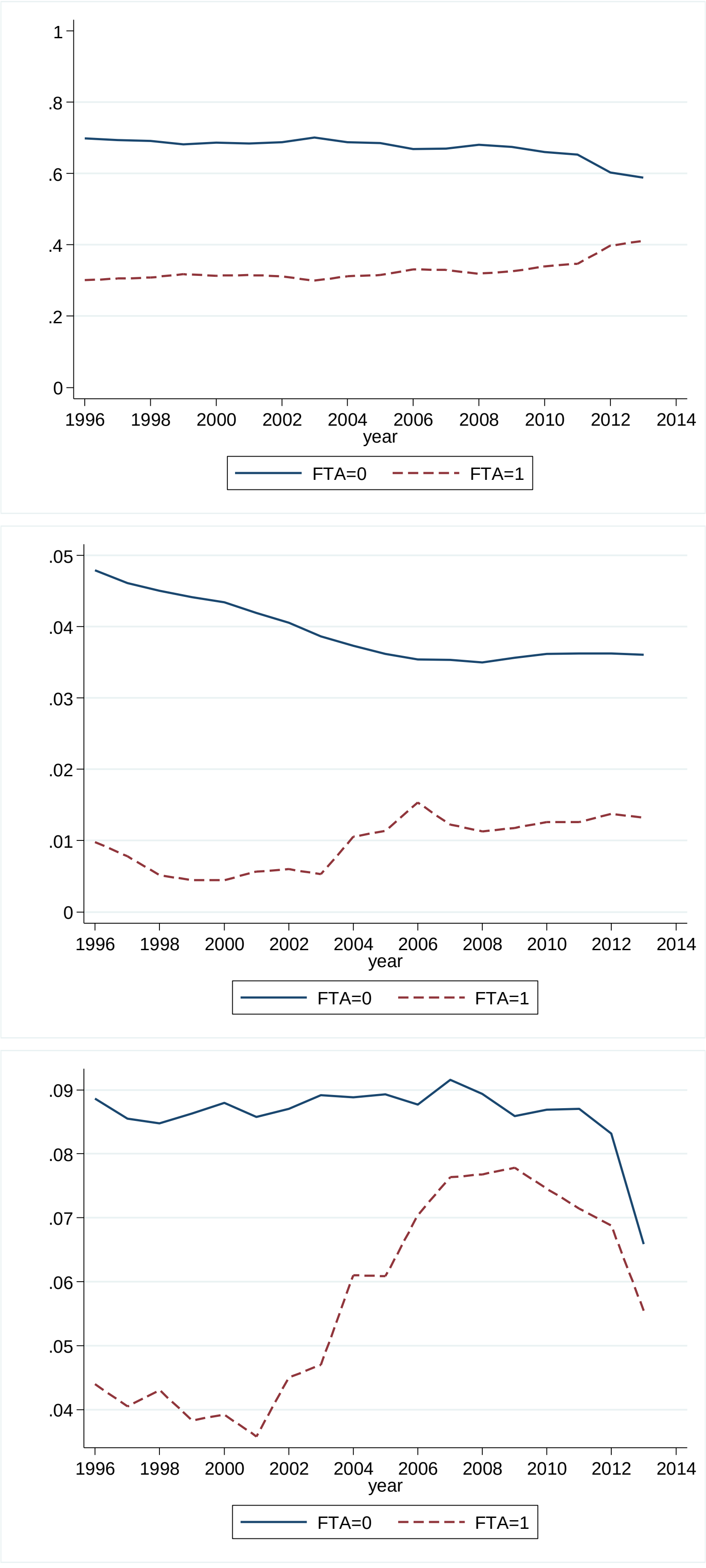
Notes: Border takes a value of one for countries that have a common border with the U.S.

Figure A.3 - Descriptive Statistics: Effects of Having a Colonial Relationship



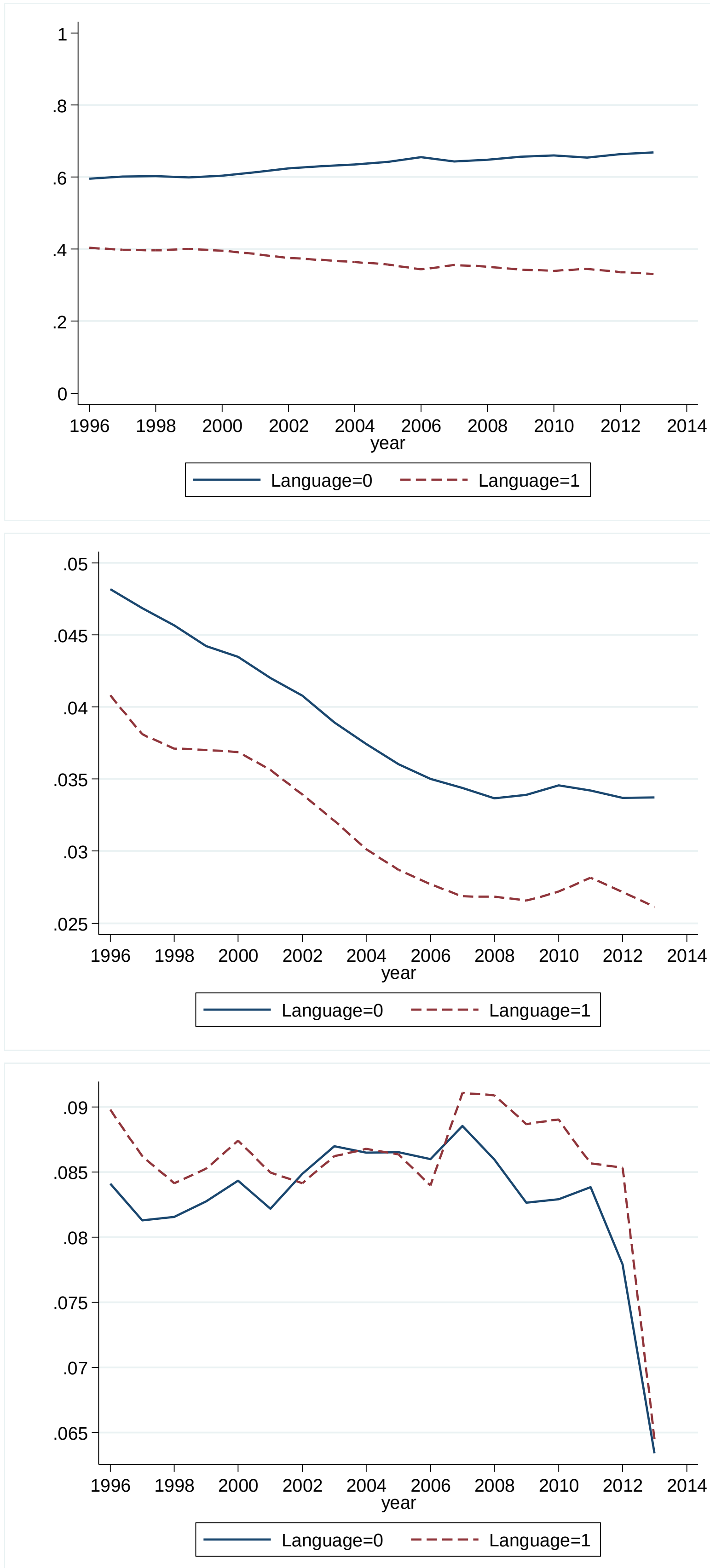
Notes: Colony takes a value of one for countries that have colonial relationships with the U.S.

Figure A.4 - Descriptive Statistics: Effects of Having a Free Trade Agreement



Notes: FTA takes a value of one for countries that have a free trade agreement with the U.S.

Figure A.5 - Descriptive Statistics: Effects of Having a Common Language



Notes: Language takes a value of one for countries that have a common language with the U.S.

Table A.1 - Estimation Results of 3SLS regressions with Random Taste Parameters in 1996

	Dependent Variable:			
	Log Trade	Log Duties	Log Transport Costs	Log Prices
Log Duties	-1.384***			
	(0.0544)			
Log Transport Costs	-1.384***			
	(0.0544)			
Log Prices	-1.384***			
	(0.0544)			
Border		0.0321***	-0.0124+	
		(0.00270)	(0.00673)	
Common Language		-0.00449***	0.00537***	
		(0.000620)	(0.00154)	
FTA		-0.0399***	-0.0126*	
		(0.00213)	(0.00530)	
Log Distance		0.0108***	0.00950***	
		(0.000578)	(0.00144)	
Colony		0.00240	-0.00716+	
		(0.00152)	(0.00379)	
Good Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	No	No	No	Yes
Sample Size	20877	20877	20877	20877
R-squared	0.078	0.633	0.188	0.722

Standard errors in parentheses. +, *, ** and *** represent significance at the 10%, 5%, 1% and 0.1% levels. All regressions include constants that are not shown.

Table A.2 - Estimation Results of 3SLS regressions with Random Taste Parameters in 1997

	Dependent Variable:			
	Log Trade	Log Duties	Log Transport Costs	Log Prices
Log Duties	-1.657***			
	(0.0556)			
Log Transport Costs	-1.657***			
	(0.0556)			
Log Prices	-1.657***			
	(0.0556)			
Border		0.0323***	-0.00684	
		(0.00266)	(0.00648)	
Common Language		-0.00565***	0.00386**	
		(0.000607)	(0.00148)	
FTA		-0.0385***	-0.0149**	
		(0.00209)	(0.00508)	
Log Distance		0.0124***	0.0119***	
		(0.000568)	(0.00138)	
Colony		0.00326*	-0.00170	
		(0.00151)	(0.00366)	
Good Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	No	No	No	Yes
Sample Size	21421	21421	21421	21421
R-squared	-0.005	0.637	0.200	0.723

Standard errors in parentheses. +, *, ** and *** represent significance at the 10%, 5%, 1% and 0.1% levels. All regressions include constants that are not shown.

Table A.3 - Estimation Results of 3SLS regressions with Random Taste Parameters in 1998

	Dependent Variable:			
	Log Trade	Log Duties	Log Transport Costs	Log Prices
Log Duties	-1.715***			
	(0.0557)			
Log Transport Costs	-1.715***			
	(0.0557)			
Log Prices	-1.715***			
	(0.0557)			
Border		0.0263***	-0.0172**	
		(0.00254)	(0.00660)	
Common Language		-0.00530***	0.00205	
		(0.000572)	(0.00149)	
FTA		-0.0366***	-0.00567	
		(0.00200)	(0.00520)	
Log Distance		0.0120***	0.0115***	
		(0.000534)	(0.00139)	
Colony		0.00288*	0.000343	
		(0.00141)	(0.00367)	
Good Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	No	No	No	Yes
Sample Size	21692	21692	21692	21692
R-squared	-0.028	0.669	0.190	0.725

Standard errors in parentheses. +, *, ** and *** represent significance at the 10%, 5%, 1% and 0.1% levels. All regressions include constants that are not shown.

Table A.4 - Estimation Results of 3SLS regressions with Random Taste Parameters in 1999

	Dependent Variable:			
	Log Trade	Log Duties	Log Transport Costs	Log Prices
Log Duties	-1.729***			
	(0.0561)			
Log Transport Costs	-1.729***			
	(0.0561)			
Log Prices	-1.729***			
	(0.0561)			
Border		0.0241***	0.00731	
		(0.00249)	(0.00660)	
Common Language		-0.00476***	0.00287+	
		(0.000573)	(0.00152)	
FTA		-0.0336***	-0.0228***	
		(0.00196)	(0.00518)	
Log Distance		0.0117***	0.0157***	
		(0.000529)	(0.00140)	
Colony		0.00320*	-0.00420	
		(0.00141)	(0.00372)	
Good Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	No	No	No	Yes
Sample Size	21776	21776	21776	21776
R-squared	-0.052	0.667	0.181	0.732

Standard errors in parentheses. +, *, ** and *** represent significance at the 10%, 5%, 1% and 0.1% levels. All regressions include constants that are not shown.

Table A.5 - Estimation Results of 3SLS regressions with Random Taste Parameters in 2000

	Dependent Variable:			
	Log Trade	Log Duties	Log Transport Costs	Log Prices
Log Duties	-1.917***			
	(0.0585)			
Log Transport Costs	-1.917***			
	(0.0585)			
Log Prices	-1.917***			
	(0.0585)			
Border		0.0227***	-0.00441	
		(0.00246)	(0.00630)	
Common Language		-0.00449***	0.00298*	
		(0.000553)	(0.00141)	
FTA		-0.0336***	-0.0174***	
		(0.00194)	(0.00495)	
Log Distance		0.0114***	0.0152***	
		(0.000511)	(0.00131)	
Colony		0.00120	-0.00174	
		(0.00138)	(0.00354)	
Good Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	No	No	No	Yes
Sample Size	22836	22836	22836	22836
R-squared	-0.137	0.673	0.196	0.728

Standard errors in parentheses. +, *, ** and *** represent significance at the 10%, 5%, 1% and 0.1% levels. All regressions include constants that are not shown.

Table A.6 - Estimation Results of 3SLS regressions with Random Taste Parameters in 2001

	Dependent Variable:			
	Log Trade	Log Duties	Log Transport Costs	Log Prices
Log Duties	-1.837***			
	(0.0576)			
Log Transport Costs	-1.837***			
	(0.0576)			
Log Prices	-1.837***			
	(0.0576)			
Border		0.0209***	-0.00392	
		(0.00261)	(0.00640)	
Common Language		-0.00508***	0.00351*	
		(0.000586)	(0.00143)	
FTA		-0.0299***	-0.0195***	
		(0.00207)	(0.00505)	
Log Distance		0.0115***	0.0139***	
		(0.000544)	(0.00133)	
Colony		0.00248+	-0.00597	
		(0.00149)	(0.00363)	
Good Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	No	No	No	Yes
Sample Size	22670	22670	22670	22670
R-squared	-0.106	0.639	0.189	0.731

Standard errors in parentheses. +, *, ** and *** represent significance at the 10%, 5%, 1% and 0.1% levels. All regressions include constants that are not shown.

Table A.7 - Estimation Results of 3SLS regressions with Random Taste Parameters in 2002

	Dependent Variable:			
	Log Trade	Log Duties	Log Transport Costs	Log Prices
Log Duties	-1.741***			
	(0.0543)			
Log Transport Costs	-1.741***			
	(0.0543)			
Log Prices	-1.741***			
	(0.0543)			
Border		0.0125***	-0.0143*	
		(0.00221)	(0.00599)	
Common Language		-0.00501***	-0.000758	
		(0.000533)	(0.00144)	
FTA		-0.0280***	-0.00656	
		(0.00166)	(0.00448)	
Log Distance		0.00777***	0.0132***	
		(0.000493)	(0.00134)	
Colony		0.00471***	-0.00590	
		(0.00135)	(0.00367)	
Good Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	No	No	No	Yes
Sample Size	22837	22837	22837	22837
R-squared	-0.062	0.656	0.177	0.726

Standard errors in parentheses. +, *, ** and *** represent significance at the 10%, 5%, 1% and 0.1% levels. All regressions include constants that are not shown.

Table A.8 - Estimation Results of 3SLS regressions with Random Taste Parameters in 2003

	Dependent Variable:			
	Log Trade	Log Duties	Log Transport Costs	Log Prices
Log Duties	-1.619***			
	(0.0477)			
Log Transport Costs	-1.619***			
	(0.0477)			
Log Prices	-1.619***			
	(0.0477)			
Border		0.0103***	-0.0102+	
		(0.00218)	(0.00597)	
Common Language		-0.00487***	-0.00140	
		(0.000528)	(0.00144)	
FTA		-0.0254***	-0.0105*	
		(0.00164)	(0.00448)	
Log Distance		0.00769***	0.0135***	
		(0.000488)	(0.00134)	
Colony		0.00499***	-0.00117	
		(0.00134)	(0.00367)	
Good Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	No	No	No	Yes
Sample Size	23362	23362	23362	23362
R-squared	0.008	0.635	0.196	0.717

Standard errors in parentheses. +, *, ** and *** represent significance at the 10%, 5%, 1% and 0.1% levels. All regressions include constants that are not shown.

Table A.9 - Estimation Results of 3SLS regressions with Random Taste Parameters in 2004

	Dependent Variable:			
	Log Trade	Log Duties	Log Transport Costs	Log Prices
Log Duties	-1.648***			
	(0.0476)			
Log Transport Costs	-1.648***			
	(0.0476)			
Log Prices	-1.648***			
	(0.0476)			
Border		0.00376*	-0.0211***	
		(0.00189)	(0.00554)	
Common Language		-0.00551***	-0.000561	
		(0.000529)	(0.00155)	
FTA		-0.0173***	-0.00356	
		(0.00113)	(0.00330)	
Log Distance		0.00821***	0.0114***	
		(0.000496)	(0.00145)	
Colony		0.00508***	-0.00102	
		(0.00136)	(0.00397)	
Good Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	No	No	No	Yes
Sample Size	23915	23915	23915	23915
R-squared	-0.011	0.610	0.170	0.721

Standard errors in parentheses. +, *, ** and *** represent significance at the 10%, 5%, 1% and 0.1% levels. All regressions include constants that are not shown.

Table A.10 - Estimation Results of 3SLS regressions with Random Taste Parameters in 2005

	Dependent Variable:			
	Log Trade	Log Duties	Log Transport Costs	Log Prices
Log Duties	-1.878***			
	(0.0496)			
Log Transport Costs	-1.878***			
	(0.0496)			
Log Prices	-1.878***			
	(0.0496)			
Border		-0.000542	-0.0205***	
		(0.00161)	(0.00511)	
Common Language		-0.00458***	0.0000549	
		(0.000472)	(0.00149)	
FTA		-0.0163***	-0.0102***	
		(0.000882)	(0.00278)	
Log Distance		0.00590***	0.00983***	
		(0.000436)	(0.00138)	
Colony		0.00513***	-0.000356	
		(0.00121)	(0.00382)	
Good Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	No	No	No	Yes
Sample Size	24578	24578	24578	24578
R-squared	-0.100	0.643	0.182	0.718

Standard errors in parentheses. +, *, ** and *** represent significance at the 10%, 5%, 1% and 0.1% levels. All regressions include constants that are not shown.

Table A.11 - Estimation Results of 3SLS regressions with Random Taste Parameters in 2006

	Dependent Variable:			
	Log Trade	Log Duties	Log Transport Costs	Log Prices
Log Duties	-2.012***			
	(0.0507)			
Log Transport Costs	-2.012***			
	(0.0507)			
Log Prices	-2.012***			
	(0.0507)			
Border		-0.00187	-0.0389***	
		(0.00143)	(0.00450)	
Common Language		-0.00594***	-0.000798	
		(0.000456)	(0.00143)	
FTA		-0.0150***	-0.00368+	
		(0.000675)	(0.00211)	
Log Distance		0.00555***	0.00378**	
		(0.000424)	(0.00133)	
Colony		0.00648***	-0.00507	
		(0.00119)	(0.00373)	
Good Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	No	No	No	Yes
Sample Size	24823	24823	24823	24823
R-squared	-0.159	0.629	0.182	0.724

Standard errors in parentheses. +, *, ** and *** represent significance at the 10%, 5%, 1% and 0.1% levels. All regressions include constants that are not shown.

Table A.12 - Estimation Results of 3SLS regressions with Random Taste Parameters in 2007

	Dependent Variable:			
	Log Trade	Log Duties	Log Transport Costs	Log Prices
Log Duties	-1.858***			
	(0.0473)			
Log Transport Costs	-1.858***			
	(0.0473)			
Log Prices	-1.858***			
	(0.0473)			
Border		0.000814	-0.0506***	
		(0.00137)	(0.00495)	
Common Language		-0.00549***	0.00366*	
		(0.000446)	(0.00161)	
FTA		-0.0193***	-0.00252	
		(0.000631)	(0.00228)	
Log Distance		0.00487***	-0.00157	
		(0.000420)	(0.00152)	
Colony		0.00565***	-0.00784+	
		(0.00117)	(0.00421)	
Good Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	No	No	No	Yes
Sample Size	24859	24859	24859	24859
R-squared	-0.087	0.632	0.165	0.715

Standard errors in parentheses. +, *, ** and *** represent significance at the 10%, 5%, 1% and 0.1% levels. All regressions include constants that are not shown.

Table A.13 - Estimation Results of 3SLS regressions with Random Taste Parameters in 2008

	Dependent Variable:			
	Log Trade	Log Duties	Log Transport Costs	Log Prices
Log Duties	-1.868***			
	(0.0480)			
Log Transport Costs	-1.868***			
	(0.0480)			
Log Prices	-1.868***			
	(0.0480)			
Border		0.00305*	-0.0533***	
		(0.00137)	(0.00492)	
Common Language		-0.00430***	0.00668***	
		(0.000448)	(0.00161)	
FTA		-0.0213***	-0.000812	
		(0.000636)	(0.00228)	
Log Distance		0.00459***	-0.00203	
		(0.000420)	(0.00151)	
Colony		0.00336**	-0.00999*	
		(0.00117)	(0.00420)	
Good Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	No	No	No	Yes
Sample Size	24871	24871	24871	24871
R-squared	-0.110	0.626	0.166	0.717

Standard errors in parentheses. +, *, ** and *** represent significance at the 10%, 5%, 1% and 0.1% levels. All regressions include constants that are not shown.

Table A.14 - Estimation Results of 3SLS regressions with Random Taste Parameters in 2009

	Dependent Variable:			
	Log Trade	Log Duties	Log Transport Costs	Log Prices
Log Duties	-1.678***			
	(0.0443)			
Log Transport Costs	-1.678***			
	(0.0443)			
Log Prices	-1.678***			
	(0.0443)			
Border		0.00202	-0.0541***	
		(0.00135)	(0.00477)	
Common Language		-0.00486***	0.00795***	
		(0.000452)	(0.00159)	
FTA		-0.0222***	-0.000215	
		(0.000593)	(0.00209)	
Log Distance		0.00364***	-0.00532***	
		(0.000430)	(0.00152)	
Colony		0.00338**	-0.00602	
		(0.00118)	(0.00417)	
Good Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	No	No	No	Yes
Sample Size	24248	24248	24248	24248
R-squared	-0.035	0.632	0.167	0.717

Standard errors in parentheses. +, *, ** and *** represent significance at the 10%, 5%, 1% and 0.1% levels. All regressions include constants that are not shown.

Table A.15 - Estimation Results of 3SLS regressions with Random Taste Parameters in 2010

	Dependent Variable:			
	Log Trade	Log Duties	Log Transport Costs	Log Prices
Log Duties	-1.875***			
	(0.0470)			
Log Transport Costs	-1.875***			
	(0.0470)			
Log Prices	-1.875***			
	(0.0470)			
Border		0.000776	-0.0508***	
		(0.00129)	(0.00470)	
Common Language		-0.00504***	0.00847***	
		(0.000432)	(0.00157)	
FTA		-0.0218***	-0.00531*	
		(0.000573)	(0.00208)	
Log Distance		0.00323***	-0.00471**	
		(0.000410)	(0.00149)	
Colony		0.00389***	-0.00810+	
		(0.00114)	(0.00415)	
Good Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	No	No	No	Yes
Sample Size	24994	24994	24994	24994
R-squared	-0.094	0.654	0.159	0.715

Standard errors in parentheses. +, *, ** and *** represent significance at the 10%, 5%, 1% and 0.1% levels. All regressions include constants that are not shown.

Table A.16 - Estimation Results of 3SLS regressions with Random Taste Parameters in 2011

	Dependent Variable:			
	Log Trade	Log Duties	Log Transport Costs	Log Prices
Log Duties	-2.005***			
	(0.0514)			
Log Transport Costs	-2.005***			
	(0.0514)			
Log Prices	-2.005***			
	(0.0514)			
Border		-0.000534	-0.0504***	
		(0.00126)	(0.00485)	
Common Language		-0.00444***	0.00411*	
		(0.000416)	(0.00161)	
FTA		-0.0217***	-0.00702***	
		(0.000551)	(0.00213)	
Log Distance		0.00286***	-0.00395**	
		(0.000396)	(0.00153)	
Colony		0.00342**	-0.00512	
		(0.00109)	(0.00421)	
Good Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	No	No	No	Yes
Sample Size	25371	25371	25371	25371
R-squared	-0.176	0.668	0.155	0.709

Standard errors in parentheses. +, *, ** and *** represent significance at the 10%, 5%, 1% and 0.1% levels. All regressions include constants that are not shown.

Table A.17 - Estimation Results of 3SLS regressions with Random Taste Parameters in 2012

	Dependent Variable:			
	Log Trade	Log Duties	Log Transport Costs	Log Prices
Log Duties	-2.227***			
	(0.0547)			
Log Transport Costs	-2.227***			
	(0.0547)			
Log Prices	-2.227***			
	(0.0547)			
Border		-0.00273*	-0.0559***	
		(0.00122)	(0.00442)	
Common Language		-0.00421***	0.0112***	
		(0.000417)	(0.00151)	
FTA		-0.0193***	-0.00870***	
		(0.000500)	(0.00181)	
Log Distance		0.00255***	-0.00759***	
		(0.000397)	(0.00143)	
Colony		0.00373***	-0.00806*	
		(0.00110)	(0.00397)	
Good Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	No	No	No	Yes
Sample Size	25584	25584	25584	25584
R-squared	-0.264	0.662	0.155	0.723

Standard errors in parentheses. +, *, ** and *** represent significance at the 10%, 5%, 1% and 0.1% levels. All regressions include constants that are not shown.

Table A.18 - Estimation Results of 3SLS regressions with Random Taste Parameters in 2013

	Dependent Variable:			
	Log Trade	Log Duties	Log Transport Costs	Log Prices
Log Duties	-2.074***			
	(0.0522)			
Log Transport Costs	-2.074***			
	(0.0522)			
Log Prices	-2.074***			
	(0.0522)			
Border		-0.00102	-0.0301***	
		(0.00124)	(0.00330)	
Common Language		-0.00487***	0.000417	
		(0.000428)	(0.00113)	
FTA		-0.0198***	-0.00377**	
		(0.000507)	(0.00134)	
Log Distance		0.00318***	0.00331**	
		(0.000411)	(0.00109)	
Colony		0.00337**	-0.00128	
		(0.00110)	(0.00291)	
Good Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	No	No	No	Yes
Sample Size	25098	25098	25098	25098
R-squared	-0.225	0.655	0.162	0.721

Standard errors in parentheses. +, *, ** and *** represent significance at the 10%, 5%, 1% and 0.1% levels. All regressions include constants that are not shown.

Table A.19 - Estimation Results of 3SLS regressions with Dyadic Taste Parameters in 1996

	Dependent Variable:			
	Log Trade	Log Duties	Log Transport Costs	Log Prices
Log Duties	-0.885***			
	(0.0540)			
Log Transport Costs	-0.885***			
	(0.0540)			
Log Prices	-0.885***			
	(0.0540)			
Border	2.281***	0.0319***	-0.0262***	
	(0.208)	(0.00270)	(0.00695)	
Common Language	-0.473***	-0.00442***	0.00928***	
	(0.0450)	(0.000620)	(0.00160)	
FTA	0.747***	-0.0400***	-0.0199***	
	(0.155)	(0.00213)	(0.00549)	
Log Distance	0.201***	0.0107***	0.00862***	
	(0.0432)	(0.000578)	(0.00149)	
Colony	1.976***	0.00211	-0.0232***	
	(0.111)	(0.00152)	(0.00392)	
Good Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	No	No	No	Yes
Sample Size	20877	20877	20877	20877
R-squared	0.238	0.633	0.189	0.729

Standard errors in parentheses. +, *, ** and *** represent significance at the 10%, 5%, 1% and 0.1% levels. All regressions include constants that are not shown.

Table A.20 - Estimation Results of 3SLS regressions with Dyadic Taste Parameters in 1997

	Dependent Variable:			
	Log Trade	Log Duties	Log Transport Costs	Log Prices
Log Duties	-1.227***			
	(0.0550)			
Log Transport Costs	-1.227***			
	(0.0550)			
Log Prices	-1.227***			
	(0.0550)			
Border	1.875***	0.0320***	-0.0164*	
	(0.215)	(0.00266)	(0.00666)	
Common Language	-0.504***	-0.00554***	0.00743***	
	(0.0463)	(0.000607)	(0.00152)	
FTA	0.940***	-0.0387***	-0.0222***	
	(0.160)	(0.00209)	(0.00524)	
Log Distance	0.117**	0.0124***	0.0118***	
	(0.0451)	(0.000568)	(0.00142)	
Colony	2.029***	0.00282+	-0.0159***	
	(0.115)	(0.00151)	(0.00377)	
Good Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	No	No	No	Yes
Sample Size	21421	21421	21421	21421
R-squared	0.179	0.637	0.201	0.728

Standard errors in parentheses. +, *, ** and *** represent significance at the 10%, 5%, 1% and 0.1% levels. All regressions include constants that are not shown.

Table A.21 - Estimation Results of 3SLS regressions with Dyadic Taste Parameters in 1998

	Dependent Variable:			
	Log Trade	Log Duties	Log Transport Costs	Log Prices
Log Duties	-1.293***			
	(0.0549)			
Log Transport Costs	-1.293***			
	(0.0549)			
Log Prices	-1.293***			
	(0.0549)			
Border	1.898***	0.0260***	-0.0267***	
	(0.217)	(0.00254)	(0.00678)	
Common Language	-0.397***	-0.00520***	0.00477**	
	(0.0464)	(0.000573)	(0.00153)	
FTA	0.838***	-0.0368***	-0.0122*	
	(0.163)	(0.00200)	(0.00536)	
Log Distance	0.105*	0.0120***	0.0114***	
	(0.0449)	(0.000535)	(0.00143)	
Colony	1.847***	0.00242+	-0.0123**	
	(0.115)	(0.00141)	(0.00378)	
Good Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	No	No	No	Yes
Sample Size	21692	21692	21692	21692
R-squared	0.163	0.669	0.191	0.730

Standard errors in parentheses. +, *, ** and *** represent significance at the 10%, 5%, 1% and 0.1% levels. All regressions include constants that are not shown.

Table A.22 - Estimation Results of 3SLS regressions with Dyadic Taste Parameters in 1999

	Dependent Variable:			
	Log Trade	Log Duties	Log Transport Costs	Log Prices
Log Duties	-1.330***			
	(0.0554)			
Log Transport Costs	-1.330***			
	(0.0554)			
Log Prices	-1.330***			
	(0.0554)			
Border	2.104***	0.0237***	-0.00493	
	(0.212)	(0.00249)	(0.00679)	
Common Language	-0.354***	-0.00469***	0.00541***	
	(0.0465)	(0.000573)	(0.00156)	
FTA	0.593***	-0.0338***	-0.0275***	
	(0.159)	(0.00196)	(0.00535)	
Log Distance	0.0848+	0.0117***	0.0158***	
	(0.0449)	(0.000529)	(0.00145)	
Colony	1.898***	0.00277*	-0.0182***	
	(0.114)	(0.00141)	(0.00384)	
Good Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	No	No	No	Yes
Sample Size	21776	21776	21776	21776
R-squared	0.137	0.667	0.182	0.737

Standard errors in parentheses. +, *, ** and *** represent significance at the 10%, 5%, 1% and 0.1% levels. All regressions include constants that are not shown.

Table A.23 - Estimation Results of 3SLS regressions with Dyadic Taste Parameters in 2000

	Dependent Variable:			
	Log Trade	Log Duties	Log Transport Costs	Log Prices
Log Duties	-1.486***			
	(0.0565)			
Log Transport Costs	-1.486***			
	(0.0565)			
Log Prices	-1.486***			
	(0.0565)			
Border	2.165***	0.0223***	-0.0157*	
	(0.218)	(0.00246)	(0.00648)	
Common Language	-0.349***	-0.00442***	0.00520***	
	(0.0468)	(0.000553)	(0.00146)	
FTA	0.790***	-0.0338***	-0.0231***	
	(0.164)	(0.00194)	(0.00510)	
Log Distance	0.146**	0.0114***	0.0148***	
	(0.0449)	(0.000511)	(0.00135)	
Colony	1.841***	0.000809	-0.0139***	
	(0.117)	(0.00138)	(0.00365)	
Good Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	No	No	No	Yes
Sample Size	22836	22836	22836	22836
R-squared	0.089	0.673	0.197	0.733

Standard errors in parentheses. +, *, ** and *** represent significance at the 10%, 5%, 1% and 0.1% levels. All regressions include constants that are not shown.

Table A.24 - Estimation Results of 3SLS regressions with Dyadic Taste Parameters in 2001

	Dependent Variable:			
	Log Trade	Log Duties	Log Transport Costs	Log Prices
Log Duties	-1.426***			
	(0.0562)			
Log Transport Costs	-1.426***			
	(0.0562)			
Log Prices	-1.426***			
	(0.0562)			
Border	1.953***	0.0205***	-0.0135*	
	(0.218)	(0.00261)	(0.00656)	
Common Language	-0.311***	-0.00501***	0.00539***	
	(0.0467)	(0.000586)	(0.00147)	
FTA	0.834***	-0.0301***	-0.0254***	
	(0.164)	(0.00207)	(0.00519)	
Log Distance	0.0819+	0.0115***	0.0140***	
	(0.0451)	(0.000544)	(0.00137)	
Colony	1.821***	0.00205	-0.0175***	
	(0.118)	(0.00149)	(0.00374)	
Good Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	No	No	No	Yes
Sample Size	22670	22670	22670	22670
R-squared	0.105	0.639	0.190	0.736

Standard errors in parentheses. +, *, ** and *** represent significance at the 10%, 5%, 1% and 0.1% levels. All regressions include constants that are not shown.

Table A.25 - Estimation Results of 3SLS regressions with Dyadic Taste Parameters in 2002

	Dependent Variable:			
	Log Trade	Log Duties	Log Transport Costs	Log Prices
Log Duties	-1.346***			
	(0.0530)			
Log Transport Costs	-1.346***			
	(0.0530)			
Log Prices	-1.346***			
	(0.0530)			
Border	2.546***	0.0122***	-0.0289***	
	(0.199)	(0.00221)	(0.00615)	
Common Language	-0.348***	-0.00496***	0.00154	
	(0.0460)	(0.000533)	(0.00148)	
FTA	0.447**	-0.0281***	-0.00992*	
	(0.143)	(0.00166)	(0.00461)	
Log Distance	0.125**	0.00777***	0.0130***	
	(0.0445)	(0.000493)	(0.00137)	
Colony	1.758***	0.00444**	-0.0177***	
	(0.117)	(0.00135)	(0.00377)	
Good Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	No	No	No	Yes
Sample Size	22837	22837	22837	22837
R-squared	0.129	0.656	0.178	0.732

Standard errors in parentheses. +, *, ** and *** represent significance at the 10%, 5%, 1% and 0.1% levels. All regressions include constants that are not shown.

Table A.26 - Estimation Results of 3SLS regressions with Dyadic Taste Parameters in 2003

	Dependent Variable:			
	Log Trade	Log Duties	Log Transport Costs	Log Prices
Log Duties	-1.320***			
	(0.0475)			
Log Transport Costs	-1.320***			
	(0.0475)			
Log Prices	-1.320***			
	(0.0475)			
Border	2.433***	0.0101***	-0.0250***	
	(0.194)	(0.00218)	(0.00613)	
Common Language	-0.356***	-0.00483***	0.00104	
	(0.0452)	(0.000528)	(0.00148)	
FTA	0.375**	-0.0254***	-0.0133**	
	(0.140)	(0.00164)	(0.00461)	
Log Distance	0.0765+	0.00769***	0.0135***	
	(0.0437)	(0.000488)	(0.00137)	
Colony	1.806***	0.00479***	-0.0137***	
	(0.115)	(0.00134)	(0.00377)	
Good Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	No	No	No	Yes
Sample Size	23362	23362	23362	23362
R-squared	0.151	0.635	0.198	0.722

Standard errors in parentheses. +, *, ** and *** represent significance at the 10%, 5%, 1% and 0.1% levels. All regressions include constants that are not shown.

Table27 - Estimation Results of 3SLS regressions with Dyadic Taste Parameters in 2004

	Dependent Variable:			
	Log Trade	Log Duties	Log Transport Costs	Log Prices
Log Duties	-1.302***			
	(0.0471)			
Log Transport Costs	-1.302***			
	(0.0471)			
Log Prices	-1.302***			
	(0.0471)			
Border	2.800***	0.00396*	-0.0385***	
	(0.170)	(0.00189)	(0.00567)	
Common Language	-0.323***	-0.00553***	0.00172	
	(0.0451)	(0.000529)	(0.00159)	
FTA	0.0984	-0.0173***	-0.00446	
	(0.0962)	(0.00113)	(0.00338)	
Log Distance	0.156***	0.00821***	0.0109***	
	(0.0441)	(0.000496)	(0.00149)	
Colony	1.700***	0.00522***	-0.0131**	
	(0.116)	(0.00136)	(0.00407)	
Good Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	No	No	No	Yes
Sample Size	23915	23915	23915	23915
R-squared	0.147	0.610	0.171	0.726

Standard errors in parentheses. +, *, ** and *** represent significance at the 10%, 5%, 1% and 0.1% levels. All regressions include constants that are not shown.

Table A.28 - Estimation Results of 3SLS regressions with Dyadic Taste Parameters in 2005

	Dependent Variable:			
	Log Trade	Log Duties	Log Transport Costs	Log Prices
Log Duties	-1.588***			
	(0.0502)			
Log Transport Costs	-1.588***			
	(0.0502)			
Log Prices	-1.588***			
	(0.0502)			
Border	2.184***	-0.000443	-0.0323***	
	(0.178)	(0.00161)	(0.00523)	
Common Language	-0.410***	-0.00461***	0.00278+	
	(0.0480)	(0.000472)	(0.00153)	
FTA	0.375***	-0.0163***	-0.0132***	
	(0.0905)	(0.000882)	(0.00285)	
Log Distance	0.0406	0.00590***	0.0101***	
	(0.0466)	(0.000436)	(0.00141)	
Colony	1.781***	0.00523***	-0.0121**	
	(0.123)	(0.00121)	(0.00392)	
Good Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	No	No	No	Yes
Sample Size	24578	24578	24578	24578
R-squared	0.058	0.643	0.183	0.722

Standard errors in parentheses. +, *, ** and *** represent significance at the 10%, 5%, 1% and 0.1% levels. All regressions include constants that are not shown.

Table A.29 - Estimation Results of 3SLS regressions with Dyadic Taste Parameters in 2006

	Dependent Variable:			
	Log Trade	Log Duties	Log Transport Costs	Log Prices
Log Duties	-1.717***			
	(0.0505)			
Log Transport Costs	-1.717***			
	(0.0505)			
Log Prices	-1.717***			
	(0.0505)			
Border	2.555***	-0.00180	-0.0528***	
	(0.161)	(0.00143)	(0.00460)	
Common Language	-0.389***	-0.00595***	0.00159	
	(0.0481)	(0.000456)	(0.00147)	
FTA	-0.0582	-0.0150***	-0.00331	
	(0.0712)	(0.000675)	(0.00217)	
Log Distance	0.0724	0.00555***	0.00380**	
	(0.0465)	(0.000424)	(0.00136)	
Colony	1.655***	0.00653***	-0.0152***	
	(0.126)	(0.00119)	(0.00382)	
Good Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	No	No	No	Yes
Sample Size	24823	24823	24823	24823
R-squared	0.012	0.629	0.183	0.727

Standard errors in parentheses. +, *, ** and *** represent significance at the 10%, 5%, 1% and 0.1% levels. All regressions include constants that are not shown.

Table A.30 - Estimation Results of 3SLS regressions with Dyadic Taste Parameters in 2007

	Dependent Variable:			
	Log Trade	Log Duties	Log Transport Costs	Log Prices
Log Duties	-1.577***			
	(0.0473)			
Log Transport Costs	-1.577***			
	(0.0473)			
Log Prices	-1.577***			
	(0.0473)			
Border	2.837***	0.000951	-0.0681***	
	(0.153)	(0.00137)	(0.00506)	
Common Language	-0.433***	-0.00551***	0.00662***	
	(0.0471)	(0.000446)	(0.00165)	
FTA	-0.196**	-0.0193***	-0.000921	
	(0.0669)	(0.000631)	(0.00233)	
Log Distance	0.0894+	0.00487***	-0.00167	
	(0.0462)	(0.000420)	(0.00155)	
Colony	1.579***	0.00574***	-0.0186***	
	(0.123)	(0.00117)	(0.00431)	
Good Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	No	No	No	Yes
Sample Size	24859	24859	24859	24859
R-squared	0.068	0.632	0.166	0.718

Standard errors in parentheses. +, *, ** and *** represent significance at the 10%, 5%, 1% and 0.1% levels. All regressions include constants that are not shown.

Table A.31 - Estimation Results of 3SLS regressions with Dyadic Taste Parameters in 2008

	Dependent Variable:			
	Log Trade	Log Duties	Log Transport Costs	Log Prices
Log Duties	-1.584***			
	(0.0481)			
Log Transport Costs	-1.584***			
	(0.0481)			
Log Prices	-1.584***			
	(0.0481)			
Border	2.678***	0.00326*	-0.0679***	
	(0.156)	(0.00137)	(0.00500)	
Common Language	-0.391***	-0.00433***	0.00903***	
	(0.0481)	(0.000448)	(0.00164)	
FTA	-0.192**	-0.0213***	0.000547	
	(0.0685)	(0.000636)	(0.00233)	
Log Distance	0.0512	0.00459***	-0.00188	
	(0.0469)	(0.000420)	(0.00154)	
Colony	1.422***	0.00348**	-0.0184***	
	(0.126)	(0.00117)	(0.00428)	
Good Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	No	No	No	Yes
Sample Size	24871	24871	24871	24871
R-squared	0.048	0.626	0.167	0.720

Standard errors in parentheses. +, *, ** and *** represent significance at the 10%, 5%, 1% and 0.1% levels. All regressions include constants that are not shown.

Table A.32 - Estimation Results of 3SLS regressions with Dyadic Taste Parameters in 2009

	Dependent Variable:			
	Log Trade	Log Duties	Log Transport Costs	Log Prices
Log Duties	-1.432***			
	(0.0449)			
Log Transport Costs	-1.432***			
	(0.0449)			
Log Prices	-1.432***			
	(0.0449)			
Border	2.781***	0.00178	-0.0716***	
	(0.148)	(0.00135)	(0.00487)	
Common Language	-0.390***	-0.00482***	0.0106***	
	(0.0465)	(0.000452)	(0.00163)	
FTA	-0.214***	-0.0221***	0.00149	
	(0.0613)	(0.000593)	(0.00214)	
Log Distance	0.0646	0.00364***	-0.00525***	
	(0.0463)	(0.000430)	(0.00155)	
Colony	1.487***	0.00323**	-0.0163***	
	(0.122)	(0.00118)	(0.00427)	
Good Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	No	No	No	Yes
Sample Size	24248	24248	24248	24248
R-squared	0.098	0.632	0.168	0.720

Standard errors in parentheses. +, *, ** and *** represent significance at the 10%, 5%, 1% and 0.1% levels. All regressions include constants that are not shown.

Table A.33 - Estimation Results of 3SLS regressions with Dyadic Taste Parameters in 2010

	Dependent Variable:			
	Log Trade	Log Duties	Log Transport Costs	Log Prices
Log Duties	-1.623***			
	(0.0475)			
Log Transport Costs	-1.623***			
	(0.0475)			
Log Prices	-1.623***			
	(0.0475)			
Border	2.663***	0.000634	-0.0662***	
	(0.152)	(0.00129)	(0.00479)	
Common Language	-0.432***	-0.00501***	0.0112***	
	(0.0477)	(0.000432)	(0.00160)	
FTA	-0.238***	-0.0218***	-0.00354+	
	(0.0637)	(0.000573)	(0.00212)	
Log Distance	0.0515	0.00324***	-0.00459**	
	(0.0473)	(0.000410)	(0.00152)	
Colony	1.416***	0.00381***	-0.0169***	
	(0.127)	(0.00114)	(0.00424)	
Good Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	No	No	No	Yes
Sample Size	24994	24994	24994	24994
R-squared	0.049	0.654	0.160	0.718

Standard errors in parentheses. +, *, ** and *** represent significance at the 10%, 5%, 1% and 0.1% levels. All regressions include constants that are not shown.

Table A.34 - Estimation Results of 3SLS regressions with Dyadic Taste Parameters in 2011

	Dependent Variable:			
	Log Trade	Log Duties	Log Transport Costs	Log Prices
Log Duties	-1.667***			
	(0.0506)			
Log Transport Costs	-1.667***			
	(0.0506)			
Log Prices	-1.667***			
	(0.0506)			
Border	2.838***	-0.000479	-0.0646***	
	(0.157)	(0.00126)	(0.00493)	
Common Language	-0.418***	-0.00445***	0.00643***	
	(0.0491)	(0.000416)	(0.00163)	
FTA	-0.180**	-0.0217***	-0.00585**	
	(0.0650)	(0.000551)	(0.00216)	
Log Distance	0.188***	0.00286***	-0.00460**	
	(0.0479)	(0.000396)	(0.00155)	
Colony	1.276***	0.00344**	-0.0121**	
	(0.129)	(0.00109)	(0.00429)	
Good Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	No	No	No	Yes
Sample Size	25371	25371	25371	25371
R-squared	0.018	0.668	0.155	0.711

Standard errors in parentheses. +, *, ** and *** represent significance at the 10%, 5%, 1% and 0.1% levels. All regressions include constants that are not shown.

Table A.35 - Estimation Results of 3SLS regressions with Dyadic Taste Parameters in 2012

	Dependent Variable:			
	Log Trade	Log Duties	Log Transport Costs	Log Prices
Log Duties	-1.940***			
	(0.0560)			
Log Transport Costs	-1.940***			
	(0.0560)			
Log Prices	-1.940***			
	(0.0560)			
Border	2.383***	-0.00261*	-0.0662***	
	(0.162)	(0.00122)	(0.00448)	
Common Language	-0.310***	-0.00423***	0.0126***	
	(0.0519)	(0.000417)	(0.00153)	
FTA	-0.167**	-0.0193***	-0.00759***	
	(0.0630)	(0.000500)	(0.00183)	
Log Distance	0.0627	0.00255***	-0.00752***	
	(0.0514)	(0.000397)	(0.00146)	
Colony	1.238***	0.00379***	-0.0138***	
	(0.137)	(0.00110)	(0.00403)	
Good Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	No	No	No	Yes
Sample Size	25584	25584	25584	25584
R-squared	-0.084	0.662	0.156	0.725

Standard errors in parentheses. +, *, ** and *** represent significance at the 10%, 5%, 1% and 0.1% levels. All regressions include constants that are not shown.

Table A.36 - Estimation Results of 3SLS regressions with Dyadic Taste Parameters in 2013

	Dependent Variable:			
	Log Trade	Log Duties	Log Transport Costs	Log Prices
Log Duties	-1.824***			
	(0.0534)			
Log Transport Costs	-1.824***			
	(0.0534)			
Log Prices	-1.824***			
	(0.0534)			
Border	2.479***	-0.000992	-0.0387***	
	(0.158)	(0.00124)	(0.00335)	
Common Language	-0.472***	-0.00487***	0.00223+	
	(0.0511)	(0.000428)	(0.00115)	
FTA	-0.173**	-0.0198***	-0.00292*	
	(0.0613)	(0.000507)	(0.00137)	
Log Distance	0.0410	0.00318***	0.00340**	
	(0.0510)	(0.000411)	(0.00111)	
Colony	1.391***	0.00338**	-0.00656*	
	(0.131)	(0.00110)	(0.00296)	
Good Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	No	No	No	Yes
Sample Size	25098	25098	25098	25098
R-squared	-0.067	0.655	0.163	0.724

Standard errors in parentheses. +, *, ** and *** represent significance at the 10%, 5%, 1% and 0.1% levels. All regressions include constants that are not shown.